12/17/2010

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

ENTERED

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RECEIVED
DEC 2010
NMED Hazardous Waste Bureau

New Mexico Environment Department
Attn: Mr. James Bearzi
Hazardous Waste Bureau
2905 Rodeo Park Drive East
Santa Fe NM 87105-6303

Dear New Mexico Environment Department

Holloman AFB is pleased to submit the Final Supplemental Facility Investigation Work Plan Addendum (LF-10) for your review.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions, please contact Mr. David Scruggs of our Asset Management Flight at (575) 572-5395.

Sincerely

15 Dec 2010
A. DAVID BUDAK, GS-14, DAFC

Attachment:
Final Supplemental Facility Investigation Work Plan Addendum (LF-10)
cc:

(w/Atch)	(w/o Atch)	(w/o Atch)
Mr. David Strasser	Mr. Will Moats	Ms. Laurie King
Hazardous Waste Bureau	Hazardous Waste Bureau	USEPA, Region 6 (6PD-F)
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Comment Response Matrix

Draft RCRA Facility Investigation Work Plan, LF-10 – Old Main Base Landfill (SWMU 109) and Building 121 Landfill (SWMU 101) for Holloman Air Force Base; New Mexico (July 2010)

Commentator(s): Holloman Air Force Base

Comments dated: July 17, 2010

Comment No.	Page / Reference	Comment	Response
1		No mention of health and safety.	Section 7.0 has been added to the revised RFI Work Plan that discusses field health and safety and references the site-specific activity hazard analysis.
2	Section 1.2.1	Change southwest to southeast.	The referenced text has been updated as reflected in this comment.
3	Section 1.4	Did not see your field investigative approach in Section 3, did not see regulatory considerations etc in Section 4, Section 5 did not give overview of responsibilities/organization.	Section 1.4, which is Section 1.5 in the revised RFI Work Plan, has been updated to accurately reflect the work plan organization.
4	Section 1.4	You have 3 appendices not 2.	The referenced text has been updated to state that the work plan includes three appendices not two.
5	Section 4.1.4	You will need a camera pass for photographs.	A specific reference to camera passes has been added to Section 5.1 of the revised work plan. The text now states that all required badges, passes, and vehicle permits will be acquired with proper authority and prior to commencing any work at LF-10 (e.g., access pass, camera pass, etc.).
6	Section 4.2	You will need to coordinate with facility for monitoring.	A sentence has been added to the referenced section stating that coordination with the facility will be conducted to ensure that monitoring activities do not interfere with facility operations.
7	Table 5-1	Is it for soils? EPA 8260 VOCs Septa Vial?	A Table 5-1 is not included in this work. It is assumed that the commenter is referencing Table 3-2 of the QAPP Addendum (Appendix C, which is Appendix B in the revised work plan) because this is the first appearance of a VOC method number for proposed samples. The matrix is soil as indicated in the second column. The method that will be used to analyze TCL VOCs in soil will be EPA Method SW-846 5035/8260B. Method 5035 is conducted in conjunction with 8260B and vials with septas are used.
8	Table 3-2	SW610B should that be 6010?	Table 3-2 and Table 4-1 in Appendix C (Appendix B in the revised work plan) has been updated to indicate that TAL metals will be analyzed in soil using EPA Method SW-846 6010B and 7471A (mercury).

FINAL

SUPPLEMENTAL RCRA FACILITY INVESTIGATION WORK PLAN ADDENDUM FOR LF-10 OLD MAIN BASE LANDFILL (SWMU 109) AND BUILDING 121 LANDFILL (SWMU 101) HOLLOMAN AIR FORCE BASE, NEW MEXICO EPA ID# NM6572124422

Prepared for:

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Contract No. FA4890-06-D-0009
Task Order No. 5002

DECEMBER 2010

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ACRONYMS

ACC	Air Combat Command
AFCEE	Air Force Center for Engineering and the Environment
AMC	Air Materiel Command
AOC	Area of Concern
bgs	below ground surface
Bhate	Bhate Environmental Associates
BN	base/neutral
BN/AE	base/neutral/acid extractable
CES	Civil Engineering Squadron
COC	chain of custody
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
DPT	Direct Push Technology
D-TPH	diesel range – total petroleum hydrocarbons
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FM	Field Manager
ft	foot or feet
ft/day	foot or feet per day
ft/ft	feet per foot
ft/yr	feet per year
GPS	global positioning system
HAFB	Holloman Air Force Base
HSWA	1984 Hazardous and Solid Waste Amendments
in.	inch(es)
IRP	Installation Restoration Program
LF-10	Landfill 10
L	liter(s)
LEL	lower explosive limit
LTM	long-term monitoring

µg/L	micrograms per liter
MCL	Maximum Contaminant Levels
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MW	monitoring well
NFA	no further action
ng	nanograms
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMGWQ	New Mexico Ground Water Quality
NMWQCC	New Mexico Water Quality Control Commission
NOD	notice of deficiency
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
PID	photo-ionization detector
PM	Project Manager
PR/VSI	Preliminary Review/Visual Site Inspection
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SOB	Statement of Basis
SOP	standard operating procedure
SSL	Soil Screening Level
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TCE	trichloroethene
TCL	target compound list
TDS	total dissolved solids
Tetra Tech	Tetra Tech, Inc.

TRPH	total recoverable petroleum hydrocarbons
USACE	U. S. Army Corps of Engineers
USDA	U. S. Department of Agriculture
USAF	U. S. Air Force
VOC	volatile organic compound
WRRI	Water Resources Research Institute

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1.0 INTRODUCTION

This Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan Addendum was prepared by Tetra Tech, Inc. (Tetra Tech) on behalf of Holloman Air Force Base (HAFB) for the Landfill 10 (LF-10) Site, Old Main Base Landfill [Solid Waste Management Unit (SWMU) 109] and Building 121 Landfill (SWMU 101) at HAFB, New Mexico. Tetra Tech has prepared this document under contract to the U.S. Air Force Center for Engineering and the Environment (AFCEE), Contract No. FA4890-06-D-0009, Task Order No. 5002.

1.1 INSTALLATION BACKGROUND

The following sections present the location and history of HAFB.

1.1.1 Location

HAFB is situated in south-central New Mexico, in the northwest-central part of Otero County. The Base is located approximately 75 miles northeast of El Paso, Texas, and seven miles west of Alamogordo, New Mexico. The Base occupies about 50,000 acres in the northeast quarter of section Township 17 South, Range 8 East. Additional land extending northward is occupied by the White Sands Missile Range testing facilities. An installation location map is included as Figure 1-1.

1.1.2 History

HAFB, formally Alamogordo Army Airfield, was initiated as a temporary facility during World War II, with construction commencing on February 6, 1942. Its status, mission, and Command have periodically changed over its 68-year history.

Prior to 1942, the property occupied by HAFB was undeveloped rangeland. The Alamogordo Army Airfield was established in 1942 and was deactivated in 1945. The facility was reactivated in 1945 and was operated by the Air Materiel Command (AMC) until 1951. AMC tested pilot-less aircraft, guided missiles, and other equipment. The facility mission remained largely unchanged until 1971. However, the facility identification changed several times during the 20-year span:

- Air Force Missile Test Center (1951-1952),
- Holloman Air Development Center (1952-1957), and
- Air Force Missile Test Center (1957-1971).

The Tactical Air Command operated the facility from 1972 to 1992 and housed the 49th Tactical Fighter Wing, 479th Tactical Training Wing, 833rd Air Division, and 4449th Mobile Support Squadron. In 1992, HAFB was realigned under the Air Combat Command (ACC). Currently, HAFB is still operated under the Command of the ACC.

1.2 LF-10 – OLD MAIN BASE LANDFILL (SWMU 109) AND BUILDING 121 LANDFILL (SWMU 101)

The following sections present the location, site description, and history of LF-10.

1.2.1 Location

LF-10 is located in the southeastern portion of HAFB, southeast of the airfield, and bounded to the west by Creosote Avenue and to the north by Arkansas Avenue. The location of LF-10, with respect to the surrounding facility, is shown on Figure 1-2.

1.2.2 Site Description

Site LF-10, as shown on Figure 1-3, consists of approximately 20 acres and currently encompasses the area adjacent to the present day Civil Engineering Squadron (CES) 316 complex (Building 121). Other structures currently located within the CES complex include Building 120, which is located in the northwestern portion of the site; a covered patio, which is located east of Building 121; and several temporary storage sheds located north of Building 121. LF-10 also currently consists of a concrete-paved vehicle parking lot, which surrounds Building 121 on three sides. A gravel-paved equipment and supply storage lot is located adjacent to the concrete-paved parking lot. A chain-link fence surrounds the CES complex and supporting lots. Several large lighting protection poles are located within the fenced-in complex. Access to the CES complex and supporting lots is restricted to authorized personnel.

Outside the fenced-in area, LF-10 is primarily undeveloped. The surface is composed of packed-soil with sporadic fragments of former sanitary disposal items (e.g., ceramic plates, silverware, piping, wiring, bottle fragments, tires, etc.). The area is sparsely vegetated, with shrubs occurring almost exclusively along the southern edge of the Building 121 chain-link fence where a drainage swale is present. Several wooden utility poles cross the western and southern portion of the site. The Main Base Electrical Substation (OT-11) is located in the far southeastern portion of the site. This site was closed in 1999 following an NFA determination. In addition, the southern portion of the former landfill is used as a material recycling stockpile area by the Base. Stockpiles of asphalt, soil, concrete rubble,

and gravel were observed during the field investigations. The surface of the stockpile area is primarily composed of a mixture of packed soil, gravel, and concrete.

1.2.3 Waste History

Site LF-10, the Old Main Base Landfill, was utilized from 1942 to 1958. During that time, the landfill received domestic solid waste from the base and possibly drums containing waste oils and solvents (Walk, Haydel & Associates, Inc., 1990). A base incinerator was located in the area and the ash from its operation was also buried in the landfill. The landfill was closed in 1958 in accordance with Department of Defense (DoD) protocols in place at that time. Landfilling was conducted using trench and fill methods.

1.3 SCOPE AND OBJECTIVES

The scope of this Work Plan is to provide the detailed approach and methodology for trenching activities to be performed at LF-10 for the purpose of obtaining additional characterization of the landfill waste at LF-10. This work is being performed to support a no further action (NFA) status under New Mexico Environment Department (NMED) Criterion 3 and a Class III permit modification to remove the site from the list of *SWMUs and AOCs Requiring Corrective Action* (Appendix 4-A, Table A) of the RCRA permit.

1.4 TETRA TECH PERSONNEL

The following sections define the role and responsibilities of the Tetra Tech project team.

1.4.1 Project Manager

The Tetra Tech Project Manager (PM) has responsibility for the performance of technical aspects of work for Tetra Tech under this contract. The Tetra Tech PM is the point of contact for most lines of communication including direct communication with the regulatory agencies, to the client (AFCEE), and operational subcontractors including the fixed-base laboratory and field staff. The Tetra Tech PM has first-line responsibility for managing Tetra Tech and its subcontractor personnel in performance of the work, and includes managing all operational resources; scheduling project activities; implementing budgets; and ensuring the availability of necessary personnel, equipment, subcontractors, and services.

1.4.2 Field Manager

The Field Manager (FM) is responsible for ensuring that field activities are performed in a manner consistent with applicable work plans and standard operating procedures (SOPs), and for coordinating field activities with subcontractors, including the fixed-base laboratory.

1.4.3 Data Manager

The Data Manager is responsible for planning analyses for samples; coordination with laboratories; and ensuring the efficient and thorough collection, analysis, and reporting of chemical analytical information. The Data Manager is also responsible for the integrity of the data and managing the electronic database.

1.4.4 Field Team

The Tetra Tech Field Team consists of environmental technicians, geologists, scientists, and other field personnel deemed necessary for field activities. The Field Team will complete sampling activities and will be responsible for the completion of all sampling, boring, field, and chain-of-custody (COC) documentation, and will assume custody of all samples and ensure the proper handling and shipping of samples. The Field Team will perform all work in accordance with health and safety procedures detailed in the Health and Safety Plan (Tetra Tech, 2010) to ensure that an adequate level of personal protection exists for the anticipated hazards.

1.5 WORK PLAN ORGANIZATION

This work plan is organized into the following six sections:

- Section 1 is the introduction;
- Section 2 provides the environmental setting;
- Section 3 provides a summary of the previous investigations conducted at LF-10;
- Section 4 presents the field investigative approach;
- Section 5 presents regulator considerations, permits, and approvals;
- Section 6 provides an overview of the data evaluation and reporting process,
- Section 7 provides an overview of field health and safety, and
- Section 8 presents the references cited in this work plan.

The tables and figures referenced in this work plan are included following Section 6. This work plan also includes three appendices.

- Appendix A provides HAFB's SOPs,
- Appendix B provides a site-specific Quality Assurance Project Plan (QAPP) Addendum, and
- Appendix C provides a site-specific Activity Hazardous Analysis.

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2.0 SITE-SPECIFIC ENVIRONMENTAL SETTING

The following sections present the environmental setting at HAFB and LF-10.

2.1 DEMOGRAPHICS

Alamogordo is the county seat of Otero County and the only town of appreciable size within 30 to 50 miles of the Base. The population of Alamogordo was 23,535 in 1975 and has since grown to approximately 35,000 (2000 census). The economy of Alamogordo depends largely upon HAFB and other military installations in the area. Approximately 5,500 people live at HAFB.

2.2 CLIMATE

The climate in the Tularosa Basin is arid with low annual rainfall and low relative humidity. The surrounding mountain ranges greatly influence the local weather. They modify approaching weather systems and provide orographic lifting which produces summer thunderstorms.

HAFB receives most of its total annual rainfall from thunderstorm activity from May through October. Winter is generally dry and is characterized by clear skies and erratic snowfall. The period from March through May is characterized by strong southerly wind flow and periods of blowing dust and sand. Mean annual precipitation is 7.9 in. The mean annual lake evaporation rate, commonly used as an estimate of the mean annual evapotranspiration rate, is approximately 67 in. per year. As presented by Huff in the 49th Annual New Mexico Water Conference Proceedings (Huff, 2005), approximately 30,000 acre-ft per year of groundwater left the Tularosa basin through evapotranspiration under 1995 conditions.

2.3 TOPOGRAPHY

The current overall topography of LF-10 is relatively flat with a general southwesterly dip. Minor variations in the topography occur to promote surface water runoff or result from soil subsidence within the former disposal trenches. In the northern portion of LF-10, within the Building 121 complex, linear shallow depressions have warped the concrete pavement of the vehicle parking lot. Along the western edge of the former landfill and within the Building 121 complex, shallow depressions have also developed. Precipitation typically accumulates within these depressions during and immediately after rain events. Due to the unpaved and primarily unvegetated condition of the units, the paved condition of

the northern portion of the site and the arid climate of HAFB, the majority of precipitation falling onto site soils likely evaporates or infiltrates into the underlying soils with minimal runoff.

LF-10 is bounded on the east by Dillard Draw, an arroyo (a dry creek bed which temporarily fills with water after a heavy rain or seasonally). A southeasterly dipping slope, ranging from 10 to 20 ft, separates LF-10 from the base of the arroyo. The steepness of the slope varies from a steep slope along the northeastern and southeastern edges of the site to a more gradual slope along the east-central edge of the site.

2.4 SURFACE WATER

No permanent surface water bodies are present onsite. Dillard Draw is the closest surface water body feature to LF-10, and abuts the site to the east as discussed above.

2.5 GEOLOGY

Based on historic and supplemental RFI subsurface investigations, LF-10 is underlain by a heterogeneous layering of sands, silts, and clays. The shallow subsurface is generally underlain with layers of silty sands, sandy clays, and sandy silts; however, silty clay to clay soil particles increase with depth. Caliche and gypsum precipitates were encountered in many of the supplemental RFI soil borings; these precipitates were encountered as shallow as 1 ft below ground surface (bgs) and up to 32 ft bgs.

The predominant soils underlying LF-10 are classified by the U.S. Department of Agriculture (USDA) Soil Conservation Service as belonging to the well-drained, sandy loam and gypsum of the Holloman-Gypsum Land-Yesum complex (USDA, 1981). The Holloman-Gypsum Land-Yesum complex is formed from alluvial and eolian gypsiferous sediments. The Mead Silty Clay Loam appears to be present along the extreme eastern edge of the site, predominantly within Dillard Draw. This soil consists of reddish-brown, silty clay loam, clay loam, and clay with a high salt content.

2.6 HYDROGEOLOGY

Groundwater occurs beneath LF-10 as a shallow unconfined aquifer within the underlying silt, silty sand, and clay sediments. A groundwater potentiometric surface map of the underlying water table based on 2003 groundwater elevation data is included as Figure 2-1.

Depth to water at the site in 2003 (excluding monitoring well MW-5, several hundred ft to the northeast) ranged from approximately 6.7 ft below grade at MW-4 to 10.9 feet below grade at MW-2. Field slug tests were performed during the Remedial Investigation (RI) to estimate hydraulic conductivity at the site. Using an average hydraulic conductivity of 0.886 ft per day (ft/day) (as determined by the slug tests), a hydraulic gradient of 0.003 feet per foot (ft/ft) (from the 2003 LTM event), and an estimated porosity of 30 percent, the linear groundwater flow velocity across the site is estimated to be 0.009 ft/day, or 3.3 feet per year (ft/yr).

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3.0 SITE INVESTIGATIONS

The sections below present background information on the Base Environmental Restoration Program (ERP) and summarizes previous investigations that have been conducted at LF-10.

3.1 BASE ENVIRONMENTAL RESTORATION PROGRAM

In September 1988, the RCRA Facility Assessment (RFA) Preliminary Review (PR) / Visual Site Inspection (VSI) were completed by A.T. Kearney and DPRA Incorporated for U.S. Environmental Protection Agency (EPA) Region VI. In November 1980, HAFB, in accordance with RCRA, submitted a RCRA Part A and Part B Permit Application. The RCRA Part A Permit Application was submitted to request interim status for existing facilities and the initial permitting step for new facilities. The RCRA Part B Permit Application was prepared for the Defense Reutilization and Marketing Office (DRMO) and described how the facility is designed, constructed, maintained, and operated to be protective of public health and the environment, as well as release prevention measures and a contingency plan in the event of a spill or release). A total of 11 SWMUs were included in the initial permit applications. The RCRA permit for the Hazardous Waste Storage Facility was submitted by HAFB at EPA's request in July 1985. The 1984 Hazardous and Solid Waste Amendments (HSWA) provided new authority to EPA to require comprehensive corrective actions at SWMUs and other areas of concern (AOCs) at interim status facilities. These corrective actions were intended to address unregulated releases of hazardous constituents. The intent of the RFA PR/VSI was to support this authority by identifying releases or potential releases warranting further investigation. The RFA PR/VSI process identified 228 SWMUs (35 of which no longer existed or could not be located) and 21 AOCs at HAFB. Five additional SWMUs and one AOC were identified at the Primate Research Institute operated by New Mexico State University on HAFB property. The SWMUs and AOCs included all 43 ERP sites previously identified by Holloman AFB.

3.2 PREVIOUS INVESTIGATIONS

The following sections summarize the previous investigations conducted at LF-10.

3.2.1 Subsurface Investigation

A subsurface investigation was conducted by HAFB in November 1987 to determine why the CES 316 complex (Building 121) was exhibiting signs of differential settling and concrete distress. Seven borings

were advanced by the U.S. Army Corps of Engineers (USACE) predominantly south of Building 121. According to a narrative description of this effort, landfill material was encountered in four borings south of the building and in one boring east of the building. Boring logs for these borings are not located in the Administrative Record, and no samples were collected for laboratory analysis. The 1987 subsurface investigation concluded that trash existed under the majority of the hardstand with a maximum thickness of approximately 10 ft, and that trash lenses were variable and intermittent across the site. A description of the material encountered and its distribution in the subsurface from the USACE borings and other investigations is included in Table 3-1.

3.2.2 Remedial Investigation

An RI was conducted on the site to investigate the level of potential contamination at the site and to establish the subsurface extent of the landfill, in part to support a proposed construction project. During the RI, 7 monitoring wells, designated MW-1 through MW-7, were installed; 14 soil borings were advanced into the subsurface; and 3 Dennison cores (i.e., undisturbed samples for geotechnical evaluation) were obtained (Radian Corporation, 1992a and 1992b).

During the RI, the approximate boundaries of the landfill were determined in the field by visual observations and test borings. Monitoring wells MW-2 through MW-5 were installed in areas not observed to contain fill material, thus encircling the landfill.

Soil samples were obtained and analyzed for volatile organic compounds (VOCs), RCRA metals, total recoverable petroleum hydrocarbons (TRPH), and base/neutral/acid extractable (BN/AE) organic compounds. A summary of the analytical results from these soil samples can be found in Table 3-2, and the locations of these samples are shown on Figure 3-1. Samples from 8A25-523 from the depth intervals 7.5 to 10.5 ft bgs were within the landfill material and exhibited elevated photo-ionization detector (PID) readings. The sample from depth interval 13.5 to 15 ft bgs appears to have been collected at the water table interface. In boring 8A25-524, depth interval of 7.5 to 9.0 ft bgs, the sample was obtained where fill (i.e., a nylon rope) was observed; the sample from this boring at 12.5 to 14 ft bgs appears to be associated with the underlying water table interface. All samples from borings 8A25-528 and 8A25-532 were collected from below the water table at intervals where elevated PID readings were observed.

Low levels of VOCs were detected in the two soil samples exhibiting elevated PID readings; the total maximum VOC concentration was low (0.24 mg/kg) in sample 8A25-532-D, 13.5 to 15 ft bgs. All

results were below current NMED soil screening levels (SSLs) (NMED, 2009). Only one BN/AE, di-n-butylphthalate (a common laboratory contaminant), was detected (at a concentration of 0.48 mg/kg in one sample: 8A25-532-D, at 13.5 to 15 ft bgs), well below current NMED SSLs. Several metals were detected at concentrations slightly above their respective background level In samples where background levels were exceeded, beryllium was consistently at 2 mg/kg, cadmium ranged from 2 to 9 mg/kg, copper ranged from 23 to 31 mg/kg, iron ranged from 9,236 to 16,415 mg/kg, manganese ranged from 176 to 216 mg/kg, nickel ranged from 19 to 27 mg/kg, and silver ranged from 2 to 3 mg/kg. A comparison to current human health-based NMED SSLs shows that manganese was above the construction worker SSL in sample 8A25-524, 12.5 to 14 ft bgs and its duplicate. Additionally, arsenic was detected at a concentration exceeding the residential SSL in sample 8A25-523, 9 to 10.5 ft bgs. The construction worker SSLs are very low, due to inhalation pathway of particulates potentially generated during construction activities. The samples where the manganese construction worker SSL was exceeded were either at the water table interface, within the capillary fringe and moist, or below the water table and saturated, indicating minimal potential for dust generation and risk.

Groundwater samples were analyzed for VOCs, BN/AE compounds, pesticides, polychlorinated biphenyls (PCBs), TRPH, and metals. Analytical results were compared to New Mexico Water Quality Control Commission (NMWQCC) standards and EPA Maximum Contaminant Levels (MCLs). A summary of the analytical results can be found in Table 3-3 and the locations of these samples are shown on Figure 3-1. Total Dissolved Solids (TDS) concentrations at LF-10 are well above 10,000 mg/L, which is the threshold above which water is no longer a potential domestic or agricultural water supply according to New Mexico Administrative Code (NMAC) 20.6.2.3101.

VOCs were not present in any of the samples. BN/AE and pesticide compounds were detected at low concentrations in upgradient wells; however, none were detected in downgradient wells. Low concentrations (3 mg/L) of TRPH were detected in MW-3 and MW-4, but no targeted contaminants were present based on the VOC and BN analyses.

Four downgradient wells contained total metals above background/upgradient concentrations and groundwater standards. Arsenic was detected at 47 µg/L at MW-4, above both the EPA MCL and the NMWQCC Standard. Copper concentrations ranged from 108 to 259 µg/L in monitoring wells MW-1, MW-3, and MW-4, which exceeded background/upgradient concentrations. Manganese was present at MW-1 (1,604 µg/L) and MW-6 (1,204 µg/L) above EPA MCLs. Mercury was detected at a concentration of 2,012 µg/L at MW-4 above both the EPA MCL and the NMWQCC Standard. Nickel was present at 218

µg/L in MW-1 above the NMWQCC Standard. Silver was present in MW-1, MW-4, and MW-6 at concentrations ranging from 17 to 26 µg/L, above the background/upgradient concentrations.

The RI risk assessment selected benzene, 2-butanone, 2,4-dinitrotoluene, phenol, aldrin, heptachlor epoxide, beryllium, cadmium, chromium, nickel, 1-ethyl-2-methyl-benzene and 1,3,5-trimethyl-benzene as "indicator chemicals" or chemicals of concern for the site. The exposure assessment identified only one possible quantifiable exposure pathway for these indicator chemicals: leaching from contaminated subsurface soil to groundwater. A hypothetical off base well located downgradient of the site was chosen as the worst-case exposure point. The route of concern selected was ingestion of groundwater by livestock (the receptor). Modeling was used to determine concentrations of indicator chemicals at the exposure point and concentrations were compared with standards and criteria. Heptachlor epoxide, 2-butanone, 1-ethyl-2-methyl-benzene and 1,3,5-trimethyl-benzene do not have standards or criteria; therefore, a toxicity assessment was performed for all these chemicals. To attain toxic doses of these chemicals, a receptor would have to ingest more than 111,400 L of groundwater at the exposure point. Based on the risk assessment, it was deemed unlikely that a receptor would be adversely affected from constituents LF-10, and it was concluded that LF-10 posed no significant risk to public health or the environment (Radian Corporation, 1992a and 1992b).

3.2.3 Decision Document

The Decision Document concluded that the only control measure considered for LF-10 was the no action measure. The basis for this control measure was the Baseline Risk Assessment's conclusion that LF-10 posed no significant risk to public health or the environment. NMED concurred with the 1990 Decision Document in correspondence dated September 26, 1991. Although HAFB requested that LF-10 be removed from the draft RCRA Permit in light of this no significant risk determination, EPA kept the site on Table 1 of the permit pending EPA review of the Installation Restoration Program (IRP) study results. The HAFB RCRA permit was issued jointly by EPA Region VI and NMED with an effective date of September 25, 1991. The correspondence mentioned in this section can be found in Appendix D of the Draft Supplemental RCRA Facility Investigation Work Plan, July 2005.

3.2.4 Compliance Groundwater Monitoring

The first round of LTM at LF-10 was conducted from August 23 through September 13, 1995, in accordance with the LTM field sampling plan finalized by EBASCO/GTI in July 1995. This report references a Decision Document for LF-10 signed by the HAFB Base Commander and NMED in April

1994, which recommended 10 years of LTM at biennial intervals consistent with other LTM sites at HAFB. LTM continued every two years through 2003, which completed the required five rounds of sampling.

The initial LTM program included sampling and analysis of wells MW-2, MW-3, MW-4, and MW-6 for VOCs, metals, and organochlorine pesticides. A summary of the analytical results from LTM at LF-10 can be found in Table 3-4, and the locations of these samples are shown on Figure 3-1. Based on the lack of detections of the majority of constituents, NMED approved the recommendations in the 2001 LTM report to limit 2003 sampling to arsenic, barium, manganese, and selenium. This approval is provided in Appendix E of the supplemental RFI Work Plan (HGL, 2005a). With the exception of lead in the first round of sampling, no constituents in downgradient wells have exceeded standards or background/upgradient concentrations. As provided by Bhate Environmental Associates (Bhate) in the Final 2003 LTM report, TDS concentrations at the site have ranged from 16,700 mg/L (MW-7) to 59,300 mg/L (MW-5) in June 2002, 13,300 mg/L (MW-7) to 74,300 mg/L (MW-5) in September 2002, and 17,700 mg/L (MW-7) to 74,900 mg/L (MW-5) in March 2003 (Bhate, 2003a). Based on these results, the 2003 LTM report recommended closeout of the site.

3.2.5 Statement of Basis

HAFB submitted a Statement of Basis (SOB) summary in February 2004 requesting NFA and subsequent removal of the site from the HAFB Part B RCRA permit. Upon submittal of the SOB summary, NMED conducted a site visit at LF-10. At the conclusion of site visit, NMED informed HAFB that LTM could be suspended but NFA for LF-10 would only be considered after additional characterization was performed at the site. Additional characterization requirements are summarized in U.S. Air Force (USAF) correspondence of May 21, 2004 (USAF, 2004), and NMED correspondence of August 10, 2004 (NMED, 2004b).

3.2.6 Supplemental RFI Field Activities

Supplemental RFI activities were conducted at LF-10 between September 2005 and May 2006 in accordance with the supplemental RFI Work Plans (HGL, 2005a, 2005b, 2006c), and the response to the RFI Work Plan Notice of Deficiency (NOD) (HGL, 2006b). Field sampling activities included a non-invasive geophysical survey to identify potential former disposal pits/trenches, a passive soil gas survey, and a subsurface soil investigation. The geophysical surveys and initial soil gas survey methodologies and results were presented in Attachment A of the Response to NMED NOD as a technical memorandum. The technical memorandum served as the basis to address NMED comments on the

project work plan, as well as to provide the basis for further soil and passive gas sampling at LF-10. The soil gas survey results were used to locate borings for soil sampling and analysis. A description of the additional geophysical surveys, passive gas sampling and direct push technology (DPT) subsurface sampling conducted at LF-10 are provided below.

3.2.6.1 Geophysical Survey

The geophysical survey at LF-10 was performed on approximately 24 acres of the site and immediate surroundings. The survey consisted of an electromagnetic survey and a magnetic survey. The purpose of the geophysical survey was to delineate the extent of the landfill and identify areas within the landfill containing significant metallic anomalies. The geophysical surveys were extended beyond the inferred limits of the landfill established during previous studies in an effort to confirm the landfill boundaries.

The geophysical survey results are provided on Figure 3-2. High conductivity regions, when they were not associated with surface structures such as fence lines, lightning poles, and subsurface utility access ports, were attributed to changes in moisture content. Higher conductivities were most commonly associated with water-saturated gypsum soils located within the arroyo drainage channel or topographic lows where soils were saturated. These soils were generally encountered at approximately 0.5 to 2 ft bgs. Several negative conductive anomalies were identified within the concrete-paved vehicle parking lot. The low conductive anomalies were attributed to rebar within the concrete pavement or possible voids spaces between the pavement and the underlying soils as observed during the PR/VSI.

At LF-10, the G-858 unit was configured as a vertical dual-sensor gradiometer to minimize the effects of cultural “noise” associated with the myriad surface metallic objects observed at the site (e.g., rebar, buildings, vehicles, surficial debris). Calibration testing of the G-858 magnetometer at LF-10 indicated that a two-meter line spacing provided 100 percent survey coverage. Therefore, a two-meter line spacing and a 10 reading per second sampling rate was employed at LF-10.

The area magnetically surveyed and the results are shown on Figure 3-3. Excluding onsite metallic or magnetically susceptible structures, large discrete magnetic anomalies were not identified beneath LF-10. Rather, LF-10 is underlain by numerous northwest-southeast trending linear magnetic anomalies, which represent former disposal trenches, consistent with common historic DoD trench/fill landfill practices. The magnetic highs and lows within the linear anomalies were not robust; however, a sufficient amount of metal must be present for the linear anomalies to be detected during the gradiometer magnetic survey. These anomalies cross the entire LF-10 area as shown on the figure. The linear anomalies generally

disappear beneath the developed sections of the landfill, the result of reworking during the construction of the Building 121 complex or due to signal interferences from metallic or magnetically susceptible objects present around the Building 121 complex. The shallow depressions present across the Building 121 parking lot trend in the same direction as the magnetic anomalies indicating the former disposal trenches are still present in this area beneath the Building 121 complex. In addition to the linear magnetic anomalies, scattered magnetic anomalies were observed along the western and northern survey boundaries and within the arroyo. These anomalies were associated with surficial debris and metallic and magnetically susceptible objects.

3.2.6.2 Passive Soil Gas Assessment

A passive soil gas survey of LF-10 was conducted concurrently with the non-invasive geophysical survey between September 28 and October 5, 2005. As discussed in the soil gas and geophysical survey result technical memorandum (HGL, 2006c), the soil gas survey was conducted using a 100-ft by 100-ft grid spacing, equating to one sample per 0.2 acres. The 2005 soil gas survey was completed across the entire landfill as defined by historic sampling results. The results of the soil gas survey can be found in Table 3-5.

A total of 107 soil gas samples were installed across the site in 2005 and sampled for VOCs. Upon review of the 2005 soil gas survey results and interpretation of the geophysical survey data, the LF-10 landfill was determined to extend farther south and west than historic data suggested. Consequently, a second passive soil gas survey was conducted in May 2006 as proposed in the Response to NOD. These additional soil gas samples were installed west and south of the 2005 soil gas sample survey and on the same grid spacing employed during the 2005 survey. Approximately 32 additional passive soil gas samples were installed and sampled three days later as part of this subsequent effort. Therefore, a total of 139 soil gas samples (107 from 2005 and 32 from 2006) were submitted for 40 target VOCs using gas chromatography/mass spectrometry instrumentation following modified EPA Method 8260B procedures.

Twelve VOCs (chloroform, benzene, ethylbenzene, n-butylbenzene, naphthalene, tetrachloroethene (PCE), toluene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, trichloroethene (TCE), and xylenes) were detected in the soil gas samples. 1,2,4-trimethylbenzene was detected in every soil gas sample collected including trip blanks during the survey. Toluene and m&p-xylenes were detected in many of the samples including one or more of the trip blanks. Because the three VOCs were positively detected in the trip blanks, all three VOCs were considered indicative of blank contamination.

The nine remaining VOCs were detected sporadically across LF-10. With the exception of a few sample locations, VOC detections of these six compounds were low and at unique locations (i.e., detected concentrations of one VOC were not co-located with another VOC). Several of the VOCs (i.e., chloroform, n-butylbenzene, and naphthalene), when detected, were generally detected in several adjacent sample locations across LF-10, suggesting localized areas of potential contamination. The remaining VOCs were detected at discrete sample locations, suggesting a distinct area of contamination.

The majority of the VOCs detected in the soil gas samples were detected in the central, western, and southern portions of LF-10. Chloroform was detected primarily in the central to south-central portion of the landfill, ranging from 14 ng to 56 ng. TCE, at 14 ng and 606 ng, was detected in two samples located along the survey's southern boundary while PCE, ranging from 14 ng to 103 ng, was detected sporadically across LF-10. Sample LF10-N100E200 contained PCE (62 ng) and TCE (14 ng). 1,3,5-trimethylbenzene (25 ng to 79 ng) and n-butylbenzene (27 ng to 49 ng) were detected at relatively similar concentrations throughout the central portion of the landfill. Naphthalene was detected primarily in the western north-central portion of the landfill (ranging from 26 ng to 143 ng) and along the survey's south-central boundary (34 ng to 65 ng).

No VOCs were positively detected along the survey's eastern and northern borders. The lack of VOC detections along the northern and eastern survey boundaries suggests the soil gas survey extended beyond the influence of the landfill, if the landfill is a source of soil gas VOCs.

Based on soil gas survey results, both halogenated and fuel-related VOCs are present in the soil gas of LF-10. Nine VOCs were detected in the soil gas samples; however, three of the VOCs, 1,2,4-trimethylbenzene, toluene, and xylenes, were detected in the trip blanks, suggesting that their detections were the result of blank contamination.

The six remaining VOCs were detected sporadically across LF-10, and with the exception of a few sample locations, were not detected in the same samples. Halogenated VOCs were detected primarily in the central, southern, and western portions of the landfill. Fuel-related VOCs were detected across LF-10 but primarily within the central portion of the landfill. For the most part, no VOCs were detected within 200 ft of the northern and eastern survey boundaries.

TCE was detected in only 2 of the 143 soil gas samples. Both samples were located in the south central portion of the landfill near the electrical substation. All TCE soil gas results were bounded by non-detect

results. PCE was detected in 11 soil gas samples. The PCE detections were primarily in the east central portion of the landfill the southwestern central portion of the landfill and along the western boundary of the soil gas survey. With the exceptions of the PCE detections along the western survey boundary, all PCE detections were bounded by non-detect results. Chloroform was detected in seven soil gas samples - all within the west-central to central portion of the landfill. Naphthalene was detected in multiple samples with the highest concentrations present in the north-central portion of the landfill beneath the Building 121 complex. 1,3,5-trimethylbenzene and n-butylbenzene were also detected in multiple samples but sporadically across the site and at low concentrations. As with TCE, all chloroform, naphthalene, 1,3,5-trimethylbenzene and n-butylbenzene soil gas detections were bounded by non-detect results.

3.2.6.3 DPT Subsurface Soil Assessment

Fourteen soil borings, designated as HGLSB10-01 through HGLSB10-14, were advanced within and around LF-10 in May 2006. All subsurface soil sampling activities were conducted in accordance with the LF-10 Response to NOD letter submitted to NMED in March 2006 (HGL, 2006a). Based on elevated PCE soil gas detections along the western soil gas survey boundary, an additional boring (HGLSB10-15) was drilled in June 2006.

The LF-10 subsurface soil assessment was conducted to meet three objectives:

1) Characterize the waste material within the landfill;
2) Assess the soil quality beneath the landfill waste; and
3) Verify the extent of the landfill as defined by the 2005 geophysical survey and the 2005/2006 passive soil gas surveys.

To address objectives (1) and (2), eight soil borings were advanced to maximum depths ranging between 10 and 24 ft bgs within the landfill. These borings were located using a global positioning system (GPS) to specifically target identified disposal trenches with higher concentrations of metallic or magnetically susceptible debris as observed from the magnetic survey data, and/or from soil gas survey sample locations where higher than average VOC concentrations were detected. Borings HGLSB10-01 through HGLSB10-08 were therefore completed to determine the presence or absence of landfill waste material, visually identify the material comprising the landfill waste if present, and assess the soil quality beneath the landfill waste.

To address objective (3), six additional soil borings were advanced along the perimeter of the landfill, and one boring was completed where PCE was detected along the edge of the soil gas survey. Borings HGLSB10-09 through HGLSB10-14 were advanced along the landfill boundary as defined by the 2005 magnetic survey. These seven borings were advanced to maximum depths ranging between 5 and 20 ft bgs, well below the depth at which landfill waste was detected during this or previous investigations. The majority of the boundary assessment borings were advanced to between 10 and 15 ft bgs; only boring HGLSB10-14 was advanced to 5 ft bgs due to the boring's location within Dillard Draw and the presence of saturated soils immediately below the surface.

The waste material encountered during the soil assessment (Table 3-1) included reworked native soils, glass, newsprint, thin-ply plastic sheeting, burnt and unburnt cut timber, nylon rope, ash, vinyl, scrap metal, gravel, concrete fragments, silverware, ceramics, rubber fragments, and cardboard. Landfill debris was observed in supplemental RFI borings HGLSB10-03 through HGLSB10-07. A slight sheen was observed on wood fragments retrieved from boring HGLSB10-07. No elevated PID readings were recorded within the waste material, and there was no visual evidence of contamination or leachate. No waste was encountered in boring HGLSB10-08 or within the landfill boundary assessment borings (HGLSB10-09 through HGLSB10-15).

Methane monitoring results from the soil borings, included in Table 3-6, ranged from 0.02 percent to 2.2 percent, with the highest concentration detected in boring HGLSB10-05. Consequently, the percent lower explosive limits (LELs) ranged from 4 to 44, with the highest percent LEL also located at HGLSB10-05. This location contained unburned timbers, which is the likely source of methane at this location.

A sample was retrieved from borings HGLSB10-03, -04, -05, -06, and -07 immediately below the waste material. The analytical results of these samples can be found in Table 3-7 and the locations of these samples are shown on Figure 3-1. One sample (HGLSB10-07) was collected just above the first water-bearing zone. Three VOCs (n-butylbenzene, naphthalene, and p-cymene), semivolatile organic compound (SVOC) fluoranthene, diesel range – total petroleum hydrocarbons (D-TPH), and five metals (arsenic, barium, chromium, lead, and mercury) were detected in one or more of the six soil samples (and duplicate) collected from LF-10. None of the detected analytes exceeded NMED residential, industrial, or construction SSLs.

4.0 FIELD INVESTIGATION APPROACH

The following sections detail the technical approach for implementation of Supplemental RFI field activities at LF-10. Field activities performed at LF-10 will be conducted in accordance with the HAFBs SOPs. SOPs are provided in Appendix A for reference.

4.1 LF-10 TRENCHING AND IMPLEMENTATION

The following sections present the proposed trenching activities to be conducted at LF-10.

4.1.1 Pre-Trenching Site Inspection and Trench Layout

Prior to trenching activities, field crews will conduct a pre-trenching site inspection in order to verify proposed trench locations. A GPS will be utilized to identify the locations of the proposed trenches at LF-10; however, trench locations may be revised based on field observations. Site conditions of the proposed trench locations will be documented in the field logbook and photographic documentation will be collected. Visual observations will be recorded in the logbook and may include, but are not limited to, the type of surficial waste (if any) including the presence of metallic and magnetically susceptible debris, the presence of vegetation, soil staining, and recent anthropogenic features. After the surficial conditions of the proposed trench locations are documented, trenching activities with the excavator will be initiated.

4.1.2 Trenching Location and Rationale

Approximately 20 trenches, each approximately 60 ft in length, are proposed at LF-10 to characterize the waste material. The locations of proposed trenches (Figure 4-1) were selected based upon the geophysical surveys discussed in Section 3.2.6.1. The distribution of the trenches was selected to obtain a representative characterization of the waste material across the entire landfill as well as targeted areas of high magnetic or conductive anomalies. Proposed trenches will be excavated perpendicular to the disposal trenches to verify trench orientation and to maximize characterization. The number of trenches, length of trenches, and trench locations are approximate and may be modified based on field observations and best professional judgment.

4.1.3 Trenching Methodology and Equipment

Trenches will be excavated to approximately 7 ft bgs or to the top of the water table, whichever occurs first. Proposed trench locations and distances may be altered in the field based on subsurface conditions (e.g. subsurface utility lines) and/or health and safety considerations. Soil/debris material excavated during

trenching will be stockpiled adjacent to the respective trench. Debris encountered during trenching activities will be sampled, logged, and returned to the trench. An appropriate soil cover will be maintained over the landfill debris consistent with the pre-excavated condition. Because LF-10 has generally unrestricted access, no trenches will stay open overnight. Upon completion of trenching and characterization activities, the stockpiled soil/debris material will be used to backfill the trench. Heavy construction equipment mobilized to the site for trenching activities at LF-10 will be an excavator fitted with a medium-sized toothed bucket.

4.1.4 Trench Soil Sampling Plan

During trench excavation activities, soil characterization will be conducted via the excavator bucket to examine and field screen landfill soils. Field screening will be performed with a PID. Soil characteristics (e.g., color and texture) will be documented during trenching activities. Both field screening and soils classification will be performed in accordance with the SOPs found in Appendix A. In addition, bedding structures, former disposal trench sidewalls, and descriptions of waste material (if present) will also be documented.

It is anticipated that up to 20 soil samples may be collected and sent for laboratory analysis. This would allow for one sample per trench; however, soil samples will be collected for laboratory analysis only if waste materials are encountered during trenching activities. Therefore, if waste is not encountered in a given trench, no samples will be collected from that trench. This would allow for multiple samples in a trench where waste is encountered. Waste materials, for this work, will be considered to include unusual solids or fluids leaking from containers (e.g. drum, buckets, etc.) or free phase hydrocarbons. Additionally, elevated PID readings will be used as an indication that waste material is potentially present, and a soil sample will be collected.

If waste material is encountered, soil samples will be collected directly beneath the suspected waste material. Soil samples collected during trenching will be submitted for:

- Target compound list (TCL) VOCs, Method SW-846 5350/8260B;
- TCL SVOCs, Method SW-846 8270C; and
- Target analyte list (TAL) metals, Method SW-846 6010B and 7471A (mercury).

The following describes the soil sampling procedure for laboratory analysis if waste material is encountered (a PID sample will also be collected from the soil according to the SOPs):

1. Use a clean stainless steel trowel or spoon to collect sufficient material to fill the sample containers. Fill the sample containers directly from the track hoe bucket, removing stones, twigs, grass, etc, from the sample.
2. Immediately secure the cap on the sample container.
3. Label the container with the appropriate information. NOTE: Container may be labeled prior to sample collection.
4. Record the samples (e.g. sample ID, location, depth, method, etc.) in a field logbook.
5. Pack sample in cooler with ice and properly fill out the chain of custody for the laboratory.
6. Ship to laboratory for analysis.
7. Use decontaminated sampling equipment at each sample location to minimize cross contamination.

Field logs and/or field forms will contain the following information:

- Plan and profile sketches of the trench showing materials encountered and the depth of material and sample locations. Photographic documentation will also be collected.
- A description of the material removed from the excavation.
- A record of samples collected.
- The presence or absence of water in the trench and depth encountered.
- Other readings or measurements taken during excavation, including screening readings.

4.1.5 Decontamination

Decontamination of field equipment (e.g., excavator, stainless steel trowel, etc.) will be performed prior to and during field activities. Additionally, the trenching equipment (e.g., excavator) will be inspected at the beginning of each day and periodically throughout trenching activities to ensure there are no leaks (e.g., hydraulic fluid, fuel, grease, etc.).

4.2 METHANE MONITORING

Tetra Tech will perform atmospheric air monitoring of various workspaces within Building 121 as part of site characterization activities at LF-10. Direct reading instruments using a catalytic diffision sensor specifically for methane are planned for this screening assessment. The methane results will be reported

in both percent by volume of methane gas and percent of the LEL for methane gas. The planned monitoring period will last approximately one week with specific workspaces being tested for one 48-hour period. Monitoring activities will be coordinated with the facility to minimize operational impacts.

4.3 PROJECT SCHEDULE

Fieldwork is expected to be completed within 1 week of commencement, barring unforeseen delays (e.g., weather related delays). The schedule includes:

- 1 day for mobilization and identification of trench locations;
- 5 days for trenching and characterization; and
- 1 day for site cleanup and demobilization.

5.0 REGULATORY CONSIDERATIONS, PERMITS, AND APPROVALS

Regulatory and administrative requirements are detailed in the following sections.

5.1 HAFB REGULATIONS

This work will be performed on a secure Air Force installation and the contractor personnel become familiar with and obey HAFB regulations. All required badges, passes, and vehicle permits will be acquired with proper authority and prior to commencing work at LF-10 (e.g., access pass, camera pass, etc.).

5.2 UTILITY CLEARANCES AND DIG PERMITS

Trenching activities will be required to comply with HAFB SOPs on utility clearance and dig permits within the specified timeframe prior to commencing the work. Figure 1-3 provides a detail of the underground utilities located at LF-10. If a utility line is located at LF-10 during the trenching activities, work will cease and the appropriate authority will be contacted for inspection and line determination.

5.3 UTILITY INTERRUPTION

It is not anticipated that a utility interruption will be required to complete the trenching at LF-10.

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6.0 DATA EVALUATION AND REPORTING

This section presents an overview of the evaluation and reporting of the data to be collected based on the scope of work described in this work plan.

6.1 DATA REVIEW AND VALIDATION

Data validation is the systematic review process performed to verify that the precision and accuracy of the analytical data are adequate for their intended use. The fixed-base laboratory will be responsible for performing data validation.

6.2 DATA USABILITY

Validated data will be evaluated by the Project Chemist and PM or designee to determine whether the data meet the project objectives. Field methods used to obtain environmental data will also be reviewed to identify any nonconformances or other factors that may influence the usability of data with respect to project objectives. Conclusions regarding the data including limitations on the use of the data and data gaps will be documented in the LF-10 RFI Report.

Data generated pursuant to QC results meeting acceptance criteria (i.e., validated data) will be considered usable for decision-making purposes. Limitations on the use of the data will be identified and explained. Data generated pursuant to QC results that do not meet the stated acceptance criteria may still be usable for decision-making based upon the nature of the decision (e.g., recommendation for further investigative work or the necessity of corrective actions). Factors influencing the decision-making process include, but are not limited to:

- Conformance with approved sampling methods,
- Elevated detection limits due to matrix interferences of naturally occurring compounds or high concentrations of chemicals of interest,
- Consistency with validation protocols for field and laboratory data,
- Unusable data (R-coded) based on validation results,

- Data identified as usable for limited purposes (J-coded),
- Effects of nonconformances, and
- Identified data gaps.

Every effort will be made to eliminate or reduce sources of sampling and analytical errors per the QAPP Addendum (Tetra Tech, 2010), which is included in Appendix B, and the Basewide QAPP (Bhate, 2003b). Field and laboratory audits are performed as necessary to eliminate propagation of general systematic errors. Validated data that meet the data quality indicators obtained using methods consistent with the Tetra Tech QAPP Addendum, the Basewide QAPP (Bhate, 2003b), and this work plan will be considered usable for decision-making. Data that were obtained using methodologies not specifically approved (nonconformances) will be evaluated on a case-by-case basis to determine their usability.

7.0 FIELD HEALTH AND SAFETY

The health and safety procedures followed during the execution of this plan are outlined in the Tetra Tech Health and Safety Plan (Tetra Tech, 2010). The nature of activities is expected to consist of exploratory trenching and associated characterization at LF-10. Sampling activities may include surface and subsurface soil samples. A site-specific Activity Hazardous Analysis for LF-10 is included in Appendix C. If conditions or the scope of work changes during the implementation of these RFI activities, appropriate precautions will be added and work will be stopped, if necessary, to ensure worker safety.

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TABLES

Table 3-1
LF-10 Landfill Waste Description
Holloman AFB, New Mexico

Boring	Landfill Material Top (ft bgs)	Landfill Material Bottom (ft bgs)	Material Encountered	Distribution in Subsurface	Highest PID in the Fill
Previous Investigation Groundwater Monitoring Wells					
S10-MW1	5.5	10	Dark gray landfill material (i.e., paper, trash, green sludge)	One layer	340
T-3A (well test boring)	4	4	Trash	Layer(?)	NP
T-4A (well test boring)	0	5	Landfill material	Mixed within soil unit	NP
T-4B (well test boring)	0	5	Landfill material	Mixed within soil unit	NP
T-4C (well test boring)	0	5	Landfill material	Mixed within soil unit	NP
T-4D (well test boring)	0	5	Landfill material	Mixed within soil unit	NP
S10-MW6	3	7.5	Wood chips / Landfill material	Mixed within soil unit	16[(1)]
Previous Investigation Borings					
8A25-510(L)	NP	NP	NP	NP	NP
8A25-511(L)	NP	NP	NP	NP	NP
8A25-513(L)	NP	12.5	Vials	NP	NP
8A25-514(L)	NP	NP	Dark greenish-sludge with strong odor	13	NP
8A25-515(L)	NP	NP	NP	NP	NP
825-523	4	10	Trash	Lenses between sand layers	200
8A25-524	5	10.5	Trash (nylon rope)	Mixed within soil unit	0.1
8A25-527	0.75	5	Landfill material	Mixed within soil unit	0.4
8A-278	NP	NP	NP	NP	NP
Supplemental RFI Borings					
HGLSB10-03	3.9	11	glass, vinyl, cut timber, scrap metal, burnt wood, paper	Lenses between sand layers	2.3
HGLSB10-04	7	9	concrete gravel, pebbles	layer	0
HGLSB10-05	2	10.5	cut timber, concrete gravel (green stained), rubber, glass, porcelain	Lenses between sand layers	0
HGLSB10-06	3	11	cardboard, paper, burnt wood, glass	Mixed within soil unit	0
HGLSB10-07	2	9	burnt wood with slight sheen	Mixed within soil unit	0
HGLSB10-08	1.5	2	wood, paper	One layer	0

Notes:

[(1)] Obtained from soil immediately below waste material

ft - foot

bgs - below ground surface

PID - photoionization detector

NP - not provided

? - unknown

Table 3-2
LF-10 1988 Remedial Investigation
Soil Analytical Results
Holloman AFB, New Mexico

		NMWQCC Screening Levels[2]			Soil Borings											
	Background[1]	Residential	Industrial / Occupational	Construction Worker	8A25-523			8A25-524			8A25-528		8A25-532		8A25-532-D	
Depth (ft bgs):					7.5-9	9-10.5	13.5-15	7.5-9	12.5-14	12.5-14	22.5-24	27.5-29	15-16.5	27.5-29	13.5-15	27.5
Analyte																
Volatile Organic Compounds (mg/kg)																
Acetone	--	67,455	850,852	262,713	NA	NA	NA	NA	NA	NA	NA	NA	0.034	NA	0.047	NA
Benzene	--	15.5	85.4	471	NA	NA	NA	NA	NA	NA	0.03	0.026	0.005	0.003	0.006	NA
2-Butanone	--	39,648	368,633	147,820	NA	NA	NA	NA	NA	NA	NA	NA	0.21	NA	0.24	NA
Ethylbenzene	--	70	385	6,625	NA	NA	NA	NA	NA	NA	NA	NA	0.004	NA	0.005	NA
Hexane	--	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.006	NA	NA
Toluene	--	5,570	57,863	21,127	NA	NA	NA	NA	NA	NA	NA	NA	0.002	NA	0.003	NA
1,1,1-Trichloroethane	--	21,839	77,060	64,333	NA	NA	NA	NA	NA	NA	NA	NA	0.004	NA	0.005	NA
Xylene	--	1,086	3,610	3,134	NA	NA	NA	NA	NA	NA	NA	NA	0.005	NA	0.002	NA
TRPH	--	--	--	--	NA	36	NA	20	51	NA	21	25	49	69	NA	61
BNAE Organic (mg/kg)																
Di-n-Butylphthalate	--	6,110	68,407	23,823	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.48	NA
Metals (mg/kg)																
Arsenic	6.9	3.9	17.7	65.4	NA	*5*	3	2	NA	NA	1	NA	NA	NA	NA	NA
Barium	84.4	15,596	223,980	4,353	NA	50	79	81	37	42	81	26	41	120	NA	NA
Beryllium	1.3	156	2,263	144	NA	2	2	2	2	2	2	2	2	2	NA	NA
Cadmium	1	78	1,124	309	NA	2	3	5	3	5	7	7	8	9	NA	NA
Chromium[3]	24.6	219	2,922	449	NA	20	12	13	6	10	16	5	7	6	NA	NA
Copper	21.2	3,129	45,422	12,388	NA	28	23	31	27	30	18	24	19	21	NA	NA
Iron	6,362	54,750	794,889	216,788	NA	16,415	9,236	10,428	2,763	4,967	10,624	3,351	2,260	4,452	NA	NA
Lead	12.3	400	800	800	NA	5	3	4	0.5	1.6	4	0.8	0.5	1.6	NA	NA
Manganese	146.9	10,723	144,808	463	NA	*176*	108	89	683	562	*216*	67	2	64	NA	NA
Nickel	18.1	1,564	22,711	6,194	NA	18	13	18	16	19	25	21	25	27	NA	NA
Silver	0.73	391	5,678	1,548	NA	NA	2	2	3	3	2	2	2	3	NA	NA
Sodium	5,000	--	--	--	NA	3,557	2,588	3,149	1,606	1,551	1,813	1,519	372	771	NA	NA
Zinc	48.7	23,464	340,667	92,909	NA	44	26	31	15	68	31	12	10	15	NA	NA

Notes:
[1] Radian (1992c) and Radian (1993b)
[2] Obtained from Table A-1 (NMED, 2009)
[3] Chromium VI used as a surrogate for Total Chromium
Underlined results represent values which exceed background.
Italicized results represent values which exceed residential screening levels.
Highlighted results represent values which exceed construction worker screening levels.
Combinations of the above formatting indicate values which exceed multiple regulatory values.
NA - not analyzed
NMWQCC - New Mexico Water Quality Control Commission
mg/kg - milligrams per kilogram
TRPH - Total recoverable petroleum hydrocarbons
BNAE - base/neutral/acid extractables
-- not applicable; not detected

Table 3-3
LF-10 1988 Remedial Investigation
Groundwater Analytical Results
Holloman AFB, New Mexico

Analyte	Background[1]	US EPA MCL	NMWQCC Standard[2]	Monitoring Wells						
				Upgradient Wells						
				MW-2	MW-5	MW-7	MW-1	MW-3	MW-4	MW-6
BA/NE (µg/L)										
2,4-Dinitrotoluene	--	--	2.2	ND	ND	57	ND	ND	ND	ND
Isophorone	--	--	707	ND	ND	64	ND	ND	ND	ND
2-Methylnapthalene	--	--	--	3	ND	ND	ND	ND	ND	ND
Napthalene	--	--	1.4	15	ND	ND	ND	ND	ND	ND
Phenol	--	--	10,950	10	ND	ND	ND	ND	ND	ND
Pesticides/PCB (µg/L)										
Aldrin	--	--	0.04	ND	ND	0.17	ND	ND	ND	ND
Endosulfan	--	--	219	ND	ND	0.53	ND	ND	ND	ND
Endrin	--	2	11	ND	ND	0.12	ND	ND	ND	ND
Heptachlor	--	0.4	0.15	ND	ND	**0.86**	ND	ND	ND	ND
Methoxychlor	--	40	--	1.1	ND	ND	ND	ND	ND	ND
TRPH	--	--	--	ND	ND	ND	ND	3	3	ND
Tentatively Identified Compounds (µg/L)										
1-Ethyl-2-Methylbenzene	--	--	--	113	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	--	--	--	49	ND	ND	ND	ND	ND	ND
Metals (µg/L)										
Antimony	89.6	6	14.6	ND	ND	**38**	ND	**36**	**47**	ND
Arsenic	72.3	10	0.45	<125*	<125*	**43**	**21**	**6**	**21**	<50*
Barium	929.3	2000	7300	230	286	677	637	169	492	474
Beryllium	3.8	4	73	**6**	**6**	**20**	**20**	**6**	**14**	**11**
Cadmuim	8.3	5	18.3	ND	ND	**14**	**7**	ND	5	12
Chromium	234	100	110	51	37	**124**	**108**	25	52	75
Copper	38.6	1,300	1,460	109	115	179	259	108	191	140
Cyanide	--	200	730	ND	ND	ND	40	ND	ND	ND
Iron	--	--	25,550	19,990	23,083	100,485	83,308	16,561	42,660	58,313
Lead	19.9	15	--	<200*	<70*	**50**	**38**	**22**	**18**	<500*
Manganese	--	--	876	316	575	976	1,604	184	389	1,204
Mercury	0.03	2	0.56	0.881	ND	ND	0.294	0.427	**2.012**	ND
Metals (µg/L)										
Nickel	43.6	--	730	134	145	154	218	77	130	70
Selenium	79.3	50	183	< 70*	< 500*	< 500*	15	37	13	< 500*
Silver	7.3	--	183	16	ND	6	26	11	17	22
Sodium	--	--	--	8,749,720	20,438,320	1,420,871	2,817,036	8,544,135	3,269,065	13,427,300
Thallium	94.3	2	2	< 200*	< 175*	ND	ND	ND	ND	< 20*
Zinc	253.4	--	10,950	128	100	333	261	73	124	195

Notes:
Underlined results represent values which exceed background values.
Bold results represent values which exceed EPA MCLs
Highlighted results represent values which exceed NMWQCC Standards
Combinations of the above formatting indicate values which exceed multiple regulatory values (e.g., highlighted and bold fields represent exceedances of both EPA MCLs and NMWQCC Standards).
[1] Radian, 1993b
[2] NMAC 20.6.2.3103
* Elevated detection limit due to matrix interference
US EPA MCLs and NMWQCC standards are provided for reference only in cases where total dissolved solids are > 10,000 mg/L.

BN/AE - base, neutral, extractable
ND - Not detected
-- not applicable; not detected
US EPA - U.S. Environmental Protection Agency
MCL - Maximum Contaminant Level
µg/L - micrograms per liter
NMWQCC - New Mexico Water Quality Control Commission
NMAC - New Mexico Administrative Code
TRPH - total recoverable petroleum hydrocarbons
PCB - polychlorinated biphenyls

Table 3-4
LF-10 Groundwater Compliance
Long-Term Monitoring Analytical Results
Holloman AFB, New Mexico

Analyte	Background[1]	US EPA MCL	NMWQCC Standard[2]	MW-2 (Upgradient)					MW-3					MW-4				
				Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03	Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
Volatile Organic Compounds (VOCs)[3] (µg/L)																		
Acetone	--	--	21,783	ND	ND	<5	NA	NA	ND	ND	<5	NA	NA	--	--	1 J	NA	NA
1,2-Dichloroethane	--	5	1.5	ND	ND	<3	NA	NA	ND	ND	<3	NA	NA	--	--	<3	NA	NA
Methylene	--	--	--	6.6UB	ND	<3	NA	NA	ND	ND	<3	NA	NA	--	--	<3	NA	NA
Metals[4] (µg/L)																		
Arsenic	35.4	10	0.45	ND	ND	15.5 B (J)	**10.1**	**21.1**	10	ND	18.5 B (J)	**11.9**	**21.2**	**13**	**17 J**	14.9 B (J)	**11.7**	**19.3**
Barium	85.2	2000	7,300	ND	ND	11.4 B (J)	9.5 B	8.09 J	ND	ND	13.5 B (J)	12.1	9.6 J	--	20	30.9 B (J)	28.4	9.88 J
Cadmium	7.4	5	18.3	ND	ND	0.5B	NA	NA	ND	ND	0.5B	NA	NA	--	--	1.2 B	NA	NA
Chromium	7.2	100	110	ND	ND	10.6 (J)	<20	NA	ND	ND	<0.6	<20	NA	--	--	1.2 B (J)	<20	NA
Iron	--	--	25,550	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	5.6	15	--	ND	ND	<1.5	<10 (UJ)	NA	**98**	ND	<1.5	<10 (UJ)	NA	**150**	--	<1.5	<10 (UJ)	NA
Manganese	--	--	876	ND	ND	2.2 B (J)	<10 (UJ)	<10	ND	ND	3.3 B (J)	1.1 B (J)	<10	--	80	114 J	80.2 (J)	71.3
Selenium	85.3	50	183	ND	ND	14.6 B (J)	7.9 B	6.41 UJ	ND	ND	14.2 B (J)	8.5 B	<19	--	--	12.7 B (J)	8.4 B	<13.9
Silver	6.7	--	183	ND	ND	<0.5	NA	NA	ND	ND	6.2 B (J)	NA	NA	--	--	1.4 B (J)	NA	NA
Organochlorine Pesticides[5] (µg/L)																		
All	--	--	--	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	--	--	NA	NA	NA

Notes:
Underlined results represent values which exceed background values.
Bold results represent values which exceed EPA MCLs
Highlighted results represent values which exceed NMWQCC Standards
Combinations of the above formatting indicate values which exceed multiple regulatory values (e.g., highlighted and bold fields represnet exceedances of both EPA MCLs and NMWQCC Standards).
(1) Radian, 1993b.
(2) New Mexico Administrative Code (NMAC) 20.6.2.3103
(3) Unless otherwise reported, no VOCs were detected prior to 2001 using EPA Method 8260B (EPA Method 8260A was used to analyze for VOCs in the 1995 and 1997
(4) Unless otherwise reported, no metals were detected using EPA Methods 6010B Trace
(5) Unless otherwise reported, no organochlorine pesticides were detected prior to '99 using EPA Method 8081A (EPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs).
Laboratory qualifiers -assigned as a result of internal laboratory data assessment procedures
CRDL - contract required detection limit
IDL - instrument detection limit
J - estimated value; less than CRDL but greater than or equal to IDL
UB - Qualifies as non-detect due to presence of analyte in associated laboratory blank
EPA Qualifiers -assigned as a result of independent data validation
(J) - Estimated value
(UJ) - Estimated value below the reporting limit
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
UJ - Estimated as a non-detect at the detection limit.
NA - not analyzed
-- not applicable, not detected
µg/L - micrograms per liter
NMWQCC - New Mexico Water Quality Control Commission
US EPA - U.S. Environmental Protection Agency
MCL - Maximum Contaminant Level

Table 3-4
LF-10 Groundwater Compliance
Long-Term Monitoring Analytical Results
Holloman AFB, New Mexico

Analyte	Background[1]	US EPA MCL	NMWQCC Standard[2]	MW-6				
				Aug-95	Sep-97	Sep-99	Sep-01	Apr-03
Volatile Organic Compounds (VOCs)[3] (µg/L)								
Acetone	--	--	21,783	--	--	<5	NA	NA
1,2-Dichloroethane	--	5	1.5	--	--	1 J	NA	NA
Methylene	--	--	--	--	--	<3	NA	NA
Metals[4] (µg/L)								
Arsenic	35.4	10	0.45	10	**17 J**	20.6 B (J)	**11.9**	**25.9**
Barium	85.2	2000	7,300	--	--	12.2 B (J)	11.4	8.29 J
Cadmium	7.4	5	18.3	--	--	<0.3	NA	NA
Chromium	7.2	100	110	--	--	<0.6	<20	NA
Iron	--	--	25,550	NA	NA	NA	NA	NA
Lead	5.6	15	--	**42**	--	<1.5	<10 (UJ)	NA
Manganese	--	--	876	--	110	50.5 (J)	18.2 (J)	66.7
Selenium	85.3	50	183	--	--	10.6 B (J)	3.9 B	<11.2
Silver	6.7	--	183	--	--	<0.5	NA	NA
Organochlorine Pesticides[5] (µg/L)								
All	--	--	--	--	--	NA	NA	NA

Notes:
Underlined results represent values which exceed background values.
Bold results represent values which exceed EPA MCLs
Highlighted results represent values which exceed NMWQCC Standards
Combinations of the above formatting indicate values which exceed multiple regulatory values (e.g., highlighted and bold fields represnet exceedances of both EPA MCLs and NMWQCC Standards).
(1) Radian, 1993b.
(2) New Mexico Administrative Code (NMAC) 20.6.2.3103
(3) Unless otherwise reported, no VOCs were detected prior to 2001 using EPA Method 8260B (EPA Method 8260A was used to analyze for VOCs in the 1995 and 1997
(4) Unless otherwise reported, no metals were detected using EPA Methods 6010B Trace
(5) Unless otherwise reported, no organochlorine pesticides were detected prior to '99 using EPA Method 8081A (EPA Method 8080A was used to analyze for organochlorine pesticides in the 1995 and 1997 programs).
Laboratory qualifiers -assigned as a result of internal laboratory data assessment procedures
CRDL - contract required detection limit
IDL - instrument detection limit
J - estimated value; less than CRDL but greater than or equal to IDL
UB - Qualifies as non-detect due to presence of analyte in associated laboratory blank
EPA Qualifiers -assigned as a result of independent data validation
(J) - Estimated value
(UJ) - Estimated value below the reporting limit
2003 Validation Qualifiers
J - Estimated value detected less than the CRDL but greater than the reporting limit.
UJ - Estimated as a non-detect at the detection limit.
NA - not analyzed
-- not applicable, not detected
µg/L - micrograms per liter
NMWQCC - New Mexico Water Quality Control Commission
US EPA - U.S. Environmental Protection Agency
MCL - Maximum Contaminant Level

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	Method Blank	Trip-1	LF10-N800E100	LF10-N500E300	LF10-N600E700	LF10-N1000E600	LF10-N700E400	LF10-N900E200	LF10-N600E200	LF10-N600E600	LF10-N900E700	LF10-N900E400	LF10-N800E200
Lab File ID:	5100803	5100816	5100817	5100818	5100819	5100820	5100821	5100822	5100823	5100824	5100825	5100826	5100827
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/7/2005	10/8/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)													
1,1-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	33	30	34	31	<25	29	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	66	<25	28	65
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	<25	<25	31	<25	30	<25	<25	42	<25	<25	<25
Bromoform	<25	<25	<25	<25	<25	<25	<25	<25	<25	41	<25	29	43
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	27	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	35	<25	26	38
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	94	88	113	191	69	138	75	96	<25	<25	<25	<25
1,3-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	152	68	140	209
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	143	<25	<25	<25	<25	<25	42	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	31	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N600E300	LF10-N900E600	LF10-N800E800	LF10-N800E400	LF10-N800E300	LF10-N700E100	LF10-N900E500	LF10-N800E700	LF10-N800E500	LF10-N900E300	LF10-N700E300	LF10-N1100E350	LF10-N700E700
Lab File ID:	5100828	5100829	5100830	5100831	5100832	5100833	5100834	5100835	5100836	5100837	5100838	5100839	5100840
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)													
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	28	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	30	101	120	161	59	100	59	83	<25	<25	<25	75	64
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	103	<25	58	<25	14 J	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	41	39	61	37	59	<25	30	<25	<25	<25	34	<25
Bromoform	<25	62	70	100	41	65	31	51	<25	<25	<25	52	39
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	51	59	81	36	59	27	44	<25	<25	<25	46	31
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	25	<25	79	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	98	268	295	377	137	184	121	231	98	123	91	241	161
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	25	34	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	127	<25	28	26	<25	<25	<25	26	27	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N800E600	LF10-N700E500	LF10-N700E200	LF10-N1000E400	LF10-N700E600	Trip-2	LF10-N100E700	Method Blank	LF10-N600E0	LF10-N900E100	LF10-N900E800	LF10-N1000E300	LF10-N500E500	LF10-N500E100
Lab File ID:	5100841	5100842	5100843	5100844	5100845	5100846	5100847	5100903	5100904	5100905	5100906	5100907	5100908	5100909
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)														
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	16 J	<25	<25	<25	<25	<25	<25	32	<25	<25	<25	33	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	106	44	44	66	51	55	51	<25	33	<25	62	54	48	27
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	67	<25	<25	38	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Bromoform	83	29	25	47	33	26	36	<25	29	<25	41	30	28	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	72	27	<25	40	29	<25	32	<25	27	<25	36	26	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	36	<25	<25	<25	<25	<25	<25	42	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	294	132	101	164	123	110	185	<25	145	50	185	129	131	112
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	27	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	84	<25	137	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N1000E100	LF10-N1000E800	LF10-N1100E500	LF10-N400E500	LF10-N700E0	LF10-N1070E300	LF10-N1100E800	LF10-N400E400	LF10-N600E500	LF10-N600E100	LF10-N1000E200	LF10-N1100E790	LF10-N600E400
Lab File ID:	5100910	5100911	5100912	5100913	5100914	5100915	5100916	5100917	5100918	5100919	5100920	5100921	5100922
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)													
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	14 J	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	56	39	66	42	42	<25	38	89	75	36	35	27	38
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	32	<25	<25	<25	<25
Bromoform	31	31	42	26	26	<25	26	41	50	26	30	<25	27
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	27	26	33	<25	<25	<25	<25	36	44	<25	27	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	28	<25
1,3-Dichlorobenzene	129	150	193	117	98	63	138	218	208	113	156	95	110
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N500E600	LF10-N500E0	LF10-N900E0	LF10-N1160E700	LF10-N1200E600	LF10-N500E400	LF10-N400E100	LF10-N800E0	LF10-N1070E200	Trip-3	LF10-N200E200	LF10-N400E600	LF10-N400E700	LF10-N600E800
Lab File ID:	5100923	5100924	5100925	5100926	5100927	5100928	5100929	5100930	5100931	5100932	5100933	5100934	5100935	5100936
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)														
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	48	44	73	79	32	<25	53	26	<25	41	52	43	79	47
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	15 J
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	<25	37	<25	<25	<25	<25	<25	<25	<25	<25	27	<25
Bromoform	28	33	37	53	25	<25	32	<25	<25	<25	35	26	43	31
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	26	31	46	<25	<25	26	<25	<25	<25	32	<25	38	25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	140	128	161	200	112	58	136	86	83	87	178	113	177	125
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	94	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N190E0	LF10-N100E200	LF10-N300E600	LF10-N400E900	LF10-N500E800	LF10-N200E100	LF10-N100E0	LF10-N300E500	LF10-N300E800	LF10-N600E900	LF10-N300E0	Meth_Blk	LF10-N010E0	LF10-N300E400
Lab File ID:	5100937	5100938	5100939	5100940	5100941	5100942	5100943	5100944	5100945	5100946	5100947	5101003	5101004	5101005
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)														
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	47
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	14 J	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	29	51	30	36	55	43	33	40	45	119	51	<25	58	65
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	31	62	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	51	<25	<25	<25	<25
Bromoform	<25	41	<25	29	33	41	<25	28	29	87	25	<25	31	46
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	35	<25	29	29	35	<25	<25	26	73	<25	<25	26	38
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	29	<25	40	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	93	233	108	<25	147	194	112	108	126	376	97	<25	114	192
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N200E700	LF10-N500E700	LF10-N300E100	LF10-N0E100	LF10-N500E200	LF10-N300E700	LF10-N500E900	LF10-N400E0	LF10-N100E100	LF10-N300E200	LF10-N700E800	LF10-N400E800	Trip-4	LF10-N200E400
Lab File ID:	5101006	5101007	5101008	5101009	5101010	5101011	5101012	5101013	5101014	5101015	5101016	5101017	5101018	5101019
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)														
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	56	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	606
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	<25	<25	74	44	43	44	53	58	81	53	100	55	35	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	18 J	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	34	<25	<25	<25	<25	<25	27	<25	29	44	<25	<25
Bromoform	<25	<25	45	<25	<25	<25	32	40	49	28	52	42	<25	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	36	<25	<25	<25	27	35	42	<25	42	40	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	43	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	83	68	145	78	114	92	133	177	214	116	198	188	107	59
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	27	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	34	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N0E200	LF10-N900E900	LF10-N900E1000	LF10-N700E1000	LF10-N1100E900	LF10-N400E300	LF10-N300E300	LF10-N200E300	LF10-N400E200	LF10-N800E900	LF10-N1000E1000	LF10-N700E900	LF10-N1000E900
Lab File ID:	5101020	5101021	5101022	5101023	5101024	5101025	5101026	5101027	5101028	5101029	5101030	5101031	5101032
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap
Analyte (8260 Modified)													
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	18 J	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	33	27	<25	33	<25	54	33	<25	37	31	43	43	32
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Bromoform	<25	<25	<25	<25	<25	27	<25	<25	25	<25	<25	34	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	31	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	102	83	63	100	69	119	77	95	120	92	117	108	116
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	49	<25	47	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	65	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	LF10-N1000E700	LF10-N200E600	LF10-N200E500	LF10-N1000E500	LF10-N800E1000	LF10-N600E1000	TRIP-4	N-100, E400	N-100, E500	N-100, E600	N0, E300	N0, E400	N0, E500	N0, E600	Medthod Blank
Lab File ID:	5101033	5101034	5101035	5101036	5101037	5101038	06060140.D	06060141.D	06060142.D	06060143.D	6060144.D	06060145.D	06060146.D	06060147.D	06060203.D
Received Date:	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	10/6/2005	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Units:	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng/trap	ng	ng	ng	ng	ng	ng	ng	ng	ng
Analyte (8260 Modified)															
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	<25	66	<25	50	33	<25	36	156	202	133	148	121	165	120	<25
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	<25	<25	<25	<25	<25	<25	<25	32	44	29	33	28	30	24	<25
Bromoform	<25	<25	<25	33	<25	<25	<25	38	47	30	36	<25	32	28	<25
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	<25	<25	27	<25	<25	<25	29	36	<25	28	<25	25	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	31	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	68	89	82	164	94	64	<25	78	86	56	68	43	43	53	<25
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	58	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-5
LF-10 Soil Gas Survey
VOC Analytical Results
Holloman AFB, New Mexico

Client Sample ID:	N0, E700	N0,E800	N-80,E200	N-90,E300	N100,E300	N100,E400	N100,E480	N100,E700	N100,E800	N100,E900	N200,E-100	N200,E875	N300,E-100	N400,E-100	N500,E-100	N600,E-100	N700,E-100
Lab File ID:	06060204.D	06060205.D	06060206.D	06060207.D	06060208.D	06060209.D	06060210.D	06060211.D	06060212.D	06060213.D	06060214.D	06060215.D	06060216.D	06060217.D	06060218.D	06060219.D	06060220.D
Received Date:	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006		5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006	5/30/2006
Units:	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng
Analyte (8260 Modified)																	
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichlorotrifluoroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Methyl-t-butyl Ether	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,2-Dichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Chloroform	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
2,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Carbon Tetrachloride	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichloropropane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Trichloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
cis-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
trans-1,3-Dichloropropene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,2-Trichloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Toluene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichloropropane	136	93	172	146	133	105	58	123	170	73	97	98	54	73	143	67	161
1,2-Dibromoethane (EDB)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Tetrachloroethene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,1,1,2-Tetrachloroethane	<25	<25	<25	<25	<25	17 J	<25	<25	<25	<25	<25	<25	<25	<25	40	35	66
Chlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Ethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
p & m-Xylene	28	32	37	34	30	<25	<25	25	38	<25	<25	26	<25	<25	27	<25	31
Bromoform	31	52	40	34	32	<25	<25	27	46	<25	25	<25	<25	<25	32	<25	31
1,1,2,2-Tetrachloroethane	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
o-Xylene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichloropropane	<25	39	32	27	25	<25	<25	<25	37	<25	<25	<25	<25	<25	26	<25	<25
Isopropylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,3,5-Trimethylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trimethylbenzene	<25	29	<25	<25	<25	<25	<25	<25	35	<25	<25	<25	<25	<25	<25	<25	<25
1,3-Dichlorobenzene	47	76	55	66	65	49	34	47	98	33	42	41	27	40	53	39	34
1,4-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2-Dichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
n-Butylbenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,4-Trichlorobenzene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Naphthalene	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
1,2,3-Trichlorobenzene	<25	<25	<25	<25	<25	<25	33	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25

Notes:
ng - nanograms
J - Estimated value below reported quantitation level
-- not analyzed

Table 3-6
LF-10 Landfill Vapor Monitoring Results
Holloman AFB, New Mexico

Boring[1]	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	LEL (%)
HGLSB10-01	NM	NM	NM	NM
HGLSB10-02	NM	NM	NM	NM
HGLSB10-03	0.04	0	19.6	8
HGLSB10-04	0.03	0	19.2	6
HGLSB10-05	2.2	0	19	44
HGLSB10-06	0.02	0	19.6	4
HGLSB10-07	0.02	0	18.6	4
HGLSB10-08	NM	NM	NM	NM

Notes:

[1] Only Supplemental RFI borings encountering waste were screened with methane meter

LEL - lower explosive level

% - precentage

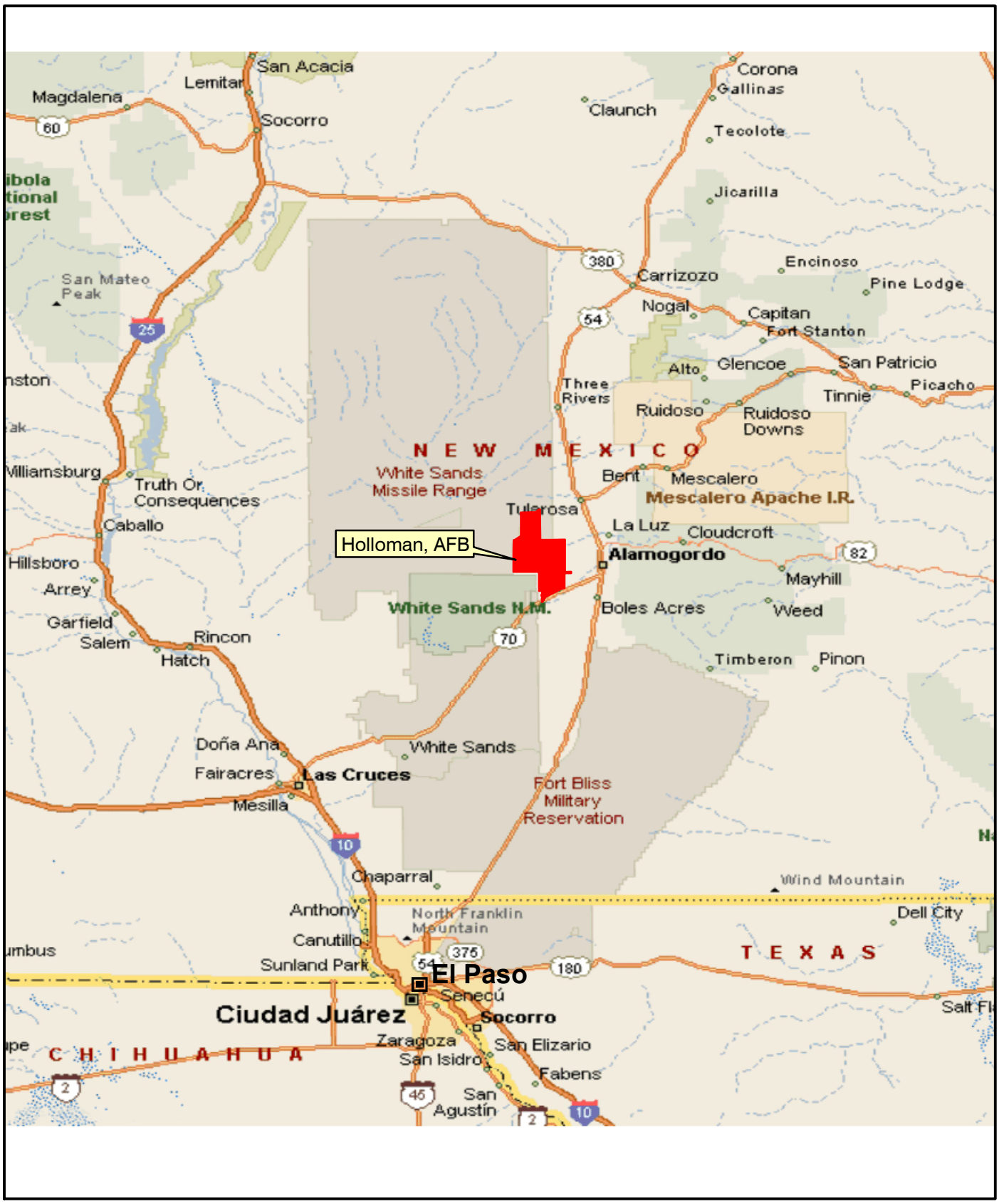
NM - not measured (waste material not consistantly observed during borehole advancement)

Table 3-7
LF-10 Supplemental RFI
Soil Analytical Results
Holloman AFB, New Mexico

Analyte	NMWQCC Soil Screening Levels[1]			SB10-03				SB10-04		SB10-05		SB10-06		SB10-07			
				15-May-06				15-May-06		15-May-06		15-May-06		15-May-06			
				20.00-22.00				8.00-10.00		10.00-11.00		11.00-12.00		10.00-11.00		13.00-14.00	
	Residential	**Industrial / Occupational**	**Construction Worker**	Val	Q	Val[2]	Q[2]	Val	Q	Val	Q	Val	Q	Val	Q	Val	Q
Volatile Organic Compounds (mg/kg)																	
n-Butylbenzene	NA	NA	NA	0.116	U	0.116	U	0.116	U	1.8	J	1.45	J	0.116	U	0.116	U
Naphthalene	45	252	702	0.258	U	4.55	J	6.76	J	4.76	J	3.77	J	3.16	J	2.78	J
p-Cymene	NA	NA	NA	0.105	U	0.105	U	0.105	U	1.21	J	0.105	U	0.105	U	0.105	U
Semivolatile Organic Compounds (mg/kg)																	
Fluoranthene	2,294	24,447	8,912	45.6	U	45.6	U	45.6	U	45.6	U	45.6	U	116	J	45.6	U
Other Compounds (mg/kg)																	
Diesel Fuel	NA	NA	NA	7.28	U	12.8	J	7.28	U	7.28	U	7.28	U	12.8	J	9.48	J
Metals (mg/kg)																	
Arsenic	3.9	17.7	65.4	1.73		3.36		0.228	U	3.07		0.228	U	0.228	U	1.34	J
Barium	15,596	223,980	4,353	43.8		46.3		24.7		23		23.3		17.8		27.7	
Chromium, total[3]	219	2,922	450	7.73		9.77		2.73		5.71		2.05		1.97		3.82	
Lead	400	800	800	22.2		47.1		3.5		8.52		3.53		2.25		4.36	
Mercury[4]	7.7	50	63.6	0.046		0.027	J	0.068		0.012	J	0.0088	U	0.0088	U	0.0088	U

Notes:
(1) Obtained from Table A-1 (NMED, 2009)
(2) Duplicate
(3) Screening criteria for Chromium VI used as a surrogate for chromium
(4) Screening criteria for methyl mercury used as a surrogate for mercury
NMWQCC - New Mexico Water Quality Control Commission
mg/kg - millograms per kilogram
ft - feet
Val - validated result
Q - qualifier
NA - not applicable
U - non-detect result, value presented indicates reporting limit
J - positive detection with reported concentration between the method detection limit and the reporting limit

FIGURES



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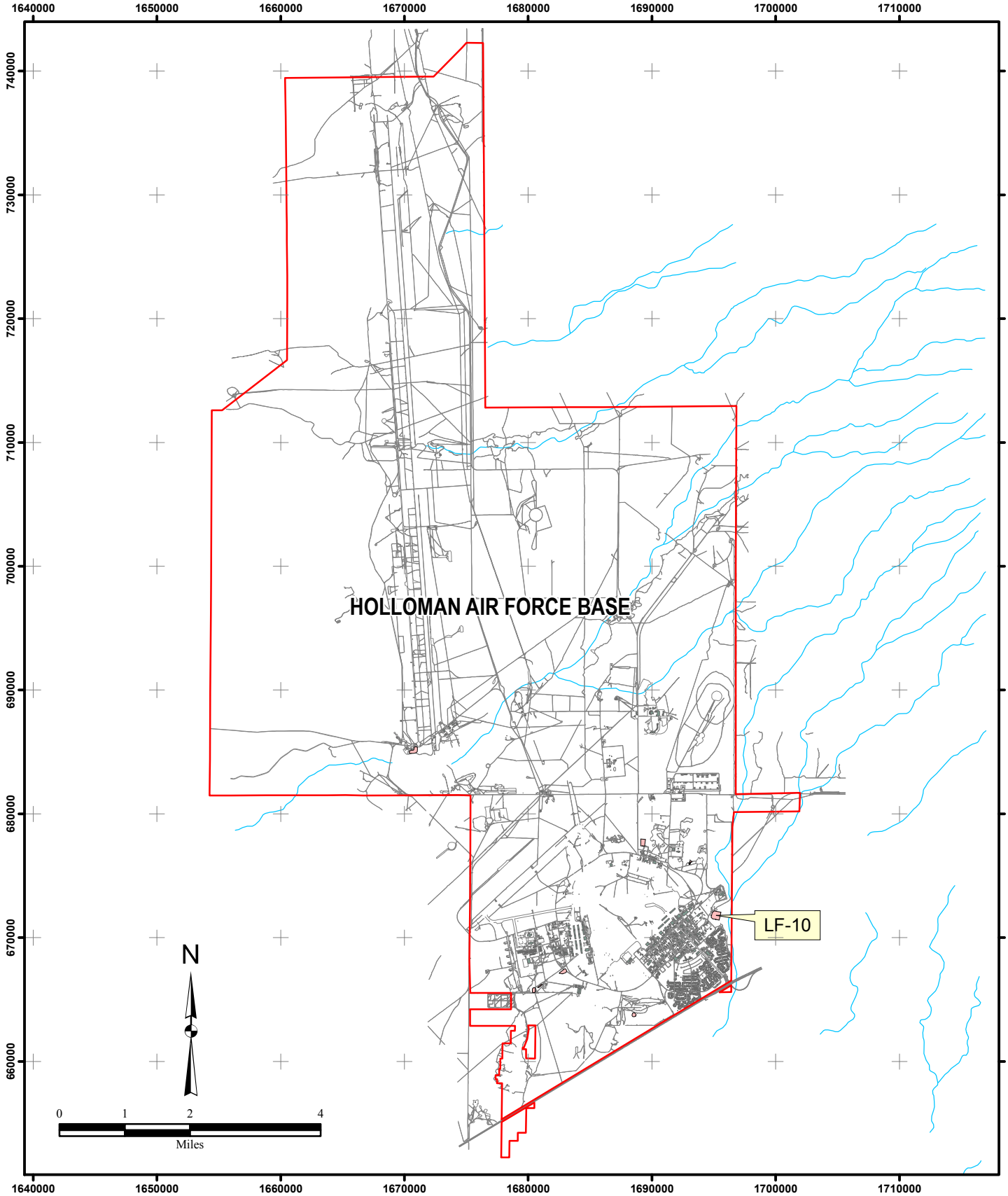
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB

N

0 25 50
Miles

FIGURE 1-1

INSTALLATION LOCATION MAP HOLLOMAN AFB



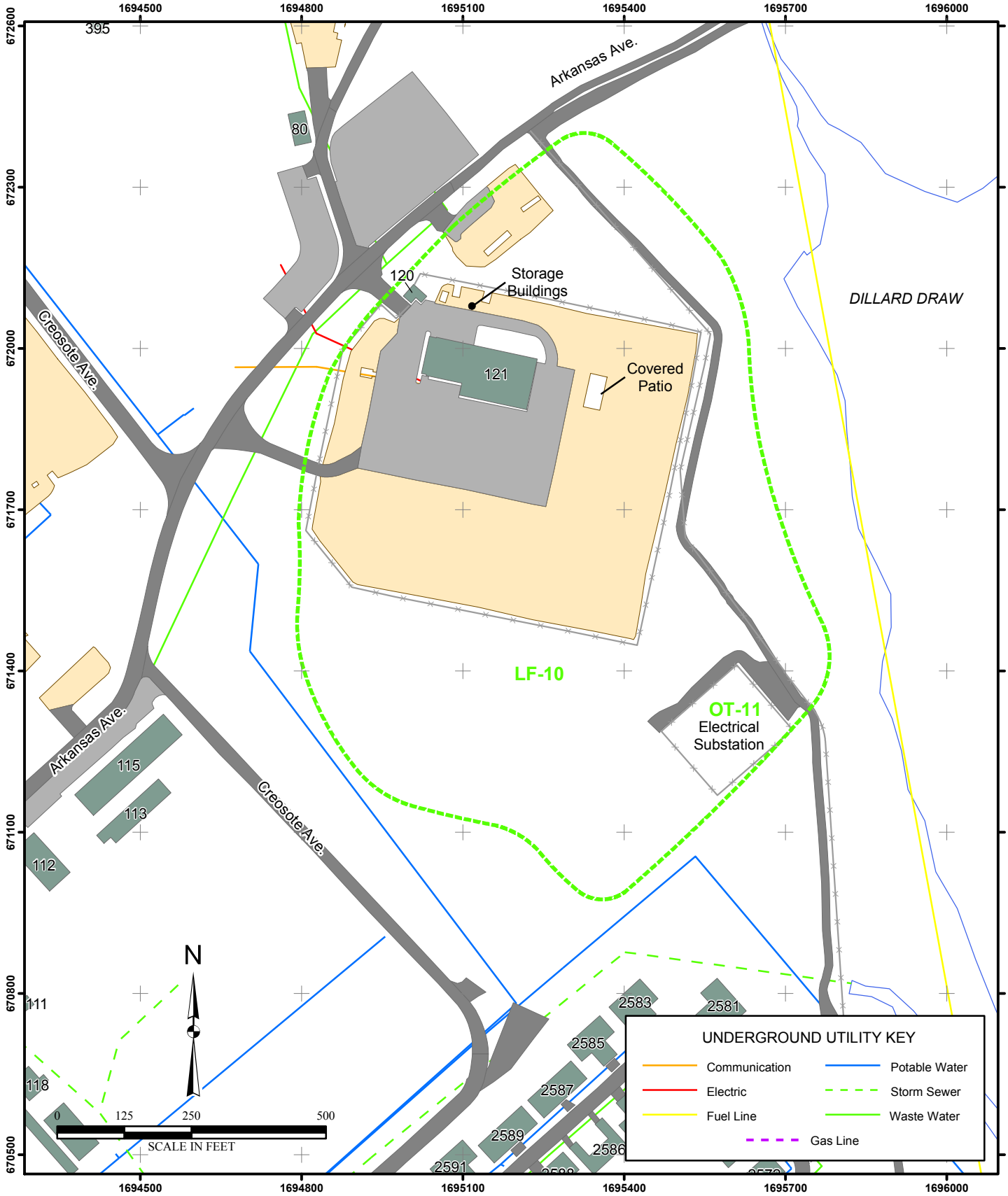
File: N:\Projects\Holloman_GIS_CADD\AFC002\Holloman_AFB\TetraTech\Tt_LF-10_Draft_WP\(1-02)Base_map.mxd
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Holloman AFB Boundary
- Building/Structure
- Operable Unit Boundary (Approx.)

FIGURE 1-2

SITE LOCATION MAP
HOLLOMAN AFB



File: N:\Projects\Holloman_GIS_CADD\AFC002\Holloman_AFB\TetraTech\Tt_LF-10_Draft_WP\(1-03)LF10_Layout.mxd
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Unit Boundary Implied by Geophysics
- Chainlink Fence
- Holloman AFB Building
- Paved Road
- Paved Parking Area
- Unpaved Parking Area

FIGURE 1-3

LF-10
(SWMUs 101 AND 109)
SITE MAP

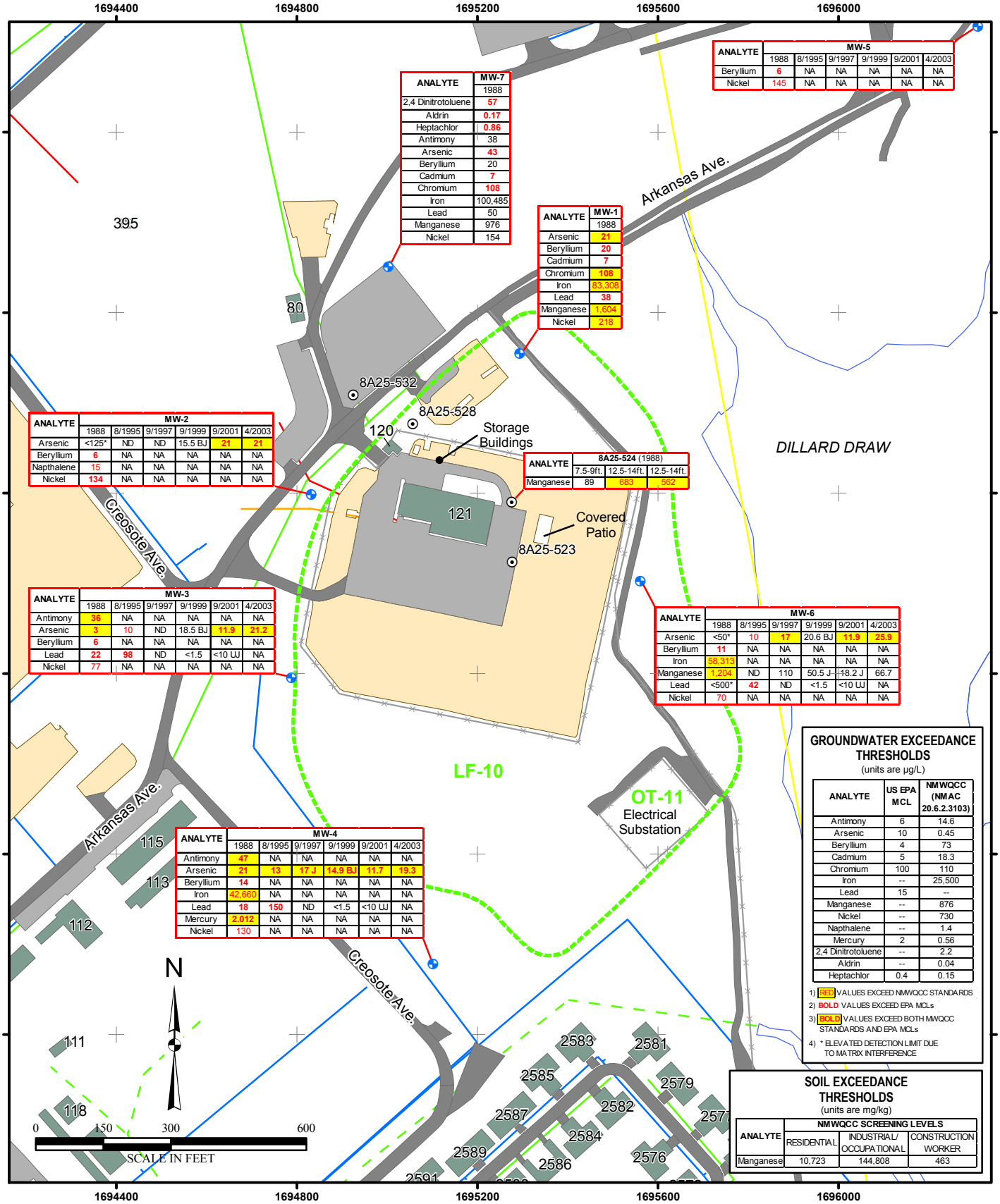
File: N:\Projects\Holloman_GIS_CADD\AFC002\Holloman_AFB\TetraTech\Tt_LF-10_Draft_WP\(2-01)LF10_GW.mxd
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Monitoring Well
- Groundwater Elevevation Contour
- 4074 Groundwater Elevevation (msl, Apr. 2003)
- Groundwater Flow
- Unit Boundary Implied by Geophysics
- Chainlink Fence

FIGURE 2-1

LF-10 SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MAP (APRIL, 2003)



ANALYTE	MW-7
	1988
2,4 Dinitrotoluene	57
Aldrin	0.17
Heptachlor	0.86
Antimony	38
Arsenic	43
Beryllium	20
Cadmium	7
Chromium	108
Iron	100,485
Lead	50
Manganese	976
Nickel	154

ANALYTE	MW-5					
	1988	8/1995	9/1997	9/1999	9/2001	4/2003
Beryllium	6	NA	NA	NA	NA	NA
Nickel	145	NA	NA	NA	NA	NA

ANALYTE	MW-1
	1988
Arsenic	21
Beryllium	20
Cadmium	7
Chromium	108
Iron	83,308
Lead	38
Manganese	1,604
Nickel	218

ANALYTE	MW-2					
	1988	8/1995	9/1997	9/1999	9/2001	4/2003
Arsenic	<125*	ND	ND	15.5 BJ	21	21
Beryllium	6	NA	NA	NA	NA	NA
Napthalene	15	NA	NA	NA	NA	NA
Nickel	134	NA	NA	NA	NA	NA

ANALYTE	8A25-524 (1988)		
	7.5-9ft.	12.5-14ft.	12.5-14ft.
Manganese	89	683	562

ANALYTE	MW-3					
	1988	8/1995	9/1997	9/1999	9/2001	4/2003
Antimony	36	NA	NA	NA	NA	NA
Arsenic	3	10	ND	18.5 BJ	11.9	21.2
Beryllium	6	NA	NA	NA	NA	NA
Lead	22	98	ND	<1.5	<10 UJ	NA
Nickel	77	NA	NA	NA	NA	NA

ANALYTE	MW-6					
	1988	8/1995	9/1997	9/1999	9/2001	4/2003
Arsenic	<50*	10	17	20.6 BJ	11.9	25.9
Beryllium	11	NA	NA	NA	NA	NA
Iron	58,313	NA	NA	NA	NA	NA
Manganese	1,204	ND	110	50.5 J	18.2 J	66.7
Lead	<500*	42	ND	<1.5	<10 UJ	NA
Nickel	70	NA	NA	NA	NA	NA

ANALYTE	MW-4					
	1988	8/1995	9/1997	9/1999	9/2001	4/2003
Antimony	47	NA	NA	NA	NA	NA
Arsenic	21	13	17 J	14.9 BJ	11.7	19.3
Beryllium	14	NA	NA	NA	NA	NA
Iron	42,660	NA	NA	NA	NA	NA
Lead	18	150	ND	<1.5	<10 UJ	NA
Mercury	2.012	NA	NA	NA	NA	NA
Nickel	130	NA	NA	NA	NA	NA

GROUNDWATER EXCEEDANCE THRESHOLDS

(units are µg/L)

ANALYTE	US EPA MCL	NMWQCC (NMAC 20.6.2.3103)
Antimony	6	14.6
Arsenic	10	0.45
Beryllium	4	73
Cadmium	5	18.3
Chromium	100	110
Iron	--	25,500
Lead	15	--
Manganese	--	876
Nickel	--	730
Napthalene	--	1.4
Mercury	2	0.56
2,4 Dinitrotoluene	--	2.2
Aldrin	--	0.04
Heptachlor	0.4	0.15

1) RED VALUES EXCEED NMWQCC STANDARDS
2) BOLD VALUES EXCEED EPA MCLs
3) BOLD VALUES EXCEED BOTH MWQCC STANDARDS AND EPA MCLs
4) * ELEVATED DETECTION LIMIT DUE TO MATRIX INTERFERENCE

SOIL EXCEEDANCE THRESHOLDS

(units are mg/kg)

ANALYTE	NMWQCC SCREENING LEVELS		
	RESIDENTIAL	INDUSTRIAL/ OCCUPATIONAL	CONSTRUCTION WORKER
Manganese	10,723	144,808	463

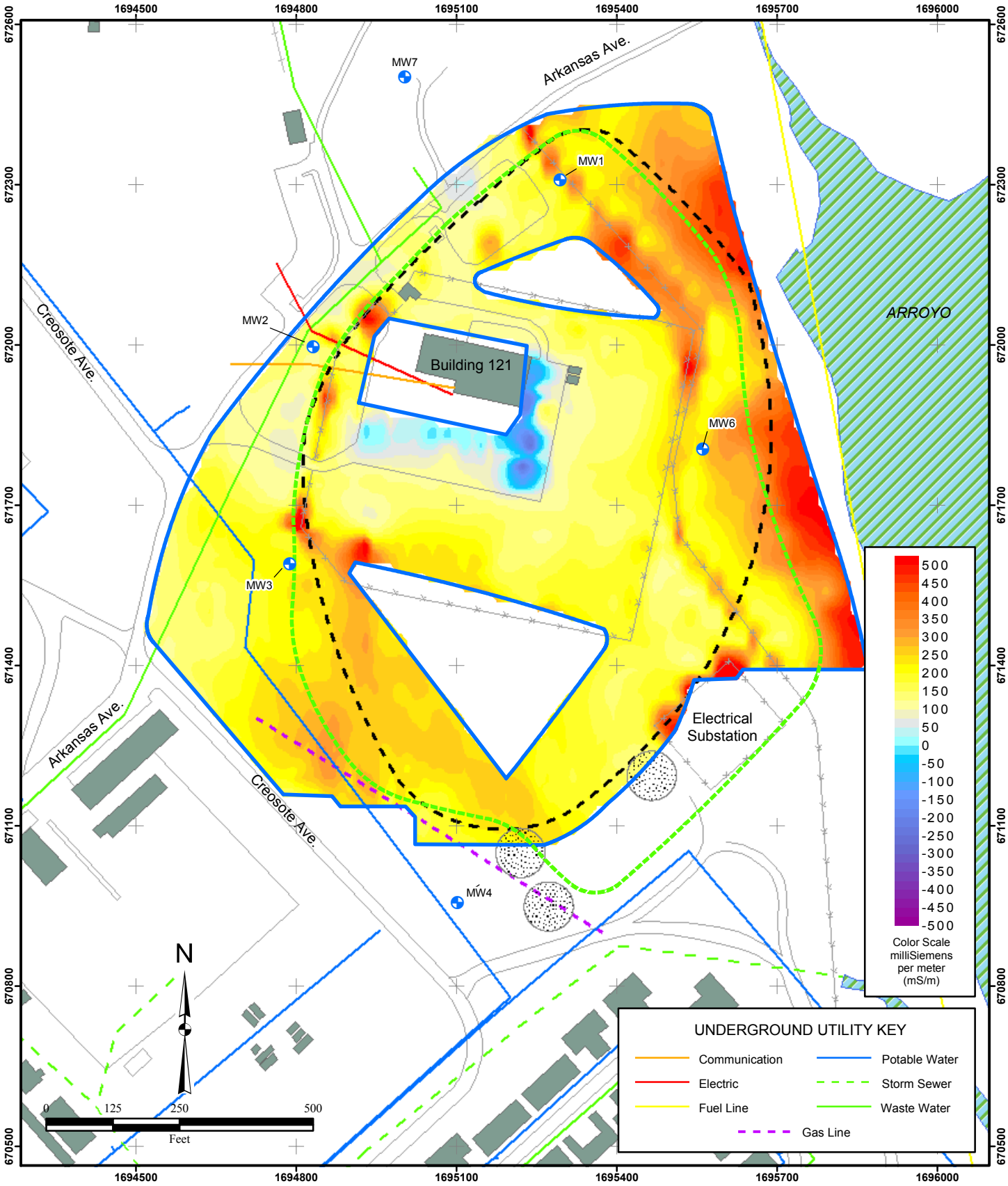
File: N:\Projects\Holloman_GIS_CADD\AFC002\Holloman_AFB\TetraTech\Tt_LF-10_Draft_WP\(3-01)LF10_Exc.mxd
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Unit Boundary Implied by Geophysics
- Chainlink Fence
- Holloman AFB Building
- Paved Road
- Paved Parking Area
- Unpaved Parking Area
- Monitoring Well
- Borehole

FIGURE 3-1

LF-10 (SWMUs 101 AND 109) EXCEEDANCES



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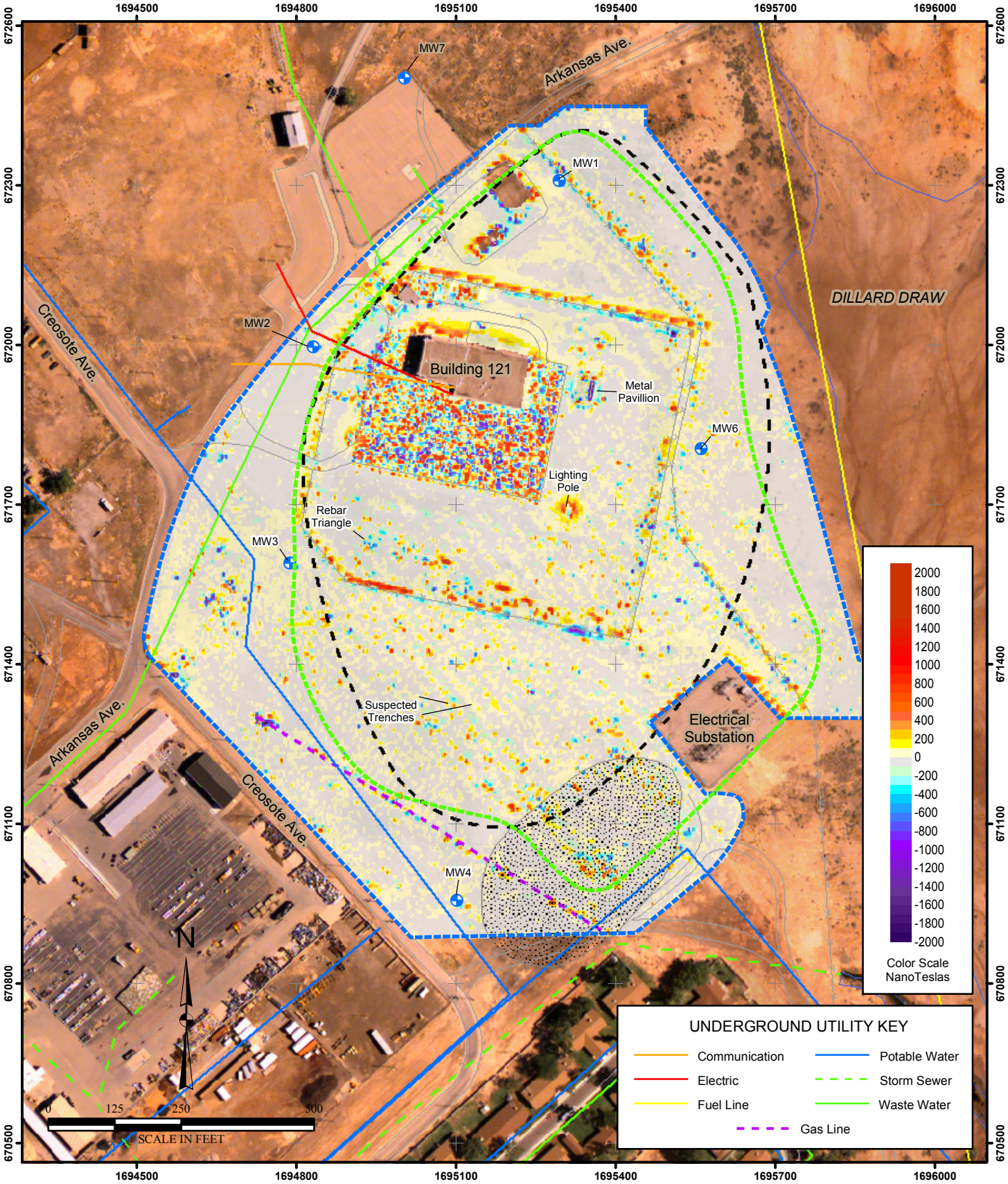
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Limit of Landfill Waste Implied by Previous Studies
- Terrain Conductivity Survey Boundary
- Unit Boundary Implied by Geophysics
- Chainlink Fence
- Stockpile of Recyclable Construction Material
- Monitoring Well

FIGURE 3-2

LF-10 TERRAIN CONDUCTIVITY SURVEY



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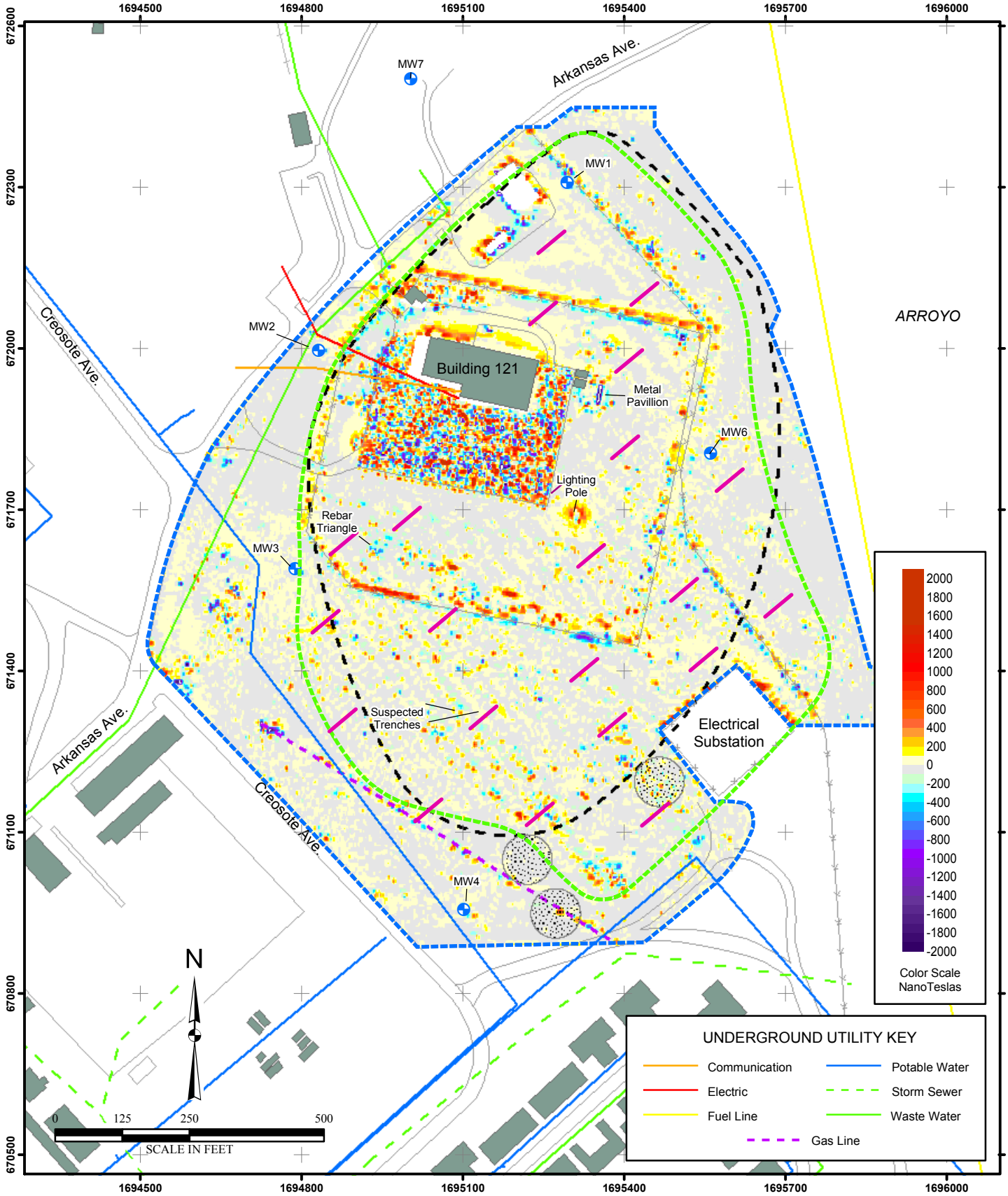
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Limit of Landfill Waste Implied by Previous Studies
- Magnetic Survey Boundary
- Unit Boundary Implied by Geophysics
- Chainlink Fence
- Stockpile of Recyclable Construction Material
- Monitoring Well

FIGURE 3-3

LF-10 MAGNETIC SURVEY MAP



File: N:\Projects\Holloman_GIS_CADD\AFC002\Holloman_AFB\TetraTech\Tt_LF-10_Draft_WP\(4-01)LF10_Mag.mxd
Project: PBR
Revised: 6/8/10 SRA
Map Source: Holloman AFB
State Plane Coordinate System, NAD83, NM Central, US Feet

LEGEND

- Tetra Tech Proposed 3x64ft. Trenches (21)
- Limit of Landfill Waste Implied by Previous Studies
- Magnetic Survey Boundary
- Unit Boundary Implied by Geophysics
- Stockpile of Recyclable Construction Material
- Chainlink Fence
- Monitoring Well

FIGURE 4-1

LF-10 PROPOSED TRENCH LOCATIONS

APPENDIX A

HOLLOMAN AIR FORCE BASE STANDARD OPERATING PROCEDURES

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; 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 object;
- 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 field manager 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:

- 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.

- 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.

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

- Ensure that each container has a properly completed label.

- Place the sample containers in re-sealable 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.

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

- Pack the container(s) with ample amounts of packing material to prevent possible breakage. This material should be placed 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.

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

- Add any needed packing material to fill all void spaces.

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

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

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

- Affix "This Side Up" arrows on two opposing sides of the center. 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 samples, 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 Service 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; and
- Health and safety equipment as outlined in the HASP.

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

- Don the appropriate PPE, as specified in the HASP and as required for the specific work area.
- Assemble containers and equipment for decontamination, designing the decontamination station in such a manner as to prevent liquid from spilling onto the ground.
- Decontaminate all new equipment or equipment not previously decontaminated before use.
- If the protective wrapping on a piece of pre-cleaned 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

- Remove any solid particles from the equipment or material by brushing and rinsing with available potable water. This will remove gross contamination.
- Wash equipment with a brush and a phosphate-free detergent solution.
- Rinse equipment thoroughly with potable water.
- Double rinse the equipment with reagent grade water.
- Allow equipment to air dry thoroughly. It 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.
- 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 SOP-9.

4.0 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 pre-cleaned 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 HAFB-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 property 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, 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; and
- Base Civil Engineering Clearance Request (Air Force Form #103).

3.0 METHODOLOGY

- 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 borehole number. If the location is on a paved surface, it should be marked with spray paint.
- 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 a control number and submit locator requests. 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 SOP 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 3.25 -inch outside diameter (OD) 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 risers and screen to make temporary wells if recovery is too slow;
- Decontamination equipment; and
- Health and safety equipment, as outlined in the HASP.

3.0 METHODOLOGY

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

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

- Verify that the sampling tip has been properly decontaminated.

- 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.

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

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

- Collect and manage all wastes as specified in the IDW SOP-9.

- Abandon all boreholes and repair pavement before moving to a new site (see the SOP-10 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 at 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.

- To obtain the actual digging permit, a Base Civil Engineering Clearance Request Form (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 a representative of the Civil Engineering's Environmental Flight (CEV). Once a digging permit has been issued, it is valid for one month.

- 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.

- New Mexico 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 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 HAFB 5-1);
- Pre-cleaned 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 HASP.

3.0 METHODOLOGY

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

- 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.

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

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

- 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 spilt spoon.
  – Log the soil and collect the required samples as specified in the Work Plan.

- 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 Work Plan.

- 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.

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

- 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 HAFB 5-1.

TABLE HAFB 5-1

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	1x4 oz wide mouth jar, G	Ice to 4°C	--	14 d
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	7d	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 mouth jar, G	Not specified	--	ASAP
EPA 8080	PCBs/Pesticides	1x8 oz wide mouth jar, G	Ice to 4°C	7d	40 d
Full suite (8240, 8270, 6000/7010)	TCLP	2x8 oz wide mouth jars, G	Ice to 4°C	--	14 d

[1]All containers must have Teflon-lined seals (Teflon-lined septa for all VOA vials).
[2]Container volumes 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.
G = glass
d = day

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 quantity 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 (isobulylene 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.

- 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.

- Allow all the samples to equilibrate to the temperature-controlled environment.

- Turn the PID or 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.

- 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 or bag.

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

- Repeat the previous steps 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 United 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;
- Munsell soil color chart;
- Hand lens;
- Knife or spatula;
- Dropper with 10% HC1 for calcium carbonate test;
- LaMotte soil texture kit or small vial;
- Water;
- Borehole log forms; and
- Health and safety equipment, as specified in the HASP.

3.0 METHODOLOGY

- 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.
- 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.
- Separate a small, representative portion of each distinct soil to be identified.
- Identity the color using the Munsell chart.
- 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).

- 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);
  - USGS Code (SM)

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

- 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.

- The sample should be placed in a soil jar or steel tube and seated with as little air as possible.

- 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 or PID is used to define extent at 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 judgment to infer contacts and lithology, using the tests listed in the ASTM method will ensure consistent results.

TABLE HAFB 7-1
CONTAINER AND PRESERVATION
REQUIREMENTS FOR GEOTECHNICAL SAMPLES

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

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 HAFB 8-l);
- Pre-cleaned 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; and
- Health and safety equipment, as specified in the HASP.

3.0 METHODOLOGY

- Ensure that all equipment is properly calibrated and operated by following the manuals provided by the equipment manufacturer. Record results of the equipment in the logbook.

- Calculate the approximate volume of the inert tubing (Teflon) using the formula

  $V = 3.1415 \times r^2 \times \text{Length} \times 7.48$ gal/ft.
  Or if the tubing is ¼ -inch, simply multiply the tubing length by 0.0102 gal/foot.

- Attach the peristaltic pump to the tubing as indicted in the pump instructions.

- 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.

- Fill sample bottles in the following order:

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

- Place sample containers on ice and handle as indicted in the appropriate SOP.

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

- 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 HAFB 5-1.

TABLE HAFB 8-1
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	--	14 d
EPA 8260	Volatile Organic compounds	3x40 mL glass Septa vials	Ice to 4°C, pH<2 with HCl	--	14 d
EPA 8270	B/N/A	2x1 L brown glass	Ice to 4°C	7d	40 d
TAL 6000/7010 series	Metals	500 mL plastic bottle	Ice to 4°C, pH<2 with HNO_3	--	6 months
SW 846:9045	pH	500 mL plastic bottle	Ice to 4°C	--	24 hrs
EPA 8080	PCBs/Pesticides	2x1 L brown glass	Ice to 4°C	7d	40 d
xxxx	Radionuclides	1 L plastic	Ice to 4°C	--	14 d

[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 provide 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;
- "Hazardous Waste" labels and Non Hazardous labels;
- 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; and
- PID or FID.

3.0 METHODOLOGY

3.1 SOIL AND WATER IDW

- Conduct sampling in accordance with the soil and groundwater sampling SOPs.
- It 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.

- 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)

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

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

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

- 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 above. DO NOT PUT SOIL AND WATER IN SAME CONTAINER.

- 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.

- If soils are containerized move to IDW drum storage area.

- Waste characterization will be conducted utilizing previously collected soil analytical results and additional characterization results. If soils contain TPH in excess of 940 ppm, arrangements will be made for off site disposal pit 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

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

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

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

- 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 HAFB-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 HASP.

3.0 METHODOLOGY

In general, borehole abandonment will be completed by the Direct Push Technology or Hollow Stem Auger 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.

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

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

- 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.

- Hydrate the seal using ample amounts of potable water.

- 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 B

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

QUALITY ASSURANCE PROJECT PLAN ADDENDUM
FOR
SUPPLEMENTAL RCRA FACILITY INVESTIGATION
WORK PLAN ADDENDUM
LF-10 (SWMUs 101 AND 109)
HOLLOMAN AIR FORCE BASE, NEW MEXICO
EPA ID# NM6572124422

Prepared for:

Air Force Center for Engineering and the Environment
San Antonio, Texas

Prepared by:

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Contract No. FA4890-06-D-0009
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Table 4-2 Summary of Laboratory QC Limits for LF-10

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ACRONYMS

Accutest	Accutest Laboratories, Inc.
AFCEE	U.S. Air Force Center for Engineering and the Environment
COC	chain of custody
EDD	electronic data deliverable
ERPIMS	Environmental Resources Program Information Management System
HAFB	Holloman Air Force Base
NELAC	National Environmental Laboratory Accreditation Conference
QA	quality assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	quality control
SOPs	standard operating procedures
SWMU	Solid Waste Management Unit
Tetra Tech	Tetra Tech, Inc.
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) Addendum was prepared by Tetra Tech, Inc. (Tetra Tech) on behalf of Holloman Air Force Base (HAFB) under contract to the U.S. Air Force Center for Engineering and the Environment (AFCEE), Contract No. FA4890-06-D-0009, Task Order No. 5002.

1.1 PURPOSE

This QAPP Addendum has been developed to assure that sample collection, analyses, and evaluations are legally and scientifically defensible for Landfill 10 (LF-10) Site, Building 121 Landfill [Solid Waste Management Unit (SWMU) 101] and Old Main Base Landfill (SWMU 109) at HAFB, New Mexico. This document is an addendum to the *Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico* (Bhate, 2003) (Basewide QAPP) and must be used in conjunction with that document. This document contains the site-specific information for proposed field activities at LF-10 outlined in the *Supplemental RCRA Facility Investigation Work Plan Addendum For LF-10 (SWMUs 101 and 109), Holloman Air Force Base, New Mexico* (Tetra Tech, 2010).

See the Basewide QAPP and the LF-10 Supplemental RFI Work Plan Addendum for additional information on HAFB and LF-10.

1.2 QAPP ADDENDUM ORGANIZATION

This QAPP Addendum is organized into the following six sections:

- Section 1 is the introduction,
- Section 2 provides project laboratory information,
- Section 3 provides information regarding the data categories,
- Section 4 provides information on sample handling procedures,
- Section 5 presents data quality assurance (QA) and quality control (QC) information, and
- Section 6 presents the references cited in this work plan.

The tables and figures referenced in this QAPP Addendum are included following Section 6.

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2.0 PROJECT LABORATORY

The analytical work for this project will be performed by Accutest Laboratories, Inc. (Accutest), 4405 Vineland Road, Suite C-15, Orlando, FL 32811. The laboratory personnel who will be involved with this project include:

- **Harry Behzadi, Ph. D.**, Vice President of Southeast Operations, Accutest Laboratories, Inc., (407) 425-6700, ext. 117;
- **Sue Bell,** Project Manager, Accutest Laboratories, Tampa Office, (813) 741-3338;
- **Rick Watkins**, Laboratory Manager, Accutest Laboratories Southeast, (407) 425-6700, ext. 104; and
- **Svetlana Izosimova, Ph. D.**, Quality Assurance Officer, Accutest Laboratories Southeast, (407) 425-6700, ext. 141.

Accutest is certified by both the National Environmental Laboratory Accreditation Council (NELAC) and has extensive previous experience in working on U.S. Air Force projects. The Accutest Laboratory Quality Assurance Manual (QAM) and Standard Operating Procedures (SOPs) have been reviewed by Tetra Tech and were found to meet the requirements for this project. The QAM and SOPs are available for further review if required.

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3.0 DATA CATEGORIES

The data use determines the required levels of data quality. For the HAFB site, AFCEE recognizes two general categories of data: (1) screening data and (2) definitive data.

Under this QAPP Addendum, the data to be generated under each level in this investigation are presented in Table 3-1 (Screening) and Table 3-2 (Definitive). The screening data collected for this project will include volatile organic compound (VOC) identification for guidance in sample selection for analysis. There will be no confirmation analyses for VOC identification, but the soil samples will be subjected to laboratory confirmation. The definitive data generated by the laboratory will be presented with limited data deliverables (i.e. Level IV data packages), using a 21 day turn-around-time. All definitive data produced by the laboratory will also be presented in an Environmental Resources Program Information Management System (ERPIMS) format electronic data deliverable (EDD).

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4.0 SAMPLE HANDLING PROCEDURES

Sample collection and sample custody procedures are designed so field custody of samples will be fully and continuously maintained and documented. These procedures require identification and documentation of the sampling event and the sample chain of custody (COC) from shipment of a sample to receipt of the sample by the subcontracted laboratory. When used in conjunction with the laboratory's custody procedures and the sample bottleware documentation, these procedures establish full legal custody and allow complete traceability of a sample. All sample collection and custody procedures will be performed in accordance with the Basewide QAPP (Bhate, 2003).

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5.0 DATA QUALITY ASSURANCE AND QUALITY CONTROL

The general data QA and QC requirements for HAFB are presented in the Basewide QAPP (Bhate, 2003). The field QC requirements for this project are presented in Table 4-1. The project specific laboratory QC limits are listed in Table 4-2.

All final definitive data will be reviewed and validated by the Tetra Tech Senior Chemist, Maureen McMyler, based on the guidelines of the U.S. Environmental Protection Agency (EPA) National Functional Guidelines for Data Validation and the site-specific laboratory QC limits.

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6.0 REFERENCES

Bhate, 2003. *Final Basewide Quality Assurance Project Plan, Holloman Air Force Base, New Mexico*. November.

Tetra Tech (Tetra Tech, Inc.), 2010. *Supplemental RCRA Facility Investigation Addendum For LF-10 (SWMUs 101 and 109), Holloman Air Force Base, New Mexico*. June.

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TABLES

Table 3-1
Summary of Screening Data for LF-10
Holloman AFB, New Mexico

Parameter	Matrix	Testing Method
Volatile Organics Compounds (VOCs)	Soil	Headspace using Photoionization detector (PID) or Flame Ionization Detector (FID)

Table 3-2
Summary of Definitive Data for LF-10
Holloman AFB, New Mexico

Parameter	Matrix	Testing Method
Target Compound List (TCL) VOCs	Soil	EPA SW-846 Method 5035/8260B
Target Compound List (TCL) SVOCs	Soil	EPA SW-846 Method 8270C
Target Analyte List (TAL) metals	Soil	EPA SW-846 Method 6010B and 7471A (mercury)

Notes:
EPA - U.S. Environmental Protection Agency
SVOCs - semivolatile organic compounds
VOCs - volatile organic compounds

Table 4-1
Summary of Field QC Samples for LF-10
Holloman AFB, New Mexico

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks*	Field Duplicates	Field Splits	MS/MSD	Total
Soil	TCL VOCs by EPA Method EPA 5035/8260B	20	0	1	2	0	2	25
	TCL SVOCs by EPA Method 8270C	20	0	0	2	0	2	24
	TAL Metals by EPA Method 6010B and 7471A (mercury)	20	0	0	2	0	2	24

Notes:

*Estimated, one trip blank will accompany every shipment of volatile samples

EPA - U.S. Environmental Protection Agency

MS/MSD - matrix spike/matrix spike duplicate

SVOCs - semivolatile organic compounds

VOCs - volatile organic compounds

TCL - Target compound list

TAL - Target analyte list

Table 4-2
Summary of Laboratory QC Limits for LF-10
Holloman AFB, New Mexico

Analyte	CAS No.	RL	MDL	Units	Control Limits (%)				
					MS/MSD			Blank Spike	
					LCL	UCL	RPD	LCL	UCL
Target Compound List (TCL) Volatile Organic Compounds (VOCs) per EPA Method 5035/8260B									
Acetone	67-64-1	50	21	µg/kg	61	144	29	61	144
Benzene	71-43-2	5	1	µg/kg	78	130	25	78	130
Bromodichloromethane	75-27-4	5	1	µg/kg	73	122	25	73	122
Bromoform	75-25-2	5	1.8	µg/kg	70	139	26	70	139
Chlorobenzene	108-90-7	5	1	µg/kg	83	122	23	83	122
Chloroethane	75-00-3	5	2	µg/kg	61	153	31	61	153
Chloroform	67-66-3	5	1	µg/kg	79	129	27	79	129
Carbon disulfide	75-15-0	5	2.4	µg/kg	61	142	27	61	142
Carbon tetrachloride	56-23-5	5	1.6	µg/kg	79	135	29	79	135
1,1-Dichloroethane	75-34-3	5	1.5	µg/kg	77	132	26	77	132
1,1-Dichloroethylene	75-35-4	5	2.3	µg/kg	66	132	27	66	132
1,2-Dichloroethane	107-06-2	5	1.2	µg/kg	78	129	24	78	129
1,2-Dichloropropane	78-87-5	5	1	µg/kg	74	127	27	74	127
Dibromochloromethane	124-48-1	5	1.7	µg/kg	78	117	27	78	117
cis-1,2-Dichloroethylene	156-59-2	5	1	µg/kg	74	123	26	74	123
cis-1,3-Dichloropropene	10061-01-5	5	1	µg/kg	79	130	23	79	130
trans-1,2-Dichloroethylene	156-60-5	5	1.9	µg/kg	77	129	27	77	129
trans-1,3-Dichloropropene	10061-02-6	5	1.1	µg/kg	87	131	27	87	131
Ethylbenzene	100-41-4	5	1.1	µg/kg	82	124	25	82	124
2-Hexanone	591-78-6	25	12	µg/kg	67	130	29	67	130
4-Methyl-2-pentanone	108-10-1	25	8.3	µg/kg	69	125	24	69	125
Methyl bromide	74-83-9	5	2	µg/kg	60	146	31	60	146
Methyl chloride	74-87-3	5	2.5	µg/kg	58	163	26	58	163
Methylene chloride	75-09-2	10	5	µg/kg	62	140	25	62	140
Methyl ethyl ketone	78-93-3	25	7.5	µg/kg	66	134	23	66	134
Naphthalene	91-20-3	5	2	µg/kg	59	143	31	59	143
Styrene	100-42-5	5	1	µg/kg	79	123	28	79	123
1,1,1-Trichloroethane	71-55-6	5	1.8	µg/kg	80	133	27	80	133
1,1,2,2-Tetrachloroethane	79-34-5	5	1.3	µg/kg	70	128	30	70	128

Table 4-2
Summary of Laboratory QC Limits for LF-10
Holloman AFB, New Mexico

Analyte	CAS No.	RL	MDL	Units	Control Limits (%)				
					MS/MSD			Blank Spike	
					LCL	UCL	RPD	LCL	UCL
Target Compound List (TCL) Volatile Organic Compounds (VOCs) per EPA Method 5035/8260B									
1,1,2-Trichloroethane	79-00-5	5	1.3	µg/kg	76	118	28	76	118
Tetrachloroethylene	127-18-4	5	1.8	µg/kg	79	132	27	79	132
Toluene	108-88-3	5	1.2	µg/kg	80	123	26	80	123
Trichloroethylene	79-01-6	5	1.6	µg/kg	78	132	28	78	132
Vinyl chloride	75-01-4	5	2	µg/kg	60	145	29	60	145
Xylene (total)	1330-20-7	15	2.2	µg/kg	83	127	24	83	127
	CAS No.							**LCL**	**UCL**
Dibromofluoromethane	1868-53-7					Surrogate Limits:		80	121
Toluene-D8	2037-26-5					Surrogate Limits:		71	130
4-Bromofluorobenzene	460-00-4					Surrogate Limits:		59	148
1,2-Dichloroethane-D4	17060-07-0					Surrogate Limits:		77	123
Target Compound List (TCL) Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C									
Benzoic acid	65-85-0	830	330	µg/kg	44	116	36	44	116
2-Chlorophenol	95-57-8	170	33	µg/kg	54	97	31	54	97
4-Chloro-3-methyl phenol	59-50-7	170	33	µg/kg	59	102	27	59	102
2,4-Dichlorophenol	120-83-2	170	33	µg/kg	60	101	30	60	101
2,4-Dimethylphenol	105-67-9	170	37	µg/kg	49	89	31	49	89
2,4-Dinitrophenol	51-28-5	830	330	µg/kg	39	107	40	39	107
4,6-Dinitro-o-cresol	534-52-1	330	33	µg/kg	58	109	37	58	109
2-Methylphenol	95-48-7	170	33	µg/kg	53	94	29	53	94
3&4-Methylphenol		170	33	µg/kg	54	95	31	54	95
2-Nitrophenol	88-75-5	170	33	µg/kg	55	96	30	55	96
4-Nitrophenol	100-02-7	830	330	µg/kg	56	106	29	56	106
Pentachlorophenol	87-86-5	830	330	µg/kg	50	115	33	50	115
Phenol	108-95-2	170	33	µg/kg	55	99	28	55	99
2,4,5-Trichlorophenol	95-95-4	170	33	µg/kg	60	101	28	60	101
2,4,6-Trichlorophenol	88-06-2	170	33	µg/kg	60	100	27	60	100
Acenaphthene	83-32-9	170	33	µg/kg	59	97	29	59	97
Acenaphthylene	208-96-8	170	33	µg/kg	58	98	30	58	98

Table 4-2
Summary of Laboratory QC Limits for LF-10
Holloman AFB, New Mexico

Analyte	CAS No.	RL	MDL	Units	Control Limits (%)				
					MS/MSD			Blank Spike	
					LCL	UCL	RPD	LCL	UCL
Target Compound List (TCL) Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C									
Anthracene	120-12-7	170	33	µg/kg	61	104	29	61	104
Benzo(a)anthracene	56-55-3	170	33	µg/kg	60	106	31	60	106
Benzo(a)pyrene	50-32-8	170	33	µg/kg	59	102	32	59	102
Benzo(b)fluoranthene	205-99-2	170	33	µg/kg	60	107	31	60	107
Benzo(g,h,i)perylene	191-24-2	170	33	µg/kg	56	103	32	56	103
Benzo(k)fluoranthene	207-08-9	170	33	µg/kg	61	107	30	61	107
4-Bromophenyl phenyl ether	101-55-3	170	33	µg/kg	60	104	26	60	104
Butyl benzyl phthalate	85-68-7	330	67	µg/kg	57	110	28	57	110
Benzyl Alcohol	100-51-6	170	33	µg/kg	51	102	34	51	102
2-Chloronaphthalene	91-58-7	170	33	µg/kg	57	95	28	57	95
4-Chloroaniline	106-47-8	170	33	µg/kg	19	85	34	19	85
Carbazole	86-74-8	170	33	µg/kg	60	106	30	60	106
Chrysene	218-01-9	170	33	µg/kg	60	107	31	60	107
bis(2-Chloroethoxy)methane	111-91-1	170	33	µg/kg	51	89	30	51	89
bis(2-Chloroethyl)ether	111-44-4	170	33	µg/kg	50	96	33	50	96
bis(2-Chloroisopropyl)ether	108-60-1	170	33	µg/kg	44	94	32	44	94
4-Chlorophenyl phenyl ether	7005-72-3	170	33	µg/kg	60	101	26	60	101
1,2-Dichlorobenzene	95-50-1	170	67	µg/kg	47	91	35	47	91
1,3-Dichlorobenzene	541-73-1	170	67	µg/kg	45	86	36	45	86
1,4-Dichlorobenzene	106-46-7	170	67	µg/kg	45	88	36	45	88
2,4-Dinitrotoluene	121-14-2	170	33	µg/kg	59	103	30	59	103
2,6-Dinitrotoluene	606-20-2	170	33	µg/kg	57	99	30	57	99
3,3'-Dichlorobenzidine	91-94-1	330	67	µg/kg	34	88	31	34	88
Dibenzo(a,h)anthracene	53-70-3	170	33	µg/kg	57	105	29	57	105
Dibenzofuran	132-64-9	170	33	µg/kg	58	103	27	58	103
Di-n-butyl phthalate	84-74-2	330	67	µg/kg	59	105	27	59	105
Di-n-octyl phthalate	117-84-0	330	67	µg/kg	59	117	28	59	117
Diethyl phthalate	84-66-2	330	170	µg/kg	59	106	27	59	106
Dimethyl phthalate	131-11-3	330	67	µg/kg	60	100	26	60	100

Table 4-2
Summary of Laboratory QC Limits for LF-10
Holloman AFB, New Mexico

Analyte	CAS No.	RL	MDL	Units	Control Limits (%)				
					MS/MSD			Blank Spike	
					LCL	UCL	RPD	LCL	UCL
Target Compound List (TCL) Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C									
bis(2-Ethylhexyl)phthalate	117-81-7	330	170	µg/kg	57	111	29	57	111
Fluoranthene	206-44-0	170	33	µg/kg	60	110	32	60	110
Fluorene	86-73-7	170	33	µg/kg	60	99	30	60	99
Hexachlorobenzene	118-74-1	170	33	µg/kg	58	103	27	58	103
Hexachlorobutadiene	87-68-3	170	33	µg/kg	49	95	33	49	95
Hexachlorocyclopentadiene	77-47-4	170	33	µg/kg	36	94	41	36	94
Hexachloroethane	67-72-1	170	83	µg/kg	44	89	38	44	89
Indeno(1,2,3-cd)pyrene	193-39-5	170	33	µg/kg	57	104	33	57	104
Isophorone	78-59-1	170	33	µg/kg	58	97	30	58	97
2-Methylnaphthalene	91-57-6	170	33	µg/kg	57	103	32	57	103
2-Nitroaniline	88-74-4	330	67	µg/kg	53	106	29	53	106
3-Nitroaniline	99-09-2	330	67	µg/kg	29	85	31	29	85
4-Nitroaniline	100-01-6	330	67	µg/kg	49	104	31	49	104
Naphthalene	91-20-3	170	33	µg/kg	54	93	32	54	93
Nitrobenzene	98-95-3	170	33	µg/kg	53	92	32	53	92
N-Nitroso-di-n-propylamine	621-64-7	170	33	µg/kg	49	94	28	49	94
N-Nitrosodiphenylamine	86-30-6	170	33	µg/kg	53	107	28	53	107
Phenanthrene	85-01-8	170	33	µg/kg	61	103	32	61	103
Pyrene	129-00-0	170	33	µg/kg	58	109	33	58	109
1,2,4-Trichlorobenzene	120-82-1	170	33	µg/kg	52	93	32	52	93
	CAS No.							**LCL**	**UCL**
2-Fluorophenol	367-12-4					Surrogate Limits:		40	102
Phenol-d5	4165-62-2					Surrogate Limits:		41	100
2,4,6-Tribromophenol	118-79-6					Surrogate Limits:		42	108
Nitrobenzene-d5	4165-60-0					Surrogate Limits:		40	105
2-Fluorobiphenyl	321-60-8					Surrogate Limits:		43	107
Terphenyl-d14	1718-51-0					Surrogate Limits:		45	119

Table 4-2
Summary of Laboratory QC Limits for LF-10
Holloman AFB, New Mexico

Analyte	CAS No.	RL	MDL	Units	Control Limits (%)				
					MS/MSD			Blank Spike	
					LCL	UCL	RPD	LCL	UCL
Target Analyte List (TAL) Metals by EPA Method 6010B									
Aluminum		10	1	mg/kg	80	120	20	80	120
Antimony		1	0.1	mg/kg	80	120	20	80	120
Arsenic		0.5	0.1	mg/kg	80	120	20	80	120
Barium		10	0.5	mg/kg	80	120	20	80	120
Beryllium		0.25	0.05	mg/kg	80	120	20	80	120
Cadmium		0.2	0.05	mg/kg	80	120	20	80	120
Calcium		250	5	mg/kg	80	120	20	80	120
Chromium		0.5	0.05	mg/kg	80	120	20	80	120
Cobalt		2.5	0.05	mg/kg	80	120	20	80	120
Copper		1.25	0.1	mg/kg	80	120	20	80	120
Iron		15	1.5	mg/kg	80	120	20	80	120
Lead		1	0.05	mg/kg	80	120	20	80	120
Magnesium		250	5	mg/kg	80	120	20	80	120
Manganese		0.75	0.05	mg/kg	80	120	20	80	120
Mercury		1	0.071	mg/kg	80	120	20	80	120
Molybdenum		2.5	0.05	mg/kg	80	120	20	80	120
Nickel		2	0.05	mg/kg	80	120	20	80	120
Potassium		500	25	mg/kg	80	120	20	80	120
Selenium		1	0.2	mg/kg	80	120	20	80	120
Silver		0.5	0.05	mg/kg	80	120	20	80	120
Sodium		500	37.5	mg/kg	80	120	20	80	120
Strontium		0.5	0.05	mg/kg	80	120	20	80	120
Thallium		0.5	0.1	mg/kg	80	120	20	80	120
Tin		2.5	0.05	mg/kg	80	120	20	80	120

Table 4-2
Summary of Laboratory QC Limits for LF-10
Holloman AFB, New Mexico

Analyte	CAS No.	RL	MDL	Units	Control Limits (%)				
					MS/MSD			Blank Spike	
					LCL	UCL	RPD	LCL	UCL
Target Analyte List (TAL) Metals by EPA Method 6010B									
Titanium		0.5	0.1	mg/kg	80	120	20	80	120
Vanadium		2.5	0.05	mg/kg	80	120	20	80	120
Zinc		1	0.25	mg/kg	80	120	20	80	120

Notes:
CAS - Chemical Abstrats Service
LCL - lower control limit
MDL - method detection limit
µg/kg - micrograms per kilogram
mg/kg - millograms per kilogram
MS/MSD - matrix spike/matrix spike duplicate
% - percent
RL - reporting limit
RPD - relative percent difference

APPENDIX C

ACTIVITY HAZARD ANALYSIS

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Mobilization/Demobilization *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Mobilization • Perform site survey • Perform initial inspections of the intended work areas • Set up material and equipment lay-down areas • Establish excavation locations • Arrange for utility permits, notify appropriate authorities • Perform inspections of vehicles and equipment arriving/preparing to depart the site • Set up on-site environmental monitoring device • Collecting and confirming applicable worker training and medical compliance documentation *Demobilization* • Clean up area • Decontaminate equipment • File project documentation in main field office	1. Minor cuts, abrasions or contusions handling equipment and tools	1. Wear cut-resistant gloves when handling items with sharp or rough edges.
	2. Heavy lifting (muscle strains and pulls)	2. Practice safe lifting techniques (use mechanical lifting devices such as a dolly whenever possible), ensure clear path of travel, good grasp on object, lift with legs not back, and obtain help when needed to lift large, bulky, or heavy items.
	3. General traffic hazard	3. Stay clear of the designated contractor's route, use signals, horns, etc. when entering site where workers are present. Post "Men at Work" signage to notify vehicular traffic of activity being performed adjacent to roadway. Use traffic cones to demarcate work zone entrance near roadway.
	4. Vehicular accident when moving large equipment to the support area	4. Designate/demarcate vehicle and equipment staging areas. Inform all site personnel of heavy equipment areas and of their responsibility to stay clear of moving vehicles and aircraft. Wear high-visibility vests and all times.
	5. Intermittent high noise levels	5. Operators/nearby personnel are to wear hearing protection if noise levels are such that they must raise their voice in order to communicate with someone who is within arm's reach (approx. 2') of them. SSHO responsible for determining and designating when hearing protection is required. Hearing protection is to consist of either ear muffs or ear plugs that have a noise reduction rating (NRR) of at least 25 dB. Workers must also be able to communicate, hear/recognize/respond to alarms, and recognize and avoid nearby moving equipment.
	6. Dust and flying debris	6. Control dust by spraying water in high traffic areas on an as-needed basis. Wear protective PPE, gloves, long pants, safety glasses.
	7. Equipment moving parts	7. Ensure that workers are thoroughly trained and competent to perform their assigned task with the equipment used in implementation work. Ensure that back-up alarms are functional on equipment. The equipment operators and on-site Supervisors responsible for the equipment are to ensure that the equipment inspection forms have been reviewed and completed, and that all moving parts are guarded if such parts are exposed. Check/test all emergency stop controls. Use escort vehicles with flashing lights to warn and control local traffic when moving large equipment to support area.

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Mobilization/Demobilization *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
	8. Striking existing utility lines	8. Pre-inspect vehicle moving lanes noting overhead utilities. Do not approach within 10' of any overhead electric line of 50 kV or less. Additional clearance distance is required for lines of > 50kV. Reference Section 4.8.8. Verify the location of utility lines. Pre-plan the move with the local utility companies if utility lines must be moved. Pre-survey the height of equipment and height of utility lines to determine which lines must be removed or raised.
	9. Overhead and foot hazards	9. Wear hard hats and steel toe shoes, use peripheral vision.
	10. Snake bite	10. Prior to moving any object or equipment, perform a visual inspection to determine if a snake is in the vicinity. If a snake is spotted contact the on-site supervisor to report the location and corrective measures will be implemented. If an incident occurs, immediately take the victim to nearest medical facility. If immediate transportation not possible, keep the victim calm and splint the extremity of the bite. An incident report shall be completed and forwarded to the Project Manager.
	11. Insect bite (mosquitoes, chiggers, fire ants, spiders, ticks, etc.)	11. Wear protective clothing and use USEPA-registered insect repellent applied and reapplied in accordance with manufacturer's recommendations (Note some repellants are intended for use directly on skin, and other more potent repellants are intended for use on clothing only. If the potential for insect bites appears to be significant, use both types of repellants). Tuck in pant legs into boots and tape up boots/pants leg joints with duct tape. Once under the skin, chiggers are difficult to remove, but can be smothered by applying a commercial ointment, nail polish, or KWELL® lotion to the affected area. Follow these procedures to remove a tick: Use tweezers to firmly grasp the tick at its head or mouth, as close to the skin as possible. Pull firmly and steadily on the tick until it lets go of the skin. Swab the bite with alcohol or antiseptic. Do not use petroleum jelly or a lit match to try to remove a tick.

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Mobilization/Demobilization *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
	12. Stung by insects	12. Spray USEPA-registered insect repellent around the pant leg, wash the bite area with soap and water, apply cool compress to the area, call poison control and take victim to hospital if affected area swells and condition worsens.
	13. Inclement weather	13. Stay informed about severe weather, follow hazard communication procedures.
	14. Heat stress	14. Drink plenty of fluids. Take frequent breaks in cool shaded areas. Monitor heat rate and temperature.
	15. Contact with contaminated media during demobilization	15. Wear appropriate PPE, including gloves, long pants, and eye protection.
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
Excavator, field vehicles, hand tools and two-way communication devices	Visual inspection prior to use by user and inspection documented in accordance with Section 4.5.2 of the HASP.	All personnel participating in this activity must be current with HAZWOPER training requirements listed in 29 CFR 1910.120 (e).
Personal Protective Equipment: **Minimum:** Steel toe boots, safety glasses, nitrile gloves (for handling contaminated materials), work gloves (when moving materials), hard hats, and high visibility vest. **Optional items:** hearing protection. **HTRW:** None anticipated for this task.	Initial PPE inspection performed by SSHO. Ongoing (prior to each use) inspections responsibilities of PPE users.	PPE training in proper use, care, storage, and limitations. It is anticipated that this has been covered in employees 40-hr General Site Worker training, which is to be verified by the SSHO through initial training documentation and reviewed prior to permitting personnel to participate in site activities, and will be confirmed by visual observations of worker's activities.

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Trenching for Waste Characterization and Soil Sampling (as necessary) *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Excavator operation • Inspect equipment • Perform safety inspection *Trenching* • Position excavator over trench • Remove soil within trench and place adjacent to trench • Remove landfill waste material, non hazardous • Remove landfill waste material, hazardous waste • Backfill with removed trench soil *Soil Sampling* • Collection of soil samples, only if suspected hazardous waste, and place in two containers. One for headspace analysis by PID and the other for lab analysis	1. Slips/Trips/Falls 2. Struck by equipment/moving parts 3. Overhead and Foot Hazards 4. Minor cuts, abrasions or contusions handling equipment and tools 5. Heavy lifting (muscle strains and pulls) 6. Noise 7. Weather 8. Vehicular hazard 9. Manhandling of heavy machinery	1. Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces. 2. Maintain visual contact with the crane operator. Ensure appropriate PPE and safe work practice. Be aware of work being performed within 5 ft. Avoid personnel working in the operator's blind spot. 3. Watch out for moving parts, wear protective equipment, hard hat, steel toe boots 4. Wear cut-resistant gloves when handling items with sharp or rough edges. 5. Use safe lifting practice, use additional help from coworker 6. Operators/nearby personnel are to wear hearing protection if noise levels are such that they must raise their voice in order to communicate with someone who is within arm's reach (approx. 2') of them. SSHO responsible for determining and designating when hearing protection is required. Hearing protection is to consist of either ear muffs or ear plugs that have a noise reduction rating (NRR) of at least 25 dB. Workers must also be able to communicate, hear/recognize/respond to alarms, and recognize and avoid nearby moving equipment. 7. SSHO will notify site workers of inclement weather 8. Establish speed limit for vehicles traveling around the site. 9. Ensure that workers are thoroughly trained and competent to perform their assigned task with the equipment used in investigation. Ensure that back-up alarms are functional on equipment. The equipment operators and on-site Supervisors responsible for the equipment are to ensure that the equipment have been inspected and completed, and that all moving parts are guarded if such parts are exposed. Check/test all emergency stop controls. Use escort vehicles with flashing lights to warn and control local traffic when moving.

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Trenching for Waste Characterization and Soil Sampling (as necessary) *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
	10. Fire hazard	10. All motors must be shut off during refueling. Smoking in the vicinity of the excavator is not permitted. An A-B-C fire extinguisher must be maintained on the excavator and associated motorized equipment. Fuel containers will not be stored within 10' of the excavator motor. Fuel will be stored in UL approved safety containers with contents clearly labeled. All personnel must stay clear of work zone and exclusion zone.
	11. Minor cuts or abrasions when handling landfill waste material (as necessary)	11. Wear cut-resistant gloves when handling items with sharp or rough edges
	12. Chemical exposure	12. Wear nitrile gloves during sample collection activities and when handling waste material.
	13. Insect bites	13. Shake out boots before donning. Use insect repellants (products containing DEET should be applied to exposed skin, products containing Permethrin should be applied to clothing only. Follow manufacturer's recommendations for application). Tape up pants leg to work boot joints with duct tape. Wear light-colored clothing to better see and remove any insects. Perform close body inspections at least daily upon leaving the site.
	14. Tools or personnel falling in open trench	14. Maintain a three foot exclusion area around open trench
	15. Air emissions	15. Monitor work/breathing zone through handheld PID; follow action levels identified in HASP.

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Trenching for Waste Characterization and Soil Sampling (as necessary) *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
Excavator Sample collection tools and containers (jars, spatulas, spoons, etc.)	Visual inspection prior to use by user.	40 hour HAZWOPER certification
Personal Protective Equipment: **Minimum:** Steel toe boots, safety glasses, hard hat, hearing protection, nitrile gloves, and high visibility vest **HTRW**: In exceptional cases (escaped VOC vapor) follow respiratory protection as described in HASP	Initial PPE inspection performed by SSHO. Ongoing (prior to each use) inspections responsibility of PPE users.	PPE training in proper use, care, storage, and limitations. It is anticipated that this has been covered in employees 40 hour HAZWOPER training, which is to be verified by the SSHO through initial training documentation and review prior to permitting personnel to participate in site activities, and will be confirmed by visual observations of worker activities. SSHO trained in proper calibration, use, and care of air monitoring devices used (PID/FID). This is a general component of 40 hour HAZWOPER training, and SSHO must become very familiar with the Operator's Manual for any instrument used.

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Equipment and Personal Decontamination *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Personal Decontamination • Wash hands • Segregate removal of PPE (wash and rinse reusable items, dispose of non-reusable items) *Decontamination of Heavy Equipment* • Use steam pressure washer in decontamination area	1. Slips, Trips, Falls	1. Clear intended decon pad location of roots, weeds, limbs and other ground hazards. Practice good housekeeping to keep the site clear of obstructions, materials, equipment and other tripping hazards. Wear appropriate foot protection to prevent slips and trips. Use caution when working on uneven and wet ground surfaces.
	2. Exposure to contaminated media	2. Follow good decontamination practices (work from top down and outside in). Nitrile gloves are to be the last item of PPE removed. Wash hands and face following personal decontamination and prior to performing any hand-to-mouth activity.
	3. Noise	3. Pressure washer operator must wear hearing protection (muffs or plugs with NRR of at least 25 dB)
	4. Flying projectiles	4. Restrict other personnel from decon pad during pressure washing operations. Pressure washer operator must exercise care when directing the wand so that it is not pointing at himself/herself or at any other worker. Pressure washer operator must wear safety glasses with side shields and brow protection or goggles.
	5. Falling objects	5. Place items to be decontaminated on ground or on washing/drying racks in a manner that they are secure and will not fall. Wear steel toe safety footwear.
	6. Strains/sprains from heavy lifting	6. Practice safe lifting techniques (use mechanical lifting devices such as a dolly whenever possible, ensure clear path of travel, good grasp on object, lift with legs not back, obtain help when needed to lift large, bulky, or heavy items)
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
Hand tools (hand brushes, garden sprayers, etc.), pressure washer, PID for screening to ensure effective decontamination	Visual inspection prior to use by user. Check wooden handles for cracks or splinters. Inspect pressure washer prior to putting into service to ensure that it is in good working order, and ensure that fittings are secure. PID to be subjected to calibration and operational checks in accordance with manufacturer's recommendations (but not less than daily)	All personnel participating in this activity must be current with HAZWOPER training requirements listed in 29 CFR 1910.120 (e).

Table C-1. LF-10 Activity Hazard Analysis (AHA)

Activity: Equipment and Personal Decontamination *Analyzed by/Date:*

ACTIVITY / PHASE	POTENTIAL HAZARDS	RECOMMENDED ACTIONS / CONTROLS
Personal Protective Equipment: **Minimum**: Steel toe boots, safety glasses **Optional items**: Hardhat, hearing protection **HTRW**: Decontamination area pressure washer operators are to wear safety impact eye protection with side shields and brow protection or goggles, hearing protection, and nitrile gloves. If contact with overspray cannot be avoided, rain suit or moisture-repellant disposable coveralls may be specified by the SSHO	Initial PPE inspection performed by SSHO. Ongoing (prior to each use) inspections responsibilities of PPE users.	PPE training in proper use, care, storage, and limitations. It is anticipated that this has been covered in employees 40-hr HAZWOPER training, which is to be verified by the SSHO through initial training documentation and reviewed prior to permitting personnel to participate in site activities, and will be confirmed by visual observations of worker's activities. SSHO trained in proper calibration, use, and care of air monitoring devices used (PID/FID). This is a general component of 40-hr HAZWOPER training, and SSHO must become very familiar with the Operator's Manual for any instrument used.