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PHASE II RCRA FACILITY INVESTIGATION WORK PLAN FOR SWMU 141

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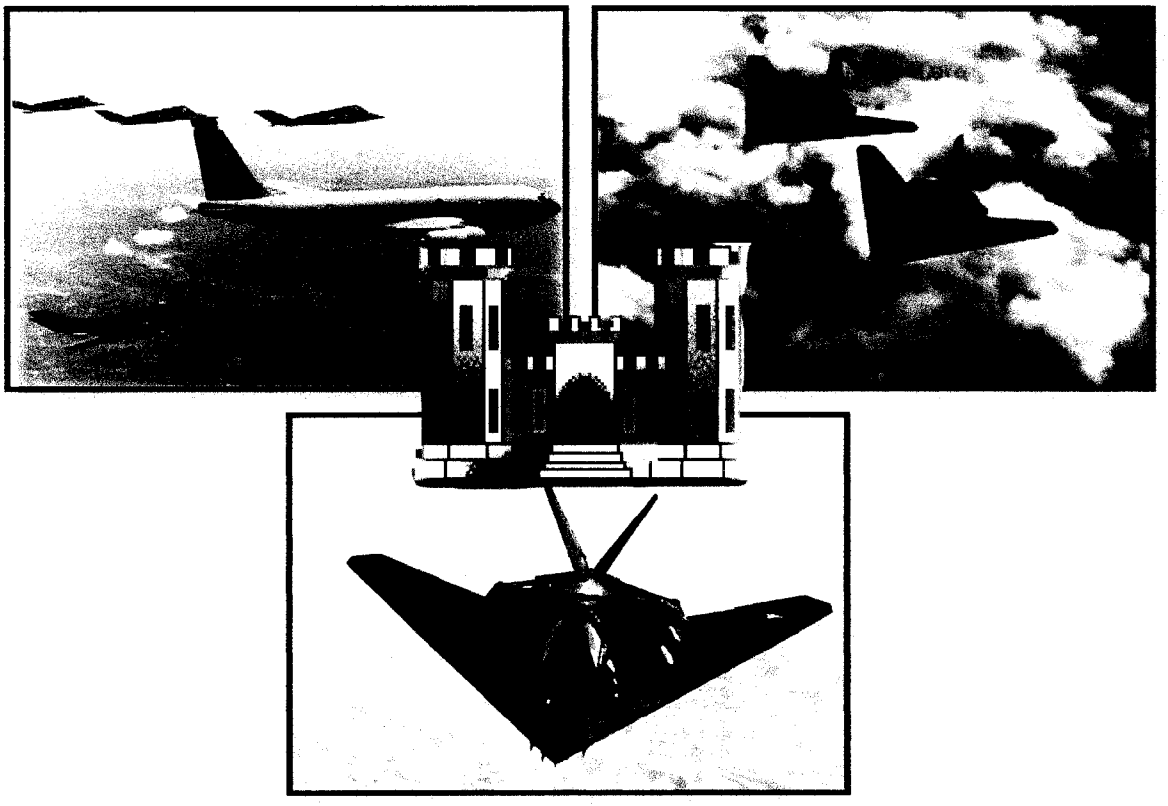

Holloman Air Force Base
New Mexico

August 2003

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Headquarters, Air Combat Command
Langley Air Force Base, Virginia

49 CES/CEV
Holloman Air Force Base, New Mexico

PHASE II RCRA FACILITY INVESTIGATION WORK PLAN SOLID WASTE MANAGEMENT (SWMU) 141

HOLLOMAN AIR FORCE BASE (HAFB) NEW MEXICO

Prepared for:

New Mexico Environment Department
Hazardous Waste Bureau
Albuquerque, New Mexico

Prepared by:

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Under Contract To:

U. S. Army Corps of Engineers
Omaha, Nebraska

Revision 0

August 2003

PHASE II RCRA FACILITY INVESTIGATION WORK PLAN SOLID WASTE MANAGEMENT (SWMU) 141

HOLLOMAN AIR FORCE BASE (HAFB) NEW MEXICO

TABLE OF CONTENTS

List of Acronyms and Abbreviations i

1 Introduction 1-1
- 1.1 Objectives 1-1
- 1.2 Approach 1-1
- 1.3 Document Organization 1-2

2 Site Background 2-1
- 2.1 Physiography 2-1
- 2.2 Geologic Setting 2-1
- 2.3 Surface Water 2-1
- 2.4 Groundwater 2-2
- 2.5 Site Conditions 2-2

3 Summary of Previous Investiagations 3-1

4 Supplemental Investigation Activities 4-1
- 4.1 Drainage Gallery Assessment 4-1
- 4.2 DPT Soil and Groundwater Assessment 4-1
- 4.3 Laboratory Analysis 4-2

5 QAPP Addendum 5-1

6 SSHP Addendum 6-1
- 6.1 Scope of Work 6-1
- 6.2 Air Monitoring 6-1
- 6.3 Hazard Identification 6-2
  - 6.3.1 Chemical Hazards 6-2
    - 6.3.1.1 Total Volatile Organics/Petroleum Hydrocarbons 6-2
    - 6.3.1.2 Metal Compounds 6-3
  - 6.3.2 Physical Hazards 6-3
    - 6.3.2.1 Fire and Explosion 6-4

6.3.2 Physical Hazards 6-3
6.3.2.1 Fire and Explosion 6-4
6.3.2.2 Heat and Cold Stress 6-4
6.3.2.3 Moving Vehicles, Traffic Safety 6-4
6.3.2.4 Pedestrian Traffic 6-5
6.3.2.5 Manual Lifting and Material Handling 6-5
6.4 Emergency Contacts 6-5
6.5 Hospital Route 6-5
7 References 7-1

Tables

Table 1 Summary of Samples Collected and Analysis Performed During the 1993 Site Investigation at SWMU 141 (Radian Corporation, 1993).

Table 2 Summary of Analytical Results from the 1993 Site Investigation at SWMU 141 (Radian Corporation, 1993).

Figures

Figure 1 Site Location Map

Figure 2 PA/SI and Proposed Soil Boring Locations

Figure 3 Hospital Route Map

Appendices

Appendix A 1993 PA/SI DPT Soil Boring Logs

Appendix B Holloman Air Force Base Standard Operating Procedures

Appendix C Forms

Appendix D Method Detection Limits

LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
Bhate	Bhate Environmental Services, Inc.
BTEX	Benzene, toluene, ethylbenzene and xylene
DPT	Direct Push Technology
eV	Electron volt
FID	Flame Ionization Detector
ft	feet
HAFB	Holloman Air Force Base
IDW	Investigation-Derived Waste
IP	Ionization Potential
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
MSL	Mean Sea Level
NFA	No Further Action
NMED	New Mexico Environment Department
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PCB's	Polychlorinated biphenols
PCE	Perchloroethylene
pCi/g	Pico Curies/gram
PEL	Permissible Exposure Limits
PID	Photo Ionization Detector
PPE	Personal Protective Equipment

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

PPM	Parts Per Million
QAPP	Quality Assurance Project Plan
RCRA	Resource and Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	Reporting Limit
SHSO	Site Health and Safety Officer
SI	Site Investigation
SOP	Standard Operating Procedures
SSHP	Site Safety and Health Plan
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
ug/kg	micrograms per kilogram
USACE	U.S. Army Corps of Engineers
VOC	Volatile Organic Compound
WAD	Work Authorization Directive

1 INTRODUCTION

The U.S. Army Corps of Engineers, Omaha District (USACE) has retained Bhate Environmental Associates, Inc. (Bhate) to prepare this Phase II RCRA Facility Investigation (RFI) Work Plan for Solid Waste Management Unit (SWMU) 141 at Holloman Air Force Base (HAFB), New Mexico. Bhate prepared this document for HAFB under the Service Contract with the USACE (Contract No. DACA-45-03-D-0008, Delivery Order (DO) No. 1, Work Authorization Directive (WAD) 01).

The purpose of this Phase II RFI Work Plan is to address comments received from the New Mexico Environment Department (NMED) regarding the HAFB request for no further action (NFA) and site close out of SWMU 141. The request for NFA was based on the original Preliminary Assessment (PA) and Site Investigation (SI) conducted in 1993 (Radian Corporation, 1993). This document was subsequently submitted to NMED by HAFB in December 2001 (HAFB, December 6, 2001). Section 2 of this document summarizes the original PA conducted for the site.

1.1 Objectives

The overall objective of the Phase II RFI is to collect additional data requested by NMED to further support the HAFB request for NFA at SWMU 141. The primary objective is to describe the scope of work, tasks, and methodologies associated with collecting this additional data. The results of the Phase II RFI will be used to prepare a revised recommendation for NFA at SWMU 141.

1.2 Approach

The approach adopted to meet the stated objectives includes conducting a field investigation to determine the condition of the washrack drainage gallery and to collect and analyze soil and groundwater samples from specific locations at SWMU 141. Soil samples will be collected using direct push technology (DPT) sampling equipment. Groundwater samples will be collected using DPT groundwater sampling methodologies and equipment such as temporary well screens and inert tubing. A detailed description of the scope of work, which will guide the field work, is presented in Section 4.0. The Phase II RFI at SWMU 141 will include the following activities:

- Visual inspection of the washrack drainage gallery.
- Advancement of 2 DPT soil borings and collection of soil samples.
- Collection of two groundwater samples from DPT borings for laboratory analyses.
- Analyze soil and groundwater samples for Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), Total Petroleum Hydrocarbons (TPH), and 8 RCRA metals. Additionally, soil samples will be analyzed for radionuclides (gross alpha, gross beta and gamma)

1.3 Document Organization

Section 2.0 of the document contains a detailed description of the site background. A summary of analytical results from the original PA/SI conducted in 1993 is presented in Section 3.0 (Radian Corporation, 1993). The RFI activities are described in Section 4.0. Section 5.0 is an addendum to Base-wide Quality Assurance Project Plan (QAPP) and Section 6.0 contains the Site Safety and Health Plan (SSHP) addendum for this site. References are contained in Section 7.0.

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2 SITE BACKGROUND

Holloman AFB is situated in south central New Mexico, in the northwest central part of Otero County (Figure 1). HAFB has a population of 6,000 and occupies about 50,000 acres in the northeast quarter of Section 1 Township 17 South, Range 8 East. The White Sands Missile Range testing facilities occupy additional land extending northward from the Base. Private and public owned lands border the remainder of HAFB. The major highway servicing HAFB is Highway 70, which runs southwest from the town of Alamogordo and separates HAFB from publicly owned lands. The nearest town of appreciable size is Alamogordo which has a population of approximately 35,000. Alamogordo and is located approximately 7 miles east.

2.1 Physiography

HAFB is located in the Tularosa Basin which is bounded by the San Andreas Mountains to the west and the Sacramento Mountains to the east. The basin's interior plain has low relief, with altitudes ranging from about 4,000 feet (ft) above mean sea level (MSL) in the southwest to approximately 4,400 ft above MSL in the northeast. The bordering mountains rise abruptly to altitudes of 7,000 to 12,000 ft above MSL.

The climate in the Tularosa Basin is arid with annual precipitation averaging 7.9 inches. Most of the precipitation falls as rain from May to October. The winter period is characterized by clear skies with light and intermittent snowfall. March through May is characterized by strong winds with extensive periods of blowing sand and dust. The mean annual evaporation rate in the basin is 67 inches per year. This evaporation rate results in a net annual precipitation rate of minus 59 in per year which results in a net loss of groundwater due to evapotranspiration (Radian Corporation, 1993).

2.2 Geologic Setting

The Tularosa Basin is a bolson, or a basin with no surface drainage outlet. The sediments of the basin are carried in by water that does not escape. Sediments in the basin are derived from the surrounding limestone, dolomite and gypsum deposits of the surrounding mountains. Coarse and heterogeneous alluvial materials are present along the boundary of the basin and the mountains. Fine-grained and fluvial sediments derived from the mountains are located in the center part of the basin. The near surface sediments are alluvial, eolian and playa or lacustrine in origin. In many locations, wind and water have reworked the sediments into discontinuous layers of silt, sand and clay. These fine-grained sediments contain gypsum crystals (Radian Corporation, 1993).

2.3 Surface Water

The Tularosa Basin is a closed basin with no surface water outlet. Surface water is lost from the basin by evaporation, transpiration, or groundwater infiltration. A small amount of water collects in Lake Lucero located approximately 20 miles southwest of HAFB. Several southwest

trending arroyos cross the Base including Malone Draw, Rita's Draw, and Dillard Draw. Malone Draw and Rita's Draw join the Lost River in the center of the Base property. The Lost River is the largest arroyo and trends southwest towards the White Sands installation. Dillard Draw, however, empties into Lake Holloman and Lake Stinky located immediately southwest of the Base property line. Surface water on the base is diverted to drains and ditches that connect with these southwest trending arroyos.

2.4 Groundwater

Groundwater occurs in unconfined conditions within the unconsolidated bolson deposits beneath HAFB. The primary source of recharge is stream runoff from the western side of the Sacramento Mountains. Water migrates through these alluvial deposits into the finer grained sediments of the center of the basin. The depth to water beneath the base ranges from less than 5 feet to 50 feet below the ground surface (bgs). Base-wide, groundwater flow direction is influenced by the surface water flow along southwest trending arroyos. In general, groundwater flow direction is west and southwest depending upon the immediate proximity of these drainage features.

Groundwater quality in the Tularosa Basin is of potable quality at the recharge areas in close proximity to the Sacramento Mountains and becomes increasing mineralized toward the central portion of the basin and discharge areas (Radian Corporation, 1993). At several SWMUs located across the base, monitoring wells contain water with greater than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS); (Foster Wheeler, 2002). Potable water wells are nonexistent on HAFB and Potable water for the base and the city of Alamogordo is derived from the nearby Sacramento Mountains. The only production water well, used for livestock irrigation, is located 10 miles southwest of the SWMU-141. At present, a base-wide study of groundwater quality, particularly TDS, is being performed. The purpose of the study is to further document the characteristics and quality of groundwater.

2.5 Site Conditions

SWMU 141, also known as the Pad 9 Washrack Area and/or IRP Site SD-27, is located east of Taxiway F, near Building 882. The washrack configuration consists of a circular concrete pad approximately 150 feet in diameter. The pad slopes gently to the center toward a grate covered drainage gallery. The drainage gallery then flows through a trough in the pad to a discharge pipe which extends to an unlined drainage pit located approximately 160 feet south of the pad. The pit is approximately 50 ft in diameter and approximately 7 ft deep.

The washrack was reportedly used to wash down drones and manned aircraft that had flown through clouds of nuclear blast materials in the late 1940s and early 1950s (Radian Corporation, 1993). In 1993, Colonel Forrest Spresster, formerly of the HAFB Bioenvironmental flight, was interviewed to obtain more information about SWMU 141. According to Colonel Spresster, interviews with civilian Base employees familiar with the washrack were conducted by Bioenvironmental Flight in the 1970s. These interviews were performed in order to determine the nature of activities conducted on the washrack. From these interviews, Bioenvironmental

Flight determined that planes washed at SWMU 141 had been involved with nuclear explosion outfall testing. In these projects, planes were flown through blast clouds to collect fallout samples from nuclear explosions. These planes were equipped with air sampling equipment to collect particulate matter resulting from the nuclear tests. The planes were washed at SWMU 141 with water. According to Colonel Spresster, the washrack was not used for other maintenance activities. Runoff from the washrack drained into the unlined drainage pit directly south of the pad area.

According to Colonel Spresster, in 1976, Bioenvironmental Flight collected samples from the bottom of the unlined drainage pit for radiation analysis. According to Colonel Spresster, the sample results indicated no radiation above normal background levels.

3 SUMMARY OF PREVIOUS INVESTIAGATIONS

In 1993, Radian Corporation advanced and collected samples from five soil borings at SWMU 141. The locations of these borings are presented in Figure 2. Two soil borings (BH-27-02, BH-27-03) were advanced in the unlined pit that received the water from the washrack. Soil boring BH-27-01 was advanced along the discharge pipe, between the pit and the washrack, and soil boring BH-27-04 was advanced adjacent to an abandoned transformer that is located in the immediate area of the site. The transformer was identified during PA activities and was selected for investigation due to the presence of stained concrete around the transformer. It is assumed that the transformer serviced Building T884, which was situated between the washrack and the settling pit. A background boring (BH-27-05) was also previously advanced 500 feet northeast of the washrack to assess background radiological conditions. All five borings were continuously sampled and logged. Copies of the boring logs are presented in Appendix A.

Based upon screening criteria, five soil samples were collected and submitted for laboratory analysis. These soil samples were analyzed for petroleum hydrocarbons (Method 8015ME), purgeable fuel hydrocarbons (Method 8015MP), gross alpha and beta particles (Method 9310) and polychlorinated byphenols (PCBs); (Method 8080). Table 1 summarizes the samples selected for analysis, the sample location, and the analysis performed. Table 2 summarizes the constituents detected at concentrations exceeding their respective reporting limit (RL).

The majority of the soil samples collected at SWMU 141 (BH-27-01, BH-27-02, and BH-27-03) were analyzed for radiological parameters such as gross alpha and gross beta. The analytical report does not indicate if gamma radiation was either detected or if gamma measurements were performed on these samples. The SI report compared the values detected at the washrack drainage pit with background values and regulatory standards. Gross alpha and gross beta concentrations were not determined to be in excess of the range of background levels (BH-27-05) or were quantified in excess of solid waste disposal limits.

The soil sample collected at the pit (BH-27-03), from 8 to 10 feet bgs was analyzed for petroleum hydrocarbons and hydrocarbon constituents. The sample exhibited a TPH concentration of 430 mg/kg as kerosene, and volatile petroleum constituents, ethylbenzene at 680 ug/kg, toluene at 51 ug/kg, and xylenes at 2700 ug/kg (Radian Corporation, 1993). Benzene was not detected in the sample above the reporting limits. Hydrocarbon staining was observed in all four borings advanced in proximity to SWMU-141. The hydrocarbon staining was observed from 8 feet to approximately 16 feet bgs. in these borings. From the boring logs, the depth of the drainage pit was determined to be approximately 7 feet bgs.

The soil sample collected adjacent to the abandoned transformer (BH-27-04), was analyzed for PCBs to determine if the concrete surface staining could potentially be transformer oil. The laboratory analysis of the soil sample indicated a PCB-1254 concentration of at 200 ug/kg compared to the regulatory clean-up goal of 20 mg/kg. The observed concentration of 200 ug/kg is approximately 100 times less than the clean-up criteria. In addition, a risked based exposure concentration for PCB-1254 at this site was determined to be 987 ug/kg. This risk-based level is nearly 5 times greater than the reported value of 200 ug/kg.

Groundwater was encountered at depth ranging from 5 to 8 ft bgs in the four borings installed at SWMU 141. However, no groundwater samples were collected or analyzed during the SI. The bulk of hydrocarbon staining observed in the boreholes was reported between 8 and 16 feet bgs, which was located just below the observed depth of groundwater at the site. Lithology encountered during boring advancement was comprised of clayey-sand, sandy clay and silty sand. A continuous 2 ft thick clay layer was observed across the site at approximately 3 to 5 ft bgs.

4 SUPPLEMENTAL INVESTIGATION ACTIVITIES

Phase II RFI sampling activities for SWMU 141 have been designed to augment information from the original site PA/SI and address NMED comments dated March 5, 2002. Additionally, the scope development was based on discussions between representatives of HAFB and NMED on March 3, 2003. These activities include:

- Document the condition of the washrack drainage gallery located on the washrack.
- Collect soil and groundwater samples to characterize the presence of any hazardous constituents beneath the washrack drainage gallery.
- Collect soil and groundwater samples from the area of the drain pit to determine if any hazardous constituents are present in the subsurface directly below the pit.

The following subsections provide detailed descriptions for completing each of these activities.

4.1 Drainage Gallery Assessment

The washrack drainage gallery is a long narrow box (approximately 16 inches wide and 70 ft long), located below grade in the center of the washrack pad. The gallery is covered with a high-traffic metal grate. The depth of the drainage gallery and whether it has a bottom is unknown. The drainage gallery contains sediments from surface runoff across the concrete pad. It is assumed that these sediments collected in the gallery over time after all design operations for the washrack had ceased. These sediments, the integrity of the gallery, and the soil beneath the gallery were not assessed during the SI.

The integrity of the drainage gallery will be examined by removing the grating, and excavating the sediment from the gallery. The sediment will be placed on and covered with plastic on the concrete portion of the washrack during the investigation. In order to assess the characteristics of the sediment, a representative sample of the material will be collected and submitted for laboratory analysis. After excavation, the condition of the gallery will be documented. To address soil beneath the gallery, a DPT soil boring will be advanced through the center of the structure. Details of the DPT soil boring operations are provided in subsection 4.2. Upon completion of the DPT boring, the sediment removed from the gallery will be returned pending analytical results and the steel cover will be replaced. If contaminated sediment is encountered, these sediments will be isolated and their disposition addressed as per HAFB Standard Operating Procedure (SOP) 9 (see Appendix B).

4.2 DPT Soil and Groundwater Assessment

The field work for the Phase II RFI will be conducted in accordance with HAFB SOPs 1 through 10. These SOPs outline methodologies for soil boring advancement, soil groundwater sampling, soil sample description, field screening, sample management, equipment decontamination, and

chain-of-custody procedures. These SOPs are located in Appendix B and will be referenced to accomplish specific tasks.

Prior to boring advancement, all necessary HAFB utility clearance permits (digging permits), flightline and security permits will be obtained in accordance with SOP HAFB-3. Three DPT soil borings will be advanced at the site to an anticipated depth of 14 ft bgs, Figure 2. Continuous soil samples will be collected from these borings in accordance with HAFB SOP-4. A fraction of each sample will be screened in the field for volatile organic compounds using a PID in accordance with SOP HAFB-6. A fourth soil boring, located downgradient of the drainage gallery if screening results indicate contamination beneath the gallery. Based on headspace screening results, two soil samples from each soil boring will be selected for laboratory analyses.

A total of 7 soil samples, including one duplicate sample, will be submitted to the laboratory for analysis. Soil samples will be collected, field screened and managed in accordance with SOP HAFB-1 and SOP HAFB-5. The samples will be placed on ice and shipped under strict chain-of-custody to Associated Laboratories located in Orange, California.

The DPT soil borehole will be converted to a groundwater sampling point by extending the probe and boreholes at least three feet below the water table. Groundwater samples will be collected directly from the borehole after releasing the drive point and partially retracting the rods. Groundwater samples will be collected with a peristaltic pump using low-flow sampling techniques. Teflon tubing connected to the pump, will be inserted through the drive rods and used as conduits to bring groundwater to the surface. The procedures for groundwater sampling are outlined in SOP HAFB-8. A single volume of the sampling device will be purged prior to sample collection (i.e. one volume of the teflon tubing). After sample collection, the DPT boreholes will be abandoned and the site will be restored in accordance with SOP HAFB-10. It is not anticipated that soil cuttings will be generated during DPT sampling, however, small amounts of water used for equipment decontamination and purge water will be generated during the field investigation. These materials will be handled in accordance with SOP HAFB-9.

A total of four groundwater samples, including one duplicate sample will be collected for laboratory analysis. Water samples will be collected and managed in accordance with SOP HAFB-1 and SOP HAFB-8. Subsequent to collection, samples will be placed on ice and shipped under strict chain-of-custody to Associated Laboratories located in Orange, California.

4.3 Laboratory Analysis

Six soil samples will be analyzed for VOCs by Method 8260, SVOCs by Method 8270, Total Petroleum Hydrocarbons by Method 8015, radionuclides (gross alpha, gross beta and gamma) by Method 900.0 and 900.1 and RCRA metals (arsenic, barium, chromium, cadmium, lead, mercury, selenium and silver). The RCRA metals will be analyzed by 6000 Series Method with the exception of mercury, which will be analyzed by Method 7421. The duplicate sample associated with the sampling event will be analyzed for VOCs only.

Two groundwater samples will be analyzed for VOCs by Method 8260, SVOCs by Method 8270, Total Petroleum Hydrocarbons by Method 8015, RCRA metals (arsenic, barium, chromium, cadmium, lead, mercury, selenium and silver) by 6000 Series Method with the exception of mercury, which will be analyzed by Method 7421. Field filtration will be performed for the fraction of samples submitted for metals analysis. The duplicate sample associated with the sampling event will be analyzed for VOCs only.

5 QAPP ADDENDUM

The laboratory performing the chemical sample analysis will follow the Chemical Data Acquisition Plan (CDAP), Volume II Quality Assurance Project Plan (QAPP); (Ebasco Services, Inc. and Groundwater Technology Government Services Inc., 1995). Two exceptions are noted:

1. No split samples will be submitted to the USACE laboratory; and

2. The contractor laboratory will be Associated Laboratories in Orange, California.

3. The quality assurance coordinator is Ms. Diane Lazarus.

Table 3 is a matrix indicating the analytical requirements for SWMU 141. All samples will be analyzed for VOCs by Method 8260, SVOCs by Method 8270, radionuclides by Method 900.0 and 900.1, and RCRA metals by 6000 Series Method with the exception of mercury, which will be analyzed by Method 7421. Appendix D details the method detection limits by method for chemical constituents indicated for SWMU 141.

6 SSHP ADDENDUM

All work will be conducted in accordance with Basewide SSHP (Foster Wheeler Corporation, 2000). However, the following addendum to the SSHP outlines project-specific information related to DPT sampling at SWMU 141. Contaminant profiles are provided in Table 4. Key personnel and their responsibilities are presented in Table 5. All personnel involved in on-site work will read Basewide SSHP and this addendum. Each onsite person will then sign the acknowledgment statement in Table 6. A project-specific contact summary sheet (Table 7) will be posted during site work.

6.1 Scope of Work

Section 4.0 of the RFI Work Plan provides a detailed description of the scope of work to be conducted during soil sampling activities at Holloman AFB. The following sections outline the addendum to the Basewide SSHP

6.2 Air Monitoring

Air monitoring action levels have been developed to indicate the chemical concentrations in the breathing zone that require an upgrade in the level of personal protective equipment (PPE). General air monitoring guidelines are presented in Basewide SSHP. All workers on-site have been properly fitted with PPE (i.e. respirators) and have been trained in their use (i.e. donning and doffing). Air monitoring measurements will be taken in the breathing zone of the worker most likely to have the highest exposure.

Transient peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a 5-minute period. The action levels apply to all tasks performed on this site. Air monitoring falls into two categories: direct reading/environmental monitoring and personal exposure monitoring. A PID, equipped with a 10.2 electron volt (eV) lamp, calibrated with isobutylene and referenced to benzene-in-air (or a FID calibrated with and referenced to methane-in-air), will be used to monitor the breathing zone of workers to assess the potential presence of volatile organic vapors. BTEX each have ionization potentials (IP) below ten and will produce relative responses of approximately 1:1 using the PID or FID as described above.

PID/FID readings are to be obtained during DPT operation from the breathing zone. Monitoring will continue intermittently throughout sampling activities at a frequency of once every 15 minutes or at some other frequency as determined by the Site Health and Safety Officer (SHSO).

Because of the low exposure limit of benzene (1.0 parts per million (ppm) for Time Weighted Average (TWA), it is not easily detected by the PID/FID. That is, the exposure limit of benzene would be indicated by a barely noticeable meter deflection of one unit on a PID/FID. And, color indicator tubes (Draeger, Sensidyne or equivalent) typically used to detect the presence of benzene in the breathing zone of workers are impractical for projects of this nature. Therefore, benzene will not be sampled separately unless a sustainable reading above background is obtained on the PID/FID. The Level C action level of 10 ppm (total ionizable volatile organics)

on the PID/FID will provide an adequate margin of safety since benzene is not expected to contribute significantly to vapor exposure levels.

6.3 Hazard Identification

6.3.1 Chemical Hazards

Previous soil analytical results from the sites were reviewed during plan addendum preparation. At SWMU 141, petroleum hydrocarbons and radionuclides have been detected. None of these constituents exceed recognized risk-based action levels (EPA Region III, 1995). Radionuclides did not exceed background conditions. TPH did not exceed the New Mexico Environment Department (NMED) guideline of 940 mg/kg for Holloman AFB. Contaminants suspected to be present can be grouped into three basic categories: volatile organics/petroleum hydrocarbons, semi-volatile organics, and metals. Although toxicological information regarding these compounds is provided in Table 4 and subsequent text, it must be noted that there is minimal risk of significant exposure to these compounds due to the small mass of each soil sample. However, significant exposure could occur if soil samples are saturated with "free product" or vapors persist in the breathing zone.

6.3.1.1 Total Volatile Organics/Petroleum Hydrocarbons

A variety of sources, including chlorinated and non-chlorinated solvents, petroleum products (such as used oil, diesel, or gasoline) and/or benzene, toluene, ethylbenzene and xylene (BTEX) containing compounds, may contribute to the total VOCs detected on the site.

Exposure to the vapors of many chlorinated organic compounds such as perchloroethylene (PCE) and trichloroethylene (TCE) above their respective permissible exposure limits (PELs) will result in similar symptoms. The actual PELs as set by the Occupational Safety and Health Administration (OSHA) vary depending on the specific compound.

Over exposure to the vapor of these compounds can cause irritation of the eyes, nose and throat. The liquid if splashed in the eyes may cause burning irritation and damage. Repeated or prolonged skin contact with the liquid may cause dermatitis. Acute overexposure to chlorinated hydrocarbons depresses the central nervous system exhibiting such symptoms as, drowsiness, dizziness, headache, blurred vision, in coordination, mental confusion, flushed skin, tremors, nausea, vomiting, fatigue and cardiac arrhythmia. Alcohol may make symptoms of overexposure worse. If alcohol has been consumed, the overexposed worker may become flushed. Some of these compounds are considered to be potential human carcinogens.

Exposure to the vapors of BTEX above each compound's respective PEL, as defined by OSHA, may produce irritation of the mucous membranes of the upper respiratory tract, nose and mouth. Overexposure may also result in the depression of the central nervous system. Symptoms of such exposure include drowsiness, headache, fatigue and drunken-like behavior. Benzene has been determined to be carcinogenic, targeting blood-forming organs and bone marrow.

The vapor pressures of these compounds are high enough to generate significant quantities of airborne vapor. On sites where high concentrations of these compounds are present, this can result in a potential inhalation hazard to the field team during subsurface investigations. However, if the site is open and the anticipated quantities of BTEX contamination are small (i.e., parts per million (ppm) concentrations in the soil or groundwater), overexposure potential will also be small.

6.3.1.2 Metal Compounds

The information in this section refers to a variety of metal compounds. This information is intended only to convey the broad scope of signs and symptoms of exposure and the control measures common to these compounds.

Overexposure to metal compounds has been associated with a variety of local and systemic health hazards, both acute and chronic in nature, with chronic effects being most significant. Direct contact with the dust of some metal compounds can result in contact or allergic dermatitis. Repeated contact with arsenic compounds may result in hyperpigmentation. Cases of skin cancer due to the trivalent inorganic arsenic compounds have been documented. The moist mucous membranes, particularly the conjunctivae, are most sensitive to the irritating effects of arsenic. Copper particles embedded in the eye result in a pronounced foreign body reaction with a characteristic discoloration of eye tissue.

Inhalation of copper and zinc dusts above their established PELs may result in flu-like symptoms known as "metal fume fever." Prolonged and repeated inhalation of the dust of inorganic arsenic compounds above the established PEL may result in weakness, loss of appetite, a sense of heaviness in the stomach and vomiting. Aerated, vapor or mists above the PEL may cause irritation of the eyes, nose, and throat. The exposure limits noted above are considered low enough to prevent systemic effects but it is not known if these levels will prevent local effects. It should also be noted that both PELs carry the *Skin* notation, indicating that these compounds adversely affect or penetrate the skin. OSHA specifies that skin exposure to substances carrying this designation is prevented or reduced through the use of the appropriate PPE.

6.3.2 Physical Hazards

The use of drill rigs, Geo-Probes, trucks and other mechanical equipment represent potentially serious construction hazards. Whenever such equipment is used, personnel in the vicinity should be limited to those who must be there to complete their assigned duties. All personnel must avoid standing within the turning radius of the equipment or below any suspended load. Job sites must be kept as clean, orderly and sanitary as possible. When water is used, care must be taken to avoid creating muddy or slippery conditions. If slippery conditions are unavoidable, barriers and warning signs must be used to warn of these dangers.

Personnel must never turn backs to operating machinery. No loose clothing, jewelry, hair or other personal items should be worn around rotating equipment or other equipment that could catch or ensnare these items. Personnel should stand far enough away from operating machinery to prevent accidental contact which may result from mechanical or human error.

Regular inspections must be made of the work area to insure safe operation of equipment and handling of materials. All personnel on site should be provided with the information and training necessary to avoid accidental injury. This includes assuring that the site is maintained in such a way that slip, trip and fall hazards are recognized and eliminated or controlled. Basic personal protective equipment (steel-toed boots, hardhats and safety eyewear) is required and use enforced.

6.3.2.1 Fire and Explosion

The possibility of flammable materials being encountered during field activities must be recognized and the appropriate steps necessary to minimize fire and explosion must be observed. This includes situations where excessive organic vapors or free products are encountered. When this occurs, monitoring with a combustible gas indicator (CGI), is required.

Excessive organic vapors, for the purposes of initiating the use of a CGI, are defined as sustained readings (i.e., continuous for at least five minutes) at or above 100 units or as an instantaneous reading at or above 1,000 units on the photo ionization detector (PID) or flame ionization detector (FID) in close proximity (within 1 foot or less) of the bore hole.

Isopropyl alcohol may be used during field activities. The following precautions will be observed: **Keep flammable and combustible materials away from heat, sparks and open flames. Do not smoke around flammable or combustible materials. Keep all flammable and combustible liquids in approved and properly labeled safety containers.**

At least one 10-pound ABC fire extinguisher must be located within 100 feet of each work area.

6.3.2.2 Heat and Cold Stress

Overexposure to temperature extremes can represent significant risks to personnel if simple precautions are not observed. Typical control measures designed to prevent heat stress including dressing properly, drinking plenty of the right fluids, and establishing an appropriate work/break regimen. Typical control measures designed to prevent cold stress also include dressing properly, and establishing an appropriate work/break regimen. The project manager must assure that the appropriate measures are observed.

6.3.2.3 Moving Vehicles, Traffic Safety

All vehicular traffic routes which could impact worker safety must be identified and communicated. Whenever necessary, barriers or other methods must be established to prevent injury from moving vehicles. This is particularly important when field activities are conducted in parking lots, driveways, ramps or roadways. OSHA 1926.201 specifies that when signs, signals or barricades do not provide adequate protection from highway or street traffic, flagmen must be utilized. **Flagmen must wear red or orange garments. Garments worn at night must be reflective.**

6.3.2.4 Pedestrian Traffic

The uncontrolled presence of pedestrians during drilling at a site can be hazardous to both pedestrians and site workers. Prior to the initiation of site activities, the site should be surveyed to determine if, when and where pedestrians may gain access. This includes walkways, parking lots, gates and doorways. Barriers or caution tape should be used to exclude all pedestrian traffic. Exclusion of pedestrian traffic is intended to prevent injury to the pedestrians and eliminate distractions which could cause injury to site workers.

6.3.2.5 Manual Lifting and Material Handling

Always bend at the knees when lifting heavy objects such as coolers and sample cases. Keep the weight close to your body. Do not twist or turn the body while lifting. Get help or use a mechanical device when lifting awkward shaped objects or objects too heavy to comfortably lift alone.

6.4 Emergency Contacts

Table 7 is a list of emergency contacts for the SWMU 141 Investigation. Mr. Jeffrey Pelfrey of Bhate Environmental, Inc. will serve as the Site Health and Safety Officer (SHSO) during the soil boring and sample collection activities.

6.5 Hospital Route

Figure 3 is a route map to the closest hospital.

7 REFERENCES

Ebasco Services, Inc. and Groundwater Technology Government Services Inc., *Chemical Data Acquisition Plan, Volume II Quality Assurance Project Plan*, 1995

Foster Wheeler Corporation, *Long Term Groundwater Monitoring Report, Holloman Air Force Base*, 2002

Foster Wheeler Corporation, *Basewide Health and Safety Plan*, 2000, *Standard Operating Procedures*.

Holloman Air Force Base Environmental Flight, *Standard Operating Procedures*

Holloman Air Force Base Environmental Flight, *Standard Letter Request for NFA at SWMU 141 to the New Mexico Environment Department*, December 6, 2001.

Radian Corporation, *Preliminary Assessment and Site Investigation Report, Investigation of Four Waste Sites, Holloman Air Force Base, New Mexico*, 1993.

TABLES

Table 1. Summary of Samples Collected and Analysis Performed During the 1993 Site Investigation at SWMU 141 (Radian Corporation, 1993).

SAMPLE NO.	DEPTH (bgs)	LOCATION	SAMPLE ANALYSIS
BH-27-1	0-2ft	Adjacent to discharge pipe between washrack and pit.	Radionuclides (Method 9030)
BH-27-2	6-8ft	Near the center of the pit	Radionuclides (Method 9030)
BH-27-3	8-10ft	Near the center of the pit	Radionuclides (Method 9030), Extractable Fuel Hydrocarbons (8015ME), Purgeable Fuel Hydrocarbons (8015MP)
BH-27-4	0-2ft	Adjacent to the abandoned transformer	PCBs (Method 8080)
BH-27-5	4-6ft	Background location for radionuclides. 500 ft. Northeast of the washrack.	Radionuclides (Method 9030)

Table 2. Summary of Analytical Results from the 1993 Site Investigation at SWMU 141 (Radian Corporation, 1993).

SAMPLE NO.	RADIONUCLIDES (METHOD 9030) (pCi/g)				FUEL HYDROCARBONS KEROSENE	ETHYLBENZENE (8015MP) ug/kg	TOLUENE (8015MP) ug/kg	XYLENES (8015MP) ug/kg	PCB 1254 (METHOD 8080) ug/kg
	GROSS ALPHA (pCi/g)	(RL) (1)	GROSS BETA (pCi/g)	(RL) (1)					
BH-27-01	**13.5**	3.71	**12.15**	3.71	**NA**	**NA**	**NA**	**NA**	NA
BH-27-02	**19.29**	3.76	**15.31**	5.22	NA	NA	NA	NA	NA
BH-27-03	**8.95**	3.63	**16.69**	5.52	430	680	51	2700	NA
BH-27-04	NA(2)	-	NA	-	NA	NA	NA	NA	200
BH-27-05	**7.35**	3.61	**7.68**	5.94	NA	NA	NA	NA	NA

Notes:

1. RL= Reporting Limit for radionuclides.
2. NA= Not Analyzed.

Table 3. Phase II RFI Work Plan Summary of Analytical Parameters for SWMU 141

ANALYTICAL CONSTITUENTS	SOIL SAMPLES	WATER SAMPLES
Gasoline-Range Organics/Diesel Range Organics Modified Method 8015	6 samples	0 samples
Volatile Organic Compounds Method 8260	7 samples (including 1 split duplicate sample)	4 samples (including 1 split duplicate sample)
Semi-Volatile Organic Compounds Method 8270	6 samples	3 samples
RCRA Metals Methods 6000s and 7421 (mercury)	6 samples	3 samples
Radionuclides Method 900.0 and 900.1	6 samples	3 samples

Table 4. Contaminant Profile

Chemical	Exposure Route	Symptoms of Overexposure
Total Volatile Organics (solvents/ Petroleum Hydrocarbons/ BTEX)	Inhalation, Ingestion	Staggering gait, slurred speech, mental confusion, shortness of breath, coughing, bloody sputum, chest pain, vomiting, abdominal pain, diarrhea
Metals	Skin contact, ingestion, inhalation	Skin and respiratory irritation, allergic symptoms, sensitization, acute, systemic and chronic disorders impacting a variety of target organs (depending upon the particular metal compound)

Table 5. Key Personnel and Responsibilities

NAME	PROJECT TITLE/ASSIGNED ROLE	PHONE NUMBERS
Jerry Pelfrey	Field Team Leader/SHSO	work: (505) 679-2100
To Be Announced	Field Samplers	work:
Jerry Pelfrey	First Aid Personnel (Note-all onsite personnel are required to be trained in CPR and first aid)	work: (505) 679-2100
Other Project Personnel		
Frank Gardner	Bhate Program Manager	work: (205) 999-0776
Judith McBride	Health and Safety Specialist	work: (205) 934-2487 cell: (205) 586-6200

Table 6. Agreement and Acknowledgment Sheet

Bhate Environmental, Inc. personnel have the authority to stop field activities at this site if any activity is not performed in accordance with the requirements of the Health and Safety Plan. All Bhate project personnel, subcontractor personnel, and visitors are required to sign the Agreement and Acknowledgment Sheet prior to conducting field activities at this site.

BHATE ENVIRONMENTAL ENGINEERS AND SCIENTISTS, INC.

AGREEMENT AND ACKNOWLEDGMENT STATEMENT

1. **I have read and fully understand the SSHP and my responsibilities.**
2. **I agree to abide by the provisions of the SSHP.**

Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date
Name	Signature
Company	Date

Table 7. Project-Specific Contact Summary Sheet

CONTAMINANTS OF CONCERN	MINIMUM LEVEL OF PROTECTION
Petroleum Hydrocarbons, VOCs, SVOCs and Metals	Modified Level D

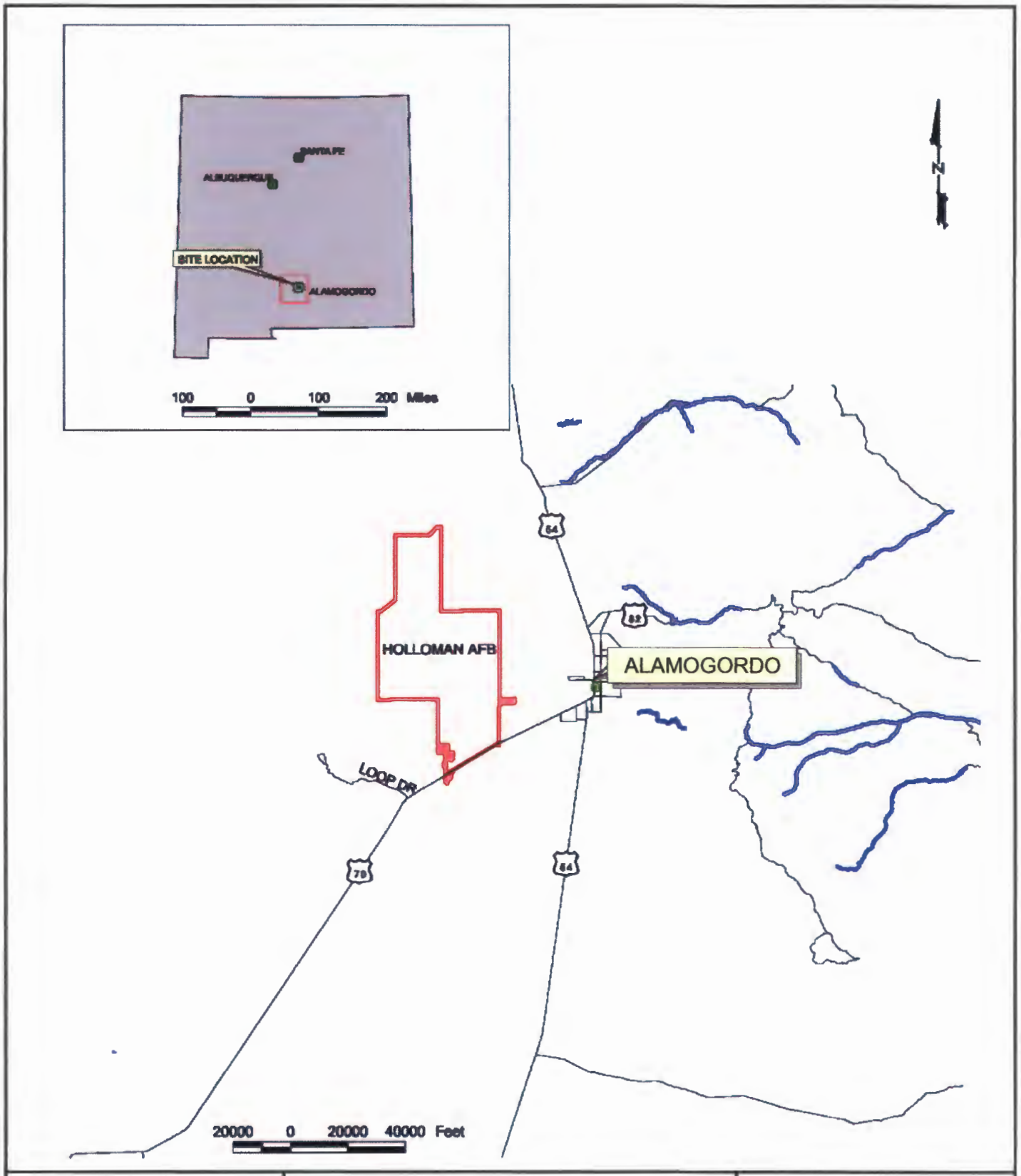
Do not endanger your life. Survey the situation before taking any action

Bhate Home Office Telephone:	(800) 886-4001
Bhate Environmental Office:	220 Eglin Parkway SE, Suite 1A Fort Walton Beach, Florida 32548 Fax: (850) 244-7655
Telephone Located at:	Cell phone with Sampling Crew _____ (Place number here)
Phone On-site:	Bhate office at Holloman (505) 679-2100

EMERGENCY PHONE NUMBERS

Ambulance HAFB:	9-911
Program Manager:	Frank Gardner (205) 999-0776
Fire Dept. HAFB:	7228
Site Manager:	Jerry Pelfrey (505) 679-2100
Base Hospital:	7171
CIH:	Judith McBride (205) 934-2487
Poison Control:	(800) 432-6866
Program Manager:	R. Burdine (850) 244-3556
EPA (info Line):	(800) 424-9346
USACE Technical Mgr.:	Tom Zink (402) 221-7666
Nat. Response Center:	(800) 424-8802
Base POC: Dan Holmquist	(505) 572-5395
Base Hospital: 833rd Medical Group Hospital:	(505) 479-7171
Civilian Hospital: Gerald Champion Memorial Hospital:	(505) 439-2100

FIGURES

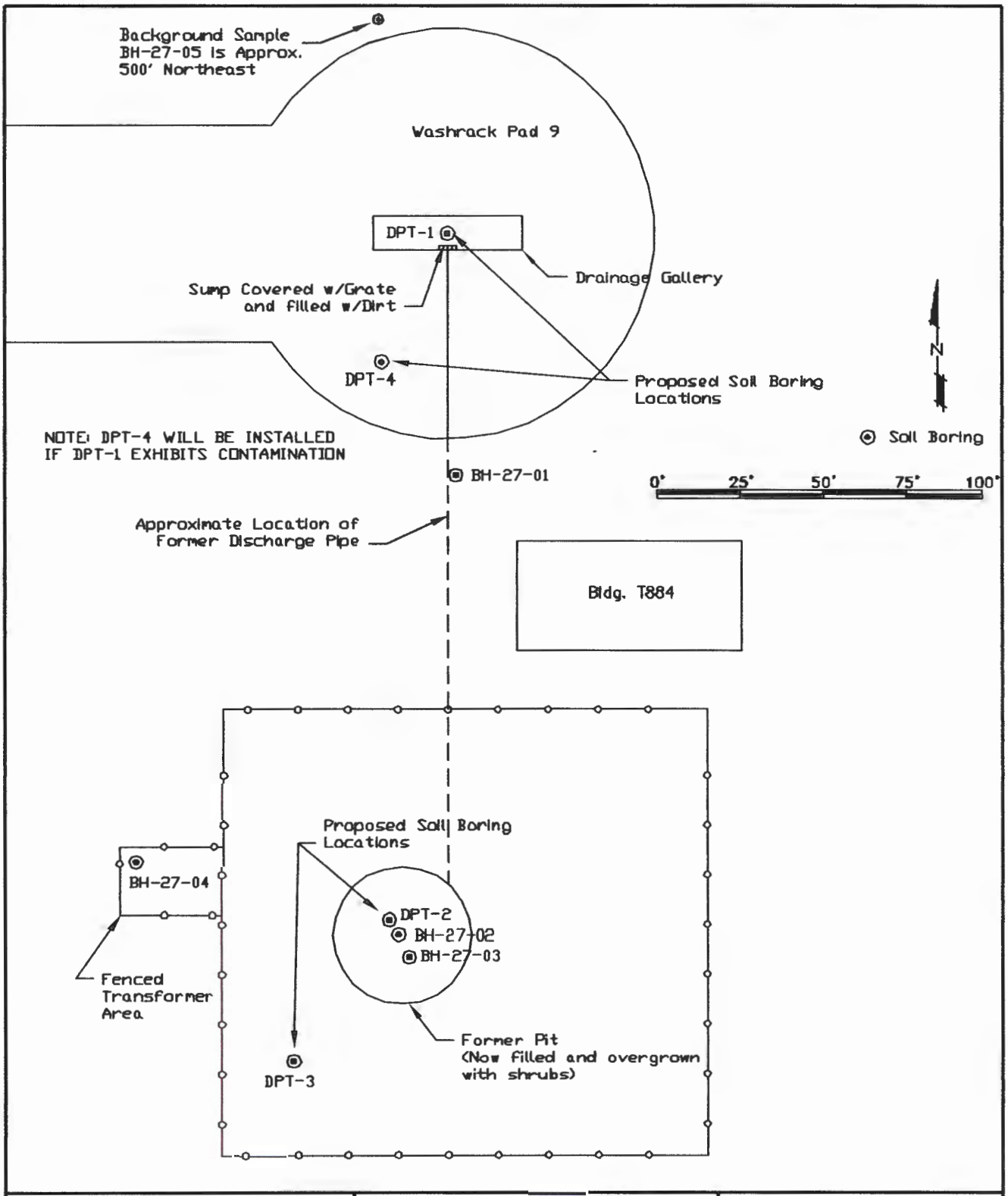


BHATE
Environmental Engineers and Scientists

SITE LOCATION MAP
SWMU-141

PROJECT NO.:	SCALE:	DATE:	DRAWN BY:
9030025	AS SHOWN	06/30/03	SRH
			FILE: HAFBSWMU141Fig1

Figure 1
Holloman AFB
New Mexico



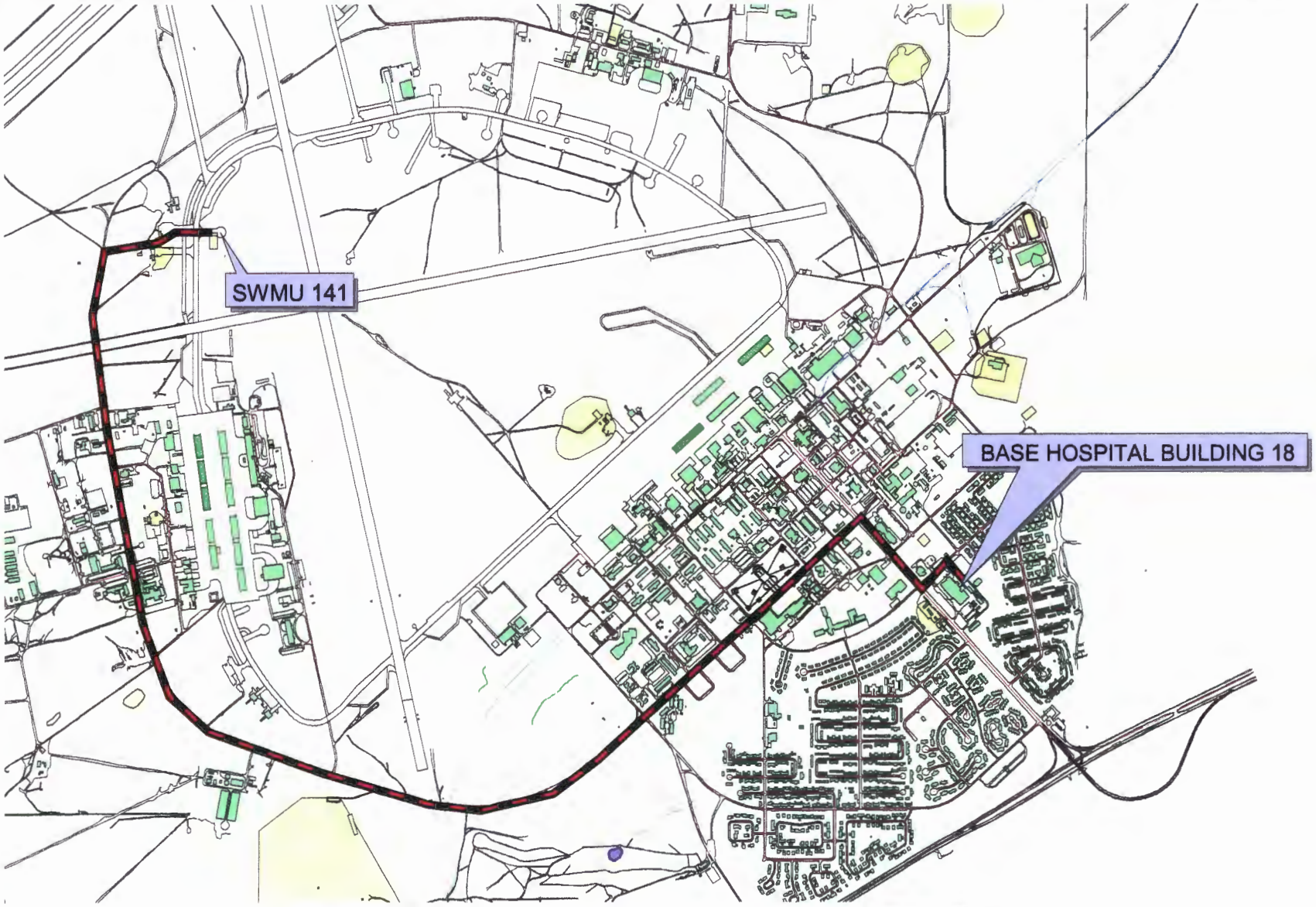
BHATE
Environmental Engineers and Scientists

PA/SI AND PROPOSED
SOIL BORING LOCATIONS
SWMU-141

PROJECT:	SCALE:	DATE:	BY:
9030025	AS SHOWN	4/14/03	SRH
			FILE: HAFBSWMU141Fig2

Figure 2

Holloman Air Force Base
New Mexico



BHATE
Environmental Engineers and Scientists

HOSPITAL ROUTE MAP

PROJECT NO.	SCALE	DATE	DRAWN BY	CM
9030025	1"=2000'	4/18/03	FILE NAME	HOS

SWMU 141
HOLLOMAN AFB

FIGURE 3

APPENDIX A

1993 PA/SI DPT SOIL BORINGS LOGS

DRILLING LOG

[redacted] FOUR SITES (HOLL_4S) | [redacted] BH-27-01 | Inspector LEM | [redacted] RADIAN (RAD) | [redacted] 20 FEB 93 | Sheet 1 of 1

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		SILTY	SAND	DK. GREY BRN	10YR 4.2	F	P	D		SM	SDSL	3.8.8.29	0–2	1.8	WINDY, DUSTY
		SILTY	CLAY	YELLOWISH BRN	10YR 5/4			D	LOW	CL	STCL				
1		CLAYEY	SILT	LT. YELLOW BRN	10YR 6/4			D	LOW	ML	STCL				
2															
3		SANDY	SILT	PALE YELLOW	2.5Y 8/4	VF	P	M	LOW	ML	SDSL	9.8.9.9	2–4	1.8	CALICHE LAYERS
4															
5		SANDY	CLAY	PALE YELLOW	2.5Y 8/4	VF	P	S	LOW	CL	SDCL	4.7.7.6	4–6	2.0	
6															TD 6.0 FT.
7															
8															
9															

F3779

DRILLING LOG

[redacted] FOUR SITES (HOLL_4S) | [redacted] BH-27-02 | Inspector LEM | [redacted] RADIAN (RAD) | [redacted] 20 FEB 93 | Sheet 1 of 1

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	LT. YELLOW BRN	2.5Y 6/3			D	LOW	ML	FILL	0,2,1,1	0-2	1.8	ROOTS AND TWIGS FROM 0.0-0.5 FT. SOME SAND
1															
2												1,2,1,2	2-4	1.8	
3															
4												2,2,4,2	4-6	2.0	
5															
6												2,2,10,12	6-8	2.0	
7		CLAYEY	SAND	DARK GREY	2.5Y 4/1	VF	P	S		SC	SDCL				PIT (NATIVE SOIL) AT 7 FT. FUEL ODOR STAINED BLACK
8												12,50+	8-9	1.0	
9															TD = 10.0 FT.

F3718

DRILLING LOG

[redacted] FOUR SITES (HOLL_4S) | [redacted] BH-27-03 | Inspector LEM | [redacted] RADIAN (RAD) | [redacted] 21 FEB 93 | Sheet 1 of 2

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	LT. YELLOW BRN	2.5Y 6/3			M	LOW	ML	FILL	1,2,3,2	0-2	1.9	
1															
2															
3															
4												1,1,1,1	4-6	1.0	
5															
6															
7															
8		CLAYEY	SAND	DK. GREY	2.5Y 4/1	VF	P	S		SC	SDCL	0,0,1,2	6-8	0	
9		SANDY	SILT	GREENISH GREY	5GY 6/1	VF	P	S	LOW	ML	SDSL	26,50+	8-9	1.0	CALICHE FUEL ORDER

F3719

DRILLING LOG

[redacted] FOUR SITES (HOLL_4S) | [redacted] BH-27-03 | Inspector LEM | [redacted] RADIAN (RAD) | [redacted] 21 FEB 93 | Sheet 2 of 2

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (VVL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
												18,21,19,26	10-12	2	FUEL ODOR STAINED GREY
11															
12												8,10,12,14	12-14	2	FUEL ODOR STAINED GREY
13															
14												5,9,17,22	14-16	2	FUEL ODOR STAINED GREY CLAY FROM 14-14.5 FT.
15		SILTY	CLAY	LT YELLOW BRN	10YR 6/4			S	HIGH	CH	STCL				UNSTAINED
		SANDY	SILT	GREENISH GREY	5GY 6/1	VF	P	S	LOW	ML	SDSL				
16															TD = 16 FT.
17															
18															
19															

F3719

DRILLING LOG

[redacted] FOUR SITES (HOLL_4S) | [redacted] 8H-27-05 | Inspector LEM | [redacted] RADIAN (RAD) | [redacted] 21 FEB 93 | Sheet 1 of 1

Depth	Graphic Log	Lithologic Description: Main Modifier	Predominant Lithology	Color	Munsell	Grain Size	Grading	Moisture	Plasticity	USCS Class (ASTM) [redacted]	[redacted] (YYL)	Blow Counts	Sample Interval	Recovery	Observations and Comments
		CLAYEY	SILT	LT. YELLOW BRN	10YR 6/4			M	LOW	ML	STCL	3,7,6,7	0-2	1.9	COLOR LIGHTER AT BASE OF UNIT
1															
												7,5,2,2	2-4	2	
2															
3		SANDY	SILT	LT. YELLOW BRN	10YR 6/4	VF	P	M	LOW	ML	SDSL	2,2,3,4	4-6	2	
															CALICHE
4															
5		SILTY	SAND	LT. YELLOW BRN	10YR 6/4	VF	P	S		SM	SDSL	4,4,8,10	6-8	2	
6															
7															
8															TD = 8 FT.
9															

F3720

APPENDIX B

HOLLOMAN AIR FORCE BASE STANDARD OPERATING PROCEDURES

- HAFB SOP-1 Documentation, Sample Handling, Chain-of-Custody, and Shipping
- HAFB SOP-2 Sampling Equipment Decontamination
- HAFB SOP-3 Staking, Utility Clearance, and Permitting
- HAFB SOP-4 Direct Push Sampling for Soil and Groundwater
- HAFB SOP-5 Soil Sampling for Chemical Analysis
- HAFB SOP-6 Procedure for Field Screening of Volatile Organics
- HABP SOP-7 Lithologic Description and Geotechnical Sampling
- HAFB SOP-8 Groundwater Sampling for Chemical Analysis
- HAFB SOP-9 Field Management of Investigation-Derived Waste (IDW)
- HAFB SOP-10 Borehole Abandonment and Site Restoration

SOP HAFB-1
DOCUMENTATION, SAMPLE HANDLING, CHAIN-OF-CUSTODY, AND SHIPPING

1.0 OBJECTIVE

This SOP contains specific details concerning sample control, documentation, and transportation procedures.

2.0 EQUIPMENT AND MATERIAL

The following equipment will be necessary to complete sample documentation, handling, and shipment:

Forms and Records

- Log books;
- Chain-of-custody forms;
- Custody seals;
- Sample identification labels; and,

Shipping Supplies

- Clear tape;
- Rigid plastic coolers;
- Strapping tape;
- "This Side Up" arrow labels;
- Address labels;
- Heavy-duty plastic trash bags and ties;

- Small and large re-sealable plastic bags;
- Protective mesh for various sample bottle sizes;
- Absorbent material for packing samples; and
- Ice.

3.0 METHODOLOGY

Sample control and documentation are necessary to ensure the defensibility of data and to verify the quality and quantity of work performed in the field. Accountable documents include field log books, instrument calibration log books, sample logs, correspondence, sample labels, chain-of-custody forms, photographs, and analytical records. All information pertinent to a field activity must be entered into a log book, including uncompleted work.

3.1 SAMPLE CONTROL AND DOCUMENTATION

All log books should be numbered and are to be bound with consecutively numbered pages; log book pages and data should never be removed. Loose-leaf forms, sample logs, and figures used for sample location will be kept in a 3-ring binder. Indelible black ink will be used for recording all data. At minimum, the following data should be recorded during the course of the investigation:

- Date, field observations, and weather conditions, including any unusual circumstances;
- Calibration of field equipment before sample analysis;
- Names of field crew members;
- Name of the sample collector;
- Identification of sampling location and depth of sample;
- Rough sketch of sampling location related to significant physical objects;
- Depth to water at groundwater sampling locations;
- Purge method and purge volume;
- Sample collection method;
- Types and numbers of sample containers used;

- Preservatives used;
- Results of field analysis; and
- Sample observations (color, turbidity, odor, soil type, etc.).

To change an incorrect entry, draw a line through the entry, write the change above or adjacent to the entry, and date and initial the change. If anyone other than the person to whom a log book is assigned makes an entry, that person should date and sign the entry. All project log books are to be turned over to the document control officer at the end of each work period and to a central file at the end of the field activity.

3.2 SAMPLE LABELING

In addition to the field log book, a complete sample label should be filled out for each sample.

All sample containers should be sealed immediately after sample collection. Samplers should place the completed sample label onto the sample container and secure it with clear tape. Sample labels must identify the sample ID, site, sample type, sampler's initials, sampling location, depth, time, date, analyses requested, laboratory, containers, and any special instructions. Labels should be completed with black waterproof ink.

3.3 SAMPLE CONTROL/CHAIN-OF-CUSTODY/SHIPMENT

Once the samples have been collected and labeled, they should be kept cool with ice or in a refrigerator. The following procedures are for sample handling and shipment to a laboratory for analysis:

A. Fill out a chain-of-custody form for every sample shipping container (cooler). Information recorded on this form includes the following:

- Samples collected and corresponding laboratory analyses;
- Time and date of sample;
- Sample number;
- Type of sample;
- Sampler's initials;

- Preservatives used;
- MS/MSD analysis;
- Relinquisher's signature, date, and time; and
- Special instructions.

B. Double check the information on the chain-of-custody form against the sample labels and sample logs. Make sure each sample is accounted for and that samples are being sent to the correct laboratory.

C. Wipe the sample container exteriors clean with a paper towel dampened with clean water.

D. Ensure that each container has a properly completed label.

E. Place the sample containers in resealable plastic bags. Containers from the same sample location and depth can be placed in the same bag, but separate samples from different sites will not be placed in the same bag to prevent cross-contamination.

F. Place the sample container(s) in a cooler lined with a large plastic garbage bag.

G. Pack the container(s) with ample amounts of packing material to prevent possible breakage and absorb liquid material released should breakage occur. This material should be place under the container(s) and between all containers for multiple container shipments to prevent the containers from touching each other or the bottom of the shipping container.

H. Place ice among the sample containers to maintain the samples at or below 4°C during transport.

I. Add any needed absorbent to fill all void spaces.

J. Seal the completed chain-of-custody form for the appropriate cooler in a resealable plastic bag and tape it to the inside of the top lid of the cooler. The sample custodian should retain the pink copy of the form and maintain it in a file of field documentation.

K. Securely close the outer shipping container with strapping tape around both ends. If there is a drain on the cooler, tape it shut.

L. Affix signed and dated custody seals to all closures on the shipping container to prevent tampering.

M. Affix "This Side Up" arrows on two opposing sides of the cooler. No DOT placards are required.

Compliance with all applicable DOT and International Air Transport Association (IATA) shipping regulations is required.

4.0 COMMENTS

- To expedite the sampling and shipping process, it is recommended that preprinted sample labels, chain-of-custody forms, address labels, and overnight delivery forms be used.
- If using a refrigerator to store sample, monitor the temperature using a thermometer and be careful not to freeze water samples.

SOP HAFB-2
SAMPLING EQUIPMENT DECONTAMINATION

1.0 OBJECTIVE

Decontamination of boring equipment and sampling tools is performed as a QA measure and safety precaution. It helps prevent cross-contamination among samples and helps maintain a clean working environment for the safety of field personnel. The methodology for decontamination was prepared in accordance with the following documents:

EPA. 1991. *Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual* (SOPQAM), U.S. Environmental Protection Agency, Region IV, Environmental Services Division, Athens, Georgia.

NIOSH, OSHA, USCG, and EPA. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.* Prepared by the National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), and EPA. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, NIOSH report, October 1985. Washington, D.C.: U.S. Government Printing Office.

2.0 EQUIPMENT AND MATERIAL NEEDS

- Soap: Laboratory grade, non-phosphated - or equivalent;
- Tap water;
- Reagent-grade water;
- Pesticide-grade isopropanol;
- Cleaning brushes;

- Cleaning containers: plastic bucket and galvanized steel pans;
- Waste containers as outlined in SOP A-14; and
- Health and safety equipment as outlined in the SSHP.

3.0 METHODOLOGY

Small, reusable equipment, including sampling equipment, is mainly decontaminated by rinsing with liquids that include soap or detergent solutions, tap water, deionized water, or solvents. Following decontamination, if the equipment is not to be reused immediately, it will be stored, protected from recontamination by wrapping in aluminum foil, and appropriately rinsed before the next use.

3.1 PRE-SAMPLING DECONTAMINATION ACTIVITIES

A. Don the appropriate PPE, as specified in the SSHP and as required for the specific work area.

B. Assemble containers and equipment for decontamination, designing the decontamination station in such a manner as to prevent liquid from spilling onto the ground.

C. Decontaminate all new equipment or equipment not previously decontaminated before use.

D. If the protective wrapping on a piece of precleaned equipment has been torn, or if there is any question about its cleanliness, the equipment should be considered contaminated and undergo the full decontamination procedures before it is used.

3.2 DECONTAMINATING SAMPLING EQUIPMENT

A. Remove any solid particles from the equipment or material by brushing and rinsing with available potable water. This will remove gross contamination.

B. Wash equipment with a brush and a phosphate-free detergent solution.

C. Rinse equipment thoroughly with potable water.

D. Double rinse the equipment with reagent-grade water.

E. Allow equipment to air dry thoroughly. If there is not enough time to air dry completely, the equipment should be rinsed with copious amounts of reagent water. Equipment may then be reused immediately.

F. Unless the equipment is going to be used immediately, it must be wrapped in new aluminum foil, shiny side out, to keep it clean until needed. For large bulky equipment, new visqueen can be substituted for the aluminum foil.

3.3 DECONTAMINATION OF LARGE EQUIPMENT

Drilling equipment (rigs, drill rods, augers, bits, etc.), DPT equipment, and other large pieces of field equipment, unable to be decontaminated using the method described above, must be high-pressure steam cleaned before and after each use.

Steam cleaning will be performed at an appropriate central decontamination area specified by the Base. The decontamination area must be capable of containing decontamination fluids and allow for managing of investigation-derived wastes (IDW) as specified in the appropriate SOP.

3.4 COMMENTS

- Any field equipment not used during a field activity must be decontaminated before its return to the equipment stock for reuse at another site. This requirement applies even if the aluminum foil on precleaned equipment is not torn. This requirement can be waived only if after initial decontamination, the equipment was sealed in plastic.
- At each phase of the decontamination process, decontamination fluids and rinsates should be collected and managed as outlined in the appropriate SOP.
- Isopropanol rinse should be omitted for any equipment such as plastic well-sounding tapes.
- Solvents should not be used on any type of non-Teflon plastic equipment that will contact an environmental sample or be introduced into a monitoring well.

SOP B-3
STAKING, UTILITY CLEARANCE, AND PERMITTING

1.0 OBJECTIVE

To ensure the health and safety of field sampling personnel and prevent damage to underground utilities during soil sampling, precautions must be taken to properly locate hazards such as gas lines, high-voltage electrical lines, water mains, communication lines, sewer lines, and so forth.

Before any intrusive work (including hand-auger borings) can begin at Holloman Air Force Base (AFB), sampling locations at each site must be cleared and a proper digging permit must be obtained.

2.0 EQUIPMENT AND MATERIAL NEEDS

- Wooden stakes, lathes, hubs, surveyor flags, and/or spray paint;
- Small sledge-type hammer;
- Permanent marker;
- Site maps from Section 2; and
- Base Civil Engineering Clearance Request (Air Force Form #103).

3.0 METHODOLOGY

A) Begin the site clearance procure by locating and marking all soil boring locations at each site, using the following guidelines:

- If possible, procure ahead of time utility maps so that the preliminary positioning of sample locations will avoid underground obstructions.
- Visually scan each sample location to be sure that there are no obvious underground lines or obstructions
- Pound the flag and the hub/stake firmly into the ground, making sure that it is clearly marked with the site number and the bore-hole number (DP-01). If the location is on a paved surface, it should be marked with spray paint.

B) To obtain all utility clearances, site tours must be completed with appropriate representatives of the Base utilities (electric, plumbing, and Army cable) and New Mexico One Call.

New Mexico One Call coordinates the location of on-Base utilities, including US West phone lines, Simmons' cable lines, and Standard Transport pipe fuel lines. They will provide you with a control

number and submit locator requests for you. New Mexico One Call can be reached at (800) 321-2537.

- During the site tours, have the locators mark utility locations with flags or spray paint.
- If possible, obtain a blanket site clearance to cover possible additional boring locations at the site. (For certain utilities, this may not be possible. In which case, inquire about the procedure necessary to gain additional clearances).

SOP HAFB-4
DIRECT PUSH SAMPLING FOR SOIL AND GROUNDWATER

1.0 OBJECTIVE

Direct push technology (DPT) will be used to rapidly collect soil and water samples. This technique provides for collection of undisturbed samples and does not generate soil cuttings. This SOP discusses the DPT method only; for actual soil and groundwater sampling procedures. Please refer to the appropriate SOPs for soil and groundwater sampling.

2.0 EQUIPMENT AND MATERIAL NEEDS

The DPT operator will need a copy of the subcontractor work plan, waste containers and appropriate health and safety gear. All additional equipment and materials will be provided by the DPT subcontractor. The DPT subcontractor should be equipped with a rig capable of pushing 20 ft and collecting soil and groundwater samples from any interval within that depth. Equipment should include at minimum the following items:

- Hydraulic ram with hammer assembly;
- 1- to 1.5-inch diameter drill rods;
- Piston-type, split-spoon, or equivalent soil sampling device that allows for lithologic characterization and retrieval of at least 400 mL of sample volume;
- GeoProbe, Hydrocone, bailer, Teflon tubing and peristaltic pump, or equivalent water sampling device;
- Small diameter PVC riser and screen to make temporary wells if recovery is too slow,
- Decontamination equipment; and
- Health and safety equipment, as outlined in the SSHP.

3.0 METHODOLOGY

A) Verify that the subcontractor has the necessary drilling and sampling equipment, as well as proper decontamination supplies.

B) Confirm that sampling locations are staked and that the clearances from all on-Base and off-Base utilities have been obtained. Do not begin the sampling until proper digging permits have been obtained and all of the utilities have been marked.

C) Locate the sample location and position the DPT rig. If the sample point is on thick asphalt or concrete, the DPT subcontractor will use hammer-drill or equivalent to drill a hole through the pavement

D) Verify that the sampling tip has been properly decontaminated.

E) For soil sampling, hydraulically advance the sampler to above the target sample interval, unlock the piston point, and advance the sampling device through the sampling interval:

- Pull the rods using the hydraulic apparatus and remove the sample insert or split spoon.
- Log the soil and collect the required samples as specified in the field sampling plan.

F) Continue sampling at additional depth intervals or abandon the borehole, as appropriate for the location.

G) If groundwater sampling is necessary, advance the sampler into the water table and collect a sample with the sampling device.

H) Collect and manage all wastes as specified in IDW SOP.

I) Abandon all boreholes and repair pavement before moving to a new site (see the SOP for abandonment).

4.0 COMMENTS

- If a buried object impedes the DPT sampler or if an insufficient sample volume is recovered, reposition the rig in a location to satisfy the intent of the original sample point and try again. Note this on the borehole logging form.
- If the total recovered sample volume is insufficient for both screening and laboratory analysis, a second hole will be pushed as close as possible to the original hole and an additional sample will be taken from the same depth interval. The two samples will be composited prior to sampling for chemical analysis.
- If a situation arises in which the groundwater recharge is too slow to allow sampling, a PVC well can be inserted temporarily for sampling at a later time.

- If obstructions exist or if a borehole must be moved to avoid utilities, it should be relocated to a position that satisfies the intent of the original location.

C) To obtain the actual digging permit, a Base Civil Engineering Clearance Request Forms (AF103) must be completed and signed by appropriate parties. (Note that the locators should also sign the form in the appropriate space, as well as initial the site figures.) This process is usually expedited through coordination with representative of Civil Engineering's Environmental Flight (CEV). Once a digging permit has been issued, it is valid for one month.

4.0 COMMENTS

- Proper preparation in the initial location and staking is critical for expediting the sampling process. If sampling locations are not properly marked and cleared, significant costs could be incurred through delays while waiting for drilling permits.

- NM One Call requires a 48-hour advance notice before drilling may proceed

- Utility locators may require information about how long the job will last, the type of marker being used, and the location of the boreholes. Be prepared to provide the various utility locators and signatories on the drilling permit with multiple copies of site figures and location maps.

- When doing any intrusive work on the Base, the contractor must have a valid permit on hand.

SOP HAFB-5
SOIL SAMPLING FOR CHEMICAL ANALYSIS

1.0 OBJECTIVE

Soil samples will be collected for chemical analysis to enable determination of the nature and extent of contamination in soil. Groundwater samples will be collected from monitoring wells or from with inert tubing through the direct push sampling methods.

The following procedures were designed to ensure consistent and high quality data collection and are in accordance with EPA procedures for sample collection as detailed in the following document:

EPA. 1991. *Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual* (SOPQAM), U.S. Environmental Protection Agency, Region IV, Environmental Services Division, Athens, Georgia.

2.0 EQUIPMENT AND MATERIAL NEEDS

- Appropriate number and types of sample containers (see Table HAFB5-1);
- Precleaned stainless steel sampling spoons and knife;
- Sample coolers and ice;
- Appropriate field documentation forms and an indelible ink pen;
- Sampling equipment decontamination supplies;
- Waste containers;
- Health and safety equipment, as specified in the SSHP.

3.0 METHODOLOGY

A) Verify that the subcontractor has the necessary drilling and sampling equipment, as well as proper decontamination supplies.

B) Confirm that sampling locations are staked and that the clearances from all on-Base and off-Base utilities have been obtained. Do not begin the sampling until proper digging permits have been obtained and all of the utilities have been marked.

C) Locate the sample location and position the DPT rig. If the sample point is on thick asphalt or concrete, the DPT subcontractor will use hammer-drill or equivalent to drill a hole through the pavement.

D) Verify that the sampling tip has been properly decontaminated, as specified in decontamination SOP before beginning penetration.

E) For soil sampling, hydraulically advance the sampler to above the target sample interval, unlock the piston point, and advance the sampling device through the sampling interval:

- Pull the rods using the hydraulic apparatus and remove the sample insert or split spoon.
- Log the soil and collect the required samples as specified in Field Sampling Plan (FSP).

F) Continue sampling at additional depth intervals or abandon the borehole, as appropriate for the location. To determine if sufficient depth has been covered, see the FSP section of this document.

G) If groundwater sampling is necessary, advance the sampler into the water table and collect a sample with the sampling device as specified in appropriate SOP.

H) Collect and manage all wastes as specified in the appropriate SOP.

I) Abandon all boreholes and repair pavement before moving to a new site as specified in appropriate SOP.

4.0 COMMENTS

- The supervising geologist should be prepared and have all the supplies available on site to conduct all planned sampling at each site.
- Container and preservation requirements for various analytical methods are detailed in Table HAFB5-1.

TABLE HAFB5-1
CONTAINER AND PRESERVATION REQUIREMENTS FOR SOIL SAMPLING

REFERENCE METHOD	PARAMETER	CONTAINER[1]	SAMPLE PRESERVATION[2]	MAXIMUM HOLDING TIME[3] EXTRACTION	ANALYSIS
EPA 8015	TPH-gas/diesel/BTEX	1.4 oz wide mouth jar, G	Ice to 4°C	--	14d
EPA 418.1	TRPH	1x8 oz wide mouth jar, G	Ice to 4°C	--	14 d
EPA 8260	Volatile Organics	2x40 mL G, Septa vial	Ice to 4°C	--	14 d
EPA 8270	B/N/A	1x8 oz wide mouth jar, G	Ice to 4°C	7 d	40 d
TAL 6000/7010 series	Metals	1x8 oz wide mouth jar, G	Ice to 4°C	--	6 months
SW-846:9045	pH	1x2 oz wide moth jar, G	Not specified	--	ASAP
EPA 8080	PCBs/Pesticides	1x8 oz wide mouth jar, G	Ice to 4°C	7 d	40 d
Full suite (8240, 8270, 6000/7010)	TCLP	2x8 oz wide mouth jar, G	Ice to 4°C	--	14d

1 All containers must have Teflon-lined seals (Teflon-lined septa for all VOA vials). G= Glass, P = High density polyethylene.
2 Container volume may vary slightly depending upon laboratory specific requirements.
3 When only one holding time is given, it implies total holding time from sampling until analysis.

SOP HAFB-6
PROCEDURE FOR FIELD SCREENING OF VOLATILE ORGANICS

1.0 OBJECTIVE

Soil samples can be screened in the field for relative concentrations of total volatile organic constituents (VOCs) rapidly and inexpensively. It is important to note, however, that the screening technique is relative and will not quantify the exact concentration of the particular constituents present in the sample matrix. The procedure is only used to determine the relative concentrations of VOCs between sets of soil samples. For example, if 10 soil samples are collected vertically from one soil boring, the screening technique can be used to determine which samples may have relatively higher concentrations of VOCs with respect to the other samples. Section 2.0 covers equipment required to perform the screening. Section 3.0 presents the steps required to perform the sampling.

2.0 EQUIPMENT AND MATERIAL

The following equipment is required for field VOC screening:

- A photoionization detector (PID) or a flame ionization detector (FID);
- Sample containers such as glass jars and aluminum foil or resealable plastic bags; and,
- Calibration gas for the FID or PID (Isobutylene for PIDs, methane for FIDs).

3.0 METHODOLOGY

The following steps are employed when screening soil samples for total concentrations of VOCs. The procedure assumes that a fraction of the soil sample has already been collected using the soil sample procedure SOPs.

A) Place a fraction of the soil sample collected in a glass jar and cover the jar mouth with aluminum foil or place the sample in a resealable plastic bag. Place the samples in a warm place or area of stable temperature such as a building or temperature controlled environment.

B) Allow all the samples to equilibrate to the temperature controlled environment.

C) Turn the PID and FID on and calibrate the instrument using the appropriate calibration gas (i.e. methane for a FID and isobutylene for a PID) using the procedures specified by the manufacturer.

D) Insert the probe from the PID or FID into the headspace of the jar (i.e., through the aluminum foil lined lid or through the plastic bag and collect a sample of the air in the headspace of the jar.

E) Observe and record the headspace measurement as parts per million (ppm) in the field notebook or soil boring log. Note which type of instrument and the calibration gas that was used.

F) Repeat steps D and F until all the samples have been screened.

4.0 COMMENTS

- Obtaining a good sample for chemical analysis for VOCs is the first priority.
- Field screening the sample for VOCs using a PID or FID is second priority.
- Transcribing the lithologic descriptions and collecting geotechnical samples is the last priority.

SOP HAFB-7
LITHOLOGIC DESCRIPTION AND GEOTECHNICAL SAMPLING

1.0 OBJECTIVE

Lithologic logging will be performed to define the subsurface geology. All soils will be described using the Unified Soils Classification System (ASTM Designation D 2488-84: Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]).

2.0 EQUIPMENT AND MATERIAL NEEDS

- Tape measure;
- Munsall soil color chart;
- Hand lens;
- Knife or spatula;
- Dropper with 10% HCl for calcium carbonate test;
- LaMotte soil texture kit or small vial;
- Water;
- Borehole log forms (Attached); and
- Health and safety equipment, as specified in the SSHP.

3.0 METHODOLOGY

A) Note penetration rates and comments in "remarks" section of logging form (e.g., "easy penetration", "hammering required", "2 ft in 3 minutes", etc.). If using a drop hammer, record blow counts.

B) Measure entire sample length and record recovery (as total footage recovered over the total length that sampler was pushed) to nearest tenth of a foot. Mark lithologic changes on logging form.

C) Separate a small, representative portion of each distinct soil to be identified.

D) Identify the color using the Munsall chart.

E) Identify the soil type using the field tests outlined in the ASTM guidance. All required tests considered appropriate for soil type should be performed (i.e. tests for fine-grained soils, such as plasticity, need not be performed on coarse-grained soil).

F) Record descriptions of the soil on the borehole log form. To facilitate the comparison of logs, all descriptions should use the following order and style:

- Soil type (*Silty SAND w/Clay*);
- Soil Color (***Moderate yellow brown (10YR5/4)***;
- Moisture content;
- Angularity and shape of particles (if a sand or gravel);
- Consistency;
- Cementation;
- Structure;
- Dry strength;
- Dilatancy;
- Toughness;
- Plasticity;
- Miscellaneous descriptors (roots, nodules, odors, texture percentages from the LaMotte kit, etc.);
- USCS Code (*SM*).

G) Note all visible contamination, PID/FID measurements, odor, or any observed evidence of contamination in the sample.

H) As necessary, identify the percentages of sand, silt, and clay in each sample using a LaMotte soil texture kit, or by settling using a small vial or bottle.

I) The sample should be placed in a soil jar or steel tube and sealed with as little air as possible (Table A8-1).

J) Label the contained for shipment to a lab for geotechnical grain size distribution (without the hydrocarbons portion of the test) (ASTM D421 and D422). Atterberg Limits (ASTM D4318), and moisture content (ASTM D2216).

4.0 COMMENTS

- Obtaining a good sample for chemical analysis is the first priority; collect chemical samples for volatile organic compounds (VOCs) before logging the soil core or taking geotechnical samples.
- Because visible contamination and field screening by FID/PID is used to define extent of contamination, it is essential that all observations concerning odor and staining and PID or FID readings are recorded on the logging form.
- Consistent logging is important for accurate characterization of site geology. Although the geologist may need to use his/her professional judgement to infer contacts and lithology, using the tests listed in the ASTM method will ensure consistent results.

TABLE B7-1
CONTAINER AND PRESERVATION
REQUIREMENTS FOR GEOTECHNICAL

Reference Method	Parameter	Minimum Volume	Container
ASTM D4318	Atterberg Limits	100 grams	4 oz glass jar[1]
ASTM D2216	Moisture content	50-100 grams	4 oz glass jar[1]
ASTM D421 & 422	Grain size	30-40 grams	2- to 4- oz glass jar[1]

[1] OK to combine these analyses into a larger container

SOP HAFB-8
GROUNDWATER SAMPLING FOR CHEMICAL ANALYSIS

1.0 OBJECTIVE

Water samples will be collected for chemical analysis to enable determination of the nature and extent of contamination in groundwater. Groundwater samples will be collected from monitoring wells or from with inert tubing through the direct push sampling methods.

The following procedures were designed to ensure consistent and high quality data collection and are in accordance with EPA procedures for sample collection as detailed in the following document:

EPA. 1991. *Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual* (SOPQAM), U.S. Environmental Protection Agency, Region IV, Environmental Services Division, Athens, Georgia

2.0 EQUIPMENT AND MATERIAL NEEDS

- Appropriate number and types of sample containers (see Table HAFB8-1);
- Precleaned stainless steel sampling spoons and knife;
- Sample coolers and ice;
- Appropriate field documentation forms and an indelible ink pen;
- Sampling equipment decontamination supplies;
- Waste containers;
- Health and safety equipment, as specified in the SSHP.

3.0 METHODOLOGY

A) Ensure that all equipment is properly calibrated and operating bby following the manuals provided by the equipment manufacturer. Record results of the equipment in the log book.

B) Calculate the approximate volume of the inert tubing (teflon) using the formula

$V = 3.1415 \times r^2 \times \text{Length} \times 7.48\ \text{gal/ft}^3$.

Or if the tubing is ¼-inch, simply multiply the tubing length by 0.0102 gal/foot.

C) Attach the peristaltic pump to the tubing as indicted in the pump instructions.

D) Purge the tubing slowly at first to avoid entraining air in the tube. Purge the appropriate volume and store it in the appropriate waste container.

E) Fill sample bottles in the following order:

- Volatile organic compounds
- Semi-volatile organic compounds
- Metals
- Wet tests,

F) Place sample containers on Ice and handle as indicted in the appropriate SOP.

G) When sampling is complete, remove tubing from the DPT rods and dispose of all IDW as directed in the SOP.

H) Abandon the boring as directed in the appropriate SOP.

4.0 COMMENTS

- The supervising geologist should be prepared and have all the supplies available on site to conduct all planned sampling at each site.
- Container and preservation requirements for various analytical methods are detailed in Table HAFB5-1.

TABLE HAFB8-1
CONTAINER AND PRESERVATION REQUIREMENTS FOR GROUNDWATER SAMPLING

REFERENCE METHOD	PARAMETER	CONTAINER[1]	SAMPLE PRESERVATION[2]	MAXIMUM HOLDING TIME[3]	
				EXTRACTION	ANALYSIS
EPA 8015	TPH-gas/diesel/BTEX	500 ml brown glass bottle	Ice to 4°C	--	14d
EPA 8260	Volatile organic compounds	3x40 mL G, Septa vials	Ice to 4°C, pH <2 with HCl	--	14 d
EPA 8270	B/N/A	2 x 1 L brown glass	Ice to 4°C	7 d	40 d
TAL 6000/7010 series	Metals	500 ml plastic bottle	Ice to 4°C pH <2 with HNO3	--	6 months
SW-846:9045	pH	500 ml plastic	Ice to 4°C	--	24 hrs
EPA 8080	PCBs/Pesticides	2 x 1 L brown glass	Ice to 4°C	7 d	40 d
xxxx	Radionucleides	1 L plastic	Ice to 4°C	--	14d

1 All containers must have Teflon-lined seals (Teflon-lined septa for all VOA vials) glass= brown glass. Plastic = High density polyethylene.
2 Container volume may vary slightly depending upon laboratory specific requirements.
3 When only one holding time is given, it implies total holding time from sampling until analysis.

SOP HAFB-9

FIELD MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

1.0 OBJECTIVE

To collect and manage IDW in accordance with state and federal regulations, this SOP provides easy-to-follow procedures for characterizing, handling, storing and disposing of IDW generated during the additional characterization program. IDW management techniques emphasize waste minimization.

2.0 EQUIPMENT AND MATERIAL NEEDS

- DOT-approved drums and containers;
- IDW "Analysis Pending" labels (Attached);
- "Hazardous Waste" labels and Non Hazardous labels (Attached);
- Indelible markers (i.e., Sharpie);
- Clear adhesive tape;
- Ratchet, socket, and crescent wrench for opening/closing drums;
- PPE;
- Plastic buckets for carrying purge water to drums;
- Absorbent pads or booms for cleaning up spills;
- Wooden pallets;
- Waste inventory form (Attached); and
- PID or FID.

3.0 METHODOLOGY

3.1 SOIL AND WATER IDW

A) Conduct sampling in accordance with the soil and groundwater sampling SOPs.

B) If soil is stained, place excess soil (and any excess water sample) in appropriately sized DOT-approved drums or cans. DO NOT PUT SOIL AND WATER IN SAME CONTAINER.

C) Place an adhesive label on the side of the container. Using an indelible marker, write the following information on the label

- The phrase "Analysis Pending"
- Accumulation start date
- Name of waste (e.g., soil from soil or well boring ID numbers)
- Name and phone number of Holloman AFB contact (CES/CEV)

D) When label is complete, cover it with a piece of clear adhesive tape.

E) If soil is not stained, conduct VOC screening with a PID or FID.

F) If no VOCs are detected in headspace analysis, spread excess soil and water (if any) around borehole.

G) If VOCs are detected in the soil, place excess soil and water (if any) in DOT-approved drums, and label the drum (or container) in accordance with step C) above. DO NOT PUT SOIL AND WATER IN SAME CONTAINER.

H) If the site is developed and will not accommodate the spreading of soils then soils containing TPH concentration less than 940 ppm will be spread at a site to be designated by the Base.

I) If soils are containerized move to IDW drum storage area.

J) Waste characterization will be conducted utilizing previously-collected soil analytical results and additional characterization results. No soil generated during the POL remediation activities at the SWMUs was characterized as hazardous waste. If soils contain TPH in excess of 940 ppm, arrangements will be made for off-site disposal at a permitted petroleum-contaminated soil disposal facility. Decontamination solutions will either be spread on site or placed in the Base sanitary sewer system, following approval from the Base.

3.2 PPE AND DISPOSABLE SAMPLING EQUIPMENT WASTE

A) Remove excess solid and liquid waste from PPE and disposable sampling equipment.

B) Place all PPE and sampling equipment to be disposed of in sealed plastic trash bags.

C) Dispose of trash bags in a dumpster at the IDW staging area.

D) If a Base dumpster is not located near the IDW staging area, arrange for one that can be used during the course of the investigation.

SOP B-10
BOREHOLE ABANDONMENT AND SITE RESTORATION

1.0 OBJECTIVE

All boreholes must be sealed to prevent the spread of contaminants with depth and to eliminate direct pathways from the surface to the subsurface and groundwater. Surface materials such as asphalt and cement that have been drilled or pushed through must also be repaired to a satisfactory condition.

2.0 EQUIPMENT AND MATERIAL NEEDS

- Bentonite chips or granular bentonite and funnel;
- Cold-patch asphalt material and quick-set concrete;
- Ample amounts of water; and
- Health and safety equipment, as specified in the SSHP.

3.0 METHODOLOGY

In general, borehole abandonment will be completed by the DPT or HSA subcontractor under supervision of the rig geologist. The subcontractor will supply all necessary materials listed above. The contractor, however, may need small amounts of bentonite to seal hand-auger boreholes.

A) After a boring has been completed by **DPT technique**, leave the drive rods in place pending abandonment.

B) Add bentonite chips or granular bentonite slowly into the top of the drive rods using a funnel. As the rods are being slowly pulled from the borehole, add bentonite to complete the seal to the surface.

C) If the rods have been driven into groundwater, it will not be possible to seal the borehole through the rods. (The bentonite chips will stick to the inside of the rods, clogging the end). In this case, carefully extract the rods and slowly add bentonite chips, being careful not to allow bridging.

D) Hydrate the seal using ample amounts of potable water.

E) If the borehole is through asphalt or concrete, leave the seal below the bottom of the pavement to allow for sufficient fill and patching material.

APPENDIX C

FORMS

- Borehole Log
- Containerized Materials Log
- Chain of Custody
- Equipment Calibration Sheet
- Air Monitoring Form

HTW DRILLING LOG

HOLE NO

1 COMPANY NAME	2 DRILLING CONTRACTOR	SHEET OF SHEETS
3 PROJECT	4 LOCATION	
5 NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL	
7 SIZES & TYPES OF DRILLING & SAMPLING EQUIPMENT	8 HOLE LOCATION North East	
	9. SURFACE ELEVATION (ft. NGVD)	
	10 DATE STARTED	11 DATE COMPLETED
12 OVERBURDEN THICKNESS	15 DEPTH GROUNDWATER ENCOUNTERED	
13 DEPTH DRILLED INTO ROCK	16 DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14 TOTAL DEPTH OF HOLE	17 OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18 GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19 TOTAL NUMBER OF CORE BOXES

20 SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21 TOTAL CORE REC %

22 DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23 SIGNATURE OF INSPECTOR

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No e	Analytical Sample No f	Blow Counts g	REMARKS h
	0						
	1						
	2						
	3						
	4						
	5						

PROJECT

HOLE NO

HTW DRILLING LOG

HOLE NO

PROJECT

INSPECTOR

SHEET
OF SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	Field Screening Results d	Geotech Sample or Core Box No e	Analytical Sample No. f	Blow Counts g	REMARKS h

PROJECT

HOLE NO

Page _____ of _____

CONTAINERIZED MATERIALS LOG

PROJECT _____
CITY _____
STATE _____

Drum Number	Well or Boring Number	Material Type	Date Filled First	Date Filled Last	Location moved To	Final Disposition	Signatures of Movers

SHATE

Environmental Engineers and Scientists

Chain of Custody and Analytical Request

Page _____ of _____

Project Number: _____

Chain of Custody Number [1]: _____

LIMS Number: _____

Facility/Base I.D.:

Project Name / Site Name:

Client Name:

Collected by:

Field Sample ID (30 Characters Max)	ERPIMS LOCID (15 Characters Max)	Date Collected (dd-mmm-yyyy)	Time Collected (Military) (hhmm)	Sample Depth (beginning - ending)	SA Code [2]	Sample Number [3]	Sample Matrix [4]	Sample Analysis Requested [5]: Number of containers									Quality Assurance Samples [6]: Ambient Blank Lot Control Number	Equipment Blank Lot Control Number	Trip Blank Lot Control Number	Cooler ID
				-																
				-																
				-																
				-																
				-																
				-																
				-																
				-																
				-																
				-																
				-																

COMMENTS: _____

Custody Transfers Prior to Receipt by Laboratory

Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1.			1.		
2.			2.		
3.			3.		

Sample Delivery Details / Laboratory Receipt

Delivered Directly to Lab: _____ Shipped No.: _____

Method of Shipment: _____ Airbill Number: _____

Analytical Lab: _____ Delivery Location: _____

Lab Recipient: Delivery Date/Time:

1.) Chain of Custody Number = date collected + custody number (e.g. 09-02-1999-01)

2.) Sample Type (SA) Codes: N = Normal Sample, TB = Trip Blank (-c) Sample, FD = Field Duplicate (-a) Samples, FR = Field Replicate (-b) Samples, EB = Equipment Blank (-d) Samples, MS = Matrix Spike, SD = Matrix Spike Duplicate, AB = Ambient Blank (-e)

3.) Sample Number: Unique sample number collected from a particular location per day. (e.g. Groundwater sample collected from MW-1 on 10/10/99 = 01, if sampled again on 10/10/99 = 02, etc.)

4.) Matrix Codes: GS = Soil Gas, WG = Groundwater, WS = Surface Water, SO = Soil, SE = Sediment, SL = Sludge, SS = Surface Soil Samples, WQ = Aqueous Blank Samples (trip, equipment, ambient, etc), SQ = Soil Blanks

5.) Sample Analysis Requested: Analytical method requested and number of containers provided for each.

6.) Quality assurance samples are assigned by date (ddmmyy) and the sample number associated with the sample (01, 02, etc) (e.g. Equipment blank collected in association with MW-1 on 10/10/99 will be designated 10109901 in the Equipment Blank Lot Control

BASE ID CODES

NAME	CODE
Eglin AFB	EGLIN
Homestead AFB	HMSTD
Hurlburt Field	HRLB
Macdill AFB	MCDL
Patrick AFB	PTRCK
Pope AFB	POPE
Robins AFB	ROBIN
Seymour Johnson AFB	SEYMR
Shaw AFB	SHAW
Tyndall AFB	TYNDL

SAMPLE METHOD CODES

NAME	CODE
5-ft. Continuous Core Sampler	CC
Air Lift Pump	AP
Bailer	B
Centrifugal Pump	CP
Cone Penetrometer	CN
Continuous Flight Auger	C
Cutting Returns	CR
Electric Submersible Pump (gear-driven)	GD
Electric Submersible Pump (1982+)	E2
Electric Submersible Pump (pre-1982)	E1
Gas-operated Bladder Pump	BP
Grab	GD
Hand Auger	HA
Hollow Stem Auger	H
Hydropunch	HP
Peristaltic Pump	PP
Shelby Tube	T
Split Spoon	SS
Submersible Pump	SP

MATRIX CODES

NAME	CODE
Animal Tissue	TA
Aqueous Blank Samples (trip, equipment, ambient, etc.)	WQ
Drill Cuttings	SD
Groundwater	WG
Headspace	GL
Plant Tissue	TP
Sediment	SE
Soil	SO
Soil Blanks	SQ
Soil Gas	GS
Sludge	SL
Surface Soil Samples	SS
Surface Water	WS

DAILY AIR MONITORING INSTRUMENT CALIBRATION & REFERENCE STANDARD CHECKS

Project/Task Name: **Project/Task Numbers:**

Form Completed By: (print name) (signature) (date)

DATE	TIME	AIR MONITORING INSTRUMENT			BATTERY CHECK		REFERENCE (SPAN) GAS		UNADJUSTED INSTRUMENT READING	CALIBRATION	
		TYPE	LAMP eV	SERIAL #	OK	LOW	TYPE	CONCENTRATION		OK	ADJUSTMENT REQ'D

COMMENTS: _____

_____

_____

Instrument (Name/Model No./Serial No.): _____

Manufacturer _____ Date Purchased _____

Calibration Date	Initial Settings	Standard/Gas Used	Procedure	Adjustments Made	Final Settings	Signature	Comments

Atmospheric Monitoring Log
Field Health and Safety

Page No. _____ of _____

Date: _____

Circle: Sun Mon Tue Wed Thu Fri Sat

Site: _____ Project Number: _____

Site Safety Officer: _____

Action Levels: D ☐ _____ C ☐ _____ B ☐ _____ (Stop work, call in for instructions)
(Check box and write in levels for upgrade)

Task/Equipment: _____

Weather: _____

Time	OVA ppm	HNu ppm	O_2 %	LEL %	H_2S ppm	Comments: duration of readings, upgrades, location, etc.

Additional comments: _____

_____

_____

Signature: _____

NOTE: Place in project files.

C:\jamie\bhate field forms\atmosmonitor.doc

APPENDIX D

METHOD DETECTION LIMITS

- Method 8260B Volatile Organic Compounds
- Method 7470A Mercury in Water
- Method 8270C Acid/Base/Neutral Extractables
- Method 6010B ICP Metals
- Method 900 Radioactivity - Gross Alpha and Beta

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY
TESTNO: 8260B
DEPARTMENT: GCMS/SVOA
TESTNAME: 8260B Volatile Organic Compounds
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
1,1,1,2-Tetrachloroethane	2.19	5	ug/Kg	SOLID
1,1,1-Trichloroethane	0.47	5	ug/Kg	SOLID
1,1,2,2-Tetrachloroethane	0.50	5	ug/Kg	SOLID
1,1,2-Trichloroethane	0.57	5	ug/Kg	SOLID
1,1,2-Trichlorotrifluoroethane	0.10	5	ug/Kg	SOLID
1,1-Dichloroethane	0.74	5	ug/Kg	SOLID
1,1-Dichloroethene	0.43	5	ug/Kg	SOLID
1,1-Dichloropropene	1.30	5	ug/Kg	SOLID
1,2,3-Trichlorobenzene	0.54	5	ug/Kg	SOLID
1,2,3-Trichloropropane	0.65	5	ug/Kg	SOLID
1,2,4-Trichlorobenzene	0.54	5	ug/Kg	SOLID
1,2,4-Trimethylbenzene	0.60	5	ug/Kg	SOLID
1,2-Dibromo-3-chloropropane	1.92	5	ug/Kg	SOLID
1,2-Dibromoethane	0.43	5	ug/Kg	SOLID
1,2-Dichlorobenzene	0.45	5	ug/Kg	SOLID
1,2-Dichloroethane	0.59	5	ug/Kg	SOLID
1,2-Dichloropropane	0.58	5	ug/Kg	SOLID
1,3,5-Trimethylbenzene	0.55	5	ug/Kg	SOLID
1,3-Dichlorobenzene	0.44	5	ug/Kg	SOLID
1,3-Dichloropropane	0.51	5	ug/Kg	SOLID
1,4-Dichlorobenzene	0.46	5	ug/Kg	SOLID
1,4-Dioxane	200	200	ug/Kg	SOLID
1-Chlorohexane	0.38	5	ug/Kg	SOLID
2,2-Dichloropropane	0.47	5	ug/Kg	SOLID
2-Butanone (MEK)	0.98	100	ug/Kg	SOLID
2-Chloroethyl vinyl ether	0.46	5	ug/Kg	SOLID
2-Chlorotoluene	0.92	5	ug/Kg	SOLID
2-Hexanone	4.7	5	ug/Kg	SOLID
4-Chlorotoluene	0.52	5	ug/Kg	SOLID
4-Methyl -2- Pentanone	0.49	5	ug/Kg	SOLID
Acetone	3.81	5	ug/Kg	SOLID
Acetonitrile	0.7	5	ug/Kg	SOLID
Acrolein	172	200	ug/Kg	SOLID
Acrylonitrile	1.3	5	ug/Kg	SOLID
Allyl chloride	0.4	5	ug/Kg	SOLID
Benzene	0.39	5	ug/Kg	SOLID
Benzyl chloride	0.38	5	ug/Kg	SOLID
Bromobenzene	0.65	5	ug/Kg	SOLID
Bromochloromethane	0.36	5	ug/Kg	SOLID
Bromodichloromethane	0.48	5	ug/Kg	SOLID
Bromoform	0.53	5	ug/Kg	SOLID
Bromomethane	2.07	5	ug/Kg	SOLID
Carbon Disulfide	0.8	5	ug/Kg	SOLID
Carbon tetrachloride	0.40	5	ug/Kg	SOLID
Chlorobenzene	0.42	5	ug/Kg	SOLID
Chloroethane	1.1	5	ug/Kg	SOLID
Chloroform	0.46	5	ug/Kg	SOLID
Chloromethane	0.25	5	ug/Kg	SOLID
Dibromochloromethane	0.44	5	ug/Kg	SOLID
Dibromomethane	0.46	5	ug/Kg	SOLID
Dichlorodifluoromethane	0.16	5	ug/Kg	SOLID
Ethyl benzene	0.41	5	ug/Kg	SOLID
Ethyl methacrylate	1.8	5	ug/Kg	SOLID
Hexachlorobutadiene	0.29	5	ug/Kg	SOLID

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY
TESTNO: 8260B
DEPARTMENT: GCMS/SVOA
TESTNAME: 8260B Volatile Organic Compounds
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Iodomethane	0.6	5	ug/Kg	SOLID
Isopropylbenzene (Cumene)	0.38	5	ug/Kg	SOLID
Methacrylonitrile	2.70	5	ug/Kg	SOLID
Methyl methacrylate	0.21	5	ug/Kg	SOLID
Methyl-tert-butylether (MTBE)	0.51	5	ug/Kg	SOLID
Methylene chloride	0.91	5	ug/Kg	SOLID
Naphthalene	0.60	5	ug/Kg	SOLID
Pentachloroethane	0.6	5	ug/Kg	SOLID
Propionitrile	5	5	ug/Kg	SOLID
Styrene	0.37	5	ug/Kg	SOLID
Surr1 - Dibromofluoromethane			%	SOLID
Surr2 - 1,2-Dichloroethane-d4			%	SOLID
Surr3 - Toluene-d8			%	SOLID
Surr4 - p-Bromofluorobenzene			%	SOLID
Tetrachloroethene	0.49	5	ug/Kg	SOLID
Toluene	0.42	5	ug/Kg	SOLID
Trichloroethene	0.43	5	ug/Kg	SOLID
Trichlorofluoromethane	0.40	5	ug/Kg	SOLID
Vinyl acetate	10.2	50	ug/Kg	SOLID
Vinyl chloride	0.47	5	ug/Kg	SOLID
Xylenes, total	0.8	5	ug/Kg	SOLID
cis-1,2-Dichloroethene	0.79	5	ug/Kg	SOLID
cis-1,3-Dichloropropene	0.38	5	ug/Kg	SOLID
cis-1,4-Dichloro-2-butene	0.59	5	ug/Kg	SOLID
m and p-Xylene	0.67	5	ug/Kg	SOLID
n-Butylbenzene	0.38	5	ug/Kg	SOLID
n-Propylbenzene	0.32	5	ug/Kg	SOLID
o-Xylene	0.35	5	ug/Kg	SOLID
p-Isopropyltoluene	0.32	5	ug/Kg	SOLID
sec-Butylbenzene	0.31	5	ug/Kg	SOLID
tert-Butylbenzene	0.41	5	ug/Kg	SOLID
trans-1,2-Dichloroethene	0.48	5	ug/Kg	SOLID
trans-1,3-Dichloropropene	0.44	5	ug/Kg	SOLID
trans-1,4-Dichloro-2-butene	2.35	5	ug/Kg	SOLID
1,1,1,2-Tetrachloroethane	0.83	5	ug/L	WATER
1,1,1-Trichloroethane	0.25	5	ug/L	WATER
1,1,2,2-Tetrachloroethane	0.26	5	ug/L	WATER
1,1,2-Trichloroethane	0.15	5	ug/L	WATER
1,1,2-Trichlorotrifluoroethane	0.10	5	ug/L	WATER
1,1-Dichloroethane	0.31	5	ug/L	WATER
1,1-Dichloroethene	0.62	5	ug/L	WATER
1,1-Dichloropropene	0.72	5	ug/L	WATER
1,2,3-Trichlorobenzene	0.61	5	ug/L	WATER
1,2,3-Trichloropropane	0.22	5	ug/L	WATER
1,2,4-Trichlorobenzene	0.61	5	ug/L	WATER
1,2,4-Trimethylbenzene	0.49	5	ug/L	WATER
1,2-Dibromo-3-chloropropane	1.74	5	ug/L	WATER
1,2-Dibromoethane	0.26	5	ug/L	WATER
1,2-Dichlorobenzene	0.18	5	ug/L	WATER
1,2-Dichloroethane	0.17	5	ug/L	WATER
1,2-Dichloropropane	0.26	5	ug/L	WATER
1,3,5-Trimethylbenzene	0.26	5	ug/L	WATER
1,3-Dichlorobenzene	0.41	5	ug/L	WATER
1,3-Dichloropropane	0.24	5	ug/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY
TESTNO: 8260B
DEPARTMENT: GCMS/SVOA
TESTNAME: 8260B Volatile Organic Compounds
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
1,4-Dichlorobenzene	0.35	5	ug/L	WATER
1,4-Dioxane	18.2	57	ug/L	WATER
1-Chlorohexane	0.32	5	ug/L	WATER
2,2-Dichloropropane	0.30	5	ug/L	WATER
2-Butanone (MEK)	0.75	100	ug/L	WATER
2-Chloroethyl vinyl ether	0.25	5	ug/L	WATER
2-Chlorotoluene	0.18	5	ug/L	WATER
2-Hexanone	0.78	20	ug/L	WATER
4-Chlorotoluene	0.18	5	ug/L	WATER
4-Methyl -2- Pentanone	0.20	10	ug/L	WATER
Acetone	3.18	100	ug/L	WATER
Acetonitrile	0.49	50	ug/L	WATER
Acrolein	3.3	200	ug/L	WATER
Acrylonitrile	1.6	10	ug/L	WATER
Allyl chloride	0.3	5	ug/L	WATER
Benzene	0.22	1	ug/L	WATER
Benzyl chloride	0.37	5	ug/L	WATER
Bromobenzene	0.58	5	ug/L	WATER
Bromochloromethane	0.30	5	ug/L	WATER
Bromodichloromethane	0.25	5	ug/L	WATER
Bromoform	0.17	5	ug/L	WATER
Bromomethane	1.15	5	ug/L	WATER
Carbon Disulfide	2.56	5	ug/L	WATER
Carbon tetrachloride	0.49	5	ug/L	WATER
Chlorobenzene	0.18	5	ug/L	WATER
Chloroethane	0.4	5	ug/L	WATER
Chloroform	0.36	5	ug/L	WATER
Chloromethane	0.27	5	ug/L	WATER
Dibromochloromethane	0.22	5	ug/L	WATER
Dibromomethane	0.25	5	ug/L	WATER
Dichlorodifluoromethane	0.08	5	ug/L	WATER
Ethyl benzene	0.31	5	ug/L	WATER
Ethyl methacrylate	0.2	50	ug/L	WATER
Hexachlorobutadiene	0.24	5	ug/L	WATER
Iodomethane	0.5	5	ug/L	WATER
Isopropylbenzene (Cumene)	0.23	5	ug/L	WATER
Methacrylonitrile	0.43	35	ug/L	WATER
Methyl methacrylate	0.38	5	ug/L	WATER
Methyl-tert-butylether (MTBE)	0.18	1	ug/L	WATER
Methylene chloride	0.64	5	ug/L	WATER
Naphthalene	0.88	5	ug/L	WATER
Pentachloroethane	0.4	5	ug/L	WATER
Propionitrile	1.9	100	ug/L	WATER
Propylbenzene	0.18	5	ug/L	WATER
Styrene	0.20	5	ug/L	WATER
Surr1 - Dibromofluoromethane			%	WATER
Surr2 - 1,2-Dichloroethane-d4			%	WATER
Surr3 - Toluene-d8			%	WATER
Surr4 - p-Bromofluorobenzene			%	WATER
Tetrachloroethene	0.36	5	ug/L	WATER
Toluene	0.32	5	ug/L	WATER
Trichloroethene	0.23	5	ug/L	WATER
Trichlorofluoromethane	0.35	5	ug/L	WATER
Vinyl acetate	0.3	50	ug/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY
TESTNO: 8260B
DEPARTMENT: GCMS/SVOA
TESTNAME: 8260B Volatile Organic Compounds
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Vinyl chloride	0.27	5	ug/L	WATER
Xylenes, total	0.4	5	ug/L	WATER
cis-1,2-Dichloroethene	0.30	5	ug/L	WATER
cis-1,3-Dichloropropene	0.22	5	ug/L	WATER
cis-1,4-Dichloro-2-butene	0.28	20	ug/L	WATER
m and p-Xylene	0.54	5	ug/L	WATER
n-Butylbenzene	0.35	5	ug/L	WATER
n-Propylbenzene	0.18	5	ug/L	WATER
o-Xylene	0.24	5	ug/L	WATER
p-Isopropyltoluene	0.24	5	ug/L	WATER
sec-Butylbenzene	0.28	5	ug/L	WATER
tert-Butylbenzene	0.35	5	ug/L	WATER
trans-1,2-Dichloroethene	0.41	5	ug/L	WATER
trans-1,3-Dichloropropene	0.28	5	ug/L	WATER
trans-1,4-Dichloro-2-butene	0.28	20	ug/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TESTNO: 7470A
DEPARTMENT: AA/ICP
TESTNAME: 7470A Mercury in Water
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Mercury	0.00007	0.0004	mg/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TESTNO: 8270C
DEPARTMENT: GCMS/SVOA
TESTNAME: 8270C Acid/Base/Neutral Extractables
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
1,2,4-Trichlorobenzene	32.1	333	ug/Kg	SOLID
1,2-Dichlorobenzene	69.1	333	ug/Kg	SOLID
1,3-Dichlorobenzene	133.5	333	ug/Kg	SOLID
1,4-Dichlorobenzene	58.0	333	ug/Kg	SOLID
2,4,5-Trichlorophenol	33.6	1665	ug/Kg	SOLID
2,4,6-Tribromophenol (sur)			%	SOLID
2,4,6-Trichlorophenol	31.9	1665	ug/Kg	SOLID
2,4-Dichlorophenol	35.3	333	ug/Kg	SOLID
2,4-Dimethylphenol	37.1	333	ug/Kg	SOLID
2,4-Dinitrophenol	60.5	1665	ug/Kg	SOLID
2,4-Dinitrotoluene	58.4	333	ug/Kg	SOLID
2,6-Dinitrotoluene	50.4	333	ug/Kg	SOLID
2-Chloronaphthalene	18.2	333	ug/Kg	SOLID
2-Chlorophenol	230.8	333	ug/Kg	SOLID
2-Fluorobiphenyl (sur)			%	SOLID
2-Fluorophenol (sur)			%	SOLID
2-Methylnaphthalene	31.6	333	ug/Kg	SOLID
2-Methylphenol	194.3	333	ug/Kg	SOLID
2-Nitroaniline	30.8	1665	ug/Kg	SOLID
2-Nitrophenol	63.4	333	ug/Kg	SOLID
3,3-Dichlorobenzidine	52.3	333	ug/Kg	SOLID
3-Methylphenol	211.4	333	ug/Kg	SOLID
3-Nitroaniline	31.1	1665	ug/Kg	SOLID
4,6-Dinitro-2-methylphenol	44.9	1665	ug/Kg	SOLID
4-Bromophenyl-phenylether	29.6	333	ug/Kg	SOLID
4-Chloro-3-methylphenol	48.8	333	ug/Kg	SOLID
4-Chloroaniline	19.2	333	ug/Kg	SOLID
4-Chlorophenyl-phenylether	38.1	333	ug/Kg	SOLID
4-Methylphenol	211.4	333	ug/Kg	SOLID
4-Nitroaniline	134.9	1665	ug/Kg	SOLID
4-Nitrophenol	84.8	1665	ug/Kg	SOLID
Acenaphthene	17.4	333	ug/Kg	SOLID
Acenaphthylene	14.8	333	ug/Kg	SOLID
Anthracene	9.9	333	ug/Kg	SOLID
Benzidine	260	333	ug/Kg	SOLID
Benzo(a)anthracene	26.2	333	ug/Kg	SOLID
Benzo(a)pyrene	20.0	333	ug/Kg	SOLID
Benzo(b)fluoranthene	29.9	333	ug/Kg	SOLID
Benzo(g,h,i)perylene	13.9	333	ug/Kg	SOLID
Benzo(k)fluoranthene	23.7	333	ug/Kg	SOLID
Benzoic Acid	70.0	333	ug/Kg	SOLID
Benzyl alcohol	197.0	333	ug/Kg	SOLID
Butylbenzylphthalate	25.9	333	ug/Kg	SOLID
Chrysene	38.0	333	ug/Kg	SOLID
Di-n-butylphthalate	30.7	333	ug/Kg	SOLID
Di-n-octylphthalate	66.3	333	ug/Kg	SOLID
Dibenz(a,h)anthracene	32.3	333	ug/Kg	SOLID
Dibenzofuran	16.4	333	ug/Kg	SOLID
Diethylphthalate	43.8	333	ug/Kg	SOLID
Dimethylphthalate	28.6	333	ug/Kg	SOLID
Fluoranthene	28.2	333	ug/Kg	SOLID
Fluorene	19.3	333	ug/Kg	SOLID
Hexachlorobenzene	49.4	333	ug/Kg	SOLID
Hexachlorobutadiene	40.1	333	ug/Kg	SOLID

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TESTNO: 8270C
DEPARTMENT: GCMS/SVOA
TESTNAME: 8270C Acid/Base/Neutral Extractables
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Hexachlorocyclopentadiene	48.3	333	ug/Kg	SOLID
Hexachloroethane	180.8	333	ug/Kg	SOLID
Indeno(1,2,3-c,d)pyrene	36.1	333	ug/Kg	SOLID
Isophorone	30.4	333	ug/Kg	SOLID
N-Nitroso-di-n-propylamine	221.8	333	ug/Kg	SOLID
N-Nitrosodiphenylamine	29.1	333	ug/Kg	SOLID
Naphthalene	15.6	333	ug/Kg	SOLID
Nitrobenzene	60.6	333	ug/Kg	SOLID
Nitrobenzene-d5 (sur)			%	SOLID
Pentachlorophenol	38.0	1665	ug/Kg	SOLID
Phenanthrene	19.4	333	ug/Kg	SOLID
Phenol	229.8	333	ug/Kg	SOLID
Phenol-d5 (sur)			%	SOLID
Pyrene	28.2	333	ug/Kg	SOLID
Terphenyl-d14 (sur)			%	SOLID
bis(2-Chloroethoxy)methane	22.6	333	ug/Kg	SOLID
bis(2-Chloroethyl)ether	291.5	333	ug/Kg	SOLID
bis(2-Chloroisopropyl) ether	275.3	333	ug/Kg	SOLID
bis(2-Ethylhexyl)phthalate	36.1	333	ug/Kg	SOLID
1,2,4-Trichlorobenzene	0.92	10	ug/L	WATER
1,2-Dichlorobenzene	3.27	10	ug/L	WATER
1,3-Dichlorobenzene	3.52	10	ug/L	WATER
1,4-Dichlorobenzene	4.11	10	ug/L	WATER
2,4,5-Trichlorophenol	0.93	50	ug/L	WATER
2,4,6-Tribromophenol (sur)			%	WATER
2,4,6-Trichlorophenol	0.98	50	ug/L	WATER
2,4-Dichlorophenol	1.08	10	ug/L	WATER
2,4-Dimethylphenol	1.22	10	ug/L	WATER
2,4-Dinitrophenol	2.02	50	ug/L	WATER
2,4-Dinitrotoluene	0.60	10	ug/L	WATER
2,6-Dinitrotoluene	1.23	10	ug/L	WATER
2-Chloronaphthalene	0.99	10	ug/L	WATER
2-Chlorophenol	0.90	10	ug/L	WATER
2-Fluorobiphenyl (sur)			%	WATER
2-Fluorophenol (sur)			%	WATER
2-Methylnaphthalene	0.85	10	ug/L	WATER
2-Methylphenol	1.31	10	ug/L	WATER
2-Nitroaniline	1.27	50	ug/L	WATER
2-Nitrophenol	0.90	10	ug/L	WATER
3,3-Dichlorobenzidine	0.73	10	ug/L	WATER
3-Methylphenol	1.33	10	ug/L	WATER
3-Nitroaniline	1.27	50	ug/L	WATER
4,6-Dinitro-2-methylphenol	1.26	50	ug/L	WATER
4-Bromophenyl-phenylether	0.70	10	ug/L	WATER
4-Chloro-3-methylphenol	1.60	10	ug/L	WATER
4-Chloroaniline	0.66	10	ug/L	WATER
4-Chlorophenyl-phenylether	0.86	10	ug/L	WATER
4-Methylphenol	1.33	10	ug/L	WATER
4-Nitroaniline	1.79	50	ug/L	WATER
4-Nitrophenol	2.16	50	ug/L	WATER
Acenaphthene	0.78	10	ug/L	WATER
Acenaphthylene	0.37	10	ug/L	WATER
Anthracene	0.53	10	ug/L	WATER
Benzidine	0.3	50	ug/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TESTNO: 8270C
DEPARTMENT: GCMS/SVOA
TESTNAME: 8270C Acid/Base/Neutral Extractables
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Benzo(a)anthracene	0.64	10	ug/L	WATER
Benzo(a)pyrene	0.54	10	ug/L	WATER
Benzo(b)fluoranthene	0.90	10	ug/L	WATER
Benzo(g,h,i)perylene	0.67	10	ug/L	WATER
Benzo(k)fluoranthene	0.91	10	ug/L	WATER
Benzoic Acid	2.66	10	ug/L	WATER
Benzyl alcohol	1.20	10	ug/L	WATER
Butylbenzylphthalate	0.62	10	ug/L	WATER
Chrysene	0.65	10	ug/L	WATER
Di-n-butylphthalate	0.53	10	ug/L	WATER
Di-n-octylphthalate	0.82	10	ug/L	WATER
Dibenz(a,h)anthracene	0.62	10	ug/L	WATER
Dibenzofuran	0.56	10	ug/L	WATER
Diethylphthalate	0.72	10	ug/L	WATER
Dimethylphthalate	0.74	10	ug/L	WATER
Fluoranthene	0.69	10	ug/L	WATER
Fluorene	0.77	10	ug/L	WATER
Hexachlorobenzene	0.60	10	ug/L	WATER
Hexachlorobutadiene	1.50	10	ug/L	WATER
Hexachlorocyclopentadiene	1.46	10	ug/L	WATER
Hexachloroethane	4.22	10	ug/L	WATER
Indeno(1,2,3-c,d)pyrene	0.72	10	ug/L	WATER
Isophorone	1.20	10	ug/L	WATER
N-Nitroso-di-n-propylamine	6.47	10	ug/L	WATER
N-Nitrosodiphenylamine	1.34	10	ug/L	WATER
Naphthalene	1.30	10	ug/L	WATER
Nitrobenzene	1.52	10	ug/L	WATER
Nitrobenzene-d5 (sur)			%	WATER
Pentachlorophenol	1.19	50	ug/L	WATER
Phenanthrene	0.86	10	ug/L	WATER
Phenol	1.93	10	ug/L	WATER
Phenol-d5 (sur)			%	WATER
Pyrene	1.26	10	ug/L	WATER
Terphenyl-d14 (sur)			%	WATER
bis(2-Chloroethoxy)methane	1.22	10	ug/L	WATER
bis(2-Chloroethyl)ether	1.29	10	ug/L	WATER
bis(2-Chloroisopropyl) ether	2.89	10	ug/L	WATER
bis(2-Ethylhexyl)phthalate	0.63	10	ug/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TEST NO: 6010B
DEPARTMENT: AA/ICP
TESTNAME: 6010B ICP Metals - Solid/Liquid
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Aluminum	0.61	20.0	mg/Kg	SOLID
Antimony	0.62	3.00	mg/Kg	SOLID
Arsenic	0.62	1.00	mg/Kg	SOLID
Barium	0.05	1.00	mg/Kg	SOLID
Beryllium	0.16	0.50	mg/Kg	SOLID
Bismuth	0.44	2.00	mg/Kg	SOLID
Boron	0.23	5.00	mg/Kg	SOLID
Cadmium	0.06	0.50	mg/Kg	SOLID
Calcium	3.21	50.0	mg/Kg	SOLID
Chromium	0.14	1.00	mg/Kg	SOLID
Cobalt	0.06	0.50	mg/Kg	SOLID
Copper	0.10	1.00	mg/Kg	SOLID
Iron	0.62	5.00	mg/Kg	SOLID
Lead	0.16	0.50	mg/Kg	SOLID
Magnesium	1.13	25.0	mg/Kg	SOLID
Manganese	0.03	1.00	mg/Kg	SOLID
Molybdenum	0.38	1.00	mg/Kg	SOLID
Nickel	0.29	1.50	mg/Kg	SOLID
Phosphorus	19.2	50.0	mg/Kg	SOLID
Potassium	12.0	50.0	mg/Kg	SOLID
Selenium	0.55	1.00	mg/Kg	SOLID
Silicon	0.14	50	mg/Kg	SOLID
Silver	0.12	0.50	mg/Kg	SOLID
Sodium	3.36	50.0	mg/Kg	SOLID
Thallium	0.33	1.00	mg/Kg	SOLID
Tin	0.16	1.00	mg/Kg	SOLID
Titanium	0.09	1.00	mg/Kg	SOLID
Vanadium	0.17	0.50	mg/Kg	SOLID
Zinc	0.07	5.00	mg/Kg	SOLID
Aluminum	0.008	0.05	mg/L	WATER
Antimony	0.006	0.02	mg/L	WATER
Arsenic	0.004	0.005	mg/L	WATER
Barium	0.007	0.010	mg/L	WATER
Beryllium	0.002	0.005	mg/L	WATER
Bismuth	0.004	0.050	mg/L	WATER
Boron	0.003	0.02	mg/L	WATER
Cadmium	0.001	0.005	mg/L	WATER
Calcium	0.015	0.10	mg/L	WATER
Chromium	0.002	0.010	mg/L	WATER
Cobalt	0.002	0.005	mg/L	WATER
Copper	0.002	0.010	mg/L	WATER
Iron	0.004	0.02	mg/L	WATER
Lead	0.002	0.005	mg/L	WATER
Magnesium	0.011	0.05	mg/L	WATER
Manganese	0.002	0.010	mg/L	WATER
Molybdenum	0.005	0.010	mg/L	WATER
Nickel	0.002	0.020	mg/L	WATER
Phosphorus	0.14	0.50	mg/L	WATER
Potassium	0.15	0.50	mg/L	WATER
Selenium	0.004	0.006	mg/L	WATER
Silicon	0.003	0.10	mg/L	WATER
Silver	0.003	0.005	mg/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TEST NO: 6010B
DEPARTMENT: AA/ICP
TESTNAME: 6010B ICP Metals - Solid/Liquid
AS OF: 04/18/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Sodium	0.029	0.10	mg/L	WATER
Thallium	0.002	0.005	mg/L	WATER
Tin	0.002	0.050	mg/L	WATER
Titanium	0.002	0.010	mg/L	WATER
Vanadium	0.002	0.005	mg/L	WATER
Zinc	0.003	0.020	mg/L	WATER

ASSOCIATED LABORATORIES METHOD SPECIFICATION SUMMARY

TEST NO: 900.0
DEPARTMENT: TOC/RAD
TESTNAME: 900.0 Radioactivity - Gross Alpha and Beta
AS OF: 04/22/03

ANALYTE	MDL	DLR	UNITS	MATRIX
Radioactivity - Beta	0.18	0.5	pCi/L	DRINKING WATER
Radioactivity - Gross Alpha	0.43	1.0	pCi/L	DRINKING WATER
Radioactivity - Beta		1.0	pCi/g	SOLID
Radioactivity - Gross Alpha		0.5	pCi/g	SOLID
Radioactivity - Beta	0.18	0.5	pCi/L	WATER
Radioactivity - Gross Alpha	0.43	1.0	pCi/L	WATER