BHATE
Environmental Engineers and Scientists
1608 13th Avenue South, Suite 300
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November 25, 2003

RECEIVED
DEC 2003
NMED Hazardous
Waste Bureau

Ms. Sandra Martin
NMED/Hazardous Waste Bureau
2905 Rodeo Park Dr. East
Santa Fe, NM 87505-6303

Subject: ***Voluntary Corrective Measures Work Plan***
T-38 Test Cell Fuel Spill Site
Holloman AFB, New Mexico
Contract No.: DACA45-03-D-0008
Delivery Order No: 3
Bhate Project No.: 9030072

Dear Ms. Martin:

Enclosed please find one (1) copy of the above-referenced document

If you have any questions or need additional assistance, please feel free to call me at (970) 216-7819.

Sincerely,
BHATE ENVIRONMENTAL ASSOCIATES, INC.

Frank Gardner
Program Manager
Holloman Air Force Base

cc Cornelius Amindyas (NMED)
Steve Jetter (NMED)
James Harris (USEPA)

BHATE ENVIRONMENTAL, INC.

1608 13th Avenue South • Suite 300
Birmingham, AL 35205
Phone (205) 918-4000 • Fax (205) 918-4050

LETTER OF TRANSMITTAL

DATE	JOB NO
11-26-03	9030072

ATTENTION: Tom Zink

RE: Voluntary Corrective Measures
T-38 Cell Fuel Spill Site
Holloman Air Force Base
New Mexico

TO: USACE - Omaha District
Attn: CENWO-PM-HA
~~106 South 15th Street~~
Omaha, NE 68102

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via ______ the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ ______

COPIES	DATE	NO.	DESCRIPTION
3	11-25-03	--	Work Plan

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval

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☐ For review and comment ☐ ______

☐ FOR BIDS DUE ______ 19 ____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS

Federal Express to Tom Zink

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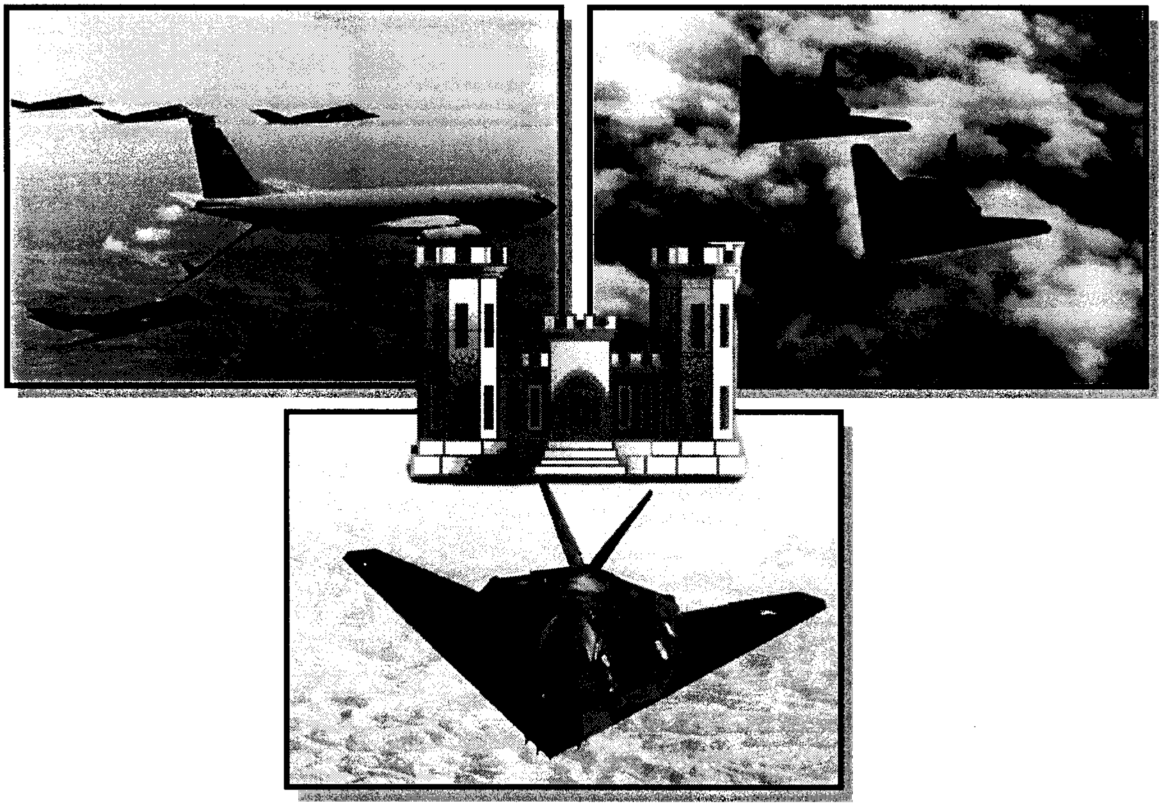
SIGNED: Frank Gardner

If enclosures are not as noted, kindly notify us at once.

WORK PLAN
VOLUNTARY CORRECTIVE MEASURES
T-38 TEST CELL FUEL SPILL SITE



Holloman Air Force Base
New Mexico

November 2003

CONTRACT NO. DACA45-03-D-0008
DELIVERY ORDER NO. 3
Bhate Project No. 9030072

Headquarters, Air Combat Command
Langley Air Force Base, Virginia

49 CES/CEV
Holloman Air Force Base, New Mexico

WORK PLAN

VOLUNTARY CORRECTIVE MEASURE
T-38 TEST CELL FUEL SPILL SITE

HOLLOMAN AFB, NEW MEXICO

CONTRACT NO. DACA45-03-D-0008
DELIVERY ORDER NO. 3
Bhate Project Number: 9030072

Prepared For

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

Prepared By

Bhate Environmental Associates, Inc.
1608 13th Avenue South
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Birmingham, Alabama 35205

November 2003

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WORK PLAN

VOLUNTARY CORRECTIVE MEASURE T-38 TEST CELL FUEL SPILL SITE

HOLLOMAN AFB, NEW MEXICO

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS WORK PLAN

Frank Gardner	Frank Gardner	11-26-03
Program Manager	Signature	Date
for Jerry Pelfrey	[signature]	11/26/03
Site Manager	Signature	Date

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WORK PLAN

VOLUNTARY CORRECTIVE MEASURE T-38 TEST CELL FUEL SPILL SITE

HOLLOMAN AFB, NEW MEXICO

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FIGURES

APPENDICES

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ACRONYMS AND ABBREVIATIONS

AAF	Army Air Field
AOC	Area of Concern
AFB	Air Force Base
AF Fm	Air Force Form
amsl	Above Mean Sea Level
ANSI	American National Standards Institute
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
Bhate	Bhate Environmental Associates, Inc.
BTEX	Benzene, toluene, ethyl benzene, xylenes
CDW	Construction Derived Waste
CES/CEV	Civil Engineering Squadron/Combat Engineer Vehicle
CFM	Cubic Feet per Minute
cm	Centimeter
cm/sec	Centimeter per second
COC	Chain-of-Custody
CRZ	Contamination Reduction Zone
DoD	Department of Defense
DQOs	Data Quality Objectives
DRMO	Defense Reutilization and Marketing Office
DPE	Dual Phase Extraction
DRO	Diesel-Range Organics
ERPIMS	Environmental Restoration Program Information Management System
EZ	Exclusion Zone
FID	Flame Ionization Detector
GAC	Granular Activated Carbon
gpm	Gallons per minute
GRO	Gasoline-Range Organics
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
hr	Hour
HVDPE	High Vacuum Dual-Phase Extraction
IRA	Interim Remedial Action
IRP	Installation Restoration Program
kg	Kilogram
L	Liter
lbs	Pounds
LNAPL	Light Non-aqueous Phase Liquid
LTM	Long Term Monitoring
mg	Milligram

ACRONYMS AND ABBREVIATIONS- CONTINUED

mL	Milliliter
NFA	No Further Action
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Commission
ORO	Oil-Range Organics
OSHA	Occupational Safety and Health Administration
OWS	Oil/water Separator
OVA	Organic Vapor Analyzer
PA/SI	Preliminary Assessment/Site Investigation
PCS	Petroleum-Contaminated Soils
PID	Photo Ionization Detector
POL	Petroleum, Oil and Lubricants
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
sec	Second
SOP	Standard Operating Procedure
SSL	Soil Screening Level
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compounds
SWPPP	Storm Water Pollution Prevention Plan
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UVF	Ultra Violet Fluorometer
VOC	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

Bhate Environmental Associates, Inc. (Bhate) has been retained by the U.S. Army Corps of Engineers (USACE), under contract DACA45-03-D-0008, Delivery Order No. 3, to conduct Voluntary Corrective Measures (VCMs) at several of the Areas of Concern (AOC) at Holloman Air Force Base (HAFB), New Mexico. The VCMs include multiple tasks as outlined in the USACE Scope of Services dated February 24, 2003. This document is to provide a work plan that will serve as the primary working document for the excavation activities at T-38 Test Cell Fuel Spill Site (T-38). This plan provides the relevant site information and requirements as outlined in the respective Scope of Work for remedial activities at T-38. The primary objective of this VCM is to remove, through excavation, and properly treat or dispose, petroleum-contaminated soils (PCS) at the site. During this process, required data will be collected to support the closure of the site based on guidance from the New Mexico Environment Department (NMED). The ultimate objective is to achieve approval for site closure from NMED.

1.1 Purpose

This Work Plan has been constructed to provide relevant information on the geologic, hydrologic and other environmental conditions for HAFB and the site. Information is provided for the entire Base and its surrounding environ as well as T-38, specifically. Likewise, the procedures encompassing the site excavation, sampling and waste management are presented.

1.2 Description

HAFB is located in southeastern New Mexico in Otero County, approximately 100 miles north-northeast of El Paso, Texas, and six miles west of Alamogordo, New Mexico (Figure 1). HAFB was first established in 1942 as Alamogordo Army Air Field (AAF). From 1942 through 1945, Alamogordo AAF served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the base. In 1947, Air Material Command announced the air field would be its primary site for the testing and development of un-manned aircraft, guided missiles, and other research programs. On January 13, 1948, the Alamogordo installation was renamed Holloman Air Force Base, in honor of the late Col. George V. Holloman, a pioneer in guided missile research. In 1968, the 49th Tactical Fighter Wing arrived at HAFB and has remained since. Today, HAFB also serves as the German Air Force's Tactical Training Center.

1.3 Project Background

Reportedly, the T-38 Test Cell was used as an F4 trim pad from 1966 through 1977 [Foster Wheeler, April 2002]. During this time, an aboveground storage tank (AST) and the power check pad were installed in the area. In 1977, the test cell was upgraded for T-38 aircraft. A temporary test cell was used in conjunction with a 1,000-gallon AST for approximately 3 years. DynaCorp assumed operation of the T-38 Test Cell in 1988, and in 1991, after a week of nonuse, the level was checked and it was discovered that the 5,000-gallon JP-4 jet fuel AST had been leaking. It was estimated that approximately 2,000 gallons had leaked from the underground line system leading to the test cell. Subsequently, the underground lines were replaced with aboveground lines.

Various investigations by U.S. Environmental Protection Agency (EPA) and U.S. Air Force (USAF) contractors have been conducted since 1992. During these studies, monitoring wells were installed; soil and groundwater samples were collected to assist in the delineation of the jet fuel free product and characterization of the site parameters that would influence product recovery.

1.3.1 Site Description

T-38 is located along the northwest edge of Taxiway A (Figure 2). The 11.5-acre site consists of a Soil Vapor Extraction (SVE) system, located north of Building 638, connected to 133 extraction wells. Prior to 1998, the system was a dual-phase extraction system (DPE). Extracted free product, groundwater and soil vapors were treated aboveground. Soil vapors were treated in an onsite thermal oxidizing unit and treated groundwater was discharged through an infiltration gallery located northeast of the treatment system. Free product was stored in an AST (for subsequent use as an auxiliary fuel for the onsite thermal oxidizing unit).

Adjacent to the site to the northeast is a concrete area that contains the outdoor power check pad where T-38 planes are tested. In this area are the Hush House (Building 639), a 5,000-gallon JP-4 AST, two oil/water separators (OWS), a water tank that is no longer in use, and Building 638, which is used for general support and maintenance activities.

To the northwest is the radar building. Transmission lines and emergency lines are located underground west of the site. There is an electrical underground utility line traversing the center of the site. The remaining area contains sparse vegetation.

1.3.2 Dual-Phase Extraction System

In 1994, groundwater and SVE models were performed to analyze a 19-hour DPE pilot test to support a full-scale design. The Interim Remedial Action (IRA) recovery system was installed in mid-1994. The high-vacuum (HV) DPE system pulled liquids and soil vapors from a series of 11 extraction wells. The liquids were separated from the vapors and treated through an OWS with the product going to an 8,000-gallon AST, the groundwater treated through a 60 gallon per minute (gpm) air stripping tower followed by polishing through a granular activated carbon (GAC) system prior to re-injection via the infiltration gallery. Vapors from the HVDPE system and the air stripping tower were treated through a 5,000- cubic feet per minute (CFM) thermal oxidizer.

A *Corrective Measure Study* (CMS), conducted after the IRA system was installed, concluded that a light non-aqueous phase liquid (LNAPL) plume was detected across the site, 150 feet upgradient and 500 feet downgradient of the test cell tank system. In the CMS, the volume of free product was estimated to be 450,000 to 480,000 gallons [Foster Wheeler, 1995].

From November 1995 through May 1996, an expansion of the high vacuum DPE system was completed. Two DPE package systems and a bioventing package system, in addition to 122 extraction wells, were installed and combined with the existing system to enhance free product recovery. Additional pilot test studies were conducted in 1997 and 1999 to optimize the operation of the system.

1.3.3 Soil Vapor Extraction System

In 1998, the extraction of groundwater was terminated and efforts for product recovery were switched to vacuum-enhanced (VE) skimming. SVE was performed on all of the 133 extraction wells while oil-skimmers operated on 20 sealed wells. The system was reconfigured so the thermal oxidizer could include a dual-phase option to burn either natural gas or jet fuel. A natural gas pipeline was routed from the base natural gas main to T-38. Also, a temporary discharge line was run from the groundwater treatment system to the HAFB wastewater treatment plant (WWTP). However, since 2001, the system has been shut down.

In 2002, a study was conducted to model the multi-phase extraction system, make recommendations to optimize the extraction of free product, update the estimate of remediation time, and to revise the estimate of the volume of jet fuel released. The modeling indicated a revised estimate of 1,013,009 gallons released, an estimate of 851,897 gallons of product remaining in the ground (214,005 gallons of free product and 637,892 residual product), and an estimated time period for closure of 77 years. However, the estimated practical timeframe was calculated at 13 years, based on asymptotic behavior of the modeling graph.

1.4 Physiography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains (Figure 3). The region is characterized by high tablelands with rolling summit plains; cuesta-formed mountains dipping eastward and of west-facing escarpments with the wide bracketed basin forming the basin and range complex. HAFB is approximately 59,600 acres in area, and is located at a mean elevation of 4,093 feet above mean sea level (amsl). The Base is located in the Tularosa Sub-basin which is part of the Central Closed Basins. The San Andreas Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east. At its widest, the basin is about 60 miles east to west and stretches approximately 150 miles north to south.

1.5 Surface Water

The Tularosa Sub-basin contains all of the surface flow in its boundaries. The nearest inflow of surface waters to HAFB comes from Lost River, located in the north-central region of the Base. The upper reaches of the Three Rivers and the Sacramento River are perennial in the basin.

HAFB is dissected by several southwest trending arroyos that control the surface drainage. Hay Draw is located in the far north. Malone and Rita's Draw, which drain into the Lost River, and Dillard's Draw are located along the eastern perimeter of the Base. Approximately 10,000 years ago, indications are of a much wetter climate. The present day Lake Otero encompassed a much larger area, possibly upwards of several hundred square miles. Its remains are the Alkali Flat and Lake Lucero. Lake Lucero is a temporary feature of merely a few inches in depth during the rainy season.

Ancient lakes and streams deposited water bearing deposits over the older bedrock basement material. Fractures, cracks and fissures, in the Permian and Pennsylvanian bedrock, yield small quantities of relatively good quality water in the deeper peripheral. Potable water is only found from a handful of wells near the edges of the basin with more saline water towards the center. Two of the principal sources of potable water are a long narrow area on the upslope sides of Tularosa and Alamogordo with the other in the far southwestern part of the basin. Alamogordo's water, as well as water for HAFB, is supplied from Lake Bonito (which is in the Pecos River Basin).

1.6 Groundwater

The predominance of the groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream run-off along the western edge of the Sacramento Mountains. Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges, and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Sub-basin is a closed system, water that enters the area only leaves either through evaporation or percolation. This elevated amount of percolation results in a fairly high water table. Beneath HAFB, groundwater ranges from 5 to 50 feet. Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. Near the arroyos, groundwater flows directly toward the surface drainage feature.

Previous analyses indicate total dissolved solids (TDS) of greater than 10,000 mg/L in groundwater beneath HAFB. This exceeds the New Mexico Water Quality Control Commission (NMWQCC) limit as potable water and thus, the groundwater beneath HAFB has been designated as unfit for human consumption. Likewise, USEPA guidelines have identified the groundwater as a Class IIIB water source, characterized by TDS concentrations exceeding 10,000 mg/L.

1.7 Climate

As a whole, New Mexico has a mild, arid to semi-arid continental climate characterized by light precipitation totals, abundant sunshine, relatively low humidity and relatively large annual and diurnal temperature range. The climate of the Central Closed Basins varies with elevation. HAFB is found in the low areas and is characterized by warm temperatures and dry air. Daytime temperatures often exceed 100° F in the summer months and middle 50s °F in the winter. A preponderance of clear skies and relatively low humidity permits rapid night time cooling resulting in average diurnal temperature ranges of 25 to 35° F. Potential evapotranspiration, at 67 inches per year, significantly exceeds annual precipitation, usually less than 10 inches [Foster Wheeler and Radian, 1997]. The very low rainfall amounts resulting in the arid conditions, which with the topographically induced wind patterns combining with the sparse vegetation, tend to cause localized "dust devils". Much of the precipitation falls during the mid-summer monsoonal period (July and August) as brief, yet frequent, intense thunderstorms culminating to 30 – 40% of the annual total rainfall.

1.8 Geology

The sedimentary rocks which make up the adjacent mountain ranges are between 500 and 250 million years old. During the period when the area was submerged under the shallow intra-continental sea, the layers of limestone, shale, gypsum and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces forming a large bulge on the surface. Approximately 10 million years ago, the center began to subside resulting in a vertical drop of thousands of feet leaving the edges still standing (the present day Sacramento and San Andreas mountain ranges). In the millions of years following, rainfall, snowmelt and wind eroded the mountain sediments depositing them in the valley (i.e. Tularosa Sub-basin). Water carrying eroded gypsum, gravel and other matter continues to flow into the basin.

As the Tularosa Sub-basin is a bolson, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands and clays. Soils in the basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite and gypsum. A fining sequence from the ranges towards the basin's center characterizes the area with the near surface soils as alluvial, eolian and lacustrine deposits. The alluvial fan deposits are laterally discontinuous units of interbedded sand, silt and clay while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of clay containing gypsum and are contiguous with the alluvial fan and eolian deposits throughout HAFB. There has been the identification of stiff caliche layers, varying in thickness, at different areas of HAFB. At the site, soils are predominantly silty sands and interbedded clays.

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2 EXCAVATION PROCEDURES

Excavation/VCM activities at T-38 will be conducted incrementally based on yearly funding allocations; therefore, remediation in support of site closure will be accomplished over a period of years. The objective of the soil excavation is to remove contaminated subsurface soil, down to the groundwater, that contains more than 940 mg/kg of TPH and where there is a risk due to an exposure to volatile organic compounds (VOCs) and/or semi-volatile organic compounds (SVOCs). The level of 940 mg/kg is the Residential Direct Exposure Limit for kerosene and jet fuel as listed in Table 2 of the *New Mexico Environment Department TPH Screening Guidelines,* June 24, 2003 (Appendix A).

Excavations should be completed to approximately one foot below the local water table at the site with lateral extent based upon previous investigations, recent water level measurements and relevant site knowledge.

The excavation of PCS at T-38 presents unique challenges due to the location of the site. As stated in Section 1.3.1, T-38 is located northwest of Taxiway A. The only access to T-38 is to cross the tarmac, which makes access to the site severely restricted.

2.1 Pre-Excavation Activities

Before excavation and other site activities can begin, there are several pre-construction documents and approval requirements to be met: Form 332 approval, Base dig permit with utility clearances, site security and erosion control mechanisms. Remediation activities at T-38 will be conducted in accordance with the *Draft Storm Water Pollution Prevention Plan T-38 Test Cell Fuel Spill Site* (SWPPP) [Bhate, December 2003] and the *Sediment Control Plan* (SCP) [Bhate, December 2003], so that petroleum-impacted soils will not result in a discharge of contaminated stormwater.

Bhate will coordinate project requests for HAFB installation support services through the 49 CES/CEV. Pertinent to the start of activities, a pre-construction meeting and site walk-through will be conducted with the USACE Resident Engineer, HAFB personnel, and Bhate Site Manager, to inspect site conditions for site/equipment access, equipment staging area, soil stockpile areas, potential site hazards and emergency evacuation routes. Also, reviewed at this time will be project procedures in accordance with the schedule and planned activities.

2.1.1 Air Force Form 332

Air Force Form (AF Fm) 332 authorizes construction work at HAFB and is required for the initiation of any construction work (Appendix B). This work order describes what activities will take place at the location. The AF Fm 332 is also the mechanism by which the utility clearance/dig permit is authorized. AF Fm 332 will be initiated by Bhate personnel. Both the

AF Fm 332 and dig permit will be reviewed by required HAFB personnel for their approvals to begin work in their area or that which may affect a utility under their authority.

2.1.2 Dig Permit/Utility Clearances

As note above, utility clearance approvals will be completed by HAFB personnel. Upon receipt of the approved dig permit with the utility clearances, the Bhate Site Manager or other authorized project personnel will complete a site walk-down confirming the dig permit authorizations and make any required changes.

2.1.3 Site Security

Site security is concerned with safety at the site of the excavation and the areas around the excavation. Items of concern include the proper designation and demarcation of construction boundaries (i.e. exclusion zone (EZ), contamination reduction zone (CRZ) and support zone (SZ)), compliance with excavation requirements, posting of potential hazards, and control of un-authorized site personnel, as discussed in the *Basewide Health and Safety Plan* (HASP) [Bhate, November 2003]. Based upon the OSHA classifications of the various excavations, this site will be a Class II excavation.

At a minimum, the site will be secured with caution tape surrounding the perimeter of the site delineating the outer boundary of the CZ. This is essential in the utility clearance process and it serves as the demarcation of the site for both project and non-project persons. Due to the presumed free product within the soils to be excavated, a CRZ and EZ will be established as guided by the Basewide HASP [Bhate, November 2003] and site prevailing conditions. Depth to bottom of the excavation is expected to reach upwards of 15 feet below grade.

2.2 Excavation Area

Prior to excavation, a final round of water and product levels will be collected from monitoring/ extraction wells in the area of the site to finalize the planned excavation boundaries. The primary obstacle to excavation is the presence of the SVE system with associated extraction wells, piping and treatment system. Prior to the excavation of overburden and contaminated soils, piping runs of the SVE system that are within the area to be excavated will be isolated from the system, abandoned and removed.

2.2.1 Monitoring Well Abandonment

Prior to excavation activities, monitoring wells located within the excavation area will be properly abandoned. The surface fittings, well box, well casing and other materials shall be removed to a depth of 3 feet below grade. Each monitoring well will then be grouted in-place to the surface in accordance with American Society for Testing and materials (ASTM) Guidance D 5299-92. They will be pressure grouted with a 6% to 8% bentonite powder/grout mixture. For wells with a depth less than 50 feet, grout shall be placed via tremmie pipe.

2.2.2 SVE Treatment System Abandonment and Removal

During the VCM activities conducted under this Excavation Work Plan, parts of the existing SVE system will be abandoned; however, the majority of the system will remain in use. Groundwater and associated free product will be removed by the existing SVE system. The water will be routed through the existing water treatment system to remove free product and ultimately discharged to the HAFB WWTP.

Piping within the excavation area will be blank flanged or equivalent. The extraction wells will be removed during the excavation activities. Due to the high levels of contaminated vapors being processed through the piping and remaining system, disposal will be dependant upon appropriate sampling of the pipe according to 40 CFR 261 procedures. Any potentially re-usable equipment will be relinquished to the HAFB Defense Reutilization and Marketing Office (DRMO). Characterization sampling also applies to any equipment at the treatment pad that will not be relinquished to the Base DRMO but designated for disposal.

2.3 Soil Screening

During the excavation process, soils will be screened for potential and real contamination. Initial screening will be visual, observance of discoloration. Likewise, soils will be periodically screened utilizing soil-headspace screening techniques via the field flame ionization detector/photoionization detector (FID/PID).

Soils will be screened via headspace analysis every 100 cubic yards (cy). Confirmatory field TPH analysis will be completed with the UV fluorometer (UVF) at a frequency of 10%. Although the NMED clean-up level is 940 mg/kg, soils resulting in a headspace reading with the FID/PID above 850 ppm will be designated TPH contaminated, allowing for a 10% instrument error and variability between the screening method and the NMED approved laboratory analysis. This confirmatory TPH analysis is the siteLAB® Analytical Test Kit UVF-3100A. Information regarding the procedure is included as Appendix C. This test uses a 10-gram sample of soil, where the petroleum compounds are extracted with methanol. The extract is decanted into a quartz cuvette and placed in the chamber of the fluorometer. The TPH concentration is displayed as parts per million.

Final soils characterization will be completed via laboratory analysis using TPH method EPA Method 8015 M for gasoline-range organics (TPH-GRO) [C_6-C_{10}], diesel-range organics (TPH-DRO) [C_{10}-C_{22}] and oil-range organics (TPH-ORO) [C_{22}-C_{36}] at a frequency of 10% of the samples screened by the UVF.

2.4 Soil Excavation

Prior to excavation of overburden or contaminated soils, the site will be prepared according to the Draft SWPPP [Bhate, December 2003]. Excavation activities will utilize an excavator or trackhoe for the primary soil removal with either a front loader or rubber tired backhoe to assist with soil management. Overburden soil shall be removed, with appropriate screening, and stockpiled onsite in the designated location. Stockpiles will be managed in accordance with the Draft SWPPP and the Draft SCP [Bhate, December 2003]. Contaminated soils will be temporarily stockpiled for offsite disposal or treatment and processing at the onsite landfarm.

The suspected area of contamination within the soil is projected to be the lower three to four feet just above the groundwater surface. Free product on the water table will be encountered over some portion of the site. During the excavation process, periodic trenching may be required to promote the amassing of the free product. Accumulated free product will be removed by the existing treatment system and collected into an onsite storage tank for disposal through the onsite thermal oxidizing unit.

2.5 Free Product Removal

It is anticipated that free product will be encountered on the groundwater that accumulates inside the excavation. Free product and groundwater will be removed from the excavation using the existing SVE system. With the current configuration of the extraction wells and piping system, extraction wells will be located around the perimeter of the excavation (Figure 4). Using this system will create a slight gradient to enhance the removal of free product currently on the water table a T-38.

The recovered groundwater will be treated through the onsite treatment system. Free product will be stored in the onsite AST and the treated groundwater will be discharged to the HAFB WWTP.

2.6 Excavation Backfilling and Compaction

Clean overburden soils removed from the site will be emplaced into the excavation with periodic compaction using the loader and a compactor. Because there will be a void space, treated soils from the onsite landfarm will be used as backfill material once remediation levels have been attained or soils will be transported onsite from the HAFB borrow area. Borrow soils will be tested for TPH prior to being placed in the excavation. Any soils with TPH levels above 940 mg/kg will not be used as backfill material. It is not anticipated that the site is to be reused for any future construction activities (buildings, structures, etc.) due to its location.

2.7 Soil Disposal

Accumulated contaminated soils shall be transported offsite for proper disposal or transferred to the landfarm operating at the T-38 site. Soils treated onsite will be used as backfill material when testing indicates TPH concentrations are below the 940 mg/kg level.

2.8 Site Restoration

Upon completion of site excavation and backfill activities, the site will be restored with grading to the surrounding grade with a thin to moderate layer of crushed stone. Construction equipment and debris will be removed. The site will be canvassed for trash, debris, etc. Final grade for the site will allow for positive drainage in accordance with the surrounding area.

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3 SOIL SAMPLING AND ANALYSIS

3.1 Field Screening Evaluation

The 940 mg/kg action level for PCS is found as the NMED Residential Direct Exposure Limit for kerosene and jet fuel, listed in Table 2, of the T*PH Screening Guidelines*, June 24, 2003. This cleanup level is part of previous agreement between HAFB and NMED. The TPH-GRO and TPH-DRO concentrations will be summed for the total TPH value as the comparison to the NMED TPH allowable limit of 940 mg/kg for PCS. The excavation sampling quantities and analyses are presented in Table 1. Un-impacted soils are the overburden soils which have historically demonstrated no contamination and the source of the contamination is not from a surface release. Suspected contaminated soils are those primarily within the smear zone. These are typically contained in a 2 to 3 foot zone above the contaminated soils. The contaminated soils are those that are definitively contaminated through sample data.

Table 3-1. Sampling Plan for T-38

Soil Origin	Contamination Profile	Method/ Analyses	Rate/Quantity	Purpose	Quantity
Excavation (during excavation process)	Un-impacted Soils	OVA/VOCs	Every 500 yds	Field Screening	1 per sampling
		UVF/TPH	10% of OVA	OVA QA	1 per sampling
		Laboratory TPH	5% or 1 per site	UVF QA	1 per sampling
	Suspected Contaminated Soils (smear zone)	OVA/VOCs	Every 100 yds	Field Screening	1 per sampling
		UVF/TPH	10% of OVA	OVA QA	1 per sampling
		Laboratory TPH	10% or 1 per site	UVF QA	1 per sampling
	Contaminated Soils (contamination zone)	OVA/VOCs	Every 500 yds	Field Screening	1 per sampling
		UVF/TPH	10% of OVA	OVA QA	1 per sampling
		Laboratory TPH	10% or 1 per site	UVF QA	1 per sampling
Stock Piles	Un-impacted Soils	Laboratory TPH, VOCs and SVOCs	Every 500 yds	Backfill characterization	TPH = 1 per sampling VOCs = 3 per sampling SVOCs = 1 per sampling
	Contaminated Soils	Laboratory TPH, VOCs and SVOCs	1 per site	Waste Characterization	TPH = 1 per sampling VOCs = 3 per sampling SVOCs = 1 per sampling

Soil Origin	Contamination Profile	Method/ Analyses	Rate/Quantity	Purpose	Quantity
Confirmation	Un-impacted	Laboratory TPH, VOCs and SVOCs	Every 20 ln. ft, at mid-depth within contamination zone; every 50 ln. ft for excavations with greater than 50,000 cu yds. of contamination zone soils.	Waste Characterization	TPH = 1 per sampling VOCs = 3 per sampling SVOCs = 1 per sampling

3.2 Field Soil Screening

During the excavation process, soils will be field screened for contamination. Throughout the excavation, observation will be completed for discoloration and unusual odors. Un-impacted soils will be field screened every 500 cubic yards (cy) for head space screening with the organic vapor analyzer (OVA). An on-site confirmatory field TPH analysis will be completed for every 10% of the OVA head space samples with the field fluorometer in accordance with the *EPA Field Measurement Technologies for Total Petroleum Hydrocarbons in Soil* guideline (Attachment C). From these samples, 10% will be sent to a fixed-base laboratory for final QA confirmation analysis in accordance with the NMED specified gas chromatographic (GC) methods. For the suspected contaminated soils, the initial OVA screening will be increased to every 100 cy. The contaminated soils will adhere to the clean soils regiment of one OVA sample screening per 500 cy.

3.3 Confirmation Sampling

When it has been determined, through site screening, that the POL impacted soils have been removed, confirmation samples will be collected. One confirmation sample will be collected from each side wall of the excavation every 50 linear feet and analyzed by a fixed base laboratory, ELAB of Tennessee LLC. Nashville, TN. Soil samples will be analyzed for TPH using EPA Method 8015M, VOCs by EPA Method 8260B and SVOCs by EPA Method 8270C. Turnaround time will be the standard of 21 days. If any single sample demonstrates a TPH level above the NMED soil value for TPH of 940 mg/kg, excavation will continue along that face until field screening deems termination with re-evaluation via laboratory confirmation analysis. Analytical confirmation sampling from the bottom of the excavation is not required because excavation will be terminated at one foot below the water table. Data will adhere to DQO requirements, method reporting limits, duplicate field samples and QC samples as established within the T-38 addendum to the *Basewide Quality Assurance Project Plan* (QAPP) [Bhate, November 2003]. Sample quantities, containers, methods of preservation and holding times will be consistent with the requirements of associated method protocols.

3.4 Soil Stockpile Samples

Field screening of samples will be conducted as discussed in Section 2.3. Stockpiled soil that is field screened and deemed clean for backfill purposes, laboratory confirmation samples will be collected at a frequency of one sample per 500 cy. Stockpiled soil that is suspected of contamination and onsite soil screening for TPH indicate levels greater than 850 ppm will be sampled for analysis by the offsite laboratory at a frequency of one sample per 500 cy.

3.5 Sample Identification

Each environmental sample collected will be identified on the sample label and COC records, regardless of type. USACE duplicates will be paired with another random sample and will be blind samples. The duplicate samples will appear in sequence with the regular samples. The identifier nomenclature will be as follows:

####AA##BB

####	Site alpha-numeric identifier, T38
AA	Sample type identifier; CF = confirmation sample, ES = excavation screening sample
##	Sequential sample number in the excavation
BB	reserved for QA sample identifiers
	FD = field duplicate
	MS = matrix spike
	MSD = matrix spike duplicate

3.6 Standard Operating Procedures

Applicable Basewide Standard Operating Procedures (SOPs) for completing this excavation are located in the Basewide QAPP [Bhate, November 2003].

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4 RISK-BASED CLEANUP APPROACH

The objective of the VCM activities presented is to remove PCS and free product from T-38 to support closure of the site. Data collected as a result of field screening will be evaluated based upon the DQO's of the project. The results from the offsite laboratory confirmation samples will be evaluated to determine whether excavation activities at the site have removed the contaminated soil to the point where there is an acceptable risk due to exposure at the site.

4.1 Evaluation of TPH

Based on the direction provided by NMED, pertaining to the remediation of petroleum-impacted sites, a residential exposure TPH screening level of 940 mg/kg will be used to evaluate the data provided by the offsite analytical laboratory. Samples will be analyzed for GRO, DRO and ORO. Concentrations detected will be totaled and that result will be compared to the screening level of 940 mg/kg.

4.2 Evaluation of VOCs and SVOCs

For any VOCs or SVOCs that are detected in soil, the concentration will be evaluated against the screening levels provided in the NMED guidance document *Technical Background Document for Development of Soil Screening Levels* [NMED, December 2000]. Tables containing the soil screening levels (SSLs) from this guidance document are provided in Appendix D. The laboratory data for each soil sample collected will be compared to these SSLs. If the completed evaluation indicates an acceptable risk, then no further excavation will be required and the site can be considered for closure with no further action.

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5 HEALTH AND SAFETY REQUIREMENTS

Project Health and Safety practices will adhere to the Basewide HASP [Bhate, November 2003] and the Activity Hazards Analysis included as an attachment to the *Site Specific Addendum to the Basewide Health and Safety Plan, T-38 Test Cell Fuel Spill Site* [Bhate, November 2003] included as Appendix E. It is anticipated that no greater than modified Level D personal protective equipment (PPE) will be required to complete the excavation and sampling activities at T-38. This includes: OSHA approved safety shoes, ANSI approved safety glasses (Z87.1) and hard hat (Z89.1-1997: Type I), sleeved shirt and long pants, and as required, hearing protection, leather work gloves and nitrile gloves during sampling. A copy of the Basewide HASP [Bhate, November 2003] will be maintained onsite.

Excavation depths are expected to exceed four feet yet less than 20 ft. Side wall benching shall be conducted in accordance with OSHA regulations 29 CFR 1926 Subpart P.

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6 CONSTRUCTION-DERIVED WASTE MANAGEMENT

Construction-Derived Waste (CDW) will be managed and characterized according to the approach presented in Table 2. Whenever possible, waste minimization techniques will be used to reduce the amount of CDW. Wastes generated during this field program will be characterized using the analytical results available from samples collected. The management of CDW generated in the field will be specified for each waste stream category indicated in Table 2. A summary of CDW management for each waste stream is presented in the following sections.

Table 2. Proposed Waste Streams for the Voluntary Corrective Measure

ACTIVITY	WASTE STREAM			
	Excavated Soil	Recycled Material	PPE	Decontamination Water
Excavation	X		X	X
Soil Sampling	X		X	X
SVE Piping		X	X	X
Equipment Decontamination			X	X

6.1 Excavated Soil

Stockpiled soil will be segregated in the field based on visual observation, headspace readings, and onsite analysis of TPH using the UVF-3100A. Stockpiled soil that is suspected of contamination and onsite analytical results for TPH are less than 850 ppm will be sampled for TPH, VOC and SVOCs at a frequency of one sample per 100 c.y. If concentrations are below the SSL for TPH of 940 mg/kg, the stockpiled soil will be used as backfill once the excavation activities are complete. Soil with staining or elevated TPH based on field-screening results will be segregated and placed on 40-mil to 80-mil plastic sheeting within a constructed berm for protection from distribution by wind and rain until characterization is complete.

Excavated contaminated soils will be handled in accordance with Sections 2 and 3. Stockpiled contaminated soils will be transported offsite for treatment and disposal or transferred to the onsite landfarm.

6.2 Decontamination Water

Small equipment, such as sampling tools, will be decontaminated in accordance with the Basewide QAPP [Bhate, November 2003]. Heavy equipment, such as the backhoe, trackhoe, etc., will be decontaminated at a temporary decontamination pad set up at the site. The containers and decontamination pad will be managed in a secure area and the decontamination water will be either allowed to evaporate or combined with the treated groundwater and discharged to the HAFB WWTP. Decontamination water is anticipated to be non-hazardous and as such, can be disposed of through the WWTP. Sediment remaining in the decontamination pad area after the water has either evaporated or been discharged to the WWTP, will be combined with the soil to be remediated in the onsite landfarm or with the soil disposed offsite.

6.3 Personal Protective Equipment, Disposable Sampling Equipment, and Decontamination Pad Materials

PPE and other site non-hazardous debris/waste shall be placed in plastic trash bags and disposed in a standard trash dumpster or receptacle as directed by HAFB personnel.

6.4 SVE Piping

Decommissioned piping from the SVE system will be handled in accordance with Section 2.

7 SAMPLE DOCUMENTATION

Sample documentation, identification and tracking will adhere to the prescribed methods found in the Basewide QAPP [Bhate, November 2003]. Sampling activities will include documentation of significant activities, significant occurrences and sample identification information. At a minimum, field log books will be utilized to record dates and times, sampling protocols, project numbers, and sampler's name. Other pertinent information will include COC numbers and air-bill tracking number. COC forms will be completed and included with each sample shipment.

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8 DATA REPORTING

Data obtained during the excavation, confirmation or field screening samples, will be reported according to the Basewide QAPP [Bhate, November 2003]. Risk evaluation and sampling results will be tabulated and summarized in the closure report for the site. An Environmental Restoration Program Information Management System (ERPIMS) submittal is not required for this project.

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9 ORGANIZATION AND SCHEDULE

During the excavation operations at T-38, *Mr. Jerry Pelfry* will serve as the Bhate Site Manager overseeing and directing excavation and construction activities. Mr. Pelfry will also provide on-site management of sub-contractors for the project. *Mr. Frank Gardner* is the Bhate Program Manager and will ensure required project documents, permits, contractual agreements and other program tasks are completed.

Bhate personnel, or its sub-contractors, will complete tasks in regards to the dismantling of the SVE piping system, as needed. A geologist will oversee the abandonment of the monitoring/extraction wells. Likewise, qualified, licensed operators will provide excavation and transportation services.

Excavation is anticipated to begin around February 2004. The actual start schedule is highly dependant upon the completion of existing and scheduled remedial actions at HAFB (i.e. SS17 and SS02/05).

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10 REFERENCES

Bhate Environmental Associates, Inc., *Basewide Health and Safety Plan,* November 2003.

Bhate Environmental Associates, Inc., *Basewide Quality Assurance Project Plan,* November 2003.

Bhate Environmental Associates, Inc., *Health and Safety Plan Site Specific Addendum, T-38 Test Cell Fuel Spill Site,* Bhate, November 2003.

Bhate Environmental Associates, Inc., *Draft Storm Water Pollution Prevention Plan T-38 Test Cell Fuel Spill Site*, December 2003.

Environmental Protection Agency, *Innovative Technology Report: Field Measurement Technologies for Total Petroleum Hydrocarbons in Soil – siteLAB® Analytical Test Kit UVF-3100,* September 2001.

Foster Wheeler Environmental Corporation, *Corrective Measure Study,* 1995.

Foster Wheeler Environmental Corporation, *Draft Final Addendum to the Draft Final Workplan Operation and Maintenance of Interim System at T-38 Test Cell*, January 1997.

Foster Wheeler Environmental Corporation, *Final Multiphase Modeling and Recommendations Report for ERP Site SS-59, SWMU 229 (T-38 Test Cell Fuel Spill Site)*, April 2002.

Foster Wheeler Environmental Corporation and Radian Corporation, *Phase II RCRA Facility Investigation Report, Table 1 Solid Waste Management Units*, June 1997.

New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, *Technical Background Document for the Development of Soil Screening Levels*, December 2000.

New Mexico Environment Department TPH Screening Guidelines, June 24, 2003.

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FIGURES