Shemya AFB, Alaska 1992 IRP FIELD INVESTIGATION REPORT

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EXECUTIVE SUMMARY

The U.S. Air Force is currently investigating 22 sites on Shemya Air Force Base (AFB) to determine if past spill and disposal activities have caused environmental damage. These investigations are being carried out under the Air Force's Installation Restoration Program (IRP). As a part of the IRP program, field investigations were performed in 1992 to obtain the information needed to assess what future actions will need to be carried out at each site. The island's drinking water supply was also investigated.

Activities completed at 10 selected sites during the 1992 field investigation included surface sampling to determine the lateral extent of contamination, subsurface sampling to determine the vertical extent of contamination, and the installation of well points and monitoring wells to determine the direction of groundwater flow and if the groundwater has been affected by a site. In addition, geophysical surveys were performed at most sites to identify site boundaries and check for the presence of buried metal to be avoided during drilling activities.

Sites were also surveyed to develop site-specific maps and document the location of sampling points and monitoring wells. Table E.1 lists the activities that were performed at each of the IRP sites on Shemya plus the water gallery.

The results of the geophysical investigations and the analytical data from the samples that were taken were combined with past sampling results to determine the nature and extent of contamination present at each site. Analytical results were used to establish numerical preliminary risk levels for human and ecological receptors. Analytical results were then compared to risk levels to determine if there is human health or ecological risk at each site. If there was sufficient information to determine the nature and extent of contamination at a site, then, based on risk levels, a recommendation for remedial action or a No Further

TABLE E.1. Sites Investigated in 1992 and Future Actions

<u>Site</u>	<u>Types of Investigation</u>	<u>Future Action</u>
Water Gallery	Surface sampling, well points, monitoring wells, geophysics, surveying	Water treatment to remove TCE
FT-1	Surface sampling, subsurface sampling, monitoring wells, geophysics, surveying	Additional investigation
FT-2	Surface sampling, subsurface sampling, monitoring wells, geophysics, surveying	Additional investigation
FT-3	Geophysics	Additional investigation
SW-4	Surface sampling, subsurface sampling, geophysics, surveying	Site grading and monitoring wells
SW-5	Surface water sampling, sediment sampling, geophysics, surveying	No further action
SW-10	Surface sampling, monitoring wells, geophysics, surveying	Remedial action (impermeable cap) and seawall stabilization
SW-12	Surface sampling, monitoring wells, geophysics, surveying	Remedial action (permeable cap)
SW-14	Geophysics, surveying	Additional investigation
PS-1A	Surface sampling, subsurface sampling, surveying	No further action
PS-1B	Surface sampling, subsurface sampling, geophysics, surveying	Additional investigation
PS-2	Surface sampling, surveying	No further action
PS-3	Geophysics	Additional investigation
PS-4	None	Additional investigation
PS-5	Surveying	Additional investigation
PS-6	Geophysics, surveying	RCRA program
PS-7	Geophysics, surveying	RCRA program
PS-8	Subsurface sampling, geophysics, surveying	Remedial action
PS-9	Geophysics, surveying	Remedial action
PS-10	Surface sampling, surveying	RCRA program
PS-11	None	Additional investigation
PS-83	Geophysics	Additional investigation

Action Decision was made. If there was not sufficient information to determine the nature and extent of contamination, further investigations were recommended for that site. Table E.1 presents the actions recommended for each site. Three sites are recommended for no further action, four sites are recommended for remedial action, three sites are being transferred to other programs, and twelve sites still require additional investigations.

Introduction

1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

The U.S. Air Force is currently investigating several sites on Shemya Air Force Base (AFB) to determine if past spill and disposal activities have caused environmental damage. As part of these investigations, environmental samples were collected and analyzed during the summer of 1992. This report presents a brief history and background of the island (Chapter 1), then describes the field activities that were carried out (Chapter 2), and presents the findings of this investigation and makes recommendations for future activities at each site (Chapter 3). Recommendations are based on the results of all sampling efforts on Shemya. A summary is presented in Chapter 4.

1.2 BACKGROUND

1.2.1 Description and History of Shemya AFB

Shemya AFB occupies the entire 3.5-mile-long by 1.5-mile-wide Shemya Island. The island is located at the western tip of the Aleutian Archipelago, 1,500 miles southwest of Anchorage. Figures 1.1, 1.2, and 1.3 are the Location Map, Vicinity Map, and a detailed vicinity map, respectively, for Shemya AFB.

The following history of the installation is taken from the 1984 IRP Phase I report prepared by JRB Associates (JRBA 1984).

Historically, Shemya Island was uninhabited. It was known to support a limited fur hunting trade as long ago as 1824 (Cohen 1981). One of the few low-lying platforms in the windswept western islands, it was first developed in May 1943 by the U.S. Army, which constructed the existing 10,000-foot runway and hangars for use in the war campaign against the Japanese occupation forces then on Attu, Agattu, and Kiska Islands (Ross 1969). Shemya became the home of the 28th Bomber Group and later the 343rd Fighter Group. The latter was inactivated on August 15, 1946. Shemya Air Force Station activities were reduced following World War II, but again served as a refueling and staging point on the Great Circle Route for air support and supplies during the Korean conflict. When the Korean conflict terminated, activities on Shemya once again were reduced, and

1.2

FIGURE 1.1. Location Map

26 February 1993

Approx Scale 1"=15,500 feet
26 February 1993

FIGURE 1.2. Vicinity Map

on July 1, 1954, the base was declared surplus and inactivated. Facilities were transferred to the Civil Aeronautics Authority (CAA) in 1955 and subsequently leased to a commercial carrier (Northwest Airlines) for support and communication purposes.

The Air Force returned to Shemya in 1958 in support of various Air Force and Army strategic intelligence collection activities. Shemya was redesignated from an Air Force Station to an Air Force Base on June 21, 1968. There are currently no aircraft squadrons assigned to the base. Instead, a number of tenant units are located at Shemya AFB. The base mission has been and remains an early warning radar installation whose principal purpose involves monitoring space and missile activities. Shemya Island is part of the Alaska Maritime National Wildlife Refuge administered by the U.S. Fish and Wildlife Service (FWS). The FWS has agreed to let the Air Force use Shemya Island as long as it is needed for national defense.

Approximately 700 personnel are assigned to the base on an annual basis, 400 of whom are U.S. Air Force (USAF) personnel who operate and maintain all structures, utilities, and exterior facilities, and provide base support. The remaining 300 persons are contractor personnel who operate and maintain Department of Defense (DOD) facilities. During the summer months, base population may increase by another 200 to 400 persons, most of whom are contractors providing construction and related support services.

During the military operations on Shemya, vast quantities of diesel fuel, heating oil, aviation fuel, and gasoline were used on the island. Spills during transfer operations and disposal of contaminated fuels have resulted in areas of the island being contaminated. In addition to fuels, solvents have been used on the island and residual amounts have been found at several locations. The remoteness of Shemya and associated difficulty and expense in shipping unwanted materials off of the island has compounded the hazardous waste disposal problems that are found on most military installations. Because of these past disposal activities, the Air Force is investigating various areas under the Installation Restoration Program (IRP).

FIRE TRAINING AREAS (FT SITES)

- ① LIGHTNING STRIKE
- ② AIRCRAFT MOCKUP
- ③ FIRE DEPT. STRUCTURAL TRAINING AREA

SOLID WASTE STORAGE
& DISPOSAL (SW SITES)

- ④ BARREL DUMP SITE
- ⑤ HOSPITAL LAKE
- ⑩ BARREL BAY
- ⑫ SCRAP METAL DUMP
- ⑭ SCRAP METAL LANDFILL

LIQUID FUELS MANAGEMENT
(PS SITES)

- ①A NEW COBRA DANE
- ①B OLD COBRA DANE
- ② WEST DOCK
- ③ WEST END OIL/WATER SEPARATOR
- ④ DIESEL FUEL TANK NO. 123
- ⑤ POWER PLANT
- ⑥ REFUELING VEHICLE MAINTENANCE SHOP
- ⑦ VEHICLE MAINTENANCE SHOP
- ⑧ WHITE ALICE
- ⑨ ASPHALT TAR DRUM STORAGE
- ⑩ BASE OPERATIONS TERMINAL
- ⑪ CURRENT BARREL DRUM STORAGE AREA
- ⑧3 OLD BULK FUEL STORAGE AREA

MISC SITES

- ▲ WATER GALLERY
- ① Hg-1 MERCURY SITE BEHIND DOD ANDERS

FIGURE 1.3. 22 Sites Inc

1.3 AIR FORCE INSTALLATION RESTORATION PROGRAM

1.3.1 Introduction

The IRP is a DOD program, established to identify and remediate hazardous waste problems on DOD property resulting from past practices. The program is funded by the Defense Environmental Restoration Account (DERA).

The U.S. Air Force IRP objectives at Shemya AFB are to assess past hazardous waste disposal and spill sites on Air Force installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for those sites that are determined to pose a threat to human health and/or the environment. Under the IRP, future actions at Shemya AFB must meet the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, or Superfund), as amended by the Superfund Amendment and Reauthorization Act (SARA) and the NCP. The work phases of the IRP are similar to the U.S. Environmental Protection Agency (EPA) Remedial Investigation/Feasibility Study (RI/FS) in that a field investigation is performed and the requirements for site restoration, or remediation, are evaluated, where appropriate. These phases may be performed separately or in parallel.

1.3.2 History of Installation Restoration Program on Shemya

Phase I work under the IRP was a records search conducted by JRBA for Shemya AFB in September 1984, that identified 28 sites as potentially containing hazardous materials from past activities. The sites consisted of 10 petroleum, oil, and lubricants (POL) spill sites (identified as PS); 15 solid waste disposal sites (identified as SW); and three fire training sites (identified as FT). Eight of these sites were assessed as having a low potential for contaminant release (JRBA 1984) and were therefore removed from the IRP list.

JRBA used the Air Force Hazard Assessment Rating Methodology (HARM) system to prioritize the 20 remaining sites for purposes of IRP scheduling and budgeting (JRBA 1984). Table 1.1 lists the HARM score ranking for each site. These sites were determined to be likely sites of hazardous material contamination where significant potential for contaminant migration was thought to exist.

TABLE 1.1. Priority HARM Ranking of Disposal Sites--Shemya AFB

<u>Site No.</u>	<u>Site Name</u>	<u>HARM Score</u>
PS-5	Power Plant Spills	75
FT-1	Lightning Strike	74
PS-4	Diesel Fuel Tank No. 123	62
PS-7	Vehicle Maintenance Waste Oil Storage and Spill Area	61
PS-1	Transformer Oil (PCB) Spills at Cobra Dane	57
FT-2	Aircraft Mockup	57
PS-3	West End Oil/Water Separator Ponds	68 ^(a) /56
PS-9	Asphaltic Drum Storage	56
SW-15	Ammunitions Disposal Area ^(b)	55
SW-12	Scrap Metal Disposal Site	54
SW-10	Barrel Bay	53
SW-13	Base Sanitary Landfill ^(c)	52
PS-6	JP-4 Spill at Refueling Vehicle Maintenance Shop	52
PS-2	West Dock JP-4 Spill	49
FT-3	Fire Department Foam Training Area	47
PS-10	JP-4 Spill at Base Operations Terminal	47
SW-5	Hospital Lake	46
SW-4	Barrel Dump Site	46
SW-14	Scrap Metal Landfill	43
PS-8	Old White Alice	6 ^(d)

^(a)Before removal of spilled oil only.

^(b)Munition site handled by USAF munitions specialists; not addressed further under the IRP.

^(c)Active site; permitted by ADEC, removed from IRP list.

^(d)Reflects post-closure cleanup and soils chemistry.

Source: Adapted from JRBA (1984).

The Alaskan Air Command (now called the 11th Air Force) elected to include all 20 sites for follow-on investigation. Two of the sites (SW-13, SW-15) were subsequently removed from the IRP list and were not included in the 1988 investigation conducted by CH2M HILL. Four additional sites were later identified and added to the IRP list (PS-1B, HG-1, PS-11, and PS-83) in 1988, resulting in a total of 22 sites (Figure 1.3) identified as being potentially contaminated with hazardous materials that may pose a threat to human health and/or the environment.

CH2M HILL prepared a Stage I Work Plan to address these 22 IRP sites and conducted field sampling in 1988. The general objectives of the work were: to determine what contaminants were present; to determine the effectiveness of previous restoration activities; and to recommend further action, whether it be remedial measures, expanded confirmation, or no further action. Three of the 22 sites were determined to contain very low or no potential for contaminant release and environmental degradation. These sites are the old hospital site (HG-1), West Dock (PS-2), and Base Operations Terminal (PS-10). The results of the field investigation are presented in the September 14, 1990, *Final Technical Report*, prepared by CH2M HILL. Two of these sites, West Dock (PS-2) and Base Operations Terminal (PS-10), were restored to the list to be investigated in 1992. A No Further Action Decision (NFAD) document was prepared for HG-1 in 1992. Data collected in 1988 are used to support the NFAD.

On March 7, 1991, CH2M HILL entered into an agreement with Battelle Environmental Management Operations (EMO) to prepare work plans and perform follow-on work at Shemya AFB. In addition to the IRP sites, the water gallery, which is used to collect the base drinking water, was to be investigated to determine the potential for current or future contaminant sources that could affect water quality.

1.3.3 Other Investigations

Environmental samples have been collected in or near the IRP sites during several recent investigations on Shemya. Table 1.2 lists these investigations and how the resulting data are used in this report. Evaluation of the data is based on the field documentation available and the type of laboratory quality

TABLE 1.2. Previous Investigations of IRP Sites

<u>Investigation</u>	<u>Date</u>	<u>Sites Covered</u>	<u>Use of Data in this Report</u>	<u>Explanation</u>
CH2M HILL IRP	1988	All Sites	Quantitative	Data validation completed
U.S. Army Corps of Engineers	1989	Water Gallery	Qualitative	No parameter-specific QA/QC data
USAF Bioenvironmental Engineering	1989-1992	Water Gallery	Qualitative	No QA/QC data, sample locations unclear
U.S. Army Corps of Engineers	1992	PS-1A	Quantitative	Lab QA/QC and data validation available

assurance/quality control (QA/QC) data available for review. Data from these investigations are discussed in the appropriate site sections. These data may fall into one of three categories: not of sufficient quality for use; to be used in a qualitative manner, but not in a quantitative manner; or to be used the same as the data generated during the current sampling effort in a quantitative manner.

Concurrent with the 1992 field season, samples were collected on behalf of EPA Region 10. These samples will be used by Region 10 to score the site for potential addition to the National Priority List (NPL) and are used in this report where appropriate.

There may be other investigations that have been completed on behalf of the Air Force at some of the Shemya IRP sites. However, any information produced has not been made available.

1.4 HISTORY AND ENVIRONMENTAL SETTING

1.4.1 Physiography

Shemya Island is a flat-topped seamount of the Aleutian volcanic arc in the north Pacific Ocean. The island is rimmed with small gravel beaches and rugged bedrock crags. A small raised beach platform nearly encircles Shemya Island and suggests previous sea level changes. Ground surface is typical of a hummocky glaciated terrain and tundra region. Numerous small ponds are found on the island.

Maximum local relief of the island is 275 feet. Maximum elevations are located on the north side facing the Bering Sea. The topography gently slopes south-southwest to 20 to 25 feet above the Pacific Ocean.

1.4.2 Cultural Geography

Shemya Island is owned by the U.S. Government and is part of the Alaska Maritime National Wildlife Refuge. The refuge is administered by the FWS. The Air Force occupies Shemya under permit agreement with FWS.

Shemya AFB is an active military base and is not scheduled for closure at this time. The installation occupies the entire island and

is only accessible by air or water. The major land use within the installation boundaries is that of support facilities including buildings, roads, a runway, POL tank farms, training areas, and waste disposal areas.

There are approximately 700 military and civil service personnel stationed at Shemya AFB. The population of the island often increases to nearly 1,000 during the summer construction season.

1.5 GEOLOGY

1.5.1 Geologic Setting

Shemya Island is part of the Aleutian volcanic arc of the north Pacific Ocean. The Aleutian Island arc is located on the overriding North American tectonic plate. The Pacific plate subducts beneath the islands at an estimated rate of 6 cm per year. Tectonic and volcanic activities along the Aleutian Island arc are frequent and often violent. Although there is no volcanic activity on Shemya Island, there have been at least two recent major earthquakes of 7.5 or greater on the Richter scale. These earthquakes caused some damage to runways and structures on the island.

Shemya Island is composed of a late Tertiary volcanic/sedimentary sequence of rocks, bedded pyroclastic rocks, and minor amounts of intrusive rocks, which are overlain by a varying amount of unconsolidated surficial sediments (Figure 1.4).

1.5.2 Bedrock Geology

The bedrock in the middle and western parts of the island consists of thin-bedded argillites, siltstone, graywackes, and conglomerates (Figure 1.4). Small and isolated outcrops of hornblende porphyry are also found in this area. Dips ranging from 30° to 60° north-to-northwest were measured in several exposed outcrops. Intense jointing and fracturing to a depth of approximately 10 feet causes these rocks to break apart into small gravel-sized pieces. Some fractures extend much deeper than 10 feet.

The bedrock in the eastern half of the island consists of extrusive andesite and dacite hornblende porphyries, intruded by small bodies of fine-grained basaltic rock with distinct columnar jointing. A basaltic tuff and tuff breccia extends from the northeastern

NOTE:
BASE MAP FROM FEULNER et al. 1976

FIGURE 1.4. Bedrock

TERTIARY
OR
QUATERNARY

BASALT PORPHYRY

BLACK FINE-GRAINED BASALTIC ROCKS WITH COLUMNAR JOINTING. GROUND WATER POTENTIAL UNEXPLORED.

HORNBLLENDE PORPHYRY

VERY HARD HORNBLLENDE ANDESITE OR DACITE. WEATHERED ZONE ABOUT 6 IN TO 5 FT DEEP; UNWEATHERED ROCK BREAKS INTO LARGE BLOCKS AND POLYGONAL COLUMNS. RELATIVELY LOW YIELDS (5-15 GAL/MIN) HAVE BEEN OBTAINED FROM WELLS COMPLETED IN THESE ROCKS.

TUFF AND TUFF BRECCIA

STRATIFIED SEQUENCE OF ANDESITIC AND BASALTIC TUFFS AND AGGLOMERATES 10 TO 100 FT THICK. HARDNESS VARIABLE. GROUNDWATER POTENTIAL UNEXPLORED.

INTERBEDDED SEDIMENTARY AND VOLCANIC ROCKS

STRATIFIED SEQUENCE OF THIN-BEDDED ARGILLITE, TUFF, AND GRAYWACKE CONGLOMERATE. DEEPLY WEATHERED AND SOFT BENEATH TUNDRA; HARD NEAR COAST AND WHERE BAKED BY VOLCANIC HEAT. HIGHLY FRACTURED TO DEPTHS OF ABOUT 10 FT. WELLS WITH HIGHEST YIELDS COMPLETED IN THESE ROCKS.

TERTIARY

----- FAULT, DASHED WHERE INFERRED

portion southward. Several joints exist in this outcrop but not to the extent as those found in the basement rocks. However, the basalt is believed to be in fault contact with the basement rocks (Feulner et al. 1976).

1.5.3 Surficial Geology

The surficial geology on the island consists of a veneer of Pleistocene glacial deposits, active and stable eolian deposits, a thin layer of outwash sand and silt, and an extensive layer of peat. Unconsolidated material covers the bedrock over most of the island and averages 5 to 15 feet in thickness, although some of the sand dunes are up to 50 feet thick. There is no permafrost on Shemya Island.

Glacial till and outwash deposits are relatively small and limited to the upper elevations in the northcentral-to-northeast regions of the island. Topographical features include ground moraines, outwash sand and gravel, and boulders. The average thickness is about 5 feet but occasional deposits reach 12 feet or more. Most of this is overlain by a peat layer.

A layer of tundra peat extends over most of the island except in the southern portion parallel to the coastline, and in the western quarter of the island. The peat remains saturated for most of the year, making these areas marshy. The depth of the peat ranges from 6 inches to 10 feet thick and interfingers with layers of sand and unconsolidated material below it.

Eolian deposits are represented by active and stable sand dunes along the south shore of the island. The dunes vary in size and reach up to 50 feet in height. Narrow beach deposits of sand, gravel, and boulders encircle the island.

In addition to natural deposits, large areas of the island have been filled. One area is directly north of the main runway where several support buildings exist. Material for this fill area most likely came from one or more of the quarries on the island. Information regarding the fill depth was not available.

1.6 Hydrology

Shemya Island has an annual precipitation of 31.3 inches that occurs in the form of rain, mist, or snow more than 330 days each year. A north-south topographic divide separates the island into two watersheds (Figure 1.5). A portion of the eastern watershed is used for a water gallery. The sloping topography of the island causes all significant streams to drain towards the southern coastline. A mass water balance has not been conducted on the island and it is uncertain how much precipitation contributes to surface runoff and how much infiltrates into the groundwater system. However, it is believed that any groundwater recharge to the bedrock aquifer from the overlying sediments is minimal and occurs through secondary porosity in the joints and fractures within the bedrock. Most of the precipitation probably recharges the unconsolidated uppermost aquifer.

1.6.1 Surface Water

Surface water on Shemya Island occurs as numerous small, natural ponds, creeks, and streams (Figure 1.5). The quantity and quality of this surface water is highly variable and, thus, limits its use as a water supply. A 1952 U.S. Army survey estimated surface water storage in lakes to be approximately 30 million gallons (U.S. Army 1952). During World War II, 16 ponds were used for potable water. These ponds were abandoned as a water supply source in the mid-1940s because of the deterioration of surface water quality associated with fuels and munitions handling practices.

Surface and subsurface drainage flows along the direction of the gentle structural tilt (south-southwest). Communication between the two distinct watersheds of the island is possible through ditching and abandoned sewage, water, and fuel lines. Much of the surface drainage has been modified by the construction of runways, buildings, and gravel pits. Interior drainage is poor and standing water is common, primarily as a result of tundra degradation (areas where the tundra has died), frost ponds, and open pits. During the dry months, stream baseflow is provided by groundwater discharge.

■ WATER GALLERY

APPROXIMATE GEOGRAPHIC DIVIDE

NOTE:
APPROXIMATIONS AS OBTAINED
FROM AF STORM DRAINAGE
SYSTEM MAP

FIGURE 1.5. Drainage Courses on Shemya Island

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1.6.2 Groundwater

There are two aquifer systems on Shemya Island. The upper primary aquifer consists of unconsolidated material and is generally 5 to 10 feet below ground surface (bgs). The upper aquifer is the main source of water for the island. The second aquifer system occurs in the joints and fractures within the bedrock.

Precipitation is the primary source of groundwater recharge. Both surface and groundwater discharges respond directly and rapidly to precipitation. Much of the precipitation percolates through the peat, gravel, and sand deposits to the underlying bedrock. The water then flows laterally across the bedrock/sediment interface. Some water finds its way into fractures in the bedrock where it is stored. The remaining water is either discharged by streams or springs to the southern coastline, or it is intercepted by the water gallery collection system.

The base's main water supply consists of a water gallery system (Figure 1.6) built in the early 1950s that collects approximately 140 gallons per minute (gpm) from the shallow aquifer in the eastern watershed. Water use requirements, including fire protection, total approximately 200,000 gallons per day (138 gpm). The gallery consists of eight horizontal collectors that intercept water from the peat layer of the shallow aquifer. Although subject to seasonal variations in water quantity and quality, the water gallery system sufficiently serves the present base population except during exceptionally dry periods. Two wells (Figure 1.6) provide a backup drinking water supply. They withdraw water from the bedrock aquifer and can pump up to 155 gpm.

Although groundwater flow directions are known for some sites, the overall island groundwater flow regime is not yet fully understood. The complexities associated with fracture flow phenomena within the bedrock are difficult to quantify and interpret.

1.6.3 Groundwater Quality

During World War II, approximately 30 water supply wells were drilled into the bedrock aquifer to replace contaminated surface water supplies then in use. By the end of 1944, only 18 of these wells were producing water at yields limited to 25 gpm. Reports

AREAS OF AUGER AND TEST
PIT SITES FOR FOUNDATION
STUDIES 1952, 1958.

● WELLS

■ WATER GALLERY

NOTE:
WELL 400 DRILLED AS WELL 4
WELL 410 DRILLED AS WELL 29

FIGURE 1.6. Location of Wells and Foundation Studies
Shemya Island, 1952-1958

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indicate there were problems with saltwater intrusion into many of these wells, and they were abandoned at the time the water gallery was constructed. Wells 400 and 410 (formerly Wells 4 and 29), located in the western watershed, were rehabilitated in the late 1950s, and are designated as the island's backup water supply, with a potential combined yield of 155 gpm. The two wells are probably located along a north-south trending fault or fracture zone, which may explain their significant yields. The locations of Wells 400 and 410, the abandoned wells, the water gallery, and test pit sites used for foundation studies are shown in Figure 1.6.

The hydrologic communication between the surface and subsurface on Shemya Island provides a potential pathway for contamination from surface sources to the base's primary and backup groundwater supply. Surface contamination in the eastern watershed could have an effect on the shallow groundwater that supplies the water gallery.

Backup water supply wells are also at risk because of spills and leaks from the Power Plant (PS-5), Oil/Water Separator (PS-3), and Diesel Fuel Tank 123 (PS-4) (Figure 1.3). One source of groundwater contamination is the base power plant (Figure 1.3), located in the western watershed, that has been the site of several major fuel oil spills in past years. Fuel spilled at this site has been observed to flow westward in a drainage ditch along North Road. Fuel cannot move directly across the surface drainage divide to the east watershed, but could enter the water supply after it seeps into the ground if the groundwater moves east beneath the topographic divide.

Other sources of groundwater contamination are five "temporary" oil/water separator ponds (PS-3) constructed in drainageways in the mid-1980s to collect spilled or leaked fuel oil. During this time, two fuel oil tanks reportedly failed as the result of corrosion and spillage. In addition, Diesel Fuel Tank 123 was overfilled in 1984, resulting in the spilling of 67,000 gallons of fuel oil. All of this volume was reportedly recovered during cleanup operations. Tank 123, located approximately 800 feet southeast from Well 410, received a HARM score of 62 (JRBA 1984). These recent events demonstrate that the backup wells are continually at risk of contamination from surface facilities and military activities.

The backup wells may also be at risk from the Cobra Dane facility, which uses and stores polychlorinated biphenyl (PCB) oils and, possibly, degreasing solvents. Analyses of water samples collected from the two backup wells at various times have detected the presence of petroleum hydrocarbons and volatile organics (U.S. Army 1958; CH2M HILL 1990). In addition, water from these two wells has been described as having a sulfur smell and a disagreeable taste (COE 1988). Groundwater within the bedrock aquifer may have been affected in other locations as well.

The water gallery system is at risk from other sources. A sanitary waste sewer line runs across the eastern watershed, near the water gallery and upgradient. Failure of this line could have immediate detrimental effects on the quality of the shallow water supply. The possibility of this occurring is increased by the potential for earthquakes in this area.

The quality of water from the water gallery has been evaluated within the last several years and some trace levels of trichloroethylene (TCE) contamination have been detected (less than 5 $\mu\text{g/L}$). However, the TCE levels are acceptable and within current EPA drinking water standards. Available water quality information recorded for Shemya Island can be found in the IRP Phase I Records Search (JRBA 1984) and Appendix J of the CH2M HILL Stage 1 Final Technical Report 1990. Overall, the quality of surface and groundwater has not changed since 1958. Quarterly monitoring of the water supply is conducted by USAF Bioenvironmental Engineering on Shemya Island.

Isolated reports of water contamination in other parts of the island have been recorded. Specifically: 1) "In 1945, many wells began pumping saltwater or gasoline ..." (U.S. Army 1952); and 2) "Water from well No. 7 is abnormally high in sulfate. This condition is undoubtedly the result of contamination by runoff or seepage from a nearby area (hospital boiler plant) where sulfate material had been stockpiled and subsequently dispersed." (U.S. Army 1958). In addition, several leachate-type seeps occurring along the south shore of the island are contaminated by nearby solid waste landfills (SW-10 and SW-12).

1.7 AIR QUALITY

Potential sources of airborne emissions on Shemya Island include: exhaust from gasoline, diesel, propane, and aircraft engines; exhaust fan power plant operations; solid waste burning; and construction. Air sampling has been performed on the Shemya incinerator, but no records of previous or existing air sampling related to the investigation areas are available. With an average of 31 inches of precipitation per year and an annual average wind velocity of nearly 20 mph, dilution and dispersion of airborne emissions is extreme.

1.8 MINERAL RESOURCES

Several active sand and gravel operations, operated by the 11th Civil Engineering Operations Squadron (CEOS) and a local contractor, are located on the Island as summarized below.

TABLE 1.3. Sand and Gravel Operations on Shemya Island

<u>Quarry Description</u>	<u>Location</u>	<u>Operator</u>
East Quarry, South	West of Current Landfill	11th CEOS
East Quarry, North	West of Current Landfill	Contractor
North Beach Quarry	Behind Building 3050	11th CEOS
Grand Canyon Quarry	North of Cross Island Road	Contractor
Lagoon Quarry*	Southwest End of Runway	11th CEOS
Five Point Quarry	North of Landfill at Road Intersection	Contractor

*The Lagoon Quarry is no longer active; it was last used in 1987.

These facilities produce sand and gravel for concrete and other mixtures for construction and road surface preparation. Estimates of annual production and known reserves at these sand and gravel facilities are not available.

1.9 CULTURAL RESOURCES

The State Office of History and Archaeology has identified five potential historical sites on Shemya Island, four of which are listed in the Alaska Heritage Resources Survey (AHRS). Copies of these reports are attached in Appendix I of CH2M HILL's *1990 Final Technical Report* (CH2M HILL 1990). The report for the remaining site, the Old White Alice Communications location, has not been completed.

Although descriptions of the sites are very limited, the AHRS indicates that two of the sites are located on the north side of the island. Another site is on the south coast and south of the western end of the airport, and a fourth is on the northeast coast of the island. The fifth site (White Alice) is on the east coast of the island. Except for the Old White Alice site, none of the historical sites are adjacent to any of the IRP sites.

1.10 BIOLOGY AND ECOLOGY

1.10.1 Communities and Habitats

Vegetation on Shemya Island consists primarily of various grasses, lichens, and mosses. Much of the land surface is covered with peat and meadow types of vegetation. Seaweeds are common along the rocky shore and reef areas of the island. Only a few of the trees that were planted by soldiers during World War II remain on the island.

Substantial transient water fowl populations stop on Shemya Island. During a 5-season survey in the late 1970s, 145 species of 27 families of birds were recorded on the island. The principal land mammal on the island is the blue phase arctic fox. Sea lions are frequently observed basking on rocks along the shoreline. Other marine mammals in the area include several types of whales and porpoises.

1.10.2 Environmentally Sensitive Areas

Environmentally sensitive areas are those areas where a small disturbance can have a very large impact. To date, there have been no environmentally sensitive areas identified on Shemya Island.

1.10.3 Endangered Species

No endangered species currently inhabit Shemya Island.

The Aleutian Canadian goose (Branta canadensis leucopareia) is indigenous to the Aleutian Islands of the north Pacific. The Aleutian tundra serves as a nesting area for this migratory endangered species. The presence of these geese on Shemya Island is solely limited to their migratory path. At one time they nested throughout the Aleutian Islands. Now, Buldir and Agattu Islands (80 miles east and 20 miles southwest, respectively) have the only known nesting populations of Aleutian Canadian geese. The population is known to be increasing as more than 1,600 birds were believed to frequent the islands in 1978 (Todd 1979). The intentional introduction of the blue phase arctic fox by fur farmers between the 1830s and 1930s proved to be detrimental to the Aleutian Canadian goose and was responsible for their extinction on Shemya Island. No Aleutian Canadian geese are expected to nest on Shemya Island unless the fox is eliminated from the island.

1.10.4 Economic Species

No species considered of economic importance currently inhabit Shemya Island. However, there is commercial fishing in the ocean around Shemya.

1.11 Climatology/Meteorology

Detachment 3, 11th Weather Squadron, at Shemya AFB maintains meteorological data for the island. Review of their records indicates that Shemya Island is dominated by a persistent low pressure system referred to as the "Aleutian Low." Frequent storms track across the north Pacific into the Aleutian Islands. The Aleutian low pressure cells are responsible for the relatively mild maritime climate of the Aleutian Islands. Summer fogs are severe and frequent. The persistent wind, fog, and salt spray are responsible for the highly corrosive and harsh conditions at Shemya AFB.

1.11.1 Precipitation

Average precipitation on Shemya Island is 31.3 inches, and the maximum 24-hour rainfall was recorded as 5.20 inches during

October 1962 (Becker 1978). Precipitation occurs more than 330 days per year. The average annual snowfall is 70 inches, with an average 24-hour snowfall of 3 inches (Becker 1978). Drifting snow and driving rain are common because of high wind velocities. The highest precipitation typically occurs in the months of October and November.

1.11.2 Temperature

The mean annual temperature at Shemya AFB is 38.5°F (Becker 1978). The maximum and minimum recorded temperatures are 63°F and 7°F, respectively. The diurnal temperature variation rarely exceeds 10°F.

1.11.3 Wind

The average surface wind speed on Shemya Island is 17 knots (approximately 20 miles per hour) (Becker 1978). The direction of the wind is evenly distributed, without any true prevailing wind direction. All months of the year have recorded wind speeds greater than 55 knots (approximately 63 miles per hour).

1.11.4 Evaporation

There is no identified information available at this time on evaporation rates.

1992 Field Season

2.0 1992 FIELD SEASON

To determine what remedial actions are appropriate, if any, at the IRP sites on Shemya, additional data were required. Because of funding and time constraints it was not possible to obtain all of the information required in 1992 for all of the IRP sites on Shemya. Therefore, each IRP site investigation was prioritized and the sites with the highest priorities were completed first. Table 2.1 presents the sites and the type of investigations that were completed at each site. Prioritization of the IRP sites was based on input from the Alaska Department of Environmental Conservation (ADEC) and the Air Force 11th CEOS. ADEC and the Air Force had different criteria for selecting sites to be investigated first; however, the top priorities of each were investigated in 1992. The first priority in the 1992 field season was the water gallery because of the contamination that had been discovered. Second in priority were the Fire Training (FT) sites that had the potential of having heavy contamination. Following the FT sites were sites where it was believed that sufficient data for closure could be obtained in one field season.

During the 1992 field season on Shemya, a Close Support Laboratory (CSL) was used to analyze samples quickly for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene, and Xylene (BTEX). These data were used to guide further sampling. Additionally, samples were sent to an offsite laboratory for analysis of a greater list of parameters. Offsite analyses were completed in accordance with SW 846 protocols. The CSL and the offsite laboratory were used during both shifts of the field season. The two shifts were from July 9 through July 30, and from August 24 through September 15.

Collected data were used to complete preliminary human health and ecological risk assessments (Appendices C and D). These assessments are the basis for determining the need for, and the type of, remedial action necessary for each site.

TABLE 2.1. Site Activities Completed in 1992

Site	Types of Activities
Water Gallery	Surface sampling, well points, monitoring wells, geophysics, surveying
FT-1	Surface sampling, subsurface sampling, monitoring wells, geophysics, surveying
FT-2	Surface sampling, subsurface sampling, monitoring wells, geophysics, surveying
FT-3	Geophysics
SW-4	Surface sampling, subsurface sampling, geophysics, surveying
SW-5	Surface water sampling, sediment sampling, geophysics, surveying
SW-10	Surface sampling, monitoring wells, geophysics, surveying
SW-12	Surface sampling, monitoring wells, geophysics, surveying
SW-14	Geophysics, surveying
PS-1A	Surface sampling, subsurface sampling, surveying
PS-1B	Surface sampling, subsurface sampling, geophysics, surveying
PS-2	Surface sampling, surveying
PS-3	Geophysics
PS-4	None
PS-5	Surveying
PS-6	Geophysics, surveying
PS-7	Geophysics, surveying
PS-8	Subsurface sampling, geophysics, surveying
PS-9	Geophysics, surveying
PS-10	Surface sampling, surveying
PS-11	None
PS-83	Geophysics

2.1 SITES INVESTIGATED IN 1992

Presented below is a discussion of the rationale for the data collected and the types of techniques used to collect the data. A more detailed account is presented in the Field Investigation Plan (CH2M HILL 1991).

Table 2.1 presents the types of investigations that were completed at each of the sites to obtain the needed information. Chapter 3 discusses the results of these investigations and future actions.

2.1.1 Water Gallery

Because the water gallery is the primary drinking water source for the base, any threats to its water quality are serious. Low levels of TCE have been detected, making an investigation of the water gallery the highest priority during the 1992 field season. The purposes of the investigations at the water gallery were to provide data necessary to:

- define the area contributing recharge to the shallow aquifer
- determine if any large areas of surface contamination exist within the watershed
- determine the extent of groundwater contamination.

2.1.2 Fire Training Sites (FT)

The FT sites were used for fire training activities in which a variety of fuels and oils were burned and then extinguished. Some of the fuels burned contained contaminants that were left on the ground. Also, during the burning process other contaminants may have been formed. The investigations at the FT sites were designed to determine what chemicals were currently present at each site. Surface and subsurface sampling were used to determine the lateral and vertical extent of contamination, monitoring wells were used to determine the impact that the site had on the groundwater, and geophysics was used to determine if large areas of buried metal were present at the site.

The goal of the investigations at the FT sites was to collect sufficient data to design a closure strategy.

A suitably protective closure for the FT sites is expected to significantly limit human exposure to soil and groundwater contamination and to attenuate any contaminant migration. Closure of FT sites may include one or more of the following remedial strategies:

1. excavation and removal of soil contaminated above the site-specific cleanup levels
2. surface capping over all or part of the site, as needed
3. free-floating product removal, if any, from groundwater
4. groundwater remediation, if needed.

2.1.3 Solid Waste Disposal Sites (SW)

The SW sites investigated had all been used for the storage and disposal of drums and various pieces of metal debris. The amount of metal buried at each site and the depth of burial are not known. Some remediation has occurred at each of the five sites in the past. The investigations at these sites were designed to: 1) identify the extent of each site by use of geophysical techniques; 2) determine the risk posed by surface sampling; and 3) determine if they were impacting the local groundwater through the use of monitoring wells.

Each of the five sites is similar in terms of field investigation and possible closure options. The intent of these investigations is to collect sufficient data to determine an appropriate site closure. Closure strategies for the SW sites could involve capping the land-fill surface area with an impermeable or a permeable material and embankment stabilization.

Capping would be used site-specifically over all or portions of the affected site as appropriate to: 1) control exposure from contaminated surface soils; and 2) minimize leachate production. The SW sites without contamination above risk-based concentrations will be closed using a minimal cap design consisting of the following elements:

1. drainage control using surface grading to: a) divert and minimize offsite runoff onto the site, and b) maximize runoff and minimize infiltration on the site, and
2. covering exposed debris with rock-rubble blankets.

The SW sites displaying contamination that cannot be controlled by simple surface grading or with groundwater contamination will require more impermeable cap implementation. These designs may use, if needed, engineered soil or geosynthetic elements to isolate contaminated surface soils and minimize leachate production. In addition, SW sites exposed to the ocean will need special hard bank designs.

2.1.4 Petroleum Spill Sites (PS)

There are 13 PS sites on Shemya. The PS sites are areas that have contaminated soil from spilled petroleum products. These spills may have also contaminated the groundwater that underlies the site. The 1992 investigations at the PS sites included geophysics to identify areas of buried metal and surface and subsurface sampling to determine the lateral and vertical extent of contamination. The sites investigated in 1992 were those where No Further Action Decisions (NFADs) were probable. The restoration for each PS site is expected to reduce human and ecological exposure to soil and groundwater contamination. The PS site restoration may include one or more of the following actions on all or portions of each site:

1. excavation and removal of soil contaminated above risk-based cleanup levels
2. surface capping
3. free-floating product removal, if any, from groundwater
4. groundwater remediation, if needed.

The general strategy at each PS site is to determine, to a level of detail adequate to support risk assessment and remedial design, the nature and extent of soil and groundwater contamination.

2.2 FIELD METHODOLOGIES USED

During the 1992 field season on Shemya, several field investigative techniques were used. The following briefly describes each of the techniques; a more thorough description can be found in the IRP Field Investigation Plan (CH2M HILL 1991).

2.2.1 Geophysics

Geophysical electromagnetic (EM) conductivity surveys were performed to aid in locating buried metal, wastes, or utilities and delineating boundaries for a given site. Data were used to locate monitoring wells by identifying potential problem areas for drilling as well as by delineating the extent of buried waste or fill. Detailed surveys were performed at the water gallery, FT-1, FT-2, FT-3, SW-4, SW-5, SW-10, SW-12, SW-14, PS-1B, PS-6, PS-7, PS-8, and PS-9. Reconnaissance-level surveys were performed at PS-3 and PS-83. No geophysical surveys were conducted at PS-1A, PS-2, PS-4, PS-5, PS-10, or PS-11 because of time constraints. Detailed surveys consisted of recording measurements at known locations and subsequently plotting and analyzing the data.

Reconnaissance surveys were performed by directly observing conductivity values while walking along the traverses. Reconnaissance investigations were performed to provide a basis for planning future work at the area, but site boundaries were not delineated at the time.

2.2.1.1 Data Acquisition

The geophysical EM conductivity investigations were performed between July 15 and July 29, 1992. Detailed surveys were performed over approximately 49 acres and reconnaissance surveys were performed over approximately 20 acres. Prior to acquisition of detailed geophysical data, a grid was established over each site by registered surveyors.

Data were collected at 5-foot intervals along parallel grid lines using a Geonics EM31 ground conductivity meter. Measurements consisted of conductivity and in-phase values and were stored along with the grid coordinates for each measurement location in a digital data logger.

The raw EM data consist of computer files in X, Y, Z formats. The X and Y refer to the grid location and the Z refers to the measurement. Several data processing steps were performed prior to interpretation of the data:

1. Data files were edited to remove unwanted data, such as that from sections of lines that were duplicated.
2. Data were input into a spreadsheet program and rearranged into a grid format. Profile plots of the data were generated using the spreadsheet program (in Appendix B).
3. Contour maps of the data were generated using the edited X, Y, Z files (in Appendix B).

2.2.1.2 Data Interpretation

Both the profile plots (cross sections) of the data and the contour maps were used to interpret the data. Data profile plots were used to identify anomalies and determine their location along the survey lines. Anomaly positions were transferred to a base map. Contour maps of the conductivity and in-phase values were used to help establish spatial relationships between anomalies on adjacent lines. Anomalies, or groups of anomalies, on adjacent lines that appear to be related to the same source have been grouped together and are shown as a single area on the interpretation maps. Only the interpretive maps are presented in the main part of this document. Profile plots and contour maps are presented in Appendix B.

Buried metal can often be mapped with EM conductivity methods because of the characteristic change in the soil conductivity produced by the metal. If enough metal is present and is relatively shallow, both conductivity and in-phase values will be negative compared to a positive response in background soils. With lesser amounts of metal or deeper burial, the conductivity may exhibit values less than background without going negative. If the fill contains scattered metal rather than closely packed metal, the amplitude of the EM data may not be particularly anomalous. Instead, variations in values along the survey line indicate the presence of metal (i.e., the data appear "noisy.") Fill material containing little or no metal can often be identified by conductivity and/or

in-phase measurements that are different from the surrounding area.

Several types of features have been interpreted from the data based on the appearance of the data as described above. Although the distinction between these interpreted features is somewhat subjective, there has been an attempt to maintain consistency in categorizing the features interpreted in the different areas. A description of each of these features follows:

Isolated Buried Metal. An anomaly was observed in the data that indicates buried metal. Corresponding anomalies on adjacent lines were not observed.

Possible Isolated Buried Metal. A relatively weak anomaly that does not exhibit all the characteristics of buried metal was observed in the data. Corresponding anomalies were not observed on adjacent lines.

Buried Utility. If narrow metal or possible metal responses were observed on several adjacent lines and if they lined up in a straight line, this was interpreted as a utility line and may be either a buried pipe or cable.

Area of Buried Metal. Anomalies observed on a single traverse indicated multiple buried metal objects or wide continuous sections of buried metal. Similar anomalies were observed on adjacent lines, indicating extensive areas of metal.

Area of Scattered Buried Metal. This category is similar to Areas of Buried Metal, except that the buried metal is more scattered. Metal objects are sufficiently close together to make delineation of individual sources unwarranted, however.

Area of Waste or Fill with Little or No Metal. These areas are defined by anonymously high conductivities, but there are few in any of the characteristic metal-type responses. Similar anomalies are observed on adjacent lines, indicating some extent of these features.

2.2.2 Surface Sampling

Surface samples were used to delineate the lateral extent of surface contamination and to determine exposure concentrations and pathways during risk assessment.

Surface soil samples were collected at the water gallery, SW-4, SW-10, SW-12, PS-1A, PS-1B, PS-2, PS-10, FT-1, and FT-2. Samples were taken at the surface from an interval of 0 to 6 inches with the exception of FT-1 (samples were taken below fill) and FT-2 (samples were taken below the asphalt) (see Sections 3.2 and 3.3, respectively). All surface samples were collected with stainless steel trowels and placed directly into sample jars as specified in the Field Investigation Plan.

2.2.3 Backhoe Pits

Backhoe pits were dug at SW-4, FT-1, and the water gallery to collect soil samples at depth. Backhoe pits were used at sites where the soil was too rocky for soil boring, a better profile was needed, or in areas that were to be remediated (i.e., the water gallery). Samples were collected from the pit when the pit was less than 4 feet deep. For pits deeper than 4 feet, samples were taken from the backhoe bucket, using care to sample undisturbed soil.

2.2.4 Soil Borings

Soil borings were used to collect samples to determine the vertical extent of contamination.

Soil borings were advanced using a CME 850 track-mounted hollow stem auger drill rig belonging to the 11th CEOS. Samples from the soil borings were obtained by driving a stainless steel split spoon sampler ahead of the augers. Soil borings were used at FT-2, PS-1A, and PS-8. Soil borings were scheduled for FT-1 but, because of the rocky conditions, backhoe pits were used instead.

2.2.5 Well Points

Well points (drive points) were used in the water gallery to obtain groundwater level data and to obtain groundwater samples for analyses. Well points were used in place of monitoring wells where the emphasis was on obtaining water level data. Since well points can be installed much faster than monitoring wells, they were used to collect more data in a short period of time to direct further field activities.

Well points consisted of a 5-foot-long, 1-1/4-inch-diameter, stainless steel, factory-fabricated screen with one or more pieces of 5-foot-long blank pipe. Well points were manually driven into the ground using a fence post pounder until the screen was within the water table. The top of pipe was surveyed so that water level comparisons between well points could be made. Water level measurements were made using electronic water level probes.

2.2.6 Monitoring Wells

Groundwater monitoring wells were installed at the water gallery, FT-1, FT-2, SW-10, and SW-12. All wells were completed with 2-inch PVC Schedule 40, factory-slotted (0.01-inch) screens and blank pipe. The area around the screen on each well was filled with 10/20 Colorado silica sand. Above the silica sand, 2 feet of bentonite pellets were placed followed by a cement-bentonite slurry to 2 feet below ground surface. A concrete surface seal was placed at each well that also anchored the well protector. Centralizers were used on each well to ensure that the PVC pipe remained vertical.

Locking well protectors were placed over each well and cemented into the ground. All wells were developed by bailing after completion, and allowed to equilibrate for a minimum of 2 days with the aquifer before sampling. All monitoring wells were installed using an 850 CME auger drill rig with 4-1/4-inch ID augers (10-inch OD).

2.2.7 Lake Sampling

Lake surface water samples and lake sediment samples were collected from Hospital Lake (SW-5). Surface water samples were collected using a Van Dorn sampler at the midpoint of the water column, approximately 2 feet below the surface. Sediment

samples were collected using a stainless steel hand auger. Sediment samples were obtained from just below the sediment water interface.

2.2.8 Surveying

All grids used in sampling, and geophysical surveys, well points, monitoring wells, and sampling locations were surveyed. Where possible, all site locations were tied into the UTM grid system that is currently being used by the Air Force on Shemya. All horizontal coordinates were surveyed to within 1 foot accuracy and all monitoring well elevations were surveyed to within 0.01-foot accuracy. All survey data have been reduced and are incorporated into the site drawings presented in this document.

2.3 ANALYTICAL METHODS

EPA Methods (EPA 1990), were used by both the onsite and off-site laboratories for all analyses except soil moisture which was measured following ASTM Procedure D2216 (ASTM 1992). The CSL was equipped to perform TPH analyses on soil using a fixed wavelength infrared spectrophotometer. The CSL was not set up to analyze for TPH in water. A purge and trap gas chromatograph was also set up onsite to analyze for benzene, toluene, ethylbenzene, and xylenes (BTEX); trichloroethene (TCE); and tetrachloroethane (PCE) in soil and groundwater. Calibration curves for each analyte were developed and are presented in Appendix F.

The general strategy used for soil samples analyzed by the CSL was to screen each sample (head space) in the laboratory using a photoionization device (OVM 580B). Those with a positive detection with the organic vapor monitor (OVM) were analyzed for TPH and volatile organics. Those that did not register a detection were analyzed only for TPH.

As a QA check, a minimum of 1 in 10 soil samples was analyzed for both TPH and volatile organics. As a further QA check, 10 percent of all samples analyzed by the CSL were shipped to the offsite laboratory for confirmation of the CSL results. Percent moistures were not determined at the onsite laboratory and all results are presented on a wet weight basis. All offsite analytical results are presented on a dry weight basis. Therefore, in the

comparison between the onsite and offsite analyses, the onsite would have a low bias. The CSL was used to provide sample results to guide subsequent sampling activities. This "observational approach" was necessary to optimize the collection of data in the field.

2.4 SAMPLES COLLECTED AND ANALYZED

The number of samples collected at each site are presented in Table 2.2, along with the types of analysis requested for each sample and whether it was analyzed on or offsite. Table 2.2 does not include QA/QC samples that were collected and analyzed. Analytical results of all samples collected during this investigation are presented in Appendix A and a site-by-site discussion of the results is presented in Chapter 3.

2.5 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The quality assurance objective for data collection is to develop and implement procedures that provide data of known and sufficient quality as a basis for engineering decisions. These decisions include the degree of human health and ecological risk, the amount of contaminated material, and potential remedial alternatives. Data quality was determined through data validation and comparison to blank data to assess representativeness, comparability, accuracy, precision, and completeness. Each of these areas is discussed in this section, following a brief discussion of data validation procedures. A complete QA/QC assessment of the data for the 1992 field investigation is presented in Appendix F.

2.5.1 Data Validation

In the data validation process, analytical results are reviewed to determine if they are within acceptable guidelines. These guidelines are developed from established field and laboratory protocols that are based partially on historical performance and partially on what is perceived to be reasonable. It is expected in all data bases that some data will be "qualified." That is, the result of an analysis may not be as near the true value as desired. The qualification of data is based on comparing the laboratory results with stated quality criteria presented in the Field Investigation Plan and applying professional judgment.

TABLE 2.2. Samples Collected and Analyzed During 1992 by Site Location, Analysis Method, and Analysis Location

Site	Onsite TPH (418.1)	Onsite VOA 8010/ 8020	Offsite TPH (418.1)	Offsite VOA 8010/ 8020	Offsite VOA 8240	Offsite Semi VOA 8270	Offsite PCB/ Pesticides 8080	Offsite Metals (6010)	Offsite Nitrate (300)	Offsite TOC (9060)	Offsite Dioxins (8280)	TCLP Metals (1311)
Water Gallery	106	169	7	10	13	13	11	13	0	0	0	0
FT-1	42	9	3	0	12	12	12	12	0	7	4	0
FT-2	87	33	8	1	12	12	12	0	0	9	4	0
SW-4	14	7	0	0	13	13	13	13	0	0	0	0
SW-5	5	8	6	0	10	10	10	10	6	0	0	0
SW-10	22	9	0	0	22	22	22	22	0	2	0	3
SW-12	17	9	0	1	22	22	22	22	0	2	0	1
PS-1A	2	1	0	0	3	3	3	3	0	0	0	0
PS-1B	1	0	0	0	2	2	2	2	0	0	0	0
PS-2	4	1	1	0	0	0	0	0	0	0	0	0
PS-8	5	0	0	0	0	0	5	0	0	0	0	0
PS-10	4	0	0	0	0	0	0	0	0	0	0	0
Background	0	1	0	0	5	5	5	5	0	0	0	0
Well 400	0	1	0	0	1	1	1	1	0	0	0	0
Well 410	0	1	0	0	1	1	1	1	0	0	0	0
Total	309	249	25	12	116	116	119	104	6	20	8	4

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Initial data reduction, validation, and reporting were performed at the laboratory in compliance with SW 846 (EPA 1990). Data associated with offsite sample analyses were reviewed outside the laboratory using EPA data review guidelines from *Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses* (EPA 1988a), and *Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analyses* (EPA 1988b). CSL data were also evaluated with respect to the criteria presented in the Field Investigation Plan. These evaluations were done on a daily basis and discrepancies were corrected before sample analysis.

Although some data are qualified, the data quality assurance reports generally indicate that the analyses were completed properly. Data quality is adequate to meet the objectives of the sampling program for the Shemya IRP project. The remainder of this section details various quality control requirements and their potential effect on the usability of the data if the requirements were not met.

2.5.2 Representativeness

Representativeness is a measure of how closely a collected sample resembles the entire medium from which the sample is taken. Representativeness is assured through proper sample collection, handling, and analysis procedures (Sections 2.3 through 2.5) as specified in the Field Investigation Plan.

Holding times for all samples were reviewed during external data validation. Holding time criteria are specified for constituents in the various SW 846 procedures. Data validators used sample holding time criteria for qualification of sample data. Data validation indicates that holding times are acceptable for all analytes. The QA audits indicate that sample collection, handling, and analysis procedures were followed as specified in the Field Investigation Plan.

Most samples analyzed offsite were shipped to the CH2M HILL laboratory in Redding, California. From Redding, selected samples were sent to the CH2M HILL laboratory in Montgomery, Alabama (for TPH analysis), the CH2M HILL laboratory in Gainesville, Florida (for TOC analysis), and Enseco Laboratories in Sacramento, California (for BNA, Pesticides/PCB and GC/MS VOA

analyses). Samples collected for dioxin analysis were shipped to Pacific Northwest Laboratory (PNL) in Richland, Washington, and then to TMS Laboratory in Indiana for analysis. Sample integrity was maintained throughout the program through the proper use of sample containers, chain-of-custody seals, and custody forms as verified by QA audits. Chain-of-custody procedures are presented in detail in the Field Investigation Plan.

2.5.3 Comparability

Comparability is a measure of how closely data generated by different methods compare with each other. Data comparability is maintained by use of consistent methods and consistent units.

Comparability of the data has been maintained by using EPA-defined procedures, where available, and other documented procedures when EPA methods were not applicable (Table 2.2). Data comparability was also maintained by using consistent methods and consistent units.

Field Sampling Procedures

Operation of the sample collection effort was presented in the Field Investigation Plan. Field audits indicated that the sampling procedures presented were followed. The Field Investigation Plan standardized the sample collection and analysis effort so that data collected are comparable and representative of the material being sampled.

Laboratory Procedures

Samples were analyzed following the procedures in SW 846, or other EPA methodologies. Comparability of data has been maintained through the use of standard laboratory procedures.

Data Comparison

Duplicates of samples analyzed by the CSL were submitted to the offsite laboratory at a frequency of 10 percent, for confirmation of the CSL data. Appendix F presents an indepth comparison of the two sample sets.

Forty-eight samples were submitted for confirmatory analysis of BTEX, TCE, and PCE. Only one sample (SW10-68) did not meet the duplicate sample criteria between onsite and offsite analyses (variation of ± 35 percent). Onsite analysis of sample SW10-68 indicated levels of toluene, ethylbenzene, and the xylenes of 62.8, 54.2, and 171 $\mu\text{g/L}$, respectively, although the offsite laboratory results were all less than the 12 $\mu\text{g/L}$ detection limit.

Six samples had suspicious comparisons. Three samples (FT1T25.9, FT1T41.2, and FT1W219.5) had CSL results of less than detection and offsite results of greater than 1,000 $\mu\text{g/kg}$, while three other samples (FT2B20.5, FT2B25.0, and FT2B210.0) had CSL results of greater than 500 $\mu\text{g/kg}$ and offsite results of less than detection. It should be noted that all six samples were delivered to the offsite laboratory in the same shipment but were delivered to the CSL on different days. It is therefore unlikely that the CSL switched the samples. It is thought that these six samples may have been mislabeled at the offsite laboratory but a review of the documentation did not reveal any discrepancy. Data from the CSL will be used for these samples.

Thirty-three samples were submitted for confirmatory TPH analysis. Seventeen samples were determined to be below the detection limit for TPH analysis (25 mg/kg). Sample data from these 17 nondetect samples were consistent between the two laboratories. Twelve other samples were determined by the onsite laboratory to contain higher levels of TPH than reported by the offsite laboratory. After investigation of both methods used by the laboratories, it was discovered that the offsite laboratory used only a one-point calibration curve, whereas the onsite laboratory compared the sample to either a low concentration five-point curve or a high concentration five-point curve. The use of the one-point calibration curve by the offsite laboratory may have resulted in the flattening of the curve at higher TPH concentrations. Because of the better definition provided by the CSL calibration curves, it is felt that the CSL data has more validity and it will be used in this report.

2.5.4 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy, or bias, of the chemical test results was assessed in this investigation by evaluating matrix spikes.

For matrix spike analyses, one sample in every sample delivery group (SDG) is divided into two aliquots. One is analyzed in the normal fashion while the other is spiked with known amounts of certain analytes and reanalyzed. A comparison of the detected value for the spiked sample (after subtracting the original sample concentration) with the actual amount of analyte added indicates the accuracy of the method for spiked analytes. Accuracy is a combined parameter taking into account method suitability as well as matrix effects. It is possible in certain instances to isolate the matrix effects from the method suitability by using the method precision data. For example, in the event of a good precision agreement, any accuracy deviations can be attributed to matrix effects. All matrix spikes for the CSL were in compliance and more than 95 percent of the matrix spikes at the offsite laboratories were in compliance. Samples associated with out-of-compliance matrix spike data have been qualified with a "J".

2.5.5 Precision

Precision of data is a measure of the spread of the data when more than one measurement is taken on the same sample. For duplicate measurements, precision can be expressed as the relative percent difference, or RPD.

To establish laboratory duplicate precision, a sample is divided in two portions and analyzed in duplicate to establish the reproducibility (precision) of the laboratory sample preparation and analysis procedures, and the homogeneity of the sample matrix. Duplicate precision information does not lend itself to a prediction of bias. Both onsite and offsite laboratory duplicate analyses are discussed in more detail in Appendix F. Both CSL and offsite duplicate analyses were within recommended ranges (± 20 percent for water and ± 35 percent for soil) over 95 percent of the time. Samples associated with duplicate analyses exceeding these ranges have been flagged with a "J".

2.5.6 Completeness

Completeness is a measure of the amount of usable data obtained from the analytical measurement system. It is the number of nonrejected data points compared with the total number of data points generated by the laboratory. No data collected in this investigation are rejected and completeness is 100 percent.

2.5.7 Laboratory Blanks

Laboratory blanks are contaminant-free water that is analyzed using identical protocols as field samples to determine if there is any laboratory contamination that could be affecting analytical results. Laboratory blanks indicate the presence of some common laboratory contaminants, such as methylene chloride, acetone, and bis(2-ethylhexyl) phthalate. This indicates that low concentrations of these compounds reported by the laboratory may not be associated with the field sample but may have been introduced in the laboratory. Therefore, these analytes in the affected SDGs have been qualified (flagged with a "B" or "J1") in the data base (Appendix A).

2.5.8 Summary of Data Usability

Data collected during this sampling and analysis effort have been qualified through data validation, as shown by the flags on appropriate data in Appendix A. A prediction of bias is indicated by the qualifier. While not as good as unqualified values, the qualified values with known bias are more usable than values with unknown bias. These qualified data are used in conjunction with unqualified data for the purpose of this report. The data are of known and sufficient quality to be used in the Shemya Installation Restoration Program.

2.6 AUDITS PERFORMED

Three audits were performed during the 1992 field season on Shemya; two quality assurance audits and a health and safety audit. These are discussed below.

2.6.1 Quality Assurance Audits

Two quality assurance audits were performed during the first shift of the field season, one by an EMO representative and one by a CH2M HILL auditor. Each of these audits reviewed the procedures being followed both in the CSL and by the field crew. Procedures were compared to what was stated in the Field Investigation Plan (CH2M HILL 1991). Audit findings indicated that procedures were being followed with the exception of some minor discrepancies concerning required paperwork and placement of the required information on the paperwork. All discrepancies were corrected in the field and no corrections to the Field Investigation Plan were required.

2.6.2 Health and Safety Audit

A health and safety audit was performed by a CH2M HILL Health and Safety Specialist. This audit was performed to ensure that the provisions of the health and safety plan were being followed and to assess if the conditions on the island required any modification of the health and safety plan. Audit results indicated that some modification of the plan was necessary because of the weather conditions (high winds and rain). Modifications included frequent rest periods during cold weather, not drinking caffeine in the field, and holding daily health and safety meetings. All modifications were implemented in the field and an addendum to the health and safety plan was issued.

2.7 RISK ASSESSMENT PROTOCOLS

2.7.1 Introduction

Human health and ecological risk assessments have been completed for the 10 IRP sites investigated during the 1992 field season. The detailed assessments are included as Appendixes C (Human Health) and D (Ecological) to this report.

The objective of the risk assessment for the IRP sites at Shemya AFB is to generate preliminary risk levels (PRLs) for soil and groundwater. These risk assessment levels can then be compared to analytical results from each site to determine if remediation is necessary. This information, in turn, can be used to

determine the approximate volume of material to be remediated and the appropriate action can be selected.

PRLs are cleanup levels that: 1) are protective of human health and the environment; and 2) comply with regulatory standards, criteria, or action levels. Federal or state recommended action levels for soil and groundwater were used when available. If no action level exists for exposure to humans, a risk-based PRL was calculated following procedures outlined by the EPA (EPA 1989b; EPA 1991a). Methods and equations used for development of the human health PRLs are provided in Appendix C. If no action level exists for ecological receptors (i.e., ambient water quality), soil and groundwater concentrations associated with no adverse health effect have been calculated for each chemical of concern using literature-derived values. Methods and equations used for the ecological assessment are provided in Appendix D.

2.7.2 Development of Human Health PRLs

The human health PRLs consist of medium-specific (i.e., groundwater and soil) goals for protecting human receptors. PRLs have been established using readily available information such as reference doses, slope factors (used in the development of risk-based levels) and federal or state action levels.

The receptor used in all exposure scenarios for this project was the construction worker for a 30-year period, following standard EPA guidance.

This scenario was chosen because it is more conservative than the scenario involving base personnel or a trespasser on the island. The base personnel are on the island only 1 year, compared to 15 to 20 years for a construction worker.

The exposure scenarios used in the development of the human health PRLs were the construction worker exposed to:
1) contaminated surface and subsurface soil; 2) contaminated surface water; and 3) contaminated drinking water from the water gallery.

Equations presented in Part B of Risk Assessment Guidelines for Superfund (RAGS) have been used to calculate risk-based remediation goals (EPA 1991a). Two risk-based PRLs for each

exposure scenario have been developed based upon the type of toxicological effect the chemical may exhibit (noncarcinogenic or carcinogenic). The PRLs were calculated for the following target risk levels: 10^{-4} , 10^{-5} , and 10^{-6} for carcinogens and a hazard quotient equal to one for noncarcinogens.

2.7.3 Development of Ecological PRLs

The objective of the Ecological Risk Assessment is to identify conditions at the areas of concern that may pose a threat to ecological receptors. Guidance utilized for the completion of this effort includes:

- Risk Assessment Guidance for Superfund-Volume II, Environmental Evaluation Manual (EPA 1989c)
- Framework for Ecological Risk Assessment (EPA 1992)
- Summary Report on Issues in Ecological Risk Assessment (EPA 1991b)
- Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference (EPA 1989a)
- Ecological Risk Assessment (Suter 1992)

The purpose of the Ecological Risk Assessment is to provide a method of comparing levels of potential exposure to wildlife from site-related contaminants to establish levels which do not have an adverse effect on wildlife. Because of the uncertainties and lack of standard procedures, an overall semiquantitative approach has been used, whereby, observed concentrations of chemicals in soil and surface water were utilized to calculate incidental soil ingestion dose and surface water ingestion dose for terrestrial life. These dose levels were then compared to literature toxicity values to assess risk.

Terrestrial wildlife species and aquatic species were addressed as the potential receptors since surface water, soil sediment, and groundwater matrices are the primary concern. Because of limited information regarding existing aquatic species, the risk posed to aquatic environments was addressed by comparisons of observed chemical concentrations in sediment and surface water

to applicable surface water and sediment criteria for the protection of aquatic life.

Groundwater seep exposure to aquatic organisms was limited to SW-10 because of the lack of data at other sites to prove the existence of this exposure pathway. For those locations with soil and groundwater contamination, terrestrial organism risk was determined. For those locations with surface water and sediment contamination, aquatic and terrestrial organism risk was established.

Maximum concentrations of the contaminants of concern observed at each area were used as potential exposure concentrations and compared to concentrations with no observed effect. If observed concentrations exceed the no-effect concentrations, risk to the potentially exposed populations may exist.

Physical Characteristics and Nature and Extent of Contamination

3.0 PHYSICAL CHARACTERISTICS AND NATURE AND EXTENT OF CONTAMINATION

This chapter presents what is currently known about each site. At sites where there is sufficient data, risk assessment information is presented. Future actions are recommended for all sites.

3.1 BACKGROUND SAMPLES

As a part of the 1992 field investigation, five background samples were obtained [two soil samples (BS-124, BS-125), two beach sand samples (BSSD-126, BSSD-127), and one groundwater sample (BKG-01)]. Each of the sample locations is shown in Figure 3.1.

All of these samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (semi VOCs), PCB/pesticides, and metals. All of the soil/beach samples show low levels (79 to 630 $\mu\text{g/kg}$) of bis (2-ethylhexyl)phthalate, but this compound was also present in the laboratory blanks and is therefore considered a lab contaminant. All other organic compounds were less than their respective detection limits. Metals concentrations are shown in Table 3.1. Most of these concentrations are fairly low compared to other samples in this investigation, except chromium in soil sample BS-124 at 18.2 mg/kg, and arsenic in sediment sample BSSD-126 at 8.3 mg/kg.

3.2 WATER GALLERY

3.2.1 Site Background

The water gallery (WG) is located in the south central part of the island south of Hangar 4 and east of Hangar 3 (Figure 1.3, Figure 3.2, and Figure 3.3). Since the early 1950s, potable water has been collected by a permanent infiltration gallery system. The gallery uses eight horizontal infiltration collectors to intercept shallow groundwater in the unconfined aquifer just above the bedrock (Figure 3.4). There are no defined stream channels within the water gallery and nearly all precipitation infiltrates into the peat layer.

TABLE 3.1. Positive Results from Offsite Data from Background Samples

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
BG-BS124	BS-124 (0-0.5)	ALUMINUM	MG/KG	18900.00	*
BG-BS124	BS-124 (0-0.5)	ARSENIC	MG/KG	.82	B
BG-BS124	BS-124 (0-0.5)	BARIUM	MG/KG	26.30	*B
BG-BS124	BS-124 (0-0.5)	BERYLLIUM	MG/KG	.42	B
BG-BS124	BS-124 (0-0.5)	CALCIUM	MG/KG	6040.00	*
BG-BS124	BS-124 (0-0.5)	CHROMIUM	MG/KG	18.20	
BG-BS124	BS-124 (0-0.5)	COBALT	MG/KG	9.40	B
BG-BS124	BS-124 (0-0.5)	COPPER	MG/KG	26.50	
BG-BS124	BS-124 (0-0.5)	IRON	MG/KG	15300.00	
BG-BS124	BS-124 (0-0.5)	LEAD	MG/KG	1.60	*
BG-BS124	BS-124 (0-0.5)	MAGNESIUM	MG/KG	5830.00	
BG-BS124	BS-124 (0-0.5)	MANGANESE	MG/KG	241.00	*
BG-BS124	BS-124 (0-0.5)	NICKEL	MG/KG	33.80	
BG-BS124	BS-124 (0-0.5)	POTASSIUM	MG/KG	504.00	B
BG-BS124	BS-124 (0-0.5)	SILVER	MG/KG	.47	B
BG-BS124	BS-124 (0-0.5)	SODIUM	MG/KG	1890.00	
BG-BS124	BS-124 (0-0.5)	VANADIUM	MG/KG	60.10	
BG-BS124	BS-124 (0-0.5)	ZINC	MG/KG	33.60	
BG-BS124	BS-124 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	80.00	BJ
BG-BS125	BS-125 (0-0.5)	ALUMINUM	MG/KG	5280.00	*
BG-BS125	BS-125 (0-0.5)	BARIUM	MG/KG	12.80	*B
BG-BS125	BS-125 (0-0.5)	CALCIUM	MG/KG	7600.00	*B
BG-BS125	BS-125 (0-0.5)	CHROMIUM	MG/KG	6.10	B
BG-BS125	BS-125 (0-0.5)	COPPER	MG/KG	19.20	B
BG-BS125	BS-125 (0-0.5)	IRON	MG/KG	4630.00	
BG-BS125	BS-125 (0-0.5)	MAGNESIUM	MG/KG	2950.00	B
BG-BS125	BS-125 (0-0.5)	MANGANESE	MG/KG	19.20	*B
BG-BS125	BS-125 (0-0.5)	SODIUM	MG/KG	2530.00	B
BG-BS125	BS-125 (0-0.5)	VANADIUM	MG/KG	11.80	B
BG-BS125	BS-125 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	630.00	BJ
BG-BS125	BS-125 (0-0.5)	ACETONE	UG/KG	2.00	BJ

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.1. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
EG-BS125	BS-125 (0-0.5)	METHYLENE CHLORIDE	UG/KG	9.00	BJ
EG-BS126	BSSD-126 (0-0.5)	ALUMINUM	MG/KG	9210.00	*
EG-BS126	BSSD-126 (0-0.5)	ARSENIC	MG/KG	8.30	S
EG-BS126	BSSD-126 (0-0.5)	BARIIUM	MG/KG	8.50	*B
EG-BS126	BSSD-126 (0-0.5)	BERYLLIUM	MG/KG	.26	B
EG-BS126	BSSD-126 (0-0.5)	CALCIUM	MG/KG	23100.00	*
EG-BS126	BSSD-126 (0-0.5)	CHROMIUM	MG/KG	12.80	
EG-BS126	BSSD-126 (0-0.5)	COBALT	MG/KG	3.60	B
EG-BS126	BSSD-126 (0-0.5)	COPPER	MG/KG	22.40	
EG-BS126	BSSD-126 (0-0.5)	IRON	MG/KG	19500.00	
EG-BS126	BSSD-126 (0-0.5)	LEAD	MG/KG	1.10	*S
EG-BS126	BSSD-126 (0-0.5)	MAGNESIUM	MG/KG	8000.00	
EG-BS126	BSSD-126 (0-0.5)	MANGANESE	MG/KG	194.00	*
EG-BS126	BSSD-126 (0-0.5)	NICKEL	MG/KG	5.60	B
EG-BS126	BSSD-126 (0-0.5)	POTASSIUM	MG/KG	1370.00	
EG-BS126	BSSD-126 (0-0.5)	SODIUM	MG/KG	3130.00	
EG-BS126	BSSD-126 (0-0.5)	VANADIUM	MG/KG	55.70	
EG-BS126	BSSD-126 (0-0.5)	ZINC	MG/KG	33.00	
EG-BS126	BSSD-126 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	79.00	BJ
EG-BS126	BSSD-126 (0-0.5)	METHYLENE CHLORIDE	UG/KG	1.00	BJ
EG-BS127	BSSD-127 (0-0.5)	ALUMINUM	MG/KG	7330.00	*
EG-BS127	BSSD-127 (0-0.5)	ARSENIC	MG/KG	4.50	
EG-BS127	BSSD-127 (0-0.5)	BARIIUM	MG/KG	9.40	*B
EG-BS127	BSSD-127 (0-0.5)	BERYLLIUM	MG/KG	.17	B
EG-BS127	BSSD-127 (0-0.5)	CALCIUM	MG/KG	99000.00	*
EG-BS127	BSSD-127 (0-0.5)	CHROMIUM	MG/KG	6.50	
EG-BS127	BSSD-127 (0-0.5)	COPPER	MG/KG	14.10	
EG-BS127	BSSD-127 (0-0.5)	IRON	MG/KG	9210.00	
EG-BS127	BSSD-127 (0-0.5)	LEAD	MG/KG	1.00	*S
EG-BS127	BSSD-127 (0-0.5)	MAGNESIUM	MG/KG	6330.00	
EG-BS127	BSSD-127 (0-0.5)	MANGANESE	MG/KG	112.00	*

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.1. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
BG-BS127	BSSD-127 (0-0.5)	NICKEL	MG/KG	6.80	B
BG-BS127	BSSD-127 (0-0.5)	POTASSIUM	MG/KG	810.00	B
BG-BS127	BSSD-127 (0-0.5)	SODIUM	MG/KG	4430.00	
BG-BS127	BSSD-127 (0-0.5)	VANADIUM	MG/KG	28.30	
BG-BS127	BSSD-127 (0-0.5)	ZINC	MG/KG	20.40	
BG-BS127	BSSD-127 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	93.00	BJ
BG-BW01	A-BKGD1	ALUMINUM	UG/L	4190.00	
BG-BW01	A-BKGD1	ANTIMONY	UG/L	31.10	
BG-BW01	A-BKGD1	ARSENIC	UG/L	2.00	
BG-BW01	A-BKGD1	BARIUM	UG/L	3.30	J
BG-BW01	A-BKGD1	BERYLLIUM	UG/L	.50	
BG-BW01	A-BKGD1	CADMIUM	UG/L	2.70	
BG-BW01	A-BKGD1	CALCIUM	UG/L	27800.00	
BG-BW01	A-BKGD1	COBALT	UG/L	8.80	
BG-BW01	A-BKGD1	COPPER	UG/L	20.70	J
BG-BW01	A-BKGD1	IRON	UG/L	5880.00	
BG-BW01	A-BKGD1	LEAD	UG/L	6.90	
BG-BW01	A-BKGD1	MAGNESIUM	UG/L	29700.00	
BG-BW01	A-BKGD1	MANGANESE	UG/L	803.00	
BG-BW01	A-BKGD1	MERCURY	UG/L	.20	
BG-BW01	A-BKGD1	NICKEL	UG/L	17.30	
BG-BW01	A-BKGD1	POTASSIUM	UG/L	2750.00	J
BG-BW01	A-BKGD1	SELENIUM	UG/L	2.90	
BG-BW01	A-BKGD1	SILVER	UG/L	1.50	
BG-BW01	A-BKGD1	SODIUM	UG/L	44000.00	
BG-BW01	A-BKGD1	THALLIUM	UG/L	1.60	
BG-BW01	A-BKGD1	VANADIUM	UG/L	20.60	J
BG-BW01	A-BKGD1	ZINC	UG/L	25.60	

 (a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
 RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

FIGURE 3.2.

LEGEND

- * SOIL SAMPLE LOCATION
- COLLECTOR TUBES
- WELL POINT LOCATION
- ▲ MONITORING WELL LOCATION
- ◎ MANHOLE

FIGURE 3.

0 75 150 300
SCALE: 1"=150'

LEGEND

- * SOIL SAMPLE LOCATION
- COLLECTOR TUBES
- WELL POINT LOCATION
- ▲ MONITORING WELL LOCATION
- MANHOLE

ABBREVIATIONS

MH=MANHOLE
 CMP=CORRUGATED METAL PIPE
 CONC=CONCRETE PIPE

FIGURE 3.4. Water

Water is collected in a central gallery holding tank with an approximate capacity of 24,000 gallons. Water is chlorinated and pumped to three water storage holding tanks with a combined capacity of 800,000 gallons. Water requirements of Shemya AFB are normally met by this system. Most of the area around the water gallery has been impacted by human activities. To the northwest of the water gallery is an abandoned tank farm with possible petroleum contamination. Two aircraft hard stands are just north of the system, as is Hangar 4. All of the immediate area has been disturbed; however, native vegetation is starting to return. Much of the water gallery was rebuilt in 1992 after this investigation had finished. During the late 1980s, sampling of the water at the gallery indicated the presence of TCE. Subsequent sampling confirmed that the water entering the system was contaminated with TCE. This led the Air Force to request that the water gallery be studied along with the rest of the IRP sites.

Investigations in the area of the water gallery indicate that much of the area has been disturbed. A silty sand layer 1 to 5 feet thick covers the original peat surface of the area. The peat layer varies from less than 1 foot thick to over 7 feet thick in some areas. Areas of buried peat horizons have also been observed in the water gallery. Under the peat is a layer of gravel or gravel mixed with sand that varies in thickness from 5 to 10 feet. The gravel, probably a hornblende dacite porphyry, has some lenses of sandy clay mixed in. The depth to bedrock varies from 11 to 22 feet below ground surface (bgs) and is also made up of hornblende.

3.2.2 Previous Investigations

The base Bioenvironmental Engineering (BE) office and the U.S. Army Corps of Engineers (COE) have both conducted investigations within the area of the water gallery. Each of these investigations is discussed below. The water gallery was not part of the 1988 IRP investigation.

BE has been collecting water samples from the drinking water system on Shemya since 1989. Results of this sampling indicate a consistent presence of TCE at 3 to 4.5 $\mu\text{g/L}$. Table 3.2 presents the sampling data and only those compounds detected. In addition to TCE, many chlorination by-products are also found in the

TABLE 3.2. Sampling Performed by Bioenvironmental Engineering

Date Sampled	EPA Method	Compounds Found	Concentration
08/29/89	503.1	Trichloroethylene	3.4 µg/L
11/11/89	503.1	Trichloroethylene	2.5 µg/L
01/03/90	502.2	Trichloroethylene	3.6 µg/L
01/21/90	503.1	Trichloroethylene Benzene	2.9 µg/L 0.6 µg/L
02/26/90	503.1	Trichloroethylene	4.5 µg/L
03/29/90	502.1	Trichloroethylene 1,1,1-Trichloroethylene	3.0 µg/L 0.6 µg/L
06/12/90	503.1	None detected	
08/27/90	502.2	Trichloroethylene Dichlorodifluoromethane* Bromomethane*	2.8 µg/L 0.83 µg/L 2.2 µg/L
09/25/90	503.1	Trichloroethylene	1.2 µg/L
10/23/90	503.1	Trichloroethylene Benzene 1,2-Dichlorobenzene	3.5 µg/L 0.66 µg/L 3.57 µg/L
12/17/90	503.1	Trichloroethylene	3.2 µg/L
01/30/91	502.2	Trichloroethylene	4.2 µg/L
02/28/91	502.2	Trichloroethylene cis-1,2-Dichloroethane	3.2 µg/L 0.41 µg/L
03/19/91	502.2	Trichloroethylene	4.1 µg/L
06/18/91	501.1	None detected	
06/18/91	502.2	Trichloroethylene	3.0 µg/L
06/18/91		cis-1,2-Dichloroethane	0.8 µg/L
06/18/91	EPA 600/4-81-053	None detected Iron Manganese	 330 µg/L 402 µg/L
09/04/91	502.2	Trichloroethylene cis-1,2-Dichloroethene	3.2 µg/L 0.44 µg/L
10/16/91	502.2	Trichloroethylene cis-1,2-Dichloroethene	28 24 µg/L 3.49 µg/L

TABLE 3.2. (cont.)

Date Sampled	EPA Method	Compounds Found	Concentration
10/16/91	502.2	Chlorodibromoethane*	33 µg/L
		cis-1,2-Dichloroethene	0.33 µg/L
		Bromodichloromethane*	23 µg/L
		Bromoform*	9.0 µg/L
		Chloroform*	7.5 µg/L
		Trichloroethylene	3.9 µg/L
01/02/92	502.2	Chlorodibromomethane*	33 µg/L
		cis-1,2-Dichloroethene	0.33 µg/L
		Bromodichloromethane*	23 µg/L
		Bromoform*	9.0 µg/L
		Chloroform*	7.5 µg/L
		Trichloroethylene	3.9 µg/L

*Chlorination by-products.

water supply; these compounds are common when water with a high organic content is chlorinated and are not considered to be contamination caused by external sources.

The COE has drilled borings and installed monitoring wells in and around the water gallery on several occasions, beginning in 1984. Soil samples and water samples have been collected and analyzed during these investigations. During 1989, the COE performed an investigation of the water gallery on Shemya to determine groundwater flow patterns, identify POL contamination, and determine the depth to bedrock. This information was necessary to design changes to the collection system of the gallery to increase the flow. Eleven borings were drilled using a hollow stem auger and eight of the holes were completed as monitoring wells. Eighteen soil samples were sent to an offsite laboratory for analysis of POL constituents. Drilling logs are available for each borehole. Analytical data from this investigation are used in this report in a qualitative manner only because of the lack of parameter-specific QA/QC that is available for the offsite analyses. No TCE was found in any of the seven water or soil samples analyzed for TCE by the COE (COE 1990). However, petroleum contamination was found in some of the soil samples.

3.2.3 1992 Investigation

During the 1992 investigation, surface soil sampling, well points, monitoring wells, and backhoe pits were used to try to identify the source area of TCE contamination. A geophysical survey was conducted over approximately 2 acres at the water gallery (Figure 3.5) to locate any buried objects. Data were collected at 5-foot intervals along lines 25 feet apart. The data are presented as contour maps of conductivity and in-phase values in Appendix B.

Results of the geophysical investigation are shown in Figure 3.5. An area identified as buried metal was identified in the west side of the survey area. This feature probably corresponds to utility lines along the east side of the road, but because the survey lines are parallel to the utility line, its location is poorly defined. Several other interpreted utility lines are shown in the figure. These are apparently water lines since they align with manholes seen at the

FIGURE 3.5. WG Geophysical I

LEGEND

- ⊙ MANHOLE
- GEOPHYSICAL SURVEY LINE
- ⊗ AREA OF BURIED METAL
- POSSIBLE BURIED METAL
- ISOLATED BURIED METAL
- UTILITY LINE

site. Short features also identified as utility lines are mapped at 140 north between 100 and 200 east. These do not line up with the manholes or connect with the other utility lines shown and may not be water lines. Isolated buried metal and possible isolated buried metal have also been identified at several locations (Figure 3.5).

Surface soil samples (0 to 6 inches) were collected at each location where a well point was installed. Each sample was analyzed for TPH, and if volatiles were detected using an organic vapor monitor (OVM), then the sample was also analyzed for BTEX, TCE, and PCE. A total of 57 samples were collected and analyzed at the CSL for TPH, with the range of concentrations being <25 mg/kg to 4,763 mg/kg; 29 of the 57 samples were over 100 mg/kg (Table 3.3). Most of the surface samples with TPH concentrations above 100 mg/kg were taken from just north of the collection system and along both sides of Tower Road west of Hangar 4. In addition to onsite analysis, five surface samples were collected for offsite analysis of volatile organics (VOAs), semivolatile organics (semi VOAs), pesticides/PCBs, and metals. Positive results from these analyses are summarized in Table 3.4. All five samples showed some contamination, while only one sample (WG-109), taken east of Hangar 4, was heavily contaminated with semivolatile compounds. This area east of Hangar 4 has since been remediated by the 11th CEOS through excavation of contaminated soil and stockpiling elsewhere for bioremediation.

A total of 55 well points were installed upgradient of the water gallery collection system to map the potentiometric surface. Water levels were measured in each well point that reached the water table (48 of 55) and the results are presented in Figure 3.6. As can be seen, the area from the collection system to north of Hangar 4 contributes water to the collection system.

In addition to water level data, a water sample was obtained from each well point and analyzed for BTEX, TCE, and PCE. No TCE or PCE was found in any of the well points. The well points installed immediately north of the water gallery (Figure 3.3) appear to have intercepted a perched water table. The well points were unable to be driven to the same depth as the collection tubes. One well point (WP7, Figure 3.2) was positive for benzene at 1.8 $\mu\text{g/L}$, and two well points (EWP9 and EWP22) were positive

TABLE 3.3. Positive Results from Onsite (CSL) Data at Water Gallery

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(b)
WG-C1	GWG-90	TRICHLOROETHENE (TCE)	UG/L	3.50	
WG-C1	SHGWWG-05	TRICHLOROETHENE (TCE)	UG/L	4.40	
WG-C1	SHGWWG-56	TRICHLOROETHENE (TCE)	UG/L	3.10	
WG-C2	GWG-91	TRICHLOROETHENE (TCE)	UG/L	1.50	
WG-C2	SHGWWG-06	TRICHLOROETHENE (TCE)	UG/L	2.80	
WG-C2	SHGWWG-57	TRICHLOROETHENE (TCE)	UG/L	1.40	
WG-C5	SHGWWG-09	TRICHLOROETHENE (TCE)	UG/L	5.30	
WG-C5	SHGWWG-60	TRICHLOROETHENE (TCE)	UG/L	2.30	
WG-C6	SHGWWG-10	TRICHLOROETHENE (TCE)	UG/L	3.50	
WG-C6	SHGWWG-61	TRICHLOROETHENE (TCE)	UG/L	1.70	
WG-CM1	WGCM1	TRICHLOROETHENE (TCE)	UG/L	7.20	
WG-EWP22	GWG-84-EWP22	TOLUENE	UG/L	1.30	
WG-EWP9	GWG143-EWP9	TOLUENE	UG/L	1.00	
WG-HANGAR4	SHSOSWG-49 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	161.53	
WG-PIT	PIT (11.0)	m, p-XYLENES	UG/KG	29.00	
WG-PIT	PIT (11.0)	o-XYLENE	UG/KG	35.00	
WG-S1	WGS01	TRICHLOROETHENE (TCE)	UG/L	4.80	
WG-S2	WGS02	TRICHLOROETHENE (TCE)	UG/L	5.10	
WG-T1	TRENCH112.0 (12.0)	ETHYLBENZENE	UG/KG	6.90	
WG-T1	TRENCH112.0 (12.0)	m, p-XYLENES	UG/KG	16.60	
WG-T3	TRENCH311.0 (11.0)	m, p-XYLENES	UG/KG	9.50	
WG-T3	TRENCH311.0 (11.0)	o-XYLENE	UG/KG	21.60	
WG-T3	TRENCH37.0 (7.0)	TOLUENE	UG/KG	20.40	
WG-T3	TRENCH37.0 (7.0)	m, p-XYLENES	UG/KG	87.40	
WG-T3	TRENCH37.0 (7.0)	o-XYLENE	UG/KG	260.00	
WG-T5	TRENCH59.5 (9.5)	m, p-XYLENES	UG/KG	60.40	
WG-T5	TRENCH59.5 (9.5)	o-XYLENE	UG/KG	156.00	
WG-T8	TRENCH82.0 (2.0)	ETHYLBENZENE	UG/KG	41.00	
WG-T8	TRENCH82.0 (2.0)	m, p-XYLENES	UG/KG	25.00	
WG-T8	TRENCH82.0 (2.0)	o-XYLENE	UG/KG	108.00	
WG-T8	TRENCH83.0 (3.0)	o-XYLENE	UG/KG	142.00	
WG-T8	TRENCH83.5 (3.5)	m, p-XYLENES	UG/KG	40.00	
WG-T8	TRENCH83.5 (3.5)	o-XYLENE	UG/KG	197.00	
WG-T8	TRENCH86.5 (6.5)	o-XYLENE	UG/KG	26.00	
WG-T8E	TRENCH10E (10.0)	o-XYLENE	UG/KG	40.00	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.3. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(b)
WG-W1	WGWI11.0 (11.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	59.42	
WG-W1	W10.5	TRICHLOROETHENE (TCE)	UG/L	2.00	
WG-W1	W10.5	m,p-XYLENES	UG/L	.70	
WG-W1	W10.5	O-XYL ^{FT} E	UG/L	.80	
WG-W1	WGWI	TRICHLOROETHENE (TCE)	UG/L	2.40	
WG-W2	WGWI19.0 (19.0)	HEADSPACE	PPM	11.00	
WG-W2	WGWI23.5 (23.5)	HEADSPACE	PPM	5.00	
WG-W2	W25.0	ETHYLBENZENE	UG/L	2.10	
WG-W2	W25.0	TOLUENE	UG/L	9.20	
WG-W2	W25.0	m,p-XYLENES	UG/L	6.40	
WG-W2	W25.0	O-XYLENE	UG/L	26.60	
WG-W2	WGWI	ETHYLBENZENE	UG/L	3.70	
WG-W2	WGWI	TOLUENE	UG/L	16.30	
WG-W2	WGWI	m,p-XYLENES	UG/L	13.30	
WG-W2	WGWI	O-XYLENE	UG/L	5.60	
WG-W2	WGWI19.0 (19.0)	ETHYLBENZENE	UG/KG	24.50	
WG-W2	WGWI19.0 (19.0)	TOLUENE	UG/KG	98.70	
WG-W2	WGWI19.0 (19.0)	m,p-XYLENES	UG/KG	87.60	
WG-W2	WGWI19.0 (19.0)	O-XYLENE	UG/KG	34.10	
WG-W2	WGWI23.5 (23.5)	TOLUENE	UG/KG	10.00	
WG-W2	WGWI23.5 (23.5)	m,p-XYLENES	UG/KG	10.10	
WG-W3	WGWI	TRICHLOROETHENE (TCE)	UG/L	4.50	
WG-W3	WGWI	TRICHLOROETHENE (TCE)	UG/L	4.60	
WG-W3	WGWI	TRICHLOROETHENE (TCE)	UG/L	4.90	
WG-W4	WGWI12.3 (12.3)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	25.45	
WG-W4	WGWI4.0 (4.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	65.33	
WG-W4	WGWI6.0 (6.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	24.96	
WG-W4	WGWI	TRICHLOROETHENE (TCE)	UG/L	16.40	
WG-W4	WGWI	TRICHLOROETHENE (TCE)	UG/L	22.20	
WG-W4	WGWI	TRICHLOROETHENE (TCE)	UG/L	24.90	
WG-W4	WGWI1.5 (1.5)	m,p-XYLENES	UG/KG	13.60	
WG-W5	WGWI0.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	112.84	
WG-W5	WGWI10.5 (10.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	98.33	
WG-W5	WGWI56.5 (6.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	81.06	
WG-W5	WGWI57.0 (7.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	88.88	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.3. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(b)
WG-W5	WGW5	TRICHLOROETHENE (TCE)	UG/L	1.50	
WG-W6	WGW60.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	117.49	
WG-W6	WGW66.8 (6.8)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	48.78	
WG-W6	WGW67.0 (7.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	58.81	
WG-W7	WGW7	TRICHLOROETHENE (TCE)	UG/L	17.60	
WG-W7	WGW7	TRICHLOROETHENE (TCE)	UG/L	18.20	
WG-W8	WGW86.5 (6.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	71.01	
WG-WP1	SHS0SSWG-01 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	263.28	
WG-WP1	GWNG101-WP1	ETHYLENE	UG/L	1.00	
WG-WP1	GWNG101-WP1	m,p-XYLENES	UG/L	5.40	
WG-WP1	GWNG101-WP1	O-XYLENE	UG/L	2.80	
WG-WP10	SHS0SSWG-16 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1440.22	
WG-WP11	SHS0SSWG-17 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	3203.24	
WG-WP12	SHS0SSWG-18 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	2317.23	
WG-WP13	SHS0SSWG-19 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	443.46	
WG-WP14	SHS0SSWG-20 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	25.53	
WG-WP15	SHS0SSWG-22 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	144.12	
WG-WP16	SHS0SSWG-23 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	192.08	
WG-WP17	SHS0SSWG-24 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1239.71	
WG-WP18	SHS0SSWG-25 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	2072.05	
WG-WP19	SHS0SSWG-26 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	54.64	
WG-WP2	SHS0SSWG-02 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	175.70	
WG-WP2	GWNG102-WP2	m,p-XYLENES	UG/L	2.50	
WG-WP2	GWNG102-WP2	O-XYLENE	UG/L	1.80	
WG-WP20	SHS0SSWG-27 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	54.64	
WG-WP21	SHS0SSWG-28 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1135.30	
WG-WP22	SHS0SSWG-29 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1840.15	
WG-WP23	SHS0SSWG-30 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	70.22	
WG-WP29	SHS0SSWG-36 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	68.20	
WG-WP3	SHS0SSWG-03 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1260.46	
WG-WP32	SHS0SSWG-39 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	28.21	
WG-WP33	SHS0SSWG-40 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	35.10	
WG-WP36	SHS0SSWG-46 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	172.82	
WG-WP37	SHS0SSWG-47 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	47.05	
WG-WP4	SHS0SSWG-04 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	71.18	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.3. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(b)
WG-WP41	SHSOSSWG-53 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	28.76	
WG-WP42	SHSOSSWG-54 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	167.48	
WG-WP43	SHSOSSWG-55 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	128.36	
WG-WP44	SO-WG-069 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	248.14	
WG-WP45	SO-WG-070 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	230.07	
WG-WP47	SO-WG-072 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	165.73	
WG-WP48	SO-WG-073 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	110.64	
WG-WP49	SO-WG-074 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	244.22	
WG-WP5	SHSOSSWG-11 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4763.21	
WG-WP50	SO-WG-081 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	29.04	
WG-WP51	SO-WG-095 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	46.38	
WG-WP52	SO-WG-096 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	25.70	
WG-WP53	SO-WG-097 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	92.38	
WG-WP54	SO-WG-141 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	91.02	
WG-WP55	SO-WG-142 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	66.00	
WG-WP56	SO-WG-143 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	147.69	
WG-WP6	SHSOSSWG-12 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	75.24	
WG-WP7	SHSOSSWG-13 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	618.92	
WG-WP7	GWG114-WP7	BENZENE	UG/L	1.80	
WG-WP8	SHSOSSWG-14 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1997.00	
WG-WP9	SHSOSSWG-15 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	544.54	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. Positive Results from Offsite Data at Water Gallery

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-S2	A-WGSUMPB	bis(2-ETHYLHEXYL) PHTHALATE	UG/L	1.00	J
WG-S2	A-WGSUMPB	TRICHLOROETHENE (TCE)	UG/L	3.00	J
WG-W2	5-A-WGW2 (8.5)	ALUMINUM	MG/KG	28000.00	
WG-W2	5-A-WGW2 (8.5)	ANTIMONY	MG/KG	11.80	
WG-W2	5-A-WGW2 (8.5)	ARSENIC	MG/KG	2.00	J
WG-W2	5-A-WGW2 (8.5)	BARIUM	MG/KG	25.00	J
WG-W2	5-A-WGW2 (8.5)	BERYLLIUM	MG/KG	.23	J
WG-W2	5-A-WGW2 (8.5)	CADMIUM	MG/KG	1.00	
WG-W2	5-A-WGW2 (8.5)	CALCIUM	MG/KG	4430.00	
WG-W2	5-A-WGW2 (8.5)	CHROMIUM	MG/KG	18.10	
WG-W2	5-A-WGW2 (8.5)	COBALT	MG/KG	6.00	J
WG-W2	5-A-WGW2 (8.5)	COPPER	MG/KG	38.70	
WG-W2	5-A-WGW2 (8.5)	CYANIDE	MG/KG	.95	
WG-W2	5-A-WGW2 (8.5)	IRON	MG/KG	11500.00	
WG-W2	5-A-WGW2 (8.5)	LEAD	MG/KG	4.60	
WG-W2	5-A-WGW2 (8.5)	MAGNESIUM	MG/KG	6090.00	
WG-W2	5-A-WGW2 (8.5)	MANGANESE	MG/KG	147.00	
WG-W2	5-A-WGW2 (8.5)	MERCURY	MG/KG	.19	
WG-W2	5-A-WGW2 (8.5)	NICKEL	MG/KG	17.20	
WG-W2	5-A-WGW2 (8.5)	POTASSIUM	MG/KG	618.00	J
WG-W2	5-A-WGW2 (8.5)	SELENIUM	MG/KG	2.00	
WG-W2	5-A-WGW2 (8.5)	SILVER	MG/KG	.57	
WG-W2	5-A-WGW2 (8.5)	SODIUM	MG/KG	946.00	J
WG-W2	5-A-WGW2 (8.5)	THALLIUM	MG/KG	.61	
WG-W2	5-A-WGW2 (8.5)	VANADIUM	MG/KG	101.00	
WG-W2	5-A-WGW2 (8.5)	ZINC	MG/KG	41.50	
WG-W2	5-A-WGW2 (8.5)	TOLUENE	UG/KG	3.00	J
WG-W2	5-A-WGW2 (8.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	19.10	
WG-W2	WG25.0 (5.0)	ALUMINUM	UG/L	30400.00	
WG-W3	A-WGW3	ANTIMONY	UG/L	31.10	
WG-W3	A-WGW3	ARSENIC	UG/L	2.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
WG-W3	A-WGW3	BARIUM	UG/L	135.00	J
WG-W3	A-WGW3	BERYLLIUM	UG/L	.75	J
WG-W3	A-WGW3	CADMIUM	UG/L	2.70	
WG-W3	A-WGW3	CALCIUM	UG/L	58400.00	
WG-W3	A-WGW3	CHROMIUM	UG/L	53.40	
WG-W3	A-WGW3	COBALT	UG/L	19.80	J
WG-W3	A-WGW3	COPPER	UG/L	200.00	
WG-W3	A-WGW3	IRON	UG/L	17900.00	
WG-W3	A-WGW2	LEAD	UG/L	8.80	
WG-W3	A-WGW3	MAGNESIUM	UG/L	21100.00	
WG-W3	A-WGW3	MANGANESE	UG/L	2170.00	
WG-W3	A-WGW3	MERCURY	UG/L	.20	
WG-W3	A-WGW3	NICKEL	UG/L	32.20	J
WG-W3	A-WGW3	POTASSIUM	UG/L	7760.00	
WG-W3	A-WGW3	SELENIUM	UG/L	2.90	
WG-W3	A-WGW3	SILVER	UG/L	2.00	J
WG-W3	A-WGW3	SODIUM	UG/L	55000.00	
WG-W3	A-WGW3	THALLIUM	UG/L	1.60	
WG-W3	A-WGW3	VANADIUM	UG/L	56.00	
WG-W3	A-WGW3	ZINC	UG/L	150.00	
WG-W3	A-WGW3	TRICHLOROETHENE (TCE)	UG/L	3.00	J
WG-W4	A-WGW4	ALUMINUM	UG/L	1610.00	J
WG-W4	A-WGW4	ANTIMONY	UG/L	31.10	
WG-W4	A-WGW4	ARSENIC	UG/L	2.00	
WG-W4	A-WGW4	BARIUM	UG/L	24.80	J
WG-W4	A-WGW4	BERYLLIUM	UG/L	.50	
WG-W4	A-WGW4	CADMIUM	UG/L	2.70	
WG-W4	A-WGW4	CALCIUM	UG/L	39300.00	
WG-W4	A-WGW4	COBALT	UG/L	8.80	
WG-W4	A-WGW4	COPPER	UG/L	21.60	J
WG-W4	A-WGW4	IRON	UG/L	1370.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-W4	A-WGW4	LEAD	UG/L	6.20	J
WG-W4	A-WGW4	MAGNESIUM	UG/L	15800.00	
WG-W4	A-WGW4	MANGANESE	UG/L	892.00	J
WG-W4	A-WGW4	MERCURY	UG/L	.20	
WG-W4	A-WGW4	NICKEL	UG/L	19.40	J
WG-W4	A-WGW4	POTASSIUM	UG/L	3130.00	J
WG-W4	A-WGW4	SELENIUM	UG/L	2.90	
WG-W4	A-WGW4	SILVER	UG/L	1.50	
WG-W4	A-WGW4	SODIUM	UG/L	45000.00	
WG-W4	A-WGW4	THALLIUM	UG/L	1.60	
WG-W4	A-WGW4	VANADIUM	UG/L	6.30	J
WG-W4	A-WGW4	ZINC	UG/L	18.30	J
WG-W4	A-WGW4	1,2-DICHLOROETHENE (total)	UG/L	1.00	J
WG-W4	A-WGW4	TRICHLOROETHENE (TCE)	UG/L	15.00	
WG-W4	A-WGW4	ALUMINUM	MG/KG	9500.00	
WG-W4	A-WGW4	ANTIMONY	MG/KG	7.60	
WG-W4	A-WGW4	ARSENIC	MG/KG	3.30	
WG-W4	A-WGW4	BARIUM	MG/KG	32.00	J
WG-W4	A-WGW4	BERYLLIUM	MG/KG	.17	J
WG-W4	A-WGW4	CADMIUM	MG/KG	.66	
WG-W4	A-WGW4	CALCIUM	MG/KG	11100.00	
WG-W4	A-WGW4	CHROMIUM	MG/KG	11.20	
WG-W4	A-WGW4	COBALT	MG/KG	5.20	J
WG-W4	A-WGW4	COPPER	MG/KG	48.50	
WG-W4	A-WGW4	CYANIDE	MG/KG	.61	
WG-W4	A-WGW4	IRON	MG/KG	13100.00	
WG-W4	A-WGW4	LEAD	MG/KG	1.70	
WG-W4	A-WGW4	MAGNESIUM	MG/KG	5250.00	
WG-W4	A-WGW4	MANGANESE	MG/KG	319.00	
WG-W4	A-WGW4	MERCURY	MG/KG	.12	
WG-W4	A-WGW4	NICKEL	MG/KG	18.90	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-W4	A-WGW4 (6.0)	POTASSIUM	MG/KG	622.00	J
WG-W4	A-WGW4 (6.0)	SELENIUM	MG/KG	.71	
WG-W4	A-WGW4 (6.0)	SILVER	MG/KG	.47	J
WG-W4	A-WGW4 (6.0)	SODIUM	MG/KG	1230.00	
WG-W4	A-WGW4 (6.0)	THALLIUM	MG/KG	.39	
WG-W4	A-WGW4 (6.0)	VANADIUM	MG/KG	42.50	
WG-W4	A-WGW4 (6.0)	ZINC	MG/KG	42.10	
WG-W4	A-WGW4 (6.0)	ZINC	UG/L	13.00	C
WG-W4	WGW4	TRICHLOROETHENE (TCE)	MG/KG	41900.00	
WG-W5	5-A-WGW5 (6.5)	ALUMINUM	MG/KG	24.80	
WG-W5	5-A-WGW5 (6.5)	ANTIMONY	MG/KG	4.10	J
WG-W5	5-A-WGW5 (6.5)	ARSENIC	MG/KG	60.50	J
WG-W5	5-A-WGW5 (6.5)	BARIUM	MG/KG	.40	
WG-W5	5-A-WGW5 (6.5)	BERYLLIUM	MG/KG	2.20	
WG-W5	5-A-WGW5 (6.5)	CADMIUM	MG/KG	7480.00	
WG-W5	5-A-WGW5 (6.5)	CALCIUM	MG/KG	30.60	
WG-W5	5-A-WGW5 (6.5)	CHROMIUM	MG/KG	7.50	
WG-W5	5-A-WGW5 (6.5)	COBALT	MG/KG	122.00	J
WG-W5	5-A-WGW5 (6.5)	COPPER	MG/KG	2.00	
WG-W5	5-A-WGW5 (6.5)	CYANIDE	MG/KG	20600.00	J
WG-W5	5-A-WGW5 (6.5)	IRON	MG/KG	6.20	
WG-W5	5-A-WGW5 (6.5)	LEAD	MG/KG	11400.00	J
WG-W5	5-A-WGW5 (6.5)	MAGNESIUM	MG/KG	250.00	J
WG-W5	5-A-WGW5 (6.5)	MANGANESE	MG/KG	.40	
WG-W5	5-A-WGW5 (6.5)	MERCURY	MG/KG	15.30	J
WG-W5	5-A-WGW5 (6.5)	NICKEL	MG/KG	1450.00	J
WG-W5	5-A-WGW5 (6.5)	POTASSIUM	MG/KG	3.60	
WG-W5	5-A-WGW5 (6.5)	SELENIUM	MG/KG	1.30	J
WG-W5	5-A-WGW5 (6.5)	SILVER	MG/KG	1510.00	J
WG-W5	5-A-WGW5 (6.5)	SODIUM	MG/KG	1.30	
WG-W5	5-A-WGW5 (6.5)	THALLIUM	MG/KG	216.00	
WG-W5	5-A-WGW5 (6.5)	VANADIUM	MG/KG		

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
WG-W5	5-A-WGW5 (6.5)	ZINC	MG/KG	86.30	
WG-W5	5-A-WGW5 (6.5)	2-BUTANONE	UG/KG	200.00	J
WG-W5	5-A-WGW5 (6.5)	ACETONE	UG/KG	920.00	
WG-W5	5-A-WGW5 (6.5)	TOLUENE	UG/KG	11.00	J
WG-W5	WG50.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	45.80	
WG-W6	5-A-WGW6 (7.0)	ALUMINUM	MG/KG	26400.00	
WG-W6	5-A-WGW6 (7.0)	ANTIMONY	MG/KG	14.20	
WG-W6	5-A-WGW6 (7.0)	ARSENIC	MG/KG	3.30	J
WG-W6	5-A-WGW6 (7.0)	BARIUM	MG/KG	20.00	J
WG-W6	5-A-WGW6 (7.0)	BERYLLIUM	MG/KG	.23	
WG-W6	5-A-WGW6 (7.0)	CADMIUM	MG/KG	1.20	
WG-W6	5-A-WGW6 (7.0)	CALCIUM	MG/KG	3400.00	
WG-W6	5-A-WGW6 (7.0)	CHROMIUM	MG/KG	21.40	
WG-W6	5-A-WGW6 (7.0)	COBALT	MG/KG	9.10	J
WG-W6	5-A-WGW6 (7.0)	COPPER	MG/KG	42.00	
WG-W6	5-A-WGW6 (7.0)	CYANIDE	MG/KG	1.10	
WG-W6	5-A-WGW6 (7.0)	IRON	MG/KG	16400.00	
WG-W6	5-A-WGW6 (7.0)	LEAD	MG/KG	3.10	
WG-W6	5-A-WGW6 (7.0)	MAGNESIUM	MG/KG	4340.00	
WG-W6	5-A-WGW6 (7.0)	MANGANESE	MG/KG	184.00	
WG-W6	5-A-WGW6 (7.0)	MERCURY	MG/KG	.23	
WG-W6	5-A-WGW6 (7.0)	NICKEL	MG/KG	15.50	J
WG-W6	5-A-WGW6 (7.0)	POTASSIUM	MG/KG	533.00	J
WG-W6	5-A-WGW6 (7.0)	SELENIUM	MG/KG	1.30	
WG-W6	5-A-WGW6 (7.0)	SILVER	MG/KG	.69	
WG-W6	5-A-WGW6 (7.0)	SODIUM	MG/KG	813.00	J
WG-W6	5-A-WGW6 (7.0)	THALLIUM	MG/KG	.73	
WG-W6	5-A-WGW6 (7.0)	VANADIUM	MG/KG	87.90	
WG-W6	5-A-WGW6 (7.0)	ZINC	MG/KG	30.00	
WG-W6	5-A-WGW6 (7.0)	TOLUENE	UG/KG	8.00	J
WG-W8	0-A-WGW8 (7.0)	ALUMINUM	MG/KG	16700.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
WG-W8	0-A-WGW8 (7.0)	ANTIMONY	MG/KG	8.70	
WG-W8	0-A-WGW8 (7.0)	ARSENIC	MG/KG	3.40	
WG-W8	0-A-WGW8 (7.0)	BARIUM	MG/KG	18.80	J
WG-W8	0-A-WGW8 (7.0)	BERYLLIUM	MG/KG	.14	
WG-W8	0-A-WGW8 (7.0)	CADMIUM	MG/KG	.76	
WG-W8	0-A-WGW8 (7.0)	CALCIUM	MG/KG	5810.00	
WG-W8	0-A-WGW8 (7.0)	CHROMIUM	MG/KG	17.70	
WG-W8	0-A-WGW8 (7.0)	COBALT	MG/KG	7.50	J
WG-W8	0-A-WGW8 (7.0)	COPPER	MG/KG	24.70	
WG-W8	0-A-WGW8 (7.0)	CYANIDE	MG/KG	.70	
WG-W8	0-A-WGW8 (7.0)	IRON	MG/KG	28200.00	
WG-W8	0-A-WGW8 (7.0)	LEAD	MG/KG	29.00	
WG-W8	0-A-WGW8 (7.0)	MAGNESIUM	MG/KG	5560.00	
WG-W8	0-A-WGW8 (7.0)	MANGANESE	MG/KG	379.00	
WG-W8	0-A-WGW8 (7.0)	MERCURY	MG/KG	.11	
WG-W8	0-A-WGW8 (7.0)	NICKEL	MG/KG	23.00	
WG-W8	0-A-WGW8 (7.0)	POTASSIUM	MG/KG	412.00	J
WG-W8	0-A-WGW8 (7.0)	SELENIUM	MG/KG	.81	
WG-W8	0-A-WGW8 (7.0)	SILVER	MG/KG	.42	
WG-W8	0-A-WGW8 (7.0)	SODIUM	MG/KG	1090.00	J
WG-W8	0-A-WGW8 (7.0)	THALLIUM	MG/KG	.45	
WG-W8	0-A-WGW8 (7.0)	VANADIUM	MG/KG	72.50	
WG-W8	0-A-WGW8 (7.0)	ZINC	MG/KG	32.00	
WG-W8	0-A-WGW8 (7.0)	TOLUENE	UG/KG	3.00	J
WG-W8	0-A-WGW8RE (7.0, RE)	TOLUENE	UG/KG	3.00	J
WG-WP10	WG-107 (0-0.5)	ALUMINUM	MG/KG	13200.00	*
WG-WP10	WG-107 (0-0.5)	ARSENIC	MG/KG	5.00	
WG-WP10	WG-107 (0-0.5)	BARIUM	MG/KG	26.10	*B
WG-WP10	WG-107 (0-0.5)	BERYLLIUM	MG/KG	.23	B
WG-WP10	WG-107 (0-0.5)	CALCIUM	MG/KG	8130.00	*
WG-WP10	WG-107 (0-0.5)	CHROMIUM	MG/KG	20.50	

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(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
WG-WP10	WG-107 (0-0.5)	COBALT	MG/KG	7.60	B
WG-WP10	WG-107 (0-0.5)	COPPER	MG/KG	19.60	
WG-WP10	WG-107 (0-0.5)	IRON	MG/KG	18500.00	*
WG-WP10	WG-107 (0-0.5)	LEAD	MG/KG	16.80	
WG-WP10	WG-107 (0-0.5)	MAGNESIUM	MG/KG	7750.00	*
WG-WP10	WG-107 (0-0.5)	MANGANESE	MG/KG	269.00	
WG-WP10	WG-107 (0-0.5)	NICKEL	MG/KG	28.70	
WG-WP10	WG-107 (0-0.5)	POTASSIUM	MG/KG	584.00	B
WG-WP10	WG-107 (0-0.5)	SILVER	MG/KG	.58	B
WG-WP10	WG-107 (0-0.5)	SODIUM	MG/KG	1700.00	
WG-WP10	WG-107 (0-0.5)	VANADIUM	MG/KG	68.60	
WG-WP10	WG-107 (0-0.5)	ZINC	MG/KG	43.90	
WG-WP10	WG-107 (0-0.5)	AROCOR-1254	UG/KG	36.00	JP
WG-WP10	WG-107 (0-0.5)	FLUORANTHENE	UG/KG	70.00	J
WG-WP10	WG-107 (0-0.5)	PHENANTHRENE	UG/KG	60.00	J
WG-WP10	WG-107 (0-0.5)	bis (2-ETHYLHEXYL) PHTHALATE	UG/KG	190.00	BJ
WG-WP10	WG-107 (0-0.5)	METHYLENE CHLORIDE	UG/KG	9.00	J
WG-WP20	SOSSWG27 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	327.00	
WG-WP21	WG-108 (0-0.5)	ALUMINUM	MG/KG	13100.00	*
WG-WP21	WG-108 (0-0.5)	ARSENIC	MG/KG	3.30	B
WG-WP21	WG-108 (0-0.5)	BARIUM	MG/KG	26.40	*B
WG-WP21	WG-108 (0-0.5)	BERYLLIUM	MG/KG	.32	B
WG-WP21	WG-108 (0-0.5)	CADMIUM	MG/KG	1.50	*B
WG-WP21	WG-108 (0-0.5)	CALCIUM	MG/KG	7580.00	*
WG-WP21	WG-108 (0-0.5)	CHROMIUM	MG/KG	28.80	
WG-WP21	WG-108 (0-0.5)	COBALT	MG/KG	4.70	B
WG-WP21	WG-108 (0-0.5)	COPPER	MG/KG	25.40	
WG-WP21	WG-108 (0-0.5)	IRON	MG/KG	18300.00	
WG-WP21	WG-108 (0-0.5)	LEAD	MG/KG	44.10	*S
WG-WP21	WG-108 (0-0.5)	MAGNESIUM	MG/KG	6430.00	
WG-WP21	WG-108 (0-0.5)	MANGANESE	MG/KG	187.00	*

(a) The information within the parenthesis indicates sample depth (feet). See Note (b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-WP21	WG-108 (0-0.5)	NICKEL	MG/KG	29.50	
WG-WP21	WG-108 (0-0.5)	POTASSIUM	MG/KG	336.00	B
WG-WP21	WG-108 (0-0.5)	SODIUM	MG/KG	1530.00	B
WG-WP21	WG-108 (0-0.5)	VANADIUM	MG/KG	75.90	
WG-WP21	WG-108 (0-0.5)	ZINC	MG/KG	94.30	
WG-WP21	WG-108 (0-0.5)	4-METHYLPHENOL	UG/KG	1000.00	
WG-WP21	WG-108 (0-0.5)	PHENOL	UG/KG	160.00	J
WG-WP21	WG-108 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	300.00	BJ
WG-WP21	WG-108 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	174.00	
WG-WP33	SOSSWG42 (0-0.5)	ALUMINUM	MG/KG	9830.00	*
WG-WP33	WG-110 (0-0.5)	ARSENIC	MG/KG	5.10	
WG-WP33	WG-110 (0-0.5)	BARIUM	MG/KG	23.80	*B
WG-WP33	WG-110 (0-0.5)	BERYLLIUM	MG/KG	.23	B
WG-WP33	WG-110 (0-0.5)	CALCIUM	MG/KG	6390.00	*
WG-WP33	WG-110 (0-0.5)	CHROMIUM	MG/KG	14.90	
WG-WP33	WG-110 (0-0.5)	COBALT	MG/KG	5.00	B
WG-WP33	WG-110 (0-0.5)	COPPER	MG/KG	26.00	
WG-WP33	WG-110 (0-0.5)	IRON	MG/KG	18700.00	*
WG-WP33	WG-110 (0-0.5)	LEAD	MG/KG	6.40	
WG-WP33	WG-110 (0-0.5)	MAGNESIUM	MG/KG	7850.00	
WG-WP33	WG-110 (0-0.5)	MANGANESE	MG/KG	288.00	*
WG-WP33	WG-110 (0-0.5)	NICKEL	MG/KG	13.80	
WG-WP33	WG-110 (0-0.5)	POTASSIUM	MG/KG	945.00	B
WG-WP33	WG-110 (0-0.5)	SODIUM	MG/KG	857.00	B
WG-WP33	WG-110 (0-0.5)	VANADIUM	MG/KG	57.90	
WG-WP33	WG-110 (0-0.5)	ZINC	MG/KG	38.40	
WG-WP33	WG-110 (0-0.5)	FLUORANTHENE	UG/KG	59.00	J
WG-WP33	WG-110 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	180.00	BJ
WG-WP33	WG-110 (0-0.5)	METHYLENE CHLORIDE	UG/KG	17.00	B
WG-WP5	WG-110 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	212.00	
WG-WP7	SOSSWG11 (0-0.5)	ALUMINUM	MG/KG	16100.00	*

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-WP7	WG-109 (0-0.5)	ARSENIC	MG/KG	4.00	*
WG-WP7	WG-109 (0-0.5)	BARIUM	MG/KG	370.00	*
WG-WP7	WG-109 (0-0.5)	BERYLLIUM	MG/KG	.33	B
WG-WP7	WG-109 (0-0.5)	CADMIUM	MG/KG	1.40	*
WG-WP7	WG-109 (0-0.5)	CALCIUM	MG/KG	11600.00	*
WG-WP7	WG-109 (0-0.5)	CHROMIUM	MG/KG	32.90	*
WG-WP7	WG-109 (0-0.5)	COBALT	MG/KG	8.10	B
WG-WP7	WG-109 (0-0.5)	COPPER	MG/KG	95.70	*
WG-WP7	WG-109 (0-0.5)	IRON	MG/KG	25100.00	*
WG-WP7	WG-109 (0-0.5)	LEAD	MG/KG	137.00	*
WG-WP7	WG-109 (0-0.5)	MAGNESIUM	MG/KG	8430.00	*
WG-WP7	WG-109 (0-0.5)	MANGANESE	MG/KG	327.00	*
WG-WP7	WG-109 (0-0.5)	NICKEL	MG/KG	27.00	*
WG-WP7	WG-109 (0-0.5)	POTASSIUM	MG/KG	766.00	B
WG-WP7	WG-109 (0-0.5)	SODIUM	MG/KG	2330.00	B
WG-WP7	WG-109 (0-0.5)	THALLIUM	MG/KG	.47	B
WG-WP7	WG-109 (0-0.5)	VANADIUM	MG/KG	89.10	*
WG-WP7	WG-109 (0-0.5)	ZINC	MG/KG	320.00	*
WG-WP7	WG-109 (0-0.5)	2-METHYLNAPHTHALENE	UG/KG	1200.00	J
WG-WP7	WG-109 (0-0.5)	ACENAPHTHENE	UG/KG	15000.00	*
WG-WP7	WG-109 (0-0.5)	ANTHRACENE	UG/KG	38000.00	*
WG-WP7	WG-109 (0-0.5)	BENZO(A)ANTHRACENE	UG/KG	43000.00	*
WG-WP7	WG-109 (0-0.5)	BENZO(A)PYRENE	UG/KG	36000.00	*
WG-WP7	WG-109 (0-0.5)	BENZO(B)FLUORANTHENE	UG/KG	61000.00	*
WG-WP7	WG-109 (0-0.5)	BENZO(G,H,I)PERYLENE	UG/KG	13000.00	*
WG-WP7	WG-109 (0-0.5)	BENZO(K)FLUORANTHENE	UG/KG	21000.00	*
WG-WP7	WG-109 (0-0.5)	CARBAZOLE	UG/KG	13000.00	*
WG-WP7	WG-109 (0-0.5)	CHRYSENE	UG/KG	35000.00	*
WG-WP7	WG-109 (0-0.5)	DIBENZO(A,H)ANTHRACENE	UG/KG	4800.00	*
WG-WP7	WG-109 (0-0.5)	DIBENZOFURAN	UG/KG	12000.00	*
WG-WP7	WG-109 (0-0.5)	FLUORANTHENE	UG/KG	130000.00	E

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 RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-WP7	WG-109 (0-0.5)	FLUORENE	UG/KG	21000.00	
WG-WP7	WG-109 (0-0.5)	INDENO(1,2,3-C,D) PYRENE	UG/KG	20000.00	
WG-WP7	WG-109 (0-0.5)	NAPHTHALENE	UG/KG	1600.00	J
WG-WP7	WG-109 (0-0.5)	PHENANTHRENE	UG/KG	120000.00	E
WG-WP7	WG-109 (0-0.5)	PYRENE	UG/KG	81000.00	E
WG-WP7	WG-109 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	2000.00	BJ
WG-WP7	WG-109 (0-0.5)	METHYLENE CHLORIDE	UG/KG	7.00	J
WG-WP7	WG-109DL (0-0.5, DIL)	ACENAPHTHENE	UG/KG	16000.00	DJ
WG-WP7	WG-109DL (0-0.5, DIL)	ANTHRACENE	UG/KG	34000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	BENZO(A) ANTHRACENE	UG/KG	38000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	BENZO(A) PYRENE	UG/KG	33000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	BENZO(B) FLUORANTHENE	UG/KG	56000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	BENZO(G,H,I) PERYLENE	UG/KG	17000.00	DJ
WG-WP7	WG-109DL (0-0.5, DIL)	CARBAZOLE	UG/KG	10000.00	DJ
WG-WP7	WG-109DL (0-0.5, DIL)	CHRYSENE	UG/KG	41000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	DIBENZO(A,H) ANTHRACENE	UG/KG	5400.00	DJ
WG-WP7	WG-109DL (0-0.5, DIL)	DIBENZOFURAN	UG/KG	13000.00	DJ
WG-WP7	WG-109DL (0-0.5, DIL)	FLUORANTHENE	UG/KG	96000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	FLUORENE	UG/KG	21000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	INDENO(1,2,3-C,D) PYRENE	UG/KG	25000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	PHENANTHRENE	UG/KG	110000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	PYRENE	UG/KG	79000.00	D
WG-WP7	WG-109DL (0-0.5, DIL)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	2100.00	BDJ
WG-WP7	WG-109RE (0-0.5, RE)	ENDRIN KETONE	UG/KG	3.40	JP
WG-WP9	WG-106 (0-0.5)	ALUMINUM	MG/KG	21300.00	*
WG-WP9	WG-106 (0-0.5)	ARSENIC	MG/KG	6.80	
WG-WP9	WG-106 (0-0.5)	BARIUM	MG/KG	36.90	*B
WG-WP9	WG-106 (0-0.5)	BERYLLIUM	MG/KG	.36	B
WG-WP9	WG-106 (0-0.5)	CALCIUM	MG/KG	12700.00	*
WG-WP9	WG-106 (0-0.5)	CHROMIUM	MG/KG	38.70	
WG-WP9	WG-106 (0-0.5)	COBALT	MG/KG	11.30	B

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(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.4. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
WG-WP9	WG-106 (0-0.5)	COPPER	MG/KG	22.30	
WG-WP9	WG-106 (0-0.5)	IRON	MG/KG	31600.00	
WG-WP9	WG-106 (0-0.5)	LEAD	MG/KG	17.90	*S
WG-WP9	WG-106 (0-0.5)	MAGNESIUM	MG/KG	10700.00	
WG-WP9	WG-106 (0-0.5)	MANGANESE	MG/KG	349.00	*
WG-WP9	WG-106 (0-0.5)	NICKEL	MG/KG	37.10	
WG-WP9	WG-106 (0-0.5)	POTASSIUM	MG/KG	763.00	B
WG-WP9	WG-106 (0-0.5)	SODIUM	MG/KG	2730.00	
WG-WP9	WG-106 (0-0.5)	VANADIUM	MG/KG	129.00	
WG-WP9	WG-106 (0-0.5)	ZINC	MG/KG	61.20	
WG-WP9	WG-106 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	180.00	BJ
WG-WP9	WG-106 (0-0.5)	METHYLENE CHLORIDE	UG/KG	8.00	BJ

 (a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
 RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

FIGURE 3.6. WG Ground

LEGEND

— GROUNDWATER
CONTOURS
(CONTOUR INTERVAL 5 FEET)

for toluene at 1.3 and 1.0 $\mu\text{g/L}$, respectively (Table 3.3). Well points WP1 and WP2 were positive for xylenes at 8 $\mu\text{g/L}$ and 5 $\mu\text{g/L}$, respectively. All well points with BTEX compounds detected in the groundwater had surface TPH concentrations of over 100 mg/kg. However, many of the well points with high surface TPH concentrations did not have BTEX in the water samples.

Water samples were collected at three different times during the investigation from inside the water gallery collection tubes where the tubes enter the water collection manhole (Figure 3.4). These samples were analyzed for BTEX, TCE, and PCE. Results indicated that most of the TCE contaminant was coming from the collection tubes to the west of the center manhole. These two tubes also were providing the majority of the flow for the system. TCE concentrations during the first shift were approximately 3 to 5 $\mu\text{g/L}$ (Table 3.3) and approximately 7 $\mu\text{g/L}$ during the second shift.

Using the information from the well points, monitoring wells were installed to more closely define where the TCE contamination was originating. Eight monitoring wells were installed and sampled for BTEX, TCE, and PCE using the CSL for quick turnaround. Figure 3.3 shows the locations of the wells, and Table 3.5 presents the contaminants found in each well.

During the drilling of each well, soil samples were obtained throughout the soil profile and again analyzed for TPH, BTEX, TCE, and PCE. TPH concentrations ranged from less than detection (25 mg/kg) to 117 mg/kg (Table 3.3). Well 4 (WG-W4) showed minor amounts of xylene (14 $\mu\text{g/kg}$) and Well 2 (WG-W2) had higher concentrations of xylene (124 $\mu\text{g/kg}$) (Table 3.3) and minor amounts of other volatiles. No other wells had detects of volatile compounds in the soil samples.

TABLE 3.5. Water Gallery Monitoring Wells

Well (w)	Groundwater Contaminants ($\mu\text{g/L}$)
1	TCE = 2.4
2	T = 16.3, E = 3.7, X = 18.9
3	TCE = 4.7
4	TCE = 20, DCE = 1
5	TCE = 1, Acetone = 920, T = 11
6	T = 8
7	TCE = 18
8	T = 3

T = Toluene

E = Ethylbenzene

X = Xylene

No source for TCE was found in the drilled sediments above the water table, although the concentration in the groundwater indicated that the source was just north of the collection system.

As a last effort to locate the source of the TCE, backhoe trenches and pits were dug in the berm on the north side of the water gallery. These pits extended to a hardpan where water was pooling during excavation. Soil samples were analyzed for BTEX, TCE, and PCE. Results from these samples again showed some BTEX compounds present in the soil but no TCE.

The soil boring logs (Appendix E) indicate that the surface material comprises peat and sand. Because most of the area has been disturbed, the thickness of these layers varies widely, from 2 feet to 13 feet. Below these layers is a gravel hardpan of 2 to 4 feet followed by bedrock. The top of the bedrock is fairly weathered and was penetrated up to 2 feet before auger refusal.

3.2.4 Nature and Extent of Contamination

Sampling that has been performed within the water gallery indicates that there is fairly widespread low-level TPH contamination within the watershed of the water gallery. Table 3.6 and Table 3.7 present the analytes with positive results, the total number of samples analyzed, the number of samples with a positive result, and the range of the positive results. The area around Hangar 4 seems to be the most heavily contaminated, although some of that contamination has been removed since it was sampled in July.

An area of TCE contamination exists between monitoring wells 4, 6, 7, and 8 (WG-W4, WG-W6, WG-W7, and WG-W8). Backhoe pits dug in the area did not reveal any TCE contamination in the zone between the surface and the water table. Because the TCE does not appear to be coming from the vadose zone, it may be a dense non aqueous phase liquid (DNAPL) lying in a pool on top of, or within, the bedrock.

3.2.5 Preliminary Risk Assessment

Several water samples from the water gallery exceeded preliminary risk levels (PRLs) for human health. These samples are listed in Table 3.8. Only one soil sample exceeded the PRLs, sample WG-109, taken from an area southeast of Hangar 4. This area has been excavated since the time the sample was taken and the excavated material is stockpiled on Runway B.

Monitoring wells 4 (WG-W4) and 7 (WG-W7) exceeded the maximum contaminant level (MCL) ($5 \mu\text{g/L}$) for TCE as did one of the samples taken from the center manhole (CM1) of the collection gallery and a sump in the pump house (SO2). This indicates that, at times, the drinking water from the water gallery may be above the MCL for TCE. With reconstruction of the water gallery in late 1992, now complete, it is not known how this has affected the TCE concentrations. Well 3 (WG-W3) exceeded the MCL for chromium. Other metals were also above PRLs for wells 3 and 4 (Table 3.8).

TABLE 3.6. Analytes with Positive Results in Soils at the Water Gallery

Analyte	Total Number of Samples	Number of Samples with Positive Result	Range of Results ^(a)
Bis(2-ethylhexyl)phthalate	5	5	180 to 2,000
Fluoranthene	5	2	59 to 130,000
Aroclor-1254	5	1	36
Phenol	5	1	160
4-methylphenol	5	1	1,000
Naphthalene	5	1	1,600
2-methylnaphthalene	5	1	1,200
Acenaphthalene	5	1	15,000
Dibenzofuran	5	1	12,000
Fluorene	5	2	70 to 21,000
Phenanthrene	5	2	60 to 120,000
Anthracene	5	1	38,000
Carbazole	5	1	13,000
Pyrene	5	1	81,000
Benzo(a)anthracene	5	1	43,000
Chrysene	5	1	35,000
Benzo(b)fluoranthene	5	1	61,000
Benzo(k)fluoranthene	5	1	21,000
Benzo(a)pyrene	5	1	36,000
Indeno(1,2,3-cd)pyrene	5	1	20,000
Dibenzo(a,h)anthracene	5	1	4,800
Benzo(g,h,i)perylene	5	1	13,000
Endrin Ketone	5	1	3.4
Methylene Chloride	5	3	8 to 17
Xylene	106	15	7 to 347
Toluene	106	3	10 to 99
Arsenic	5	5	5 to 6.8
Chromium	5	5	20.5 to 38.7
Lead	5	5	6.4 to 137
Zinc	5	5	38.4 to 320
Total Petroleum Hydrocarbons	106	60	25 to 4,763

^(a)Metals and TPH are in mg/kg. All other analytes are in $\mu\text{g/kg}$.

TABLE 3.7. Analytes with Positive Results in Water at the Water Gallery

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Result</u>	<u>Range of Results^(a)</u>
Trichloroethene	68	12	2 - 25
Acetone	6	1	920
Benzene	68	1	2
Toluene	68	7	1 - 11
Ethylbenzene	68	2	1 - 2
Xylene	68	6	1 - 33
2-Butanone	6	1	200
1,2-Dichloroethene	6	1	1
Bis(2-ethylhexyl)phthalate	6	1	1

TABLE 3.8. Contaminants of Potential Concern (COPCs) at the Water Gallery that Exceed Human Health Preliminary Risk Levels (PRLs)

Sample No	Depth (ft.)	Chemical	Concentration	Qualifier	Laboratory	PRL Concentration	PRL Source
GROUNDWATER COPCs			(ug/L)			(ug/L)	
<i>Water Gallery</i>							
CM1		Trichloroethylene	7.2		ONSITE	5	MCL
SO2		Trichloroethylene	5.1		ONSITE	5	MCL
WGW4		Trichloroethylene	24.9		ONSITE	5	MCL
WG4		Trichloroethylene	16.4		ONSITE	5	MCL
WGW4		Trichloroethylene	22.2		ONSITE	5	MCL
WG7		Trichloroethylene	17.6		ONSITE	5	MCL
WGW7		Trichloroethylene	18.2		ONSITE	5	MCL
A-WGW3		Antimony(a)	31.1		WC	10	MCL-p
A-WGW3		Beryllium	0.75		WC	0.0039	WQC
A-WGW3		Chromium	53.4		WC	50	MCL
A-WGW3		Manganese	2170		WC	710	NC
A-WGW4		Antimony(a)	31.1		WC	10	MCL-p
A-WGW4		Beryllium(a)	0.5		WC	0.0039	WQC
A-WGW4		Manganese	892		WC	710	NC
A-WGW4		Trichloroethene	15		WC	5	MCL
SURFACE SOILS COPCs			(ug/kg)			(ug/kg)	
<i>WG: Water Gallery</i>							
WG-109	0.5	Chrysene	35000		OFFSITE	1400	C
WG-109	0.5	Benzo(a)anthracene	43000		OFFSITE	1400	C
WG-109	0.5	Benzo(b)fluoranthene	61000		OFFSITE	1400	C
WG-109	0.5	Benzo(k)fluoranthene	21000		OFFSITE	1400	C
WG-109	0.5	Benzo(a)pyrene	36000		OFFSITE	1400	C
WG-109	0.5	Indeno(1,2,3-cd)pyrene	20000		OFFSITE	1400	C
WG-109	0.5	Arsenic	6800		OFFSITE	5700	C

(a) = detection limit

Notes:

MCL = Safe Drinking Water Act Maximum Contaminant Level

MCL-p = Proposed Safe Drinking Water Act Maximum Contaminant Level

WQC = Ambient Water Quality Criteria

NC = Risk-based Concentration/Noncarcinogenic Effects

C = Risk-based Concentration/Carcinogenic Effects

ONSITE = Close Support Laboratory (on Shemya Island)

OFFSITE = Contract Laboratory Program Methodology (samples sent to offsite lab)

WC = Woodward-Clyde Data

J = estimated value

D = dilution

B = blank contamination

The preliminary ecological risk assessment (Appendix D) determined that indeno (1, 2, 3-cd) pyrene and phenanthrene in one soil sample (WG-WP7 sample ID = WG-109) may present some risk to terrestrial animals at the site. However, the area was remediated after the sample was taken. No groundwater constituents were determined to pose an ecological risk. Antimony, iron, aluminum, and cobalt also exceeded ecological PRLs within the water gallery.

3.2.6 Future Actions

The probable location of the TCE source is a DNAPL pool on, or within, the fractured bedrock. This location makes removal of the source very difficult and expensive for the concentrations being found in the drinking water.

Consequently, recommended actions at the water gallery include monthly sampling for TCE, moving vehicle maintenance activities out of Hangar 4, restricting all future development within the water gallery, and the installation of a filtration system capable of removing TCE from the water. As an interim measure, until the filtration system is installed, water from the backup wells could be mixed with the water from the collection system to ensure that TCE levels remain below the MCL.

3.3 FIRE TRAINING SITE 1: LIGHTNING STRIKE (FT-1)

3.3.1 Site Background

FT-1 is located on a peninsula on the west side of Skoot Cove (Figure 3.7). It is bordered by bedrock cliffs that rise to a grassy knoll on the west and the ocean on the south and the east. The only road access to the site is from the north where a narrow flat piece of land leads to the main portion of the island. The site has been graded flat and is approximately 5 feet above the high tide mark on the adjacent beach. Surface water drainage from this site is directly into the ocean. However, because of the flat terrain of the site and the low intensity of rainfall that is normal for Shemya, little surface water runoff is created at this site and no defined drainage channels exist.

From the early 1970s until the mid-1980s, FT-1 was used as a fire training area by the Air Force. Waste oil, diesel, and JP-4 were used to start and sustain fires that were then put out by the fire department using aqueous film-forming foam (AFFF). After the fire was extinguished some of the flammable fluids remained and were allowed to infiltrate into the soil. In recent years, the area has been used by base personnel for barbecues and to build bonfires.

The entire area of FT-1 has been disturbed by past activities. The surface of the area is a silty sand and gravel that extends down to 3 to 4 feet. This is generally followed by a claystone down to at least 20 feet bgs, the deepest of the boreholes at this site. It is not known what lies beneath the claystone. Groundwater has been encountered within the claystone but well below the gravel layer.

3.3.2 Previous Investigations

In September 1987, the CH2M HILL investigation team reported that no barrels or drums were visible and no oil-stained soil was noted. The 1988 field investigation identified an approximately 100-foot-diameter darkened soils area at this site. One backhoe pit was excavated near the center of the disturbed area. The pit exposed ash and oxidized residues, broken glass, metal debris, and darkened soils. The backhoe pit was excavated to a depth of 4 feet. At this depth, it appears that the amount of debris diminished. Large fill rock and sloughing of the pit walls made excavation of the pit below 4 feet too difficult to continue.

Concentrations of TPH identified in the backhoe pit sampling were 2,300 mg/kg at the 2-foot depth and 2,000 mg/kg at the 4-foot depth. Total lead was detected at 320 mg/kg at the 2-foot depth and 280 mg/kg at the 4-foot depth. The semivolatile compound di-n-Butyl-phthalate was detected at 0.55 mg/kg at the 4-foot depth (result was qualified as an estimate). Volatile analysis results showed 1.4 mg/kg 2-butanone at the 4-foot depth. Both of these compounds are common laboratory contaminants.

Whether or not these debris exist throughout the disturbed area was not ascertained. Since that investigation, this area has been graded and a crushed rock cover placed over the disturbed area by the 11th CEOS.

LOCATION MAP

FIGURE 3.7. FT-1 Lighttr

016

LEGEND

- * SOIL SAMPLE LOCATION
- ⊕ BORING LOCATION
- TRENCH LOCATION
- 1988 SAMPLE LOCATIONS
- △ WELL LOCATION

3.3.3 1992 Investigation

During the 1992 field investigation, surface soil sampling, subsurface soil sampling, groundwater sampling, and a geophysical survey were performed at FT-1. Each of these is discussed below.

A 50-foot by 50-foot grid pattern was established at FT-1 to aid in the geophysical investigation and to establish surface sampling locations. The geophysical survey conductivity investigation covered approximately 0.4 acre (Figure 3.8). Conductivity data were collected at 5-foot intervals along lines 10 feet apart. The objective of the survey was to locate buried features (metal or utilities) to be avoided during drilling. Contour maps of the conductivity and in-phase measurements are presented in Appendix B.

Figure 3.8 shows the locations of buried features interpreted from the geophysical data. Two areas of buried metal have been identified. One is adjacent to the cliff at the northwest corner of the survey area and the other is centered on the west side of the site. A utility line was interpreted near the east side of the site, in an area overgrown with weeds. The location of the utility shown in the figure is approximate because the survey lines are nearly parallel to the feature and resolution is lost under these circumstances. Isolated buried metal and possible buried metal have also been identified in several locations as shown in the figure.

Twenty-three surface samples were collected and analyzed onsite for TPH, and three were analyzed for volatile organics (Figure 3.7). The TPH concentrations ranged from less than 25 mg/kg to 1,255 mg/kg (Table 3.9). The highest TPH concentrations were found on the west side of the site near the cliffs. However, only 4 of the 24 surface sample locations had TPH concentrations below the detection limit, indicating widespread TPH contamination. One sample (FT1-022) had a positive hit for xylene at 26.8 $\mu\text{g/kg}$. All samples were taken at the original soil surface, or under the rock cap where it was present.

TABLE 3.9. Positive Results from Onsite (CSL) Data at FT-1

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
FT1-001	SHSOSSFT1-01 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	91.00	
FT1-002	SHSOSSFT1-02 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1254.68	
FT1-003	SHSOSSFT1-03 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	116.87	
FT1-004	SHSOSSFT1-04 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1192.38	
FT1-005	SHSOSSFT1-05 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	784.07	
FT1-006	SHSOSSFT1-06 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	43.78	
FT1-007	SHSOSSFT1-07 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	11.64	
FT1-008	SHSOSSFT1-08 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	8.61	
FT1-009	SHSOSSFT1-09 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	38.24	
FT1-010	SHSOSSFT1-10 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	62.20	
FT1-011	SHSOSSFT1-11 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	480.22	
FT1-012	SHSOSSFT1-12 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	909.70	
FT1-013	SHSOSSFT1-13 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	137.32	
FT1-014	SHSOSSFT1-14 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	24.84	
FT1-015	SHSOSSFT1-15 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	52.29	
FT1-016	SHSOSSFT1-16 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	24.84	
FT1-017	SHSOSSFT1-17 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	351.60	
FT1-018	SHSOSSFT1-18 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	35.48	
FT1-019	SHSOSSFT1-19 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	91.77	
FT1-020	SHSOSSFT1-20 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	104.69	
FT1-021	SHSOSSFT1-21 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	521.41	
FT1-022	SHSOSSFT1-22 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	26.80	
FT1-023	SHSOSSFT1-23 (0-0.5)	m,p-XYLENES	UG/KG	62.41	
FT1-024	SHSOSSFT1-24 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	117.48	
FT1-T1	FT1T14.8 (4.8)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	207.15	
FT1-T3	FT1T30.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	196.32	
FT1-T3	FT1T36.7 (6.7)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	64.36	
FT1-T4	FT1T41.2 (1.2)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	25.45	
FT1-T4	FT1T46.1 (6.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	45.93	
FT1-W1	FT1W114.0 (14.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	109.89	
FT1-W1	FT1W14.5 (4.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1061.53	
FT1-W1	FT1W14.5 (4.5)	HEADSPACE	PPM	4.00	
FT1-W1	FT1W19.5 (9.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	38.50	
FT1-W1	FT1W14.5 (4.5)	m,p-XYLENES	UG/KG	5.50	
FT1-W1	FT1W14.5 (4.5)	o-XYLENE	UG/KG	18.20	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

FIGURE 3.8. FT-1 Gec

LEGEND

— GEOPHYSICAL SURVEY
LINE

INTERPRETED FEATURES

- AREA OF BURIED METAL
- POSSIBLE BURIED METAL
- ISOLATED BURIED METAL
- UTILITY LINE

Subsurface soil sampling locations were selected based on the results of the surface sampling. The location of the two highest TPH concentrations, a low concentration next to a high concentration, and the center of the fire training burn area were chosen. Because of the amount of rock at this site, backhoe trenches were used to collect the subsurface samples instead of soil borings. Trench locations are shown in Figure 3.7. Two samples were collected from each trench, one near the surface and one at the bottom of the trench. All samples were analyzed onsite for TPH (Table 3.9) and offsite for VOAs, semi VOAs, pesticides/PCBs, and metals (Table 3.10). The upper sample from each trench was also analyzed for dioxins (Table 3.10). Logs of the test pits are presented in Appendix E.

Three monitoring wells were attempted at FT-1; however, only one was completed as two of the holes were still dry at the time of auger refusal. Soil boring logs for each borehole are presented in Appendix E. Soil samples were taken for onsite analysis of TPH at approximately 5-foot intervals from each boring. The well that was completed, FT1-W1, had the highest TPH concentration of any of the borings, at 1,062 mg/kg at a depth of 4.5 feet (Table 3.9). One soil sample from each boring, near the bottom of the hole, was sent offsite for analysis of VOAs, semi VOAs, pesticides/PCBs, and metals. Results are presented in Table 3.10.

The one well that was completed was developed and sampled. The water level in this well was approximately 13 feet below ground surface. A single sample was shipped offsite and analyzed for VOAs, semi VOAs, pesticides/PCBs, and metals. Results indicate no organics present, and metals were below MCLs (Table 3.10). Based on a sodium content of 739 mg/L, it does not appear as if the well is completed in seawater, although some saltwater intrusion is probable.

3.3.4 Nature and Extent of Contamination

Table 3.11 presents a summary of the analytical results from FT-1. The table presents the analytes found, the total number of samples, the number of samples with positive results, and the range of the positive results.

TABLE 3.10. Positive Results from Offsite Data at FT-1

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-004	SOSFT104 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	734.00	
FT1-014	SOSFT114 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	15.70	
FT1-024	SOSFT124 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	53.10	
FT1-T1	FT1T12.0 (2.0)	TOTAL ORGANIC CARBON	MG/KG	1050.00	
FT1-T1	FT1T12.0 (2.0)	ALUMINUM	MG/KG	6060.00	
FT1-T1	FT1T12.0 (2.0)	BARIIUM	MG/KG	18.70	
FT1-T1	FT1T12.0 (2.0)	CADMIUM	MG/KG	1.10	
FT1-T1	FT1T12.0 (2.0)	CALCIUM	MG/KG	4690.00	
FT1-T1	FT1T12.0 (2.0)	CHROMIUM	MG/KG	7.30	
FT1-T1	FT1T12.0 (2.0)	COBALT	MG/KG	5.40	
FT1-T1	FT1T12.0 (2.0)	COPPER	MG/KG	82.00	
FT1-T1	FT1T12.0 (2.0)	IRON	MG/KG	11900.00	
FT1-T1	FT1T12.0 (2.0)	LEAD	MG/KG	43.00	J4
FT1-T1	FT1T12.0 (2.0)	MAGNESIUM	MG/KG	5430.00	
FT1-T1	FT1T12.0 (2.0)	MANGANESE	MG/KG	198.00	J4
FT1-T1	FT1T12.0 (2.0)	NICKEL	MG/KG	7.20	
FT1-T1	FT1T12.0 (2.0)	POTASSIUM	MG/KG	230.00	
FT1-T1	FT1T12.0 (2.0)	SODIUM	MG/KG	930.00	
FT1-T1	FT1T12.0 (2.0)	THALLIUM	MG/KG	6.50	J4
FT1-T1	FT1T12.0 (2.0)	VANADIUM	MG/KG	21.90	J4
FT1-T1	FT1T12.0 (2.0)	ZINC	MG/KG	93.10	J4
FT1-T1	FT1T12.0 (2.0)	BUTYLBENZYLPHTHALATE	UG/KG	63.00	J2
FT1-T1	FT1T12.0 (2.0)	bis (2-ETHYLHEXYL) PHTHALATE	UG/KG	46.00	J2
FT1-T1	FT1T14.8 (4.8)	TOTAL ORGANIC CARBON	MG/KG	6610.00	
FT1-T1	FT1T14.8 (4.8)	ALUMINUM	MG/KG	13700.00	
FT1-T1	FT1T14.8 (4.8)	BARIIUM	MG/KG	54.20	
FT1-T1	FT1T14.8 (4.8)	BERYLLIUM	MG/KG	.42	
FT1-T1	FT1T14.8 (4.8)	CADMIUM	MG/KG	1.20	
FT1-T1	FT1T14.8 (4.8)	CALCIUM	MG/KG	4390.00	
FT1-T1	FT1T14.8 (4.8)	CHROMIUM	MG/KG	16.00	
FT1-T1	FT1T14.8 (4.8)	COBALT	MG/KG	10.30	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-T1	FT1T14.8 (4.8)	COPPER	MG/KG	55.00	
FT1-T1	FT1T14.8 (4.8)	IRON	MG/KG	24800.00	
FT1-T1	FT1T14.8 (4.8)	MAGNESIUM	MG/KG	10100.00	
FT1-T1	FT1T14.8 (4.8)	MANGANESE	MG/KG	452.00	J4
FT1-T1	FT1T14.8 (4.8)	NICKEL	MG/KG	12.40	
FT1-T1	FT1T14.8 (4.8)	POTASSIUM	MG/KG	1380.00	
FT1-T1	FT1T14.8 (4.8)	SODIUM	MG/KG	1800.00	
FT1-T1	FT1T14.8 (4.8)	THALLIUM	MG/KG	34.30	J4
FT1-T1	FT1T14.8 (4.8)	VANADIUM	MG/KG	71.80	J4
FT1-T1	FT1T14.8 (4.8)	ZINC	MG/KG	68.80	J4
FT1-T1	FT1T14.8 (4.8)	BENZO(B)FLUORANTHENE	UG/KG	62.00	J
FT1-T1	FT1T14.8 (4.8)	PYRENE	UG/KG	40.00	J
FT1-T1	FT1T14.8 (4.8)	ETHYLBENZENE	UG/KG	8300.00	J
FT1-T1	FT1T14.8 (4.8)	TOLUENE	UG/KG	46000.00	BJ1
FT1-T1	FT1T14.8 (4.8)	XYLENE (total)	UG/KG	130000.00	BJ1
FT1-T2	FT1T21.0 (1.0)	PCDD	UG/KG	.30	
FT1-T2	FT1T21.0 (1.0)	TOTAL ORGANIC CARBON	MG/KG	15300.00	
FT1-T2	FT1T21.0 (1.0)	ALUMINUM	MG/KG	16200.00	
FT1-T2	FT1T21.0 (1.0)	ARSENIC	MG/KG	9.40	
FT1-T2	FT1T21.0 (1.0)	BARIUM	MG/KG	102.00	
FT1-T2	FT1T21.0 (1.0)	BERYLLIUM	MG/KG	.69	
FT1-T2	FT1T21.0 (1.0)	CADMIUM	MG/KG	2.00	
FT1-T2	FT1T21.0 (1.0)	CALCIUM	MG/KG	5590.00	
FT1-T2	FT1T21.0 (1.0)	CHROMIUM	MG/KG	46.10	
FT1-T2	FT1T21.0 (1.0)	COBALT	MG/KG	17.80	
FT1-T2	FT1T21.0 (1.0)	COPPER	MG/KG	66.70	
FT1-T2	FT1T21.0 (1.0)	IRON	MG/KG	33800.00	
FT1-T2	FT1T21.0 (1.0)	MAGNESIUM	MG/KG	10700.00	
FT1-T2	FT1T21.0 (1.0)	MANGANESE	MG/KG	685.00	J4
FT1-T2	FT1T21.0 (1.0)	NICKEL	MG/KG	39.90	
FT1-T2	FT1T21.0 (1.0)	POTASSIUM	MG/KG	1150.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-T2	FT1T21.0 (1.0)	SILVER	MG/KG	.30	
FT1-T2	FT1T21.0 (1.0)	SODIUM	MG/KG	1440.00	
FT1-T2	FT1T21.0 (1.0)	THALLIUM	MG/KG	45.00	J4
FT1-T2	FT1T21.0 (1.0)	VANADIUM	MG/KG	100.00	J4
FT1-T2	FT1T21.0 (1.0)	ZINC	MG/KG	182.00	J4
FT1-T2	FT1T21.0 (1.0)	TOTAL ORGANIC CARBON	MG/KG	4350.00	
FT1-T2	FT1T25.9 (5.9)	ALUMINUM	MG/KG	10900.00	
FT1-T2	FT1T25.9 (5.9)	BARIUM	MG/KG	25.40	
FT1-T2	FT1T25.9 (5.9)	BERYLLIUM	MG/KG	.57	
FT1-T2	FT1T25.9 (5.9)	CADMIUM	MG/KG	1.40	
FT1-T2	FT1T25.9 (5.9)	CALCIUM	MG/KG	5440.00	
FT1-T2	FT1T25.9 (5.9)	CHROMIUM	MG/KG	12.90	
FT1-T2	FT1T25.9 (5.9)	COBALT	MG/KG	8.80	
FT1-T2	FT1T25.9 (5.9)	COPPER	MG/KG	42.30	
FT1-T2	FT1T25.9 (5.9)	IRON	MG/KG	16000.00	
FT1-T2	FT1T25.9 (5.9)	MAGNESIUM	MG/KG	3090.00	
FT1-T2	FT1T25.9 (5.9)	MANGANESE	MG/KG	365.00	J4
FT1-T2	FT1T25.9 (5.9)	NICKEL	MG/KG	18.50	
FT1-T2	FT1T25.9 (5.9)	POTASSIUM	MG/KG	581.00	
FT1-T2	FT1T25.9 (5.9)	SILVER	MG/KG	.29	
FT1-T2	FT1T25.9 (5.9)	SODIUM	MG/KG	1290.00	
FT1-T2	FT1T25.9 (5.9)	THALLIUM	MG/KG	16.20	J4
FT1-T2	FT1T25.9 (5.9)	VANADIUM	MG/KG	42.80	J4
FT1-T2	FT1T25.9 (5.9)	ZINC	MG/KG	57.40	J4
FT1-T2	FT1T25.9 (5.9)	BENZENE	UG/KG	1600.00	J
FT1-T2	FT1T25.9 (5.9)	ETHYLBENZENE	UG/KG	7700.00	J
FT1-T2	FT1T25.9 (5.9)	TOLUENE	UG/KG	51000.00	BJ1
FT1-T2	FT1T25.9 (5.9)	XYLENE (total)	UG/KG	59000.00	BJ1
FT1-T3	FT1T30.5 (0-0.5)	PCDD	UG/KG	4.90	
FT1-T3	FT1T30.5 (0-0.5)	PCDF	UG/KG	1.10	
FT1-T3	FT1T30.5 (0-0.5)	TOTAL ORGANIC CARBON	MG/KG	31000.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

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RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-T3	FT1T30.5 (0-0.5)	ALUMINUM	MG/KG	13200.00	
FT1-T3	FT1T30.5 (0-0.5)	ANTIMONY	MG/KG	8.50	
FT1-T3	FT1T30.5 (0-0.5)	ARSENIC	MG/KG	19.30	
FT1-T3	FT1T30.5 (0-0.5)	BARIUM	MG/KG	588.00	
FT1-T3	FT1T30.5 (0-0.5)	BERYLLIUM	MG/KG	.59	
FT1-T3	FT1T30.5 (0-0.5)	CADMIUM	MG/KG	3.50	
FT1-T3	FT1T30.5 (0-0.5)	CALCIUM	MG/KG	41600.00	
FT1-T3	FT1T30.5 (0-0.5)	CHROMIUM	MG/KG	39.00	
FT1-T3	FT1T30.5 (0-0.5)	COBALT	MG/KG	12.70	
FT1-T3	FT1T30.5 (0-0.5)	COPPER	MG/KG	216.00	
FT1-T3	FT1T30.5 (0-0.5)	IRON	MG/KG	23300.00	
FT1-T3	FT1T30.5 (0-0.5)	LEAD	MG/KG	171.00	J4
FT1-T3	FT1T30.5 (0-0.5)	MAGNESIUM	MG/KG	9060.00	
FT1-T3	FT1T30.5 (0-0.5)	MANGANESE	MG/KG	428.00	J4
FT1-T3	FT1T30.5 (0-0.5)	MOLYBDENUM	MG/KG	2.50	
FT1-T3	FT1T30.5 (0-0.5)	NICKEL	MG/KG	20.30	
FT1-T3	FT1T30.5 (0-0.5)	POTASSIUM	MG/KG	882.00	
FT1-T3	FT1T30.5 (0-0.5)	SILVER	MG/KG	2.90	
FT1-T3	FT1T30.5 (0-0.5)	SODIUM	MG/KG	1290.00	
FT1-T3	FT1T30.5 (0-0.5)	THALLIUM	MG/KG	31.70	J4
FT1-T3	FT1T30.5 (0-0.5)	VANADIUM	MG/KG	70.90	J4
FT1-T3	FT1T30.5 (0-0.5)	ZINC	MG/KG	594.00	J4
FT1-T3	FT1T30.5 (0-0.5)	ANTHRACENE	UG/KG	98.00	J
FT1-T3	FT1T30.5 (0-0.5)	BENZO(A)ANTHRACENE	UG/KG	220.00	J
FT1-T3	FT1T30.5 (0-0.5)	BENZO(A)PYRENE	UG/KG	200.00	J
FT1-T3	FT1T30.5 (0-0.5)	BENZO(B)FLUORANTHENE	UG/KG	280.00	J
FT1-T3	FT1T30.5 (0-0.5)	BENZO(K)FLUORANTHENE	UG/KG	84.00	J
FT1-T3	FT1T30.5 (0-0.5)	CHRYSENE	UG/KG	440.00	J
FT1-T3	FT1T30.5 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	160.00	BJ
FT1-T3	FT1T30.5 (0-0.5)	DIBENZOFURAN	UG/KG	92.00	J
FT1-T3	FT1T30.5 (0-0.5)	FLUORANTHENE	UG/KG	490.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

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RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-T3	FT1T30.5 (0-0.5)	FLUORENE	UG/KG	78.00	J
FT1-T3	FT1T30.5 (0-0.5)	NAPHTHALENE	UG/KG	130.00	J
FT1-T3	FT1T30.5 (0-0.5)	PHENANTHRENE	UG/KG	630.00	J
FT1-T3	FT1T30.5 (0-0.5)	PYRENE	UG/KG	460.00	J
FT1-T3	FT1T30.5 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	790.00	
FT1-T3	FT1T36.7 (6.7)	TOTAL ORGANIC CARBON	MG/KG	7000.00	
FT1-T3	FT1T36.7 (6.7)	ALUMINUM	MG/KG	16500.00	
FT1-T3	FT1T36.7 (6.7)	ANTIMONY	MG/KG	4.70	
FT1-T3	FT1T36.7 (6.7)	BARIIUM	MG/KG	46.30	
FT1-T3	FT1T36.7 (6.7)	BERYLLIUM	MG/KG	.51	
FT1-T3	FT1T36.7 (6.7)	CADMIUM	MG/KG	1.40	
FT1-T3	FT1T36.7 (6.7)	CALCIUM	MG/KG	6670.00	
FT1-T3	FT1T36.7 (6.7)	CHROMIUM	MG/KG	13.10	
FT1-T3	FT1T36.7 (6.7)	COBALT	MG/KG	12.40	
FT1-T3	FT1T36.7 (6.7)	COPPER	MG/KG	47.60	
FT1-T3	FT1T36.7 (6.7)	IRON	MG/KG	19100.00	
FT1-T3	FT1T36.7 (6.7)	MAGNESIUM	MG/KG	15500.00	
FT1-T3	FT1T36.7 (6.7)	MANGANESE	MG/KG	272.00	J4
FT1-T3	FT1T36.7 (6.7)	NICKEL	MG/KG	30.80	
FT1-T3	FT1T36.7 (6.7)	POTASSIUM	MG/KG	743.00	
FT1-T3	FT1T36.7 (6.7)	SODIUM	MG/KG	2150.00	
FT1-T3	FT1T36.7 (6.7)	THALLIUM	MG/KG	37.70	J4
FT1-T3	FT1T36.7 (6.7)	VANADIUM	MG/KG	51.70	J4
FT1-T3	FT1T36.7 (6.7)	ZINC	MG/KG	41.00	J4
FT1-T4	FT1T41.2 (1.2)	PCDD	UG/KG	.90	
FT1-T4	FT1T41.2 (1.2)	PCDF	UG/KG	.10	
FT1-T4	FT1T41.2 (1.2)	ALUMINUM	MG/KG	11300.00	
FT1-T4	FT1T41.2 (1.2)	ANTIMONY	MG/KG	55.30	
FT1-T4	FT1T41.2 (1.2)	ARSENIC	MG/KG	21.50	
FT1-T4	FT1T41.2 (1.2)	BARIIUM	MG/KG	396.00	
FT1-T4	FT1T41.2 (1.2)	BERYLLIUM	MG/KG	.61	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-T4	FT1T41.2	CADMIUM	MG/KG	8.30	
FT1-T4	FT1T41.2	CALCIUM	MG/KG	3310.00	
FT1-T4	FT1T41.2	CHROMIUM	MG/KG	79.90	
FT1-T4	FT1T41.2	COBALT	MG/KG	18.00	
FT1-T4	FT1T41.2	COPPER	MG/KG	193.00	
FT1-T4	FT1T41.2	IRON	MG/KG	132000.00	
FT1-T4	FT1T41.2	LEAD	MG/KG	671.00	J4
FT1-T4	FT1T41.2	MAGNESIUM	MG/KG	8790.00	
FT1-T4	FT1T41.2	MANGANESE	MG/KG	459.00	J4
FT1-T4	FT1T41.2	MOLYBDENUM	MG/KG	14.00	
FT1-T4	FT1T41.2	NICKEL	MG/KG	111.00	
FT1-T4	FT1T41.2	POTASSIUM	MG/KG	1190.00	
FT1-T4	FT1T41.2	SODIUM	MG/KG	1130.00	
FT1-T4	FT1T41.2	THALLIUM	MG/KG	13.90	J4
FT1-T4	FT1T41.2	VANADIUM	MG/KG	86.30	J4
FT1-T4	FT1T41.2	ZINC	MG/KG	1320.00	J4
FT1-T4	FT1T41.2	2-METHYLNAPHTHALENE	UG/KG	130.00	J
FT1-T4	FT1T41.2	BENZO(A) PYRENE	UG/KG	140.00	J
FT1-T4	FT1T41.2	CHRYSENE	UG/KG	150.00	J
FT1-T4	FT1T41.2	DI-n-BUTYLPHTHALATE	UG/KG	140.00	J
FT1-T4	FT1T41.2	NAPHTHALENE	UG/KG	500.00	J
FT1-T4	FT1T41.2	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	92.00	J
FT1-T4	FT1T41.2	TOLUENE	UG/KG	3700.00	J4
FT1-T4	FT1T41.2	XYLENE (total)	UG/KG	2200.00	J4
FT1-T4	FT1T46.1	ALUMINUM	MG/KG	22600.00	
FT1-T4	FT1T46.1	ANTIMONY	MG/KG	4.30	
FT1-T4	FT1T46.1	ARSENIC	MG/KG	14.60	
FT1-T4	FT1T46.1	BARIUM	MG/KG	105.00	
FT1-T4	FT1T46.1	BERYLLIUM	MG/KG	.60	
FT1-T4	FT1T46.1	CADMIUM	MG/KG	3.10	
FT1-T4	FT1T46.1	CALCIUM	MG/KG	9370.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-T4	FT1T46.1 (6.1)	CHROMIUM	MG/KG	22.30	
FT1-T4	FT1T46.1 (6.1)	COBALT	MG/KG	18.90	
FT1-T4	FT1T46.1 (6.1)	COPPER	MG/KG	118.00	
FT1-T4	FT1T46.1 (6.1)	IRON	MG/KG	50200.00	
FT1-T4	FT1T46.1 (6.1)	LEAD	MG/KG	41.30	J4
FT1-T4	FT1T46.1 (6.1)	MAGNESIUM	MG/KG	16200.00	
FT1-T4	FT1T46.1 (6.1)	MANGANESE	MG/KG	821.00	
FT1-T4	FT1T46.1 (6.1)	NICKEL	MG/KG	24.60	
FT1-T4	FT1T46.1 (6.1)	POTASSIUM	MG/KG	1340.00	
FT1-T4	FT1T46.1 (6.1)	SILVER	MG/KG	.48	J1
FT1-T4	FT1T46.1 (6.1)	SODIUM	MG/KG	3700.00	
FT1-T4	FT1T46.1 (6.1)	THALLIUM	MG/KG	81.60	J4
FT1-T4	FT1T46.1 (6.1)	VANADIUM	MG/KG	126.00	J4
FT1-T4	FT1T46.1 (6.1)	ZINC	MG/KG	226.00	J4
FT1-T4	FT1T46.1 (6.1)	BENZO (A) ANTHRACENE	UG/KG	76.00	J
FT1-T4	FT1T46.1 (6.1)	BENZO (A) PYRENE	UG/KG	63.00	J
FT1-T4	FT1T46.1 (6.1)	BENZO (B) FLUORANTHENE	UG/KG	200.00	J
FT1-T4	FT1T46.1 (6.1)	BENZO (K) FLUORANTHENE	UG/KG	58.00	J
FT1-T4	FT1T46.1 (6.1)	CHRYSENE	UG/KG	140.00	J
FT1-T4	FT1T46.1 (6.1)	DI-n-BUTYLPHTHALATE	UG/KG	89.00	J
FT1-T4	FT1T46.1 (6.1)	FLUORANTHENE	UG/KG	73.00	J
FT1-T4	FT1T46.1 (6.1)	INDENO (1,2,3-C,D) PYRENE	UG/KG	69.00	J
FT1-T4	FT1T46.1 (6.1)	PYRENE	UG/KG	45.00	J
FT1-T4	FT1T46.1 (6.1)	bis (2-ETHYLHEXYL) PHTHALATE	UG/KG	56.00	J
FT1-T4	FT1T46.1 (6.1)	XYLENE (total)	UG/KG	2100.00	J4
FT1-W1	FT1T46.1	ALUMINUM	UG/L	28400.00	
FT1-W1	FT1-W1	BARIUM	UG/L	83.50	
FT1-W1	FT1-W1	BERYLLIUM	UG/L	1.40	
FT1-W1	FT1-W1	CADMIUM	UG/L	2.90	
FT1-W1	FT1-W1	CALCIUM	UG/L	29200.00	
FT1-W1	FT1-W1	CHROMIUM	UG/L	9.60	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
FT1-W1	FT1-W1	COBALT	UG/L	41.20	
FT1-W1	FT1-W1	COPPER	UG/L	72.00	
FT1-W1	FT1-W1	IRON	UG/L	89200.00	
FT1-W1	FT1-W1	MAGNESIUM	UG/L	65700.00	
FT1-W1	FT1-W1	MANGANESE	UG/L	1770.00	
FT1-W1	FT1-W1	MOLYBDENUM	UG/L	4.00	
FT1-W1	FT1-W1	POTASSIUM	UG/L	30900.00	
FT1-W1	FT1-W1	SILVER	UG/L	1.80	
FT1-W1	FT1-W1	SODIUM	UG/L	739000.00	
FT1-W1	FT1-W1	THALLIUM	UG/L	35.70	
FT1-W1	FT1-W1	VANADIUM	UG/L	136.00	
FT1-W1	FT1-W1	ZINC	UG/L	163.00	
FT1-W1	FT1W114.0 (14.0)	ALUMINUM	MG/KG	25500.00	
FT1-W1	FT1W114.0 (14.0)	ARSENIC	MG/KG	12.00	
FT1-W1	FT1W114.0 (14.0)	BARIUM	MG/KG	84.50	
FT1-W1	FT1W114.0 (14.0)	BERYLLIUM	MG/KG	.51	
FT1-W1	FT1W114.0 (14.0)	CADMIUM	MG/KG	1.60	
FT1-W1	FT1W114.0 (14.0)	CALCIUM	MG/KG	10500.00	
FT1-W1	FT1W114.0 (14.0)	CHROMIUM	MG/KG	26.20	
FT1-W1	FT1W114.0 (14.0)	COBALT	MG/KG	17.20	
FT1-W1	FT1W114.0 (14.0)	COPPER	MG/KG	74.80	
FT1-W1	FT1W114.0 (14.0)	IRON	MG/KG	40900.00	
FT1-W1	FT1W114.0 (14.0)	MAGNESIUM	MG/KG	15500.00	J4
FT1-W1	FT1W114.0 (14.0)	MANGANESE	MG/KG	678.00	
FT1-W1	FT1W114.0 (14.0)	NICKEL	MG/KG	12.60	
FT1-W1	FT1W114.0 (14.0)	POTASSIUM	MG/KG	2320.00	
FT1-W1	FT1W114.0 (14.0)	SILVER	MG/KG	.53	
FT1-W1	FT1W114.0 (14.0)	SODIUM	MG/KG	9050.00	
FT1-W1	FT1W114.0 (14.0)	THALLIUM	MG/KG	106.00	J4
FT1-W1	FT1W114.0 (14.0)	VANADIUM	MG/KG	114.00	J4
FT1-W1	FT1W114.0 (14.0)	ZINC	MG/KG	76.20	J4

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-W2	FT1W219.5 (19.5)	TOTAL ORGANIC CARBON	MG/KG	650.00	
FT1-W2	FT1W219.5 (19.5)	ALUMINUM	MG/KG	27100.00	
FT1-W2	FT1W219.5 (19.5)	ARSENIC	MG/KG	9.40	
FT1-W2	FT1W219.5 (19.5)	BARIUM	MG/KG	60.20	
FT1-W2	FT1W219.5 (19.5)	BERYLLIUM	MG/KG	.49	
FT1-W2	FT1W219.5 (19.5)	CADMIUM	MG/KG	1.90	
FT1-W2	FT1W219.5 (19.5)	CALCIUM	MG/KG	6350.00	
FT1-W2	FT1W219.5 (19.5)	CHROMIUM	MG/KG	5.10	
FT1-W2	FT1W219.5 (19.5)	COBALT	MG/KG	23.50	
FT1-W2	FT1W219.5 (19.5)	COPPER	MG/KG	135.00	
FT1-W2	FT1W219.5 (19.5)	IRON	MG/KG	53400.00	
FT1-W2	FT1W219.5 (19.5)	MAGNESIUM	MG/KG	20500.00	
FT1-W2	FT1W219.5 (19.5)	MANGANESE	MG/KG	935.00	J4
FT1-W2	FT1W219.5 (19.5)	NICKEL	MG/KG	8.20	
FT1-W2	FT1W219.5 (19.5)	POTASSIUM	MG/KG	513.00	
FT1-W2	FT1W219.5 (19.5)	SILVER	MG/KG	.55	
FT1-W2	FT1W219.5 (19.5)	SODIUM	MG/KG	16900.00	
FT1-W2	FT1W219.5 (19.5)	THALLIUM	MG/KG	119.00	J4
FT1-W2	FT1W219.5 (19.5)	VANADIUM	MG/KG	152.00	J4
FT1-W2	FT1W219.5 (19.5)	ZINC	MG/KG	80.60	J4
FT1-W2	FT1W219.5 (19.5)	ETHYLBENZENE	UG/KG	270.00	J4
FT1-W2	FT1W219.5 (19.5)	TOLUENE	UG/KG	1600.00	J4
FT1-W2	FT1W219.5 (19.5)	XYLENE (total)	UG/KG	1700.00	J4
FT1-W3	FT1W316.5 (16.5)	ALUMINUM	MG/KG	21300.00	
FT1-W3	FT1W316.5 (16.5)	ANTIMONY	MG/KG	4.70	
FT1-W3	FT1W316.5 (16.5)	ARSENIC	MG/KG	14.00	
FT1-W3	FT1W316.5 (16.5)	BARIUM	MG/KG	22.10	
FT1-W3	FT1W316.5 (16.5)	BERYLLIUM	MG/KG	.86	
FT1-W3	FT1W316.5 (16.5)	CADMIUM	MG/KG	2.30	
FT1-W3	FT1W316.5 (16.5)	CALCIUM	MG/KG	11700.00	
FT1-W3	FT1W316.5 (16.5)	CHROMIUM	MG/KG	9.10	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.10. (Cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT1-W3	FT1W316.5 (16.5)	COBALT	MG/KG	19.80	
FT1-W3	FT1W316.5 (16.5)	COPPER	MG/KG	81.00	
FT1-W3	FT1W316.5 (16.5)	IRON	MG/KG	56200.00	
FT1-W3	FT1W316.5 (16.5)	LEAD	MG/KG	13.00	J14
FT1-W3	FT1W316.5 (16.5)	MAGNESIUM	MG/KG	23900.00	
FT1-W3	FT1W316.5 (16.5)	MANGANESE	MG/KG	1020.00	J4
FT1-W3	FT1W316.5 (16.5)	MOLYBDENUM	MG/KG	4.30	
FT1-W3	FT1W316.5 (16.5)	NICKEL	MG/KG	14.30	
FT1-W3	FT1W316.5 (16.5)	POTASSIUM	MG/KG	747.00	
FT1-W3	FT1W316.5 (16.5)	SELENIUM	MG/KG	41.40	
FT1-W3	FT1W316.5 (16.5)	SILVER	MG/KG	.65	J1
FT1-W3	FT1W316.5 (16.5)	SODIUM	MG/KG	6640.00	
FT1-W3	FT1W316.5 (16.5)	THALLIUM	MG/KG	93.80	J4
FT1-W3	FT1W316.5 (16.5)	VANADIUM	MG/KG	142.00	J4
FT1-W3	FT1W316.5 (16.5)	ZINC	MG/KG	77.00	J4
FT1-W3	FT1W316.5 (16.5)	DI-n-BUTYLPHTHALATE	UG/KG	710.00	B
FT1-W3	FT1W316.5 (16.5)	DI-n-OCTYLPHTHALATE	UG/KG	68.00	J
FT1-W3	FT1W316.5 (16.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	78.00	J
FT1-W3	FT1W316.5 (16.5)	BENZENE	UG/KG	12.00	
FT1-W3	FT1W316.5 (16.5)	ETHYLBENZENE	UG/KG	1.00	J
FT1-W3	FT1W316.5 (16.5)	TOLUENE	UG/KG	48.00	
FT1-W3	FT1W316.5 (16.5)	XYLENE (total)	UG/KG	12.00	

 (a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
 RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.11. Analytes with Positive Results in Soil at FT-1

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Result</u>	<u>Range of Results^(a)</u>
Di-n-Butylphthalate	11	2	160 - 710
Fluoranthene	11	1	490
Fluorene	11	1	78
Pyrene	11	1	460
Benzo(a)anthracene	11	1	220
Chrysene	11	1	440
bis(2-ethylhexyl)phthalate	11	3	46 - 760
Benzo(b)fluoranthene	11	1	280
Benzo(k)fluoranthene	11	1	84
Benzo(a)pyrene	11	1	200
Naphthalene	11	1	130
Dibenzofuran	11	1	92
Phenanthrene	11	1	630
Anthracene	11	1	98
Butylbenzylphthalate	11	1	63
Di-n-octylphthalate	11	1	68
Benzene	11	1	12
Toluene	11	2	48 - 1,600
Ethylbenzene	11	2	1 - 270
Xylene	11	4	12 - 1,700
PCDD	4	3	0.3 - 4.9
PCDF	4	2	0.1 - 1.1
TOC	7	7	650 - 31,000
Cadmium	11	11	1.1 - 11
Chromium	11	11	5.1 - 87.3
Copper	11	11	42.3 - 238

TABLE 3.11. (cont.)

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Result</u>	<u>Range of Results^(a)</u>
Lead	11	5	6.9 μ - 671
Zinc	11	11	41 - 1,320
TPH	34	26	35 - 1,255

^(a)Metals, TOC, and TPH are in mg/kg. All other analytes are in μ g/kg.

The results of the 1988 and 1992 sampling at FT-1 indicate that the area has widespread, but low-level, contamination with TPH, semivolatile compounds, and metals. Some volatile compounds (BTEX) have been detected that are associated with diesel fuel and JP-4, but again at low concentrations. This residual contamination at FT-1 is probably from the fire fighting training sessions where the fuels were used to start and sustain fires. Dioxins were also found at this site in three out of the four samples analyzed; however, because of the limited number of samples analyzed for dioxins, the extent of dioxin contamination is not known at this time. But it does not appear that the dioxins correlate directly to concentrations of any other constituents found at this site. The dioxins may have been the result of burning waste oil with PCBs.

3.3.5 Preliminary Risk Assessment

The maximum concentrations of each contaminant above the detection limit were compared with PRLs for human health and ecological risk (presented in Appendixes C and D). All concentrations were less than the PRLs, with the exception of dioxins (Table 3.12).

3.3.6 Future Actions

Disposal of dioxin-contaminated soil is problematic at this time. There is no allowable land disposal of these soils and incineration is the only alternative disposal technique, although it is extremely expensive. Another possible alternative at this site is in situ vitrification. This process uses electricity to melt the surrounding soil and encapsulate the contamination. High heat is also produced, which may destroy the dioxins. At this time, it is recommended that site access be permanently restricted and clean fill material be placed over the trench areas where dioxins were discovered. The EPA is reevaluating its dioxin regulations and may come out with new guidelines for disposal in 1993. If soil removal is contemplated in the future, a more detailed study of the dioxin concentrations in the near surface soils is recommended. A more intense sample grid should be used with all samples being analyzed for dioxins. Determining exactly how much dioxin contaminated soil may have to be removed prior to any removal effort could greatly reduce the cost of the removal.

TABLE 3.12. Contaminants of Potential Concern (COPCs) at FT-1 that Exceed Human Health Preliminary Risk Levels (PRLs)

Sample No.	Depth (ft.)	Chemical	Concentration	Qualifier	Laboratory	PRL Concentration	PRL Source
SURFACE SOILS COPCs			(ug/kg)			(ug/kg)	
<i>FT-1: Lightning Strike</i>							
FT1T21.0	1	PCDD	0.3		OFFSITE	0.066	C
FT1T310.5	0.5	PCDD	4.9		OFFSITE	0.066	C
FT1T310.5	0.5	PCDF	1.1		OFFSITE	0.066	C
FT1T41.2	1.2	PCDD	0.9		OFFSITE	0.066	C
FT1T41.2	1.2	PCDF	0.1		OFFSITE	0.066	C
FT1T41.2D	1.2	PCDD	15		OFFSITE	0.066	C
FT1T41.2D	1.2	PCDF	1.1		OFFSITE	0.066	C

Notes:

C = Risk-based Concentration/Carcinogenic Effects

OFFSITE = Contract Laboratory Program Methodology (samples sent to offsite lab)

3.4 FIRE TRAINING SITE 2: AIRCRAFT MOCKUP (FT-2)

3.4.1 Site Background

FT-2 is located on the northern end of abandoned Runways C and B (Figure 3.9). Three distinct areas are now included in FT-2: 1) the recently identified old fire training area at the north end of Runway B; 2) the fire training area near the union of Runways B and C; and 3) another recently identified area to the west of Runway C where numerous 55-gallon drums have been dumped (Figure 3.9). The runways are paved with asphalt and the fire training areas were built on top of the asphalt. The two recently identified areas were incorporated into the IRP program too late to be included in the 1992 field season. The following discussion focuses on the fire training area at the union of Runways B and C.

FT-2 was used as a training area from the early 1970s until the mid-1980s. Waste oil, diesel, and JP-4 were used to create fires that were then extinguished, leaving residual fuel to penetrate the asphalt and infiltrate into the underlying soils. The area located at the end of Runway B had the surface debris removed from the area in 1985 by the 11th CEOS (CH2M HILL 1990), and the newer area had all surface debris removed in 1992 during the time this investigation was in progress. None of these areas have been used in recent years. Because of the pavement, much of the precipitation creates runoff. Surface drainage in this area is to catch basins in the runways or toward the edge of the runway.

The fire training area investigated in 1992 consisted of an aircraft mockup of metal cylinders, which was located inside two concentric earthen berms. The inner berm was approximately 90 feet in diameter and the outer berm was approximately 170 feet in diameter (Figure 3.10). During the first shift of the 1992 field season, the metal cylinders and the berms were removed from the site. The surface at FT-2 is covered with a very weathered asphalt that is underlain by a silty sand layer that extends to at least 12 feet. The bottom of the silty sand layer has not been encountered in any of the borings to date.

FIGURE 3.9. FT-2 Location Map

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3.4.2 Previous Investigations

In the 1988 field investigation of the fire training area on Runway C, a backhoe was used to remove the asphalt within the bermed area along the north side. A hand-augured soil boring indicated that approximately 4 feet of a poorly graded sand lies beneath the asphalt. Below the sand, a hard layer, which the hand auger could not penetrate, was encountered. An additional boring was located near the catch basin to determine whether migration of hazardous constituents from within the bermed area had occurred. The backhoe was again used to peel away the asphalt to expose the underlying soils.

Analytical results from these two soil borings (FT-2-1 and FT-2-2, Figure 3.10) indicate a variety of volatile and semivolatile contaminants at the site (Table 3.13). Lead levels were at or below background levels. Most of the contamination encountered was within the burn area with only minor amounts (less than the PRLs) near the catch basin.

Two additional soil borings were placed at the northeastern edge of the paved area to determine the northerly extent of subsurface contaminants. No organic vapor analysis (OVA) measurements above background levels were observed at either of these locations; therefore, no soil samples were collected.

3.4.3 1992 Investigation

During the 1992 field investigation at FT-2, surface and near surface sampling, subsurface sampling, groundwater sampling, and a geophysical survey were performed at the newer fire training area on Runway C. The other two areas were added to FT-2 during the 1992 field season, too late for investigations to be carried out.

The extent of the geophysical conductivity investigation is shown in Figure 3.11. The data were collected at 5-foot intervals along lines 10 feet apart. Approximately 1.2 acres were investigated. The objective of the survey was to identify buried metal or utilities to be avoided during drilling. Conductivity and in-phase data are presented as contour maps in Appendix B. Fire refuse, including

FIGURE 3.10. FT

FIGURE 3.11. FT-2

- LEGEND**
- GEOPHYSICAL SURVEY LINE
- Ⓜ METAL OBSERVED AT SURFACE
- INTERPRETED FEATURES***
- POSSIBLE BURIED METAL
- ISOLATED BURIED METAL
- UTILITY LINE
- * SEE TEXT FOR FURTHER EXPLANATION

TABLE 3.13. 1988 FT-2 Analytical Results for Soil (mg/kg)

	FT-2-1 Depth (ft)		FT-2-2 Depth (ft)	
	2	4	3	8
TPH	6,300	12,000	300	<75
Lead	2	2.3	1.6	1.4
Naphthalene	9.1	8.8		
2-methylnaphthalene	16	18		
Fluorene	1.2J	1.6		
n-Nitrosodiphenylamine		0.95J		
Phenanthrene	0.94J	1.3J		
Methylene Chloride	3.4J	3.3J		
Acetone		5.4		
2-Butanone	8.6J			
Tetrachloroethene	3.3J			
Toluene	20	50		
Ethylbenzene	3.9J			
Xylenes	93	210	0.51J	0.037
Chlorobenzene	0.018J			0.018J
Styrene				0.022J

J = Estimate.

Blank = Below detection limit.

scrap metal, was present within the inner berm, which could have resulted in missing some areas of buried metal. Steel beams, which also interfered with the measurements, were present in the northeastern portion of the site.

The data indicate several utility lines are present at the site. These are shown in Figure 3.11. Isolated buried metal and possible buried metal were encountered at several locations and are also shown in the figure. Data collected within the inner berm and within about 15 feet of the steel beams could not be used to identify buried metal.

This first sampling at FT-2 consisted of obtaining samples from soil on the surface of the asphalt and at a depth of 0.5 foot below the asphalt at the perimeter of the outside ring. Samples were collected every 25 feet for a total of 21 sites and 42 samples (Figure 3.10). These samples were analyzed onsite for TPH (Table 3.14). The duplicate results indicated highly erratic TPH values at both the surface and the 0.5-foot depths (2,000 to 5,000 mg/kg range). It was believed this could be due to the asphalt and not be connected with the activities at the fire training area. Therefore, deeper samples (1.2 feet) were collected from 10 of the sample locations and a pair of samples (surface and 0.5 foot) were taken 500 feet south of the burn area. All 1.2-foot samples had TPH less than 200 mg/kg and the samples 500 feet away were greater than 1,500 mg/kg (Table 3.14). Results from these samples indicate that the asphalt is a major contributor to the TPH and that most of the fuel oils used in the fires are not migrating laterally under the asphalt. One sample was also taken from a sump 125 feet to the east of the area. This sump appears to collect runoff water from the FT-2 area. TPH results of this sample were 1,150 mg/kg. The final part of the surface sampling consisted of collecting six samples at a depth of 1.2 feet within the inner circle of the burn area. These samples were collected on a 50-foot grid spacing. They were analyzed for TPH onsite with results being highly variable, ranging from 164 mg/kg to 29,883 mg/kg (Table 3.14). Three of the six samples were greater than 20,000 mg/kg, indicating petroleum contamination from the fire fighting activities at this site.

TABLE 3.14. Positive Results from Onsite (CSL) Data at FT-2

LOCATION	SAMPLE- ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
FT2-001	SHSOSFT2-01	(0-0.1)			
FT2-001	SHSOSFT2-02	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	5361.96	MG/KG
FT2-003	SHSOSFT2-03	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	1507.69	MG/KG
FT2-003	SHSOSFT2-04	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	5669.51	MG/KG
FT2-005	SHSOSFT2-05	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	1009.54	MG/KG
FT2-005	SHSOSFT2-06	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	6289.20	MG/KG
FT2-005	SHSOSFT2-06	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	6190.78	MG/KG
FT2-005	SHSOSFT2-62	(1.2)	TOTAL PETROLEUM HYDROCARBONS	166.33	MG/KG
FT2-005	SHSOSFT2-62	(1.2)	HEADSPACE	20.00	PPM
FT2-005	SHSOSFT2-62	(1.2)	TOLUENE	31.70	UG/KG
FT2-005	SHSOSFT2-62	(1.2)	m, p-XYLENES	90.50	UG/KG
FT2-005	SHSOSFT2-62	(1.2)	O-XYLENE	42.90	UG/KG
FT2-007	SHSOSFT2-07	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	4136.68	MG/KG
FT2-007	SHSOSFT2-08	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	4733.40	MG/KG
FT2-007	SHSOSFT2-08	(0-0.5)	HEADSPACE	1.00	PPM
FT2-007	SHSOSFT2-46	(1.2)	TOTAL PETROLEUM HYDROCARBONS	745.01	MG/KG
FT2-007	SHSOSFT2-46	(1.2)	HEADSPACE	15.00	PPM
FT2-007	SHSOSFT2-46	(1.2)	ETHYLBENZENE	13.10	UG/KG
FT2-007	SHSOSFT2-46	(1.2)	TOLUENE	83.10	UG/KG
FT2-007	SHSOSFT2-46	(1.2)	m, p-XYLENES	70.10	UG/KG
FT2-007	SHSOSFT2-46	(1.2)	O-XYLENE	49.10	UG/KG
FT2-009	SHSOSFT2-09	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	4383.59	MG/KG
FT2-009	SHSOSFT2-10	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	2684.77	MG/KG
FT2-011	SHSOSFT2-11	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	4446.03	MG/KG
FT2-011	SHSOSFT2-12	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	2848.48	MG/KG
FT2-013	SHSOSFT2-13	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	3145.86	MG/KG
FT2-013	SHSOSFT2-14	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	619.08	MG/KG
FT2-015	SHSOSFT2-15	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	2830.21	MG/KG
FT2-015	SHSOSFT2-16	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	3633.53	MG/KG
FT2-015	SHSOSFT2-53	(1.2)	TOTAL PETROLEUM HYDROCARBONS	136.56	MG/KG
FT2-017	SHSOSFT2-17	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	4184.60	MG/KG
FT2-017	SHSOSFT2-18	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	2304.04	MG/KG
FT2-019	SHSOSFT2-19	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	3958.05	MG/KG
FT2-019	SHSOSFT2-20	(0-0.5)	TOTAL PETROLEUM HYDROCARBONS	2659.22	MG/KG
FT2-019	SHSOSFT2-54	(1.2)	TOTAL PETROLEUM HYDROCARBONS	142.84	MG/KG
FT2-021	SHSOSFT2-21	(0-0.1)	TOTAL PETROLEUM HYDROCARBONS	1878.98	MG/KG

 (a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.14. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
FT2-021	SHSOSFT2-22 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	389.19	
FT2-021	SHSOSFT2-21 (0-0.1)	m, p-XYLENES	UG/KG	38.70	
FT2-023	SHSOSFT2-23 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1540.79	
FT2-023	SHSOSFT2-24 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	3445.34	
FT2-025	SHSOSFT2-25 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4763.21	
FT2-025	SHSOSFT2-26 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1587.68	
FT2-027	SHSOSFT2-27 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1028.06	
FT2-027	SHSOSFT2-28 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4217.23	
FT2-027	SHSOSFT2-56 (1.2)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	44.62	
FT2-029	SHSOSFT2-29 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4477.36	
FT2-029	SHSOSFT2-29 (0-0.1)	HEADSPACE	MG/KG	3.00	
FT2-029	SHSOSFT2-30 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	PPM	9937.92	
FT2-029	SHSOSFT2-30 (0-0.5)	HEADSPACE	PPM	15.00	
FT2-029	SHSOSFT2-29 (0-0.1)	ETHYLBENZENE	UG/KG	28.60	
FT2-029	SHSOSFT2-29 (0-0.1)	TOLUENE	UG/KG	112.60	
FT2-029	SHSOSFT2-29 (0-0.1)	m, p-XYLENES	UG/KG	112.60	
FT2-029	SHSOSFT2-29 (0-0.1)	o-XYLENE	UG/KG	25.90	
FT2-029	SHSOSFT2-30 (0-0.5)	TOLUENE	UG/KG	113.70	
FT2-029	SHSOSFT2-30 (0-0.5)	m, p-XYLENES	UG/KG	25.10	
FT2-029	SHSOSFT2-30 (0-0.5)	o-XYLENE	UG/KG	28.80	
FT2-031	SHSOSFT2-31 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	6438.19	
FT2-031	SHSOSFT2-32 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1450.10	
FT2-031	SHSOSFT2-45 (1.2)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	267.90	
FT2-031	SHSOSFT2-57 (1.2)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	121.26	
FT2-031	SHSOSFT2-57 (1.2)	BENZENE	UG/KG	10.90	
FT2-031	SHSOSFT2-57 (1.2)	ETHYLBENZENE	UG/KG	16.90	
FT2-031	SHSOSFT2-57 (1.2)	m, p-XYLENES	UG/KG	35.00	
FT2-031	SHSOSFT2-57 (1.2)	o-XYLENE	UG/KG	19.90	
FT2-033	SHSOSFT2-33 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	3957.79	
FT2-033	SHSOSFT2-34 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4228.75	
FT2-035	SHSOSFT2-35 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	3242.97	
FT2-035	SHSOSFT2-36 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1734.18	
FT2-035	SHSOSFT2-58 (1.2)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	97.34	
FT2-037	SHSOSFT2-37 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4282.21	
FT2-037	SHSOSFT2-38 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1787.50	

 (a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.14. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(b)
FT2-037	SHSOSSFT2-37 (0-0.1)	ETHYLBENZENE	UG/KG	27.40	
FT2-037	SHSOSSFT2-37 (0-0.1)	TOLUENE	UG/KG	86.50	
FT2-037	SHSOSSFT2-37 (0-0.1)	m, p-XYLENES	UG/KG	114.40	
FT2-037	SHSOSSFT2-37 (0-0.1)	o-XYLENE	UG/KG	29.20	
FT2-039	SHSOSSFT2-39 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1375.74	
FT2-039	SHSOSSFT2-40 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	2942.83	
FT2-039	SHSOSSFT2-59 (1.2)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	113.62	
FT2-039	SHSOSSFT2-59 (1.2)	HEADSPACE	PPM	57.00	
FT2-039	SHSOSSFT2-59 (1.2)	TOLUENE	UG/KG	56.10	
FT2-039	SHSOSSFT2-59 (1.2)	m, p-XYLENES	UG/KG	65.10	
FT2-039	SHSOSSFT2-59 (1.2)	o-XYLENE	UG/KG	77.60	
FT2-041	SHSOSSFT2-41 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1318.58	
FT2-041	SHSOSSFT2-42 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	3382.27	
FT2-041	SHSOSSFT2-42 (0-0.5)	HEADSPACE	PPM	24.00	
FT2-041	SHSOSSFT2-42 (0-0.5)	TOLUENE	UG/KG	95.80	
FT2-041	SHSOSSFT2-42 (0-0.5)	m, p-XYLENES	UG/KG	62.70	
FT2-041	SHSOSSFT2-42 (0-0.5)	o-XYLENE	UG/KG	66.70	
FT2-047	SHSOSSFT2-47 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1150.43	
FT2-047	SHSOSSFT2-48 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1799.94	
FT2-049	SHSOSSFT2-49 (0-0.1)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4671.89	
FT2-049	SHSOSSFT2-50 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1693.08	
FT2-128	SO-FT2-128-.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	29360.31	
FT2-128	SO-FT2-128-.5 (0-0.5)	HEADSPACE	PPM	330.00	
FT2-128	SO-FT2-128-.5 (0-0.5)	ETHYLBENZENE	UG/KG	88000.00	
FT2-128	SO-FT2-128-.5 (0-0.5)	TOLUENE	UG/KG	440000.00	
FT2-128	SO-FT2-128-.5 (0-0.5)	m, p-XYLENES	UG/KG	770000.00	
FT2-128	SO-FT2-128-.5 (0-0.5)	o-XYLENE	UG/KG	29000.00	
FT2-130	SO-FT2-130-.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	28034.35	
FT2-130	SO-FT2-130-.5 (0-0.5)	HEADSPACE	PPM	302.00	
FT2-130	SO-FT2-130-.5 (0-0.5)	BENZENE	UG/KG	14000.00	
FT2-130	SO-FT2-130-.5 (0-0.5)	ETHYLBENZENE	UG/KG	19000.00	
FT2-130	SO-FT2-130-.5 (0-0.5)	TOLUENE	UG/KG	160000.00	
FT2-130	SO-FT2-130-.5 (0-0.5)	m, p-XYLENES	UG/KG	310000.00	
FT2-130	SO-FT2-130-.5 (0-0.5)	o-XYLENE	UG/KG	110000.00	
FT2-131	SO-FT2-131-.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	163.62	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.14. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
FT2-131	SO-FT2-131-.5 (0-0.5)	TRICHLOROETHENE (TCE)	UG/KG	12.50	
FT2-132	SO-FT2-132-.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	2652.64	
FT2-132	SO-FT2-132-.5 (0-0.5)	HEADSPACE	PPM	115.00	
FT2-132	SO-FT2-132-.5 (0-0.5)	ETHYLBENZENE	UG/KG	2000.00	
FT2-132	SO-FT2-132-.5 (0-0.5)	TOLUENE	UG/KG	14000.00	
FT2-132	SO-FT2-132-.5 (0-0.5)	m, p-XYLENES	UG/KG	17000.00	
FT2-132	SO-FT2-132-.5 (0-0.5)	o-XYLENE	UG/KG	9600.00	
FT2-133	SO-FT2-133-.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1528.15	
FT2-133	SO-FT2-133-.5 (0-0.5)	HEADSPACE	PPM	200.00	
FT2-133	SO-FT2-133-.5 (0-0.5)	BENZENE	UG/KG	1200.00	
FT2-133	SO-FT2-133-.5 (0-0.5)	ETHYLBENZENE	UG/KG	1500.00	
FT2-133	SO-FT2-133-.5 (0-0.5)	TOLUENE	UG/KG	9300.00	
FT2-133	SO-FT2-133-.5 (0-0.5)	m, p-XYLENES	UG/KG	8000.00	
FT2-133	SO-FT2-133-.5 (0-0.5)	o-XYLENE	UG/KG	2500.00	
FT2-134	SO-FT2-134-.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	20107.24	
FT2-134	SO-FT2-134-.5 (0-0.5)	HEADSPACE	PPM	350.00	
FT2-134	SO-FT2-134-.5 (0-0.5)	ETHYLBENZENE	UG/KG	50000.00	
FT2-134	SO-FT2-134-.5 (0-0.5)	TOLUENE	UG/KG	81000.00	
FT2-134	SO-FT2-134-.5 (0-0.5)	m, p-XYLENES	UG/KG	190000.00	
FT2-134	SO-FT2-134-.5 (0-0.5)	o-XYLENE	UG/KG	120000.00	
FT2-B2	FT2B20.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	654.87	
FT2-B2	FT2B20.5 (0-0.5)	HEADSPACE	PPM	154.00	
FT2-B2	FT2B210.0 (10.0)	HEADSPACE	PPM	22.00	
FT2-B2	FT2B25.0 (5.0)	HEADSPACE	PPM	124.00	
FT2-B2	FT2B20.5 (0-0.5)	ETHYLBENZENE	UG/KG	530.00	
FT2-B2	FT2B20.5 (0-0.5)	TOLUENE	UG/KG	600.00	
FT2-B2	FT2B20.5 (0-0.5)	m, p-XYLENES	UG/KG	330.00	
FT2-B2	FT2B20.5 (0-0.5)	o-XYLENE	UG/KG	460.00	
FT2-B2	FT2B210.0 (10.0)	ETHYLBENZENE	UG/KG	125.00	
FT2-B2	FT2B210.0 (10.0)	TOLUENE	UG/KG	75.00	
FT2-B2	FT2B210.0 (10.0)	m, p-XYLENES	UG/KG	460.00	
FT2-B2	FT2B210.0 (10.0)	o-XYLENE	UG/KG	160.00	
FT2-B2	FT2B25.0 (5.0)	TOLUENE	UG/KG	660.00	
FT2-B2	FT2B25.0 (5.0)	m, p-XYLENES	UG/KG	1200.00	
FT2-B2	FT2B25.0 (5.0)	o-XYLENE	UG/KG	740.00	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.14. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
FT2-B3	FT2B30.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	13742.90	
FT2-B3	FT2B30.5 (0-0.5)	HEADSPACE	PPM	1000.00	GT
FT2-B3	FT2B35.0 (5.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	23649.30	
FT2-B3	FT2B35.0 (5.0)	HEADSPACE	PPM	1000.00	GT
FT2-B3	FT2B30.5 (0-0.5)	ETHYLBENZENE	UG/KG	55000.00	
FT2-B3	FT2B30.5 (0-0.5)	TOLUENE	UG/KG	240000.00	
FT2-B3	FT2B30.5 (0-0.5)	m,p-XYLENES	UG/KG	450000.00	
FT2-B3	FT2B30.5 (0-0.5)	o-XYLENE	UG/KG	170000.00	
FT2-B3	FT2B35.0 (5.0)	ETHYLBENZENE	UG/KG	130000.00	
FT2-B3	FT2B35.0 (5.0)	TOLUENE	UG/KG	610000.00	
FT2-B3	FT2B35.0 (5.0)	m,p-XYLENES	UG/KG	480000.00	
FT2-B3	FT2B35.0 (5.0)	o-XYLENE	UG/KG	150000.00	
FT2-B4	FT2B40.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	6123.42	
FT2-B4	FT2B40.5 (0-0.5)	HEADSPACE	PPM	1000.00	GT
FT2-B4	FT2B45.0 (5.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	11592.02	
FT2-B4	FT2B45.0 (5.0)	HEADSPACE	PPM	915.00	
FT2-B4	FT2B40.5 (0-0.5)	TOLUENE	UG/KG	42000.00	
FT2-B4	FT2B40.5 (0-0.5)	m,p-XYLENES	UG/KG	88000.00	
FT2-B4	FT2B40.5 (0-0.5)	o-XYLENE	UG/KG	52000.00	
FT2-B4	FT2B45.0 (5.0)	ETHYLBENZENE	UG/KG	71000.00	
FT2-B4	FT2B45.0 (5.0)	TOLUENE	UG/KG	550000.00	
FT2-B4	FT2B45.0 (5.0)	m,p-XYLENES	UG/KG	510000.00	
FT2-B4	FT2B45.0 (5.0)	o-XYLENE	UG/KG	150000.00	
FT2-B6	FT2B60.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	20572.81	
FT2-B6	FT2B60.5 (0-0.5)	HEADSPACE	PPM	992.00	
FT2-B6	FT2B65.0 (5.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	15688.83	
FT2-B6	FT2B65.0 (5.0)	HEADSPACE	PPM	1000.00	GT
FT2-B6	FT2B60.5 (0-0.5)	ETHYLBENZENE	UG/KG	21000.00	
FT2-B6	FT2B60.5 (0-0.5)	TOLUENE	UG/KG	220000.00	
FT2-B6	FT2B60.5 (0-0.5)	m,p-XYLENES	UG/KG	330000.00	
FT2-B6	FT2B60.5 (0-0.5)	o-XYLENE	UG/KG	120000.00	
FT2-B6	FT2B65.0 (5.0)	ETHYLBENZENE	UG/KG	53000.00	
FT2-B6	FT2B65.0 (5.0)	TOLUENE	UG/KG	260000.00	
FT2-B6	FT2B65.0 (5.0)	m,p-XYLENES	UG/KG	280000.00	
FT2-B6	FT2B65.0 (5.0)	o-XYLENE	UG/KG	110000.00	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.14. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
FT2-W1	FT2W10.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	879.90	
FT2-W1	FT2W15.0 (5.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	48.53	
FT2-W1	FT2W1	BENZENE	UG/L	512.00	
FT2-W1	FT2W1	ETHYLBENZENE	UG/L	511.00	
FT2-W1	FT2W1	TOLUENE	UG/L	896.00	
FT2-W1	FT2W1	m, p-XYLENES	UG/L	1954.00	
FT2-W1	FT2W1	o-XYLENE	UG/L	798.00	
FT2-W1	FT2W50.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	59.96	
FT2-W5	FT2W5	m, p-XYLENES	UG/L	1.50	
FT2-W7	FT2W70.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	655.29	

 (a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

Samples from inside the ring were also analyzed for BTEX in the onsite laboratory with very high concentrations of total BTEX greater than 1,000,000 $\mu\text{g/kg}$. Several of the samples from outside the ring were also run for BTEX with total BTEX concentrations ranging to 100 $\mu\text{g/kg}$ (Table 3.14).

Four borings were completed at FT-2 to check for the vertical extent of contamination. Three were completed within the fire ring and one adjacent to the ring (Figure 3.10). Two to three samples were collected from each boring and analyzed for VOAs, semi-VOAs, pesticides/PCBs, and metals. The three borings within the ring showed high concentrations of BTEX (Table 3.15) with some semivolatiles associated with petroleum at the surface and near the water table (water at about 7 feet bgs). The boring outside the ring had only minor amounts of contamination, orders of magnitude less than the amounts found within the ring. The first sample in each boring was also analyzed for dioxins and furans. All samples had less than the detection limits for these compounds (Appendix A).

Three monitoring wells were installed at FT-2 (Figure 3.10), to determine if the groundwater has been contaminated by the surface activities and to determine the direction of groundwater flow. Each well was developed and allowed to equilibrate with the aquifer and then sampled for VOAs, semi VOAs, pesticides/PCBs, and metals. Results of the samples indicate that Well No. 1 (FT-W1) is contaminated with the same compounds observed in the surface and subsurface sampling within the fire training area (Table 3.15). Results from the other two wells showed no organic contamination. All three wells had relatively high concentrations of zinc (59 to 87.6 $\mu\text{g/L}$) and chromium (13.5 to 15.6 $\mu\text{g/L}$). Water level measurements indicate that the flow direction is to the northwest (Figure 3.12). However, this is based on a single measurement and only three wells and therefore may not be entirely accurate.

The soil boring logs from FT-2 indicate that the runway was built on top of silty sand (Appendix E). In the seven boreholes drilled, only silty sand was encountered. The maximum depth drilled was 12 feet.

TABLE 3.15. Positive Results from Offsite Data at FT-2

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT2-005	SOSSFT206 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1990.00	
FT2-015	SOSSFT216 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	2160.00	
FT2-027	SOSSFT228 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1700.00	
FT2-037	SOSSFT238 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	863.00	
FT2-047	SOSSFT248 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	810.00	
FT2-128	SOFT2128 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	18300.00	
FT2-134	SOFT2134 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	11900.00	
FT2-B2	FT2B20.5 (0-0.5)	TOTAL ORGANIC CARBON	MG/KG	6330.00	
FT2-B2	FT2B20.5 (0-0.5)	ALUMINUM	MG/KG	4620.00	
FT2-B2	FT2B20.5 (0-0.5)	BARIUM	MG/KG	7.40	
FT2-B2	FT2B20.5 (0-0.5)	BERYLLIUM	MG/KG	.25	
FT2-B2	FT2B20.5 (0-0.5)	CADMIUM	MG/KG	.45	
FT2-B2	FT2B20.5 (0-0.5)	CALCIUM	MG/KG	2860.00	
FT2-B2	FT2B20.5 (0-0.5)	CHROMIUM	MG/KG	3.50	
FT2-B2	FT2B20.5 (0-0.5)	COBALT	MG/KG	4.00	
FT2-B2	FT2B20.5 (0-0.5)	COPPER	MG/KG	46.20	
FT2-B2	FT2B20.5 (0-0.5)	IRON	MG/KG	5990.00	
FT2-B2	FT2B20.5 (0-0.5)	MAGNESIUM	MG/KG	4900.00	
FT2-B2	FT2B20.5 (0-0.5)	MANGANESE	MG/KG	271.00	J4
FT2-B2	FT2B20.5 (0-0.5)	NICKEL	MG/KG	6.00	
FT2-B2	FT2B20.5 (0-0.5)	POTASSIUM	MG/KG	208.00	
FT2-B2	FT2B20.5 (0-0.5)	SODIUM	MG/KG	550.00	
FT2-B2	FT2B20.5 (0-0.5)	THALLIUM	MG/KG	5.40	J4
FT2-B2	FT2B20.5 (0-0.5)	VANADIUM	MG/KG	11.70	J4
FT2-B2	FT2B20.5 (0-0.5)	ZINC	MG/KG	20.20	J4
FT2-B2	FT2B20.5 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	700.00	J2
FT2-B2	FT2B20.5 (0-0.5)	METHYLENE CHLORIDE	UG/KG	11.00	BJ12
FT2-B2	FT2B20.5 (0-0.5)	XYLENE (total)	UG/KG	19.00	X
FT2-B2	FT2B210.0 (10.0)	ALUMINUM	MG/KG	12200.00	
FT2-B2	FT2B210.0 (10.0)	ARSENIC	MG/KG	10.40	
FT2-B2	FT2B210.0 (10.0)	BARIUM	MG/KG	16.40	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT2-B2	FT2B210.0 (10.0)	BERYLLIUM	MG/KG	.48	
FT2-B2	FT2B210.0 (10.0)	CADMIUM	MG/KG	1.50	
FT2-B2	FT2B210.0 (10.0)	CALCIUM	MG/KG	6270.00	
FT2-B2	FT2B210.0 (10.0)	CHROMIUM	MG/KG	20.80	
FT2-B2	FT2B210.0 (10.0)	COBALT	MG/KG	9.10	
FT2-B2	FT2B210.0 (10.0)	COPPER	MG/KG	17.10	
FT2-B2	FT2B210.0 (10.0)	IRON	MG/KG	22900.00	
FT2-B2	FT2B210.0 (10.0)	MAGNESIUM	MG/KG	8500.00	
FT2-B2	FT2B210.0 (10.0)	MANGANESE	MG/KG	247.00	J4
FT2-B2	FT2B210.0 (10.0)	NICKEL	MG/KG	27.40	
FT2-B2	FT2B210.0 (10.0)	POTASSIUM	MG/KG	569.00	
FT2-B2	FT2B210.0 (10.0)	SODIUM	MG/KG	1120.00	
FT2-B2	FT2B210.0 (10.0)	THALLIUM	MG/KG	52.10	J4
FT2-B2	FT2B210.0 (10.0)	VANADIUM	MG/KG	83.10	J4
FT2-B2	FT2B210.0 (10.0)	ZINC	MG/KG	41.20	J4
FT2-B2	FT2B210.0R (10.0, RE)	ACETONE	UG/KG	30.00	J24
FT2-B2	FT2B25.0 (5.0)	ALUMINUM	MG/KG	12100.00	
FT2-B2	FT2B25.0 (5.0)	ARSENIC	MG/KG	9.30	
FT2-B2	FT2B25.0 (5.0)	BARIUM	MG/KG	21.30	
FT2-B2	FT2B25.0 (5.0)	BERYLLIUM	MG/KG	.39	
FT2-B2	FT2B25.0 (5.0)	CADMIUM	MG/KG	1.30	
FT2-B2	FT2B25.0 (5.0)	CALCIUM	MG/KG	4970.00	
FT2-B2	FT2B25.0 (5.0)	CHROMIUM	MG/KG	19.00	
FT2-B2	FT2B25.0 (5.0)	COBALT	MG/KG	8.20	
FT2-B2	FT2B25.0 (5.0)	COPPER	MG/KG	17.90	
FT2-B2	FT2B25.0 (5.0)	IRON	MG/KG	22800.00	
FT2-B2	FT2B25.0 (5.0)	MAGNESIUM	MG/KG	7680.00	
FT2-B2	FT2B25.0 (5.0)	MANGANESE	MG/KG	259.00	J4
FT2-B2	FT2B25.0 (5.0)	NICKEL	MG/KG	19.20	
FT2-B2	FT2B25.0 (5.0)	POTASSIUM	MG/KG	501.00	
FT2-B2	FT2B25.0 (5.0)	SODIUM	MG/KG	834.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT2-B2	FT2B25.0 (5.0)	THALLIUM	MG/KG	42.20	J4
FT2-B2	FT2B25.0 (5.0)	VANADIUM	MG/KG	82.60	J4
FT2-B2	FT2B25.0 (5.0)	ZINC	MG/KG	40.50	J4
FT2-B2	FT2B25.0 (5.0)	4-METHYL-2-PENTANONE	UG/KG	15.00	J2
FT2-B2	FT2B25.0 (5.0)	CHLOROBENZENE	UG/KG	5.00	BJ
FT2-B3	FT2B25.0 (5.0)	TOTAL ORGANIC CARBON	MG/KG	15600.00	
FT2-B3	FT2B30.5 (0-0.5)	ALUMINUM	MG/KG	4830.00	
FT2-B3	FT2B30.5 (0-0.5)	BERYLLIUM	MG/KG	8.40	
FT2-B3	FT2B30.5 (0-0.5)	CALCIUM	MG/KG	2890.00	
FT2-B3	FT2B30.5 (0-0.5)	CHROMIUM	MG/KG	3.50	
FT2-B3	FT2B30.5 (0-0.5)	COBALT	MG/KG	4.30	
FT2-B3	FT2B30.5 (0-0.5)	COPPER	MG/KG	43.00	
FT2-B3	FT2B30.5 (0-0.5)	IRON	MG/KG	5740.00	
FT2-B3	FT2B30.5 (0-0.5)	MAGNESIUM	MG/KG	4750.00	
FT2-B3	FT2B30.5 (0-0.5)	MANGANESE	MG/KG	140.00	J4
FT2-B3	FT2B30.5 (0-0.5)	NICKEL	MG/KG	4.40	
FT2-B3	FT2B30.5 (0-0.5)	POTASSIUM	MG/KG	557.00	
FT2-B3	FT2B30.5 (0-0.5)	SELENIUM	MG/KG	11.30	
FT2-B3	FT2B30.5 (0-0.5)	SODIUM	MG/KG	667.00	
FT2-B3	FT2B30.5 (0-0.5)	THALLIUM	MG/KG	2.50	J4
FT2-B3	FT2B30.5 (0-0.5)	VANADIUM	MG/KG	13.10	J4
FT2-B3	FT2B30.5 (0-0.5)	ZINC	MG/KG	31.70	J4
FT2-B3	FT2B30.5 (0-0.5)	2-METHYLNAPHTHALENE	UG/KG	45000.00	J2
FT2-B3	FT2B30.5 (0-0.5)	DIBENZOFURAN	UG/KG	1700.00	J
FT2-B3	FT2B30.5 (0-0.5)	FLUORENE	UG/KG	2200.00	J
FT2-B3	FT2B30.5 (0-0.5)	NAPHTHALENE	UG/KG	27000.00	
FT2-B3	FT2B30.5 (0-0.5)	PHENANTHRENE	UG/KG	1500.00	J
FT2-B3	FT2B30.5 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	2200.00	J2
FT2-B3	FT2B30.5 (0-0.5)	BENZENE	UG/KG	5600.00	J
FT2-B3	FT2B30.5 (0-0.5)	ETHYLBENZENE	UG/KG	56000.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT2-B3	FT2B30.5 (0-0.5)	TOLUENE	UG/KG	210000.00	BJ1
FT2-B3	FT2B30.5 (0-0.5)	XYLENE (total)	UG/KG	680000.00	BJ12
FT2-B3	FT2B35.0 (5.0)	ALUMINUM	MG/KG	11600.00	
FT2-B3	FT2B35.0 (5.0)	ARSENIC	MG/KG	9.10	
FT2-B3	FT2B35.0 (5.0)	BARIIUM	MG/KG	17.70	
FT2-B3	FT2B35.0 (5.0)	BERYLLIUM	MG/KG	.63	
FT2-B3	FT2B35.0 (5.0)	CADMIUM	MG/KG	1.80	
FT2-B3	FT2B35.0 (5.0)	CALCIUM	MG/KG	5310.00	
FT2-B3	FT2B35.0 (5.0)	CHROMIUM	MG/KG	23.30	
FT2-B3	FT2B35.0 (5.0)	COBALT	MG/KG	9.00	
FT2-B3	FT2B35.0 (5.0)	COPPER	MG/KG	16.30	
FT2-B3	FT2B35.0 (5.0)	IRON	MG/KG	23800.00	
FT2-B3	FT2B35.0 (5.0)	MAGNESIUM	MG/KG	8090.00	
FT2-B3	FT2B35.0 (5.0)	MANGANESE	MG/KG	246.00	J4
FT2-B3	FT2B35.0 (5.0)	NICKEL	MG/KG	30.80	
FT2-B3	FT2B35.0 (5.0)	POTASSIUM	MG/KG	520.00	
FT2-B3	FT2B35.0 (5.0)	SODIUM	MG/KG	1010.00	
FT2-B3	FT2B35.0 (5.0)	THALLIUM	MG/KG	61.70	J4
FT2-B3	FT2B35.0 (5.0)	VANADIUM	MG/KG	92.50	J4
FT2-B3	FT2B35.0 (5.0)	ZINC	MG/KG	45.70	J4
FT2-B3	FT2B35.0 (5.0)	2-METHYLNAPHTHALENE	UG/KG	16000.00	J4
FT2-B3	FT2B35.0 (5.0)	NAPHTHALENE	UG/KG	9200.00	J4
FT2-B3	FT2B35.0 (5.0)	BENZENE	UG/KG	22000.00	
FT2-B3	FT2B35.0 (5.0)	ETHYLBENZENE	UG/KG	120000.00	
FT2-B3	FT2B35.0 (5.0)	TOLUENE	UG/KG	460000.00	BJ12
FT2-B3	FT2B35.0DL (5.0, DIL)	XYLENE (total)	UG/KG	590000.00	BJ12
FT2-B3	FT2B35.0DL (5.0, DIL)	BENZENE	UG/KG	24000.00	DJ
FT2-B3	FT2B35.0DL (5.0, DIL)	ETHYLBENZENE	UG/KG	140000.00	D
FT2-B3	FT2B35.0DL (5.0, DIL)	TOLUENE	UG/KG	550000.00	D
FT2-B3	FT2B35.0DL (5.0, DIL)	XYLENE (total)	UG/KG	690000.00	DJ2
FT2-B4	FT2B40.5 (0-0.5)	TOTAL ORGANIC CARBON	MG/KG	9280.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
FT2-B4	FT2B40.5 (0-0.5)	ALUMINUM	MG/KG	16900.00	
FT2-B4	FT2B40.5 (0-0.5)	ARSENIC	MG/KG	10.20	
FT2-B4	FT2B40.5 (0-0.5)	BARIUM	MG/KG	43.10	
FT2-B4	FT2B40.5 (0-0.5)	BERYLLIUM	MG/KG	.41	
FT2-B4	FT2B40.5 (0-0.5)	CADMIUM	MG/KG	1.50	
FT2-B4	FT2B40.5 (0-0.5)	CALCIUM	MG/KG	9290.00	
FT2-B4	FT2B40.5 (0-0.5)	CHROMIUM	MG/KG	17.10	
FT2-B4	FT2B40.5 (0-0.5)	COBALT	MG/KG	13.60	
FT2-B4	FT2B40.5 (0-0.5)	COPPER	MG/KG	39.30	
FT2-B4	FT2B40.5 (0-0.5)	IRON	MG/KG	27300.00	
FT2-B4	FT2B40.5 (0-0.5)	MAGNESIUM	MG/KG	10400.00	
FT2-B4	FT2B40.5 (0-0.5)	MANGANESE	MG/KG	448.00	J4
FT2-B4	FT2B40.5 (0-0.5)	NICKEL	MG/KG	19.10	
FT2-B4	FT2B40.5 (0-0.5)	POTASSIUM	MG/KG	1170.00	
FT2-B4	FT2B40.5 (0-0.5)	SILVER	MG/KG	.25	J1
FT2-B4	FT2B40.5 (0-0.5)	SODIUM	MG/KG	1540.00	
FT2-B4	FT2B40.5 (0-0.5)	THALLIUM	MG/KG	67.80	J4
FT2-B4	FT2B40.5 (0-0.5)	VANADIUM	MG/KG	94.40	J4
FT2-B4	FT2B40.5 (0-0.5)	ZINC	MG/KG	57.20	J4
FT2-B4	FT2B40.5 (0-0.5)	2-METHYLNAPHTHALENE	UG/KG	11000.00	J2
FT2-B4	FT2B40.5 (0-0.5)	FLUORANTHENE	UG/KG	1500.00	J
FT2-B4	FT2B40.5 (0-0.5)	FLUORENE	UG/KG	760.00	J
FT2-B4	FT2B40.5 (0-0.5)	NAPHTHALENE	UG/KG	6400.00	J
FT2-B4	FT2B40.5 (0-0.5)	PHENANTHRENE	UG/KG	1600.00	J
FT2-B4	FT2B40.5 (0-0.5)	PYRENE	UG/KG	1300.00	J
FT2-B4	FT2B40.5 (0-0.5)	XYLENE (total)	UG/KG	160000.00	BJ1
FT2-B4	FT2B45.0 (5.0)	ALUMINUM	MG/KG	10300.00	
FT2-B4	FT2B45.0 (5.0)	ANTIMONY	MG/KG	4.10	
FT2-B4	FT2B45.0 (5.0)	ARSENIC	MG/KG	11.60	
FT2-B4	FT2B45.0 (5.0)	BARIUM	MG/KG	16.80	
FT2-B4	FT2B45.0 (5.0)	BERYLLIUM	MG/KG	.31	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
FT2-B4	FT2B45.0 (5.0)	CADMIUM	MG/KG	1.20	
FT2-B4	FT2B45.0 (5.0)	CALCIUM	MG/KG	4820.00	
FT2-B4	FT2B45.0 (5.0)	CHROMIUM	MG/KG	15.70	
FT2-B4	FT2B45.0 (5.0)	COBALT	MG/KG	6.00	
FT2-B4	FT2B45.0 (5.0)	COPPER	MG/KG	17.80	
FT2-B4	FT2B45.0 (5.0)	IRON	MG/KG	20200.00	
FT2-B4	FT2B45.0 (5.0)	MAGNESIUM	MG/KG	7660.00	
FT2-B4	FT2B45.0 (5.0)	MANGANESE	MG/KG	237.00	J4
FT2-B4	FT2B45.0 (5.0)	NICKEL	MG/KG	21.00	
FT2-B4	FT2B45.0 (5.0)	POTASSIUM	MG/KG	571.00	
FT2-B4	FT2B45.0 (5.0)	SILVER	MG/KG	.31	J1
FT2-B4	FT2B45.0 (5.0)	SODIUM	MG/KG	782.00	
FT2-B4	FT2B45.0 (5.0)	THALLIUM	MG/KG	48.20	J4
FT2-B4	FT2B45.0 (5.0)	VANADIUM	MG/KG	69.60	J4
FT2-B4	FT2B45.0 (5.0)	ZINC	MG/KG	40.90	J4
FT2-B4	FT2B45.0 (5.0)	2-METHYLNAPHTHALENE	UG/KG	5700.00	J2
FT2-B4	FT2B45.0 (5.0)	NAPHTHALENE	UG/KG	3500.00	J
FT2-B4	FT2B45.0 (5.0)	BENZENE	UG/KG	3200.00	J
FT2-B4	FT2B45.0 (5.0)	ETHYLBENZENE	UG/KG	46000.00	
FT2-B4	FT2B45.0 (5.0)	TOLUENE	UG/KG	260000.00	BJ1
FT2-B4	FT2B45.0 (5.0)	XYLENE (total)	UG/KG	620000.00	BJ12
FT2-B6	FT2B60.5 (0-0.5)	ALUMINUM	MG/KG	5460.00	
FT2-B6	FT2B60.5 (0-0.5)	BARIUM	MG/KG	7.00	
FT2-B6	FT2B60.5 (0-0.5)	CALCIUM	MG/KG	3090.00	
FT2-B6	FT2B60.5 (0-0.5)	CHROMIUM	MG/KG	3.30	
FT2-B6	FT2B60.5 (0-0.5)	COBALT	MG/KG	4.70	
FT2-B6	FT2B60.5 (0-0.5)	COPPER	MG/KG	52.50	
FT2-B6	FT2B60.5 (0-0.5)	IRON	MG/KG	6300.00	
FT2-B6	FT2B60.5 (0-0.5)	MAGNESIUM	MG/KG	5990.00	
FT2-B6	FT2B60.5 (0-0.5)	MANGANESE	MG/KG	194.00	
FT2-B6	FT2B60.5 (0-0.5)	NICKEL	MG/KG	6.20	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
FT2-B6	FT2B60.5 (0-0.5)	POTASSIUM	MG/KG	275.00	
FT2-B6	FT2B60.5 (0-0.5)	SODIUM	MG/KG	643.00	
FT2-B6	FT2B60.5 (0-0.5)	THALLIUM	MG/KG	4.90	
FT2-B6	FT2B60.5 (0-0.5)	VANADIUM	MG/KG	13.50	
FT2-B6	FT2B60.5 (0-0.5)	ZINC	MG/KG	25.80	
FT2-B6	FT2B60.5 (0-0.5)	2-METHYLNAPHTHALENE	UG/KG	9200.00	J
FT2-B6	FT2B60.5 (0-0.5)	NAPHTHALENE	UG/KG	5500.00	J
FT2-B6	FT2B60.5 (0-0.5)	BENZENE	UG/KG	6200.00	J
FT2-B6	FT2B60.5 (0-0.5)	ETHYLBENZENE	UG/KG	20000.00	
FT2-B6	FT2B60.5 (0-0.5)	TOLUENE	UG/KG	190000.00	BJ1
FT2-B6	FT2B60.5 (0-0.5)	XYLENE (total)	UG/KG	540000.00	BJ12
FT2-B6	FT2B60.5 (0-0.5)	ALUMINUM	MG/KG	9630.00	
FT2-B6	FT2B65.0 (5.0)	BARIUM	MG/KG	26.50	
FT2-B6	FT2B65.0 (5.0)	CADMIUM	MG/KG	.95	
FT2-B6	FT2B65.0 (5.0)	CALCIUM	MG/KG	3890.00	
FT2-B6	FT2B65.0 (5.0)	CHROMIUM	MG/KG	18.70	
FT2-B6	FT2B65.0 (5.0)	COBALT	MG/KG	4.80	J1
FT2-B6	FT2B65.0 (5.0)	COPPER	MG/KG	18.70	
FT2-B6	FT2B65.0 (5.0)	IRON	MG/KG	20000.00	
FT2-B6	FT2B65.0 (5.0)	MAGNESIUM	MG/KG	4960.00	
FT2-B6	FT2B65.0 (5.0)	MANGANESE	MG/KG	199.00	
FT2-B6	FT2B65.0 (5.0)	NICKEL	MG/KG	14.90	
FT2-B6	FT2B65.0 (5.0)	POTASSIUM	MG/KG	459.00	
FT2-B6	FT2B65.0 (5.0)	SODIUM	MG/KG	699.00	
FT2-B6	FT2B65.0 (5.0)	THALLIUM	MG/KG	32.10	
FT2-B6	FT2B65.0 (5.0)	VANADIUM	MG/KG	73.30	
FT2-B6	FT2B65.0 (5.0)	ZINC	MG/KG	31.50	
FT2-B6	FT2B65.0 (5.0)	2-METHYLNAPHTHALENE	UG/KG	32000.00	J24
FT2-B6	FT2B65.0 (5.0)	DIBENZOFURAN	UG/KG	1200.00	J4
FT2-B6	FT2B65.0 (5.0)	FLUORENE	UG/KG	1600.00	J4
FT2-B6	FT2B65.0 (5.0)	NAPHTHALENE	UG/KG	18000.00	J4

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT2-B6	FT2B65.0 (5.0)	PHENANTHRENE	UG/KG	1900.00	J4
FT2-B6	FT2B65.0 (5.0)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	790.00	J24
FT2-B6	FT2B65.0 (5.0)	BENZENE	UG/KG	21000.00	
FT2-B6	FT2B65.0 (5.0)	ETHYLBENZENE	UG/KG	97000.00	
FT2-B6	FT2B65.0 (5.0)	TOLUENE	UG/KG	450000.00	BJ12
FT2-B6	FT2B65.0 (5.0)	XYLENE (total)	UG/KG	640000.00	BJ12
FT2-B6	FT2B65.0DL (5.0, DIL)	BENZENE	UG/KG	14000.00	DJ
FT2-B6	FT2B65.0DL (5.0, DIL)	ETHYLBENZENE	UG/KG	74000.00	D
FT2-B6	FT2B65.0DL (5.0, DIL)	TOLUENE	UG/KG	350000.00	D
FT2-B6	FT2B65.0DL (5.0, DIL)	XYLENE (total)	UG/KG	500000.00	D
FT2-W1	FT2-W1	ALUMINUM	UG/L	18900.00	
FT2-W1	FT2-W1	BARIUM	UG/L	71.40	
FT2-W1	FT2-W1	BERYLLIUM	UG/L	1.50	
FT2-W1	FT2-W1	CADMIUM	UG/L	2.40	
FT2-W1	FT2-W1	CALCIUM	UG/L	73600.00	
FT2-W1	FT2-W1	CHROMIUM	UG/L	13.90	
FT2-W1	FT2-W1	COBALT	UG/L	7.60	
FT2-W1	FT2-W1	COPPER	UG/L	49.10	
FT2-W1	FT2-W1	IRON	UG/L	29800.00	
FT2-W1	FT2-W1	MAGNESIUM	UG/L	17700.00	
FT2-W1	FT2-W1	MANGANESE	UG/L	1760.00	
FT2-W1	FT2-W1	POTASSIUM	UG/L	3600.00	
FT2-W1	FT2-W1	SODIUM	UG/L	41100.00	
FT2-W1	FT2-W1	VANADIUM	UG/L	110.00	
FT2-W1	FT2-W1	ZINC	UG/L	87.60	
FT2-W1	FT2-W1	2,4-DIMETHYLPHENOL	UG/L	26.00	
FT2-W1	FT2-W1	2-METHYLNAPHTHALENE	UG/L	1.00	J
FT2-W1	FT2-W1	2-METHYLPHENOL	UG/L	18.00	
FT2-W1	FT2-W1	4-METHYLPHENOL	UG/L	31.00	
FT2-W1	FT2-W1	NAPHTHALENE	UG/L	32.00	J2
FT2-W1	FT2-W1	PHENOL	UG/L	11.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
FT2-W1	FT2-W1	BENZENE	UG/L	460.00	E
FT2-W1	FT2-W1	ETHYLBENZENE	UG/L	690.00	E
FT2-W1	FT2-W1	TOLUENE	UG/L	720.00	E
FT2-W1	FT2-W1	XYLENE (total)	UG/L	2000.00	E
FT2-W1	FT2-W1DL (DIL)	BENZENE	UG/L	200.00	D
FT2-W1	FT2-W1DL (DIL)	ETHYLBENZENE	UG/L	200.00	D
FT2-W1	FT2-W1DL (DIL)	TOLUENE	UG/L	200.00	D
FT2-W1	FT2-W1DL (DIL)	XYLENE (total)	UG/L	200.00	D
FT2-W1	FT2W17.0 (7.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	18.70	
FT2-W5	FT2-W5	ALUMINUM	UG/L	26400.00	
FT2-W5	FT2-W5	BARIIUM	UG/L	68.20	
FT2-W5	FT2-W5	BERYLLIUM	UG/L	1.40	
FT2-W5	FT2-W5	CALCIUM	UG/L	58200.00	
FT2-W5	FT2-W5	CHROMIUM	UG/L	15.60	
FT2-W5	FT2-W5	COBALT	UG/L	6.40	
FT2-W5	FT2-W5	COPPER	UG/L	33.00	
FT2-W5	FT2-W5	IRON	UG/L	23100.00	
FT2-W5	FT2-W5	MAGNESIUM	UG/L	13400.00	
FT2-W5	FT2-W5	MANGANESE	UG/L	1400.00	
FT2-W5	FT2-W5	POTASSIUM	UG/L	3540.00	
FT2-W5	FT2-W5	SODIUM	UG/L	38600.00	
FT2-W5	FT2-W5	VANADIUM	UG/L	126.00	
FT2-W5	FT2-W5	ZINC	UG/L	75.80	
FT2-W7	FT2-W7	ALUMINUM	UG/L	62500.00	
FT2-W7	FT2-W7	BARIIUM	UG/L	130.00	
FT2-W7	FT2-W7	BERYLLIUM	UG/L	3.10	
FT2-W7	FT2-W7	CADMIUM	UG/L	2.70	
FT2-W7	FT2-W7	CALCIUM	UG/L	22300.00	
FT2-W7	FT2-W7	CHROMIUM	UG/L	15.50	
FT2-W7	FT2-W7	COBALT	UG/L	9.70	
FT2-W7	FT2-W7	COPPER	UG/L	18.80	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.15. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
FT2-W7	FT2-W7	IRON	UG/L	54700.00	
FT2-W7	FT2-W7	MAGNESIUM	UG/L	5730.00	
FT2-W7	FT2-W7	MANGANESE	UG/L	1050.00	
FT2-W7	FT2-W7	NICKEL	UG/L	17.00	
FT2-W7	FT2-W7	POTASSIUM	UG/L	1900.00	
FT2-W7	FT2-W7	SODIUM	UG/L	27600.00	
FT2-W7	FT2-W7	VANADIUM	UG/L	286.00	
FT2-W7	FT2-W7	ZINC	UG/L	. 59.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

3.4.4 Nature and Extent of Contamination

Tables 3.16 and 3.17 present the analytes with positive results at FT-2. These tables present the analytes, the number of samples, the number of samples with positive results, and the range of the positive results.

The surface and subsurface sampling indicate that all of the soil underlying the ringed fire training area is contaminated with petroleum-related compounds. TPH concentrations exceeded 20,000 mg/kg in samples taken from within the bermed area, and concentrations of other volatile and semivolatile compounds associated with petroleum products were elevated. This contamination extends to the water table, but does not seem to have spread laterally within the soil column. Groundwater is also contaminated with petroleum-related compounds that probably originated from the fire training area. Metals found in the groundwater are below MCLs. The extent of the groundwater contamination is not known. No dioxins were found in any of the soil samples analyzed.

Because the other two areas of FT-2 were incorporated into the site too late to be investigated, no information was collected at the fire training area at the north end of Runway B, or the location where drums were disposed of on the west side of Runway C.

3.4.5 Preliminary Risk Assessment

Comparing the maximum values found at FT-2 in both soils and groundwater to the risk-based PRLs developed in Appendixes C and D, benzene and methylene chloride in the water sample taken from well W1 (FT2-W1) exceed the human health risk criteria (Table 3.18). The TPH concentrations in five soil samples exceeded the human health risk PRLs in soil (Table 3.18). This indicates that the groundwater, and the soil that is contaminating the groundwater, may have to be cleaned up to attain human health criteria. Benzene concentrations in soil were determined to be a potential ecological threat to terrestrial receptors as were lead concentrations.

FIGURE 3.12. FT-2 Ground

LEGEND

— GROUNDWATER
CONTOURS

TABLE 3.16. Analytes with Positive Results in Soil at FT-2

Analyte	Total Number of Samples	Number of Samples with Positive Result	Range of Results ^(a)
Xylene	80	25	2 - 660,000
Benzene	80	4	11 - 14,000
Toluene	80	22	32 - 610,000
Ethylbenzene	80	17	13 - 13,000
4-Methyl-2-Pentanone	12	1	15
Chlorobenzene	12	1	5
Naphthalene	12	6	3,500 - 27,000
2-Methylnaphthalene	12	6	5,700 - 45,000
Fluorene	12	3	760 - 2,200
Phenanthrene	12	3	1,500 - 1,900
Fluoranthene	12	1	1,500
Pyrene	12	1	1,300
Dibenzofuran	12	2	1,200 - 1,700
bis(2-ethylhexyl)phthalate	12	3	700 - 2,200
Methylene Chloride	12	1	11
Acetone	12	1	30
TOC	3	3	6,330 - 15,600
TPH	80	72	45 - 29,360

^(a)Metals, TOC, and TPH are in mg/kg. All other analytes are in $\mu\text{g/kg}$.

TABLE 3.17. Analytes with Positive Results in Water at FT-2

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Result</u>	<u>Range of Results^(a)</u>
Benzene	3	1	710
Toluene	3	1	1,400
Ethylbenzene	3	1	680
Xylene	3	1	3,600
Phenol	3	1	11
2-Methylphenol	3	1	18
4-Methylphenol	3	1	31
2-4-Dimethylphenol	3	1	26
2 Methylnaphthalene	3	1	1
Naphthalene	3	1	32
Chromium	3	3	13.9 - 15.6
Zinc	3	3	59 - 87.6

^(a) All analytes are in $\mu\text{g/L}$.

TABLE 3.18. Contaminants of Potential Concern (COPCs) at FT-2 that Exceed Human Health Preliminary Risk Levels (PRLs)

Sample No.	Depth (ft.)	Chemical	Concentration	Qualifier	Laboratory	PRL Concentration	PRL Source
GROUNDWATER COPCs			(ug/L)			(ug/L)	
<i>FT-2: Aircraft Mockup</i>							
FT2-W1		Benzene	512		ONSITE	5	MCL
FT2-W1DL		Benzene	710	D	OFFSITE	5	MCL
FT2-W1DL		Methylene Chloride	420	BDJ2	OFFSITE	0.19	WQC
SOILS COPCs			(ug/kg)			(ug/kg)	
<i>FT-2: Aircraft Mockup</i>							
FT2-128	0.5	Total Petroleum Hydrocarbon	29360		ONSITE	20000	NC
FT2-130	0.5	Total Petroleum Hydrocarbon	28034		ONSITE	20000	NC
FT2-134	0.5	Total Petroleum Hydrocarbon	20107		ONSITE	20000	NC
FT2-B3	5.0	Total Petroleum Hydrocarbon	23649		ONSITE	20000	NC
FT2-B6	0.5	Total Petroleum Hydrocarbon	20573		ONSITE	20000	NC

Notes:

MCL = Safe Drinking Water Act Maximum Contaminant Level
WQC = Ambient Water Quality Criteria
NC = Risk-based Concentration/Noncarcinogenic Effects
ONSITE = Close Support Laboratory (on Shemya Island)
OFFSITE = SW 846 Methodology (samples sent to offsite lab)
J = estimated value
D = dilution
B = blank contamination

3.4.6 Future Actions

Remediation of the burn pit area investigated in 1992 is recommended. Soil excavation to groundwater and stockpiling for bioremediation is the most logical alternative. Removal of 6,000 cubic yards of material is anticipated based on the 1992 field investigation data of 7 feet to groundwater and assuming that all of the soil within the bermed area will require remediation and that the area outside the berms will not need to be excavated.

Groundwater remediation may be recommended to alleviate further groundwater degradation. After soil excavation, a groundwater monitoring system should be developed to monitor groundwater quality. The extent of the groundwater contamination has not been defined. This will need to be accomplished to determine if the quality of the groundwater improves after remediation. If the quality of the groundwater does not improve, then a pump and treatment system will need to be developed for the aquifer. To develop such a system, groundwater flow direction needs to be more closely defined and the groundwater flow velocity must be determined. In order to better determine the groundwater flow direction and groundwater fluctuations, water level measurements in the three-well network should be made, monthly if possible. Other required investigations can be coupled with site investigations at the north end of Runway B and the barrel area to the west of Runway C.

Further investigations will be required at FT-2 to determine what impacts the area at the north end of Runway B and the barrel area to the west of Runway C have on the environment. These investigations should consist of surface and subsurface sampling, similar to that conducted at FT-2 in 1992, and the installation of groundwater monitoring wells to determine if the uppermost aquifer has been impacted by these additional areas.

3.5 FIRE TRAINING SITE 3: FIRE DEPARTMENT STRUCTURAL TRAINING AREA (FT-3)

3.5.1 Site Background

FT-3 is located approximately 1,000 feet southeast of Upper Lake on the south side of the old taxiway (Figure 3.13). It is bordered on the south by rolling tundra and to the north by the foundation and floor of an old hangar. Surface water from this site tends to flow southeast; however, because of the adjacent tundra, most water infiltrates and moves within the soil profile except during intense rainfall periods. Groundwater flow patterns in this area are not known.

Originally the site of an old hangar building, the site consisted of a small concrete structure, about 30 by 15 by 15 feet, on the edge of the concrete on-grade slab of the original hangar. This building was used as a structural fire training area. Wood, paper, and other combustible materials were burned in the structure along with JP-4 and diesel fuel. There were holes in the concrete pad, which allowed fluids (i.e., diesel, JP-4, and AFFF) to drain through the foundation and possibly contaminate underlying soils. The 11th CEOS removed the debris and placed backfill material at this site. Since the 1988 field investigation, this building and concrete pad have been removed. The former hangar area is currently being used to stockpile asphalt removed from adjacent hardstands. The asphalt is stockpiled in mounds approximately 7 feet high and covers almost the entire area. The land to the east and south of FT-3 slopes down toward Lower Lake.

3.5.2 Previous Investigations

During the 1988 investigation, an auger boring was placed near the building in a darkened soils area. A poorly graded fine sand was observed to a depth of 5 feet, underlain by bedrock. OVA measurements up to 2 ppm were observed in the near-surface soils.

Soil samples collected from the boring near the concrete building (Figure 3.14) showed TPH levels of 170 and 430 mg/kg at 2 and 5.5 feet, respectively. No semivolatile organics were detected in these samples. Volatile organic analysis results indicated methylene chloride concentrations at 0.015 and 0.017 mg/kg at 2 and

5.5 feet, respectively. Acetone concentrations were 0.013 and 0.021 mg/kg at 2 and 5.5 feet, respectively. Both methylene chloride and acetone are common laboratory contaminants and may not indicate site contamination. Detected lead levels at 2 and 5.5 feet are within background levels.

3.5.3 1992 Investigation

During the 1992 investigation, a geophysical survey of FT-3 was performed. The extent of the geophysical investigation is shown in Figure 3.14. Conductivity data were collected at 5-foot intervals along lines 10 feet apart. The conductivity and in-phase data are presented as contour maps in Appendix B. The objective of the investigation was to identify buried features to be avoided during drilling. Approximately 0.6 acre was covered by the investigation. The site was gridded by the geophysics team. The grid was tied into foundations of an old hangar. Grid line 100 north was established along the south side of the foundation, and grid line 100 east was established in line with the metal hangar door tracks near the east side of the foundation.

Figure 3.14 shows the results of the investigation. A large area of buried metal was identified in the center of the site. The southern limit of the area of buried metal extends beyond the limits of the investigation and is not fully defined. Little or no metal extends northward beneath the rubble pile. Buried metal was also encountered in the extreme southwest part of the site, but the limits were not defined as this was beyond the scope of work at this site.

No other investigations were performed during the 1992 field season.

3.5.4 Nature and Extent of Contamination

Based on the limited soils data from 1988, contamination at FT-3 appears to be fairly minor (Table 3.19). The TPH found is much lower than at FT-1 and FT-2, and the volatile organics detected could be from laboratory contamination, as methylene chloride and acetone are common laboratory reagents and the concentrations found were very low. However, the true extent or nature of contamination at this site is not possible to determine, based on the information available.

FIGURE 3.13. FT-3

FIGURE 3.14. FT-3

LEGEND

— GEOPHYSICAL SURVEY LINE

Ⓜ METAL OBSERVED AT SURFACE

INTERPRETED FEATURES

⊗ AREA OF BURIED METAL

○ 1988 SAMPLING LOCATION

— UTILITY LINE

TABLE 3.19. Analytes with Positive Results at FT-3 (1988 Data)

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Result</u>	<u>Range of Results (mg/kg)</u>
Methylene Chloride	2	2	0.015 - 0.017
Acetone	2	2	0.013 - 0.021
Total Petroleum Hydrocarbons	2	2	170 - 430

3.5.5 Preliminary Risk Assessment

Concentrations of compounds detected in 1988 were all below the preliminary risk levels for human health and ecological risk, which are established in Appendixes C and D. However, because the full nature and extent of contamination is not known, a complete risk assessment is not practical at this time.

3.5.6 Future Actions

Because the nature and extent of contamination has not been defined at this site, further sampling is recommended. As outlined in the Field Investigation Plan, a gridded surface sampling should be performed along with soil borings to evaluate contamination at depth. The areas of buried metal discovered during the geophysical survey should be included in the investigation. Monitoring wells may also be required if additional contamination is discovered during the surface and subsurface sampling.

3.6 SOLID WASTE SITE SW-4: BARREL DUMP

3.6.1 Site Background

SW-4 currently covers approximately 15 acres along the north shore of Shemya (see Figure 3.15). It is bordered on the east, south, and west by 200-foot high grass-covered slopes and on the north by the ocean (within 50 feet). The area is relatively flat and is covered with various debris, mainly peat scraped off other parts of the island. The entire area appears to be covered with a peat layer of irregular depth. The landfill is estimated to be up to 8 feet deep and there are no regular drainage patterns.

The barrel dump site along North Beach Road had been used as a disposal area since World War II for more than 1,000 barrels with unknown contents. Since the records search of 1984, the 11th CEOS has removed barrels and scrap metal from the barrel dump area and backfilled the old dump site with 4- to 12-inch-diameter rock. This restoration was completed in July 1987. During the September 1991 site visit, the rock backfill was not evident, as the area was covered with peat.

FIGURE 3.15. SW-4 Location Map

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The area is currently not used by the air base; however, the north-east portion of the landfill is used to access a local "jade" mine that is visited by some base personnel, as is another mine shaft in the southwest portion of the site.

Investigations have shown that the SW-4 site contains various kinds of debris including concrete, metal, and domestic debris. The debris layer ranges from less than 1 foot to approximately 8 feet deep. Beneath the debris lie beach sands and cobbles intermixed with some organic matter (peat).

3.6.2 Previous Investigations

In the 1988 investigation, two backhoe pits were excavated within the southeast and northwest corners of the landfill. Samples were taken from these two backhoe pits. The TPH levels at one pit were 150 and 340 mg/kg at a depth of 1 to 4 feet, respectively. Metal concentrations from SW-4 were above the 1988 background levels at the 1-foot level for chromium (48.2 mg/kg), lead (242 mg/kg), zinc (68.8 mg/kg); and at the 4-foot level for arsenic (25 mg/kg), chromium (107 mg/kg), lead (534 mg/kg), nickel (96.5 mg/kg), and zinc (143 mg/kg), as would be expected in a metal debris landfill.

No semivolatile organic compounds were detected in 1988. Organic volatile compounds detected included methylene chloride (0.053 and 0.054 mg/kg at the 1- and 4-foot depths, respectively), 2-butanone (estimated at 0.082 mg/kg at 4-foot depth), and toluene (estimated at 0.038 mg/kg at 4-foot depth). Methylene chloride and 2-butanone are common laboratory contaminants.

3.6.3 1992 Investigation

The intent of the 1992 investigation was to collect sufficient data to recommend a remedial action, if necessary. Closure strategies could involve capping the landfill surface and installing monitoring wells outside the landfill boundary to determine leachate quantity, and the potential for offsite migration of contaminants.

The objectives of the investigation were to determine:

- areal extent of the dump area
- nature of surface soil contamination, if any

- nature of groundwater contamination, if any
- groundwater depth and direction
- significant, mappable site features.

The boundary (areal extent) of the site was determined by geophysical methods (Figure 3.16). The estimated area of the site from the 1992 field investigation is 14.7 acres. Geophysical mapping is shown in Figure 3.16.

Ten random surface samples were collected in 10 locations at the site (Figure 3.16). Offsite laboratory analysis was completed for each of the 10 samples for VOAs, semi VOAs, pesticides/PCBs, and metals.

Three trenches were dug by a backhoe to collect samples at depth (Figure 3.16). One sample from each of the three trenches was also analyzed for the above parameters. No groundwater monitoring wells were installed at the site in 1992.

Tables 3.20 and 3.21 list the SW-4 sampling results from the CSL and offsite analytical laboratories, respectively.

The extent of the geophysical conductivity investigation is shown in Figure 3.16. The gravel road defined the northern site limit. The southern and eastern limit of the survey was defined by the base of the bluff. The survey extended to the west until it was apparent from the data that the western limit of the buried waste had been defined. Data were collected at 5-foot intervals along lines 25 feet apart. Contours of the conductivity and in-phase measurements are presented in Appendix B. An estimated 14.7 acres were covered by the investigation. The objective of the survey was to determine the extent of buried waste material at the site, which would help define site boundaries.

A survey was performed at the site to establish a grid prior to the geophysical investigation.

The results of the geophysical investigation are presented in Figure 3.16. Extensive areas of buried waste and metal are present across the site. Area 1 is the largest area of buried metal. It is located along the south side of the site and covers about

TABLE 3.20. Positive Results from Onsite (CSL) Data at SW-4

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
S4-094	SHSOSSSW4-094	(0-0.5) TOTAL PETROLEUM HYDROCARBONS	MG/KG	76.10	
S4-096	SHSOSSSW4-096	(0-0.5) TOTAL PETROLEUM HYDROCARBONS	MG/KG	45.14	
S4-097	SHSOSSSW4-097	(0-0.5) TOTAL PETROLEUM HYDROCARBONS	MG/KG	66.21	
S4-098	SHSOSSSW4-098	(0-0.5) TOTAL PETROLEUM HYDROCARBONS	MG/KG	106.60	
S4-137	SOSW4-137-TP1	(6.0) TOTAL PETROLEUM HYDROCARBONS	MG/KG	530.23	
S4-137	SOSW4-137-TP1	(6.0) HEADSPACE	PPM	4.00	
S4-138	SOSW4-138-TP2	(9.0) TOTAL PETROLEUM HYDROCARBONS	MG/KG	1373.09	
S4-138	SOSW4-138-TP2	(9.0) O-XYLENE	UG/KG	29.80	
S4-139	SOSW4-139-TP3	(8.0) TOTAL PETROLEUM HYDROCARBONS	MG/KG	67.19	
S4-139	SOSW4-139-TP3	(8.0) HEADSPACE	PPM	9.00	
S4-139	SOSW4-139-TP3	(8.0) O-XYLENE	UG/KG	27.30	

 (a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

Figure 3.16 F/O

FIGURE 3.16. SV

TABLE 3.21. Positive Results from Offsite Data at SW-4

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S4-089	SOSW489 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	218.00	
S4-089	SOSW489 (0-0.5)	ALUMINUM	MG/KG	21500.00	
S4-089	SOSW489 (0-0.5)	BARIIUM	MG/KG	76.40	
S4-089	SOSW489 (0-0.5)	CADMIUM	MG/KG	.91	
S4-089	SOSW489 (0-0.5)	CALCIUM	MG/KG	1790.00	
S4-089	SOSW489 (0-0.5)	CHROMIUM	MG/KG	20.00	
S4-089	SOSW489 (0-0.5)	COBALT	MG/KG	10.20	
S4-089	SOSW489 (0-0.5)	COPPER	MG/KG	52.80	
S4-089	SOSW489 (0-0.5)	IRON	MG/KG	14300.00	J
S4-089	SOSW489 (0-0.5)	LEAD	MG/KG	17.00	
S4-089	SOSW489 (0-0.5)	MAGNESIUM	MG/KG	5680.00	
S4-089	SOSW489 (0-0.5)	MANGANESE	MG/KG	176.00	J
S4-089	SOSW489 (0-0.5)	NICKEL	MG/KG	17.20	
S4-089	SOSW489 (0-0.5)	POTASSIUM	MG/KG	629.00	
S4-089	SOSW489 (0-0.5)	SILVER	MG/KG	.75	
S4-089	SOSW489 (0-0.5)	SODIUM	MG/KG	789.00	
S4-089	SOSW489 (0-0.5)	THALLIUM	MG/KG	53.90	
S4-089	SOSW489 (0-0.5)	VANADIUM	MG/KG	99.40	
S4-089	SOSW489 (0-0.5)	ZINC	MG/KG	48.40	*
S4-089	SOSW489 (0-0.5)	ACETONE	UG/KG	9.00	J
S4-089	SOSW489RE (0-0.5, RE)	AROCLOR-1260	UG/KG	90.00	
S4-089	SOSW490 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	15.60	
S4-090	SOSW490 (0-0.5)	ALUMINUM	MG/KG	24000.00	
S4-090	SOSW490 (0-0.5)	BARIIUM	MG/KG	105.00	
S4-090	SOSW490 (0-0.5)	CADMIUM	MG/KG	1.70	
S4-090	SOSW490 (0-0.5)	CALCIUM	MG/KG	8210.00	
S4-090	SOSW490 (0-0.5)	CHROMIUM	MG/KG	16.50	
S4-090	SOSW490 (0-0.5)	COBALT	MG/KG	19.90	
S4-090	SOSW490 (0-0.5)	COPPER	MG/KG	63.50	
S4-090	SOSW490 (0-0.5)	IRON	MG/KG	41300.00	J
S4-090	SOSW490 (0-0.5)	LEAD	MG/KG	26.80	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S4-090	SOSW490 (0-0.5)	MAGNESIUM	MG/KG	15500.00	
S4-090	SOSW490 (0-0.5)	MANGANESE	MG/KG	749.00	J
S4-090	SOSW490 (0-0.5)	NICKEL	MG/KG	20.60	
S4-090	SOSW490 (0-0.5)	POTASSIUM	MG/KG	1160.00	
S4-090	SOSW490 (0-0.5)	SILVER	MG/KG	1.10	
S4-090	SOSW490 (0-0.5)	SODIUM	MG/KG	2840.00	
S4-090	SOSW490 (0-0.5)	THALLIUM	MG/KG	92.40	
S4-090	SOSW490 (0-0.5)	VANADIUM	MG/KG	134.00	
S4-090	SOSW490 (0-0.5)	ZINC	MG/KG	85.60	*
S4-090	SOSW490 (0-0.5)	ACETONE	UG/KG	3.00	J
S4-090	SOSW490RE (0-0.5, RE)	AROCLOR-1260	UG/KG	92.00	
S4-090	SOSW491 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	6.80	
S4-091	SOSW491 (0-0.5)	ALUMINUM	MG/KG	8870.00	
S4-091	SOSW491 (0-0.5)	BARIUM	MG/KG	7.30	
S4-091	SOSW491 (0-0.5)	CALCIUM	MG/KG	3000.00	
S4-091	SOSW491 (0-0.5)	CHROMIUM	MG/KG	5.40	
S4-091	SOSW491 (0-0.5)	COBALT	MG/KG	6.80	
S4-091	SOSW491 (0-0.5)	COPPER	MG/KG	37.10	
S4-091	SOSW491 (0-0.5)	IRON	MG/KG	13100.00	J
S4-091	SOSW491 (0-0.5)	MAGNESIUM	MG/KG	8750.00	
S4-091	SOSW491 (0-0.5)	MANGANESE	MG/KG	563.00	J
S4-091	SOSW491 (0-0.5)	NICKEL	MG/KG	8.90	
S4-091	SOSW491 (0-0.5)	POTASSIUM	MG/KG	227.00	
S4-091	SOSW491 (0-0.5)	SODIUM	MG/KG	860.00	
S4-091	SOSW491 (0-0.5)	THALLIUM	MG/KG	12.00	
S4-091	SOSW491 (0-0.5)	VANADIUM	MG/KG	24.60	
S4-091	SOSW491 (0-0.5)	ZINC	MG/KG	40.20	*
S4-091	SOSW491 (0-0.5)	ACETONE	UG/KG	14.00	
S4-092	SOSW492 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	84.20	
S4-092	SOSW492 (0-0.5)	ALUMINUM	MG/KG	17900.00	
S4-092	SOSW492 (0-0.5)	BARIUM	MG/KG	69.20	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S4-092	SOSW492 (0-0.5)	CADMIUM	MG/KG	1.00	
S4-092	SOSW492 (0-0.5)	CALCIUM	MG/KG	2660.00	
S4-092	SOSW492 (0-0.5)	CHROMIUM	MG/KG	17.80	
S4-092	SOSW492 (0-0.5)	COBALT	MG/KG	11.00	
S4-092	SOSW492 (0-0.5)	COPPER	MG/KG	36.40	
S4-092	SOSW492 (0-0.5)	IRON	MG/KG	19600.00	J
S4-092	SOSW492 (0-0.5)	LEAD	MG/KG	26.10	
S4-092	SOSW492 (0-0.5)	MAGNESIUM	MG/KG	7300.00	
S4-092	SOSW492 (0-0.5)	MANGANESE	MG/KG	301.00	J
S4-092	SOSW492 (0-0.5)	NICKEL	MG/KG	14.20	
S4-092	SOSW492 (0-0.5)	POTASSIUM	MG/KG	510.00	
S4-092	SOSW492 (0-0.5)	SILVER	MG/KG	.59	
S4-092	SOSW492 (0-0.5)	SODIUM	MG/KG	784.00	
S4-092	SOSW492 (0-0.5)	THALLIUM	MG/KG	50.00	
S4-092	SOSW492 (0-0.5)	VANADIUM	MG/KG	82.30	
S4-092	SOSW492 (0-0.5)	ZINC	MG/KG	48.80	*
S4-092	SOSW492 (0-0.5)	ACETONE	UG/KG	5.00	J
S4-093	SOSW493 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	91.80	
S4-093	SOSW493 (0-0.5)	ALUMINUM	MG/KG	19100.00	
S4-093	SOSW493 (0-0.5)	BERIUM	MG/KG	34.70	
S4-093	SOSW493 (0-0.5)	BERYLLIUM	MG/KG	.32	
S4-093	SOSW493 (0-0.5)	CADMIUM	MG/KG	1.10	
S4-093	SOSW493 (0-0.5)	CALCIUM	MG/KG	5720.00	
S4-093	SOSW493 (0-0.5)	CHROMIUM	MG/KG	20.00	
S4-093	SOSW493 (0-0.5)	COBALT	MG/KG	8.30	
S4-093	SOSW493 (0-0.5)	COPPER	MG/KG	25.90	
S4-093	SOSW493 (0-0.5)	IRON	MG/KG	27300.00	J
S4-093	SOSW493 (0-0.5)	LEAD	MG/KG	55.70	
S4-093	SOSW493 (0-0.5)	MAGNESIUM	MG/KG	11200.00	
S4-093	SOSW493 (0-0.5)	MANGANESE	MG/KG	381.00	J
S4-093	SOSW493 (0-0.5)	NICKEL	MG/KG	15.60	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S4-093	SOSW493 (0-0.5)	POTASSIUM	MG/KG	1430.00	
S4-093	SOSW493 (0-0.5)	SILVER	MG/KG	.45	
S4-093	SOSW493 (0-0.5)	SODIUM	MG/KG	1510.00	
S4-093	SOSW493 (0-0.5)	THALLIUM	MG/KG	72.80	
S4-093	SOSW493 (0-0.5)	VANADIUM	MG/KG	115.00	
S4-093	SOSW493 (0-0.5)	ZINC	MG/KG	54.80	*
S4-094	SOSW494 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	371.00	
S4-094	SOSW494 (0-0.5)	ALUMINUM	MG/KG	12600.00	
S4-094	SOSW494 (0-0.5)	BARIUM	MG/KG	41.60	
S4-094	SOSW494 (0-0.5)	CALCIUM	MG/KG	2820.00	
S4-094	SOSW494 (0-0.5)	CHROMIUM	MG/KG	13.90	
S4-094	SOSW494 (0-0.5)	COBALT	MG/KG	12.80	
S4-094	SOSW494 (0-0.5)	COPPER	MG/KG	25.10	
S4-094	SOSW494 (0-0.5)	IRON	MG/KG	14500.00	J
S4-094	SOSW494 (0-0.5)	LEAD	MG/KG	28.70	
S4-094	SOSW494 (0-0.5)	MAGNESIUM	MG/KG	4270.00	
S4-094	SOSW494 (0-0.5)	MANGANESE	MG/KG	361.00	J
S4-094	SOSW494 (0-0.5)	NICKEL	MG/KG	10.10	
S4-094	SOSW494 (0-0.5)	POTASSIUM	MG/KG	406.00	
S4-094	SOSW494 (0-0.5)	SILVER	MG/KG	.58	
S4-094	SOSW494 (0-0.5)	SODIUM	MG/KG	1080.00	
S4-094	SOSW494 (0-0.5)	THALLIUM	MG/KG	39.70	
S4-094	SOSW494 (0-0.5)	VANADIUM	MG/KG	61.40	
S4-094	SOSW494 (0-0.5)	ZINC	MG/KG	29.70	*
S4-094	SOSW494 (0-0.5)	4,4'-DDD	UG/KG	5.60	JX
S4-094	SOSW494 (0-0.5)	ACETONE	UG/KG	8.00	J
S4-095	SOSW495 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	21.30	
S4-095	SOSW495 (0-0.5)	ALUMINUM	MG/KG	9790.00	
S4-095	SOSW495 (0-0.5)	BARIUM	MG/KG	6.60	
S4-095	SOSW495 (0-0.5)	CALCIUM	MG/KG	3570.00	
S4-095	SOSW495 (0-0.5)	CHROMIUM	MG/KG	3.30	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S4-095	SOSW495 (0-0.5)	COBALT	MG/KG	7.80	
S4-095	SOSW495 (0-0.5)	COPPER	MG/KG	46.70	
S4-095	SOSW495 (0-0.5)	IRON	MG/KG	9750.00	J
S4-095	SOSW495 (0-0.5)	MAGNESIUM	MG/KG	5640.00	
S4-095	SOSW495 (0-0.5)	MANGANESE	MG/KG	386.00	J
S4-095	SOSW495 (0-0.5)	NICKEL	MG/KG	6.20	
S4-095	SOSW495 (0-0.5)	POTASSIUM	MG/KG	317.00	
S4-095	SOSW495 (0-0.5)	SILVER	MG/KG	.71	
S4-095	SOSW495 (0-0.5)	SODIUM	MG/KG	812.00	
S4-095	SOSW495 (0-0.5)	THALLIUM	MG/KG	4.60	
S4-095	SOSW495 (0-0.5)	VANADIUM	MG/KG	12.80	
S4-095	SOSW495 (0-0.5)	ZINC	MG/KG	25.60	*
S4-095	SOSW495 (0-0.5)	ACETONE	UG/KG	4.00	J
S4-096	SOSW496 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	147.00	
S4-096	SOSW496 (0-0.5)	ALUMINUM	MG/KG	27700.00	
S4-096	SOSW496 (0-0.5)	BARIUM	MG/KG	126.00	
S4-096	SOSW496 (0-0.5)	CADMIUM	MG/KG	1.30	
S4-096	SOSW496 (0-0.5)	CALCIUM	MG/KG	4320.00	
S4-096	SOSW496 (0-0.5)	CHROMIUM	MG/KG	22.80	
S4-096	SOSW496 (0-0.5)	COBALT	MG/KG	15.80	
S4-096	SOSW496 (0-0.5)	COPPER	MG/KG	52.30	
S4-096	SOSW496 (0-0.5)	IRON	MG/KG	32800.00	J
S4-096	SOSW496 (0-0.5)	LEAD	MG/KG	44.70	
S4-096	SOSW496 (0-0.5)	MAGNESIUM	MG/KG	8800.00	
S4-096	SOSW496 (0-0.5)	MANGANESE	MG/KG	511.00	J
S4-096	SOSW496 (0-0.5)	NICKEL	MG/KG	16.90	
S4-096	SOSW496 (0-0.5)	POTASSIUM	MG/KG	758.00	
S4-096	SOSW496 (0-0.5)	SILVER	MG/KG	1.50	
S4-096	SOSW496 (0-0.5)	SODIUM	MG/KG	1150.00	
S4-096	SOSW496 (0-0.5)	THALLIUM	MG/KG	75.30	
S4-096	SOSW496 (0-0.5)	VANADIUM	MG/KG	115.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S4-096	SOSW496 (0-0.5)	ZINC	MG/KG	65.60	*
S4-096	SOSW496 (0-0.5)	4,4'-DDD	UG/KG	4.80	J
S4-096	SOSW496 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	140.00	J2
S4-096	SOSW496 (0-0.5)	ACETONE	UG/KG	14.00	J
S4-096	SOSW496RE (0-0.5, RE)	AROCLO-1260	UG/KG	98.00	R
S4-097	SOSW497 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	97.00	
S4-097	SOSW497 (0-0.5)	ALUMINUM	MG/KG	28300.00	
S4-097	SOSW497 (0-0.5)	BARIUM	MG/KG	131.00	
S4-097	SOSW497 (0-0.5)	CADMIUM	MG/KG	1.80	
S4-097	SOSW497 (0-0.5)	CALCIUM	MG/KG	7090.00	
S4-097	SOSW497 (0-0.5)	CHROMIUM	MG/KG	20.30	
S4-097	SOSW497 (0-0.5)	COBALT	MG/KG	17.10	
S4-097	SOSW497 (0-0.5)	COPPER	MG/KG	65.40	
S4-097	SOSW497 (0-0.5)	IRON	MG/KG	38000.00	J
S4-097	SOSW497 (0-0.5)	LEAD	MG/KG	108.00	
S4-097	SOSW497 (0-0.5)	MAGNESIUM	MG/KG	12000.00	
S4-097	SOSW497 (0-0.5)	MANGANESE	MG/KG	612.00	J
S4-097	SOSW497 (0-0.5)	NICKEL	MG/KG	18.00	
S4-097	SOSW497 (0-0.5)	POTASSIUM	MG/KG	840.00	
S4-097	SOSW497 (0-0.5)	SILVER	MG/KG	1.50	
S4-097	SOSW497 (0-0.5)	SODIUM	MG/KG	1130.00	
S4-097	SOSW497 (0-0.5)	THALLIUM	MG/KG	83.70	
S4-097	SOSW497 (0-0.5)	VANADIUM	MG/KG	137.00	*
S4-097	SOSW497 (0-0.5)	ZINC	UG/KG	70.00	
S4-097	SOSW497 (0-0.5)	4,4'-DDD	UG/KG	4.90	J
S4-097	SOSW497 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	140.00	J2
S4-097	SOSW497 (0-0.5)	ACETONE	UG/KG	5.00	J
S4-097	SOSW497RE (0-0.5, RE)	AROCLO-1260	UG/KG	59.00	
S4-097	SOSW498 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	19.60	
S4-098	SOSW498 (0-0.5)	ALUMINUM	MG/KG	14200.00	
S4-098	SOSW498 (0-0.5)	BARIUM	MG/KG	60.90	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S4-098	SOSW498 (0-0.5)	CADMIUM	MG/KG	1.50	
S4-098	SOSW498 (0-0.5)	CALCIUM	MG/KG	6520.00	
S4-098	SOSW498 (0-0.5)	CHROMIUM	MG/KG	12.20	
S4-098	SOSW498 (0-0.5)	COBALT	MG/KG	17.50	
S4-098	SOSW498 (0-0.5)	COPPER	MG/KG	48.30	
S4-098	SOSW498 (0-0.5)	IRON	MG/KG	25400.00	J
S4-098	SOSW498 (0-0.5)	LEAD	MG/KG	37.50	
S4-098	SOSW498 (0-0.5)	MAGNESIUM	MG/KG	9550.00	
S4-098	SOSW498 (0-0.5)	MANGANESE	MG/KG	805.00	J
S4-098	SOSW498 (0-0.5)	NICKEL	MG/KG	13.60	
S4-098	SOSW498 (0-0.5)	POTASSIUM	MG/KG	1370.00	
S4-098	SOSW498 (0-0.5)	SILVER	MG/KG	2.80	
S4-098	SOSW498 (0-0.5)	SODIUM	MG/KG	1730.00	
S4-098	SOSW498 (0-0.5)	THALLIUM	MG/KG	62.00	
S4-098	SOSW498 (0-0.5)	VANADIUM	MG/KG	79.10	
S4-098	SOSW498 (0-0.5)	ZINC	MG/KG	94.20	*
S4-098	SOSW498 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	91.00	J
S4-098	SOSW498RE (0-0.5, RE)	AROCLOR-1260	UG/KG	110.00	
S4-137	SOSW4137 (6.0)	ALUMINUM	MG/KG	17700.00	
S4-137	SOSW4137 (6.0)	BARIUM	MG/KG	47.20	
S4-137	SOSW4137 (6.0)	BERYLLIUM	MG/KG	.43	
S4-137	SOSW4137 (6.0)	CADMIUM	MG/KG	1.40	
S4-137	SOSW4137 (6.0)	CALCIUM	MG/KG	6050.00	
S4-137	SOSW4137 (6.0)	CHROMIUM	MG/KG	20.70	
S4-137	SOSW4137 (6.0)	COBALT	MG/KG	10.80	
S4-137	SOSW4137 (6.0)	COPPER	MG/KG	51.40	
S4-137	SOSW4137 (6.0)	IRON	MG/KG	31100.00	
S4-137	SOSW4137 (6.0)	LEAD	MG/KG	23.80	
S4-137	SOSW4137 (6.0)	MAGNESIUM	MG/KG	11600.00	
S4-137	SOSW4137 (6.0)	MANGANESE	MG/KG	499.00	J4
S4-137	SOSW4137 (6.0)	NICKEL	MG/KG	15.10	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S4-137	SOSW4137 (6.0)	POTASSIUM	MG/KG	1860.00	
S4-137	SOSW4137 (6.0)	SILVER	MG/KG	3.10	
S4-137	SOSW4137 (6.0)	SODIUM	MG/KG	1700.00	
S4-137	SOSW4137 (6.0)	THALLIUM	MG/KG	44.80	
S4-137	SOSW4137 (6.0)	VANADIUM	MG/KG	103.00	
S4-137	SOSW4137 (6.0)	ZINC	MG/KG	69.80	
S4-137	SOSW4137 (6.0)	bis (2-ETHYLHEXYL) PHTHALATE	UG/KG	60.00	J
S4-138	SOSW4138 (9.0)	ALUMINUM	MG/KG	10000.00	
S4-138	SOSW4138 (9.0)	BARIUM	MG/KG	36.40	
S4-138	SOSW4138 (9.0)	BERYLLIUM	MG/KG	.29	
S4-138	SOSW4138 (9.0)	CADMIUM	MG/KG	1.10	
S4-138	SOSW4138 (9.0)	CALCIUM	MG/KG	18900.00	
S4-138	SOSW4138 (9.0)	CHROMIUM	MG/KG	11.10	
S4-138	SOSW4138 (9.0)	COBALT	MG/KG	8.10	
S4-138	SOSW4138 (9.0)	COPPER	MG/KG	32.10	
S4-138	SOSW4138 (9.0)	IRON	MG/KG	19500.00	
S4-138	SOSW4138 (9.0)	LEAD	MG/KG	45.90	
S4-138	SOSW4138 (9.0)	MAGNESIUM	MG/KG	9690.00	
S4-138	SOSW4138 (9.0)	MANGANESE	MG/KG	300.00	J4
S4-138	SOSW4138 (9.0)	NICKEL	MG/KG	13.80	
S4-138	SOSW4138 (9.0)	POTASSIUM	MG/KG	851.00	
S4-138	SOSW4138 (9.0)	SILVER	MG/KG	1.10	
S4-138	SOSW4138 (9.0)	SODIUM	MG/KG	1140.00	
S4-138	SOSW4138 (9.0)	THALLIUM	MG/KG	18.90	
S4-138	SOSW4138 (9.0)	VANADIUM	MG/KG	57.40	
S4-138	SOSW4138 (9.0)	ZINC	MG/KG	87.60	
S4-138	SOSW4138 (9.0)	TETRACHLOROETHENE (PCE)	UG/KG	2.00	J
S4-139	SOSW4139 (8.0)	ALUMINUM	MG/KG	8490.00	
S4-139	SOSW4139 (8.0)	BARIUM	MG/KG	10.50	
S4-139	SOSW4139 (8.0)	CADMIUM	MG/KG	.81	
S4-139	SOSW4139 (8.0)	CALCIUM	MG/KG	7110.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.21. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S4-139	SOSW4139 (8.0)	CHROMIUM	MG/KG	11.00	
S4-139	SOSW4139 (8.0)	COBALT	MG/KG	5.60	
S4-139	SOSW4139 (8.0)	COPPER	MG/KG	27.80	
S4-139	SOSW4139 (8.0)	IRON	MG/KG	16100.00	
S4-139	SOSW4139 (8.0)	MAGNESIUM	MG/KG	7940.00	
S4-139	SOSW4139 (8.0)	MANGANESE	MG/KG	271.00	J4
S4-139	SOSW4139 (8.0)	NICKEL	MG/KG	12.20	
S4-139	SOSW4139 (8.0)	POTASSIUM	MG/KG	433.00	
S4-139	SOSW4139 (8.0)	SODIUM	MG/KG	703.00	
S4-139	SOSW4139 (8.0)	THALLIUM	MG/KG	17.30	
S4-139	SOSW4139 (8.0)	VANADIUM	MG/KG	47.10	
S4-139	SOSW4139 (8.0)	ZINC	MG/KG	41.70	
S4-139	SOSW4139 (8.0)	DI-n-BUTYLPHTHALATE	UG/KG	160.00	J
S4-139	SOSW4139 (8.0)	DIETHYLPHTHALATE	UG/KG	1000.00	

 (a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
 RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

4 acres. The data indicate that metal distribution is essentially continuous through Area 1, with no identifiable areas without metal responses, except at the extreme western end where buried metal appears to be more scattered. Elevated conductivities in the west end of this area are interpreted as being due to buried wastes without much metal.

Area 2 is located along the south side of the road between 600 east and 1400 east. The anomalies between 925 and 1000 east indicate a concentration of buried metal; however, elsewhere the anomalies indicate waste material with only scattered metal.

Two trenches (Trenches 1 and 2) were dug in Area 2 to verify that the geophysical anomalies were related to waste material. A third trench was dug in an area with no geophysical anomalies. The locations are shown in Figure 3.16. The locations were chosen to evaluate the source of anomalies of different strengths. Trench locations were limited to within a few feet from the road because surface conditions prevented the backhoe from moving farther into the site. Trench 1 (TP-1) was located over a strong anomaly at 790 north on line 850 east. Excavations encountered miscellaneous waste including a drum, miscellaneous scrap metal, cloth, paper, and cans. A petroleum odor was present and elevated readings (maximum 4 ppm) with the organic vapor detector were observed. Trench 1 was dug to a depth of 5.5 feet, where native beach sands and cobbles were found. Water was encountered at 8 feet. Trench 2 (TP-2) was located over a strong anomaly on line 1225 east at 880 north. Concrete with metal reinforcing was encountered and was the most significant source of the geophysical anomaly. The concrete may have been from a runway destroyed in an earthquake in the mid 1970s. Beneath the concrete was waste consisting of scrap metal, wood, fiberglass insulation, and domestic type trash (beverage cans and bottles). The debris extended to a depth of 7.8 feet under which beach sands and gravels were encountered.

Areas 3 and 4 are located in the west end of the site. The data indicate little metal is present here, but elevated conductivities are interpreted as being due to buried waste or fill material.

Scattered isolated buried metal was indicated throughout the site and these locations are shown in Figure 3.16.

Trench 3 (TP-3) was located at 525 east, 800 north, in an area relatively free from anomalies. A thin horizon of miscellaneous waste was encountered there, but for the most part the fill was free of debris. The fill layer appeared to be approximately 6 feet deep, under which lay native beach sand and gravels. Groundwater with an oily sheen was encountered at 7 feet.

3.6.4 Nature and Extent of Contamination

Table 3.22 presents a summary of the analytical results from SW-4. This table presents the analytes with positive results, the total number of samples analyzed, the number of samples with positive results, and the range of the positive values. The sampling at SW-4 indicates some surface contamination with TPH, PCB, and 4,4'-DDD. In addition, metals concentrations at the surface are above background values. Subsurface contamination appears to be much less than that at the surface; fewer compounds were detected and at lower concentrations, with the exception of TPH, which tended to be higher in the subsurface. This could be due to contaminated fill material being placed on top of the debris. The contamination at this site, while widespread, is at low concentrations.

TABLE 3.22. Analytes with Positive Results at SW-4

Analyte	Total Number of Samples	Samples with Positive Results	Range ^(a)
Analytical results from composite samples from the top 6 inches			
TPH	10	4	45 - 107
Acetone	10	8	3 - 14
Di-n-butylphthalate	10	2	140
Bis(2-ethylhexyl)phthalate	10	1	91
PCB (Aroclor 1260)	10	5	59 - 110
4,4'-DDD	10	3	25 - 56
Cadmium	10	1	2
Chromium	10	5	17.7 - 22.8
Copper	10	6	48.3 - 66.1
Lead	10	9	17.0 - 108
Zinc	10	8	48.4 - 94.2
Analytical results from samples collected at a depth of 4 feet below ground surface			
TPH	3	3	67 - 1,373
PCE	3	1	2
Diethylphthalate	3	1	1,000
Di-n-butylphthalate	3	1	160
Bis(2-ethylhexyl)phthalate	3	1	60
Chromium	3	1	20.7
Copper	3	1	51.4
Lead	3	2	23.8 - 45.9
Zinc	3	2	69.8 - 87.6

^(a)Metals and TPH are in mg/kg. All other analytes are in $\mu\text{g/kg}$.

3.6.5 Preliminary Risk Assessment

Preliminary risk assessment calculations indicate that constituent concentrations in soil are not high enough to warrant remedial action at this site based on human health and ecological risks.

3.6.6 Future Actions

Prior to the 1992 field season it was assumed that the remedial action to be taken at the site would be a landfill cap. The type of cap cannot be selected yet since the impact of the landfill on the groundwater has not been determined. As an interim measure, it

is recommended that the landfill area be graded to allow surface water drainage away from the landfill. This will reduce the contact time between the contaminated soil and the water, reducing the leaching of the contamination. This grading is a minimum requirement that would be required prior to the further development of a cap over the site. Groundwater monitoring wells should be installed along the north side of the site to determine impacts to the groundwater. If future groundwater information indicates that the landfill is not impacting the groundwater from an ecological risk perspective, then the cap development would be complete. If there is adverse groundwater impact, then the cap would require further development, perhaps including flexible membrane liners and other impermeable materials.

3.7 SOLID WASTE SITE SW-5: HOSPITAL LAKE

3.7.1 Site Background

Hospital Lake is in the north central portion of the island (Figure 3.17). It covers approximately 2 acres, and the depth of the lake is approximately 4 feet. The area surrounding the lake is gently rolling hills covered with tundra. The only shrubs on the island are on the west bank of the lake.

The lake is not currently used by the air base and it does not appear to be used in any recreational capacity. It was used as a disposal area for old ammunition after World War II. Following an accident with a live round in the 1980s, Navy divers were brought in to remove the ammunition. It is not known whether all of the ammunition was removed, or whether any decomposition of the materials had occurred prior to removal.

3.7.2 Previous Investigations

During the September 1987 visit, water in the lake was dark brown, possibly from the organics in the surrounding soil. No particular area of the lake could be identified as a past disposal area during the 1988 field investigation. One surface water sample and one sediment sample were collected near the drainage outlet of the lake; one sediment sample was collected near the inlet (Figure 3.17). At the time of sampling, no significant inflow or outflow of lake water was observed at the sampling points. Levels for all parameters (organics and metals) were

nondetectable or were at or below background levels except sediment samples for barium (94.7 mg/kg) and zinc (58.7 mg/kg), and TPH (200 mg/kg) at the 2-foot sampling depth.

3.7.3 1992 Investigation

The 1992 investigation focused on determining if there was lake sediment and surface water contamination at the site. Also, the bottom of the lake was surveyed to determine its depth. This information would be necessary if a remedial design would be required for contaminated sediment.

The geophysical investigation covered the whole lake. The objective of the investigation at this site was to determine the extent of buried material at the bottom of the lake.

The site was gridded by staking the survey line endpoints on either side of the lake. A rope marked in 10-foot intervals was stretched between corresponding stakes across the lake. Data were collected from a rubber raft that was pulled along the rope, stopping at 5-foot intervals to make a reading. Survey lines were 25 feet apart.

The results of the investigation are shown in Figure 3.17. Contour maps of the conductivity and in-phase data are presented in Appendix B. A single isolated metal object was detected at the southern tip of the lake at 885 east, 525 north. Two other possible metal objects were also identified and are shown in the figure. The anomalies defining these features are very weak and may actually be a topographic effect due to the steep bank rising above the EM instrument at the edge of the lake.

The bottom survey showed a fairly uniform lake bottom with an average depth of 4 feet.

Sediment and surface water sample locations are indicated in Figure 3.17. Six surface water samples and four lake sediment samples were collected. Surface water samples were collected from the water column midway between the lake bottom and the top of water using a Van Dorn sampler. Sediment samples were collected from the top of the lake sediment. Tables 3.23 and 3.24 list the analytical results from SW-5 samples analyzed at the CSL and offsite laboratories, respectively.

* SAMPLES 1 THRU 7 WATER
SAMPLES 8 THRU 12 SEDIMENT

FIGURE 3.17. 9

0 50 100 200
SCALE: 1"=100'

LOCATION MAP

LEGEND

* SAMPLE LOCATION

— GEOPHYSICAL SURVEY LINE

INTERPRETED FEATURES

■ BURIED METAL

○ POSSIBLE BURIED METAL

⬡ 1988 SEDIMENT SAMPLE LOCATIONS

◇ 1988 WATER SAMPLE LOCATION

--- SITE BOUNDARY

TABLE 3.23. Positive Results from Onsite (CSL) Data at SW-5

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
S5-004	SHSDHL-03 (3.9)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	50.58	
S5-008	SHSDHL-01 (2.35)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	273.59	
S5-012	SHSDHL-05 (0.7)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	72.00	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.24. Positive Results from Offsite Data at SW-5

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S5-001	SWHL01-3 (3.0)	TOTAL PETROLEUM HYDROCARBONS	MG/L	.17	
S5-001	SWHL01-3 (3.0)	ALUMINUM	UG/L	217.00	
S5-001	SWHL01-3 (3.0)	BARIUM	UG/L	2.40	
S5-001	SWHL01-3 (3.0)	CALCIUM	UG/L	6610.00	
S5-001	SWHL01-3 (3.0)	COPPER	UG/L	4.50	
S5-001	SWHL01-3 (3.0)	IRON	UG/L	338.00	J4
S5-001	SWHL01-3 (3.0)	MAGNESIUM	UG/L	4730.00	
S5-001	SWHL01-3 (3.0)	MANGANESE	UG/L	9.40	
S5-001	SWHL01-3 (3.0)	POTASSIUM	UG/L	1440.00	
S5-001	SWHL01-3 (3.0)	SODIUM	UG/L	32300.00	
S5-001	SWHL01-3 (3.0)	ZINC	UG/L	13.30	
S5-003	SWHL03 (3.0)	ALUMINUM	UG/L	226.00	
S5-003	SWHL03 (3.0)	BARIUM	UG/L	2.20	
S5-003	SWHL03 (3.0)	CALCIUM	UG/L	6600.00	
S5-003	SWHL03 (3.0)	COPPER	UG/L	4.50	
S5-003	SWHL03 (3.0)	IRON	UG/L	344.00	J4
S5-003	SWHL03 (3.0)	MAGNESIUM	UG/L	4760.00	
S5-003	SWHL03 (3.0)	MANGANESE	UG/L	9.10	
S5-003	SWHL03 (3.0)	POTASSIUM	UG/L	1490.00	
S5-003	SWHL03 (3.0)	SODIUM	UG/L	32300.00	
S5-003	SWHL03 (3.0)	ZINC	UG/L	5.30	
S5-003	SWHL03 (3.0)	NITRATE AND NITRITE AS N	MG/L	.07	
S5-004	SDHL03 (3.9)	ALUMINUM	MG/KG	8850.00	
S5-004	SDHL03 (3.9)	BARIUM	MG/KG	19.70	
S5-004	SDHL03 (3.9)	CALCIUM	MG/KG	4030.00	
S5-004	SDHL03 (3.9)	CHROMIUM	MG/KG	11.50	
S5-004	SDHL03 (3.9)	COPPER	MG/KG	15.80	
S5-004	SDHL03 (3.9)	IRON	MG/KG	6580.00	
S5-004	SDHL03 (3.9)	MAGNESIUM	MG/KG	3020.00	
S5-004	SDHL03 (3.9)	MANGANESE	MG/KG	65.40	J4
S5-004	SDHL03 (3.9)	MOLYBDENUM	MG/KG	3.10	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.24. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S5-004	SDHL03 (3.9)	POTASSIUM	MG/KG	333.00	
S5-004	SDHL03 (3.9)	SILVER	MG/KG	.86	
S5-004	SDHL03 (3.9)	SODIUM	MG/KG	1070.00	
S5-004	SDHL03 (3.9)	THALLIUM	MG/KG	26.80	
S5-004	SDHL03 (3.9)	VANADIUM	MG/KG	26.10	
S5-004	SDHL03 (3.9)	ZINC	MG/KG	46.30	
S5-004	SDHL03 (3.9)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	95.00	J
S5-004	SWHL04 (3.0)	TOTAL PETROLEUM HYDROCARBONS	MG/L	.06	
S5-004	SWHL04 (3.0)	ALUMINUM	UG/L	237.00	
S5-004	SWHL04 (3.0)	BARIUM	UG/L	2.20	
S5-004	SWHL04 (3.0)	CALCIUM	UG/L	6580.00	
S5-004	SWHL04 (3.0)	COPPER	UG/L	3.30	
S5-004	SWHL04 (3.0)	IRON	UG/L	516.00	J4
S5-004	SWHL04 (3.0)	MAGNESIUM	UG/L	4760.00	
S5-004	SWHL04 (3.0)	MANGANESE	UG/L	10.10	
S5-004	SWHL04 (3.0)	POTASSIUM	UG/L	1410.00	
S5-004	SWHL04 (3.0)	SODIUM	UG/L	32000.00	
S5-004	SWHL04 (3.0)	ZINC	UG/L	4.70	
S5-004	SWHL04 (3.0)	bis(2-ETHYLHEXYL) PHTHALATE	UG/L	1.00	J
S5-005	SWHL05-3 (3.0)	TOTAL PETROLEUM HYDROCARBONS	MG/L	.06	
S5-005	SWHL05-3 (3.0)	ALUMINUM	UG/L	315.00	
S5-005	SWHL05-3 (3.0)	BARIUM	UG/L	2.40	
S5-005	SWHL05-3 (3.0)	CALCIUM	UG/L	6750.00	
S5-005	SWHL05-3 (3.0)	COPPER	UG/L	9.60	
S5-005	SWHL05-3 (3.0)	IRON	UG/L	458.00	J4
S5-005	SWHL05-3 (3.0)	MAGNESIUM	UG/L	4870.00	
S5-005	SWHL05-3 (3.0)	MANGANESE	UG/L	14.10	
S5-005	SWHL05-3 (3.0)	POTASSIUM	UG/L	1530.00	
S5-005	SWHL05-3 (3.0)	SODIUM	UG/L	32900.00	
S5-005	SWHL05-3 (3.0)	VANADIUM	UG/L	2.20	
S5-005	SWHL05-3 (3.0)	ZINC	UG/L	9.20	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.24. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S5-005	SWHL05-3 (3.0)	NITRATE AND NITRITE AS N	MG/L	.04	
S5-006	SWHL06-3 (3.0)	TOTAL PETROLEUM HYDROCARBONS	MG/L	.07	
S5-006	SWHL06-3 (3.0)	ALUMINUM	UG/L	230.00	
S5-006	SWHL06-3 (3.0)	BARIIUM	UG/L	2.40	
S5-006	SWHL06-3 (3.0)	CALCIUM	UG/L	6540.00	
S5-006	SWHL06-3 (3.0)	COPPER	UG/L	3.50	
S5-006	SWHL06-3 (3.0)	IRON	UG/L	342.00	J4
S5-006	SWHL06-3 (3.0)	MAGNESIUM	UG/L	4730.00	
S5-006	SWHL06-3 (3.0)	MANGANESE	UG/L	9.70	
S5-006	SWHL06-3 (3.0)	POTASSIUM	UG/L	1440.00	
S5-006	SWHL06-3 (3.0)	SODIUM	UG/L	32100.00	
S5-006	SWHL06-3 (3.0)	ZINC	UG/L	4.70	
S5-006	SWHL06-3 (3.0)	NITRATE AND NITRITE AS N	MG/L	1.38	
S5-007	SWHL07-3 (3.0)	TOTAL PETROLEUM HYDROCARBONS	MG/L	.06	
S5-007	SWHL07-3 (3.0)	ALUMINUM	UG/L	220.00	
S5-007	SWHL07-3 (3.0)	BARIIUM	UG/L	2.20	
S5-007	SWHL07-3 (3.0)	CALCIUM	UG/L	6540.00	
S5-007	SWHL07-3 (3.0)	COPPER	UG/L	3.50	
S5-007	SWHL07-3 (3.0)	IRON	UG/L	333.00	J4
S5-007	SWHL07-3 (3.0)	MAGNESIUM	UG/L	4700.00	
S5-007	SWHL07-3 (3.0)	MANGANESE	UG/L	9.10	
S5-007	SWHL07-3 (3.0)	POTASSIUM	UG/L	1420.00	
S5-007	SWHL07-3 (3.0)	SODIUM	UG/L	31900.00	
S5-007	SWHL07-3 (3.0)	VANADIUM	UG/L	2.20	
S5-007	SWHL07-3 (3.0)	NITRATE AND NITRITE AS N	MG/L	1.39	
S5-008	SDHL01 (2.35)	ALUMINUM	MG/KG	12500.00	
S5-008	SDHL01 (2.35)	BARIIUM	MG/KG	18.70	
S5-008	SDHL01 (2.35)	CALCIUM	MG/KG	4800.00	
S5-008	SDHL01 (2.35)	CHROMIUM	MG/KG	13.90	
S5-008	SDHL01 (2.35)	COPPER	MG/KG	14.00	
S5-008	SDHL01 (2.35)	IRON	MG/KG	15100.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.24. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S5-008	SDHL01 (2.35)	LEAD	MG/KG	9.50	
S5-008	SDHL01 (2.35)	MAGNESIUM	MG/KG	6130.00	J4
S5-008	SDHL01 (2.35)	MANGANESE	MG/KG	151.00	N
S5-008	SDHL01 (2.35)	NICKEL	MG/KG	13.90	
S5-008	SDHL01 (2.35)	POTASSIUM	MG/KG	427.00	
S5-008	SDHL01 (2.35)	SODIUM	MG/KG	1140.00	
S5-008	SDHL01 (2.35)	THALLIUM	MG/KG	38.20	
S5-008	SDHL01 (2.35)	VANADIUM	MG/KG	49.60	
S5-008	SDHL01 (2.35)	ZINC	MG/KG	51.70	
S5-008	SDHL01 (2.35)	FLUORANTHENE	UG/KG	46.00	J
S5-008	SDHL01 (2.35)	ACETONE	UG/KG	12.00	J
S5-008	SDHL01 (2.35)	ALUMINUM	MG/KG	20000.00	
S5-011	SDHL04 (3.5)	BARIUM	MG/KG	34.00	
S5-011	SDHL04 (3.5)	CALCIUM	MG/KG	4260.00	
S5-011	SDHL04 (3.5)	CHROMIUM	MG/KG	15.20	
S5-011	SDHL04 (3.5)	COPPER	MG/KG	28.40	
S5-011	SDHL04 (3.5)	IRON	MG/KG	8440.00	
S5-011	SDHL04 (3.5)	MAGNESIUM	MG/KG	3370.00	
S5-011	SDHL04 (3.5)	MANGANESE	MG/KG	39.70	J4
S5-011	SDHL04 (3.5)	NICKEL	MG/KG	22.90	
S5-011	SDHL04 (3.5)	POTASSIUM	MG/KG	320.00	
S5-011	SDHL04 (3.5)	SODIUM	MG/KG	1240.00	
S5-011	SDHL04 (3.5)	THALLIUM	MG/KG	42.80	
S5-011	SDHL04 (3.5)	VANADIUM	MG/KG	59.30	
S5-011	SDHL04 (3.5)	ZINC	MG/KG	31.10	
S5-011	SDHL04 (3.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	130.00	J
S5-011	SDHL04 (3.5)	ACETONE	UG/KG	16.00	J
S5-012	SDHL05 (0.7)	ALUMINUM	MG/KG	25700.00	
S5-012	SDHL05 (0.7)	BARIUM	MG/KG	95.50	
S5-012	SDHL05 (0.7)	CADMIUM	MG/KG	1.20	
S5-012	SDHL05 (0.7)	CALCIUM	MG/KG	8620.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.24. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S5-012	SDHL05 (0.7)	CHROMIUM	MG/KG	34.10	
S5-012	SDHL05 (0.7)	COBALT	MG/KG	20.50	J1
S5-012	SDHL05 (0.7)	COPPER	MG/KG	55.30	
S5-012	SDHL05 (0.7)	IRON	MG/KG	24700.00	
S5-012	SDHL05 (0.7)	LEAD	MG/KG	36.10	
S5-012	SDHL05 (0.7)	MAGNESIUM	MG/KG	10800.00	
S5-012	SDHL05 (0.7)	MANGANESE	MG/KG	229.00	J4
S5-012	SDHL05 (0.7)	MOLYBDENUM	MG/KG	3.60	
S5-012	SDHL05 (0.7)	NICKEL	MG/KG	26.10	
S5-012	SDHL05 (0.7)	POTASSIUM	MG/KG	1340.00	
S5-012	SDHL05 (0.7)	SODIUM	MG/KG	2080.00	
S5-012	SDHL05 (0.7)	THALLIUM	MG/KG	60.20	
S5-012	SDHL05 (0.7)	VANADIUM	MG/KG	107.00	
S5-012	SDHL05 (0.7)	ZINC	MG/KG	101.00	
S5-012	SDHL05 (0.7)	4,4'-DDD	UG/KG	5.80	
S5-012	SDHL05 (0.7)	ENDRIN KETONE	UG/KG	21.00	
S5-012	SDHL05 (0.7)	PYRENE	UG/KG	88.00	J
S5-012	SDHL05 (0.7)	2-BUTANONE	UG/KG	18.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

3.7.4 Nature and Extent of Contamination

Table 3.25 presents a summary of the analytical results at SW-5. Presented are the analytes detected, the total number of samples analyzed, the number of samples with positive results, and the range of the results.

Some elevated levels of copper and zinc occasionally appear in the water column and the sediment samples. TPH and nitrate/nitrite were detected in all water samples collected. The nitrate/nitrite may be caused by decaying organic matter entering the lake. With the possible exception of the buried metal objects, no apparent sources of contamination were located during the field investigation.

In the water samples, bis(2-ethylhexyl)phthalate was detected in one sample. All sediment contaminants, with the exception of bis(2-ethylhexyl)phthalate, a common laboratory contaminant, were detected only once in the four samples collected.

3.7.5 Preliminary Risk Assessment

All of the constituents detected at SW-5 are less than the human health risk PRLs developed in Appendix C. However, the preliminary ecological risk assessment indicated potential risk aquatic receptors near or in the lake based upon metals concentrations. Chromium, copper, lead, barium, and zinc in the sediment and water samples were above the PRLs and were also above background soil concentrations. These elevated metals concentrations could be the result of past disposal activities at this site.

3.7.6 Future Actions

Analytical results indicate relatively few constituents in the sediment and the surface water at concentrations less than that which pose human health risk. Metals concentrations in the submerged sediments may pose a threat to aquatic organisms, but, because there are no fish in this lake, there is no pathway for exposure at this time. Therefore, no further action is the suggested remedial decision for this site and an NFAD document should be developed.

TABLE 3.25. Analytes with Positive Results at SW-5

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Total Number of Detects</u>	<u>Results^{(a)(b)}</u>
Water sample results:			
Bis(2-ethylhexyl)phthalate	6	1	1
TPH	6	6	0.06 - 0.17
Copper	6	1	9.6
Zinc	6	1	13.3
Nitrate/Nitrite	6	6	0.038 - 1.41
Sediment samples collected from top of lake bottom:			
2-Butanone	4	1	18
Fluoranthene	4	1	46
Bis(2-ethylhexyl)phthalate	4	2	95 - 130
Pyrene	4	1	88
4,4' DDD	4	1	5.8
Endrin Ketone	4	1	21
Chromium	4	1	34.1
Copper	4	1	55.3
Lead	4	1	36.1
Zinc	4	1	101

(a) Metals and TPH in soils are in mg/kg. All other soil analytes are in $\mu\text{g/kg}$.

(b) TPH and nitrate/nitrite in water are in mg/L. All other water analytes are in $\mu\text{g/L}$.

3.8 SOLID WASTE SITE SW-10: BARREL BAY

3.8.1 Site Background

SW-10, Barrel Bay is located on a flat area overlooking Skoot Cove (see Figure 3.18). SW-10 was the site of a 55-gallon drum storage area after World War II. The number of drums placed in the solid waste disposal site is reported to be in the thousands. The site has been subject to wave action that exposed the landfill. Various pieces of metal debris are visible in the bank and along the toe of the bank. These include truck bodies, batteries, and truck engines. The top of the landfill is covered with partially crushed rock and is relatively flat. SW-10 is not currently used by the Air Force or base personnel for recreational activities.

Past restoration efforts, completed in July 1987, by the 11th CEOS, consisted of some debris removal, backfilling with gravel and riprap, and grading. Various types of debris such as vehicle axles, rims, and tires; gas cylinder tanks; electrical cable; and pipe were observed during September 1987. No barrels or drums were observed.

Investigations at this site have shown that the surface of the area is covered with a silty sand down to a depth of 1.5 to 5 feet. This is followed by a sandy to silty gravel layer that ranges from 4 to 10 feet thick. Under the gravel layer is claystone or hornblende dacite porphyry, which appear to be the bedrock in this area.

3.8.2 Previous Investigations

In 1988, two backhoe pits were excavated within the disposal area in locations of dense debris concentrations (Figure 3.18). The backhoe pits were dug from the face of the bluff back into the bank to ascertain the width of the disposal area.

One backhoe pit sample revealed TPH levels of 16,000 mg/kg at 2 feet and 14,000 mg/kg at 4 feet. Analysis of samples for volatile organic constituents revealed detectable concentrations of 2-Butanone, a common laboratory contaminant, at 2 feet (0.65 and 1.0 mg/kg) and at 4 feet (estimated at 0.59 and 0.95 mg/kg). The semivolatile compound bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was detected at between 0.98 and

5.3 mg/kg at 2 feet, and between 0.56 and 2.9 mg/kg at 4 feet. Metals analysis results ranged from 11 to 53.1 mg/kg for arsenic, 47.2 to 561 mg/kg for barium, 54.8 to 81.3 mg/kg for chromium, 348 to 1,740 mg/kg for lead, 33.8 to 57.3 mg/kg for nickel, and 313 to 2,110 mg/kg for zinc, all of which were above background.

During September 1991, similar debris was observed protruding from the side of the bank, and a corroded battery was partially buried in the tidal area adjacent to the bank. In addition, in the cove between SW-10 and SW-12, parts of 55-gallon drums were observed above the high tide mark.

3.8.3 1992 Investigation

The intent of the 1992 investigation was to collect sufficient data to recommend a remedial action, if necessary. Closure strategies could involve capping the landfill surface area with an impermeable material and installing monitoring wells outside the landfill boundary to determine the impact of the landfill on groundwater quality, and the potential for offsite migration of contaminants.

The objectives of the investigation were to determine:

- areal extent of the dump area
- nature of surface soil contamination, if any
- nature of groundwater contamination, if any
- groundwater depth and direction
- significant, mappable site features.

The objective of the investigation was to delineate the extent of buried waste material at the site. The extent of the geophysical investigation is shown in Figure 3.19. The site consists of the area between the road on the north and the top of the bank on the south. It also includes a section of beach in the southeastern portion of the site and the section of beach between SW-10 and SW-12. Data were collected at 5-foot intervals along survey lines 25 feet apart. Contour maps of EM conductivity and in-phase values are presented in Appendix B. Approximately 9.8 acres were investigated.

11°59'35"

LEGEND

- * SOIL SAMPLE LOCATION
- BORING LOCATION
- ⊕ WELL POINT LOCATION
- △ MONITORING WELL LOCATION
- STEEP BANK
- 1988 SAMPLING LOCATION

FIGURE 3.18

0 60 120 240
SCALE: 1"=120'

LOCATION MAP

11°59'35"

SCALE: 1"=120'

FIGURE 3.19. SW-10

LEGEND

- GEOPHYSICAL SURVEY LINE
- Ⓜ METAL OBSERVED AT SURFACE
- ⌋ STEEP BANK

INTERPRETED FEATURES

- ▨ AREA WITH BURIED WASTE OR FILL WITH SCATTERED BURIED METAL
- ▩ AREA OF POSSIBLE BURIED WASTE OR FILL WITH LITTLE OR NO BURIED METAL
- ⊗ AREA OF BURIED METAL
- POSSIBLE BURIED METAL
- ISOLATED BURIED METAL
- BURIED UTILITY LINE
- - - SITE BOUNDARY

Buried metal was mapped mostly along the southern edge of the site, along the top of the bank. In several locations scrap metal could be seen protruding from the bank. The buried metal mapped between 4650 east and 4900 east does not extend below the bank to the beach. However, the beach does contain one area of scattered buried metal as well as isolated buried metal in several locations. An extensive area of buried metal was also delineated at the beach between SW-10 and SW-12, between 5200 east and 5500 east. Most of the area between the bank and the edge of the water has buried metal. Drums were observed in the bank, particularly where eroded. The geophysical data indicate buried metal is present up to the water's edge. The southern limit of metal has not been fully defined and metal may extend beneath the water. If the survey had been performed at low tide, perhaps the full extent of buried metal could have been defined.

Two areas of possible buried waste or fill have been identified by the investigation. One is located within a borrow pit, centered at 4275 east, 4850 north. The other is located at 4550 east, 4900 north, at the base of a small topographic ledge. The data at both areas show elevated conductivity, but indicate little or no metal.

Buried utilities have been identified at several locations at the site. Utility 1 is located at the west end of the site along the south side of the road. It appears to turn north and cross beneath the road at 4350 east. Utility 1 connects with Utility 2 at 4300 east, which runs to the south at least as far as the bank. Utility 3 has been identified oriented diagonally in the west end of the site. It is at the edge of an area of buried metal and the anomalies caused by the utility line have interfered with the interpretation of the limit of buried metal in the vicinity. Utilities 4 and 5 are associated with a ditch at the north side of a dirt track.

Isolated metal and possible metal have also been identified at several locations around the site as shown in Figure 3.19.

Twenty two surface soil samples were collected at SW-10 (see Figure 3.18); 10 from a random grid (S10-64 to 74), and 9 from specific locations [seeps (S10-100, 101), areas of metal (S10-102, 111-116)]. All samples were analyzed for VOAs, semi VOAs, pesticides/PCBs, and metals. Three samples (S10-103, 104, 105) were collected and analyzed for toxicity characteristic leaching

procedure (TCLP) metals. The TCLP samples were collected to help determine if the soil would have to be treated as a RCRA waste if it were to be removed. In addition, the TCLP results are useful in determining how much metal might be leached out of the soil by infiltrating water.

Tables 3.26 and 3.27 list the analytical results from the CSL and the offsite laboratory, respectively.

In addition, three groundwater monitoring wells were installed at SW-10 (see Figure 3.18). Soil samples were taken from each boring at 5-foot intervals for onsite TPH analysis, and a sample was taken just above the water table for analysis of VOAs, semi VOAs, pesticides/PCBs, and metals. Well No. 1 (S10-W1) and Well No. 2 (S10-W2) showed minor amounts of toluene, and Well No. 1 (S10-W1) showed carbon disulfide at the water table sample. After the wells were developed and allowed to equilibrate with the aquifer, a groundwater sample was obtained from each well and analyzed for VOAs, semi VOAs, pesticides/PCBs, and metals. Tables 3.26 and 3.27 list the groundwater sample analytical results.

Groundwater elevations were taken from the three monitoring wells and a potentiometric groundwater map developed (Figure 3.20). Groundwater flows to the south toward the ocean.

3.8.4 Nature and Extent of Contamination

Table 3.28 presents a summary of the analytical data for SW-10. Presented are the analytes with positive results, the total number of samples analyzed, the number of samples with positive results, and the range of the results.

The boundary (areal extent) of the site was determined by geophysical methods and is shown in Figure 3.19. The estimated area of the site from the 1992 field investigation is 9.8 acres.

11°59'35"

LEGEND

- STEEP BANK
- MONITORING WELL LOCATION
- (CONTOUR INTERVAL 1 FOOT)

FIGURE 3.20. SW-10 Groun

TABLE 3.26. Positive Results from Onsite (CSL) Data at SW-10

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
S10-066	SHSOSSSW10-066	(0-0.5 TOTAL PETROLEUM HYDROCARBONS	MG/KG	24.26	
S10-067	SHSOSSSW10-067	(0-0.5 TOTAL PETROLEUM HYDROCARBONS	MG/KG	245.28	
S10-068	SHSOSSSW10-068	(0-0.5 TOTAL PETROLEUM HYDROCARBONS	MG/KG	16244.32	
S10-068	SHSOSSSW10-068	HEADSPACE	PPM	7.00	
S10-068	SHSOSSSW10-068	(0-0.5 ETHYLBENZENE	UG/KG	50.20	
S10-068	SHSOSSSW10-068	(0-0.5 TOLUENE	UG/KG	62.80	
S10-068	SHSOSSSW10-068	(0-0.5 m, p-XYLENES	UG/KG	114.20	
S10-068	SHSOSSSW10-068	(0-0.5 o-XYLENE	UG/KG	56.70	
S10-100	SHSOSSSW10-100	(0-0.5 TOTAL PETROLEUM HYDROCARBONS	MG/KG	908.65	
S10-102	SHSOSSSW10-102	HEADSPACE	PPM	1.00	
S10-W1	SW10W11.5 (1.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	148.96	
S10-W2	SW10W215.0 (15.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	41.88	
S10-W2	SW10W2	BENZENE	UG/L	5.10	
S10-W2	SW10W2	ETHYLBENZENE	UG/L	1.60	
S10-W2	SW10W2	TOLUENE	UG/L	2.90	
S10-W2	SW10W2	o-XYLENE	UG/L	.70	
S10-W3	SW10W311.5 (11.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	133.75	
S10-W3	SW10W313.5 (13.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	120.40	
S10-W3	SW10W39.5 (9.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	75.73	
S10-W3	SW10W3	BENZENE	UG/L	3.60	
S10-W3	SW10W3	TOLUENE	UG/L	1.70	
S10-W3	SW10W3	m, p-XYLENES	UG/L	3.60	
S10-W3	SW10W3	o-XYLENE	UG/L	2.60	

 (a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. Positive Results from Offsite Data at SW-10

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-064	SOSSSW1064 (0-0.5)	ALUMINUM	MG/KG	9210.00	*
S10-064	SOSSSW1064 (0-0.5)	BARIUM	MG/KG	34.20	
S10-064	SOSSSW1064 (0-0.5)	CADMIUM	MG/KG	.65	
S10-064	SOSSSW1064 (0-0.5)	CALCIUM	MG/KG	15000.00	
S10-064	SOSSSW1064 (0-0.5)	CHROMIUM	MG/KG	11.40	*
S10-064	SOSSSW1064 (0-0.5)	COBALT	MG/KG	6.80	
S10-064	SOSSSW1064 (0-0.5)	COPPER	MG/KG	25.40	
S10-064	SOSSSW1064 (0-0.5)	IRON	MG/KG	15000.00	
S10-064	SOSSSW1064 (0-0.5)	MAGNESIUM	MG/KG	7050.00	
S10-064	SOSSSW1064 (0-0.5)	MANGANESE	MG/KG	240.00	J4
S10-064	SOSSSW1064 (0-0.5)	NICKEL	MG/KG	13.40	
S10-064	SOSSSW1064 (0-0.5)	POTASSIUM	MG/KG	780.00	
S10-064	SOSSSW1064 (0-0.5)	SILVER	MG/KG	.47	
S10-064	SOSSSW1064 (0-0.5)	SODIUM	MG/KG	1240.00	
S10-064	SOSSSW1064 (0-0.5)	THALLIUM	MG/KG	22.20	
S10-064	SOSSSW1064 (0-0.5)	VANADIUM	MG/KG	46.20	
S10-064	SOSSSW1064 (0-0.5)	ZINC	MG/KG	38.40	
S10-065	SOSSSW1065 (0-0.5)	ALUMINUM	MG/KG	12300.00	*
S10-065	SOSSSW1065 (0-0.5)	ARSENIC	MG/KG	8.60	
S10-065	SOSSSW1065 (0-0.5)	BARIUM	MG/KG	12.10	
S10-065	SOSSSW1065 (0-0.5)	CADMIUM	MG/KG	.65	
S10-065	SOSSSW1065 (0-0.5)	CALCIUM	MG/KG	45300.00	
S10-065	SOSSSW1065 (0-0.5)	CHROMIUM	MG/KG	12.50	*
S10-065	SOSSSW1065 (0-0.5)	COBALT	MG/KG	3.50	
S10-065	SOSSSW1065 (0-0.5)	COPPER	MG/KG	16.50	
S10-065	SOSSSW1065 (0-0.5)	IRON	MG/KG	17100.00	
S10-065	SOSSSW1065 (0-0.5)	LEAD	MG/KG	11.20	
S10-065	SOSSSW1065 (0-0.5)	MAGNESIUM	MG/KG	6230.00	
S10-065	SOSSSW1065 (0-0.5)	MANGANESE	MG/KG	164.00	J4
S10-065	SOSSSW1065 (0-0.5)	NICKEL	MG/KG	10.80	
S10-065	SOSSSW1065 (0-0.5)	POTASSIUM	MG/KG	1190.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-065	SOSSSW1065 (0-0.5)	SODIUM	MG/KG	2550.00	
S10-065	SOSSSW1065 (0-0.5)	THALLIUM	MG/KG	24.10	
S10-065	SOSSSW1065 (0-0.5)	VANADIUM	MG/KG	50.20	
S10-065	SOSSSW1065 (0-0.5)	ZINC	MG/KG	45.20	
S10-065	SOSSSW1065 (0-0.5)	4,4'-DDT	UG/KG	8.70	
S10-065	SOSSSW1065 (0-0.5)	CHLOROFORM	UG/KG	2.00	J
S10-066	SOSSSW1066 (0-0.5)	ALUMINUM	MG/KG	11900.00	*
S10-066	SOSSSW1066 (0-0.5)	ARSENIC	MG/KG	12.30	
S10-066	SOSSSW1066 (0-0.5)	BERIUM	MG/KG	16.50	
S10-066	SOSSSW1066 (0-0.5)	BERYLLIUM	MG/KG	.22	
S10-066	SOSSSW1066 (0-0.5)	CADMIUM	MG/KG	.89	
S10-066	SOSSSW1066 (0-0.5)	CALCIUM	MG/KG	14900.00	
S10-066	SOSSSW1066 (0-0.5)	CHROMIUM	MG/KG	15.20	*
S10-066	SOSSSW1066 (0-0.5)	COBALT	MG/KG	6.20	
S10-066	SOSSSW1066 (0-0.5)	COPPER	MG/KG	19.50	
S10-066	SOSSSW1066 (0-0.5)	IRON	MG/KG	21100.00	
S10-066	SOSSSW1066 (0-0.5)	MAGNESIUM	MG/KG	3020.00	
S10-066	SOSSSW1066 (0-0.5)	MANGANESE	MG/KG	244.00	J4
S10-066	SOSSSW1066 (0-0.5)	NICKEL	MG/KG	16.30	
S10-066	SOSSSW1066 (0-0.5)	POTASSIUM	MG/KG	732.00	
S10-066	SOSSSW1066 (0-0.5)	SILVER	MG/KG	.50	
S10-066	SOSSSW1066 (0-0.5)	SODIUM	MG/KG	1350.00	
S10-066	SOSSSW1066 (0-0.5)	THALLIUM	MG/KG	35.90	
S10-066	SOSSSW1066 (0-0.5)	VANADIUM	MG/KG	65.70	
S10-066	SOSSSW1066 (0-0.5)	ZINC	MG/KG	47.90	
S10-067	SOSSSW1067 (0-0.5)	ALUMINUM	MG/KG	11800.00	*
S10-067	SOSSSW1067 (0-0.5)	BERIUM	MG/KG	42.60	
S10-067	SOSSSW1067 (0-0.5)	BERYLLIUM	MG/KG	.35	
S10-067	SOSSSW1067 (0-0.5)	CADMIUM	MG/KG	4.30	
S10-067	SOSSSW1067 (0-0.5)	CALCIUM	MG/KG	5620.00	*
S10-067	SOSSSW1067 (0-0.5)	CHROMIUM	MG/KG	24.40	*

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-067	SOSSSW1067 (0-0.5)	COBALT	MG/KG	13.80	
S10-067	SOSSSW1067 (0-0.5)	COPPER	MG/KG	62.40	
S10-067	SOSSSW1067 (0-0.5)	IRON	MG/KG	31000.00	
S10-067	SOSSSW1067 (0-0.5)	LEAD	MG/KG	179.00	
S10-067	SOSSSW1067 (0-0.5)	MAGNESIUM	MG/KG	10800.00	
S10-067	SOSSSW1067 (0-0.5)	MANGANESE	MG/KG	533.00	J4
S10-067	SOSSSW1067 (0-0.5)	MOLYBDENUM	MG/KG	1.30	
S10-067	SOSSSW1067 (0-0.5)	NICKEL	MG/KG	18.60	
S10-067	SOSSSW1067 (0-0.5)	POTASSIUM	MG/KG	705.00	
S10-067	SOSSSW1067 (0-0.5)	SILVER	MG/KG	2.20	
S10-067	SOSSSW1067 (0-0.5)	SODIUM	MG/KG	1770.00	
S10-067	SOSSSW1067 (0-0.5)	THALLIUM	MG/KG	26.80	
S10-067	SOSSSW1067 (0-0.5)	VANADIUM	MG/KG	72.70	
S10-067	SOSSSW1067 (0-0.5)	ZINC	MG/KG	252.00	
S10-067	SOSSSW1067 (0-0.5)	4,4'-DDD	UG/KG	15.00	
S10-067	SOSSSW1067 (0-0.5)	4,4'-DDE	UG/KG	3.20	JX
S10-067	SOSSSW1067 (0-0.5)	4,4'-DDT	UG/KG	12.00	
S10-067	SW10-113 (0-0.5)	ALUMINUM	MG/KG	17300.00	*
S10-067	SW10-113 (0-0.5)	ARSENIC	MG/KG	3.70	
S10-067	SW10-113 (0-0.5)	BARIUM	MG/KG	59.60	*
S10-067	SW10-113 (0-0.5)	BERYLLIUM	MG/KG	.39	B
S10-067	SW10-113 (0-0.5)	CADMIUM	MG/KG	1.80	*
S10-067	SW10-113 (0-0.5)	CALCIUM	MG/KG	6540.00	*
S10-067	SW10-113 (0-0.5)	CHROMIUM	MG/KG	31.40	
S10-067	SW10-113 (0-0.5)	COBALT	MG/KG	21.90	
S10-067	SW10-113 (0-0.5)	COPPER	MG/KG	78.30	
S10-067	SW10-113 (0-0.5)	IRON	MG/KG	41400.00	
S10-067	SW10-113 (0-0.5)	LEAD	MG/KG	317.00	
S10-067	SW10-113 (0-0.5)	MAGNESIUM	MG/KG	15900.00	*
S10-067	SW10-113 (0-0.5)	MANGANESE	MG/KG	715.00	*
S10-067	SW10-113 (0-0.5)	MERCURY	MG/KG	.23	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-067	SW10-113 (0-0.5)	NICKEL	MG/KG	26.10	
S10-067	SW10-113 (0-0.5)	POTASSIUM	MG/KG	1170.00	B
S10-067	SW10-113 (0-0.5)	SILVER	MG/KG	3.50	
S10-067	SW10-113 (0-0.5)	SODIUM	MG/KG	2350.00	
S10-067	SW10-113 (0-0.5)	THALLIUM	MG/KG	.47	WB
S10-067	SW10-113 (0-0.5)	VANADIUM	MG/KG	123.00	
S10-067	SW10-113 (0-0.5)	ZINC	MG/KG	401.00	
S10-067	SW10-113 (0-0.5)	4,4'-DDT	UG/KG	2.50	JP
S10-067	SW10-113 (0-0.5)	AROCLOR-1254	UG/KG	39.00	P
S10-067	SW10-113 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	190.00	BJ
S10-067	SW10-113 (0-0.5)	METHYLENE CHLORIDE	UG/KG	13.00	B
S10-067	SW10-113 (0-0.5)	ALUMINUM	MG/KG	13700.00	*
S10-068	SOSSSW1068 (0-0.5)	BARIUM	MG/KG	26.10	
S10-068	SOSSSW1068 (0-0.5)	BERYLLIUM	MG/KG	.30	
S10-068	SOSSSW1068 (0-0.5)	CADMIUM	MG/KG	1.60	
S10-068	SOSSSW1068 (0-0.5)	CALCIUM	MG/KG	1830.00	
S10-068	SOSSSW1068 (0-0.5)	CHROMIUM	MG/KG	12.20	*
S10-068	SOSSSW1068 (0-0.5)	COBALT	MG/KG	4.40	
S10-068	SOSSSW1068 (0-0.5)	COPPER	MG/KG	83.10	
S10-068	SOSSSW1068 (0-0.5)	IRON	MG/KG	14000.00	
S10-068	SOSSSW1068 (0-0.5)	LEAD	MG/KG	22.90	
S10-068	SOSSSW1068 (0-0.5)	MAGNESIUM	MG/KG	5670.00	
S10-068	SOSSSW1068 (0-0.5)	MANGANESE	MG/KG	127.00	J4
S10-068	SOSSSW1068 (0-0.5)	NICKEL	MG/KG	12.90	
S10-068	SOSSSW1068 (0-0.5)	POTASSIUM	MG/KG	640.00	
S10-068	SOSSSW1068 (0-0.5)	SODIUM	MG/KG	2150.00	
S10-068	SOSSSW1068 (0-0.5)	THALLIUM	MG/KG	22.60	
S10-068	SOSSSW1068 (0-0.5)	VANADIUM	MG/KG	50.50	
S10-068	SOSSSW1068 (0-0.5)	ZINC	MG/KG	94.70	
S10-068	SOSSSW1068 (0-0.5)	4,4'-DDD	UG/KG	2.10	JX
S10-069	SOSSSW1069 (0-0.5)	ALUMINUM	MG/KG	8710.00	*

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(C)
S10-069	SOSSSW1069 (0-0.5)	BARIUM	MG/KG	11.00	
S10-069	SOSSSW1069 (0-0.5)	CADMIUM	MG/KG	.91	
S10-069	SOSSSW1069 (0-0.5)	CALCIUM	MG/KG	4410.00	
S10-069	SOSSSW1069 (0-0.5)	CHROMIUM	MG/KG	6.10	*
S10-069	SOSSSW1069 (0-0.5)	COBALT	MG/KG	8.30	
S10-069	SOSSSW1069 (0-0.5)	COPPER	MG/KG	44.00	
S10-069	SOSSSW1069 (0-0.5)	IRON	MG/KG	15000.00	
S10-069	SOSSSW1069 (0-0.5)	MAGNESIUM	MG/KG	11400.00	
S10-069	SOSSSW1069 (0-0.5)	MANGANESE	MG/KG	506.00	J4
S10-069	SOSSSW1069 (0-0.5)	NICKEL	MG/KG	12.30	
S10-069	SOSSSW1069 (0-0.5)	POTASSIUM	MG/KG	386.00	
S10-069	SOSSSW1069 (0-0.5)	SILVER	MG/KG	.25	
S10-069	SOSSSW1069 (0-0.5)	SODIUM	MG/KG	1630.00	
S10-069	SOSSSW1069 (0-0.5)	THALLIUM	MG/KG	12.20	
S10-069	SOSSSW1069 (0-0.5)	VANADIUM	MG/KG	35.10	
S10-069	SOSSSW1069 (0-0.5)	ZINC	MG/KG	48.60	
S10-070	SOSSSW1070 (0-0.5)	ALUMINUM	MG/KG	9350.00	*
S10-070	SOSSSW1070 (0-0.5)	BARIUM	MG/KG	30.70	
S10-070	SOSSSW1070 (0-0.5)	CADMIUM	MG/KG	1.20	
S10-070	SOSSSW1070 (0-0.5)	CALCIUM	MG/KG	9670.00	
S10-070	SOSSSW1070 (0-0.5)	CHROMIUM	MG/KG	11.50	*
S10-070	SOSSSW1070 (0-0.5)	COBALT	MG/KG	7.40	
S10-070	SOSSSW1070 (0-0.5)	COPPER	MG/KG	63.80	
S10-070	SOSSSW1070 (0-0.5)	IRON	MG/KG	20600.00	
S10-070	SOSSSW1070 (0-0.5)	LEAD	MG/KG	46.60	
S10-070	SOSSSW1070 (0-0.5)	MAGNESIUM	MG/KG	9050.00	
S10-070	SOSSSW1070 (0-0.5)	MANGANESE	MG/KG	352.00	J4
S10-070	SOSSSW1070 (0-0.5)	NICKEL	MG/KG	17.80	
S10-070	SOSSSW1070 (0-0.5)	POTASSIUM	MG/KG	628.00	
S10-070	SOSSSW1070 (0-0.5)	SILVER	MG/KG	.34	
S10-070	SOSSSW1070 (0-0.5)	SODIUM	MG/KG	1580.00	

 (a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
 RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S10-070	SOSSSW1070 (0-0.5)	THALLIUM	MG/KG	24.10	
S10-070	SOSSSW1070 (0-0.5)	VANADIUM	MG/KG	46.00	
S10-070	SOSSSW1070 (0-0.5)	ZINC	MG/KG	137.00	
S10-072	SOSSSW1072 (0-0.5)	ALUMINUM	MG/KG	10200.00	
S10-072	SOSSSW1072 (0-0.5)	ARSENIC	MG/KG	9.30	
S10-072	SOSSSW1072 (0-0.5)	BARIUM	MG/KG	30.10	
S10-072	SOSSSW1072 (0-0.5)	CADMIUM	MG/KG	1.70	
S10-072	SOSSSW1072 (0-0.5)	CALCIUM	MG/KG	8600.00	
S10-072	SOSSSW1072 (0-0.5)	CHROMIUM	MG/KG	16.10	
S10-072	SOSSSW1072 (0-0.5)	COBALT	MG/KG	6.70	
S10-072	SOSSSW1072 (0-0.5)	COPPER	MG/KG	27.10	
S10-072	SOSSSW1072 (0-0.5)	IRON	MG/KG	25900.00	J4
S10-072	SOSSSW1072 (0-0.5)	LEAD	MG/KG	40.20	
S10-072	SOSSSW1072 (0-0.5)	MAGNESIUM	MG/KG	7600.00	
S10-072	SOSSSW1072 (0-0.5)	MANGANESE	MG/KG	275.00	J4
S10-072	SOSSSW1072 (0-0.5)	NICKEL	MG/KG	16.90	
S10-072	SOSSSW1072 (0-0.5)	POTASSIUM	MG/KG	785.00	
S10-072	SOSSSW1072 (0-0.5)	SILVER	MG/KG	1.90	
S10-072	SOSSSW1072 (0-0.5)	SODIUM	MG/KG	1720.00	
S10-072	SOSSSW1072 (0-0.5)	THALLIUM	MG/KG	28.20	
S10-072	SOSSSW1072 (0-0.5)	VANADIUM	MG/KG	54.50	
S10-072	SOSSSW1072 (0-0.5)	ZINC	MG/KG	58.60	*
S10-072	SOSSSW1072 (0-0.5)	FLUORANTHENE	UG/KG	45.00	J
S10-072	SOSSSW1072 (0-0.5)	PHENANTHRENE	UG/KG	54.00	J
S10-072	SOSSSW1072 (0-0.5)	PYRENE	UG/KG	44.00	J
S10-072	SOSSSW1072 (0-0.5)	ALUMINUM	MG/KG	8310.00	*
S10-072	SW10-111 (0-0.5)	ARSENIC	MG/KG	1.20	B
S10-072	SW10-111 (0-0.5)	BARIUM	MG/KG	7.00	*B
S10-072	SW10-111 (0-0.5)	BERYLLIUM	MG/KG	.20	B
S10-072	SW10-111 (0-0.5)	CALCIUM	MG/KG	4130.00	*
S10-072	SW10-111 (0-0.5)	CHROMIUM	MG/KG	5.30	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIJ = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-072	SW10-111 (0-0.5)	COBALT	MG/KG	6.90	B
S10-072	SW10-111 (0-0.5)	COPPER	MG/KG	39.90	
S10-072	SW10-111 (0-0.5)	IRON	MG/KG	12500.00	
S10-072	SW10-111 (0-0.5)	LEAD	MG/KG	10.50	*
S10-072	SW10-111 (0-0.5)	MAGNESIUM	MG/KG	11000.00	
S10-072	SW10-111 (0-0.5)	MANGANESE	MG/KG	415.00	*
S10-072	SW10-111 (0-0.5)	NICKEL	MG/KG	9.90	
S10-072	SW10-111 (0-0.5)	POTASSIUM	MG/KG	318.00	B
S10-072	SW10-111 (0-0.5)	SILVER	MG/KG	.36	B
S10-072	SW10-111 (0-0.5)	SODIUM	MG/KG	2090.00	
S10-072	SW10-111 (0-0.5)	VANADIUM	MG/KG	20.30	
S10-072	SW10-111 (0-0.5)	ZINC	MG/KG	51.10	
S10-072	SW10-111 (0-0.5)	AROCLOR-1248	UG/KG	150.00	P
S10-072	SW10-111 (0-0.5)	AROCLOR-1254	UG/KG	23.00	JP
S10-072	SW10-111 (0-0.5)	Bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	120.00	BJ
S10-072	SW10-111 (0-0.5)	METHYLENE CHLORIDE	UG/KG	8.00	J
S10-072	SW10-111 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	548.00	J2
S10-100	SOSW10100 (0-0.5)	ALUMINUM	MG/KG	19200.00	
S10-100	SOSW10100 (0-0.5)	BARIUM	MG/KG	108.00	
S10-100	SOSW10100 (0-0.5)	BERYLLIUM	MG/KG	.40	
S10-100	SOSW10100 (0-0.5)	CADMIUM	MG/KG	5.50	
S10-100	SOSW10100 (0-0.5)	CALCIUM	MG/KG	8020.00	
S10-100	SOSW10100 (0-0.5)	CHROMIUM	MG/KG	59.20	
S10-100	SOSW10100 (0-0.5)	COBALT	MG/KG	19.60	
S10-100	SOSW10100 (0-0.5)	COPPER	MG/KG	77.30	
S10-100	SOSW10100 (0-0.5)	IRON	MG/KG	41900.00	
S10-100	SOSW10100 (0-0.5)	LEAD	MG/KG	166.00	
S10-100	SOSW10100 (0-0.5)	MAGNESIUM	MG/KG	13700.00	
S10-100	SOSW10100 (0-0.5)	MANGANESE	MG/KG	612.00	J4
S10-100	SOSW10100 (0-0.5)	NICKEL	MG/KG	36.70	
S10-100	SOSW10100 (0-0.5)	POTASSIUM	MG/KG	981.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-100	SOSW10100 (0-0.5)	SILVER	MG/KG	1.30	
S10-100	SOSW10100 (0-0.5)	SODIUM	MG/KG	1330.00	
S10-100	SOSW10100 (0-0.5)	THALLIUM	MG/KG	74.70	
S10-100	SOSW10100 (0-0.5)	VANADIUM	MG/KG	136.00	
S10-100	SOSW10100 (0-0.5)	ZINC	MG/KG	169.00	
S10-100	SOSW10100 (0-0.5)	4,4'-DDT	UG/KG	3.10	JX
S10-100	SOSW10100 (0-0.5)	ENDRIN KETONE	UG/KG	2.10	JX
S10-100	SOSW10100 (0-0.5)	ANTHRACENE	UG/KG	68.00	J
S10-100	SOSW10100 (0-0.5)	BENZO(A)ANTHRACENE	UG/KG	130.00	J
S10-100	SOSW10100 (0-0.5)	BENZO(A)PYRENE	UG/KG	330.00	J
S10-100	SOSW10100 (0-0.5)	BENZO(B)FLUORANTHENE	UG/KG	300.00	J
S10-100	SOSW10100 (0-0.5)	BENZO(G,H,I)PERYLENE	UG/KG	270.00	J
S10-100	SOSW10100 (0-0.5)	BENZO(K)FLUORANTHENE	UG/KG	270.00	J
S10-100	SOSW10100 (0-0.5)	CHRYSENE	UG/KG	390.00	J
S10-100	SOSW10100 (0-0.5)	FLUORANTHENE	UG/KG	68.00	J
S10-100	SOSW10100 (0-0.5)	INDENO(1,2,3-C,D)PYRENE	UG/KG	300.00	J
S10-100	SOSW10100 (0-0.5)	PYRENE	UG/KG	80.00	J
S10-100	SOSW10100 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	56.00	J
S10-101	SOSW10101 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	19.70	J2
S10-101	SOSW10101 (0-0.5)	ALUMINUM	MG/KG	11800.00	
S10-101	SOSW10101 (0-0.5)	ARSENIC	MG/KG	9.80	*
S10-101	SOSW10101 (0-0.5)	BARIUM	MG/KG	20.00	
S10-101	SOSW10101 (0-0.5)	CADIUM	MG/KG	.58	
S10-101	SOSW10101 (0-0.5)	CALCIUM	MG/KG	23000.00	
S10-101	SOSW10101 (0-0.5)	CHROMIUM	MG/KG	12.30	
S10-101	SOSW10101 (0-0.5)	COBALT	MG/KG	6.40	
S10-101	SOSW10101 (0-0.5)	COPPER	MG/KG	20.30	
S10-101	SOSW10101 (0-0.5)	IRON	MG/KG	18900.00	
S10-101	SOSW10101 (0-0.5)	LEAD	MG/KG	12.40	
S10-101	SOSW10101 (0-0.5)	MAGNESIUM	MG/KG	6430.00	
S10-101	SOSW10101 (0-0.5)	MANGANESE	MG/KG	383.00	J4

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-101	SOSW10101 (0-0.5)	NICKEL	MG/KG	9.80	
S10-101	SOSW10101 (0-0.5)	POTASSIUM	MG/KG	895.00	
S10-101	SOSW10101 (0-0.5)	SILVER	MG/KG	.32	
S10-101	SOSW10101 (0-0.5)	SODIUM	MG/KG	1930.00	
S10-101	SOSW10101 (0-0.5)	THALLIUM	MG/KG	28.50	
S10-101	SOSW10101 (0-0.5)	VANADIUM	MG/KG	55.00	
S10-101	SOSW10101 (0-0.5)	ZINC	MG/KG	54.90	
S10-101	SOSW10101 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	46.00	J
S10-102	SOSW10102 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	6.40	J2
S10-102	SOSW10102 (0-0.5)	ALUMINUM	MG/KG	11700.00	
S10-102	SOSW10102 (0-0.5)	BARIUM	MG/KG	13.80	
S10-102	SOSW10102 (0-0.5)	CADMIUM	MG/KG	.61	
S10-102	SOSW10102 (0-0.5)	CALCIUM	MG/KG	53700.00	
S10-102	SOSW10102 (0-0.5)	CHROMIUM	MG/KG	11.30	
S10-102	SOSW10102 (0-0.5)	COBALT	MG/KG	5.20	
S10-102	SOSW10102 (0-0.5)	COPPER	MG/KG	18.00	
S10-102	SOSW10102 (0-0.5)	IRON	MG/KG	18100.00	
S10-102	SOSW10102 (0-0.5)	LEAD	MG/KG	10.10	
S10-102	SOSW10102 (0-0.5)	MAGNESIUM	MG/KG	6720.00	
S10-102	SOSW10102 (0-0.5)	MANGANESE	MG/KG	166.00	J4
S10-102	SOSW10102 (0-0.5)	NICKEL	MG/KG	8.20	
S10-102	SOSW10102 (0-0.5)	POTASSIUM	MG/KG	1220.00	
S10-102	SOSW10102 (0-0.5)	SODIUM	MG/KG	3420.00	
S10-102	SOSW10102 (0-0.5)	THALLIUM	MG/KG	30.70	
S10-102	SOSW10102 (0-0.5)	VANADIUM	MG/KG	53.30	
S10-102	SOSW10102 (0-0.5)	ZINC	MG/KG	45.20	
S10-102	SOSW10102 (0-0.5)	PENTACHLOROPHENOL	UG/KG	210.00	BJ2
S10-102	SOSW10102 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	46.00	J
S10-103	SOSW10103 (0-0.5)	BARIUM	UG/L	568.00	
S10-103	SOSW10103 (0-0.5)	CADMIUM	UG/L	10.30	
S10-103	SOSW10103 (0-0.5)	LEAD	UG/L	40797.90	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-104	SOSW10104 (0-0.5)	BARIUM	UG/L	635.80	
S10-104	SOSW10104 (0-0.5)	CADMIUM	UG/L	20.20	
S10-104	SOSW10104 (0-0.5)	LEAD	UG/L	135.70	
S10-104	SOSW10104 (0-0.5)	SILVER	UG/L	2.20	
S10-104	SW10-112 (0-0.5)	ALUMINUM	MG/KG	18500.00	*
S10-104	SW10-112 (0-0.5)	ARSENIC	MG/KG	2.90	
S10-104	SW10-112 (0-0.5)	BARIUM	MG/KG	27.90	*B
S10-104	SW10-112 (0-0.5)	BERYLLIUM	MG/KG	.35	B
S10-104	SW10-112 (0-0.5)	CADMIUM	MG/KG	5.80	*
S10-104	SW10-112 (0-0.5)	CALCIUM	MG/KG	4910.00	*
S10-104	SW10-112 (0-0.5)	CHROMIUM	MG/KG	18.30	
S10-104	SW10-112 (0-0.5)	COBALT	MG/KG	7.80	B
S10-104	SW10-112 (0-0.5)	COPPER	MG/KG	41.00	
S10-104	SW10-112 (0-0.5)	IRON	MG/KG	22000.00	
S10-104	SW10-112 (0-0.5)	LEAD	MG/KG	50.70	*S
S10-104	SW10-112 (0-0.5)	MAGNESIUM	MG/KG	7580.00	
S10-104	SW10-112 (0-0.5)	MANGANESE	MG/KG	274.00	*
S10-104	SW10-112 (0-0.5)	NICKEL	MG/KG	20.00	
S10-104	SW10-112 (0-0.5)	POTASSIUM	MG/KG	934.00	B
S10-104	SW10-112 (0-0.5)	SODIUM	MG/KG	3530.00	
S10-104	SW10-112 (0-0.5)	VANADIUM	MG/KG	73.80	
S10-104	SW10-112 (0-0.5)	ZINC	MG/KG	183.00	
S10-104	SW10-112 (0-0.5)	METHYLENE CHLORIDE	UG/KG	14.00	B
S10-114	SW10-114 (0-0.5)	ALUMINUM	MG/KG	11600.00	*
S10-114	SW10-114 (0-0.5)	ARSENIC	MG/KG	6.00	
S10-114	SW10-114 (0-0.5)	BARIUM	MG/KG	9.50	*B
S10-114	SW10-114 (0-0.5)	BERYLLIUM	MG/KG	.18	B
S10-114	SW10-114 (0-0.5)	CALCIUM	MG/KG	74000.00	*
S10-114	SW10-114 (0-0.5)	CHROMIUM	MG/KG	13.40	
S10-114	SW10-114 (0-0.5)	COBALT	MG/KG	4.30	B
S10-114	SW10-114 (0-0.5)	COPPER	MG/KG	13.10	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S10-114	SW10-114 (0-0.5)	IRON	MG/KG	16000.00	
S10-114	SW10-114 (0-0.5)	LEAD	MG/KG	7.70	*S
S10-114	SW10-114 (0-0.5)	MAGNESIUM	MG/KG	7290.00	
S10-114	SW10-114 (0-0.5)	MANGANESE	MG/KG	183.00	*
S10-114	SW10-114 (0-0.5)	NICKEL	MG/KG	15.30	
S10-114	SW10-114 (0-0.5)	POTASSIUM	MG/KG	1100.00	B
S10-114	SW10-114 (0-0.5)	SODIUM	MG/KG	3770.00	
S10-114	SW10-114 (0-0.5)	VANADIUM	MG/KG	53.30	
S10-114	SW10-114 (0-0.5)	ZINC	MG/KG	36.40	
S10-114	SW10-114 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	92.00	BJ
S10-114	SW10-114 (0-0.5)	METHYLENE CHLORIDE	UG/KG	7.00	J
S10-115	SW10-115 (0-0.5)	ALUMINUM	MG/KG	18900.00	*
S10-115	SW10-115 (0-0.5)	ARSENIC	MG/KG	5.20	S
S10-115	SW10-115 (0-0.5)	BARIUM	MG/KG	145.00	*
S10-115	SW10-115 (0-0.5)	BERYLLIUM	MG/KG	.39	B
S10-115	SW10-115 (0-0.5)	CALCIUM	MG/KG	5650.00	*
S10-115	SW10-115 (0-0.5)	CHROMIUM	MG/KG	29.10	
S10-115	SW10-115 (0-0.5)	COBALT	MG/KG	15.50	
S10-115	SW10-115 (0-0.5)	COPPER	MG/KG	65.00	
S10-115	SW10-115 (0-0.5)	IRON	MG/KG	33900.00	
S10-115	SW10-115 (0-0.5)	LEAD	MG/KG	42.70	*S
S10-115	SW10-115 (0-0.5)	MAGNESIUM	MG/KG	13700.00	
S10-115	SW10-115 (0-0.5)	MANGANESE	MG/KG	689.00	*
S10-115	SW10-115 (0-0.5)	NICKEL	MG/KG	27.10	
S10-115	SW10-115 (0-0.5)	POTASSIUM	MG/KG	1740.00	
S10-115	SW10-115 (0-0.5)	SELENIUM	MG/KG	.76	NB
S10-115	SW10-115 (0-0.5)	SILVER	MG/KG	8.60	
S10-115	SW10-115 (0-0.5)	SODIUM	MG/KG	1980.00	
S10-115	SW10-115 (0-0.5)	VANADIUM	MG/KG	116.00	
S10-115	SW10-115 (0-0.5)	ZINC	MG/KG	83.00	
S10-115	SW10-115 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	140.00	BJX

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-115	SW10-115 (0-0.5)	METHYLENE CHLORIDE	UG/KG	7.00	J
S10-116	SW10-116 (0-0.5)	ALUMINUM	MG/KG	15400.00	*
S10-116	SW10-116 (0-0.5)	ARSENIC	MG/KG	6.90	S
S10-116	SW10-116 (0-0.5)	BARIUM	MG/KG	15.40	*B
S10-116	SW10-116 (0-0.5)	BERYLLIUM	MG/KG	.21	B
S10-116	SW10-116 (0-0.5)	CALCIUM	MG/KG	27400.00	*
S10-116	SW10-116 (0-0.5)	CHROMIUM	MG/KG	17.80	
S10-116	SW10-116 (0-0.5)	COBALT	MG/KG	7.10	B
S10-116	SW10-116 (0-0.5)	COPPER	MG/KG	24.30	
S10-116	SW10-116 (0-0.5)	IRON	MG/KG	26100.00	
S10-116	SW10-116 (0-0.5)	LEAD	MG/KG	23.80	*S
S10-116	SW10-116 (0-0.5)	MAGNESIUM	MG/KG	8160.00	
S10-116	SW10-116 (0-0.5)	MANGANESE	MG/KG	302.00	*
S10-116	SW10-116 (0-0.5)	NICKEL	MG/KG	19.90	
S10-116	SW10-116 (0-0.5)	POTASSIUM	MG/KG	1270.00	
S10-116	SW10-116 (0-0.5)	SODIUM	MG/KG	3550.00	
S10-116	SW10-116 (0-0.5)	VANADIUM	MG/KG	76.50	
S10-116	SW10-116 (0-0.5)	ZINC	MG/KG	59.50	
S10-116	SW10-116 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	110.00	BJX
S10-116	SW10-116 (0-0.5)	METHYLENE CHLORIDE	UG/KG	7.00	J
S10-W1	SW10-W1	ALUMINUM	UG/L	24300.00	
S10-W1	SW10-W1	BARIUM	UG/L	196.00	
S10-W1	SW10-W1	BERYLLIUM	UG/L	3.50	
S10-W1	SW10-W1	CADMIUM	UG/L	3.00	
S10-W1	SW10-W1	CALCIUM	UG/L	77400.00	
S10-W1	SW10-W1	CHROMIUM	UG/L	32.90	
S10-W1	SW10-W1	COBALT	UG/L	42.20	
S10-W1	SW10-W1	COPPER	UG/L	202.00	
S10-W1	SW10-W1	IRON	UG/L	54200.00	
S10-W1	SW10-W1	MAGNESIUM	UG/L	57200.00	
S10-W1	SW10-W1	MANGANESE	UG/L	2730.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-W1	SW10-W1	NICKEL	UG/L	35.20	
S10-W1	SW10-W1	POTASSIUM	UG/L	12200.00	
S10-W1	SW10-W1	SILVER	UG/L	1.60	
S10-W1	SW10-W1	SODIUM	UG/L	126000.00	
S10-W1	SW10-W1	THALLIUM	UG/L	14.20	
S10-W1	SW10-W1	VANADIUM	UG/L	235.00	
S10-W1	SW10-W1	ZINC	UG/L	261.00	
S10-W1	SW10-W1	DIETHYLPHTHALATE	UG/L	2.00	J
S10-W1	SW10-W1	bis(2-ETHYLHEXYL) PHTHALATE	UG/L	2.00	J
S10-W1	SW10W18.0 (8.0)	TOTAL ORGANIC CARBON	MG/KG	5550.00	
S10-W1	SW10W18.0 (8.0)	ALUMINUM	MG/KG	17000.00	
S10-W1	SW10W18.0 (8.0)	ARSENIC	MG/KG	8.30	
S10-W1	SW10W18.0 (8.0)	BARIUM	MG/KG	145.00	
S10-W1	SW10W18.0 (8.0)	BERYLLIUM	MG/KG	.36	
S10-W1	SW10W18.0 (8.0)	CADMIUM	MG/KG	1.30	
S10-W1	SW10W18.0 (8.0)	CALCIUM	MG/KG	3190.00	
S10-W1	SW10W18.0 (8.0)	CHROMIUM	MG/KG	17.50	
S10-W1	SW10W18.0 (8.0)	COBALT	MG/KG	14.70	
S10-W1	SW10W18.0 (8.0)	COPPER	MG/KG	68.50	
S10-W1	SW10W18.0 (8.0)	IRON	MG/KG	34400.00	
S10-W1	SW10W18.0 (8.0)	MAGNESIUM	MG/KG	13800.00	
S10-W1	SW10W18.0 (8.0)	MANGANESE	MG/KG	317.00	
S10-W1	SW10W18.0 (8.0)	NICKEL	MG/KG	16.10	
S10-W1	SW10W18.0 (8.0)	POTASSIUM	MG/KG	1280.00	
S10-W1	SW10W18.0 (8.0)	SODIUM	MG/KG	1620.00	
S10-W1	SW10W18.0 (8.0)	THALLIUM	MG/KG	38.60	
S10-W1	SW10W18.0 (8.0)	VANADIUM	MG/KG	113.00	
S10-W1	SW10W18.0 (8.0)	ZINC	MG/KG	81.40	
S10-W1	SW10W18.0 (8.0)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	53.00	J
S10-W1	SW10W18.0 (8.0)	CARBON DISULFIDE	UG/KG	1.00	J
S10-W1	SW10W18.0 (8.0)	TOLUENE	UG/KG	3.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S10-W2	SW10-W2	ALUMINUM	UG/L	22100.00	
S10-W2	SW10-W2	BARIUM	UG/L	142.00	
S10-W2	SW10-W2	BERYLLIUM	UG/L	2.60	
S10-W2	SW10-W2	CALCIUM	UG/L	178000.00	
S10-W2	SW10-W2	CHROMIUM	UG/L	48.30	
S10-W2	SW10-W2	COBALT	UG/L	8.20	
S10-W2	SW10-W2	COPPER	UG/L	79.90	
S10-W2	SW10-W2	IRON	UG/L	33600.00	
S10-W2	SW10-W2	MAGNESIUM	UG/L	105000.00	
S10-W2	SW10-W2	MANGANESE	UG/L	1010.00	
S10-W2	SW10-W2	MOLYBDENUM	UG/L	6.70	
S10-W2	SW10-W2	NICKEL	UG/L	30.40	
S10-W2	SW10-W2	POTASSIUM	UG/L	60100.00	
S10-W2	SW10-W2	SILVER	UG/L	1.00	
S10-W2	SW10-W2	SODIUM	UG/L	1240000.00	
S10-W2	SW10-W2	THALLIUM	UG/L	16.10	
S10-W2	SW10-W2	VANADIUM	UG/L	128.00	
S10-W2	SW10-W2	ZINC	UG/L	700.00	
S10-W2	SW10-W2	ACETONE	UG/L	11.00	
S10-W2	SW10-W2	BENZENE	UG/L	3.00	J
S10-W2	SW10-W2	CARBON DISULFIDE	UG/L	3.00	J
S10-W2	SW10-W2	TOLUENE	UG/L	2.00	J
S10-W2	SW10W215.0 (15.0)	TOTAL ORGANIC CARBON	MG/KG	3480.00	
S10-W2	SW10W215.0 (15.0)	ALUMINUM	MG/KG	10500.00	
S10-W2	SW10W215.0 (15.0)	BARIUM	MG/KG	21.80	
S10-W2	SW10W215.0 (15.0)	CADMIUM	MG/KG	.70	
S10-W2	SW10W215.0 (15.0)	CALCIUM	MG/KG	6140.00	
S10-W2	SW10W215.0 (15.0)	CHROMIUM	MG/KG	21.10	
S10-W2	SW10W215.0 (15.0)	COBALT	MG/KG	7.10	J1
S10-W2	SW10W215.0 (15.0)	COPPER	MG/KG	17.70	
S10-W2	SW10W215.0 (15.0)	IRON	MG/KG	14800.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S10-W2	SW10W215.0 (15.0)	MAGNESIUM	MG/KG	8570.00	
S10-W2	SW10W215.0 (15.0)	MANGANESE	MG/KG	361.00	
S10-W2	SW10W215.0 (15.0)	NICKEL	MG/KG	13.70	
S10-W2	SW10W215.0 (15.0)	POTASSIUM	MG/KG	536.00	
S10-W2	SW10W215.0 (15.0)	SODIUM	MG/KG	1810.00	
S10-W2	SW10W215.0 (15.0)	THALLIUM	MG/KG	18.30	
S10-W2	SW10W215.0 (15.0)	VANADIUM	MG/KG	44.20	
S10-W2	SW10W215.0 (15.0)	ZINC	MG/KG	49.60	
S10-W2	SW10W215.0 (15.0)	AROCOR-1248	UG/KG	110.00	P
S10-W2	SW10W215.0 (15.0)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	45.00	J
S10-W2	SW10W215.0 (15.0)	TOLUENE	UG/KG	2.00	J
S10-W3	SW10-W3	ALUMINUM	UG/L	25400.00	
S10-W3	SW10-W3	BARIUM	UG/L	99.60	
S10-W3	SW10-W3	BERYLLIUM	UG/L	2.40	
S10-W3	SW10-W3	CADMIUM	UG/L	2.20	
S10-W3	SW10-W3	CALCIUM	UG/L	38900.00	
S10-W3	SW10-W3	CHROMIUM	UG/L	25.00	
S10-W3	SW10-W3	COBALT	UG/L	14.40	
S10-W3	SW10-W3	COPPER	UG/L	71.80	
S10-W3	SW10-W3	IRON	UG/L	56100.00	
S10-W3	SW10-W3	MAGNESIUM	UG/L	41100.00	
S10-W3	SW10-W3	MANGANESE	UG/L	5510.00	
S10-W3	SW10-W3	NICKEL	UG/L	18.10	
S10-W3	SW10-W3	POTASSIUM	UG/L	8230.00	
S10-W3	SW10-W3	SILVER	UG/L	1.80	
S10-W3	SW10-W3	SODIUM	UG/L	84900.00	
S10-W3	SW10-W3	THALLIUM	UG/L	11.60	
S10-W3	SW10-W3	VANADIUM	UG/L	220.00	
S10-W3	SW10-W3	ZINC	UG/L	147.00	
S10-W3	SW10-W3	2-METHYLNAPHTHALENE	UG/L	12.00	
S10-W3	SW10-W3	DIBENZOFURAN	UG/L	1.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.27. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S10-W3	SW10-W3	FLUORENE	UG/L	2.00	J
S10-W3	SW10-W3	NAPHTHALENE	UG/L	8.00	J2
S10-W3	SW10W313.5 (13.5)	ALUMINUM	MG/KG	11100.00	
S10-W3	SW10W313.5 (13.5)	BARIUM	MG/KG	29.50	
S10-W3	SW10W313.5 (13.5)	BERYLLIUM	MG/KG	.36	
S10-W3	SW10W313.5 (13.5)	CADMIUM	MG/KG	1.70	
S10-W3	SW10W313.5 (13.5)	CALCIUM	MG/KG	5410.00	
S10-W3	SW10W313.5 (13.5)	CHROMIUM	MG/KG	26.80	
S10-W3	SW10W313.5 (13.5)	COBALT	MG/KG	9.10	
S10-W3	SW10W313.5 (13.5)	COPPER	MG/KG	52.30	J4
S10-W3	SW10W313.5 (13.5)	IRON	MG/KG	19700.00	
S10-W3	SW10W313.5 (13.5)	LEAD	MG/KG	29.80	
S10-W3	SW10W313.5 (13.5)	MAGNESIUM	MG/KG	7820.00	
S10-W3	SW10W313.5 (13.5)	MANGANESE	MG/KG	461.00	
S10-W3	SW10W313.5 (13.5)	NICKEL	MG/KG	23.90	
S10-W3	SW10W313.5 (13.5)	POTASSIUM	MG/KG	434.00	
S10-W3	SW10W313.5 (13.5)	SILVER	MG/KG	.57	
S10-W3	SW10W313.5 (13.5)	SODIUM	MG/KG	1320.00	
S10-W3	SW10W313.5 (13.5)	THALLIUM	MG/KG	27.90	J4
S10-W3	SW10W313.5 (13.5)	VANADIUM	MG/KG	53.70	
S10-W3	SW10W313.5 (13.5)	ZINC	MG/KG	79.60	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.28. Analytes with Positive Results at SW-10

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Total Number of Detects</u>	<u>Range</u>
Analytical results of water samples:			
Chromium	3	3	25.0 - 48.3
Copper	3	3	71.8 - 202
Zinc	3	3	149 - 700
Carbon Disulfide	3	1	3
Benzene	3	2	4 - 5
Toluene	3	2	2 - 3
Xylenes (Total)	3	2	3 - 7
Diethylphthalate	3	1	2
bis(2-ethylhexyl)phthalate	3	1	2
Naphthalene	3	1	8
2-Methylnaphthalene	3	1	12
Dibenzofuran	3	1	1
Fluorene	3	1	2

Analytical results of soil samples collected at a depth of 13 to 18 feet:

Carbon Disulfide	3	1	1
Toluene	3	2	2 - 3
Chromium	3	1	26.8
Copper	3	1	52.3
Lead	3	1	29.8
Zinc	3	1	79.6
bis(2-ethylhexyl)phthalate	3	2	45 - 53
Aroclor 1248	3	1	110
TPH	3	3	42 - 149

TABLE 3.28. (cont.)

Analyte	Total Number of Samples	Total Number of Detects	Range
Analytical results of soil samples collected from 0- to 6-inch depth:			
Methylene Chloride	19	6	7 - 14
Chloroform	19	1	2
Anthracene	19	1	68
Fluoranthene	19	2	45 - 68
Phenanthrene	19	1	54
Pyrene	19	2	44 - 80
Benzo(a)anthracene	19	1	130
Chrysene	19	1	390
bis(2-ethylhexyl)phthalate	19	7	46 - 190
Benzo(b)fluoranthene	19	1	300
Benzo(k)fluoranthene	19	1	270
Benzo(a)pyrene	19	1	330
Indeno(1,2,3-cd)pyrene	19	1	300
Benzo(g,h,i)perylene	19	1	270
Di-n-butylphthalate	19	1	46
4,4' DDE	19	1	3.2
4,4' DDD	19	2	2.1 - 15
4,4' DDT	19	4	2.5 - 12
Endrin Ketone	19	1	2.1
PCB (Aroclor 1248)	19	1	150
PCB (Aroclor 1254)	19	2	23 - 39
Total Organic Carbon	19	2	3,480 - 5,550
TPH	19	3	6.4 - 548
Arsenic	19	3	5.2 - 6.9
Cadmium	19	4	1.8 - 5.8
Chromium	19	6	17.8 - 59.2
Copper	19	9	39.9 - 892
Lead	19	12	7.7 - 317
Zinc	19	12	36.4 - 401
Lead (TCLP)	3	1	40.8
TPH	13	3	245 - 16,244

Analytical results indicate a greater number of constituents in the surface samples as compared to the samples collected at depth. This could be due to the at-depth samples being obtained from the wells that were located outside the landfill area and some surface samples coming from the face of the landfill. Constituents detected at depth and in the surface soils show similar concentration ranges. One TCLP sample failed for lead with a concentration of 40.8 mg/L (Table 3.28). The organic contamination at SW-10 appears to be limited in areal extent and concentrations are very low. Metals concentrations tend to be fairly high at SW-10. This is probably due to the metal debris that has been disposed of at this site. The metal debris does not extend into the groundwater, based on the depth to groundwater at the three wells. This does not apply to the areas directly in contact with the ocean.

3.8.5 Preliminary Risk Assessment

Two of the surface soil samples exceeded the human health risk PRLs for arsenic (6 and 6.9 versus 5.7 mg/kg). In addition, Well No. 2 (SW-W2) had benzene contamination (5 μ g/L) near the MCL of 5 μ g/L. Well No. 3 (S10-W3) also was above the ecological water quality criteria for 2-methylnaphthalene and fluorene. The preliminary ecological risk assessment indicates there is risk to terrestrial receptors from cadmium in soil and sediment, and risk to aquatic receptors from chromium, barium, lead, and zinc in sediment. These metals concentrations are also above background values.

3.8.6 Future Actions

Prior to the 1992 field season, it was assumed that the remedial action to be taken at the site would be a landfill cap. The extent of the landfill has been determined through geophysics and the data indicate that the landfill is impacting groundwater. Therefore, an impermeable cap is recommended to be designed and installed at this site to reduce or eliminate the impact of the landfill on groundwater and reduce the exposure to contaminated surface soil. Prior to placement of the cap, debris that is extruding from the fill should be removed and reburied at either this site or at the current metal landfill on the island. Additionally, stabilization of the southern edge of the landfill should be completed to prevent erosion by wave action.

3.9 SOLID WASTE SITE SW-12: SCRAP METAL DISPOSAL SITE

3.9.1 Site Background

The site is located at the south end of abandoned Runway B and east of Skoot Cove near Building 750 (see Figure 3.21). The landfill is on a bluff approximately 20 feet above the ocean. It covers an area of approximately 3 acres on a finger of land that juts into the ocean. Several small buildings are located within the area of the landfill and are in use at the present time. Bedrock outcroppings are visible along the bluff on both sides of the landfill.

Historically, scrap metal was dumped in this area. During September 1987, a field investigation team noted a 200-foot-diameter disposal area consisting of vehicle axles, gasoline engines, and other metal debris. Most of the area has been backfilled with large rock and graded for stabilization by the 11th CEOS. The area is actively used by the Air Force; also, there are signs of campfires suggesting that the area may receive some recreational use.

The area outside the landfilled portion of SW-12 is covered with peat to a depth of approximately 5 feet under which is a layer of gravel. This gravel layer continues to approximately 10 feet bgs where weathered bedrock of hornblende dacite porphyry is encountered. In areas where fill has been placed, the fill appears to have been put directly on the bedrock. In some locations the fill is more than 15 feet thick.

3.9.2 Previous Investigations

In 1988, samples were collected with an auger from a portion of the site left uncovered by the rock fill (Figure 3.21). The TPH levels were 380 mg/kg at 2 feet and 1,480 mg/kg at 14 inches. Metals detected above the background analytical results were arsenic (18 mg/kg), barium (65.3 to 331 mg/kg), chromium (31.8 to 45.5 mg/kg), lead (219 to 335 mg/kg), nickel (32.6 to 62.4 mg/kg), and zinc (271 to 419 mg/kg).

3.9.3 1992 Investigation

The intent of the 1992 investigation was to collect sufficient data to recommend a remedial action, if necessary. Closure strategies could involve capping the landfill surface and installing monitoring wells outside the landfill boundary to determine the impact of the landfill on groundwater quality, and the potential for offsite migration of contaminants.

The objectives of the investigation were to determine:

- areal extent of the dump area
- nature of surface soil contamination, if any
- nature of groundwater contamination, if any
- groundwater depth and direction
- significant, mappable site features.

The objective of the survey was to delineate the extent of buried metal waste at the site. The extent of the geophysical investigation is shown in Figure 3.22. The limits of the survey were defined by the road along the north side of the peninsula and the cliffs on all the other sides. A civil survey was performed to establish a grid prior to the geophysical investigation. EM data were collected at 5-foot intervals along lines 25 feet apart. The contour maps of EM conductivity and in-phase values are provided in Appendix B. Approximately 3.1 acres were covered by the investigation. Three large areas of buried metal have been identified at the site. Area 1 covers most of the peninsula south of grid line 4525 north. Buried metal is widespread in this area, resulting in numerous anomalies. Many of the anomalies are strong conductivity highs, in excess of 200 millimhos per meter. Although these anomalies are not the characteristic negative responses observed over metal objects, metal is interpreted as their source. It is believed that the EM responses are not negative because of the depth of metal burial, interpreted as being as much as 10 feet deep or more.

OCEAN

FIGURE 3.21. SW

LOCATION MAP

LEGEND

- UTILITY SERVICE BOX & POSTS
- BUILDING
- SOIL SAMPLE LOCATION
- BORING LOCATION
- MONITORING WELL LOCATION
- MARKED UNDERGROUND UTILITY LINE
- 1988 SAMPLING LOCATION

OCEAN

FIGURE 3.22. SW-12 Gc

LEGEND

◻° UTILITY SERVICE BOX & POSTS

▤ BUILDING

— GEOPHYSICAL SURVEY LINE

Ⓜ METAL OBSERVED AT SURFACE

INTERPRETED FEATURES

▤ AREA OF BURIED METAL

① AREA ID

○ POSSIBLE BURIED METAL

● ISOLATED BURIED METAL

--- MARKED UNDERGROUND UTILITY LINE

— UTILITY LINE

----- SITE BOUNDARY

Area 2 is located on the north half of the east side of the peninsula. Most of the anomalies are characteristic of buried metal which is interpreted as being present throughout this area.

The anomalies defining Area 3 are somewhat more scattered than in the other areas; however, they are close enough together that subdividing Area 3 into smaller areas is not warranted. Most of the anomalies in this area indicate buried metal.

A buried power line leading to a control box (at 5600 east, 4645 north) was partially marked before the geophysical survey started. The survey showed that the power line continued south of the box towards the building at 5650 east, 4475 north. The power line could not be traced south of 4525 north because of the EM responses of the buried metal there.

During the 1992 field investigation, 17 surface soil samples were collected (Figure 3.21). Ten were randomly selected grid samples, and seven were from specific locations from within the site (seeps, disturbed areas, etc.). All were analyzed for VOAs, semi VOAs, pesticides/PCBs, and metals, and one sample was also analyzed for TCLP metals. Tables 3.29 and 3.30 list the analytical results from the CSL and the offsite laboratories, respectively.

Two groundwater monitoring wells were installed at SW-12. A third monitoring well was attempted but was dry at auger refusal. Soil samples were collected at 5-foot intervals for onsite TPH analysis and a sample was collected from just above the water table for VOAs, semi VOAs, pesticides/PCBs, and metals. These results are presented in Tables 3.29 and 3.30. After the wells had been developed and had equilibrated with the aquifer, groundwater samples were obtained and analyzed for VOA, semi VOA, pesticides/PCBs, and metals. High metals concentrations, especially copper and zinc, were observed in the water samples.

3.9.4 Nature and Extent of Contamination

The boundary (areal extent) of the site was determined by geophysical methods (Figure 3.22). The estimated area of the site from the 1992 field investigation is 3.1 acres.

TABLE 3.29. Positive Results from Onsite (CSL) Data at SW-12

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
S12-078	SHS0SSW12-078 (0-0.5	TOTAL PETROLEUM HYDROCARBONS	MG/KG	43.34	
S12-080	SHS0SSW12-080 (0-0.5	TOTAL PETROLEUM HYDROCARBONS	MG/KG	88.00	
S12-W1	SW12W1	BENZENE	UG/L	1.60	
S12-W2	SW12W25.0 (5.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	18483.58	
S12-W2	SW12W25.0 (5.0)	HEADSPACE	PPM	17.00	
S12-W2	SW12W25.0 (5.0)	ETHYLBENZENE	UG/KG	780.00	
S12-W2	SW12W25.0 (5.0)	TOLUENE	UG/KG	990.00	
S12-W2	SW12W25.0 (5.0)	m, p-XYLENES	UG/KG	780.00	
S12-W2	SW12W25.0 (5.0)	o-XYLENE	UG/KG	1900.00	
S12-W3	SW12W3	BENZENE	UG/L	1.90	
S12-W3	SW12W3	TOLUENE	UG/L	.50	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. Positive Results from Offsite Data at SW-12

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S12-073	SOSSSW1073 (0-0.5)	ALUMINUM	MG/KG	7740.00	
S12-073	SOSSSW1073 (0-0.5)	ARSENIC	MG/KG	9.30	
S12-073	SOSSSW1073 (0-0.5)	BARIIUM	MG/KG	8.70	
S12-073	SOSSSW1073 (0-0.5)	CADIUM	MG/KG	.52	
S12-073	SOSSSW1073 (0-0.5)	CALCIUM	MG/KG	25700.00	
S12-073	SOSSSW1073 (0-0.5)	CHROMIUM	MG/KG	12.40	
S12-073	SOSSSW1073 (0-0.5)	COBALT	MG/KG	4.50	
S12-073	SOSSSW1073 (0-0.5)	COPPER	MG/KG	19.80	
S12-073	SOSSSW1073 (0-0.5)	IRON	MG/KG	18600.00	J4
S12-073	SOSSSW1073 (0-0.5)	LEAD	MG/KG	19.70	
S12-073	SOSSSW1073 (0-0.5)	MAGNESIUM	MG/KG	5390.00	
S12-073	SOSSSW1073 (0-0.5)	MANGANESE	MG/KG	165.00	J4
S12-073	SOSSSW1073 (0-0.5)	NICKEL	MG/KG	11.10	
S12-073	SOSSSW1073 (0-0.5)	POTASSIUM	MG/KG	693.00	
S12-073	SOSSSW1073 (0-0.5)	SODIUM	MG/KG	1210.00	
S12-073	SOSSSW1073 (0-0.5)	THALLIUM	MG/KG	21.80	
S12-073	SOSSSW1073 (0-0.5)	VANADIUM	MG/KG	39.50	
S12-073	SOSSSW1073 (0-0.5)	ZINC	MG/KG	40.70	*
S12-074	SOSSSW1074 (0-0.5)	ALUMINUM	MG/KG	11000.00	
S12-074	SOSSSW1074 (0-0.5)	ARSENIC	MG/KG	11.30	
S12-074	SOSSSW1074 (0-0.5)	BARIIUM	MG/KG	12.30	
S12-074	SOSSSW1074 (0-0.5)	CADIUM	MG/KG	1.40	
S12-074	SOSSSW1074 (0-0.5)	CALCIUM	MG/KG	22200.00	
S12-074	SOSSSW1074 (0-0.5)	CHROMIUM	MG/KG	17.00	
S12-074	SOSSSW1074 (0-0.5)	COBALT	MG/KG	6.90	
S12-074	SOSSSW1074 (0-0.5)	COPPER	MG/KG	892.00	
S12-074	SOSSSW1074 (0-0.5)	IRON	MG/KG	41200.00	J4
S12-074	SOSSSW1074 (0-0.5)	LEAD	MG/KG	18.70	
S12-074	SOSSSW1074 (0-0.5)	MAGNESIUM	MG/KG	7040.00	
S12-074	SOSSSW1074 (0-0.5)	MANGANESE	MG/KG	314.00	J4
S12-074	SOSSSW1074 (0-0.5)	MOLYBDENUM	MG/KG	1.40	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.3Q. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-074	SOSSSW1074 (0-0.5)	NICKEL	MG/KG	19.90	
S12-074	SOSSSW1074 (0-0.5)	POTASSIUM	MG/KG	819.00	
S12-074	SOSSSW1074 (0-0.5)	SODIUM	MG/KG	1530.00	
S12-074	SOSSSW1074 (0-0.5)	THALLIUM	MG/KG	27.80	
S12-074	SOSSSW1074 (0-0.5)	VANADIUM	MG/KG	60.50	
S12-074	SOSSSW1074 (0-0.5)	ZINC	MG/KG	86.00 *	
S12-076	SOSW1276 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	31.70	J2
S12-076	SOSW1276 (0-0.5)	ALUMINUM	MG/KG	24500.00	
S12-076	SOSW1276 (0-0.5)	BARIIUM	MG/KG	78.70	
S12-076	SOSW1276 (0-0.5)	CADMIUM	MG/KG	1.40	
S12-076	SOSW1276 (0-0.5)	CALCIUM	MG/KG	21300.00	
S12-076	SOSW1276 (0-0.5)	CHROMIUM	MG/KG	9.20	
S12-076	SOSW1276 (0-0.5)	COBALT	MG/KG	17.00	
S12-076	SOSW1276 (0-0.5)	COPPER	MG/KG	60.70	
S12-076	SOSW1276 (0-0.5)	IRON	MG/KG	40000.00	
S12-076	SOSW1276 (0-0.5)	LEAD	MG/KG	9.20	
S12-076	SOSW1276 (0-0.5)	MAGNESIUM	MG/KG	17800.00	
S12-076	SOSW1276 (0-0.5)	MANGANESE	MG/KG	710.00	J4
S12-076	SOSW1276 (0-0.5)	NICKEL	MG/KG	13.10	
S12-076	SOSW1276 (0-0.5)	POTASSIUM	MG/KG	1700.00	
S12-076	SOSW1276 (0-0.5)	SILVER	MG/KG	.48	
S12-076	SOSW1276 (0-0.5)	SODIUM	MG/KG	7500.00	
S12-076	SOSW1276 (0-0.5)	THALLIUM	MG/KG	71.20	
S12-076	SOSW1276 (0-0.5)	VANADIUM	MG/KG	113.00	
S12-076	SOSW1276 (0-0.5)	ZINC	MG/KG	74.90	
S12-076	SOSW1276 (0-0.5)	BARIIUM	UG/L	415.00	
S12-076	SOSW1276 (0-0.5)	CADMIUM	UG/L	2.40	
S12-077	SOSW1277 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	18.40	J2
S12-077	SOSW1277 (0-0.5)	ALUMINUM	MG/KG	15600.00	
S12-077	SOSW1277 (0-0.5)	BARIIUM	MG/KG	73.00	
S12-077	SOSW1277 (0-0.5)	CADMIUM	MG/KG	1.40	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-077	SOSW1277 (0-0.5)	CALCIUM	MG/KG	4510.00	
S12-077	SOSW1277 (0-0.5)	CHROMIUM	MG/KG	15.40	
S12-077	SOSW1277 (0-0.5)	COBALT	MG/KG	10.00	
S12-077	SOSW1277 (0-0.5)	COPPER	MG/KG	61.60	
S12-077	SOSW1277 (0-0.5)	IRON	MG/KG	28300.00	
S12-077	SOSW1277 (0-0.5)	LEAD	MG/KG	38.10	
S12-077	SOSW1277 (0-0.5)	MAGNESIUM	MG/KG	8750.00	
S12-077	SOSW1277 (0-0.5)	MANGANESE	MG/KG	387.00	J4
S12-077	SOSW1277 (0-0.5)	NICKEL	MG/KG	15.80	
S12-077	SOSW1277 (0-0.5)	POTASSIUM	MG/KG	1520.00	
S12-077	SOSW1277 (0-0.5)	SILVER	MG/KG	.37	
S12-077	SOSW1277 (0-0.5)	SODIUM	MG/KG	2550.00	
S12-077	SOSW1277 (0-0.5)	THALLIUM	MG/KG	39.00	
S12-077	SOSW1277 (0-0.5)	VANADIUM	MG/KG	70.40	
S12-077	SOSW1277 (0-0.5)	ZINC	MG/KG	98.80	
S12-077	SOSW1277 (0-0.5)	AROCLO-1260	UG/KG	36.00	JX
S12-077	SOSW1277 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	4300.00	E
S12-077	SOSW1277 (0-0.5)	DIETHYLPHTHALATE	UG/KG	130.00	J
S12-077	SOSW1277 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	180.00	J
S12-077	SOSW1277 (0-0.5, DIL)	DI-n-BUTYLPHTHALATE	UG/KG	5000.00	D
S12-077	SOSW1277 (0-0.5, DIL)	DIETHYLPHTHALATE	UG/KG	170.00	DJ
S12-077	SOSW1277 (0-0.5, DIL)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	200.00	DJ
S12-078	SOSW1278 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	69.70	J2
S12-078	SOSW1278 (0-0.5)	ALUMINUM	MG/KG	10100.00	
S12-078	SOSW1278 (0-0.5)	ANTIMONY	MG/KG	5.70	
S12-078	SOSW1278 (0-0.5)	BARIUM	MG/KG	39.30	
S12-078	SOSW1278 (0-0.5)	CADMIUM	MG/KG	1.50	
S12-078	SOSW1278 (0-0.5)	CALCIUM	MG/KG	8010.00	
S12-078	SOSW1278 (0-0.5)	CHROMIUM	MG/KG	14.70	
S12-078	SOSW1278 (0-0.5)	COBALT	MG/KG	7.20	
S12-078	SOSW1278 (0-0.5)	COPPER	MG/KG	100.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-078	SOSW1278 (0-0.5)	IRON	MG/KG	22000.00	
S12-078	SOSW1278 (0-0.5)	LEAD	MG/KG	85.20	
S12-078	SOSW1278 (0-0.5)	MAGNESIUM	MG/KG	6110.00	
S12-078	SOSW1278 (0-0.5)	MANGANESE	MG/KG	309.00	J4
S12-078	SOSW1278 (0-0.5)	MOLYBDENUM	MG/KG	1.00	
S12-078	SOSW1278 (0-0.5)	NICKEL	MG/KG	15.40	
S12-078	SOSW1278 (0-0.5)	POTASSIUM	MG/KG	565.00	
S12-078	SOSW1278 (0-0.5)	SILVER	MG/KG	.37	
S12-078	SOSW1278 (0-0.5)	SODIUM	MG/KG	1660.00	
S12-078	SOSW1278 (0-0.5)	THALLIUM	MG/KG	25.00	
S12-078	SOSW1278 (0-0.5)	VANADIUM	MG/KG	46.30	
S12-078	SOSW1278 (0-0.5)	ZINC	MG/KG	202.00	
S12-078	SOSW1278 (0-0.5)	AROCLOR-1260	UG/KG	89.00	
S12-078	SOSW1278 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	46.00	J
S12-078	SOSW1278 (0-0.5)	Bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	110.00	J
S12-079	SOSW1279 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	10.90	J2
S12-079	SOSW1279 (0-0.5)	ALUMINUM	MG/KG	7550.00	
S12-079	SOSW1279 (0-0.5)	BARIUM	MG/KG	13.70	
S12-079	SOSW1279 (0-0.5)	CADMIUM	MG/KG	.60	
S12-079	SOSW1279 (0-0.5)	CALCIUM	MG/KG	3690.00	
S12-079	SOSW1279 (0-0.5)	CHROMIUM	MG/KG	5.20	
S12-079	SOSW1279 (0-0.5)	COBALT	MG/KG	8.30	
S12-079	SOSW1279 (0-0.5)	COPPER	MG/KG	46.20	
S12-079	SOSW1279 (0-0.5)	IRON	MG/KG	12600.00	
S12-079	SOSW1279 (0-0.5)	MAGNESIUM	MG/KG	10400.00	
S12-079	SOSW1279 (0-0.5)	MANGANESE	MG/KG	694.00	J4
S12-079	SOSW1279 (0-0.5)	NICKEL	MG/KG	10.10	
S12-079	SOSW1279 (0-0.5)	POTASSIUM	MG/KG	389.00	
S12-079	SOSW1279 (0-0.5)	SODIUM	MG/KG	2030.00	
S12-079	SOSW1279 (0-0.5)	THALLIUM	MG/KG	8.00	
S12-079	SOSW1279 (0-0.5)	VANADIUM	MG/KG	24.50	

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RE = Reanalysis

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TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S12-079	SOSW1279 (0-0.5)	ZINC	MG/KG	43.60	
S12-079	SOSW1279 (0-0.5)	Bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	40.00	J
S12-080	SOSW1280 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	84.90	J2
S12-080	SOSW1280 (0-0.5)	ALUMINUM	MG/KG	18300.00	
S12-080	SOSW1280 (0-0.5)	ARSENIC	MG/KG	8.20	*
S12-080	SOSW1280 (0-0.5)	BARIUM	MG/KG	71.90	
S12-080	SOSW1280 (0-0.5)	CADMIUM	MG/KG	1.60	
S12-080	SOSW1280 (0-0.5)	CALCIUM	MG/KG	8400.00	
S12-080	SOSW1280 (0-0.5)	CHROMIUM	MG/KG	18.80	
S12-080	SOSW1280 (0-0.5)	COBALT	MG/KG	15.60	
S12-080	SOSW1280 (0-0.5)	COPPER	MG/KG	53.90	
S12-080	SOSW1280 (0-0.5)	IRON	MG/KG	29700.00	
S12-080	SOSW1280 (0-0.5)	LEAD	MG/KG	41.10	
S12-080	SOSW1280 (0-0.5)	MAGNESIUM	MG/KG	10300.00	
S12-080	SOSW1280 (0-0.5)	MANGANESE	MG/KG	506.00	J4
S12-080	SOSW1280 (0-0.5)	MOLYBDENUM	MG/KG	.99	
S12-080	SOSW1280 (0-0.5)	NICKEL	MG/KG	23.20	
S12-080	SOSW1280 (0-0.5)	POTASSIUM	MG/KG	1110.00	
S12-080	SOSW1280 (0-0.5)	SILVER	MG/KG	.34	
S12-080	SOSW1280 (0-0.5)	SODIUM	MG/KG	1820.00	
S12-080	SOSW1280 (0-0.5)	THALLIUM	MG/KG	43.70	
S12-080	SOSW1280 (0-0.5)	VANADIUM	MG/KG	88.90	
S12-080	SOSW1280 (0-0.5)	ZINC	MG/KG	150.00	
S12-080	SOSW1280 (0-0.5)	4,4'-DDD	UG/KG	15.00	
S12-080	SOSW1280 (0-0.5)	4,4'-DDE	UG/KG	2.70	JX
S12-080	SOSW1280 (0-0.5)	4,4'-DDT	UG/KG	34.00	
S12-080	SOSW1280 (0-0.5)	DI-n-BUTYL PHTHALATE	UG/KG	170.00	J
S12-080	SOSW1280 (0-0.5)	DIETHYL PHTHALATE	UG/KG	58.00	J
S12-080	SOSW1280 (0-0.5)	Bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	200.00	J
S12-081	SOSW1281 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	20.60	J2
S12-081	SOSW1281 (0-0.5)	ALUMINUM	MG/KG	16500.00	

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(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-081	SOSW1281 (0-0.5)	BARIUM	MG/KG	47.00	
S12-081	SOSW1281 (0-0.5)	CADMIUM	MG/KG	1.00	
S12-081	SOSW1281 (0-0.5)	CALCIUM	MG/KG	10700.00	
S12-081	SOSW1281 (0-0.5)	CHROMIUM	MG/KG	7.80	
S12-081	SOSW1281 (0-0.5)	COBALT	MG/KG	13.30	
S12-081	SOSW1281 (0-0.5)	COPPER	MG/KG	48.90	
S12-081	SOSW1281 (0-0.5)	IRON	MG/KG	27500.00	
S12-081	SOSW1281 (0-0.5)	LEAD	MG/KG	11.70	
S12-081	SOSW1281 (0-0.5)	MAGNESIUM	MG/KG	12400.00	
S12-081	SOSW1281 (0-0.5)	MANGANESE	MG/KG	561.00	J4
S12-081	SOSW1281 (0-0.5)	NICKEL	MG/KG	10.70	
S12-081	SOSW1281 (0-0.5)	POTASSIUM	MG/KG	946.00	
S12-081	SOSW1281 (0-0.5)	SODIUM	MG/KG	3450.00	
S12-081	SOSW1281 (0-0.5)	THALLIUM	MG/KG	46.30	
S12-081	SOSW1281 (0-0.5)	VANADIUM	MG/KG	74.70	
S12-081	SOSW1281 (0-0.5)	ZINC	MG/KG	52.40	
S12-081	SOSW1281 (0-0.5)	4,4'-DDT	UG/KG	2.50	JX
S12-081	SOSW1281 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	48.00	J
S12-081	SOSW1281 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	58.00	J
S12-081	SOSW1281 (0-0.5)	ACETONE	UG/KG	6.00	BJ
S12-081	SOSW1281 (0-0.5)	METHYLENE CHLORIDE	UG/KG	5.00	BJ
S12-082	SOSW1282 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	42.40	J2
S12-082	SOSW1282 (0-0.5)	ALUMINUM	MG/KG	9270.00	
S12-082	SOSW1282 (0-0.5)	BARIUM	MG/KG	30.80	
S12-082	SOSW1282 (0-0.5)	CADMIUM	MG/KG	.73	
S12-082	SOSW1282 (0-0.5)	CALCIUM	MG/KG	5350.00	
S12-082	SOSW1282 (0-0.5)	CHROMIUM	MG/KG	9.20	
S12-082	SOSW1282 (0-0.5)	COBALT	MG/KG	7.70	
S12-082	SOSW1282 (0-0.5)	COPPER	MG/KG	74.70	
S12-082	SOSW1282 (0-0.5)	IRON	MG/KG	11300.00	
S12-082	SOSW1282 (0-0.5)	LEAD	MG/KG	49.30	

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TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-082	SOSW1282 (0-0.5)	MAGNESIUM	MG/KG	5940.00	
S12-082	SOSW1282 (0-0.5)	MANGANESE	MG/KG	620.00	J4
S12-082	SOSW1282 (0-0.5)	NICKEL	MG/KG	10.70	
S12-082	SOSW1282 (0-0.5)	POTASSIUM	MG/KG	580.00	
S12-082	SOSW1282 (0-0.5)	SODIUM	MG/KG	1800.00	
S12-082	SOSW1282 (0-0.5)	THALLIUM	MG/KG	11.80	
S12-082	SOSW1282 (0-0.5)	VANADIUM	MG/KG	28.60	
S12-082	SOSW1282 (0-0.5)	ZINC	MG/KG	88.80	
S12-082	SOSW1282 (0-0.5)	CHLOROFORM	UG/KG	1.00	J
S12-083	SOSW1283 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	9.90	J2
S12-083	SOSW1283 (0-0.5)	ALUMINUM	MG/KG	7160.00	
S12-083	SOSW1283 (0-0.5)	BARIUM	MG/KG	6.90	
S12-083	SOSW1283 (0-0.5)	CADIUM	MG/KG	.64	
S12-083	SOSW1283 (0-0.5)	CALCIUM	MG/KG	3750.00	
S12-083	SOSW1283 (0-0.5)	CHROMIUM	MG/KG	5.80	
S12-083	SOSW1283 (0-0.5)	COBALT	MG/KG	9.20	
S12-083	SOSW1283 (0-0.5)	COPPER	MG/KG	34.00	
S12-083	SOSW1283 (0-0.5)	IRON	MG/KG	14900.00	
S12-083	SOSW1283 (0-0.5)	MAGNESIUM	MG/KG	10700.00	
S12-083	SOSW1283 (0-0.5)	MANGANESE	MG/KG	421.00	J4
S12-083	SOSW1283 (0-0.5)	NICKEL	MG/KG	10.20	
S12-083	SOSW1283 (0-0.5)	POTASSIUM	MG/KG	314.00	
S12-083	SOSW1283 (0-0.5)	SODIUM	MG/KG	1500.00	
S12-083	SOSW1283 (0-0.5)	THALLIUM	MG/KG	13.90	
S12-083	SOSW1283 (0-0.5)	VANADIUM	MG/KG	35.30	
S12-083	SOSW1283 (0-0.5)	ZINC	MG/KG	44.70	
S12-083	SOSW1283 (0-0.5)	DI-n-BUTYLPHTHALATE	UG/KG	50.00	J
S12-084	SOSW1284 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	11.90	J2
S12-084	SOSW1284 (0-0.5)	ALUMINUM	MG/KG	28100.00	
S12-084	SOSW1284 (0-0.5)	BARIUM	MG/KG	95.70	
S12-084	SOSW1284 (0-0.5)	CADIUM	MG/KG	1.60	

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TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-084	SOSW1284 (0-0.5)	CALCIUM	MG/KG	21600.00	
S12-084	SOSW1284 (0-0.5)	CHROMIUM	MG/KG	11.20	
S12-084	SOSW1284 (0-0.5)	COBALT	MG/KG	16.40	
S12-084	SOSW1284 (0-0.5)	COPPER	MG/KG	56.50	
S12-084	SOSW1284 (0-0.5)	IRON	MG/KG	40600.00	
S12-084	SOSW1284 (0-0.5)	LEAD	MG/KG	9.20	
S12-084	SOSW1284 (0-0.5)	MAGNESIUM	MG/KG	18000.00	
S12-084	SOSW1284 (0-0.5)	MANGANESE	MG/KG	661.00	J4
S12-084	SOSW1284 (0-0.5)	NICKEL	MG/KG	13.90	
S12-084	SOSW1284 (0-0.5)	POTASSIUM	MG/KG	1990.00	
S12-084	SOSW1284 (0-0.5)	SILVER	MG/KG	.43	
S12-084	SOSW1284 (0-0.5)	SODIUM	MG/KG	6270.00	
S12-084	SOSW1284 (0-0.5)	THALLIUM	MG/KG	77.00	
S12-084	SOSW1284 (0-0.5)	VANADIUM	MG/KG	122.00	
S12-084	SOSW1284 (0-0.5)	ZINC	MG/KG	60.70	
S12-085	SOSW1285 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	31.90	J2
S12-085	SOSW1285 (0-0.5)	ALUMINUM	MG/KG	6510.00	
S12-085	SOSW1285 (0-0.5)	BARIUM	MG/KG	12.90	
S12-085	SOSW1285 (0-0.5)	CADMIUM	MG/KG	.49	
S12-085	SOSW1285 (0-0.5)	CALCIUM	MG/KG	3250.00	
S12-085	SOSW1285 (0-0.5)	CHROMIUM	MG/KG	3.90	
S12-085	SOSW1285 (0-0.5)	COBALT	MG/KG	7.00	
S12-085	SOSW1285 (0-0.5)	COPPER	MG/KG	45.60	
S12-085	SOSW1285 (0-0.5)	IRON	MG/KG	10400.00	
S12-085	SOSW1285 (0-0.5)	MAGNESIUM	MG/KG	9190.00	
S12-085	SOSW1285 (0-0.5)	MANGANESE	MG/KG	505.00	J4
S12-085	SOSW1285 (0-0.5)	NICKEL	MG/KG	8.40	
S12-085	SOSW1285 (0-0.5)	POTASSIUM	MG/KG	227.00	
S12-085	SOSW1285 (0-0.5)	SODIUM	MG/KG	1110.00	
S12-085	SOSW1285 (0-0.5)	THALLIUM	MG/KG	6.80	
S12-085	SOSW1285 (0-0.5)	VANADIUM	MG/KG	15.20	

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TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-085	SOSWI285 (0-0.5)	ZINC	MG/KG	39.80	
S12-085	SOSWI285 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	40.00	J
S12-086	SOSWI286 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	12.10	J2
S12-086	SOSWI286 (0-0.5)	ALUMINUM	MG/KG	14400.00	
S12-086	SOSWI286 (0-0.5)	BARIIUM	MG/KG	63.00	
S12-086	SOSWI286 (0-0.5)	CADMIUM	MG/KG	1.20	
S12-086	SOSWI286 (0-0.5)	CALCIUM	MG/KG	5710.00	
S12-086	SOSWI286 (0-0.5)	CHROMIUM	MG/KG	16.70	
S12-086	SOSWI286 (0-0.5)	COBALT	MG/KG	11.40	
S12-086	SOSWI286 (0-0.5)	COPPER	MG/KG	45.50	
S12-086	SOSWI286 (0-0.5)	IRON	MG/KG	28400.00	
S12-086	SOSWI286 (0-0.5)	LEAD	MG/KG	8.80	
S12-086	SOSWI286 (0-0.5)	MAGNESIUM	MG/KG	10800.00	
S12-086	SOSWI286 (0-0.5)	MANGANESE	MG/KG	360.00	J4
S12-086	SOSWI286 (0-0.5)	NICKEL	MG/KG	17.80	
S12-086	SOSWI286 (0-0.5)	POTASSIUM	MG/KG	936.00	
S12-086	SOSWI286 (0-0.5)	SILVER	MG/KG	.34	
S12-086	SOSWI286 (0-0.5)	SODIUM	MG/KG	1760.00	
S12-086	SOSWI286 (0-0.5)	THALLIUM	MG/KG	46.10	
S12-086	SOSWI286 (0-0.5)	VANADIUM	MG/KG	88.20	
S12-086	SOSWI286 (0-0.5)	ZINC	MG/KG	65.10	
S12-087	SOSWI287 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	7.80	J2
S12-087	SOSWI287 (0-0.5)	ALUMINUM	MG/KG	6600.00	
S12-087	SOSWI287 (0-0.5)	BARIIUM	MG/KG	20.40	
S12-087	SOSWI287 (0-0.5)	CALCIUM	MG/KG	3690.00	
S12-087	SOSWI287 (0-0.5)	CHROMIUM	MG/KG	8.50	
S12-087	SOSWI287 (0-0.5)	COBALT	MG/KG	5.20	
S12-087	SOSWI287 (0-0.5)	COPPER	MG/KG	45.20	
S12-087	SOSWI287 (0-0.5)	IRON	MG/KG	9850.00	
S12-087	SOSWI287 (0-0.5)	LEAD	MG/KG	22.80	
S12-087	SOSWI287 (0-0.5)	MAGNESIUM	MG/KG	4570.00	

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TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S12-087	SOSW1287 (0-0.5)	MANGANESE	MG/KG	182.00	J4
S12-087	SOSW1287 (0-0.5)	NICKEL	MG/KG	9.80	
S12-087	SOSW1287 (0-0.5)	POTASSIUM	MG/KG	440.00	
S12-087	SOSW1287 (0-0.5)	SODIUM	MG/KG	997.00	
S12-087	SOSW1287 (0-0.5)	THALLIUM	MG/KG	13.60	
S12-087	SOSW1287 (0-0.5)	VANADIUM	MG/KG	25.40	
S12-087	SOSW1287 (0-0.5)	ZINC	MG/KG	44.60	
S12-105	SOSW10105 (0-0.5)	BARIUM	UG/L	374.00	
S12-117	SW12-117 (0-0.5)	ALUMINUM	MG/KG	9880.00	*
S12-117	SW12-117 (0-0.5)	ARSENIC	MG/KG	10.30	+
S12-117	SW12-117 (0-0.5)	BERYLLIUM	MG/KG	12.70	*B
S12-117	SW12-117 (0-0.5)	CALCIUM	MG/KG	.28	B
S12-117	SW12-117 (0-0.5)	CHROMIUM	MG/KG	42400.00	*
S12-117	SW12-117 (0-0.5)	COBALT	MG/KG	59.30	
S12-117	SW12-117 (0-0.5)	COPPER	MG/KG	10.80	B
S12-117	SW12-117 (0-0.5)	LEAD	MG/KG	137.00	
S12-117	SW12-117 (0-0.5)	MAGNESIUM	MG/KG	12.90	*S
S12-117	SW12-117 (0-0.5)	MANGANESE	MG/KG	6050.00	*
S12-117	SW12-117 (0-0.5)	NICKEL	MG/KG	540.00	*
S12-117	SW12-117 (0-0.5)	POTASSIUM	MG/KG	38.60	
S12-117	SW12-117 (0-0.5)	SODIUM	MG/KG	801.00	B
S12-117	SW12-117 (0-0.5)	VANADIUM	MG/KG	2330.00	
S12-117	SW12-117 (0-0.5)	ZINC	MG/KG	46.70	
S12-117	SW12-117 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	MG/KG	44.40	
S12-117	SW12-117 (0-0.5)	METHYLENE CHLORIDE	UG/KG	90.00	BJ
S12-118	SW12-118 (0-0.5)	ALUMINUM	MG/KG	7.00	J
S12-118	SW12-118 (0-0.5)	ARSENIC	MG/KG	23000.00	*
S12-118	SW12-118 (0-0.5)	BARIUM	MG/KG	6.10	
S12-118	SW12-118 (0-0.5)	BERYLLIUM	MG/KG	93.70	*
S12-118	SW12-118 (0-0.5)	CALCIUM	MG/KG	.40	B
S12-118	SW12-118 (0-0.5)		MG/KG	15400.00	*

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-118	SW12-118 (0-0.5)	CHROMIUM	MG/KG	13.10	
S12-118	SW12-118 (0-0.5)	COBALT	MG/KG	17.60	
S12-118	SW12-118 (0-0.5)	COPPER	MG/KG	68.70	
S12-118	SW12-118 (0-0.5)	IRON	MG/KG	39500.00	
S12-118	SW12-118 (0-0.5)	LEAD	MG/KG	57.60	*
S12-118	SW12-118 (0-0.5)	MAGNESIUM	MG/KG	15200.00	*
S12-118	SW12-118 (0-0.5)	MANGANESE	MG/KG	968.00	
S12-118	SW12-118 (0-0.5)	NICKEL	MG/KG	15.40	
S12-118	SW12-118 (0-0.5)	POTASSIUM	MG/KG	1870.00	
S12-118	SW12-118 (0-0.5)	SODIUM	MG/KG	4130.00	
S12-118	SW12-118 (0-0.5)	VANADIUM	MG/KG	116.00	
S12-118	SW12-118 (0-0.5)	ZINC	MG/KG	83.70	
S12-118	SW12-118 (0-0.5)	METHYLENE CHLORIDE	UG/KG	5.00	J
S12-119	SW12-119 (0-0.5)	ALUMINUM	MG/KG	19800.00	*
S12-119	SW12-119 (0-0.5)	ANTIMONY	MG/KG	8.70	B
S12-119	SW12-119 (0-0.5)	ARSENIC	MG/KG	5.50	
S12-119	SW12-119 (0-0.5)	BARIUM	MG/KG	153.00	*
S12-119	SW12-119 (0-0.5)	BERYLLIUM	MG/KG	.48	B
S12-119	SW12-119 (0-0.5)	CADMIUM	MG/KG	2.10	*
S12-119	SW12-119 (0-0.5)	CALCIUM	MG/KG	9070.00	*
S12-119	SW12-119 (0-0.5)	CHROMIUM	MG/KG	31.80	
S12-119	SW12-119 (0-0.5)	COBALT	MG/KG	20.50	
S12-119	SW12-119 (0-0.5)	COPPER	MG/KG	371.00	
S12-119	SW12-119 (0-0.5)	IRON	MG/KG	65500.00	
S12-119	SW12-119 (0-0.5)	LEAD	MG/KG	381.00	
S12-119	SW12-119 (0-0.5)	MAGNESIUM	MG/KG	14600.00	*
S12-119	SW12-119 (0-0.5)	MANGANESE	MG/KG	779.00	
S12-119	SW12-119 (0-0.5)	MERCURY	MG/KG	.16	
S12-119	SW12-119 (0-0.5)	NICKEL	MG/KG	39.80	
S12-119	SW12-119 (0-0.5)	POTASSIUM	MG/KG	1560.00	
S12-119	SW12-119 (0-0.5)	SILVER	MG/KG	1.60	B

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-119	SW12-119 (0-0.5)	SODIUM	MG/KG	3490.00	
S12-119	SW12-119 (0-0.5)	VANADIUM	MG/KG	120.00	
S12-119	SW12-119 (0-0.5)	ZINC	MG/KG	567.00	
S12-119	SW12-119 (0-0.5)	4,4'-DDD	UG/KG	5.30	J
S12-119	SW12-119 (0-0.5)	4,4'-DDE	UG/KG	2.60	J
S12-119	SW12-119 (0-0.5)	4,4'-DDT	UG/KG	17.00	P
S12-119	SW12-119 (0-0.5)	AROCLOR-1254	UG/KG	87.00	JP
S12-119	SW12-119 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	390.00	BJ
S12-119	SW12-119 (0-0.5)	METHYLENE CHLORIDE	UG/KG	9.00	J
S12-120	SW12-120 (0-0.5)	ALUMINUM	MG/KG	10300.00	*
S12-120	SW12-120 (0-0.5)	ARSENIC	MG/KG	8.30	
S12-120	SW12-120 (0-0.5)	BARIIUM	MG/KG	9.90	*B
S12-120	SW12-120 (0-0.5)	BERYLLIUM	MG/KG	.23	B
S12-120	SW12-120 (0-0.5)	CALCIUM	MG/KG	45800.00	*
S12-120	SW12-120 (0-0.5)	CHROMIUM	MG/KG	20.40	
S12-120	SW12-120 (0-0.5)	COBALT	MG/KG	9.10	B
S12-120	SW12-120 (0-0.5)	COPPER	MG/KG	53.50	
S12-120	SW12-120 (0-0.5)	IRON	MG/KG	71700.00	
S12-120	SW12-120 (0-0.5)	LEAD	MG/KG	15.40	*
S12-120	SW12-120 (0-0.5)	MAGNESIUM	MG/KG	9790.00	
S12-120	SW12-120 (0-0.5)	MANGANESE	MG/KG	475.00	*
S12-120	SW12-120 (0-0.5)	NICKEL	MG/KG	19.30	
S12-120	SW12-120 (0-0.5)	POTASSIUM	MG/KG	1110.00	B
S12-120	SW12-120 (0-0.5)	SODIUM	MG/KG	5660.00	
S12-120	SW12-120 (0-0.5)	VANADIUM	MG/KG	64.50	
S12-120	SW12-120 (0-0.5)	ZINC	MG/KG	58.60	
S12-120	SW12-120 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	78.00	BJ
S12-120	SW12-120 (0-0.5)	METHYLENE CHLORIDE	UG/KG	6.00	J
S12-121	SW12-121 (0-0.5)	ALUMINUM	MG/KG	6950.00	*
S12-121	SW12-121 (0-0.5)	BARIIUM	MG/KG	6.70	*B
S12-121	SW12-121 (0-0.5)	BERYLLIUM	MG/KG	.19	B

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S12-121	SW12-121 (0-0.5)	CALCIUM	MG/KG	3960.00	*
S12-121	SW12-121 (0-0.5)	CHROMIUM	MG/KG	5.50	
S12-121	SW12-121 (0-0.5)	COBALT	MG/KG	7.80	B
S12-121	SW12-121 (0-0.5)	COPPER	MG/KG	41.30	
S12-121	SW12-121 (0-0.5)	IRON	MG/KG	14000.00	
S12-121	SW12-121 (0-0.5)	LEAD	MG/KG	35.20	*
S12-121	SW12-121 (0-0.5)	MAGNESIUM	MG/KG	11800.00	
S12-121	SW12-121 (0-0.5)	MANGANESE	MG/KG	457.00	*
S12-121	SW12-121 (0-0.5)	NICKEL	MG/KG	10.10	
S12-121	SW12-121 (0-0.5)	POTASSIUM	MG/KG	291.00	B
S12-121	SW12-121 (0-0.5)	SODIUM	MG/KG	1810.00	
S12-121	SW12-121 (0-0.5)	VANADIUM	MG/KG	27.20	
S12-121	SW12-121 (0-0.5)	ZINC	MG/KG	48.00	
S12-121	SW12-121 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	68.00	BJ
S12-121	SW12-121 (0-0.5)	METHYLENE CHLORIDE	UG/KG	19.00	B
S12-W1	SW12-121	ALUMINUM	UG/L	27000.00	
S12-W1	SW12-W1	ARSENIC	UG/L	62.80	
S12-W1	SW12-W1	BARIUM	UG/L	276.00	
S12-W1	SW12-W1	BERYLLIUM	UG/L	3.60	
S12-W1	SW12-W1	CADMIUM	UG/L	3.30	
S12-W1	SW12-W1	CALCIUM	UG/L	78800.00	
S12-W1	SW12-W1	CHROMIUM	UG/L	52.80	
S12-W1	SW12-W1	COBALT	UG/L	60.50	
S12-W1	SW12-W1	COPPER	UG/L	52.90	
S12-W1	SW12-W1	IRON	UG/L	47300.00	
S12-W1	SW12-W1	MAGNESIUM	UG/L	52700.00	
S12-W1	SW12-W1	MANGANESE	UG/L	1850.00	
S12-W1	SW12-W1	MOLYBDENUM	UG/L	19.20	
S12-W1	SW12-W1	NICKEL	UG/L	55.20	
S12-W1	SW12-W1	POTASSIUM	UG/L	20800.00	
S12-W1	SW12-W1	SILVER	UG/L	1.40	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S12-W1	SW12-W1	SODIUM	UG/L	151000.00	
S12-W1	SW12-W1	THALLIUM	UG/L	10.50	
S12-W1	SW12-W1	VANADIUM	UG/L	174.00	
S12-W1	SW12-W1	ZINC	UG/L	163.00	
S12-W1	SW12-W1	CARBON DISULFIDE	UG/L	4.00	J
S12-W1	SW12W17.7 (7.7)	TOTAL ORGANIC CARBON	MG/KG	4970.00	
S12-W1	SW12W17.7 (7.7)	ALUMINUM	MG/KG	11200.00	
S12-W1	SW12W17.7 (7.7)	BARIUM	MG/KG	15.40	
S12-W1	SW12W17.7 (7.7)	BERYLLIUM	MG/KG	.28	
S12-W1	SW12W17.7 (7.7)	CADMIUM	MG/KG	.85	
S12-W1	SW12W17.7 (7.7)	CALCIUM	MG/KG	6510.00	
S12-W1	SW12W17.7 (7.7)	CHROMIUM	MG/KG	14.00	
S12-W1	SW12W17.7 (7.7)	COBALT	MG/KG	9.70	
S12-W1	SW12W17.7 (7.7)	COPPER	MG/KG	48.40	
S12-W1	SW12W17.7 (7.7)	IRON	MG/KG	25100.00	
S12-W1	SW12W17.7 (7.7)	MAGNESIUM	MG/KG	12100.00	
S12-W1	SW12W17.7 (7.7)	MANGANESE	MG/KG	290.00	
S12-W1	SW12W17.7 (7.7)	NICKEL	MG/KG	12.30	
S12-W1	SW12W17.7 (7.7)	POTASSIUM	MG/KG	460.00	
S12-W1	SW12W17.7 (7.7)	THALLIUM	MG/KG	1760.00	
S12-W1	SW12W17.7 (7.7)	VANADIUM	MG/KG	37.00	
S12-W1	SW12W17.7 (7.7)	ZINC	MG/KG	82.70	
S12-W1	SW12W17.7 (7.7)	bis(2-ETHYLHEXYL) PHTHALATE	MG/KG	58.50	
S12-W1	SW12W17.7 (7.7)	ACETONE	UG/KG	41.00	J
S12-W1	SW12W17.7 (7.7)	BENZENE	UG/KG	21.00	J2
S12-W1	SW12W17.7 (7.7)	TOLUENE	UG/KG	49.00	
S12-W1	SW12W17.7 (7.7)	XYLENE (total)	UG/KG	150.00	
S12-W1	SW12W17.7 (7.7)	ALUMINUM	UG/L	16.00	J
S12-W3	SW12-W3	ARSENIC	UG/L	71000.00	
S12-W3	SW12-W3	BARIUM	UG/L	66.90	
S12-W3	SW12-W3		UG/L	308.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
S12-W3	SW12-W3	BERYLLIUM	UG/L	4.20	
S12-W3	SW12-W3	CADMIUM	UG/L	6.20	
S12-W3	SW12-W3	CALCIUM	UG/L	58100.00	
S12-W3	SW12-W3	CHROMIUM	UG/L	80.70	
S12-W3	SW12-W3	COBALT	UG/L	66.30	
S12-W3	SW12-W3	COPPER	UG/L	255.00	
S12-W3	SW12-W3	IRON	UG/L	134000.00	
S12-W3	SW12-W3	MAGNESIUM	UG/L	67900.00	
S12-W3	SW12-W3	MANGANESE	UG/L	2740.00	
S12-W3	SW12-W3	MOLYBDENUM	UG/L	6.20	
S12-W3	SW12-W3	NICKEL	UG/L	75.20	
S12-W3	SW12-W3	POTASSIUM	UG/L	13600.00	
S12-W3	SW12-W3	SILVER	UG/L	4.20	
S12-W3	SW12-W3	SODIUM	UG/L	150000.00	
S12-W3	SW12-W3	THALLIUM	UG/L	141.00	
S12-W3	SW12-W3	VANADIUM	UG/L	420.00	
S12-W3	SW12-W3	ZINC	UG/L	369.00	
S12-W3	SW12-W3	bis(2-ETHYLHEXYL) PHTHALATE	UG/L	1.00	J
S12-W3	SW12W320.0 (20.0)	TOTAL ORGANIC CARBON	MG/KG	3850.00	
S12-W3	SW12W320.0 (20.0)	ALUMINUM	MG/KG	12500.00	
S12-W3	SW12W320.0 (20.0)	BARIUM	MG/KG	34.60	
S12-W3	SW12W320.0 (20.0)	CADMIUM	MG/KG	1.50	
S12-W3	SW12W320.0 (20.0)	CALCIUM	MG/KG	2810.00	
S12-W3	SW12W320.0 (20.0)	CHROMIUM	MG/KG	19.00	
S12-W3	SW12W320.0 (20.0)	COBALT	MG/KG	18.00	
S12-W3	SW12W320.0 (20.0)	COPPER	MG/KG	59.60	
S12-W3	SW12W320.0 (20.0)	IRON	MG/KG	28000.00	
S12-W3	SW12W320.0 (20.0)	MAGNESIUM	MG/KG	10200.00	
S12-W3	SW12W320.0 (20.0)	MANGANESE	MG/KG	1100.00	
S12-W3	SW12W320.0 (20.0)	MOLYBDENUM	MG/KG	1.00	
S12-W3	SW12W320.0 (20.0)	NICKEL	MG/KG	18.50	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.30. (cont.)

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
S12-W3	SW12W320.0 (20.0)	POTASSIUM	MG/KG	526.00	
S12-W3	SW12W320.0 (20.0)	SODIUM	MG/KG	2120.00	
S12-W3	SW12W320.0 (20.0)	THALLIUM	MG/KG	35.00	
S12-W3	SW12W320.0 (20.0)	VANADIUM	MG/KG	88.00	
S12-W3	SW12W320.0 (20.0)	ZINC	MG/KG	81.50	
S12-W3	SW12W320.0 (20.0)	bis (2-ETHYLHEXYL) PHTHALATE	UG/KG	52.00	J
S12-W3	SW12W320.0 (20.0)	BENZENE	UG/KG	9.00	J
S12-W3	SW12W320.0 (20.0)	CARBON DISULFIDE	UG/KG	2.00	J
S12-W3	SW12W320.0 (20.0)	TOLUENE	UG/KG	19.00	
S12-W3	SW12W320.0 (20.0)	XYLENE (total)	UG/KG	5.00	J

(a) The information within the parenthesis indicates sample depth (feet). See Note (b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

Table 3.31 presents a summary of the analytical results from SW-12. Presented are the analytes detected, the number of samples analyzed, and the number of samples with a positive result.

These results indicate a greater number of constituents in the surface samples as compared to the samples collected at depth. This could be due to obtaining the subsurface samples from the wells that were located outside the landfill and some of the surface samples from the face of the landfill. Constituents detected at depth and in the surface soils show similar concentration ranges. Most contaminants are at very low concentrations and, except for metals, were found only in a few samples. This indicates that organic contamination at this site is not widespread.

Groundwater contamination seems to be limited to minor amounts of volatile organics and metals. Both the upgradient and down-gradient wells have elevated metals concentrations.

3.9.5 Preliminary Risk Assessment

Three of the surface soil samples exceed the human health risk PRLs for arsenic and both the water samples from the wells had arsenic concentrations above the MCL. Some benzene was also detected in the groundwater samples but at less than the human health risk PRLs. Analytical results did not exceed the preliminary ecological risk assessment goals at this site with the exception of barium in soil samples.

3.9.6 Future Actions

Site data indicate that arsenic in surface soil and groundwater poses a potential human health risk. As a remedial measure, it is recommended that the landfill area be graded to allow surface water drainage away from the landfill and capped with a permeable material. This will reduce or eliminate the exposure to contaminated surface soil and reduce the impact of the landfill on the groundwater. It is unlikely that human exposure to groundwater from the site will ever occur, and since ecological risk is not impacted, an impermeable cap is not judged necessary.

TABLE 3.31. Analytes with Positive Results at SW-12

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Results</u>	<u>Range</u>
Analytical results of water samples:			
Arsenic	2	2	62.8 - 66.9
Chromium	2	2	19.2 - 80.7
Copper	2	2	52.9 - 255
Zinc	2	2	163 - 369
Carbon Disulfide	2	1	4
Benzene	2	2	2
bis(2-ethylhexyl)phthalate	2	1	1
Toluene	2	1	1
Analytical results of soil samples collected at a depth of 7.7 feet:			
Acetone	1	1	21
Benzene	1	1	49
Toluene	1	1	150
Xylene (Total)	1	1	16
bis(2-ethylhexyl)phthalate	1	1	41
Total Organic Carbon	1	1	4,970
Analytical results of soil samples collected at a depth of 20 feet:			
Carbon Disulfide	1	1	2
Benzene	1	1	9
Toluene	1	1	19
Xylene (Total)	1	1	5
bis(2-ethylhexyl)phthalate	1	1	52
Total Organic Carbon	1	1	3,850

TABLE 3.31. (cont.)

<u>Analyte</u>	<u>Total Number of Samples</u>	<u>Number of Samples with Positive Results</u>	<u>Range</u>
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Analytical results of soil samples collected at a depth of 5 feet:

Ethylbenzene	1	1	780
Toluene	1	1	990
Xylene (Total)	1	1	2,680

Analytical results of soil samples collected from 0- to 6-inch depth:

Chloroform	17	1	1
Diethylphthalate	17	2	58 - 130
bis(2-ethylhexyl)phthalate	17	10	40 - 390
Di-n-butylphthalate	17	5	46 - 5000
PCB (Aroclor 1260)	17	2	36 - 89
PCB (Aroclor 1254)	17	1	87
4,4' DDE	17	2	2.6 - 2.7
4,4' DDD	17	2	5.3 - 15
4,4' DDT	17	3	2.5 - 34
Methylene Chloride	17	6	5 - 19
TPH	17	2	43 - 85
Antimony	17	1	8.7
Arsenic	17	4	5.5 - 10.3
Cadmium	17	1	2.1
Chromium	17	3	20.4 - 59.3
Copper	17	9	41.3 - 371
Lead	17	9	12.9 - 381
Zinc	17	9	44.4 - 567

3.10 SOLID WASTE SITE SW-14: SCRAP METAL LANDFILL

3.10.1 Site Background

This area is located at the extreme southeast corner of the island (Figure 3.23). It appears to occur in two areas on the southeast portion of the island: 1) adjacent to the existing sanitary landfill; and 2) directly east, across the road from the sanitary landfill.

Currently, the area appears as a series of sandy hummocks interspersed with broken concrete. This site is approximately 600 feet by 600 feet, with heights averaging 10 feet above grade. The site extends to a bluff overlooking the ocean on the east, approximately 100 feet above the ocean.

3.10.2 Previous Investigations

No metal debris was observed at this site during the 1988 field investigation. However, concrete debris was observed. Two auger borings on the southern, downslope perimeter of the disposal site were used to collect soil samples. The TPH levels ranged from 250 to 460 mg/kg. No semivolatile organic compounds were detected. Common laboratory contaminant volatile organic compounds detected included methylene chloride (0.011 to 0.048 mg/kg), acetone (0.012 to 0.15 mg/kg), and 2-butanone (0.01 to 0.04 mg/kg). Metals detected above background were nickel at 21 to 23 mg/kg, zinc at 33.9 to 122 mg/kg, and lead at 9 to 36.1 mg/kg.

3.10.3 1992 Investigation

The 1992 investigation of the site consisted of a geophysical survey of the site to delineate its boundaries. No samples were collected for analysis.

The objective of the geophysical survey was to map the extent of buried metal and waste at the site. The extent of the geophysical investigation is shown in Figure 3.23. The east limit of the site is the top of the cliffs. At the north half of the site, the western limit was the road, and in the southern half, the western limit was approximately the active landfill boundary. The north limit of the survey was the northern extent of an open field. The survey extended southward to an asbestos disposal area. The asbestos

FIGURE 3.23. SW

LOCATION MAP

LEGEND

○ LARGE AREA OF SCATTERED BURIED METAL ○ OR ○ POSSIBLE ISOLATED BURIED METAL ● OR ● ISOLATED BURIED METAL ⊗ 1988 SAMPLING LOCATION --- SITE BOUNDARY	— GEOPHYSICAL SURVEY LINE Ⓜ METAL OBSERVED AT SURFACE — DITCH TTTT STEEP BANK <u>INTERPRETED FEATURES</u> ▨ AREA OF BURIED METAL ▩ AREA OF BURIED WASTE OR FILL (PRESENCE OF METAL IS UNCERTAIN)

area was specifically excluded from the geophysical investigations and although it is apparent that buried metal extends farther south, the survey stopped at the asbestos area. Data were collected at 5-foot intervals along lines 25 feet apart. The data are shown contoured in Appendix B. Approximately 9.5 acres were investigated.

The results of the investigation are shown in Figure 3.23. Several areas of buried metal were identified by the investigation and are shown in the figure. The most extensive areas of buried metal were encountered at the south end of the survey area. An area of scattered buried metal connects the two areas of buried metal at the south part of the site. Other smaller areas of buried metal were delineated at the site as shown in the figure. One area, centered at 450 north and 1330 east, is defined by anomalously high conductivity, but the data do not indicate metal is present. A short feature identified as a buried utility was mapped at approximately 850 north, 1140 east. Isolated buried metal and possible buried metal objects have been identified at numerous locations across the site and are also shown in Figure 3.23.

3.10.4 Nature and Extent of Contamination

The 1988 data indicate that some contamination may exist at this site, but data are insufficient to determine the extent of contamination.

3.10.5 Preliminary Risk Assessment

Because the nature and extent of the contamination is not known, a complete risk assessment cannot be performed. However, none of the samples from the 1988 sampling were above the human health PRLs or the ecological PRLs.

3.10.6 Future Actions

Further study is necessary at the site to determine the impact of the landfill on groundwater and the potential for surface soil contamination. A proposed investigation strategy is contained in the Installation Restoration Program Field Investigation Plan (CH2M HILL 1991).

3.11 PETROLEUM SPILL SITE PS-1A: TRANSFORMER OIL SPILL AT COBRA DANE

3.11.1 Site Background

This site is located near the northwesternmost point on the Island (Figure 3.24). The Cobra Dane is located on a bluff overlooking the ocean to the west, approximately 200 feet below. The area around the building that houses Cobra Dane has been graded flat. Beyond the flattened area around the Cobra Dane is rolling terrain that slopes to the south and is covered with vegetation. Surface water runoff flows to the south toward the tank farm and eventually to the west end oil water separator (PS-3). However, because of the vegetation and the generally light to moderate precipitation intensity, little direct runoff enters the surface water system directly, as most of the precipitation infiltrates.

Facility drawings indicate an underground tank just outside the front entrance to the Cobra Dane. This tank was fed by an underground line from several floor trenches in the Cobra Dane. Residues collected during spill response activities are collected in the trenches and routed to the tank. When fluids overflowed the sump, the tank was emptied by pumping through an above-ground, 2-inch pipe. The tank, sometimes referred to as an "Askarel" tank, was last pumped in 1985. According to the Phase I report, there have been spills in this area, and the exact contents of the tank had not been clearly identified.

3.11.2 Previous Investigations

In 1988, the residue in this 1,000-gallon underground tank was sampled as well as an auger boring soil sample near the tank. The liquid tank sample contained a TPH level of 43,000 mg/l and recorded no detectable PCBs or pesticides. The tank contents measured 36 inches deep at the time of sampling. Tank integrity was not known. The TPH level in the soil was 5,100 mg/kg at 3 feet and 100 mg/kg at 6 feet. No PCBs or pesticides were detected in the soil. The underground tank was removed in June 1992 by the COE.

FIGURE 3.24. PS-1A New Cobra Dane

3.11.3 1992 Investigation

During this project's 1992 investigation, three soil samples were obtained—one from the surface near where the tank had been located and two from borings at the approximate bottom of the tank excavation (Figure 3.24). All three samples were analyzed for VOAs, semi VOAs, pesticides/PCBs, and metals. The surface sample had positive hits on numerous semivolatile compounds (Table 3.32). These compounds are generally associated with coal tar derivatives and could have come from asphalt. Some elevated heavy metals were also found in the surface sample (Table 3.32). The two subsurface samples had one positive result for toluene at 1 $\mu\text{g/kg}$ and were below detection for all other compounds. Metals concentrations at depth were within the background range. Geophysical investigations were not performed at this site because of the large number of underground utilities.

3.11.4 Nature and Extent of Contamination

Analytical results from samples taken at PS-1A indicate the surface material that was used to construct the parking lot is contaminated with semivolatile compounds that may be associated with asphalt. Some minor amounts of TPH contamination were also found at the surface near the tank, but this is probably associated with the fill material used to construct the parking lot. However, there are no indications that the tank that was removed in June 1992 had leaked.

3.11.5 Preliminary Risk Assessment

None of the compounds detected at PS-1A were above the preliminary risk levels developed in Appendix C. Soil samples exceeded the PRLs for aluminum, cobalt, and iron.

3.11.6 Future Actions

No remedial actions are necessary for the area around where the underground storage tank had been located, based on sample results and the baseline risk assessment. Therefore, it is recommended that an NFAD document be prepared for PS-1A.

TABLE 3.32. Positive Results from Offsite Data at PS-1A

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER (c)
P1A-1	PS1A-122 (0-0.5)	ALUMINUM	MG/KG	12400.00	*
P1A-1	PS1A-122 (0-0.5)	ANTIMONY	MG/KG	7.50	B
P1A-1	PS1A-122 (0-0.5)	ARSENIC	MG/KG	2.20	
P1A-1	PS1A-122 (0-0.5)	BARIUM	MG/KG	54.20	*
P1A-1	PS1A-122 (0-0.5)	BERYLLIUM	MG/KG	.25	B
P1A-1	PS1A-122 (0-0.5)	CADMIUM	MG/KG	2.20	*
P1A-1	PS1A-122 (0-0.5)	CALCIUM	MG/KG	6990.00	*
P1A-1	PS1A-122 (0-0.5)	CHROMIUM	MG/KG	17.90	
P1A-1	PS1A-122 (0-0.5)	COBALT	MG/KG	10.30	B
P1A-1	PS1A-122 (0-0.5)	COPPER	MG/KG	65.30	
P1A-1	PS1A-122 (0-0.5)	IRON	MG/KG	19800.00	
P1A-1	PS1A-122 (0-0.5)	LEAD	MG/KG	29.10	*
P1A-1	PS1A-122 (0-0.5)	MAGNESIUM	MG/KG	9250.00	
P1A-1	PS1A-122 (0-0.5)	MANGANESE	MG/KG	397.00	*
P1A-1	PS1A-122 (0-0.5)	NICKEL	MG/KG	21.40	
P1A-1	PS1A-122 (0-0.5)	POTASSIUM	MG/KG	687.00	B
P1A-1	PS1A-122 (0-0.5)	SODIUM	MG/KG	1900.00	
P1A-1	PS1A-122 (0-0.5)	VANADIUM	MG/KG	63.80	
P1A-1	PS1A-122 (0-0.5)	ZINC	MG/KG	95.90	
P1A-1	PS1A-122 (0-0.5)	ANTHRACENE	UG/KG	120.00	J
P1A-1	PS1A-122 (0-0.5)	BENZO (A) ANTHRACENE	UG/KG	380.00	J
P1A-1	PS1A-122 (0-0.5)	BENZO (A) PYRENE	UG/KG	390.00	J
P1A-1	PS1A-122 (0-0.5)	BENZO (B) FLUORANTHENE	UG/KG	510.00	
P1A-1	PS1A-122 (0-0.5)	BENZO (G, H, I) PERYLENE	UG/KG	360.00	J
P1A-1	PS1A-122 (0-0.5)	BENZO (K) FLUORANTHENE	UG/KG	170.00	J
P1A-1	PS1A-122 (0-0.5)	CARBAZOLE	UG/KG	82.00	J
P1A-1	PS1A-122 (0-0.5)	CHRYSENE	UG/KG	410.00	J
P1A-1	PS1A-122 (0-0.5)	DIBENZO (A, H) ANTHRACENE	UG/KG	79.00	J
P1A-1	PS1A-122 (0-0.5)	FLUORANTHENE	UG/KG	1100.00	
P1A-1	PS1A-122 (0-0.5)	INDENO (1, 2, 3-C, D) PYRENE	UG/KG	440.00	
P1A-1	PS1A-122 (0-0.5)	PHENANTHRENE	UG/KG	530.00	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.32. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
P1A-1	PS1A-122 (0-0.5)	PYRENE	UG/KG	600.00	
P1A-1	PS1A-122 (0-0.5)	Bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	300.00	BJ
P1A-1	PS1A-122 (0-0.5)	METHYLENE CHLORIDE	UG/KG	9.00	BJ
P1A-B1	5-A-PS1A (11.5)	ALUMINUM	MG/KG	24400.00	
P1A-B1	5-A-PS1A (11.5)	ANTIMONY	MG/KG	6.80	
P1A-B1	5-A-PS1A (11.5)	ARSENIC	MG/KG	2.00	J
P1A-B1	5-A-PS1A (11.5)	BARIUM	MG/KG	99.40	
P1A-B1	5-A-PS1A (11.5)	BERYLLIUM	MG/KG	.22	J
P1A-B1	5-A-PS1A (11.5)	CADMIUM	MG/KG	.92	J
P1A-B1	5-A-PS1A (11.5)	CALCIUM	MG/KG	9760.00	
P1A-B1	5-A-PS1A (11.5)	CHROMIUM	MG/KG	26.40	
P1A-B1	5-A-PS1A (11.5)	COBALT	MG/KG	27.30	
P1A-B1	5-A-PS1A (11.5)	COPPER	MG/KG	133.00	
P1A-B1	5-A-PS1A (11.5)	CYANIDE	MG/KG	.55	
P1A-B1	5-A-PS1A (11.5)	IRON	MG/KG	59600.00	
P1A-B1	5-A-PS1A (11.5)	LEAD	MG/KG	2.20	
P1A-B1	5-A-PS1A (11.5)	MAGNESIUM	MG/KG	22700.00	
P1A-B1	5-A-PS1A (11.5)	MANGANESE	MG/KG	1050.00	
P1A-B1	5-A-PS1A (11.5)	MERCURY	MG/KG	.17	
P1A-B1	5-A-PS1A (11.5)	NICKEL	MG/KG	23.60	
P1A-B1	5-A-PS1A (11.5)	POTASSIUM	MG/KG	1140.00	
P1A-B1	5-A-PS1A (11.5)	SELENIUM	MG/KG	1.80	
P1A-B1	5-A-PS1A (11.5)	SILVER	MG/KG	1.20	J
P1A-B1	5-A-PS1A (11.5)	SODIUM	MG/KG	1130.00	
P1A-B1	5-A-PS1A (11.5)	THALLIUM	MG/KG	.57	J
P1A-B1	5-A-PS1A (11.5)	VANADIUM	MG/KG	213.00	
P1A-B1	5-A-PS1A (11.5)	ZINC	MG/KG	107.00	
P1A-B1	5-A-PS1A (11.5)	TOLUENE	UG/KG	1.00	J
P1A-B2	3-A-PS1A (11.3)	ALUMINUM	MG/KG	23600.00	
P1A-B2	3-A-PS1A (11.3)	ANTIMONY	MG/KG	6.70	
P1A-B2	3-A-PS1A (11.3)	ARSENIC	MG/KG	2.70	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.32. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
P1A-B2	3-A-PS1A (11.3)	BARIUM	MG/KG	80.40	
P1A-B2	3-A-PS1A (11.3)	BERYLLIUM	MG/KG	.19	J
P1A-B2	3-A-PS1A (11.3)	CADMIUM	MG/KG	.58	
P1A-B2	3-A-PS1A (11.3)	CALCIUM	MG/KG	8230.00	
P1A-B2	3-A-PS1A (11.3)	CHROMIUM	MG/KG	24.50	
P1A-B2	3-A-PS1A (11.3)	COBALT	MG/KG	23.20	
P1A-B2	3-A-PS1A (11.3)	COPPER	MG/KG	105.00	
P1A-B2	3-A-PS1A (11.3)	CYANIDE	MG/KG	.54	
P1A-B2	3-A-PS1A (11.3)	IRON	MG/KG	52800.00	
P1A-B2	3-A-PS1A (11.3)	LEAD	MG/KG	2.80	
P1A-B2	3-A-PS1A (11.3)	MAGNESIUM	MG/KG	20400.00	
P1A-B2	3-A-PS1A (11.3)	MANGANESE	MG/KG	1160.00	
P1A-B2	3-A-PS1A (11.3)	MERCURY	MG/KG	.11	
P1A-B2	3-A-PS1A (11.3)	NICKEL	MG/KG	20.90	
P1A-B2	3-A-PS1A (11.3)	POTASSIUM	MG/KG	984.00	J
P1A-B2	3-A-PS1A (11.3)	SELENIUM	MG/KG	1.80	
P1A-B2	3-A-PS1A (11.3)	SILVER	MG/KG	1.60	J
P1A-B2	3-A-PS1A (11.3)	SODIUM	MG/KG	1140.00	
P1A-B2	3-A-PS1A (11.3)	THALLIUM	MG/KG	.52	J
P1A-B2	3-A-PS1A (11.3)	VANADIUM	MG/KG	175.00	
P1A-B2	3-A-PS1A (11.3)	ZINC	MG/KG	94.50	

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

3.12 PETROLEUM SPILL SITE PS-1B: TRANSFORMER OIL (PCB) SPILL AT OLD COBRA DANE

3.12.1 Site Background

The site is located on the northern portion of the island along North Road (Figure 3.25). The area around PS-1B is rolling hummocks of tundra. The building is located near the edge of the bluff on the north part of the island. The vegetation around the site is grass and tundra. Surface water runoff from this site flows to the west and then south toward PS-3, the west end oil water separator. Much of the area around the old Cobra Dane has been disturbed, leaving bare soil exposed. This would tend to increase the amount of runoff generated from this site. Since the September 1987 site visit, OEHL personnel have reported that the original Cobra Dane site is also the location of an oil spill. Specific quantities are not known, but the oil spilled was thought to contain PCBs. The exact location of the oil spill could not be determined, but inspection of the area on the north side of Building 3050 revealed several areas of darkened soil.

3.12.2 Previous Investigations

In 1988, three samples were taken in areas of stained soil at the site of historic transformer storage (Figure 3.25). Another sample was taken in a drainage ditch north of Building 3050. Soil samples were taken by hand auger boring to 2 feet. The TPH ranged from 21,000 mg/kg at 1 foot to 129,000 mg/kg at 2 feet. No PCBs or pesticides were detected.

3.12.3 1992 Investigation

A geophysical survey of the site was conducted as part of the 1992 investigation. The extent of the geophysical conductivity investigation is shown in Figure 3.26. Conductivity data were collected at 5-foot intervals along lines 10 feet apart. The conductivity and in-phase values are presented as contour maps in Appendix B. The objective of the survey was to identify buried metal features to be avoided during drilling. Approximately 0.4 acre was covered by the investigation.

LOCATION MAP

LEGEND

- * SOIL SAMPLE LOCATION
- BORING LOCATION
- 1988 SAMPLING LOCATION

FIGURE 3.25. PS-1B Old Cobra Dane

FIGURE 3.26. PS-1B Geophysical Interpretive Map

The site was gridded by the geophysics crew. The grid was established relative to a corner of the building, as shown in Figure 3.26. The northwest side of the building defined grid north and was assigned grid coordinate 100 east. The northeast side of the building at that corner was assigned grid coordinate 0 north.

Several features present at the site interfered with the EM data. These are shown in Figure 3.26 and are the building, storage trailers, concrete foundation and ditch, and a hydrant with guard posts. Data collected within about 15 feet of these features are generally unusable for the identification of buried metal.

Three utility lines were identified by the investigation and are shown in Figure 3.26. One of the utility lines is associated with the hydrant located in the southwest corner of the site. Another interpreted utility line may be associated with the hydrant located in the northeast part of the site, although the utility line was mapped about 20 feet from the hydrant. A third utility line was identified beneath the small hill in the northern part of the site.

During the 1992 investigation, two soil samples were taken from PS-1B, a surface sample (0 to 6 inches) and a subsurface sample (6 inches to 24 inches). The surface sample had a concentration of bis (2-ethylhexyl) phthalate of 88,000 $\mu\text{g}/\text{kg}$ and minor amounts of TCA, TCE, and 4,4'-DDD (Table 3.33). Metals concentrations were elevated as compared to background concentrations, most notably mercury at 5.4 mg/kg (Table 3.33). Cyanide was also present in the surface sample at 2.2 mg/kg.

The subsurface sample had a TPH concentration of 38,503 mg/kg. The chlorinated solvents TCA and TCE were also found in the subsurface sample at 600 and 2,200 $\mu\text{g}/\text{kg}$, respectively. In addition, the breakdown by-products dichloroethane and dichloroethene were also present at 96 and 97 $\mu\text{g}/\text{kg}$, respectively.

3.12.4 Nature and Extent of Contamination

The samples taken in 1988 and 1992 indicate that the area to the north of the Old Cobra Dane has been contaminated with both organic and inorganic compounds. Both investigations concentrated on the most heavily stained areas and did not delineate the lateral or vertical extent of the contamination. In addition, there is

TABLE 3.33. Positive Results from Offsite Data at PS-1B

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
P1B-A1	0-A-PS1B (2.0)	ALUMINUM	MG/KG	41300.00	
P1B-A1	0-A-PS1B (2.0)	ANTIMONY	MG/KG	16.30	
P1B-A1	0-A-PS1B (2.0)	ARSENIC	MG/KG	6.10	
P1B-A1	0-A-PS1B (2.0)	BARIUM	MG/KG	453.00	
P1B-A1	0-A-PS1B (2.0)	BERYLLIUM	MG/KG	.62	J
P1B-A1	0-A-PS1B (2.0)	CADMIUM	MG/KG	15.30	
P1B-A1	0-A-PS1B (2.0)	CALCIUM	MG/KG	5680.00	
P1B-A1	0-A-PS1B (2.0)	CHROMIUM	MG/KG	62.60	
P1B-A1	0-A-PS1B (2.0)	COBALT	MG/KG	7.70	J
P1B-A1	0-A-PS1B (2.0)	COPPER	MG/KG	2630.00	
P1B-A1	0-A-PS1B (2.0)	CYANIDE	MG/KG	3.30	
P1B-A1	0-A-PS1B (2.0)	IRON	MG/KG	28200.00	
P1B-A1	0-A-PS1B (2.0)	LEAD	MG/KG	1430.00	J
P1B-A1	0-A-PS1B (2.0)	MAGNESIUM	MG/KG	3850.00	
P1B-A1	0-A-PS1B (2.0)	MANGANESE	MG/KG	210.00	
P1B-A1	0-A-PS1B (2.0)	MERCURY	MG/KG	.70	
P1B-A1	0-A-PS1B (2.0)	NICKEL	MG/KG	672.00	
P1B-A1	0-A-PS1B (2.0)	POTASSIUM	MG/KG	2110.00	J
P1B-A1	0-A-PS1B (2.0)	SELENIUM	MG/KG	16.10	
P1B-A1	0-A-PS1B (2.0)	SILVER	MG/KG	497.00	
P1B-A1	0-A-PS1B (2.0)	SODIUM	MG/KG	4010.00	
P1B-A1	0-A-PS1B (2.0)	THALLIUM	MG/KG	1.60	J
P1B-A1	0-A-PS1B (2.0)	VANADIUM	MG/KG	43.40	
P1B-A1	0-A-PS1B (2.0)	ZINC	MG/KG	6110.00	
P1B-A1	0-A-PS1B (2.0)	1,1,1-TRICHLOROETHANE	UG/KG	600.00	J
P1B-A1	0-A-PS1B (2.0)	1,1-DICHLOROETHANE	UG/KG	65.00	J
P1B-A1	0-A-PS1B (2.0)	1,2-DICHLOROETHANE	UG/KG	31.00	J
P1B-A1	0-A-PS1B (2.0)	1,2-DICHLOROETHENE (total)	UG/KG	97.00	J
P1B-A1	0-A-PS1B (2.0)	TRICHLOROETHENE (TCE)	UG/KG	2200.00	
P1B-A1	PS1B-123 (0-0.5)	ALUMINUM	MG/KG	27900.00	*
P1B-A1	PS1B-123 (0-0.5)	ARSENIC	MG/KG	3.40	+B

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution

RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

TABLE 3.33. (cont.)

LOCATION	SAMPLE-ID(a)	PARAMETER	UNITS	VALUE	QUALIFIER(c)
P1B-A1	PS1B-123 (0-0.5)	BARIUM	MG/KG	189.00	*
P1B-A1	PS1B-123 (0-0.5)	BERYLLIUM	MG/KG	.52	B
P1B-A1	PS1B-123 (0-0.5)	CADMIUM	MG/KG	28.90	*
P1B-A1	PS1B-123 (0-0.5)	CALCIUM	MG/KG	16500.00	*
P1B-A1	PS1B-123 (0-0.5)	CHROMIUM	MG/KG	34.70	
P1B-A1	PS1B-123 (0-0.5)	COBALT	MG/KG	20.20	B
P1B-A1	PS1B-123 (0-0.5)	COPPER	MG/KG	145.00	
P1B-A1	PS1B-123 (0-0.5)	CYANIDE	MG/KG	2.20	
P1B-A1	PS1B-123 (0-0.5)	IRON	MG/KG	42200.00	
P1B-A1	PS1B-123 (0-0.5)	LEAD	MG/KG	51.70	
P1B-A1	PS1B-123 (0-0.5)	MAGNESIUM	MG/KG	18500.00	*
P1B-A1	PS1B-123 (0-0.5)	MANGANESE	MG/KG	1110.00	*
P1B-A1	PS1B-123 (0-0.5)	MERCURY	MG/KG	5.40	
P1B-A1	PS1B-123 (0-0.5)	NICKEL	MG/KG	38.90	
P1B-A1	PS1B-123 (0-0.5)	POTASSIUM	MG/KG	1510.00	B
P1B-A1	PS1B-123 (0-0.5)	SELENIUM	MG/KG	3.60	N
P1B-A1	PS1B-123 (0-0.5)	SODIUM	MG/KG	4050.00	
P1B-A1	PS1B-123 (0-0.5)	VANADIUM	MG/KG	142.00	
P1B-A1	PS1B-123 (0-0.5)	ZINC	MG/KG	201.00	
P1B-A1	PS1B-123 (0-0.5)	4,4'-DDD	UG/KG	34.00	JP
P1B-A1	PS1B-123 (0-0.5)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	88000.00	B
P1B-A1	PS1B-123 (0-0.5)	1,1,1-TRICHLOROETHANE	UG/KG	4.00	J
P1B-A1	PS1B-123 (0-0.5)	METHYLENE CHLORIDE	UG/KG	14.00	BJ
P1B-A1	PS1B-123 (0-0.5)	TRICHLOROETHENE (TCE)	UG/KG	10.00	J
P1B-A1	PS1B-123DL (0-0.5, DIL)	bis(2-ETHYLHEXYL) PHTHALATE	UG/KG	88000.00	BD

(a) The information within the parenthesis indicates sample depth (feet). See Note(b) for other abbreviations within the parenthesis.

(b) DIL = Dilution
RE = Reanalysis

(c) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

some potential that the spill site in question may have been to the south of the Old Cobra Dane building. However, the area to the south has been part of a construction site in 1992 and has been completely disturbed, destroying any surface evidence of any spills. Because of these limitations, it is not possible to determine the extent of contamination at this site.

3.12.5 Preliminary Risk Assessment

No samples taken to date exceed the preliminary risk levels for human health risk established in Appendix C except for TPH. Cadmium, aluminum, antimony, iron, and silver in soil were determined to be potential risks to terrestrial receptors at the site. Because of the limited nature of the sampling performed to date, a complete risk assessment is not practical at this time.

3.12.6 Future Actions

Because of the lack of data and the need to define the nature and extent of the contamination, additional investigations are needed at PS-1B. The investigation described in the Field Investigation Plan of grid sampling, subsurface sampling, and the installation of groundwater monitoring wells should be implemented to obtain the information necessary to determine if remediation is necessary at this site, and, if so, what type of remedial actions would be appropriate.

3.13 PETROLEUM SPILL SITE PS-2: WEST DOCK

3.13.1 Site Background

PS-2 is located on the west side of the island approximately 1,200 feet southeast of the dock near Alcan Cove (Figure 3.27). This area of the island is covered with rolling sand dunes with limited vegetation. The dunes slope to the west, toward the ocean. There are no defined surface water channels in the area; all precipitation infiltrates into the sand.

In July 1983, a leak in the JP-4 distribution line spilled approximately 100 gallons of fuel. Sorbent material was applied to the spill area and the pipeline was repaired with a metal sleeve. All remedial actions were reported complete on the day following the spill.

FIGURE 3.27. PS-2 West Dock

3.13.2 Previous Investigations

During the 1988 investigation on Shemya, the onsite personnel could not locate any visual evidence of the spill site. Therefore, no samples from PS-2 were collected in 1988.

3.13.3 1992 Investigation

Again during the 1992 investigation, no visual indication of the spill could be located. A distance of 1,200 feet was measured from the dock, according to the report on the spill, and four surface soil samples were obtained (Figure 3.27). It was believed the spill probably occurred along the pipeline on West Beach Road and not West Road Cutoff because the distances would have been measured from closer landmarks along West Road Cutoff. The samples were taken from along the abandoned pipeline next to the West Beach Road. The samples were all analyzed for TPH with all results being less than 500 mg/kg and two samples less than the detection limit of 25 mg/kg (Table 3.34).

3.13.4 Nature and Extent of Contamination

The sampling conducted in 1992 indicates minor amounts of TPH contamination in the vicinity of the JP-4 spill that occurred in 1983. The contamination appears to be intermittent and may not be associated with the fuel spill. Samples taken from around the island show elevated TPH levels that are not associated with known spills.

3.13.5 Preliminary Risk Assessment

The TPH contamination found at PS-2 is below all preliminary risk levels established in Appendixes C and D. This indicates that, based on risk, no remediation will be required.

3.13.6 Future Actions

It is recommended that an NFAD document be prepared for this site.

TABLE 3.34. Positive Results from Onsite (CSL) Data at PS-2

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
P2-001	PS2S10.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	144.92	
P2-002	PS2S20.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	137.14	

 (a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

3.14 PETROLEUM SPILL SITE PS-3: WEST END OIL/WATER SEPARATOR PONDS

3.14.1 Site Background

The west end oil/water separator is a series of five unlined, earthen ponds constructed by the 11th CEOS near the west coast of the island (Figure 3.28). The ponds flow through an area of rolling hills. To the north of the ponds are a series of above ground storage tanks for JP-4 and diesel. To the south are the abandoned Runways B and C, to the east is the main base headquarters, and to the west is the ocean. The vegetation along the water course is mainly grass and tundra. The drainage in which the oil water separator was constructed received surface water runoff from the tank farm, Cobra Dane, and from around the power plant and part of the runoff from west side of the main base complex. While much of the area around PS-3 is covered with vegetation and produces little surface runoff, there are numerous roads, buildings, and disturbed areas that do produce appreciable quantities of runoff.

PS-3 is being actively used by the Air Force; however, no recreational use of the area has been observed. The ponds extend from an area southwest of the power plant downslope to the Bering Sea approximately 1 mile, near the intersection of North Beach and North Roads (Figure 3.28). The function of the separator is to intercept the oil-contaminated surface waters draining from areas to the northeast and trap the oil before the water reaches the ocean. Ponds 1 and 2, which treat a portion of the surface runoff from the power plant, contained soils of a blackish color, and a strong POL odor was detected. Discharge from Pond 2 carries water with an oil sheen to a subsequent Pond 3, which is 100 feet southwest of Tank 123, the location of a diesel fuel spill. Pond 4, located about 1,000 feet west of Pond 3, receives the discharge from Pond 3. Soil in this area was visibly saturated with POL, as was soil in the ditch at Pond 5, located another 1,000 feet downslope of Pond 4 near the intersection of North Beach and North Roads.

FIGURE 3.28. PS-3&4 West End Oil,

LEGEND

- △ 1988 SURFACE WATER SAMPLING LOCATION
- 1988 SOIL SAMPLING LOCATION

3.14.2 Previous Investigations

In 1988, 11 sediment and soil samples were obtained from uniformly placed locations within the drainage pathways that hydraulically connect each pond (Figure 3.28). Additionally, surface water samples were collected at the drainage outlet of Ponds 2, 3, 4, and 5.

The results of the TPH soil and surface water analyses for the ponds are shown in Table 3.35.

TABLE 3.35. Results of TPH Soil and Surface Water Analyses at Ponds

	<u>Soil TPH</u>	<u>Surface Water TPH</u>
Pond 1 ^(a)	1,520 - 17,600 mg/kg	2.5 mg/l
Pond 2	30 - 67,000 mg/kg	3.6 mg/l
Pond 3	18,000 - 141,000 mg/kg	3.1 mg/l
Pond 4	130 - 4,770 mg/kg	1.7 mg/l
Pond 5 ^(b)	340 - 710 mg/kg	2.2 mg/l

^aWest of power plant.

^bNear Alcan Cove.

Soil samples were taken by auger from 1- to 4-foot depths. Soil samples taken near Pond 2 detected 374 mg/kg of lead. Pond 3 soil samples detected 50.9 mg/kg of lead. Other soil samples were within background levels for lead.

Pond 1 levels appear to reflect drainage from the power plant. The increase in levels at Pond 3 possibly reflects a reported spill of several thousand gallons of diesel from Tank 123. The levels decrease at Ponds 4 and 5; however, a visible sheen was noticed at the outlet of Pond 5 to Alcan Cove.

3.14.3 1992 Investigation

During the 1992 investigation, a limited geophysical survey was conducted in the immediate vicinity of four of the five ponds to determine if any large quantities of buried metal was present. The results of the geophysical survey indicate the following:

Ponds 1 and 2--These ponds are located just south of North Road. The reconnaissance survey extended around both ponds out to a distance of about 50 feet. The survey indicated a utility line is located on the south side of the road and a culvert connects the two ponds. The culvert is obvious from the surface. A small area of buried metal is present near the southeast side of Pond 2.

Pond 3--This survey surrounded the pond, although most of the effort was concentrated in the area between the pond and the roads on the north and east sides. Two probable utility lines were detected near the road on the north side of the pond and a small anomaly, possibly a small piece of scrap metal, was observed on the southeast side of the pond, between the road and the pond.

Pond 4--The investigation covered only the north side of the pond because the south side was too steep to traverse with the instrument. No anomalies were detected on the north side of the pond.

Pond 5--This pond was not investigated because of the steep sides around the pond.

No other activities were performed at PS-3 during the 1992 field season because investigation of this site will require more than one field season to complete and there was insufficient time during the limited 1992 season.

3.14.4 Nature and Extent of Contamination

The samples that were collected and analyzed in 1988 along with visual observations indicate that the ponds and the sediments around the ponds are contaminated with TPH and metals. In addition, areas outside of the ponds have been contaminated by past spills and are leaching contaminants into the groundwater and the pond system. The extent of the contamination is not known.

3.14.5 Preliminary Risk Assessment

Samples collected in 1988 were not analyzed for constituents other than TPH and lead. Also, the site is currently used by the Air Force, and environmental concentrations are likely to be

different from 1988 concentrations. Therefore, a risk assessment cannot be performed at this time.

3.14.6 Future Actions

PS-3 is a complex site. It covers a large area of varying terrain and uncertain subsurface conditions. The major concern is related to TPH contamination in soil, surface water, and groundwater, including areas of potential subsurface free-floating product. Free-floating product may exist in limited areas as pools or seepage.

Restoration at PS-3 is aimed at identifying and remediating, as appropriate: 1) contaminated soil (including sediment) posing either a significant health risk or representing a significant groundwater contamination source; and 2) contaminated groundwater posing a significant health risk. Assuming the POL-contaminated surface water may continue to flow into the pond system, restoration is anticipated to include upgrading the pond system.

Significantly contaminated soil should be recommended for excavation and removal from the site, if practicable. Recommendations for soil removal should include the standard POL-release/UST-removal technique where the exact extent of affected soil removal is determined during excavation. However, one goal is to minimize excavation (and capping) of undisturbed areas. Therefore, if contaminated soil excavation is excessive or otherwise impractical, other, non-capping alternatives should be developed. Nonexcavation control alternatives may include techniques to: 1) intercept leachate in a controlled manner; and 2) hydraulically isolate undisturbed affected areas to help minimize leachate production.

It is anticipated that at least limited groundwater contamination will be identified. Groundwater should be evaluated in terms of: 1) nature and extent of contamination; 2) probable sources; and 3) remediation needs and goals. Recommendations for source control and groundwater treatment should be developed if and as needed, based on interpretation of available information.

In order to obtain the information to determine which remedial alternatives will be needed, the investigation presented in the Field Investigation Plan should be implemented. This plan calls for

surface water sampling, surface soil sampling, subsurface sampling, and groundwater monitoring wells.

3.15 PETROLEUM SPILL SITE PS-4: TANK 123

3.15.1 Site Background

Tank 123, a 490,000-gallon, above ground fuel tank surrounded by an unlined dike, is used for storage of diesel fuel. It is located on the west side of the island (Figure 3.28), approximately 1/4 mile west of the main base complex. The area around the tank has been graded and developed and no vegetation is currently growing in the area. Surface water drainage from around the tank flows into Pond No. 3 of the west end oil/water separator system.

Records indicate that this is the site of several spills, the largest being a 67,000-gallon spill in May 1984 (JRBA 1984). Of this total, 61,500 gallons of the spill were reportedly recovered for reuse, and the other 5,500 gallons were recovered and burned. This tank is located in a fuel tank farm consisting of nine fuel storage tanks scattered over an area 1/4 mile in diameter. Most of the tanks sit in depressions formed during their construction; overburden soils were removed and the tanks are founded on bedrock. This area around Tank 123 is currently being used by the Air Force as a refueling point for tanker trucks.

3.15.2 Previous Investigations

The dike and area around Tank No. 123 appeared clean in September 1987. There was no sign of spillage or leakage from the tank or fill/discharge lines. There was no oil sheen in the dike water or downstream of the sluice gate. The drums that contained oil-saturated sorbent pads, as mentioned in the Phase I report, had apparently been removed. Fill material had been placed around the tank by the 11th CEOS. During the September 1988 field investigation, a strong diesel odor was detected in the sample area around Tank 123.

Three piezometers were placed around this tank by the COE, Alaska District. The OVA headspace measurements and water levels were measured and recorded for each of the piezometers during the 1988 field investigation. No groundwater samples were collected. These results are summarized in Table 3.36.

TABLE 3.36. Tank No. 123 Piezometer Measurements

Piezometer Id	OVA Headspace Measurement (ppm)	Estimated Depth to Water ^(a) (ft)	Total Depth ^(b) (ft)
1	BG ^(c)	15.7	19.75
2	50	>15.3	15.3
3	BG ^(c)	16.8	19.25

^(a)Depth of water below ground surface.

^(b)Total depth of PVC well casing; includes casing stickup above ground surface.

^(c)Background.

Two auger borings were placed downslope from the tank (Figure 3.28). The TPH ranged from less than 75 to 230 mg/kg. Semivolatile analysis revealed the presence of di-n-butylphthalate (a common laboratory contaminant) at 0.59 mg/kg at a 3.5-foot sampling depth. No PCBs or pesticides were detected. Analytical results of volatile organics are summarized in Table 3.37.

TABLE 3.37. PS-4 Analytical Results of Volatile Organics

Analytes	PS-4-1 Depth (ft)		PS-4-2 Depth (ft)	
	2	3.5	2	9.5
Methylene Chloride	0.13	0.17	0.034J	0.046
Acetone	0.25	0.16	0.66	0.2
2-Butanone			0.18	
Toluene			1.8	
Xylenes				0.66
Styrene				0.65
Chloromethane	0.069J			
Vinyl Acetate				0.061J
4-Methyl 2-Pentanone				0.1

J = Estimated value.

All results reported in mg/kg.

The area around Tank 123 was remediated in 1991. Contaminated soil was removed and a drain system was installed around the inside of the diked area to intercept any spilled fuel.

3.15.3 1992 Investigation

No activities were performed at PS-4 during the 1992 field investigation.

3.15.4 Nature and Extent of Contamination

Samples collected and analyzed in 1988 show only minor amounts of contamination in the area outside of the berm of Tank 123. The area inside of the berm has been remediated since the last spill at this site. This indicates that probably not much near-surface contamination remains at PS-4. However, there is still the potential for groundwater contamination associated with past fuel spills.

3.15.5 Preliminary Risk Assessment

Limited soil sampling and lack of groundwater data from this site preclude the comparison of preliminary risk assessment information.

3.15.6 Future Actions

Future actions at PS-4 will concentrate on determining if the groundwater has been affected by past spills. To accomplish this, groundwater monitoring wells will need to be installed and sampled. These wells should be installed in conjunction with the work at PS-3, as stated in the IRP Field Investigation Plan.

3.16 PETROLEUM SPILL SITE PS-5: POWER PLANT

3.16.1 Site Background

The base power plant is located on the north side of the island (see Figure 3.29). The area around the power plant has been extensively modified for both the building and the storage areas near the building. All vegetation has been removed and the area is graded flat. Surface water runoff from PS-5 drains to the west

FIGURE 3.29

LEGEND

- △ 1988 SOIL SAMPLING LOCATION
- 1988 GROUNDWATER SAMPLING LOCATION

LOCATION MAP

in a man-made channel and enters Pond 1 of the West End Oil Water Separator (PS-3). Because the entire area around the power plant is disturbed, appreciable amounts of runoff are produced from this site.

The power plant has been the site of several documented diesel fuel spills since 1978. During the September 1987 site visit, the power plant was undergoing an expansion, and the concrete pads for several aboveground fuel tanks were being installed. Because of construction, the ditch between the power plant and the road running to the West End Oil/Water Separator Ponds (PS-3) had been obliterated. During the fall 1988 field investigation, there was evidence of diesel fuel spillage in several areas around the power plant. Darkened soils were noted around the south perimeter of the main building.

3.16.2 Previous Investigations

During the 1988 investigation, soil boring samples were taken from 2 feet to 9.5 feet, and one groundwater sample was taken from the bottom of a soil boring on the south side of the building (Figure 3.29). TPH levels for the soil samples ranged from 15,000 mg/kg at 2 feet to less than 210 mg/kg at 9 feet. Three samples analyzed positive for naphthalene, measuring 2.6 mg/kg at 2 feet, 3.3 mg/kg at 4 feet, and 4.2 mg/kg at 5 feet. Also detected was 2-Methylnaphthalene, measuring 5.9 mg/kg at 2 feet and 8.2 mg/kg at 4 feet. Benzo(a)pyrene was detected in one sample, measuring 5.8 mg/kg at 9.5 feet. The compound di-n-butylphthalate (a common laboratory contaminant) was detected at 0.9 mg/kg (estimated) and isophorone at 0.53 mg/kg (estimated). Volatile compounds were detected as follows: methylene chloride (a common laboratory contaminant) at 0.025 mg/kg (estimated) at 9.5 feet; and 0.11 mg/kg (estimated) at 5 feet. Acetone (a common laboratory contaminant) was detected at 0.17 mg/kg (estimated) in one 5-foot sample. Toluene and ethylbenzene were detected at the 5-foot sample depth at 0.081 and 0.11 mg/kg (both estimated), respectively. Xylenes were detected at 1.76 and 0.06 mg/kg at the 4- and 5-foot sampling depths in one location, respectively. A single groundwater sample was analyzed for TPH and 100 mg/l was detected.

3.16.3 1992 Investigation

The only activity performed during the 1992 investigation at PS-5 was a mapping survey of the site. Figure 3.29 was developed from that activity. The investigation of this site should be performed in conjunction with the investigation at PS-3 and PS-4. For this reason, this site was not investigated in 1992.

3.16.4 Nature and Extent of Contamination

Samples collected in 1988 show a wide variation in TPH concentrations and only minor amounts of volatile and semivolatile compounds. This is consistent with the reported fuel spills of at this site. The areas of the spill will have high TPH but it will not migrate very far. Sampling completed to date has focused on visually affected areas and has been very limited in scope. Therefore, the extent of the contamination cannot be defined at this time.

3.16.5 Preliminary Risk Assessment

Because of the limited quantity of data available, a risk assessment has not been performed for this site.

3.16.6 Future Actions

Because of the lack of data available for PS-5, additional investigations are recommended. Surface sampling, subsurface sampling, and the installation of groundwater monitoring wells as outlined in the Field Investigation Plan should be performed. Investigation of this site should be performed in conjunction with the investigation of the West End Oil/Water Separator (PS-3) as this site is directly upgradient of PS-3.

3.17 PETROLEUM SPILL SITE PS-6: BUILDING 605 JP-4 SPILL

3.17.1 Site Background

Building 605 (PS-6) is located southwest of the main headquarters of the base (Figure 3.30). The building is used as a refueling area and as part of the vehicle maintenance shop. To the east, north, and south of PS-6 are buildings and roads. To the west is rolling

FIGURE 3.30. PS-6 Refu

LOCATION MAP

LEGEND

- 1988 SAMPLING LOCATION
- GEOPHYSICAL SURVEY LINE
- INTERPRETED FEATURES
- ISOLATED BURIED METAL
- POSSIBLE AREA OF BURIED METAL
- UTILITY LINE

tundra that slopes to the west and south. Surface water runoff from this site flows to the west down a natural drainage.

This spill site was originally included as an IRP site because an oil/water separator inside Building 605 failed to contain a spill of about 100 gallons of JP-4 fuel. During the September 1987 site visit, oil spillage was evident in the immediate vicinity below the separator outlet, and a strong petroleum odor was noted. A stressed vegetated area, about 200 by 200 feet, west of Building 605 (Figure 3.30) was observed during the September 1988 site investigation. A small pipe that discharges from Building 605 may be the cause of the stressed area. During the 1988 site visit, it was noted that antifreeze may have been discharging from this pipe. Aluminum cans observed in the stressed area appeared to be undergoing chemical corrosion.

3.17.2 Previous Investigations

During the 1988 investigation, three borings were made along an area of stressed vegetation west of Building 605 (Figure 3.30). Soil TPH ranged from 27,000 mg/kg at 2 feet to 170 mg/kg at 6 feet. Three of the six samples collected exceeded background levels for barium (69 to 356 mg/kg), two for chromium (43.6 to 110 mg/kg), five for lead (47 to 305 mg/kg), and five for zinc (37 to 239 mg/kg). One soil sample detected 1 mg/kg PCB. No semivolatile organic compounds were detected. Analytical results of volatile organics are presented in Table 3.38.

TABLE 3.38. PS-6 Analytical Results of Volatile Organics

	PS-6-2 Depth (ft)		PS-6-3 Depth (ft)	
	2	3.5	2	6
Methylene Chloride	1.5J	0.046J		
Acetone	15	0.22		
2-Butanone			4.6	1.0
Benzene		0.032J		
Toluene	2.1J	0.37		
Ethylbenzene		0.054J		
Xylenes	5.1	1.46	7	
Chlorobenzene			1.1J	0.65

J = Estimated value.

All results are reported in units of mg/kg.

A site tour in September 1991 disclosed that contaminant releases were continuing in this area. The water being discharged from Building 605 had a thick oily sheen on it.

During 1992, the Air Force reported that the oil/ water separator inside Building 605 had been repaired and future discharges would not contain any petroleum products.

3.17.3 1992 Investigation

During the 1992 investigation, sampling grid markers set up by the 11th CEOS were surveyed and a geophysical survey was performed. The area investigated during the geophysical survey is immediately west of the refueling maintenance shop (Figure 3.30). The site is mostly a weedy field crossed by a drainage. The drainage starts at a pipe in the bottom of the bank near the west side of Building 605 and crosses the site to the southwest. The drainage becomes progressively wider with increasing distance from the pipe until the drainage is overgrown with weeds and no longer definable. The soil is visibly oil-contaminated within the drainage. Several communication cables that cross the site lie on the ground.

The extent of the EM conductivity investigation covered approximately 1.7 acres and is shown in Figure 3.30. The EM data were collected at 5-foot intervals along grid lines 25 feet apart. The EM data are presented as contour maps in Appendix B. The objective of the investigation was to identify buried features to avoid during drilling.

Figure 3.30 shows the location of features identified by the survey. Anomalies observed over the cables seen at the site are not shown in Figure 3.30, as the source of those anomalies is known. Several utility lines were delineated by the investigation.

In addition to the interpreted utilities, isolated buried metal was encountered in three locations, as shown in Figure 3.30.

No other work was performed during the 1992 field investigation.

3.17.4 Nature and Extent of Contamination

The samples collected in 1988 indicate there are areas of high TPH contamination downstream from Building 605. In addition, elevated concentrations of heavy metals were found along with some volatile organic compounds. The extent of the contamination is not known because of the small number of samples collected (three borings), and the relatively large area where there is visible surface contamination. In addition, it is not known whether the groundwater in the area has been affected by the disposal activities.

3.17.5 Preliminary Risk Assessment

Some of the samples collected in 1988 exceeded the human health risk preliminary risk levels for TPH in soil (Appendix C). However, there is sufficient data to determine the risk from this site to both human health and the environment.

3.17.6 Future Actions

PS-6 is scheduled to be remediated by the 11th CEOS outside of the IRP program. Therefore, this site will not be considered for any future IRP work.

3.18 PETROLEUM SPILL SITE PS-7: BUILDING 616 VEHICLE MAINTENANCE SHOP

3.18.1 Site Background

PS-7 is located south of the main base headquarters (Figure 3.31). This area is heavily used for the maintenance, repair, and storage of various vehicles. Runoff from around Building 616 is directed through a culvert to the west into an open field of tundra.

This area was originally rated as having potential for environmental damage because of the storage of drums, batteries, vehicle oil, and hydrochloric acid onsite, and the facility's operation of an oil/water separator. No evidence of oil-stained ground or other releases was observed around the building perimeter during the September 1987 site visit. However, stressed vegetation associated with two drainage outlets at the west end of the Building 616 parking area was noted. In 1988, it appeared that paint residues and associated solvent vapors were being discharged from the northern outlet.

3.18.2 Previous Investigations

During the 1988 investigation, three sample locations were placed within the drainage courses emanating from these discharge points (Figure 3.31). TPH levels from below detection levels (60 mg/kg) to 2,600 mg/kg were detected. Of the four samples taken, all exceeded background for barium (45 to 140 mg/kg), and three exceeded background for lead (27 to 64 mg/kg). All exceeded background for zinc (42 to 95 mg/kg). No pesticides or PCBs were detected. Volatile organic compounds detected included methylene chloride, acetone, and 2-butanone (all common laboratory contaminants). Methylene chloride concentrations were 0.02 and 0.024 mg/kg (both estimated) at a 2-foot depth and 0.078 mg/kg at a 3.5-foot depth. Acetone was detected in two samples at the 2-foot depth at 0.04 (estimated)

FIGURE 3.31. PS-7 \

LOCATION MAP

LEGEND

— GEOPHYSICAL SURVEY LINE

INTERPRETED FEATURES

- AREA OF BURIED METAL
- POSSIBLE BURIED METAL
- ISOLATED BURIED METAL
- UTILITY LINE
- ⬡ 1988 SAMPLING LOCATION

and 0.11 mg/kg. The compound 2-butanone was detected in one 2-foot sample at 0.79 mg/kg (estimated).

3.18.3 1992 Investigation

During the 1992 investigation, a sampling grid set up by the 11th CEOS was surveyed and a geophysical survey of the site was conducted along the grid lines.

The area covered by the EM investigation was approximately 0.9-acre and is shown in Figure 3.31. Data were collected at 5-foot intervals along grid lines 25 feet apart. Contour maps of the conductivity and in-phase data are located in Appendix B. The objective of the investigation was to identify buried features to avoid during drilling.

The data indicate several buried features are present at the site (Figure 3.31). An area of buried metal was delineated centered in the southern half of the site. The anomalies defining this area indicate a source wider than a utility line. However, a utility line crossed at a shallow angle may also appear similarly wide. Two utility lines were interpreted in its vicinity and the area of buried metal may be the combined effect of these. One of the utility lines lines up directly with the manhole shown in Figure 3.31. One isolated metal object was identified beneath the road and two possible isolated metal objects were also mapped.

This was the only work performed under the IRP project at PS-7 in 1992.

3.18.4 Nature and Extent of Contamination

The samples collected in 1988 indicate minor amounts of contamination at PS-7. TPH concentrations were up to 2,600 mg/kg and several metals concentrations exceeded background. Minor amounts of VOCs were found. The limited number of samples collected makes it impossible to delineate the full extent of the contamination.

3.18.5 Preliminary Risk Assessment

None of the contaminants found during the 1988 investigation were at concentrations exceeding the preliminary risk levels developed in Appendixes C and D. However, because the extent of the contamination is still not known, a complete risk assessment cannot be performed at this time.

3.18.6 Future Actions

Because there is insufficient information at PS-7 to determine if remediation is necessary or how much area is affected, additional investigations are recommended. These investigations should include surface sampling, subsurface sampling, and groundwater monitoring wells, as outlined in the Field Investigation Plan. If this site is to be investigated by the 11th CEOS, then a sampling plan should be prepared and reviewed by ADEC prior to starting the investigation.

3.19 PETROLEUM SPILL SITE PS-8: OLD WHITE ALICE

3.19.1 Site Background

An existing facility has been dismantled and replaced by a new communication facility at this site. While Old White Alice was operational, a spill from a PCB transformer was reported. During the construction of the new facility, a large amount of earth moving and hauling in of additional fill was required. These activities have destroyed all surface indications of where the reported spill occurred. No evidence of the past PCB oil spills referenced in the Phase I report could be located during the September 1988 site visit.

The Old White Alice Communication Station, PS-8, (Figure 3.32) is located on the northeast portion of the island on a bluff overlooking the north shore. The area surrounding the site is rolling tundra with several small lakes to the south. Surface water runoff drains both towards the north and the south, depending on the location within the site. The new parking lot may produce some runoff because of the compaction of the fill material, but most runoff from the area will infiltrate as soon as it reaches the tundra.

FIGURE 3.32.

- LEGEND
- ⊕ BORING LOCATION
 - ⊙ MANHOLE
 - 1988 SAMPLING LOCATIONS
 - LIGHT POLE

S-8 Old White Alice

3.237

26 February 1993

3.19.2 Previous Investigations

During the 1988 investigation, two soil borings were located in relatively undisturbed areas near the new facility (Figure 3.32). Two samples were taken from each boring; one at 2 feet and one at 4 feet. The highest TPH concentration found was 220 mg/kg at a depth of 4 feet. Maximum concentrations at 2 and 4 feet were PCB-1254 and PCB-1260 compounds (36 to 54 mg/kg), 4,4'-DDT (3.3 to 4.2 mg/kg), and methoxychlor (3.2 to 4.2 mg/kg) were detected.

3.19.3 1992 Investigation

The geophysical investigation (EM) covered approximately 1.1 acres and is shown in Figure 3.33. The area investigated with the EM survey was mostly limited to the gravel parking lot, extending into the grass only on the two northernmost lines and at the west end of the lines. The west edge of the area was limited by the top of the bluff. The EM data were collected at 5-foot intervals along survey lines 25 feet apart. Contour maps of EM conductivity and in-phase values are in Appendix B. The objective of the investigation was to locate buried objects to be avoided during drilling.

The site was gridded by the geophysics crew. The grid was established relative to the building as shown in Figure 3.33. The northwest corner of the building was assigned grid coordinate 100 east, 0 north. The north edge of the building defined grid east-west direction.

The results of the EM investigation are shown in Figure 3.33. A very conductive area has been delineated beneath the gravel parking area and is shown in the figure as an area of buried metal. One explanation for the cause of the high conductivities is that the electrical grounding mat for the electronics used in the building is present at that location. Except for a single possible buried metal object on the southwest corner of the survey area, no other buried metal was identified by the investigation.

During the 1992 field investigation, five samples were taken from soil borings (Figure 3.32). Three borings were within the parking area and were advanced approximately 5 feet to the bottom of the fill and a sample was then taken. The other two were from the

area that had the highest PCB concentrations in 1988. These two borings were advanced to approximately 4 feet and a sample taken. These samples were analyzed for pesticides/PCBs. One sample (Boring 2) had a PCB concentration (Aroclor 1260) of 140 $\mu\text{g/kg}$. All the other samples were at less than the detection limit. TPH concentrations ranged from 30 mg/kg to 1,959 mg/kg (Table 3.39).

3.19.4 Nature and Extent of Contamination

Results of the 1988 and 1992 investigations indicate there is some PCB contamination at PS-8, but it appears to be limited to isolated areas. Some TPH contamination, up to approximately 2,000 mg/kg, is also present at the site. The TPH contamination appears to be fairly wide spread. The building at PS-8 is heated with fuel oil, and fresh spills were evident around the fill spout of the underground tank. The widespread TPH contamination may be associated with the mishandling of this fuel oil.

3.19.5 Preliminary Risk Assessment

Two out of nine samples taken at PS-8 have PCB concentrations above the human health risk preliminary risk levels developed in Appendix C. All other analytes were at concentrations less than the PRLs.

3.19.6 Future Actions

Sampling results from PS-8 indicate there is a small isolated area near Borings 4 and 5, with PCB concentrations above the PRGs. This area should be excavated until acceptable levels are reached. Excavated soil should be shipped off the island to a permitted disposal facility that can accept PCB-contaminated soil. Onsite analysis for PCBs should be performed in order to expedite the removal effort. Once this small area of contamination is removed, an NFAD document should be prepared.

FIGURE 3.33. PS-8 Gc

- LEGEND**
- ⊙ MANHOLE
 - GEOPHYSICAL SURVEY LINE
 - Ⓜ METAL OBSERVED AT SURFACE
 - INTERPRETED FEATURES
 - ⊕ AREA OF BURIED METAL
 - POSSIBLE BURIED METAL
 - LIGHT POLE

3.241

26 February 1993

physical Interpretive Map

TABLE 3.39. Positive Results from Onsite (CSL) Data at PS-8

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
P8-B1	OWAB16.5 (6.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	29.92	
P8-B2	OWAB25.0 (5.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1959.21	
P8-B3	OWAB35.5 (5.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1825.79	
P8-B4	OWAB44.0 (4.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	103.81	
P8-B5	OWAB54.0 (4.0)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	1159.53	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

3.20 PETROLEUM SPILL SITE PS-9: ASPHALTIC DRUM STORAGE

3.20.1 Site Background

PS-9 is located in the central portion of the island (Figure 3.34). The land around this site is gently rolling tundra. The tar-like substance that covers the ground at PS-9 greatly increases the amount of runoff in the immediate area. However, most of the runoff, which flows to the south, infiltrates once it reaches the vegetated areas. This site is within the watershed of the water gallery.

This area has seen a moderate amount of construction in the past; however, native vegetation is returning in those areas where structures have been torn down. This area is not being actively used by the Air Force at this time and no evidence of recreational use has been noted.

3.20.2 Previous Investigations

The Phase I report noted that there were large numbers of 55-gallon drums of Pavex, some of which were leaking, located on a hardstand. During the 1987 site visit, the investigation team found Pavex, a proprietary asphalt product used for roadway construction, on Shemya in a 50-foot by 85-foot area. The site also contained the remains of rusted drums.

During the 1988 field visit, the Pavex drums were no longer at the site. All that remained were two 100-foot-diameter tar-covered asphalt pads (Figure 3.34). The tar (Pavex) cover, estimated to be 3 to 6 inches thick, is relatively soft and readily shows footprints or tire tracks.

Two soil borings were taken on the downslope edge of each pad (Figure 3.34). The samples were analyzed for TPH and volatile organics from borings to 3.5 feet. All TPH levels were at or below 200 mg/kg. Methylene chloride and acetone (common laboratory contaminants) were the only volatile organic compounds detected. Methylene chloride concentrations ranged from 0.005 (estimated) to 0.021 mg/kg. Acetone concentrations ranged from 0.009 (estimated) to 0.042 mg/kg (estimated).

FIGURE 3.34. PS-9

LEGEND

Ⓜ METAL OBSERVED
AT SURFACE

INTERPRETED FEATURES

AREA OF BURIED METAL

○ POSSIBLE BURIED METAL

● ISOLATED BURIED METAL

ISOLATED BURIED METAL

⊗ 1988 SAMPLING LOCATIONS

— UTILITY LINE

3.20.3 1992 Investigation

During the 1992 field investigation, a geophysical (EM) survey was conducted at PS-9.

The EM conductivity investigation covered approximately 1.2 acres and is shown in Figure 3.34. Data were collected at 5-foot intervals along lines 25 feet apart. Contour maps of EM conductivity and in-phase measurements are in Appendix B. Data were not collected over the peat-covered road. The objective of the investigation was to locate buried objects to be avoided during drilling.

The grid was established by the geophysical crew. A metal signpost and the south side of Spine Road shown in Figure 3.34 were the references for the grid. The signpost was assigned grid coordinates 250 east, 300 north. The south edge of the road defined the east-west direction for the grid.

The results of the investigation are shown in Figure 3.34. An area of buried metal was identified north of the peat-covered road, in the west half of the site. Additionally, numerous possible isolated metal objects were identified and are shown in the figure. A buried utility line was interpreted near the southern boundary of the site.

The geophysical survey was the only work performed at PS-9 during the 1992 IRP investigation.

3.20.4 Nature and Extent of Contamination

The two samples that were collected and analyzed in 1988 indicate very little contamination at this site. Low TPH (<200 mg/kg) concentrations were found and the methylene chloride and acetone may have been laboratory contaminants. This indicates that the compounds in the tar material are not being leached out and transported into the environment. Because of this, it is unlikely that the groundwater has been affected by the activities at this site.

3.20.5 Preliminary Risk Assessment

Analytical results from PS-9 are less than the preliminary risk levels developed in Appendixes C and D. However, more sampling is necessary to more fully characterize potential risk from the site.

3.20.6 Future Actions

Since the site is within the watershed of the water gallery, the tar-like substance should be removed to avoid direct contact. The amount of tar-like substance to be removed is approximately 1,000 cubic yards. This volume should be excavated and perhaps used as an additive to the asphalt plant located on the island. Additionally, during closure, areas of buried metal should be excavated to determine if they pose a risk to the water gallery. Excavation of these areas may generate an additional 500 cubic yards of material, although this volume is difficult to determine since the depth of the buried metal is unknown. After initial removal activities are completed, confirmatory samples should be collected and analyzed for TPH and VOCs and excavation should be continued if contamination persists. Excavated soil should be placed on a hardstand for bioremediation. After site contamination has been remediated, an NFAD document should be prepared.

3.21 PETROLEUM SPILL SITE PS-10: BASE OPERATIONS TERMINAL JP-4 SPILL

3.21.1 Site Background

This site is located in the south-central portion of the island (Figure 3.35). Most of the area around this site has been developed and is covered with buildings, asphalt, or concrete. Considerable amounts of precipitation runoff is generated in this area. The runoff is routed south under the runway and into the ocean.

On August 9, 1983, a cracked fuel tank in a damaged C-5A aircraft spilled approximately 50 gallons of JP-4 on the asphalt parking area near the Base Operations Terminal. The Base Fire Department hosed the fuel off the asphalt with water where it drained into sandy soils to the south of the runway. The

LEGEND
* SOIL SAMPLE LOCATION
& IDENTIFICATION

FIGURE 3.35.

LOCATION MAP

fuel-saturated soils were reportedly excavated, stored in barrels, and appropriately disposed at a fire training area.

3.21.2 Previous Investigations

During the 1988 investigation on Shemya, no visual evidence of the spill at PS-10 could be located and no samples were obtained.

3.21.3 1992 Investigation

During the 1992 field investigation, four surface soil samples were collected from PS-10 (Figure 3.35). No visual evidence of the historical spill was noticeable. Samples were taken from the south side of the aircraft parking area where the water that was used to wash down the fuel spill is reported to have infiltrated into the soil. All four samples were analyzed for TPH at the onsite laboratory. The results showed TPH concentrations ranged from 4,617 to 16,683 mg/kg (Table 3.40).

No geophysical survey was performed at PS-10.

3.21.4 Nature and Extent of Contamination

The TPH results of the four samples appear to indicate a widespread amount of petroleum contamination. This is not unusual at airports where large numbers of airplanes are fueled and serviced; small spills and dripping oil are common. All of the petroleum products that are spilled onto the asphalt are washed off with the rainfall to the area where the samples were collected.

3.21.5 Preliminary Risk Assessment

All of the analytical results to date are less than the PRLs that are developed in Appendixes C and D. This indicates that, based on risk, no remedial actions are necessary at this site.

3.21.6 Future Actions

Because of the potential for additional contamination from the servicing of aircraft in the general vicinity of PS-10, additional sampling or remedial actions are not appropriate at this time. In the future, when this area is no longer in use, additional sampling to

TABLE 3.40. Positive Results from Onsite (CSL) Data at PS-10

LOCATION	SAMPLE-ID (a)	PARAMETER	UNITS	VALUE	QUALIFIER (b)
P10-001	PS10S10.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	4617.06	
P10-002	PS10S20.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	7640.42	
P10-003	PS10S30.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	8986.32	
P10-004	PS10S40.5 (0-0.5)	TOTAL PETROLEUM HYDROCARBONS	MG/KG	16683.48	

(a) The information within the parenthesis indicates sample depth (feet).

(b) For an explanation of the qualifiers used, refer to the introductory section of Appendix A.

delineate the full extent of the contamination is recommended. Based on future sampling efforts, areas that require remediation can be delineated.

3.22 PETROLEUM SPILL SITE PS-11: CURRENT BARREL DRUM STORAGE

3.22.1 Site Background

This site is located around the five hardstands near abandoned Runway C (see Figure 3.36). This area in the southwest portion of the island is dominated by small sand dunes that are overgrown with native vegetation. Much of the area around PS-11 is part of Runway C and is paved. Rainfall runs off of the paved areas and infiltrates into the sand. No defined surface water channels exist near PS-11.

This area is currently being used for drum storage and for above ground tanks of fuel oil for use in heating systems. Drums are stored on four of the five hardstands, while the fifth is used for the heating oil storage area. The physical condition of the drums ranges from good to poor. Some drums are rusted, and some have leaked fluids onto the hardstands. Staff from OEHL requested that sampling for PCB and oil contamination be performed in this area during the 1988 investigation.

3.22.2 Previous Investigations

During the 1988 investigation, only three of the hardstands were being used for drum storage. Three borings were completed downslope of the north pad, two borings downslope of the center pad, and three borings downslope of the south pad (Figure 3.36). The analysis detected above background levels of TPH for the center pad (33,000 mg/kg at 2 feet and 42,000 mg/kg at 1 foot) and at the south pad (320 mg/kg to 360 mg/kg at 1 foot). Methoxychlor was detected at the center pad at 0.09 mg/kg. No other pesticides were detected. Naphthalene and di-n-butylphthalate were detected in two samples. Naphthalene was detected in one 2-foot sample at 1.9 mg/kg, while di-n-butylphthalate was estimated at 0.2 and 0.26 mg/kg at 2- and 4-foot depths at one boring location (PS-11-8). The VOCs detected included xylenes (one sample estimated at 0.01 mg/kg at 1-foot depth) and trichloroethene (two samples, 0.012 and 0.064 mg/kg at 1- and 2-foot depths, respectively).

Additionally, a groundwater sample was collected from a nearby well. Total petroleum hydrocarbons were detected at 30 mg/l. No volatile or semivolatile organic compounds were detected. Metals were within or below background levels.

3.22.3 1992 Investigation

No sampling was performed during the 1992 investigation. However, visual inspection of the area showed that the number of drums stored at this site has been greatly reduced. Drums are stored on only two of the five hardstands, with one being used for an above ground storage tank area for heating fuel oil.

3.22.4 Nature and Extent of Contamination

The 1988 sampling at this site indicates areas of high TPH contamination in areas adjacent to the pads. Because of the deteriorated nature of the asphalt, of which the pads were made, there is a possibility of contamination beneath the pads. It also appears that the groundwater may be impacted, based on the one groundwater sample.

Based on the size of the area and the small number of samples taken to date, the extent of the contamination present cannot be estimated. However, most of the contamination does seem to be petroleum-based.

3.22.5 Preliminary Risk Assessment

The sampling accomplished to date indicates there are areas within PS-11 that have TPH concentrations above the human health risk PRLs developed in Appendix C. The total area that has concentrations of TPH above the PRLs is not known because the extent of the contamination is not known at this time. All other contaminants found are less than their respective PRLs.

3.22.6 Future Actions

Additional sampling is recommended at PS-11. Surface samples, subsurface samples, and groundwater samples are needed to determine the full nature and extent of contamination. The investigations outlined in the Field Investigation Plan should be implemented at PS-11 to obtain the necessary information to

LOCATION MAP

FIGURE 3.36. PS-11 Curr

LEGEND

- 1988 SAMPLING
LOCATION

assess risk and select an appropriate remedial measure, if necessary.

3.23 PETROLEUM SPILL SITE PS-83: ABANDONED TANK FARM

3.23.1 Site Background

This site, added by the USAF during the 1988 field visit, is the location of an abandoned tank farm (Figure 3.37). This area is located in the center of the island. Most of the area is covered by tundra with the exception of the dugout areas not yet revegetated. All that remain of the tank farm are earthen berms that surrounded each pair of tanks and abandoned pipelines. The field team also observed POL seeps at this site during the 1988 site investigation. Runoff from this site enters man-made ditches and is routed south, eventually entering the ocean.

3.23.2 Previous Investigations

In 1988, the soil samples (Figure 3.37) from this site yielded TPH values from less than 420 to 1,100 mg/kg at a depth of 2 feet, less than 150 mg/kg at the 3-foot depth, and from less than 170 to 430 mg/kg at a depth of 4 feet. Semivolatiles detected were limited to di-n-butylphthalate (estimated at 0.26 mg/kg) and nitrophenol (26 mg/kg). Volatiles detected in most samples included methylene chloride (ranging from 0.22 to 0.33 mg/kg), acetone (ranging from 0.24 [estimated] to 2.6 mg/kg), and 2-butanone (ranging from 0.13 [estimated] to 0.49 mg/kg). Benzene was detected at an estimated concentration of 0.084 mg/kg in one sample. Also, toluene was detected at an estimated concentration of 0.067 mg/kg in one sample.

3.23.3 1992 Investigation

During the 1992 field investigation, a reconnaissance level geophysical (EM) survey was conducted at PS-83 to check for large areas of buried metal. This reconnaissance covered approximately 20 acres. It covered an area south of the radar station and west and north of Cross Island Road. The west side of the survey was a ditch and pipeline running approximately north-south about 300 to 400 feet west of the road. The area was investigated by walking lines approximately 40 feet apart.

Most of the anomalies encountered at PS-83 were in the vicinity of the old berms present throughout the site. Most of the anomalies were detected in the southern third of the site, although some anomalies were encountered associated with the berms elsewhere in the site. Some of the anomalies were located inside the berms and some were just outside. Few anomalies were detected in the open areas, which comprise the majority of the site. These open areas apparently have not been disturbed. Anomalies encountered in open areas appear to be associated with cables (probably communication cables) crossing the site.

This was the only work performed at PS-83 during the 1992 IRP field investigation.

3.23.4 Nature and Extent of Contamination

The soil samples obtained in 1988 indicate low level TPH contamination at PS-83, along with minor amounts of volatile and semivolatile compounds. The number of samples analyzed was insufficient to determine the extent of contamination, and compounds other than those encountered in 1988 may be present within other parts of the site.

3.23.5 Preliminary Risk Assessment

All of the contaminants found in the 1988 sampling episode were at concentrations less than the PRLs developed in Appendixes C and D. However, because the nature and extent of contamination has not been completely defined for PS-83, a complete risk assessment cannot be accomplished at this time.

3.23.6 Future Actions

Because the nature and extent of contamination has not been defined at PS-83, future sampling is recommended. Surface, sub-surface, and groundwater samples will need to be collected as outlined in the IRP Field Investigation Plan.

FIGURE 3.37. PS-83

LEGEND

○ 1988 SAMPLING LOCATION

Summary

4.0 SUMMARY

To obtain information needed to assess future remedial alternatives for the IRP sites on Shemya AFB, a field investigation was performed in 1992. Twenty-two sites were studied to varying degrees, from a reconnaissance survey with no sampling to complete site characterization. Table 4.1 presents a summary of the investigations performed at each site. Information developed during this investigation was combined with existing information to determine the nature and extent of contamination on a site-by-site basis.

As a part of the investigation, two preliminary risk assessments were performed, one focusing on human health and one on environmental receptors. These risk assessments developed Preliminary Risk Levels (PRLs) that were compared to constituent concentrations found at each site. Five sites were found to have at least one constituent above the human health PRLs (Table 4.2) along with one of the background locations. Five sites also had contaminant concentrations above the environmental PRLs (Table 4.3).

Based on the nature and extent of contamination present (if known) and the PRLs, a recommendation is made as to whether a site requires remediation, requires further investigation, or needs no further action. Table 4.4 presents recommendations for each of the 22 sites. Three sites are recommended for no further action, 4 sites for remedial action, 3 sites are being transferred to other programs, and 12 sites still require additional investigations to recommend future actions.

TABLE 4.1. Sites Investigated in 1992

<u>Site</u>	<u>Types of Investigation</u>
Water Gallery	Surface sampling, well points, monitoring wells, geophysics, surveying
FT-1	Surface sampling, subsurface sampling, monitoring wells, geophysics, surveying
FT-2	Surface sampling, subsurface sampling, monitoring wells, geophysics, surveying
FT-3	Geophysics
SW-4	Surface sampling, subsurface sampling, geophysics, surveying
SW-5	Surface water sampling, sediment sampling, geophysics, surveying
SW-10	Surface sampling, monitoring wells, geophysics, surveying
SW-12	Surface sampling, monitoring wells, geophysics, surveying
SW-14	Geophysics, surveying
PS-1A	Surface sampling, subsurface sampling, surveying
PS-1B	Surface sampling, subsurface sampling, geophysics, surveying
PS-2	Surface sampling, surveying
PS-3	Geophysics
PS-4	None
PS-5	Surveying
PS-6	Geophysics, surveying
PS-7	Geophysics, surveying
PS-8	Subsurface sampling, geophysics, surveying
PS-9	Geophysics, surveying
PS-10	Surface sampling, surveying
PS-11	None
PS-83	Geophysics

TABLE 4.2. Contaminants of Potential Concern that Exceed Human Health Preliminary Risk Levels (PRLs)

Sample No.	Depth (ft.)	Chemical	Concentration	Qualifier	Laboratory	PRL Concentration	PRL Source
GROUNDWATER COPCs			(ug/L)			(ug/L)	
<i>FT-2: Aircraft Mockup</i>							
FT2-ER		Chloroform	2	J	OFFSITE	0.19	WQC
FT2-W1		Benzene	512		ONSITE	5	MCL
FT2-W1DL		Benzene	710	D	OFFSITE	5	MCL
FT2-W1DL		Methylene Chloride	420	BDJ2	OFFSITE	0.19	WQC
<i>Water Gallery</i>							
CM1		Trichloroethylene	7.2		ONSITE	5	MCL
SO2		Trichloroethylene	5.1		ONSITE	5	MCL
WGW4		Trichloroethylene	24.9		ONSITE	5	MCL
WG4		Trichloroethylene	16.4		ONSITE	5	MCL
WGW4		Trichloroethylene	22.2		ONSITE	5	MCL
WG7		Trichloroethylene	17.6		ONSITE	5	MCL
WGW7		Trichloroethylene	18.2		ONSITE	5	MCL
A-WGW3		Antimony(a)	31.1		WC	10	MCL-p
A-WGW3		Beryllium	0.75		WC	0.0039	WQC
A-WGW3		Chromium	53.4		WC	50	MCL
A-WGW3		Manganese	2170		WC	710	NC
A-WGW4		Antimony(a)	31.1		WC	10	MCL-p
A-WGW4		Beryllium(a)	0.5		WC	0.0039	WQC
A-WGW4		Manganese	892		WC	710	NC
A-WGW4		Trichloroethene	15		WC	5	MCL

TABLE 4.2. (cont.)

Sample No.	Depth (ft.)	Chemical	Concentration	Qualifier	Laboratory	PRL Concentration	PRL Source
SURFACE SOILS COPCs			(ug/kg)			(ug/kg)	
<i>FT-1: Lightning Strike</i>							
FT1T21.0	1	PCDD	0.3		OFFSITE	0.066	C
FT1T310.5	0.5	PCDD	4.9		OFFSITE	0.066	C
FT1T310.5	0.5	PCDF	1.1		OFFSITE	0.066	C
FT1T41.2	1.2	PCDD	0.9		OFFSITE	0.066	C
FT1T41.2	1.2	PCDF	0.1		OFFSITE	0.066	C
FT1T41.2D	1.2	PCDD	15		OFFSITE	0.066	C
FT1T41.2D	1.2	PCDF	1.1		OFFSITE	0.066	C
<i>SW10: Barrel Bay</i>							
SW10-114	0.5	Arsenic	6000		OFFSITE	5700	C
SW10-116	0.5	Arsenic	6900		OFFSITE	5700	C
<i>SW-12: Scrap Metal Disposal Site</i>							
SW12-117	0.5	Arsenic	10300		OFFSITE	5700	C
SW12-118	0.5	Arsenic	6100		OFFSITE	5700	C
SW12-120	0.5	Arsenic	8300		OFFSITE	5700	C
<i>WG: Water Gallery</i>							
WG-109	0.5	Chrysene	35000		OFFSITE	1400	C
WG-109	0.5	Benzo(a)anthracene	43000		OFFSITE	1400	C
WG-109	0.5	Benzo(b)fluoranthene	61000		OFFSITE	1400	C
WG-109	0.5	Benzo(k)fluoranthene	21000		OFFSITE	1400	C
WG-109	0.5	Benzo(a)pyrene	36000		OFFSITE	1400	C
WG-109	0.5	Indeno(1,2,3-cd)pyrene	20000		OFFSITE	1400	C
WG-109	0.5	Arsenic	6800		OFFSITE	5700	C
SEDIMENT COCs			(ug/kg)			(ug/kg)	
<i>Background Samples</i>							
BSSD-126	0.5	Arsenic	8300		OFFSITE	5700	C
(a) = detection limit							
Notes:							
MCL = Safe Drinking Water Act Maximum Contaminant Level							
MCL-p = Proposed Safe Drinking Water Act Maximum Contaminant Level							
WQC = Ambient Water Quality Criteria							
NC = Risk-based Concentration/Noncarcinogenic Effects							
C = Risk-based Concentration/Carcinogenic Effects							
ONSITE = Close Support Laboratory (on Shemya Island)							
OFFSITE = Contract Laboratory Program Methodology (samples sent to offsite lab)							
WC = Woodward-Clyde Data							
J = estimated value							
D = dilution							
B = blank contamination							

**TABLE 4.3. Contaminants of Potential Concern that
Exceed Ecological Preliminary Risk Levels (PRLs)**

Site	Chemical	Media
FT-2	Benzene	Soil
SW-5	Chromium	Sediment
SW-5	Copper	Sediment
SW-5	Lead	Sediment
SW-5	Zinc	Sediment
SW-10	Cadmium	Soil
SW-10	2-Methylnaphthalene	Groundwater
SW-10	Chromium	Soil
SW-10	Lead	Soil
SW-10	Zinc	Soil
Water Gallery	Indeno(1,2,3-cd)pyrene	Soil
Water Gallery	Phenanthrene	Soil
PS-1B	Cadmium	Soil

TABLE 4.4. Future Actions at Each Site

Site	Action
Water Gallery	Water treatment to remove TCE
FT-1	Additional investigation
FT-2	Additional investigation
FT-3	Additional investigation
SW-4	Site grading and monitoring wells
SW-5	No further action
SW-10	Remedial action (impermeable cap) and seawall stabilization
SW-12	Remedial action (permeable cap)
SW-14	Additional investigation
PS-1A	No further action
PS-1B	Additional investigation
PS-2	No further action
PS-3	Additional investigation
PS-4	Additional investigation
PS-5	Additional investigation
PS-6	POL regulated (state)
PS-7	POL regulated (state)
PS-8	Remedial action
PS-9	Remedial action
PS-10	POL regulated (state)
PS-11	Additional investigation
PS-83	Additional investigation

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