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27TH SPECIAL OPERATIONS MISSION SUPPORT GROUP (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

ENTERED

APR 0 5 2018

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Dear Mr. Kieling,

Cannon AFB is pleased to submit the "*SWMU 107 Supplemental RCRA Facility Investigation Workplan*". If you have any questions regarding this submittal, please contact Ms. Brandy Chavez, Environmental Element Chief at (575) 904-6747.

Sincerely,

DOUGLAS W. GILPIN, Colonel, USAF

Attachments:
SWMU 107 Supplemental RFI Workplan Jan 16

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SUPPLEMENTAL RCRA FACILITY INVESTIGATION WORK PLAN FOR FT008

CANNON AIR FORCE BASE
NEW MEXICO
RCRA PERMIT No. NM7572124454

Contract Number: FA3002-07-D-0015

Prepared for

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
27 SOCES/CEIER	27th Special Operations, Civil Engineer Squadron
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
bgs	below ground surface
B.P.	before the present
BRA	Baseline Risk Assessment
BTEX	benzene, toluene, ethylbenzene and xylenes
CAC	corrective action complete
CEC	cation exchange capacities
cm	centimeter
CoC	chain of custody
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CPSMR	Contractor's Progress, Status, and Management Report
DL	detection limit
DQO	data quality objective
DRO	diesel range organics
ESL	ecological screening level
ESSL	Ecological Soil Screening Level
FT008	Fire Department Training Area No. 3 (SWMU 107)
FTL	Field Team Leader
gpm	gallon per minute
GPS	global positioning system
GRO	gasoline range organics
HHRA	human health risk assessment
HI	hazard index
hr	hour
HSO	Health and Safety Officer

IDW	investigation-derived waste
IMS	Integrated Master Schedule
IRP	Installation Restoration Program
JP	jet propellant
kg	kilogram
km	kilometer
L	liter
m	meter
MEC	munitions and explosives of concern
mg	milligram
min	minute
MS/MSD	matrix spike/matrix spike duplicate
msl	mean sea level
NMED	New Mexico Environment Department
No.	number
ORO	oil range organics
OSHA	Occupational Safety and Health Administration
PAL	Project Action Limits
PE	proficiency evaluation
PID	photoionization detector
PM	Project Manager
POC	point of contact
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPM	Restoration Program Manager
RSL	Regional Screening Level
SCEM	site conceptual exposure model
SCFS	Sample Collection Field Sheet

sec	second
SSL	soil screening level
SSO	Site Safety Officer
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	total analyte list
TBD	to be determined
TPH	total petroleum hydrocarbon
URS	URS Group, Inc.
U.S.	United States
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit
UXO	unexploded ordnance
VOC	volatile organic compound
W-C	Woodward-Clyde
WP	Work Plan

This document presents the Work Plan (WP) for the Supplemental Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) at Fire Department Training Area Number (No.) 3 (FT008) (Solid Waste Management Unit [SWMU] 107) at Cannon Air Force Base (AFB) near Clovis, New Mexico (**Figure 1-1**). FT008 is a former fire training area that operated from 1968 to 1974. Total petroleum hydrocarbons (TPH) were historically identified in the soils at FT008.

1.1 AUTHORITY

AECOM has been contracted by the Air Force Civil Engineer Center (AFCEC) under Contract Number FA3002-07-D-0015, Task Order 0004, to complete an RFI at FT008 at Cannon AFB. This RFI is being completed under the Environmental Restoration Program for Cannon AFB.

1.2 PURPOSE AND SCOPE

The purpose of this RFI is to provide the necessary information to further define the horizontal and/or vertical extent of soil contamination and determine if unacceptable risks to human health or the environment exist at FT008. This WP describes the scope of work required to be completed for this RFI. The site location map (**Figure 1-2**) shows the location of FT008 at Cannon AFB.

This WP provides the technical approach, rationale, field procedures, and data quality objectives (DQOs) to be followed to achieve the objectives of the RFI in accordance with the AFCEC statement of objectives dated June 24, 2015. This project will include preparing planning documents, completing a field investigation (discrete surface and subsurface soil sampling), analyzing soil samples for site-specific analytical parameters, evaluating the chemical data, comparing the analytical results to established soil screening criteria and ecological screening criteria, updating the preliminary site conceptual exposure models (SCEMs), and preparing the RFI Report.

Planned soil sampling locations, sample depths, analytical parameters, Quality Control (QC) and matrix spike/matrix spike duplicate (MS/MSD) sampling locations, and technical rationale are summarized in **Section 4**. Sampling methods for those activities described in **Section 4** are included in **Section 5**.

This WP is organized as follows:

- **Section 1** presents the authority, purpose and scope, facility description and background, and anticipated project schedule.
- **Section 2** lists the project and task organization for this RFI at FT008, including roles and responsibilities.
- **Section 3** presents the decision process, including DQOs developed for this project, a description of SCEM development, evaluation of background concentrations, and screening level evaluation methodology.

- **Section 4** presents the site description, background, and site-specific sampling activities that will be completed at FT008.
- **Section 5** presents the field sampling procedures to be used for this project.
- **Section 6** provides the project documentation and reporting requirements.
- **Section 7** provides references used to develop the WP.
- **Appendix A** – Analytical Laboratory Information: Reference Limits and Evaluation Tables and Sample Containers, Preservation, and Hold Times

1.3 FACILITY DESCRIPTION AND BACKGROUND

1.3.1 Setting – Physical Geography

Cannon AFB is situated in the Southern High Plains Physiographic Province in the Llano Estacado subprovince. The Llano Estacado is a nearly flat plain sloping gently (10 to 15 feet per mile) to the east and southeast. Elevations in the eastern New Mexico portion of the Llano Estacado exceed 4,000 feet above mean sea level (msl). In the vicinity of Cannon AFB, elevations range from 4,250 feet to 4,350 feet above msl.

The most prominent geomorphic features in the vicinity of Cannon AFB are blowouts and broad, widely spaced valleys. Less common landforms are relict sand dunes located along the northern side of the Portales Valley to the south of the Base. Relict dunes are not found on or near Cannon AFB.

Blowouts are broad shallow depressions, which form as the result of soil eroded by wind. Blowouts commonly collect surface runoff from small to moderate sized drainage areas. During periods of rainfall, runoff collects in blowouts to form ephemeral playa lakes. Playas have no external surface drainage. Water is lost by infiltration to the soil and evaporation; without recharge, playa lakes persist for only a few days or weeks. Three playas are located within the Base, and several more are found to the north and east of the Base.

Stream valleys tend to be fairly broad and widely spaced. Streams are ephemeral and drainages are poorly developed. No streams exist on or near Cannon AFB. Running Water Draw and Frio Draw (located about 10 and 20 miles, respectively, north of Cannon AFB) are the nearest streams. These are second-order streams. Both streams are very straight, flow southeast, and have rectilinear drainage patterns with short laterals (Woodward-Clyde [W-C] 1991).

1.3.2 Demographics and Land Use Near Cannon AFB

Cannon AFB is located just west of the City of Clovis, New Mexico, and just south of United States (U.S.) Highway 60/84 in a farming and ranching area. The majority of the land surrounding Cannon AFB is productive, irrigated farmland or grassland. The major crops are wheat, sorghum, sugar beets, corn, cotton, alfalfa, barley, and peanuts. The land is also used for

cattle grazing, both beef and dairy. According to 2010 US census data, the population of Clovis was 37,775 while the population of Cannon AFB was 2,245.

1.3.3 Climatology

The climate of east-central New Mexico is classified as tropical semi-arid. Average monthly temperatures range from a January low of -3.9 degrees Celsius (°C) (25 degrees Fahrenheit [°F]) to a July high of 32.8°C (91°F) (US Climate Data 2013). Extreme daily temperatures range from a historical low of –24°C (–11°F) to a historical high of 41°C (106°F) (My Forecast 2013). Average monthly precipitation ranges from 1.2 centimeter (cm) (0.39 inches) in February to 8.7 cm (3.43 inches) in July (US Climate Data 2013). The maximum-recorded 24-hour rainfall is 12.2 cm (4.8 inches), which occurred in the month of August. Rainfall occurs on an average of eight days per month during the summer precipitation maximum (My Forecast 2013). Mean annual precipitation is approximately 47 cm (18.51 inches) (US Climate Data 2013). The mean annual evapotranspiration rate is 285.9 centimeters per year (112.56 inches per year) (United States Environmental Protection Agency [USEPA] 2013). Prevailing winds are from the southwest. Average wind speed is highest at an average of 23.34 kilometers per hour (km/hr) (14.5 miles per hour) during the month of April (USDA 2013).

The atmosphere around the area of Cannon AFB is generally well mixed. The seasonal and annual average mixing heights can vary from 400 meters in the morning to 4,000 meters in the afternoon. The afternoon mixing heights are typically greater during the spring and fall seasons. The morning mixing heights are usually low, due to nighttime heat loss from the ground, producing surface-based temperature inversions. After sunrise, these inversions break up, and solar heating of the earth's surface causes vertical mixing in the atmosphere.

Dust is frequently entrained into the atmosphere in this region of the country because of gusty winds and the semiarid climate. The Texas Panhandle-eastern New Mexico area is considered the worst area in the United States for windblown dust. Occasionally, this windblown dust is of sufficient quantity to restrict visibility (W-C 1991). Most of the seasonal dust storms occur in March and April, when the wind speeds are typically high (i.e., average 27.6 km/hr) (USA.com 2015).

1.3.4 Geology

A generalized geologic section at Cannon AFB is shown in **Figure 1-3**. The near surface stratigraphic units of interest at Cannon AFB are the Late Miocene-Late Pliocene-age Ogallala Formation and the Early Triassic Dockum Group.

The Dockum Group consists of three formations. Stratigraphically, the lowest unit is the Santa Rosa Sandstone. Overlying the Santa Rosa Sandstone are the Chinle and Redonda Formations. The Chinle and Redonda Formations are composed mainly of red shales with lesser interbedded sands, and are known locally as "redbeds." The top of the Dockum Group is marked by an erosional nonconformity having relief of up to several hundred feet (Lee Wan and Associates, Inc. [Lee Wan] 1990).

Overlying the Dockum Group redbeds is the Ogallala Formation. The Ogallala Formation extends from eastern New Mexico and Colorado into Texas, Oklahoma, Kansas, Nebraska, and South Dakota. Drillers' logs from Cannon AFB indicate that the Ogallala Formation varies from 360 feet to 415 feet in thickness. The incised upper surface of Triassic redbeds strongly influences Ogallala thickness. Paleo valleys in the post Triassic nonconformity are deep and trend dominantly east to west. Ogallala thickness may vary significantly over short north to south distances (Lee Wan 1990).

The Ogallala Formation is erosionally truncated to the south along the abandoned Portales Valley, to the west along the Pecos River Valley, and to the north in a series of ephemeral stream valleys. The Ogallala Formation extends more than 125 miles to the east before terminating as an escarpment in Briscoe County, Texas. Springs and seeps are common along the erosional margins of the Ogallala.

The Ogallala Formation dips gently and monoclinally to the southeast in the vicinity of Cannon AFB. Data suggest that some quaternary warping may have occurred; however, most of these structures are located well to the northwest and southwest of Cannon AFB. No faults or buried structural lineaments are known to exist in the vicinity of Cannon AFB (Lee Wan 1990).

The Ogallala Formation is composed of unconsolidated poorly sorted gravel, sand, silts, and clays. The base of the Ogallala is generally marked by a gravel, cobble, and boulder deposit. This basal member contains sediments derived from igneous and sedimentary rocks transported from the mountains to the west. The Ogallala Formation was laid down as stream and overbank deposits formed within coalescing alluvial fans. These fans form a broad pediment along the eastern flank of the Rocky Mountains. As is typical of alluvial deposits, Ogallala internal stratigraphy varies vertically and horizontally over short distances.

Except where strongly cemented by calcium carbonate (caliche), the sediments of the Ogallala are loose and friable. Authigenic and allogenic clays are found as a trace to abundant matrix mineral. Five zones have been distinguished within the Ogallala of east central New Mexico on the basis of clay minerals. Smectites (montmorillonites) and attapulgite (with sepeotite) are the dominant clays throughout the Ogallala. Illite is a lesser, but persistent clay, as is kaolinite. Smectite is a swelling clay, causing deep cracks to form in dry surface soils. Smectite in particular and, to a lesser extent, attapulgite and illite, are clays with moderate to high cation exchange capacities (CEC). The formation as a whole should therefore have a relatively high CEC, which should inhibit the migration of charged contaminants, and especially ionic forms of metals (Lee Wan 1990).

Caliche is a major feature of the Ogallala Formation, occurring as nearly continuous to discontinuous layers throughout. Caliche is hard, white to pale tan on fresh surfaces, weathering to gray, and has a chalky appearance. Caliche forms as calcium carbonate, leached from overlying sediments, and precipitates in the pore space of the host sediments. Precipitation is caused by the evaporation of downward percolating water. The caliche may thus mark the position of ancient vadose zones. Radiocarbon dates for the upper "climax" caliche range from approximately 27,000 years before the present (B.P.) to approximately 42,000 years B.P. (Lee Wan 1990).

Caliche is relatively soluble in acidic water (i.e., water with a pH less than 7) or in waters containing dissolved carbon dioxide. The top surface of the uppermost or "climax" caliche in a fresh outcrop typically shows solution etching.

The Ogallala has numerous continuous to discontinuous caliche layers throughout its thickness. The climax caliche is pisolitic (i.e., consisting of spherical concentrically laminated aggregates 1 to 10 millimeters in diameter) (Lee Wan 1990). The pisolites are thought to have formed as the caliche was repeatedly chemically weathered and brecciated during Pleistocene pluvials (wet climate episodes) and later recemented during drier intervals. This upper caliche crops out around playas and the bounding escarpments of the Ogallala, and is locally termed "caprock." The climax caliche is typically 3 to 5 feet thick. Caliches that occur lower in the Ogallala are platy and harder. Caliche may be thin or absent below playas (W-C 1991).

1.3.5 Hydrogeology

The lower portion of the Ogallala Formation is the primary regional aquifer for both potable and irrigation water. No deeper aquifers are utilized in the vicinity of Cannon AFB. The Ogallala aquifer is part of the High Plains Aquifer that extends continuously from Wyoming and South Dakota into New Mexico and Texas. In east-central New Mexico, the Ogallala aquifer rests on Dockum Group redbeds, which serve as the basal confining layer. The Ogallala is a water table, or unconfined, aquifer. The Ogallala aquifer has a southeasterly regional gradient of about 17 feet per mile (0.0032 meters per meter, see **Figure 1-4**). Well yields vary from less than 1 gallon per minute (gpm) in thin silts and sands, and up to 1,600 gpm in thick sands and gravels. Water quality is generally good, with hardness and fluorides being somewhat high (Lee Wan 1990).

Based on data from the 2012 base-wide sampling event, the depth to groundwater at Cannon AFB varies from 287.04 to 349.79 feet below ground surface (bgs) (URS Group, Inc. [URS] 2015a). Saturated thickness is influenced by the configuration of the erosional nonconformity surface marking the top of the Dockum Group. The local groundwater gradient is southeasterly at 7.5 feet per mile. Yields in tests of Cannon AFB water wells have ranged from 776 liters per minute (L/min) (205 gpm) to 4,353 L/min (1,150 gpm). Specific capacities range from 0.14 cubic meters per meter (m^3/m) (11.4 gallons/feet) to 0.35 m^3/m (27.9 gallons/feet) (Lee Wan 1990).

Very rough estimates of hydraulic conductivity were made from well pump tests in water wells 5 and 9 (**Figure 1-5**) using the Theis equation. An estimate of hydraulic conductivity for water well 8 was based on water level recovery data using the Bouwer and Rice approach (Lee Wan 1990). The data used in these calculations were obtained to evaluate pump rates, efficiency, and well yield, and were not intended for use in calculating aquifer properties. The results of these calculations should therefore be considered as first approximations.

Hydraulic conductivity values for water wells 5 and 9 were found to be approximately 2.0×10^{-3} centimeters per second (cm/sec). Calculations for water well 8 resulted in a hydraulic conductivity of 2.0×10^{-2} cm/sec. In addition, slug testing of two monitoring wells (MW-O and MW-N) was completed by W-C in February 1995 (W-C 1995). The estimated hydraulic conductivities from these slug tests were both 3×10^{-3} cm/sec. These estimates appear to be low

when compared to published hydraulic conductivity data for sands and gravels. As reported in Lee Wan (1990), a groundwater flow velocity of about 4.5 x 10^1 meters per year (1.5 x 10^2 feet per year) has been estimated. This calculates out to a hydraulic conductivity of approximately 1.4 x 10^{-4} cm/sec. Again, this appears to be low when compared with published data (Freeze and Cherry 1979).

The presence of interstitial clays may account for both the variability and the low values of hydraulic conductivities. Boring logs from Cannon AFB projects and published reports (Lee Wan 1990) indicated that interstitial and interstratified clays are abundant in the Ogallala Formation.

Recharge to the Ogallala is primarily through precipitation. A recharge rate of 0.5 inches/year was calculated using the Theis equation; however, the recharge rate may be as much as 1.0 inches/year. Due to the high evapotranspiration rate and low precipitation, recharge probably occurs only during heavy rainfall events in which the infiltration capacity of the soil is exceeded and runoff occurs, or during cool months when precipitation exceeds evapotranspiration. Excess runoff flows to playas, and the presence of water in playas may allow deep percolation to the aquifer. The occurrence of this process is evidenced by the presence of clay deposits in, and thin or nonexistent caliche layers directly below, playas. Caliche is soluble in acidic rainwaters, and is leached over time to form percolation pathways (Lee Wan 1990).

Discharge from the Ogallala occurs through well pumping and springs along the eroded margins of the formation. Spring discharge does not occur on or near Cannon AFB. Domestic and irrigation water wells are common on and around the Base, however. The rate of discharge exceeds the rate of recharge. Water levels in the Ogallala have declined steadily from the 1930s to the present. A decline of 50 to 100 feet has been observed in the area around Clovis, New Mexico for the period from the 1930s to 1980. The largest area of water level decline exceeding 100 feet occurs south of the Canadian River extending from Curry County, New Mexico to Crosby County, Texas (Lee Wan 1990).

The dominant uses of groundwater in the Cannon AFB area are as potable and irrigation water. Numerous wells are found in the Cannon AFB area, most of which provide only irrigation water (**Figure 1-5**).

The Ogallala will continue to be used as the primary source of potable and irrigation water for eastern New Mexico. The New Mexico State Engineer designated Curry County as a Water Basin in 1989. This designation allows for regulation of water rights, usage, and well drilling (W-C 1991).

1.3.6 Soils

Soils in the vicinity of Cannon AFB are classified as silty sand to clayey sand under the Unified Soil Classification System, and as aridisols (calciorthids) under the Soil Conservation Service Comprehensive Soil Classification System. The following summary is based on the Soil Conservation Service Curry County Soil Survey (Lee Wan 1990).

The most common soil type on the Base is the Amarillo fine sandy loam, 0- to 2-percent slope phase (map symbol Ab on **Figure 1-6**). This soil consists of a thin sandy A horizon, well-defined clayey B1-3 horizons, with a calcic B3 horizon at depths below 40 inches. The calcic B3 horizon lies on a calcic C horizon, or on caliche. The Amarillo fine sandy loam is present on all relatively flat surfaces at the Base, but is also found on slopes associated with playas (map symbol Ac).

Clovis fine sandy loams, 0- to 2-percent slope phase (map symbol Cb) and 2- to 5-percent slope phase (map symbol Cc), are very similar to Amarillo fine sandy loams. In the Clovis soils, the depth to the calcic C horizon ranges from 28 to 56 inches. The depth to caliche exceeds 56 inches. Clovis and Amarillo fine sandy loams occur in close association.

In a few limited areas, particularly along the steeper slopes around playas, Mausker fine sandy loam, 0- to 2-percent slope phase (map symbol Ma), and 2- to 5-percent phase (map symbol M6) are found. Mausker fine sandy loams have no B horizons and are very calcareous. The calcic C horizon is within 2 feet of the surface.

The A and B horizons of Amarillo and Clovis fine sandy loams are rapidly to moderately permeable. Mausker fine sandy loam A and Ac horizons are rapidly permeable. Permeabilities in calcic B and C horizons are moderate (Lee Wan 1990).

1.3.7 Background Metals Concentrations in Soil

The natural soils in the vicinity of Cannon AFB are alkaline and generally rich in metals. Typically high concentrations of aluminum, iron, magnesium, manganese, and potassium combine with elevated levels of many other metals in the natural soils. Calcium is naturally present in the soils at levels up to nearly 2.00E+05 milligrams per kilogram (mg/kg). Tightly cemented layers of “caliche” are present in several horizons in the natural soils and the Ogallala aquifer below. As stated in **Section 1.3.4**, the Ogallala Formation as a whole should have a relatively high CEC, which should, in turn, inhibit the migration of charged contaminants, especially the ionic forms of metals.

The background levels of inorganic compounds in surface and subsurface soil at Cannon AFB are presented in **Table 1-1** in the form of a mean value and statistical information on the ranges encountered for each element. **Table 1-1** has been adapted from a final report by W-C dated September 1997 entitled “Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico.” This report summarizes background data for soil from numerous past investigations in the vicinity.

The upper tolerance limits (UTLs) presented in **Table 1-1** will be the background levels used in the screening of surface and subsurface soil chemical results for this RFI at FT008.

1.3.8 Water Quality

The groundwater quality at Cannon AFB is generally good, with dissolved solids ranging from 2.50E+02 to 5.00E+02 milligrams per liter (mg/L) (Gutentag, et al. 1984) and fluorides ranging from 2.2E+00 to 2.7E+00 mg/L (William Matotan and Associates, Inc. 1985).

1.4 PROJECT SCHEDULE

Fieldwork is scheduled for the spring of 2017. Preparation for field sampling activities including mobilization, acquisition of base passes and utility locates is described in **Section 5** of this WP. The proposed project schedule (i.e., Integrated Master Schedule [IMS]) is provided in the Project Management Plan (URS 2015b). The IMS will be updated on a monthly basis, and will be provided with the monthly Contractor's Progress, Status, and Management Report (CPSMR). Should New Mexico Environment Department (NMED) reviews and approval of work plans be obtained ahead of the scheduled timeframe, the field sampling activities schedule will be revised accordingly. This will be reflected in the monthly IMS provided with the monthly CPSMR. The detailed schedule for each site is included in the latest version of the IMS as provided in the monthly CPSMR.

TABLE 1-1
SUMMARY OF BACKGROUND ELEMENTAL CONCENTRATIONS[1] IN SOIL SAMPLES[2]
CANNON AFB, NEW MEXICO

	Mean (x)		Standard Deviation (s)		95% Upper Tolerance Limit (UTL) of Background Concentrations	
Element	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Aluminum	5,508	5,932	1,964	2,183	8,950	12,214
Antimony	ND [3]	ND [3]	ND [3]	ND [3]	3.15 [3]	16 [3]
Arsenic	2.1	2.1[4]	0.48	0.96 [4]	3.6	4.3 [4]
Barium	100	210	165	199	670	890
Beryllium	0.35 [4]	0.35 [4]	0.13 [4]	0.17 [4]	0.78 [4]	0.73 [4]
Cadmium	ND [3]	ND [3]	ND [3]	ND [3]	0.435 [3]	1.3 [3]
Calcium	5,645	89,410	11,366	64,611	44,800	237,498
Chromium (total)	7.1	5.6	1.3	2.3	11	13
Cobalt	2.9	2.6 [4]	1	1.4 [4]	6.6	4.7 [4]
Copper	6.8	3.8 [4]	4.6	2.0 [4]	18.3	8.3 [4]
Iron	6,458	5,148	1,349	2,262	10,100	13,148
Lead	6.8	4.7	1.6	1.7	12	8.7
Magnesium	1,066	4,260	390	3,856	1,930	19,300
Manganese	139	83	51	50	307	333
Mercury	0.025 [4]	ND [3]	0.016 [4]	ND [3]	0.056 [4]	0.019 [3]
Nickel	5.5	5.9 [4]	1.6	2.4 [4]	11	15 [4]
Potassium	1,345	1,222	413	417	2,691	2,512
Selenium	ND [3]	0.47 [4]	ND [3]	0.31 [4]	0.26 [3]	1.1 [4]
Silver	-5	ND [3]	-5	ND [3]	0.4 [5]	2.7 [3]
Sodium	91	351[4]	10	253 [4]	102	1,227 [4]
Thallium	ND [3]	ND [3]	ND [3]	ND [3]	0.6 [3]	2.65 [3]
Vanadium	15	16	2.8	5.2	23	33
Zinc	15	12	5.2	4.8	32	31

Notes:

[1] All concentrations are in milligrams per kilogram (mg/kg).

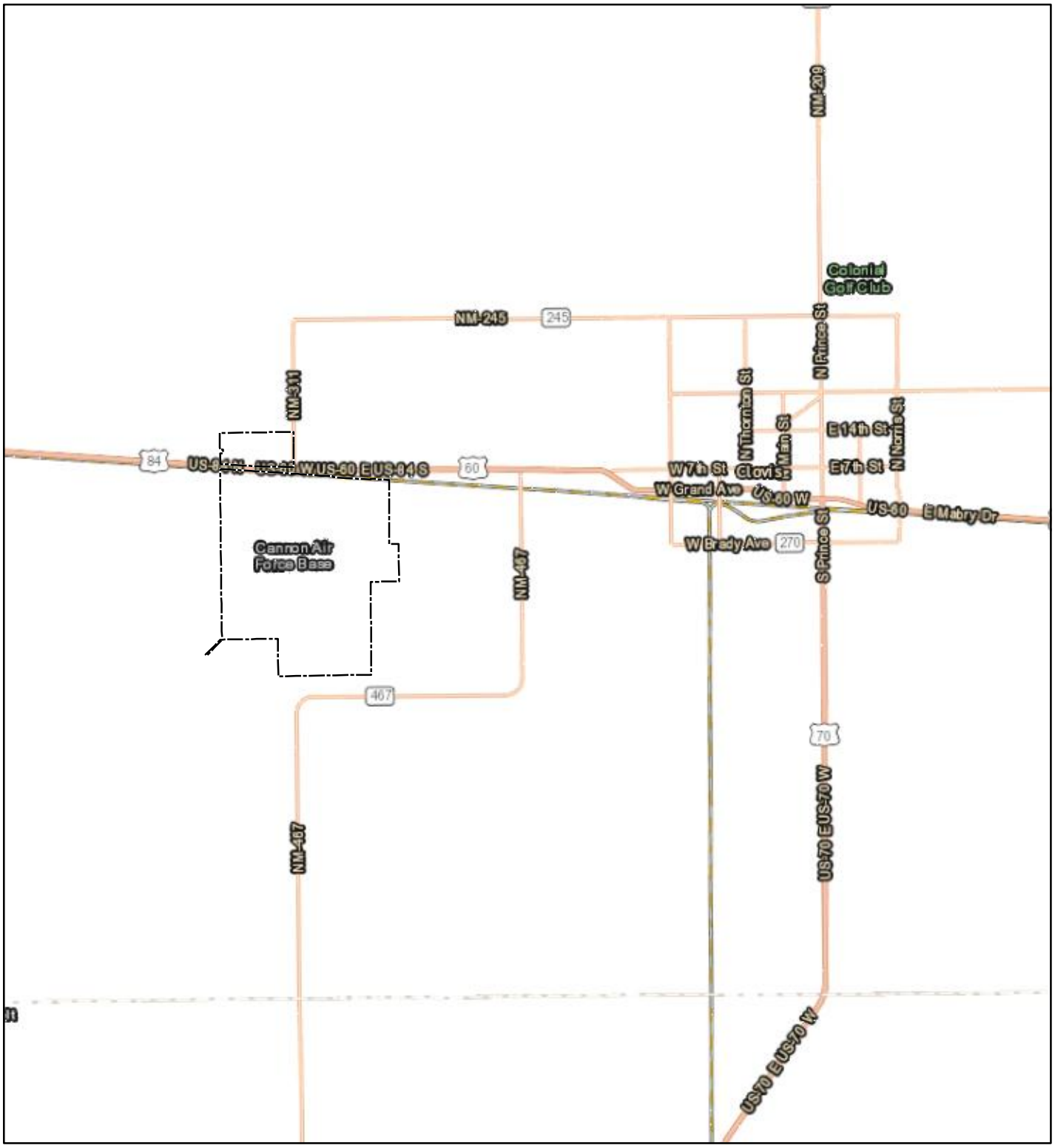
[2] From report entitled "Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico" (W-C 1997).

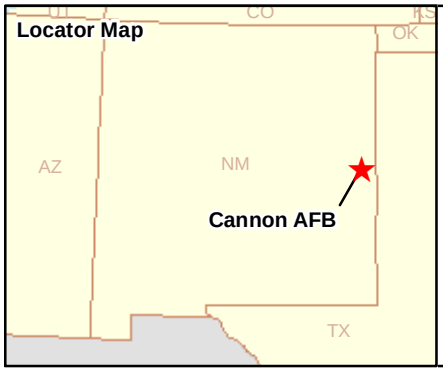
[3] All analytical samples were nondetect; therefore, a mean and standard deviation was not calculated. One-half the highest reporting limit is used as the 95% UTL. The actual mean, standard deviation, and UTL may be less than these values.

[4] Values determined from a data set including one-half of the reporting limits for nondetects.

[5] Silver was detected in only one sample; therefore, a mean and standard deviation was not calculated. The single detected concentration is used as the 95% UTL.

ND = nondetect





Legend

Base Boundary

N

10,000 5,000 0 10,000 Feet

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

Installation Location Map

Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 11/9/2015	Project No. 60440693	Figure 1-1
Checked By: MS	Revision: 0		

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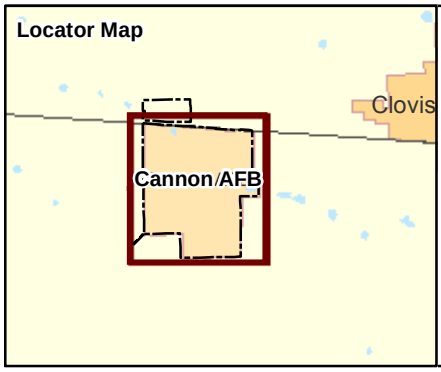
Locator Map



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Base Boundary

Site Boundary

N

2,000 1,000 0 2,000 Feet

Site Location Map
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 11/18/2015	Project No. 60440693	Figure 1-2
Checked By: MS	Revision: 0		

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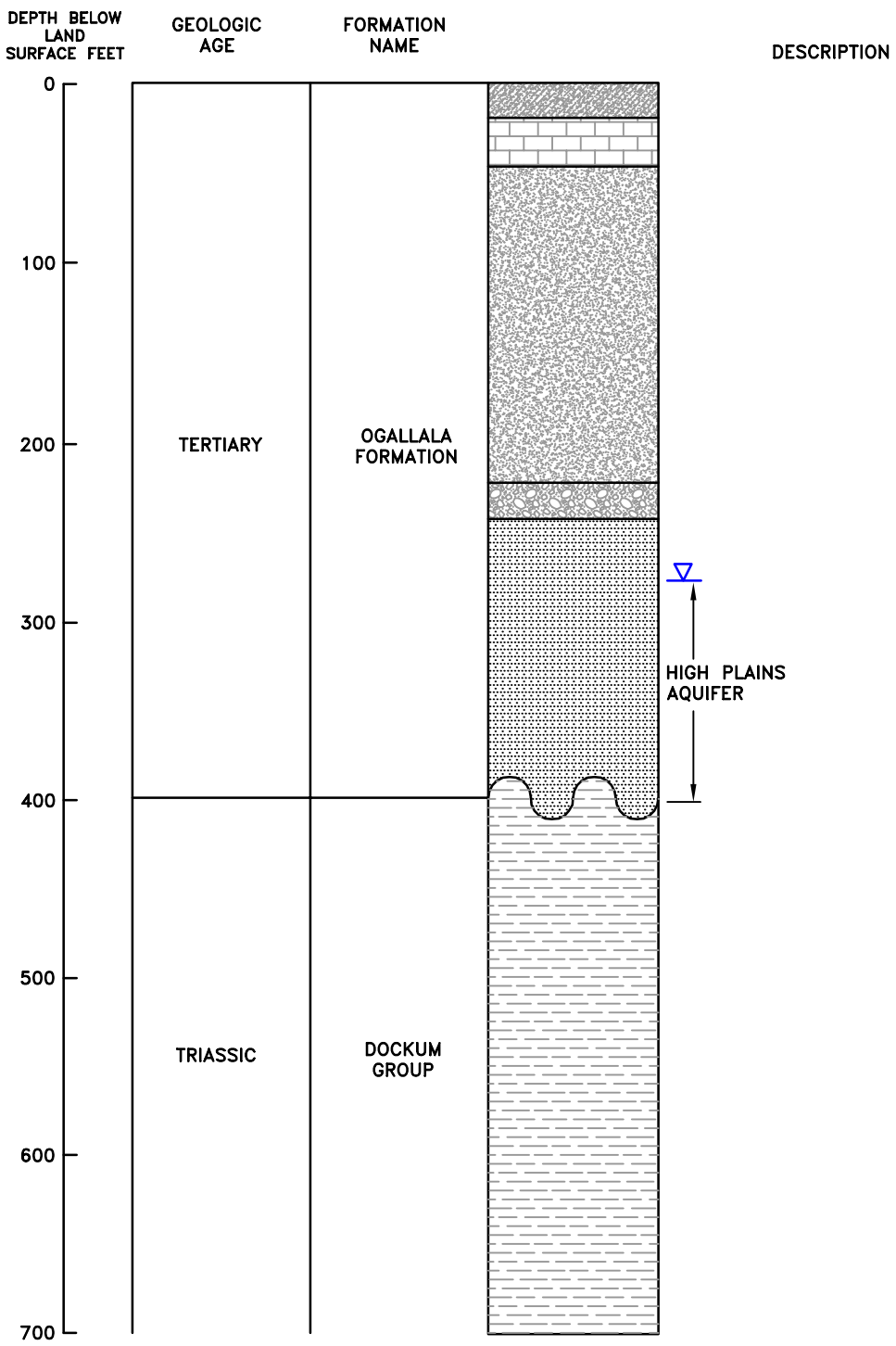

LEGEND

- SILTY SAND WITH CALICHE
- CALICHE
- SAND AND SILTY SAND
- SANDY GRAVEL
- SAND
- SANDSTONE (RED BEDS)
- LITHOLOGIC CONTACT
- EROSIONAL UNCONFORMITY
- WATER LEVEL

SOURCE: MODIFIED FROM GUTENTAG ET.AL., 1984

GENERALIZED GEOLOGIC STRATA AT CANNON AIR FORCE BASE
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 11/10/15	PROJECT NO. 60440693	FIG. NO. 1-3
CHK'D. BY: CSA	DATE: 11/10/15		

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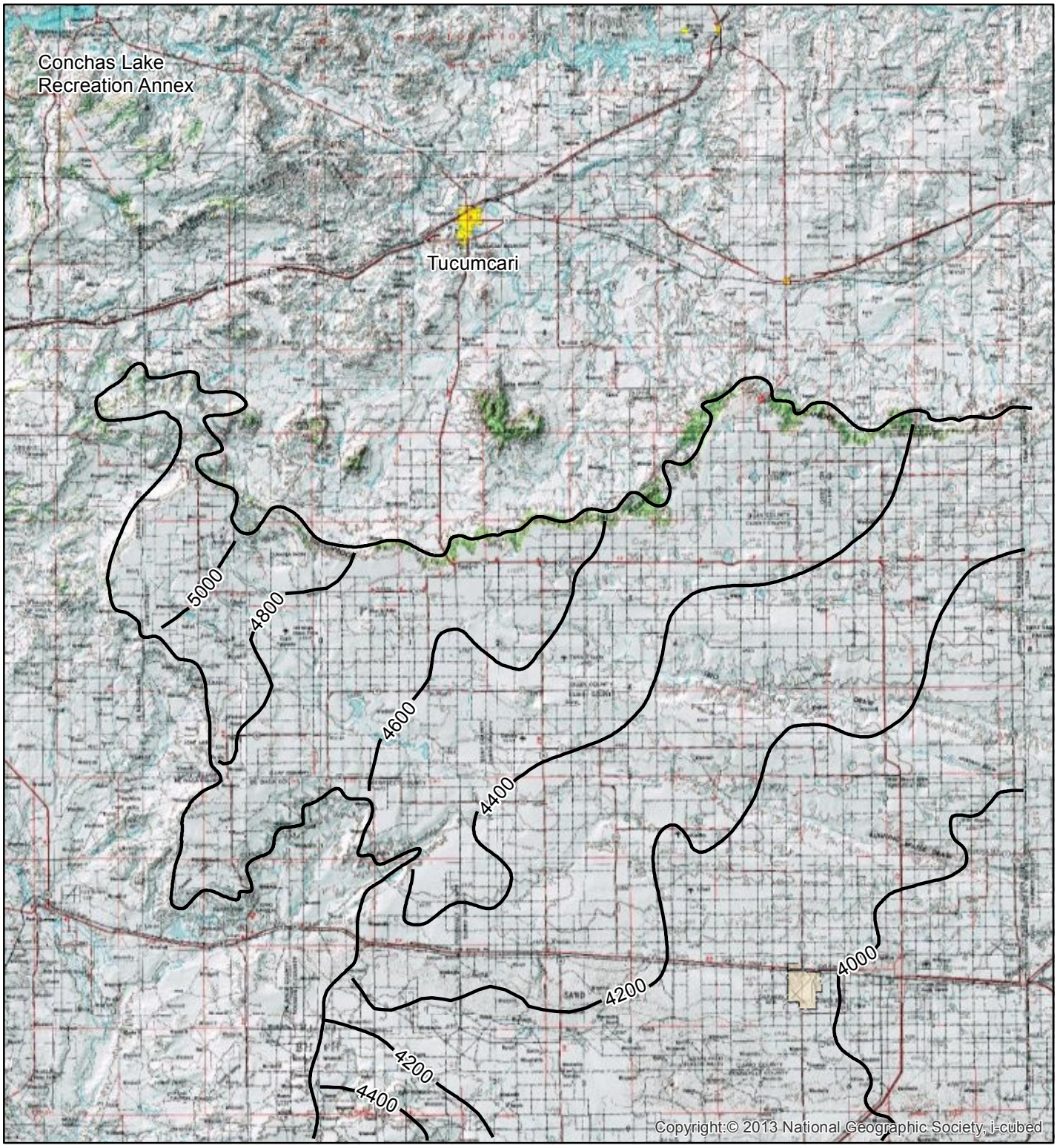

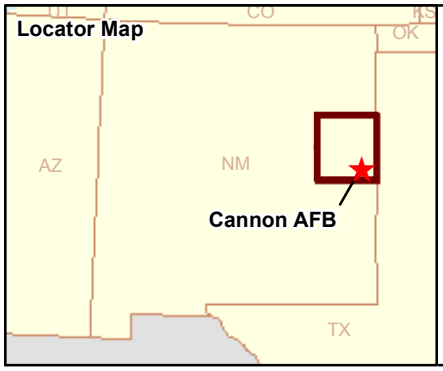

Legend

Base Boundary

Groundwater Contour
(feet above mean sea level)

Map projection: NAD83 State Plane Feet
New Mexico East (FIPS 3001)

N

10 5 0 10
Miles

Elevation and Configuration of the Water Table in the Region of Cannon Air Force Base

Cannon Air Force Base, New Mexico

Drawn By:	Date:	Project No.	
DPG	11/9/2015	60440693	Figure 1-4
Checked By:	Revision:		
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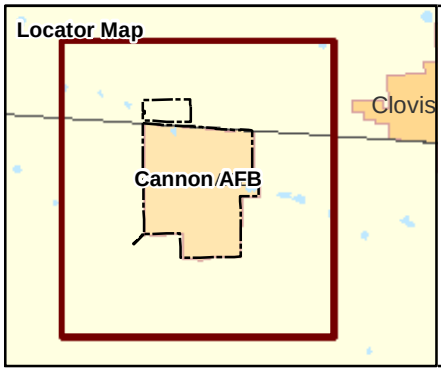

Legend

- Monitoring Well
- Private Water Well
- Base Water Well
- Base Boundary

Map projection: NAD83 State Plane Feet New Mexico, East (FIPS 3001)

N

4,000 2,000 0 4,000 Feet

Water Well Locations on and Near Cannon Air Force Base

Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 11/9/2015	Project No. 60440693	Figure 1-5
Checked By: MS	Revision: 0		

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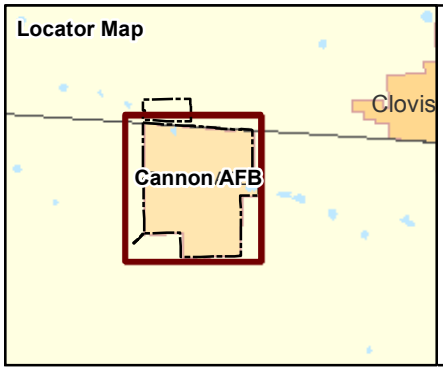
Locator Map



Legend

Base Boundary

in. = inches

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

N

2,000 1,000 0 2,000 Feet

Distribution of Soils by Type at Cannon Air Force Base

Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 11/24/2015	Project No. 60440693	Figure 1-6
Checked By: MS	Revision: 0		

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The project management team and lines of authority are presented in **Figure 2-1**. This chart includes all individuals discussed below. The names of all key participants identified in **Figure 2-1**, including organization names and telephone numbers for project, field, and laboratory project managers, are presented in **Table 2-1** and will be updated as needed.

2.1 ROLES AND RESPONSIBILITIES

This section describes the general roles and responsibilities for AFCEC, Cannon AFB, NMED, and contractor personnel.

2.1.1 AFCEC

AFCEC is represented on this project by the Contracting Officer's Representative (COR), an alternate COR, and the Cannon AFB Restoration Program Manager (RPM).

2.1.1.1 AFCEC COR

The AFCEC COR will oversee all aspects of the investigation and serve as a point of contact (POC) who will communicate directly with the Cannon AFB RPM and AECOM. In addition, AFCEC will maintain approval authority for all subcontractors and suppliers used to complete the RFI at FT008. The AFCEC COR is also responsible for project quality, as well as budget and schedule control. The AFCEC COR will coordinate with Cannon AFB representatives, AFCEC staff, NMED, and AECOM to ensure that the field work meets quality objectives, budget, and schedule.

2.1.1.2 Cannon AFB RPM

The Cannon AFB RPM has the overall responsibility for all activities associated with this RFI at Cannon AFB. The Cannon AFB RPM will:

- Coordinate Base access with AECOM and its subcontractors.
- Review all plans and reports.
- Complete oversight of investigation activities completed at Cannon AFB.
- Coordinate reviews with the Environmental Flight Chief.
- Be responsible for all direct contact/correspondence with the NMED for this project.
- Assist AECOM with obtaining digging permits and site access.

2.1.2 NMED

The NMED Project Manager (PM) has overall responsibility to ensure the environmental program and the directives specified within the RCRA Hazardous Waste Permit No. NM 7572124454, comply with the State of New Mexico's environmental program. NMED

is the lead regulatory agency for this field work. The NMED PM will coordinate NMED's involvement and receive all notices, reports, plans, and other documents prior to, during, and following the project. Where necessary, NMED will be responsible for coordinating efforts of other regulatory agencies. In addition to the NMED PM, other NMED personnel may be involved in this project and may be on site during all or part of the AFCEC field work.

2.1.3 AECOM

The roles and responsibilities of key AECOM personnel are presented below.

2.1.3.1 Program Manager

The Program Manager will serve as the direct POC with the AFCEC COR, as well as be responsible for monitoring the overall progress of the project, reviewing monthly progress reports, and ensuring that necessary resources are available. The Program Manager will also maintain close communication with AFCEC, Cannon AFB, and the NMED to assess client satisfaction during performance on this contract.

2.1.3.2 Project Manager

The PM is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The PM's primary function is to ensure technical, financial, and scheduling objectives are achieved successfully. AECOM PM is responsible for the following:

- Define project objectives and develop a detailed work schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- Develop site-specific DQOs and ensure compliance with project DQOs.
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints.
- Orient all support staff concerning the project's special considerations.
- Monitor and direct the project staff.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness.
- Review and analyze overall task order performance with respect to planned requirements and authorizations.
- Approve all reports (deliverables) before their submission to AFCEC, Cannon AFB, and NMED.

- Ultimately be responsible for the preparation and quality of Draft, Draft Final, and Final reports.
- Represent the project team at meetings.
- Update and submit the project schedule as necessary.
- Submit monthly progress reports and Funds and Man-Hour Expenditure Reports.

2.1.3.3 Task Leader

The Task Leader reports directly to the PM and is responsible for direct oversight of the planning and execution of the planning documents, field work, as well as the Draft, Draft Final, and Final reports documenting the results of the investigation. The Task Leader assists the PM in the completion of any of the identified responsibilities of the PM.

2.1.3.4 Field Team Leader

The Field Team Leader (FTL) reports directly to the task leader and is responsible for completion of his assigned activities (i.e., site visits, report preparation, etc.). The FTL is responsible for understanding and implementing provisions of the project documents as they apply to project activities.

2.1.3.5 Project Chemist

The Project Chemist reports to the PM and also works directly with other project personnel. This person is responsible for the data review of all sample results from the analytical laboratories. The Chemist will be the POC for subcontractor laboratories.

2.1.3.6 Health and Safety Officer

The Health and Safety Officer (HSO) will advise the PM on health and safety issues; however, the HSO operates independently of the PM and can also work directly with the Site Safety Officer (SSO). The HSO has the responsibility to monitor and verify work is performed in accordance with safety requirements.

2.1.3.7 Site Safety Officer

The SSO monitors all site activities and is responsible for the implementation of and compliance with AECOM safety requirements. The SSO reports to the HSO.

2.1.3.8 Quality Assurance/Quality Control Officer

The Quality Assurance (QA)/QC Officer will ensure that all QA/QC procedures for this project are being followed.

2.1.3.9 Senior Technical Reviewers

The Senior Technical Reviewers will be responsible for reviewing project documents prior to delivery. The review(s) will be conducted to ensure that the data presented and conclusions made are reasonable and accurate.

2.1.3.10 Risk Assessor

The Risk Assessor will be involved in determining risks to human health and/or the environment based on the results of the investigation.

2.2 CONTRACTOR RESPONSIBILITIES

All subcontractors chosen for the project will meet pre-established industry standards of quality criteria and experience for the types of work to be completed. Subcontractors for the project will include analytical laboratories and direct push services.

2.2.1 Test America Project Manager

The Test America PM will report the laboratory results to the AECOM Project Chemist and will communicate with the AECOM Project Chemist to facilitate the completion of laboratory activities for the project.

2.2.2 Test America QA Officer

The Test America QA Officer has the overall responsibility for data generated by the laboratory, as well as the adherence to acceptable practice. The laboratory QA Officer will communicate data issues through the laboratory PM. In addition, the laboratory QA Officer will:

- Oversee laboratory QA.
- Oversee QA/QC documentation.
- Conduct detailed data review.
- Determine whether to implement laboratory corrective actions, if required.
- Define appropriate laboratory QA procedures.
- Prepare laboratory Standard Operating Procedures.

2.2.3 Direct Push Services

The direct push subcontractor will be selected upon approval of the WP. They will be responsible for adhering to all WP procedures according to contractual arrangements and all other associated plans.

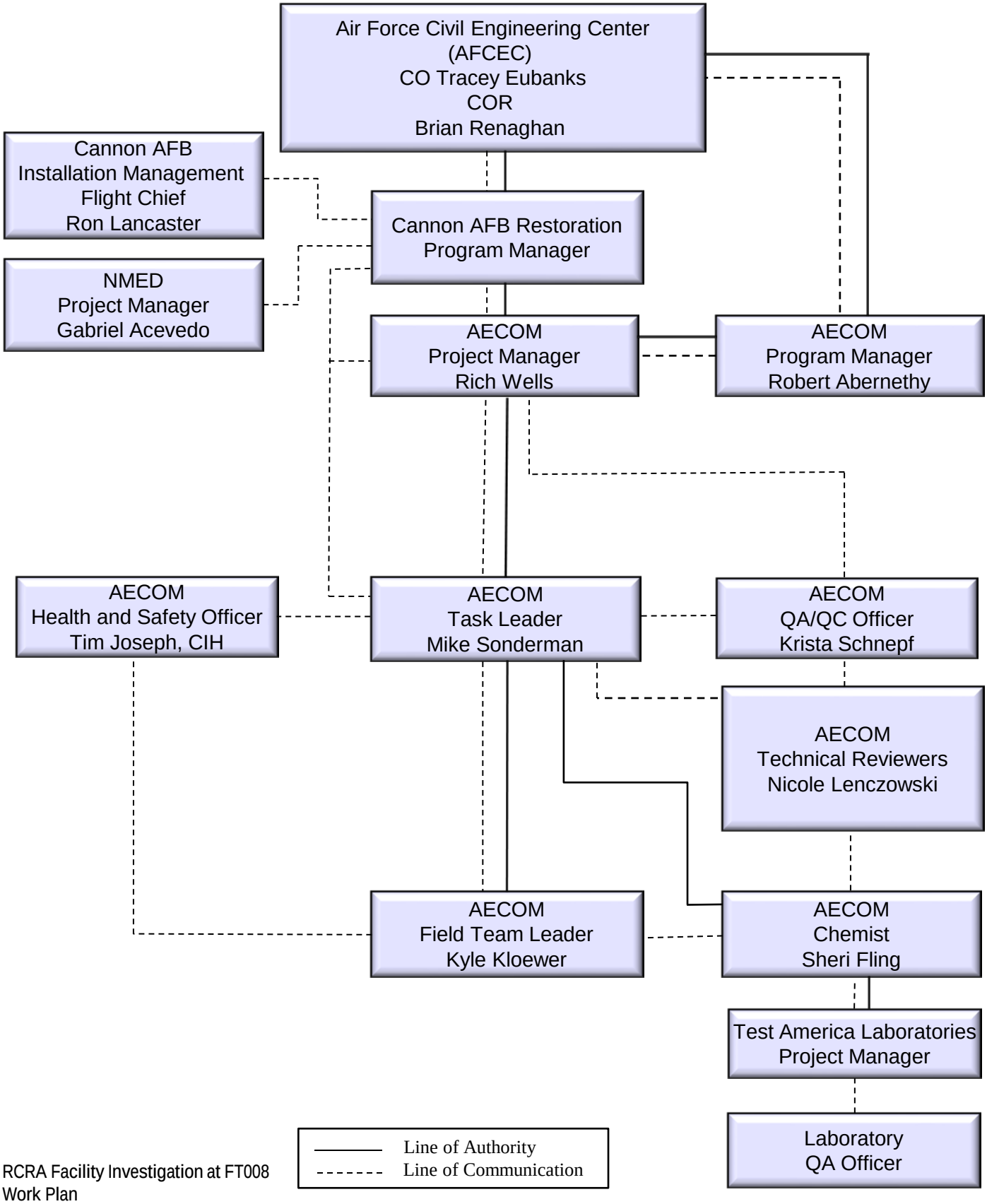
2.2.4 Drill Rig Services

The drill rig subcontractor will be selected upon approval of the WP. They will be responsible for adhering to all WP procedures according to contractual arrangement and all other associated plans.

TABLE 2-1
KEY PROJECT PERSONNEL
CANNON AFB, NEW MEXICO

Name	Title	Address	Phone Number	Email Address
Brian Renaghan	Contracting Officers Representative (COR) AFCEC	2261 Hughes Avenue, Suite 155 Lackland AFB, TX 78236-9853	(210) 395-0710	brian.renaghan@us.af.mil
Ron Lancaster	Asset Management Flight Chief Cannon AFB	27 SOCES, 506 North DL Ingram Boulevard Cannon AFB, New Mexico 88103-5003	(575) 784-1146	ron.lancaster@cannon.af.mil
Brandy Chavez	Environmental Element Chief Cannon AFB	AFCEC/CZO, 402 S. Chindit Blvd. Cannon AFB, New Mexico 88103-5003	(575) 904-6747	brandy.chavez.1@us.af.mil
Sheen Kottkamp	Environmental Program Manager/Scientist AGEISS Inc. Contractor Support Cannon AFB	AFCEC/CZO, 402 S. Chindit Blvd. Cannon AFB, New Mexico 88103-5003	(575) 904-6743	sheen.kottkamp.ctr@us.af.mil
John E. Kieling	Program Manager, Hazardous Waste Bureau, NMED	2905 Rodeo Park Drive East, Building 1 Santa Fe, New Mexico 87505-6303	(505) 476-6035	john.kieling@state.nm.us
Gabriel Acevedo	Project Manager, Hazardous Waste Bureau, NMED	2905 Rodeo Park Drive East, Building 1 Santa Fe, New Mexico 87505-6303	(505) 476-6043	Gabriel.Acevedo@state.nm.us
Richard Wells	Project Manager AECOM	7720 North 16th Street, Suite 100 Phoenix, AZ 85020	(602) 861-7409	richard.wells@aecom.com
Tim Joseph	Health and Safety Officer AECOM	8181 East Tufts Ave. Denver, CO 80237	(303) 740-2767	tim.joseph@aecom.com
Mike Sonderman	Task Leader AECOM	12120 Shamrock Plaza, Suite 100 Omaha, NE 68154	(402) 952-2537	michael.sonderman@aecom.com
Krista Schnepf	QA/QC Officer AECOM	12120 Shamrock Plaza, Suite 100 Omaha, NE 68154	(402) 952-2526	krista.schnepf@aecom.com
TBD	Site Safety Officer AECOM	12120 Shamrock Plaza, Suite 100 Omaha, NE 68154	---	---
Nicole Lenczowski	Senior Technical Reviewer AECOM	12120 Shamrock Plaza, Suite 100 Omaha, NE 68154	(402) 952-2671	nicole.lenczowski@aecom.com
Kyle Kloewer	Field Team Leader AECOM	12120 Shamrock Plaza, Suite 100 Omaha, NE 68154	(402) 952-2675	kyle.kloewer@aecom.com
Sheri Fling	Project Chemist AECOM	8181 East Tufts Avenue Denver, CO 80237	(303) 740-3909	sheri.fling@aecom.com
Carl Crane	Risk Assessor AECOM	1000 Corporate Center Drive, Suite 250 Franklin, TN 37067	(615) 224-2107	carl.crane@aecom.com
Pat McEntee	Project Manager Test America	4955 Yarrow St. Arvada, CO 80002	(303)736-0107	Patrick.McEntee@testamericainc.com
Peggy Sleevi	Laboratory QA Manager Test America	4955 Yarrow St. Arvada, CO 80002	(303)736-0116	Peggy.Sleevi@testamericainc.com

FIGURE 2-1
PROJECT TEAM AND LINES OF AUTHORITY AND COMMUNICATION
CANNON AFB, NEW MEXICO



This section presents the decision process that will be used to assess the data needs and approach at FT008. The soils investigation decision process is designed to identify appropriate actions for FT008 based on three potential recommendations: corrective action complete (CAC) without controls, CAC with controls, or further investigation, evaluation, or action. Site-specific recommendations for the selection of an appropriate action will depend on whether chemicals of potential concern (COPCs) are detected in soils at each site at levels that may pose an unacceptable risk to human health or the environment. This section provides a summary of the decision making process that will be used for FT008.

3.1 DESCRIPTION OF DECISION PROCESS

The following decision process will be used to assess the data needs and investigative approach for FT008. The DQO evaluation process is designed to provide soil data of sufficient quality and quantity to evaluate whether a release has occurred that could pose a risk to human health and to evaluate the need for further evaluation/action, such as completion of a Baseline Risk Assessment (BRA) or completion of a removal action.

A general decision diagram (**Figure 3-1**) was developed for FT008 to present a logical decision process that will be used to evaluate the data resulting from the investigation to ensure that project objectives are met.

The decision process will be implemented by first evaluating and summarizing existing historical information and analytical data. Historical information will be used to identify COPCs and to identify potential areas of chemical release.

Surface and subsurface soil will be sampled and analyzed for COPCs. COPCs are defined as chemicals that are site-related. If COPCs without appropriate toxicity criteria are identified at concentrations exceeding background levels during this investigation, additional evaluation of COPCs may be recommended. COPCs were derived from historical investigations completed for the site as described in **Section 4** of this report.

The potential for site-related contaminants to impact groundwater will be assessed by evaluating the vertical distribution of contaminants in the soil column. If the concentrations of COPCs decrease with depth and the concentrations are below soil to groundwater soil screening levels (SSLs) (based on the 2015 Risk Assessment Guidance for Site Investigations and Remediation), then no further action will be recommended. If the concentrations do not decrease with depth or concentrations exceed the soil to groundwater SSLs, fate and transport modeling will be completed to evaluate the potential for contaminant transportation to groundwater.

Concentrations of COPCs will be evaluated for potential risks by comparing maximum detected concentrations to risk screening criteria. This conservative screening approach will identify the sites that pose no unacceptable risk under highly conservative exposure assumptions and, therefore, warrant no further evaluation or action. This approach will also identify sites that may warrant further evaluation based on exceedance of stringent risk based concentrations. Derivation of human health and ecological risk screening criteria are presented in **Sections 3.6** and **3.7**, respectively.

The results of this evaluation will be used to make recommendations regarding the two alternatives stated above. The recommendations will be made on the following basis:

- If the vertical and lateral extent of contamination has been defined, no threat to human health exists above residential screening criteria, and no potential threat to the environment is apparent, then CAC without controls will be recommended.
- If the vertical and lateral extent of contamination has been defined, no threat to human health exists above industrial screening criteria, and no potential threat to the environment is apparent, then one of the following will be recommended.
  - A corrective action to eliminate risks in the soil in excess of the residential SSLs
  - CAC with controls
- If there is a potential threat to human health or the environment, then further investigation and/or evaluation will be recommended for the site. Further investigation and/or evaluation may include additional field investigation, BRA, or completion of a corrective action.

3.2 DEVELOPMENT OF PRELIMINARY SITE CONCEPTUAL EXPOSURE MODELS

The initial step in the evaluation of FT008 is the development of a SCEM, which provides a framework for evaluating potential risks associated with the site, aids in the identification of data needs, and assists in the identification of appropriate preliminary remediation goals targeted at significant exposure pathways. The SCEM was developed based on input from the historical investigations performed at the site. The SCEM is presented in **Figure 3-2**. Upon completion of the field sampling program, the SCEM will be reviewed and modified (if necessary) in order to reevaluate the site, taking into consideration the analytical results of all chemicals of concern for surface and subsurface soil.

The SCEM presents chemical release sources and transport media, potential human or ecological receptors, and intake-mechanisms for each potential exposure pathway. An exposure pathway describes the means by which release, transport, and intake by receptor populations of COPCs occurs. An exposure pathway consists of five necessary elements:

- A source
- A transport mechanism of chemical release to the environment
- An environmental exposure medium for the released chemical (e.g., contaminated soils)
- A point of potential human or ecological exposure to transported chemicals (e.g., a domestic drinking water well)
- A human or ecological intake mechanism (e.g., inhalation or ingestion) at the point of exposure

All five elements must be present for an exposure pathway to be complete and for chemical exposure to occur. In the SCEM, potentially significant pathways are denoted with solid lines.

Potential exposure pathways are evaluated with respect to potential chemical sources at FT008. Exposure pathways are considered to be potentially complete if all five necessary elements are present. Incomplete exposure pathways do not result in actual exposure to human or ecological receptors and, therefore, do not pose a potential risk. Partial or possible pathways are those that could conceivably be complete and result in an exposure, but the resulting exposure would be at levels that would not pose a significant risk.

The primary source at FT008 was the former use of the site as a fire training area from 1968 to 1974. During training exercises, the ground was saturated with water, and jet propellant (JP)-4 jet fuel was introduced and ignited for training purposes. Approximately 300 gallons of JP-4 were burned during each training exercise. The exercises occurred about eight times per year. Prior investigations identified TPH- diesel range organics (DRO) contamination at concentrations exceeding the NMED SSLs at FT008.

Chemicals from the primary sources may be transported away from the primary source areas, affecting other media that may in turn act as secondary sources. Leaching of the chemicals to the subsurface soil are shown as primary chemical release mechanisms. Subsurface soils are an important secondary source of potential chemical releases. COPCs in surface and subsurface soils could leach or percolate through the subsurface soil and be released to groundwater, even though the depth to groundwater varies from approximately 287 to 349 feet bgs (URS 2015a). However, transport to groundwater at Cannon AFB is limited by the depth to groundwater, the semiarid environment, and presence of caliche layers. Additionally, the underlying Ogallala formation contains clay minerals that attenuate contaminants by adsorption (AECOM 2011).

Other release mechanisms, such as direct contact (soil ingestion and dermal contact), surface runoff, wind erosion, or volatilization to the atmosphere, are also depicted in the SCEMs. Transport by storm runoff is not considered a significant pathway for human exposure at FT008 because there are no developed drainageways at the site.

Surface soils may provide exposures to base workers (occupational exposures), hypothetical future construction workers, future trespassers, or residents. Air emissions (volatile and particulates) from surface soil may also expose base workers, construction workers, trespassers, and residents. Subsurface soils and air emissions from subsurface soil (i.e., during excavation) may expose construction workers. Groundwater is used for domestic purposes on and off base, but the depth to groundwater in the area varies from approximately 287 to 349 feet bgs.

Contact with surface soil is considered to be the only complete and significant pathway for ecological receptors. A screening-level ecological risk assessment (and assessment if needed) will be completed for FT008 (see **Section 3.7**).

3.3 CRITICAL DATA

Critical data are data that are crucial for decision-making (e.g., determining whether a site warrants no further investigation or whether additional investigation should be considered). Critical data may be from a select sampling location or from a selected subset of samples from

locations of roughly equal importance. Data from a specific field sample, such as a soil sample immediately downgradient of a discharge point, may be designated as critical if it is necessary to evaluate contaminant concentrations at that specific location for source or exposure pathway characterization. In other cases, data from a select number of field samples (e.g., a subset of all surface soil samples collected at a site) may be designated as critical when the objective is to estimate mean contaminant concentrations over an area.

Following USEPA guidelines (USEPA 2001, 2004), critical data must be from environmental media representing each major exposure pathway and must be 100-percent complete, that is, valid results must be obtained for all data deemed critical. A complete set of critical data may be taken from more than one sample (i.e., if one sample has missing or rejected analytes, data from another comparable sample can be used to complete the critical data set). If the missing or rejected data do not hinder the decision-making process (e.g., they are not COPCs), they are not considered critical data, and the critical data set is still 100-percent complete. If decisions cannot be made because of missing or rejected data, a recommendation for an appropriate corrective action will be made. This allows for the retention of valid data from the original data set and compiling a complete, representative, and valid set of critical data without unnecessary resampling.

3.4 DETECTION LIMITS

To select appropriate analytical methods, detection limits (DLs) have been compared with analyte-specific concentrations of concern. Analytical methods selected for this RFI, and their associated DLs, are included in **Appendix A**.

3.5 EVALUATION OF BACKGROUND CONCENTRATIONS

At sites where metals are detected in surface and/or subsurface soil, the metals concentration data will be compared to established background concentrations to determine whether metals detected are site-related.

Soils are derived from parent geologic materials as a result of physical, chemical, and biological processes. The soil system is naturally a highly heterogeneous matrix of inorganic and organic components. The relative proportions of these components are dependent upon factors influencing soil formations, such as topography, climate, depositional processes, and time (Sposito and Page 1984). Total concentrations of metals in soils may vary depending upon location; for example, at the surface, soils are influenced by leaching, runoff, atmospheric deposition, and biotic uptake, as well as anthropogenic activity. The ranges of naturally occurring or “background” concentrations of metals in soils vary greatly due to the composition of parent material; therefore, care must be taken in the interpretation of metals data generated during an investigation.

Metals concentrations identified in soil samples during this investigation will be compared to background soils concentrations presented in “Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico” (W-C

1997). Background concentrations of metals at Cannon AFB are summarized in **Table 1-1**. The approach will compare the maximum concentrations detected at a given site to the 95 percent UTL of the background concentrations. Using this technique, individual samples at the sites with high concentrations relative to background levels (i.e., which could represent a site-related release) can be identified.

3.6 HUMAN HEALTH RISK ASSESSMENT

This section describes the general approach that will be used to complete a human health risk assessment (HHRA) at Cannon AFB. Potential human health impacts will be evaluated by comparing maximum chemical concentrations (above background) found at the site with NMED human health SSLs for residential exposure (NMED 2015). Where SSLs are not available, concentration data will be compared with USEPA human health regional screening levels (RSLs) for residential exposure (USEPA 2015).

Although FT008 is not used for residential purposes, the residential SSLs are more stringent than other SSLs (e.g., occupational, construction worker). There are no screening criteria for a recreational user. However, a recreational user would be less exposed than a residential receptor, and therefore, screening criteria for the residential receptor were used conservatively as protective of the recreational receptor. Screening against residential SSLs would account for possible future changes in land use. If residential SSLs are exceeded, then existing concentrations will be compared to industrial SSLs in order to determine the level of potential risk present.

3.6.1 Preliminary Site Conceptual Exposure Models

One of the first steps in formulating a risk assessment for a site is developing a conceptual model of the site that identifies relevant exposure pathways and exposure scenarios. A preliminary SCEM is presented and discussed in **Figure 3-2**. Four groups of human receptors were identified as potentially applicable to the sites:

- site worker (also referred to as an industrial/occupational worker);
- recreational user;
- resident; and,
- construction worker.

There are no surface water bodies associated with FT008 nor is groundwater readily accessible (>300 feet bgs); therefore, these two pathways are incomplete and will not addressed in this evaluation. The primary routes of exposure are ingestion of contaminated soil, dermal contact with contaminated soil, and inhalation of airborne soil particulates.

3.6.2 Target Risk Levels

A range of 1E-06 to 1E-04 (1 in 1,000,000 to 1 in 10,000) is USEPA's target excess cancer risk range for cleanup under both the Comprehensive Environmental Response, Compensation, and Liability Act and RCRA (USEPA 1991). NMED SSLs are based on 1E-05 (1 in 100,000) target excess cancer risk or a target hazard quotient of 1 for noncarcinogens. Exceeding NMED SSLs means that further evaluation of chemical concentrations and exposure assumptions may be warranted.

3.6.3 Soil Exposure Intervals

NMED guidance assumes that residents could be exposed to surface and subsurface soils during home maintenance activities, yard work, landscaping, and outdoor play activities, and specify that an exposure interval of 0 to 10 feet bgs be assumed. NMED guidance assumes construction workers are involved in digging, excavation, maintenance, and building construction projects and could be exposed to surface as well as subsurface soil. Therefore, a soil exposure interval of 0 to 10 feet bgs is considered appropriate for the construction worker. Further, NMED guidance assumes that the industrial/occupational worker activities occur at or near the surface at not greater than 1 foot bgs. Therefore, the soil exposure interval for industrial/occupational worker is defined as 0 to 1 foot bgs. Although the recreational user is not specifically addressed in NMED guidance, it is assumed that the recreational user would be exposed to surface soil only (0 to 1 foot) (NMED 2015).

3.6.4 Comparison with Background

Site concentrations will be compared with background concentrations for inorganic constituents. Background concentrations, expressed as the 95 percent UTL are available at Cannon AFB for both surface and subsurface soils (W-C 1997). The industrial worker and recreational user are only exposed to surface soils (0 to 1 foot), therefore, background comparisons for these receptors will be compared with surface background concentrations. As described previously, the residential and construction worker are exposed to soils from 0 to 10 feet; therefore, background levels for subsurface soils will be used for these receptors. If the maximum concentration for a constituent is below background, it will not be included further in the screening analysis.

3.6.5 Screening Exposure Concentrations

The maximum concentration in the soil exposure interval applicable to each receptor will be selected as the screening exposure concentration.

3.6.6 Cumulative Human Health Risk Screening

NMED guidance indicates that the potential cumulative risks and hazards should be evaluated in the screening evaluation to conclude whether further evaluation may be necessary. Therefore, consistent with the guidance, screening will be performed by comparing maximum chemical concentrations detected at the site with NMED human health soil screening levels (SSLs). NMED has published SSLs for a resident, industrial/occupational worker, and construction worker. There are no SSLs specific for a recreational user scenario. As a conservative screen,

residential SSLs will be used for the recreational user. In the absence of NMED SSLs, USEPA RSLs will be selected (carcinogenic RSLs will be adjusted to a risk of 1E-05, consistent with NMED SSLs). Residential soil RSLs will be selected for resident and recreational user scenarios. Industrial soil RSLs will be selected for the industrial/occupational worker and construction worker (NMED 2015).

SSLs for individual carcinogenic chemicals are based on a cancer risk of 1E-05. SSLs for individual noncarcinogenic chemicals are based on a hazard quotient of 1. Cumulative site screening risks and hazards will be calculated as follows:

$$Site\ Screening\ Risk = \left(\frac{C_1}{SSL_1} + \frac{C_2}{SSL_2} + \cdots \frac{C_i}{SSL_i}\right) x\ 10^{-5}$$

$$Site\ Screening\ Hazard\ Index\ (HI) = \left(\frac{C_1}{SSL_1} + \frac{C_2}{SSL_2} + \cdots \frac{C_i}{SSL_i}\right) x\ 1$$

Where:

$C_1 ... C_n$ = Screening exposure concentration for chemical "*1*" to chemical "*n*".

$SSL_1 … SSL_n$ = Soil screening level for chemical "*1*" to chemical "*n*" based on a SSL carcinogenic risk of 1E-05 or noncarcinogenic hazard of 1.

A screening hazard index (HI) of 1 or less means that noncarcinogenic effects are acceptable and no further evaluation is necessary. A cumulative risk of 1E-05 or less indicates the carcinogenic risks are acceptable and no further evaluation is warranted. If the screening HI is 1 or less and the cumulative risk is 1E-05 or less, CAC without controls will be recommended. If the screening HI is greater than 1 or the cumulative risk is greater than 1E-05, further investigation and/or evaluation of potential risks may be recommended.

3.6.7 Evaluation of Petroleum Hydrocarbons

The SSLs adopted by NMED for petroleum hydrocarbons are screening guidelines for potential impacts to potable groundwater and are not necessarily risk-based values but may reflect a ceiling level (NMED 2015). Petroleum hydrocarbons represent a complex mixture of compounds and the amount and types of constituent compounds differ between products. Hazard quotients are not calculated for petroleum hydrocarbons. For screening, the maximum detected concentration is presented simply as a comparison with the receptor-specific screening guideline. NMED (2015) provides screening guidelines for residential exposures and industrial exposures. Residential guidelines will be used for residential and recreational receptors. Industrial guidelines will be used for industrial/occupational and construction scenarios. Note that there are no NMED screening guidelines for gasoline range organics (GRO). Rather, NMED guidance refers to screening values that may comprise gasoline (such as benzene,

toluene, ethylbenzene and xylenes [BTEX]). Therefore, detections of GRO will also be interpreted in the context of BTEX results.

3.6.8 Planned Risk Assessment Activities

The HHRA will be completed for FT008 in accordance with NMED guidance (NMED 2015) if required, based on a comparison of analytical results to SSLs and background concentrations (for metals). The site-specific HHRA will be conducted incorporating the results of the soil samples collected during the RFI as well as applicable historical data.

3.7 ECOLOGICAL RISK ASSESSMENT

The overall objectives of an ecological risk assessment are to understand how site-related chemicals may be distributed in relation to ecological receptors (including both habitats and/or species potentially present) and evaluate how the entities may be affected by those chemicals. Ecological risk evaluation procedures will be in general accordance with NMED's Risk Assessment Guidance for Site Investigations and Remediation, Volume 2 (NMED 2015), USEPA Ecological Risk Assessment Guidance for Superfund (USEPA 1997), and Risk Assessment Handbook – Volume II: Environmental Evaluation (USACE 1999).

Consistent with NMED Guidance, the site will undergo a Scoping Assessment, and, if indicated, the Site Exclusion screening (NMED 2015). If the site fails the Site Exclusion screening, a screening-level ecological evaluation will be conducted. Analytical data will be used to select chemicals of potential ecological concern (COPECs). COPECs are chemicals that may have been released from the sites, have been detected in relevant exposure media, and may be significant contributors to ecological risks.

The potential for ecological impacts at FT008 will be evaluated by first comparing naturally occurring inorganic constituents with background soil concentrations as per NMED (2015) guidance, and then comparing maximum chemical concentrations with ecologically based soil screening criteria (identified as ecological Project Action Limits [PALs]). The ecological PALs were selected from the following sources in order of priority:

Source	Toxicity Information
USEPA (2005-2007) Ecological Soil Screening Levels (ESSLs); the lowest of plant, soil invertebrate, bird and mammal ESSL. ESSLs are available for metals (except mercury), polynuclear aromatic hydrocarbon and dichlorodiphenyltrichloroethane (DDT). The lowest value will be used for screening, regardless of receptor and will be considered protective of all biota potentially present at a site.	a. The ESSL for plants is calculated as a geometric mean of maximum acceptable threshold concentration (MATCs) or twentieth percentile effects concentrations (EC20s) generally measuring growth or reproduction. b. The ESSL for soil invertebrates is calculated as for plants. c. The avian ESSL was generally based on an exposure model for a ground-dwelling insectivore (woodcock) with a reproductive/growth or survival endpoint. d. The mammalian ESSL was generally based on an exposure model for a ground-dwelling insectivore (shrew) with a reproductive/growth or survival endpoint.

Source	Toxicity Information
Los Alamos National Laboratory (LANL) Ecological Screening Levels (ESLs) (LANL 2011). The lowest no observed adverse effect level (NOAEL)-based ESL will be selected and will be assumed to be protective for all biota potentially present at a site.	LANL has calculated soil screening levels for various representative receptors for which toxicity data were available. For soil, these include: • American kestrel (Avian intermediate carnivore) • American kestrel (Avian top carnivore) • American robin (Avian herbivore) • American robin (Avian insectivore) • American robin (Avian omnivore) • Deer mouse (Mammalian omnivore) • Desert cottontail (Mammalian herbivore) • Earthworm (Soil-dwelling invertebrate) • Generic plant (Terrestrial autotroph - producer) • Montane shrew (Mammalian insectivore) • Red fox (Mammalian top carnivore) Toxicity reference values are not always available for all listed receptors. For screening purposes, the lowest ESL based on a NOAEL toxicity reference value (TRV) will be selected for screening.
USEPA Region 5 ESLs (USEPA 2003)	USEPA Region 5 has calculated ecologically-based soil screening levels using an exposure model for the masked shrew (*Sorex cinerus*). These values were given a low priority because the exposure assumptions and TRVs used for the calculations have never been publically available.
Published and Grey* literature	"Published literature" means the article was published in a peer-reviewed journal and passed the scrutiny of other experts in the field. "Grey literature" refers to publications and reports that have been published through (usually) a government agency. Grey literature has also undergone a review and validation.

*Grey literature was added to distinguish such publications as those that came out of Oak Ridge and U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM).

Using the prioritization scheme noted, PALs will be selected that are protective of plants, invertebrates, and multiple bird and mammal trophic levels. For ecological receptors, the relevant soil interval is 0 to 10 feet bgs for burrowing receptors and plants, while the 0 to 5 feet bgs interval is applicable to non-burrowing receptors, as stated in NMED (2015) guidance. For the preliminary screening the 0 to 10 feet soil interval will be used. A maximum chemical concentration that exceeds an ecological PAL does not mean that an ecological risk exists, for a number of reasons: 1) the maximum concentration detected is not the concentration to which most ecological receptors would routinely be exposed; and/or 2) the exposure assumptions used to derive the ecological PALs are not site-specific; they generally assume that the receptor is in constant contact with the contaminant. PALs are not cleanup goals; cleanup goals are determined on a site-specific basis.

If site concentrations are less than the ecological PALs (or, for metals, less than background concentrations), potential risks from ecological exposure will be considered acceptable. If site concentrations exceed the PAL, the analyte will be identified as a chemical of potential concern.

FIGURE 3-1
DECISION DIAGRAM FOR RCRA FACILITY INVESTIGATION AT FT008

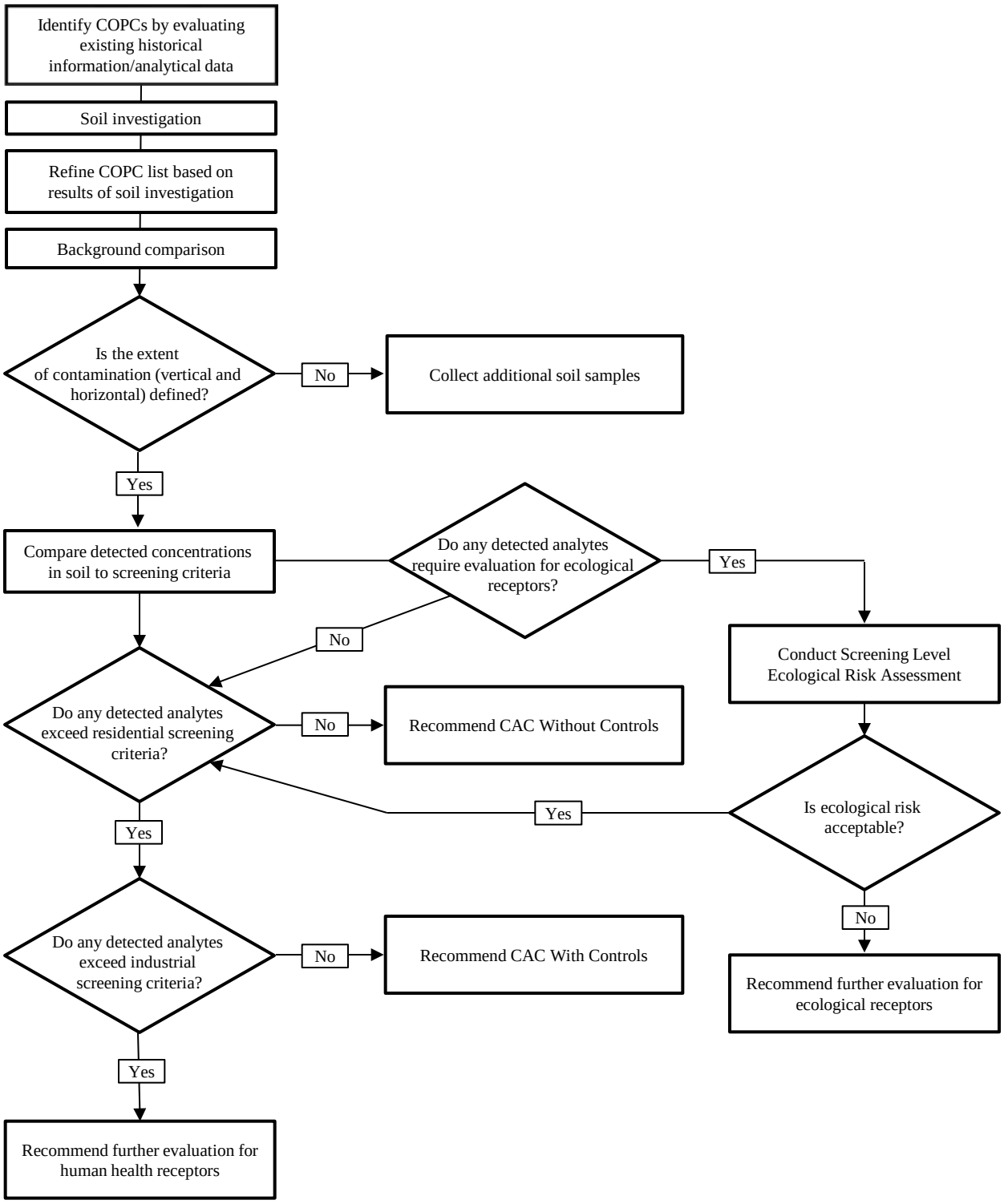
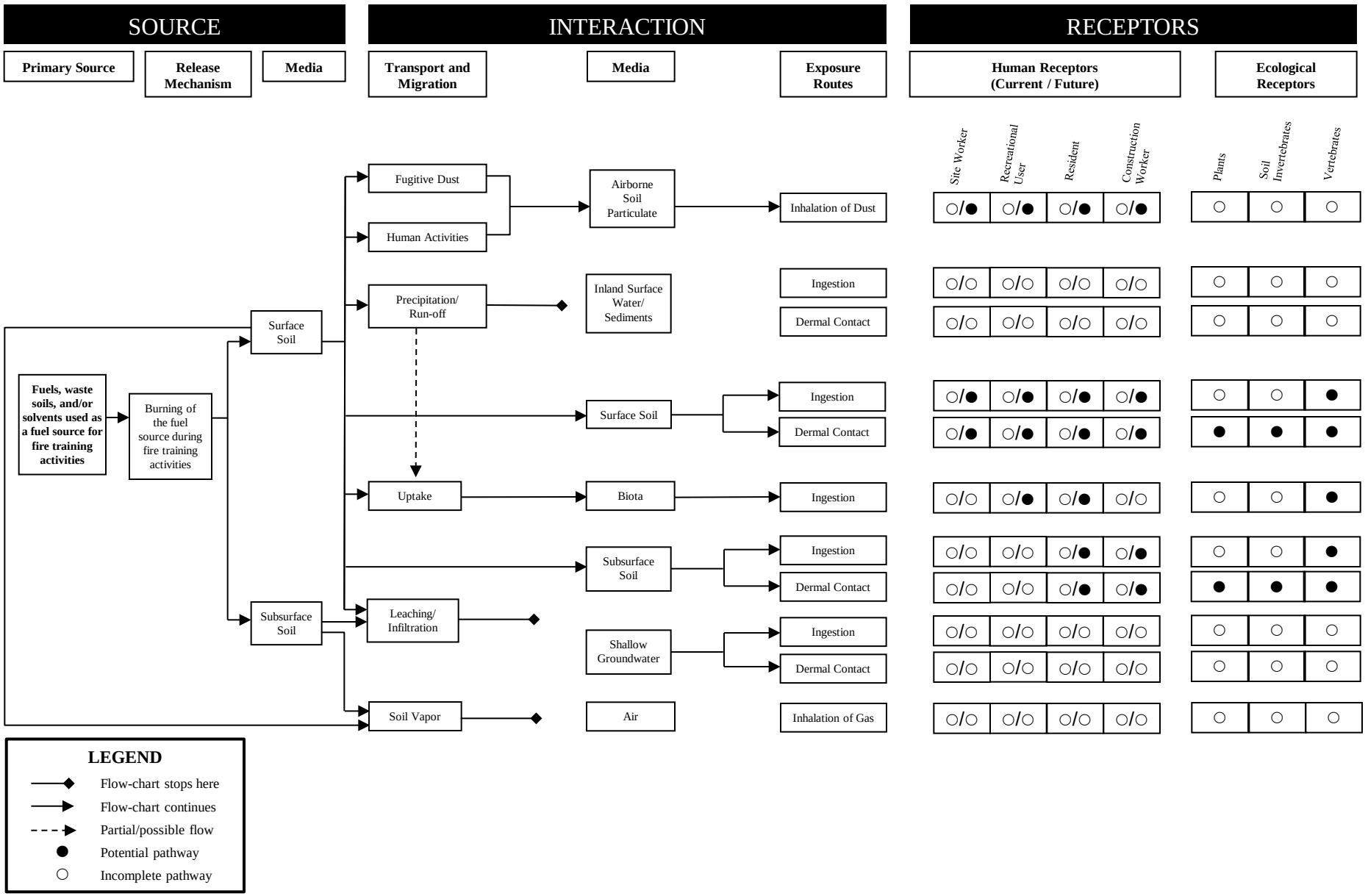


FIGURE 3-2
PRELIMINARY SITE CONCEPTUAL EXPOSURE MODEL – FT008



This section provides a site description and background, and an overview of the planned field activities for FT008.

4.1 SITE DESCRIPTION AND BACKGROUND

SWMU 107 is located in the southeast corner of the Base, adjacent to and east of abandoned north-south taxiway T-5. The training area consists of an unlined surface area in a half-moon shape that is approximately 300 feet in length. A low berm (less than one foot high) encircled the site and formed the site boundary. The site has little surface vegetation, but was littered with numerous empty storage containers of various sizes at the time of the Remedial Investigation (RI) sampling event (W-C 1992). From 1968 to 1974, the SWMU was used concurrently with SWMU 106, Fire Department Training Area No. 2 (FT007). During training exercises, the ground was saturated with water, and JP-4 jet fuel was introduced and ignited for training purposes. Approximately 300 gallons of fuel were burned during each training exercise. The exercises occurred about eight times per year. According to the 1995 RFI (W-C 1995), the area of SWMU 107 also has been used for activities associated with the adjacent ordnance training site.

4.2 PREVIOUS INVESTIGATION RESULTS (FT008)

4.2.1 Phase I Installation Restoration Program (CH2M Hill 1983)

The Phase I Installation Restoration Program (IRP) included a review of installation records and existing site conditions to identify and evaluate sites with suspected hazardous waste contamination. No soil samples were collected from FT008 as part of the IRP Phase I. The information obtained during the record search is as follows: FT008 was utilized concurrently with FT007 and operated from 1968 to 1974. Unused JP-4 was the only liquid burned at these sites. Contamination at these sites was anticipated to be minor due to the small amount of hazardous material used and the likelihood that the JP-4 was primarily consumed in the training fires.

4.2.2 Phase II Installation Restoration Program (Radian 1986)

One deep soil boring (Boring 8) was drilled at the lowest point of the area to define subsurface conditions in samples collected at approximately 2.5, 9.5, and 61.5 feet bgs (**Figure 4-1**). Samples were analyzed for oil and grease, lead, and purgeable organic compounds (Radian 1986). The results of the laboratory analysis are included in **Table 4-1** and **Figure 4-2**. A summary of the laboratory results is as follows:

- Oil and grease and lead were detected in all three samples. Oil and grease concentrations ranged from 1,700 to 3,800 mg/kg.
- No purgeable organic compounds were detected above the detection limit.
- Lead concentrations ranged from 1.7 to 3.7 mg/kg and were within the background range for Cannon AFB.

4.2.3 Remedial Investigation for 18 Solid Waste Management Units (W-C 1992)

An RI/BRA (W-C 1992) was completed for the site. A total of six soil borings were completed at FT008 during the RI (**Figure 4-1**). A summary of the borings is as follows:

- Boring 1071 was drilled to a depth of 31 feet bgs. Surface and subsurface soil samples from 5, 10, 20, and 30 feet bgs were collected for chemical analysis. Boring 1071 was located as close as possible to Boring 8 from the Phase II IRP investigation. However, the exact location of Boring 8 could not be determined based on the available data.
- Boring 1072 was drilled to a depth of 31 feet bgs. Surface and subsurface soil samples from 4, 10, 20, and 30 feet bgs were collected for chemical analysis.
- Boring 1073 was drilled to a depth of 31 feet bgs. Surface and subsurface soil samples from 4, 10, 20, and 30 feet bgs were collected for chemical analysis.
- Boring 1074 was drilled to a depth of 67.1 feet bgs. Surface and subsurface soil samples from 4, 10, 20, 30, 45, 50, and 60 feet bgs were collected for chemical analysis.
- Due to exceedance of volatile organic compound (VOC) holding times, soil boring 1073 was redrilled as boring 1076 and VOC soil samples were recollected from the 4 and 30 feet bgs intervals.
- Due to exceedance of VOC holding times, soil boring 1074 was redrilled as boring 1075 and VOC soil samples were recollected from the 10 and 50 feet bgs intervals.

Soil samples were analyzed for BTEX, VOCs, TPH, chromium, and lead. Laboratory analysis identified chromium, lead, TPH, acetone, ethylbenzene, toluene, and xylenes above laboratory detection levels. The results of the laboratory analysis for the analytes identified above detection limits are included in **Table 4-2** and **Figure 4-2**. The remaining analytes were not identified at concentrations exceeding laboratory detection levels. A summary of the laboratory detections is as follows:

- Acetone was identified in two soil samples (1076-4 and 1076-30) with a maximum concentration of 2.7E-01 mg/kg. This concentration is below the current NMED residential SSL for acetone (6.63E+04 mg/kg). The acetone identified was attributed to laboratory contamination.
- Ethylbenzene was identified in three soil samples (1074-4, 1075-10, and 1074-20) with a maximum concentration of 1.5E+01 mg/kg. This concentration is below the 2015 NMED residential SSL for ethylbenzene (7.51E+01 mg/kg).
- Toluene was identified in four soil samples (1073-0, 1074-4, 1074-20, and 1074-60) with a maximum concentration of 6.9E+00 mg/kg. This concentration is below the 2015 NMED residential SSL for toluene (5.23E+03 mg/kg).
- Xylene was identified in four soil samples (1074-4, 1075-10, 1074-20, and 1074-30) with a maximum concentration of 9.4E+01 mg/kg. This concentration is below the 2015 NMED residential SSL for xylene (8.71E+02 mg/kg).

- Chromium was identified in all soil samples analyzed for chromium with a maximum concentration of 1.11E+01 mg/kg. This concentration is below the 2015 NMED residential SSL for chromium (9.66E+01 mg/kg).
- Lead was identified in all soil samples analyzed for lead with a maximum concentration of 3.22E+02 mg/kg. This concentration is below the 2015 NMED residential SSL for lead (4.00E+02 mg/kg).
- TPH was identified at concentrations exceeding the 2015 NMED residential SSL (1.00E+03 mg/kg) in the surface soil sample (1071-0) at boring 1071. TPH was identified at concentrations exceeding the 2015 NMED residential SSL and industrial SSL (3.00E+03 mg/kg) in the surface soil sample (1073-0) at boring 1073. TPH was identified at concentrations exceeding the 2015 NMED residential SSL and industrial SSL in surface and subsurface samples (1074-0, 1074-4, 1074-10, 1074-20, and 1074-30) at boring 1074. The results of the analysis indicate TPH contamination at 1071 and 1072 is limited to the surface soils. TPH contamination at boring 1074 extends from the surface to at least 30 feet bgs. TPH was not detected in samples collected at boring 1074 from 45 to 60 feet bgs confirming the vertical extent of TPH contamination had been identified.

A BRA was completed for FT008 as part of a larger risk assessment area identified as Risk Assessment Area 1. This area included inactive Fire Training Areas (SWMU No. 106 and FT008), a current Fire Training Area (SWMU No. 109), and Landfill 5 (SWMU No. 113). The COPCs identified at the fire training areas were benzene, toluene, xylenes, TCE, ethylbenzene, chromium, and lead. The BRA indicated that there were no unacceptable adverse effects due to noncarcinogenic chemicals (i.e., hazard index less than 1.0). The risks due to carcinogenic chemicals were within the acceptable risk range of 1.00E-06 to 1.00E-04 with the exception of inhalation of VOCs by the future child resident (1.1E-04). The inhalation risk was primarily due to benzene detected at SWMU 106, where it was detected at a concentration of 1.7E-01 mg/kg in one of 37 samples. Benzene was not detected at FT008.

A risk assessment was not performed for TPH in the surface and near surface soils (0 to 10 feet bgs). This omission is not in compliance with the current NMED guidance regarding risk assessments.

A single ecological risk assessment was completed for all 18 IRP/SWMU sites included in the RI report. The ecological risk assessment identified pesticides, lead, and zinc as COPECs; however, none of the COPEC metals were shown to pose a risk to small mammalian populations based on calculated toxicity values for incidental soil ingestion. In addition, concentrations decreased with depth and the high soil/water partition coefficient for these organic chemicals indicated that limited migration to deeper soils would occur. Concentrations of chemicals in soil were evaluated in terms of potential risk to biota for the combined results from the 18 SWMUs. Six metals were detected in soils at levels which were considered to be above background (including chromium and lead); however, none of the metals were known to bioaccumulate through the food chains to levels where they would pose a risk due to direct exposure or indirect exposure by predator species. The ecological risk evaluation concluded that none of the chemicals at the site posed a significant risk to small mammalian populations or other biota.

Impacts to groundwater were considered minimal because the depth to groundwater was greater than 250 feet and soil sampling results demonstrated that contaminants are not being transported significantly in a vertical direction. No unacceptable human health or ecological risks due to chemical releases were expected from this SWMU and NFA was recommended.

4.2.4 RCRA Facility Investigation for 21 SWMUs (URS 2007)

The results and conclusions of the Phase I IRP (CH2M Hill 1983), Phase II IRP (Radian 1986), and the RI/BRA (W-C 1992) were reevaluated using current methods and screening criteria (2006 NMED soil screening levels). Based on the reevaluation of the data, further surface and subsurface soil samples were recommended to be collected for TPH and BTEX analysis.

4.2.5 RCRA Facility Investigation for SWMUs 34, 78, 85, 91, 95, and 107 Addendum Report (URS 2009)

An RFI (URS 2009) was completed for the site. Five soil borings were completed at FT008 as part of the RFI addendum (**Figure 4-1**). A summary of the boring is as follows:

- SB01 was drilled to a depth of 30 feet bgs. Surface and subsurface soil samples from 12 and 28 feet bgs were collected for chemical analysis.
- SB02 was drilled to a depth of 28 feet bgs. Surface and subsurface soil samples from 12 and 24 feet bgs were collected for chemical analysis.
- SB03 was drilled to a depth of 27 feet bgs. Subsurface soil samples from 4, 12, and 24 feet bgs were collected for chemical analysis.
- SB04 was drilled approximately 13 feet east of SB03 in an attempt to delineate the potential contamination identified during drilling at SB03. This boring was advanced to a depth of 16 feet bgs before being abandoned due to strong fuel odors in the soil. No soil samples were collected from this boring. Rather, this boring was assumed to contain elevated TPH levels and boring SB05 was installed further to the east of SB04 to delineate the extent of contamination.
- SB05 was drilled to a depth of 30 feet bgs. Surface and subsurface soil samples from 12 and 28 feet bgs were collected for chemical analysis.

Soil samples were analyzed for BTEX, TPH-DRO, and TPH-GRO. Benzene was not identified at concentrations exceeding laboratory detection levels in any of the soil samples collected. The results of the laboratory analysis for the analytes identified above detection limits are included in **Table 4-3** and **Figure 4-2**. A summary of the laboratory detections is as follows:

- Ethylbenzene, xylenes, toluene, and TPH-GRO were identified at concentrations below their respective NMED residential SSLs.
- TPH-DRO was identified at concentrations exceeding the 2015 NMED residential SSL and industrial SSL in surface and subsurface samples (C107-SB03-004, SB03-012, and SB03-024) at boring SB03. The results of the analysis indicate TPH-DRO contamination at boring SB03 extends from the near surface soils to at least 24 feet bgs. The vertical extent of contamination at this boring was not delineated.

The RFI addendum concluded that further action was required at FT008.

4.2.6 FT008 Remedial Investigation Report (EMR 2012)

An RI (EMR Inc. [EMR] 2012) was completed for the site. The goal of the investigation was to determine the presence and extent of petroleum contamination at the site. Ten soil borings were completed at FT008 as part of the RI (**Figure 4-1**). A summary of the boring is as follows:

- SB06 was drilled to a depth of 45 feet bgs.
- SB11 was drilled to a depth of 35 feet bgs.
- The remaining soil borings, SB07 through SB15, were drilled to a depth of 30 feet bgs.

The soil samples were field-screened for headspace VOCs. Soil samples were collected from the interval containing the highest photoionization detector (PID) reading and the terminus of each borehole. All soil samples were analyzed for TPH-GRO, TPH-DRO, TPH- oil range organics (ORO), and VOCs (BTEX). Benzene was not identified at concentrations exceeding laboratory detection levels in any of the soil samples collected. The results of the laboratory analysis for the analytes identified above detection limits are included in **Table 4-4** and **Figure 4-2**. A summary of the laboratory detections is as follows:

- Ethylbenzene, xylene, toluene, and TPH-GRO were identified at concentrations below their respective NMED residential SSLs.
- TPH-DRO was identified at concentrations exceeding the 2015 NMED residential SSL (sample C107-SB11-003) and industrial SSL (C107-SB11-011) at boring SB11. The results of the analysis indicate TPH-DRO contamination at boring SB11 extends from the near surface soils to at least 11 feet bgs. A sample collected from the bottom of the boring (33 to 35 feet bgs) confirmed that the vertical extent of TPH-DRO contamination had been delineated.
- TPH-ORO was identified at concentrations exceeding the residential and industrial RSL in sample C107-SB11-011. A sample collected from the bottom of the boring (33 to 35 feet bgs) confirmed that the vertical extent of TPH-ORO contamination had been delineated.

The results of the RI sampling were utilized to determine the excavation limits for removal of petroleum contaminated soils (TPH-DRO and TPH-ORO contaminated soils).

4.2.7 FT008 Soil Remediation Report (EMR 2013)

Excavation activities were completed at FT008 to remove petroleum contaminated soils from January 16, 2013 to January 17, 2013. The approximate boundaries of the excavation area were estimated to be 30 feet long by 30 feet wide by 10 feet deep based on the assessment of the RI data. The final dimensions of the excavated area were as follows: 30 feet long on the north, south, and east sides; 32 feet long on the west side; and 22 to 24 feet deep.

During the excavation, the soil was screened for potential use as backfill using a PID with the exception of the soil in the upper 10 feet at SB11. The soil from the upper 10 feet around SB11 was not screened or used as backfill, but stockpiled to be transported off site. Soil from the

remaining excavation area was screened during the excavation. Soil with an average PID reading of 9.5 parts per million (ppm) and a high reading of 37.2 ppm was stockpiled to be used as backfill.

Contaminated soil was disposed of at the Gandy-Marley facility near Roswell, New Mexico. Between 272 and 340 cubic yards of soil were disposed of at the facility. The exact amount was determined to be undeterminable due to the fact that the trucks were not weighed upon entering the facility.

In addition to the petroleum contaminated soils, approximately 30 cubic yards of arsenic contaminated soils were transported to and dispensed of at the Gandy-Marley facility. These soils had been stockpiled on the paved area (former runway) adjoining FT008 to the west.

Following the completion of the excavation, 10 confirmation soil samples were collected (**Figure 4-1**). All soil samples were analyzed for TPH-DRO and TPH-ORO. The analytical results for the confirmation soil samples are included in **Table 4-5** and **Figure 4-2**. All confirmation soil samples were below the 2015 NMED residential SSLs for TPH-DRO and TPH-ORO.

Upon receipt of the analytical results for the confirmation samples, the excavation was backfilled on January 18, 2013 and January 22, 2013. Overburden soils that were previously screened using the PID were placed in the excavation. In addition to the overburden soils, 16 loads of backfill material were utilized to fill the excavation from an approved stockpile on Cannon AFB.

The objective of the project was to remove and properly dispose of all petroleum contaminated soils in excess of NMED SSLs at FT008. Based on the completion of the excavation, the site objective was determined to have been met and the site was recommended for “Site Closure”.

4.3 SAMPLING OBJECTIVES (FT008)

The general sampling objective at FT008 is to evaluate the remaining portions of FT008 for impacts from historical use and confirm the presence or absence of petroleum contamination at historical sampling locations. A detailed summary of the objectives is as follows.

4.3.1 Historical Site Boundaries

Historical documents indicate that the training area consists of an unlined surface area in a half-moon shape that was approximately 300 feet in length. However, all historical investigations completed for FT008 have identified the boundaries of FT008 as approximately 160 feet in length. A review of aerial photographs by Cannon AFB personnel indicates that the boundaries of the SWMU may have been misinterpreted during the initial investigations and that error has been perpetuated through to the current day. Therefore, portions of FT008 have not been evaluated by the sampling completed as part of the historical investigations completed to date.

4.3.2 Historical Sampling Results

Petroleum contamination was identified by historical sampling at FT008. Subsequent investigations have failed to confirm or refute the presence of the contamination identified.

Petroleum contamination identified in soil samples above screening levels that are to be reevaluated as part of the RI are as follows:

- Soil Boring 1071 – TPH contamination was identified in the surface soils at a concentration of 2,870 mg/kg in the 1992 RI.
- Soil Boring 1073 – TPH contamination was identified in the surface soils at a concentration of 6,080 mg/kg in the 1992 RI.
- Soil Boring 1074 – TPH contamination was identified in the surface soils at a concentration of 3,610 mg/kg. TPH contamination was identified in the subsurface soils at 4, 10, 20, and 30 feet bgs with TPH concentrations of 18,300 mg/kg, 9,220 mg/kg, 11,500 mg/kg, and 4,710 mg/kg, respectively.
- Soil Boring C107-SB03 – TPH-DRO contamination was identified at 0 to 4, 12 to 16, and 24 to 28 feet bgs with TPH concentrations of 7,800, 3,700, and 4,500 mg/kg, respectively. This boring was located along the southern boundary of the excavation.

The contamination at C107-SB03 may have been removed during the 2013 excavation. However, sampling was not completed to confirm the vertical extent of contamination had been identified. Additionally, no borings were completed to the south of C107-SB03 to define the horizontal contamination. The confirmation sample closest to C107-SB03, which was collected during the excavation, was a wall sample collected at 18 feet bgs. Based on the absence of data, the vertical and horizontal extent of contamination at this boring has not been defined.

4.4 SAMPLING LOCATIONS, FREQUENCIES AND ANALYSIS (FT008)

The following site-specific activities will be completed at FT008 to meet the sampling objectives. The analyte list for FT008 is based on the historical use of the site as a fire training area and will include the following: TPH-DRO, TPH-ORO, total analyte list (TAL) metals, VOCs, semivolatile organic compounds (SVOCs), and pesticides. Planned soil sampling locations, identification numbers, depths, location coordinates, analytical parameters, and technical rationale for each soil sample location are provided for FT008 in **Table 4-6**. Planned soil sampling location(s) are shown on **Figure 4-3**.

4.4.1 Initial Soil Sampling

Thirty direct push soil borings will be completed to 20 feet bgs at FT008. These boring locations were determined by establishing a grid adjoining the existing borings where contamination has historically been identified. The soil borings extend from the historically identified contamination to the south. Historical soil sampling has consistently indicated the presence of TPH within 20 feet of ground surface with contamination often identified in the surface and near surface soils. Therefore, completing the borings to a minimum depth of 20 feet bgs was determined to be sufficient to identify contamination at the site. Should PID screening indicate the presence of contamination at 20 feet bgs that warrants additional sampling, the depth of the boring will be increased accordingly.

The surface and near surface soil (to 5 feet bgs) will also be sampled at historical boring locations 1071 and 1073. The surface soils will be sampled to confirm or refute the historical TPH concentrations identified at these locations. The near surface soils will be sampled to confirm the absence of TPH contamination in the subsurface soils at these locations.

Upon completion of the initial soil sampling, all soil analytical data will be compared to the 2015 NMED residential SSLs to identify any areas that require additional sampling to define the vertical and horizontal extent of contamination at FT008. If further sampling is required, this sampling will be completed during the secondary soil sampling.

4.4.2 Secondary Soil Sampling

To delineate vertical contamination at FT008, the subsurface soil will be sampled at historical boring locations C107-SB03 and 1074. Boring C107-SB03 will be drilled to a depth of at least 40 feet bgs. Boring 1074 will be drilled to a depth of at least 50 feet bgs. Due to previous experience in close proximity to FT008 at Cannon AFB, the deeper soil borings will be installed using sonic drilling methods.

In addition to soil borings C107-SB03 and 1074, up to two additional soil borings may be completed to a depth of 60 feet bgs to delineate the vertical extent of soil contamination at locations identified in the initial soil sampling event where refusal was encountered prior to delineation of the vertical extent of contamination using direct push drilling methods.

TABLE 4-1
SUMMARY OF THE PHASE II INSTALLATION RESTORATION PROGRAM ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID **DATE COLLECTED**	Sample Depth (feet bgs)	8-1 1984 * Result	8-2 1984 * Result	8-3 1984 * Result
Oil and Gas (mg/kg)	1.5-2	1.70E+03	3.80E+03	2.60E+03
Lead (mg/kg)	7.5-9.5	3.70E+00	2.90E+00	1.70E+00
Purgeable Organic Compounds (µg/kg)	59.8-61.5	ND	ND	ND

Notes:

* Precise date of collection could not be determined; samples were analyzed for oil/grease (maximum 3,800 mg/kg) and purgeable organics (all ND).

mg/kg = milligrams per kilogram

ND = not detected

µg/kg = micrograms per kilogram

TABLE 4-2
SUMMARY OF THE 1992 REMEDIAL INVESTIGATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID			1071-0		1071-5		1071-10		1071-20		1071-30		1072-0		1072-4		1072-10		1072-20		1072-30	
DATE COLLECTED	2014 NMED Residential SSL	2014 NMED Industrial SSL	October 11, 1991		October 8, 1991		October 8, 1991		October 8, 1991		October 9, 1991		October 23, 1991		October 24, 1991		October 24, 1991		October 24, 1991		October 25, 1991	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Ethylbenzene (mg/kg)	7.51E+01	3.68E+02	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U
Toluene (mg/kg)	5.23E+03	6.13E+04	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U
Total Xylene (mg/kg)	8.71E+02	4.28E+03	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U	<	U
Acetone (mg/kg)	6.63E+04	9.60E+05	<	U	<	U	<	U	<	U	<	U	N/A		<	U	<	U	<	U	<	U
Chromium (mg/kg)	9.66E+01	5.05E+02	5.10E+00		5.70E+00		7.70E+00		5.60E+00		6.40E+00		3.50E+00		3.30E+00	J	5.00E+00		4.90E+00		1.03E+01	
Lead (mg/kg)	4.00E+02	8.00E+02	1.51E+02		3.30E+00		4.80E+00		2.10E+00		3.80E+00		6.40E+00	J	2.10E+00		5.30E+00		2.70E+00		1.60E+00	
TPH (mg/kg)[1]	1.00E+03	3.00E+03	2.87E+03		7.42E+01		<	U	<	U	<	U	9.63E+02		<	U	<	U	<	U	<	U

Notes:

2.87E+03 = value exceeds NMED residential SSL

6.08E+03 = value exceeds NMED residential and industrial SSL

[1]Current NMED guidance does not provide screening levels for total TPH, but rather specific ranges of carbon fractions. Therefore, the screening levels for TPH applicable at the time the work was completed were included for comparison purposes.

[2] Sample was collected due to exceedance of hold times for the previous sample listed.

< = analytical result is less than the detection limit of the method utilized

J = estimated

mg/kg = milligrams per kilogram

N/A = not applicable. Sample was not analyzed for this constituent.

NMED = New Mexico Environment Department

Qual = qualifier

SSL = soil screening level

TPH = Total Petroleum Hydrocarbons

U = nondetect

TABLE 4-2
SUMMARY OF THE 1992 REMEDIAL INVESTIGATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID			1073-0		1073-4		1076-4[2]		1073-10		1073-20		1073-30		1076-30[2]		1074-0		1074-4		1074-10	
DATE COLLECTED	2014 NMED Residential SSL	2014 NMED Industrial SSL	October 23, 1991		October 25, 1991		October 26, 1991		October 25, 1991		October 25, 1991		October 25, 1991		October 26, 1991		October 25, 1991		October 25, 1991		October 25, 1991	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Ethylbenzene (mg/kg)	7.51E+01	3.68E+02	<	U	N/A		<	U	<	U	<	U	N/A		<	U	<	U	1.30E+01	J	N/A	
Toluene (mg/kg)	5.23E+03	6.13E+04	7.30E-02	J	N/A		<	U	<	U	<	U	N/A		<	U	<	U	6.90E+00	J	N/A	
Total Xylene (mg/kg)	8.71E+02	4.28E+03	<	U	N/A		<	U	<	U	<	U	N/A		<	U	<	U	9.40E+01		N/A	
Acetone (mg/kg)	6.63E+04	9.60E+05	N/A		N/A		1.00E-01		<	U	<	U	N/A		2.70E-01		N/A		<	U	N/A	
Chromium (mg/kg)	9.66E+01	5.05E+02	3.20E+00		6.10E+00		N/A		8.20E+00		7.30E+00		4.80E+00		N/A		1.11E+01		5.70E+00		5.20E+00	
Lead (mg/kg)	4.00E+02	8.00E+02	8.70E+00		2.90E+00		N/A		4.80E+00		4.10E+00		1.90E+00		N/A		3.22E+02		1.04E+01		5.80E+00	
TPH (mg/kg)[1]	1.00E+03	3.00E+03	**6.08E+03**		<	U	N/A		<	U	<	U	<	U	N/A		**3.61E+03**		**1.83E+04**		**9.22E+03**	

Notes:

2.87E+03 = value exceeds NMED residential SSL

6.08E+03 = value exceeds NMED residential and industrial SSL

[1]Current NMED guidance does not provide screening levels for total TPH, but rather specif carbon fractions. Therefore, the screening levels for TPH applicable at the time the work v completed were included for comparison purposes.

[2] Sample was collected due to exceedance of hold times for the previous sample listed.

< = analytical result is less than the detection limit of the method utilized

J = estimated

mg/kg = milligrams per kilogram

N/A = not applicable. Sample was not analyzed for this constituent.

NMED = New Mexico Environment Department

Qual = qualifier

SSL = soil screening level

TPH = Total Petroleum Hydrocarbons

U = nondetect

TABLE 4-2
SUMMARY OF THE 1992 REMEDIAL INVESTIGATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID			1075-10[2]		1074-20		1074-30		1074-45		1074-50		1075-50[2]		1074-60	
DATE COLLECTED	2014 NMED Residential SSL	2014 NMED Industrial SSL	October 26, 1991		October 25, 1991		October 25, 1991		October 25, 1991		October 26, 1991		October 26, 1991		October 26, 1991	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Ethylbenzene (mg/kg)	7.51E+01	3.68E+02	1.50E+01	J	5.80E+00		<	U	<	U	N/A		<	U	<	U
Toluene (mg/kg)	5.23E+03	6.13E+04	<	U	2.70E+00	J	<	U	<	U	N/A		<	U	4.00E+00	J
Total Xylene (mg/kg)	8.71E+02	4.28E+03	8.70E+01		2.80E+01		4.90E+00	J	<	U	N/A		<	U	<	U
Acetone (mg/kg)	6.63E+04	9.60E+05	<	U	<	U	<	U	<	U	N/A		<	U	<	U
Chromium (mg/kg)	9.66E+01	5.05E+02	N/A		7.30E+00		8.30E+00		4.40E+00		5.20E+00		N/A		2.70E+00	
Lead (mg/kg)	4.00E+02	8.00E+02	N/A		3.70E+00		3.60E+00		1.80E+00		1.50E+00		N/A		7.30E-01	
TPH (mg/kg)[1]	1.00E+03	3.00E+03	N/A		**1.15E+04**		**4.71E+03**		<	U	<	U	N/A		<	U

Notes:

2.87E+03 = value exceeds NMED residential SSL

6.08E+03 = value exceeds NMED residential and industrial SSL

[1]Current NMED guidance does not provide screening levels for total TPH, but rather specif carbon fractions. Therefore, the screening levels for TPH applicable at the time the work v completed were included for comparison purposes.

[2] Sample was collected due to exceedance of hold times for the previous sample listed.

< = analytical result is less than the detection limit of the method utilized

J = estimated

mg/kg = milligrams per kilogram

N/A = not applicable. Sample was not analyzed for this constituent.

NMED = New Mexico Environment Department

Qual = qualifier

SSL = soil screening level

TPH = Total Petroleum Hydrocarbons

U = nondetect

TABLE 4-3
SUMMARY OF THE 2009 RCRA FACILITY INVESTIGATION ADDENDUM REPORT ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-SB01-000				C107-SB01-012				C107-SB01-028			
DATE COLLECTED				October 22, 2008				October 22, 2008				October 22, 2008			
	2014 NMED Residential SSL	2014 NMED Industrial SSL	Maximum	Result	MDL	RL	Qual	Result	MDL	RL	Qual	Result	MDL	RL	Qual
VOLATILE ORGANIC COMPOUNDS (mg/kg)															
Ethylbenzene	7.51E+01	3.68E+02	2.00E+00 J	<	7.00E-04	5.00E-03	U	<	7.00E-04	6.00E-03	U	<	6.00E-04	5.00E-03	U
m,p-Xylenes	7.64E+02	3.73E+03	1.20E+01 J	<	4.00E-04	5.00E-03	U	<	5.00E-04	6.00E-03	U	<	4.00E-04	5.00E-03	U
o-Xylene	8.05E+02	3.94E+03	6.50E+00 J	<	7.00E-04	5.00E-03	U	<	7.00E-04	6.00E-03	U	<	6.00E-04	5.00E-03	U
Toluene	5.23E+03	6.13E+04	5.70E-01 J	<	7.00E-04	5.00E-03	U	<	7.00E-04	6.00E-03	U	<	6.00E-04	5.00E-03	U
TOTAL PETROLEUM HYDROCARBONS (mg/kg)															
Diesel Range Organics	1.00E+03	3.00E+03	7.80E+03	1.40E+01	1.00E+00	1.00E+01		<	1.00E+00	1.00E+01	U	<	1.00E+00	1.00E+01	U
Gasoline Range Organics[1]	8.00E+02[2]	2.00E+03[3]	6.50E+02 J	<	3.30E-01	1.10E+00	U	<	3.40E-01	1.10E+00	U	<	3.30E-01	1.10E+00	U

Notes:

[1]Current NMED guidance does not provide screening levels for TPH-GRO. Current guidance dictates that TPH-GRO be evaluated based on the constituents of fuel (benzene, toluene, ethylbenzene, and xylenes). Therefore, the screening levels for TPH-GRO applicable at the time the work was completed were included for comparison purposes.

[2]NMED Soil Screening Levels Revision 5.0 (December 2009)

[3]Table 2b. NMED TPH Soil Screening Guidelines (June 2006)

6.08E+03 = value exceeds NMED residential and industrial SSL

< = analytical result is less than the detection limit of the method utilized

J = estimated

MDL = Method Detection Limit

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

RL = reporting limit

TPH-GRO = total petroleum hydrocarbons-gasoline range organics

U = nondetect

TABLE 4-3
SUMMARY OF THE 2009 RCRA FACILITY INVESTIGATION ADDENDUM REPORT ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-SB02-000				C107-SB02-012				C107-SB02-024			
DATE COLLECTED	2014 NMED Residential SSL	2014 NMED Industrial SSL	Maximum	October 23, 2008				October 23, 2008				October 23, 2008			
				Result	MDL	RL	Qual	Result	MDL	RL	Qual	Result	MDL	RL	Qual
VOLATILE ORGANIC COMPOUNDS (mg/kg)															
Ethylbenzene	7.51E+01	3.68E+02	2.00E+00 J	<	7.00E-04	6.00E-03	U	<	7.00E-04	5.00E-03	U	<	7.00E-04	5.00E-03	U
m,p-Xylenes	7.64E+02	3.73E+03	1.20E+01 J	<	4.00E-04	6.00E-03	U	<	4.00E-04	5.00E-03	U	<	4.00E-04	5.00E-03	U
o-Xylene	8.05E+02	3.94E+03	6.50E+00 J	<	7.00E-04	6.00E-03	U	<	7.00E-04	5.00E-03	U	<	7.00E-04	5.00E-03	U
Toluene	5.23E+03	6.13E+04	5.70E-01 J	<	7.00E-04	6.00E-03	U	<	7.00E-04	5.00E-03	U	<	7.00E-04	5.00E-03	U
TOTAL PETROLEUM HYDROCARBONS (mg/kg)															
Diesel Range Organics	1.00E+03	3.00E+03	7.80E+03	8.80E+00	1.00E+00	1.00E+01	J	<	1.00E+00	1.00E+01	U	<	1.00E+00	1.00E+01	U
Gasoline Range Organics[1]	8.00E+02[2]	2.00E+03[3]	6.50E+02 J	<	3.30E-01	1.10E+00	U	<	3.30E-01	1.10E+00	U	<	3.30E-01	1.10E+00	U

Notes:

[1]Current NMED guidance does not provide screening levels for TPH-GRO. Current guidance dictates that TPH-GRO be evaluated based on the constituents of fuel (benzene, toluene, ethylbenzene, and xylenes). Therefore, the screening levels for TPH-GRO applicable at the time the work was completed were included for comparison purposes.

[2]NMED Soil Screening Levels Revision 5.0 (December 2009)

[3]Table 2b. NMED TPH Soil Screening Guidelines (June 2006)

6.08E+03 = value exceeds NMED residential and industrial SSL

< = analytical result is less than the detection limit of the method utilized

J = estimated

MDL = Method Detection Limit

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

RL = reporting limit

TPH-GRO = total petroleum hydrocarbons-gasoline range organics

U = nondetect

TABLE 4-3
SUMMARY OF THE 2009 RCRA FACILITY INVESTIGATION ADDENDUM REPORT ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-SB03-004				C107-SB03-012				C107-SB03-024			
DATE COLLECTED	2014 NMED Residential SSL	2014 NMED Industrial SSL	Maximum	October 23, 2008				October 23, 2008				October 23, 2008			
				Result	MDL	RL	Qual	Result	MDL	RL	Qual	Result	MDL	RL	Qual
VOLATILE ORGANIC COMPOUNDS (mg/kg)															
Ethylbenzene	7.51E+01	3.68E+02	2.00E+00 J	2.00E+00	2.30E-02	5.80E-01	J	1.80E+00	2.30E-02	5.70E-01		1.00E-01	1.10E-02	2.80E-01	J
m,p-Xylenes	7.64E+02	3.73E+03	1.20E+01 J	1.20E+01	4.60E-02	5.80E-01	J	7.60E+00	4.50E-02	5.70E-01		3.00E-01	2.30E-02	2.80E-01	
o-Xylene	8.05E+02	3.94E+03	6.50E+00 J	6.50E+00	2.30E-02	5.80E-01	J	3.90E+00	2.30E-02	5.70E-01		1.00E-01	1.10E-02	2.80E-01	J
Toluene	5.23E+03	6.13E+04	5.70E-01 J	2.00E-01	2.30E-02	5.80E-01	J	5.70E-01	2.30E-02	5.70E-01	J	2.00E-02	1.10E-02	2.80E-01	J
TOTAL PETROLEUM HYDROCARBONS (mg/kg)															
Diesel Range Organics	1.00E+03	3.00E+03	7.80E+03	**7.80E+03**	1.00E+02	1.00E+03		**3.70E+03**	5.00E+01	5.00E+02		**4.50E+03**	5.00E+01	5.00E+02	
Gasoline Range Organics[1]	8.00E+02[2]	2.00E+03[3]	6.50E+02 J	6.50E+02	1.40E+01	4.60E+01	J	3.50E+02	1.70E+00	5.70E+00	J	1.80E+02	6.80E+00	2.30E+01	J

Notes:

[1]Current NMED guidance does not provide screening levels for TPH-GRO. Current guidance dictates that TPH-GRO be evaluated based on the constituents of fuel (benzene, toluene, ethylbenzene, and xylenes). Therefore, the screening levels for TPH-GRO applicable at the time the work was completed were included for comparison purposes.

[2]NMED Soil Screening Levels Revision 5.0 (December 2009)

[3]Table 2b. NMED TPH Soil Screening Guidelines (June 2006)

6.08E+03 = value exceeds NMED residential and industrial SSL

< = analytical result is less than the detection limit of the method utilized

J = estimated

MDL = Method Detection Limit

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

RL = reporting limit

TPH-GRO = total petroleum hydrocarbons-gasoline range organics

U = nondetect

TABLE 4-3
SUMMARY OF THE 2009 RCRA FACILITY INVESTIGATION ADDENDUM REPORT ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-SB05-000				C107-SB05-012				C107-SB05-028			
DATE COLLECTED	2014 NMED Residential SSL	2014 NMED Industrial SSL	Maximum	October 23, 2008				October 23, 2008				October 23, 2008			
				Result	MDL	RL	Qual	Result	MDL	RL	Qual	Result	MDL	RL	Qual
VOLATILE ORGANIC COMPOUNDS (mg/kg)															
Ethylbenzene	7.51E+01	3.68E+02	2.00E+00 J	<	7.00E-04	6.00E-03	U	<	6.00E-04	5.00E-03	U	<	7.00E-04	5.00E-03	U
m,p-Xylenes	7.64E+02	3.73E+03	1.20E+01 J	<	4.00E-04	6.00E-03	U	<	4.00E-04	5.00E-03	U	<	4.00E-04	5.00E-03	U
o-Xylene	8.05E+02	3.94E+03	6.50E+00 J	<	7.00E-04	6.00E-03	U	<	6.00E-04	5.00E-03	U	<	7.00E-04	5.00E-03	U
Toluene	5.23E+03	6.13E+04	5.70E-01 J	<	7.00E-04	6.00E-03	U	<	6.00E-04	5.00E-03	U	<	7.00E-04	5.00E-03	U
TOTAL PETROLEUM HYDROCARBONS (mg/kg)															
Diesel Range Organics	1.00E+03	3.00E+03	7.80E+03	1.40E+02	2.00E+00	2.00E+01		8.40E+00	1.00E+00	1.00E+01	J	1.01E+01	1.00E+00	1.00E+01	
Gasoline Range Organics[1]	8.00E+02[2]	2.00E+03[3]	6.50E+02 J	<	3.40E-01	1.10E+00	U	<	3.20E-01	1.10E+00	U	<	3.30E-01	1.10E+00	U

Notes:

[1]Current NMED guidance does not provide screening levels for TPH-GRO. Current guidance dictates that TPH-GRO be evaluated based on the constituents of fuel (benzene, toluene, ethylbenzene, and xylenes). Therefore, the screening levels for TPH-GRO applicable at the time the work was completed were included for comparison purposes.

[2]NMED Soil Screening Levels Revision 5.0 (December 2009)

[3]Table 2b. NMED TPH Soil Screening Guidelines (June 2006)

6.08E+03 = value exceeds NMED residential and industrial SSL

< = analytical result is less than the detection limit of the method utilized

J = estimated

MDL = Method Detection Limit

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

RL = reporting limit

TPH-GRO = total petroleum hydrocarbons-gasoline range organics

U = nondetect

TABLE 4-4
SUMMARY OF 2012 REMEDIAL INVESTIGATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-SB06-033		C107-SB06-043		C107-SB07-017		C107-SB07-028		C107-SB08-014		C107-SB08-028		C107-SB09-012		C107-SB09-028		C107-SB10-004		C107-SB10-028		C107-SB11-003	
DATE COLLECTED	2015 NMED Residential SSL	2015 NMED Industrial SSL	Maximum	August 7, 2012		August 7, 2012		August 7, 2012		August 7, 2012		August 8, 2012		August 8, 2012		August 8, 2012		August 8, 2012		August 8, 2012		August 8, 2012		August 9, 2012	
				Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
VOLATILE ORGANIC COMPOUNDS (mg/kg)																									
Ethylbenzene	7.51E+01	3.68E+02	7.80E+00	1.50E+00	U	1.50E+00	U	1.70E+00	U	5.60E+00	U	1.90E+00	U	1.60E+00	U	1.80E+00	U	1.80E+00	U	1.60E+00	U	1.60E+00	U	1.60E+00	U
m,p-Xylenes	7.64E+02	3.73E+03	4.18E+01	3.00E+00	U	3.00E+00	U	3.30E+00	U	1.13E+01	U	3.80E+00	U	3.30E+00	U	3.60E+00	J	3.70E+00		3.30E+00		3.20E+00	U	1.60E+00	J
o-Xylene	8.05E+02	3.94E+03	2.14E+01	1.50E+00	U	1.50E+00	U	1.70E+00	U	5.60E+00	U	1.90E+00	U	1.60E+00	U	1.80E+00	J	1.80E+00		1.60E+00	J	1.60E+00	U	3.80E+00	
Toluene	5.23E+03	6.13E+04	8.60E-01 J	1.50E+00	U	1.50E+00	U	1.70E+00	U	5.60E+00	U	1.90E+00	U	1.60E+00	U	1.80E+00	U	1.80E+00	U	1.60E+00	U	1.60E+00	U	1.60E+00	U
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																									
Diesel Range Organics	1.00E+03	3.00E+03	4.68E+03	1.13E+01	U	4.00E+00	J	9.75E+02		1.88E+02		5.00E+00	J	3.70E+00	J	3.30E+00	J	1.07E+01	U	2.50E+01		1.05E+01	U	**1.11E+03**	
Oil Range Organics	1.00E+03	3.00E+03	3.11E+03	1.13E+01	U	1.07E+01	U	3.04E+02		1.07E+02		7.90E+00	J	6.10E+00	J	1.04E+01	U	1.07E+01	U	1.08E+02		1.05E+01	U	7.10E+02	
Gasoline Range Organics[1]	NA	NA	6.38E+02	1.30E-01		1.50E-01		6.60E-01		1.30E-01		1.30E-02	J	3.70E-01		1.60E-01		1.40E-01		3.50E-01		1.40E-01		2.20E+00	

Notes:

[1]Current NMED guidance does not provide screening levels for TPH-GRO. Current guidance (consistent with the 2012 guideance) dictates that TPH-GRO be evaluated based on the constituents of fuel (benzene, toluene, ethylbenzene, and xylenes). Therefore, no screening levels were included for TPH-GRO.

6.08E+03 = value exceeds NMED residential SSL

6.08E+03 = value exceeds NMED residential and industrial SSL

< = analytical result is less than the detection limit of the method utilized

J = estimated

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

U = nondetect

TABLE 4-4
SUMMARY OF 2012 REMEDIAL INVESTIGATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-SB11-011		C107-SB11-033		C107-SB12-023		C107-SB12-028		C107-SB13-009		C107-SB13-028		C107-SB14-023		C107-SB14-028		C107-SB15-019		C107-SB15-028	
DATE COLLECTED	2015 NMED Residential SSL	2015 NMED Industrial SSL	Maximum	August 9, 2012		August 9, 2012		August 9, 2012		August 9, 2012		August 9, 2012		August 9, 2012		August 10, 2012		August 10, 2012		August 10, 2012		August 10, 2012	
				Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
VOLATILE ORGANIC COMPOUNDS (mg/kg)																							
Ethylbenzene	7.51E+01	3.68E+02	7.80E+00	7.80E+00		2.40E+00	U	1.70E+00	U	1.90E+00	U	1.80E+00	U	1.80E+00	U	1.80E+00	U	2.80E+00	U	2.30E+00	U	2.20E+00	U
m,p-Xylenes	7.64E+02	3.73E+03	4.18E+01	4.18E+01		4.80E+00	U	3.40E+00	U	3.80E+00	U	3.60E+00	U	3.50E+00	U	3.60E+00	U	5.60E+00	U	4.60E+00	U	4.40E+00	U
o-Xylene	8.05E+02	3.94E+03	2.14E+01	2.14E+01		2.40E+00	U	1.70E+00	U	1.90E+00	U	1.80E+00	U	1.80E+00	U	1.80E+00	U	2.80E+00	U	2.30E+00	U	2.20E+00	U
Toluene	5.23E+03	6.13E+04	8.60E-01 J	8.60E-01	J	2.40E+00	U	1.70E+00	U	1.90E+00	U	1.80E+00	U	1.80E+00	U	1.80E+00	U	2.80E+00	U	2.30E+00	U	2.20E+00	U
TOTAL PETROLEUM HYDROCARBONS (mg/kg)																							
Diesel Range Organics	1.00E+03	3.00E+03	4.68E+03	**4.68E+03**		4.50E+00	J	4.40E+00	J	5.10E+00	J	4.80E+00	J	3.80E+00	J	1.06E+01	U	1.09E+01	U	3.30E+00	J	3.20E+00	J
Oil Range Organics	1.00E+03	3.00E+03	3.11E+03	**3.11E+03**		7.20E+00	J	3.69E+01		2.71E+01		1.90E+01		1.23E+01		8.40E+00	J	7.90E+00	J	6.50E+00	J	1.07E+01	U
Gasoline Range Organics[1]	NA	NA	6.38E+02	6.38E+02		1.10E-01		1.00E-01		3.60E-01		2.30E-01		2.20E-01		1.60E-01		1.70E-01		2.00E-01		1.80E-01	

Notes:

[1]Current NMED guidance does not provide screening levels for TPH-GRO. Current guidance (consistent with the 2012 guideance) dictates that TPH-GRO be evaluated based on the constituents of fuel (benzene, toluene, ethylbenzene, and xylenes). Therefore, no screening levels were included for TPH-GRO.

6.08E+03 = value exceeds NMED residential SSL

6.08E+03 = value exceeds NMED residential and industrial SSL

< = analytical result is less than the detection limit of the method utilized

J = estimated

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

U = nondetect

TABLE 4-5
SUMMARY OF 2013 SOIL EXCAVATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-BTM-24S		C107-BTM-22N		C107-N16-5WW		C107-N14-8EW		C107-S17-4WW	
DATE COLLECTED	**2015 NMED Residential SSL**	**2015 NMED Industrial SSL**	Maximum	January 12, 2013		January 12, 2013		January 12, 2013		January 12, 2013		January 12, 2013	
				Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
TOTAL PETROLEUM HYDROCARBONS (mg/kg)													
Diesel Range Organics	1.00E+03	3.00E+03	9.80E+01	3.09E+01		1.87E+01		7.30E+00		4.50E+00		1.07E+01	
Oil Range Organics	1.00E+03	3.00E+03	1.53E+02	3.35E+01	B	2.62E+01	B	1.22E+01	B	1.18E+01	B	1.79E+01	B

Notes:

< = analytical result is less than the detection limit of the method utilized

B = Analyte was found in analyticla blank as well as the sample.

J = estimated

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

U = nondetect

TABLE 4-5
SUMMARY OF 2013 SOIL EXCAVATION ANALYTICAL DATA
FT008
CANNON AFB, NEW MEXICO

FIELD ID				C107-S14-8EW		C107-E18-8NW		C107-E13-10SW		C107-W18-7SW		C107-W16-5NW	
DATE COLLECTED	**2015 NMED Residential SSL**	**2015 NMED Industrial SSL**	Maximum	January 12, 2013		January 12, 2013		January 12, 2013		January 12, 2013		January 12, 2013	
				Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
TOTAL PETROLEUM HYDROCARBONS (mg/kg)													
Diesel Range Organics	1.00E+03	3.00E+03	9.80E+01	5.86E+01		9.80E+01		7.60E+01		3.69E+01		5.10E+00	J
Oil Range Organics	1.00E+03	3.00E+03	1.53E+02	1.53E+02	B	1.02E+02	B	1.08E+02	B	4.20E+01	B	1.01E+01	JB

Notes:

< = analytical result is less than the detection limit of the method utilized

B = Analyte was found in analyticla blank as well as the sample.

J = estimated

mg/kg = milligrams per kilogram

NMED = New Mexico Environment Department

Qual = qualifier

SSL = Soil Screening Level

U = nondetect

TABLE 4-6
SUMMARY OF PLANNED SAMPLING LOCATIONS AND ANALYTICAL PARAMETERS
FT008
CANNON AFB, NEW MEXICO

Sample Location Identification	Approximate Sample Depth Interval (feet bgs)[1]	Analytical Parameters							Technical Rationale
		VOCs[2]	SVOCs[3]	TPH-DRO/TPH-ORO[4]	TAL Metals[5]	Pesticides[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]	
1071	0-1*	X	X	X	X	X			This sample will be collected to confirm or refute the historical surface contamination identified at 1071.
1073	0-1*	X	X	X	X	X			This sample will be collected to confirm or refute the historical surface contamination identified at 1073.
1074	0-1*	X	X	X	X	X		X	Samples will be collected to confirm or refute the historical contamination identified to 20 feet bgs at 1074. Additional samples will be collected to delineate the vertical extent of contamiantion at this boring location.
	4-5*	X	X	X	X	X			
	9-10*	X	X	X	X	X			
	19-20*	X	X	X	X	X			
	29-30*	X	X	X	X	X	X		
	39-40	X	X	X	X	X			
	49-50	X	X	X	X	X			
C107-SB03	0-4*	X	X	X	X	X			Samples will be collected to confirm or refute the historical contamination identified to 28 feet bgs at C107-SB03. Additional samples will be collected to delineate the vertical extent of contamiantion at this boring location.
	9-10*	X	X	X	X	X			
	14-15*	X	X	X	X	X			
	19-20*	X	X	X	X	X		X	
	24-25*	X	X	X	X	X			
	29-30	X	X	X	X	X			
	39-40	X	X	X	X	X			
C107-SB16	0-1	X	X	X	X	X			Samples will be collected to delineate the vertical and horizontal extent of contamination at FT008 as the result of historical fire training activities completed at the site.
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X	X		
C107-SB17	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X		X	
C107-SB18	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X	X		
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB19	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB20	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X	X		
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB21	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			

TABLE 4-6
SUMMARY OF PLANNED SAMPLING LOCATIONS AND ANALYTICAL PARAMETERS
FT008
CANNON AFB, NEW MEXICO

Sample Location Identification	Approximate Sample Depth Interval (feet bgs)[1]	Analytical Parameters							Technical Rationale
		VOCs[2]	SVOCs[3]	TPH-DRO/TPH-ORO[4]	TAL Metals[5]	Pesticides[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]	
C107-SB22	0-1	X	X	X	X	X			Samples will be collected to delineate the vertical and horizontal extent of contamination at FT008 as the result of historical fire training activities completed at the site.
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X	X		
	19-20	X	X	X	X	X			
C107-SB23	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X	X		
C107-SB24	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X		X	
	19-20	X	X	X	X	X			
C107-SB25	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X	X		
C107-SB26	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB27	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB28	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X	X		
C107-SB29	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X		X	
	19-20	X	X	X	X	X	X		
C107-SB30	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X	X		
C107-SB31	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			

TABLE 4-6
SUMMARY OF PLANNED SAMPLING LOCATIONS AND ANALYTICAL PARAMETERS
FT008
CANNON AFB, NEW MEXICO

Sample Location Identification	Approximate Sample Depth Interval (feet bgs)[1]	Analytical Parameters							Technical Rationale
		VOCs[2]	SVOCs[3]	TPH-DRO/TPH-ORO[4]	TAL Metals[5]	Pesticides[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]	
C107-SB32	0-1	X	X	X	X	X			Samples will be collected to delineate the vertical and horizontal extent of contamination at FT008 as the result of historical fire training activities completed at the site.
	4-5	X	X	X	X	X	X		
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB33	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB34	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB35	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB36	0-1	X	X	X	X	X	X		
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X		X	
	19-20	X	X	X	X	X			
C107-SB37	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB38	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB39	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X	X		
	19-20	X	X	X	X	X			
C107-SB40	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X	X		
	19-20	X	X	X	X	X			
C107-SB41	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			

TABLE 4-6
SUMMARY OF PLANNED SAMPLING LOCATIONS AND ANALYTICAL PARAMETERS
FT008
CANNON AFB, NEW MEXICO

Sample Location Identification	Approximate Sample Depth Interval (feet bgs)[1]	Analytical Parameters							Technical Rationale
		VOCs[2]	SVOCs[3]	TPH-DRO/TPH-ORO[4]	TAL Metals[5]	Pesticides[6]	Field Duplicate Samples[7]	MS/MSD Samples[8]	
C107-SB42	0-1	X	X	X	X	X			Samples will be collected to delineate the vertical and horizontal extent of contamination at FT008 as the result of historical fire training activities completed at the site.
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB43	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X		X	
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB44	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
C107-SB45	0-1	X	X	X	X	X			
	4-5	X	X	X	X	X			
	9-10	X	X	X	X	X			
	19-20	X	X	X	X	X			
	Totals	**136**	**136**	**136**	**136**	**136**	**14**	**7**	

Notes:

[1]The sample depth intervals may be altered based on field screening results.

[2]VOC analysis via USEPA Method 8260B

[3]SVOC analysis via USEPA Method 8270D

[4]TPH-DRO/TPH-ORO analysis via USEPA Method 8015C

[5]TAL metals analysis via USEPA Method 6010C and 7471B

[6]Pesticides analysis via USEPA Method 8081A

[7]Field duplicate samples will be collected at a rate of 10 percent (1 per 10 samples collected) for laboratory analysis.

[8]MS/MSD samples will be collected at a rate of 5 percent (1 per 20 samples collected) for laboratory analysis.

bgs = below ground surface

MS/MSD = matrix spike/matrix spike duplicate

SB = soil boring

SVOC = semivolatile organic compound

TAL = total analyte list

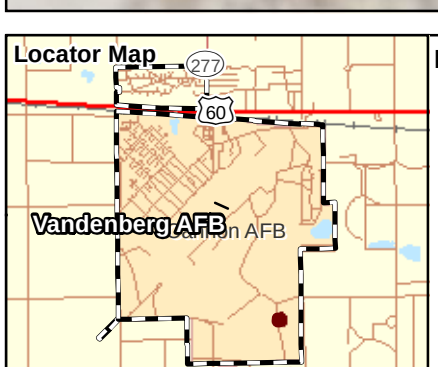
TPH-DRO = total petroleum hydrocarbons-diesel range organics

TPH-ORO = total petroleum hydrocarbons-oil range organics

USEPA = United States Environmental Protection Agency

VOC = volatile organic compounds

X = Sample will be collected



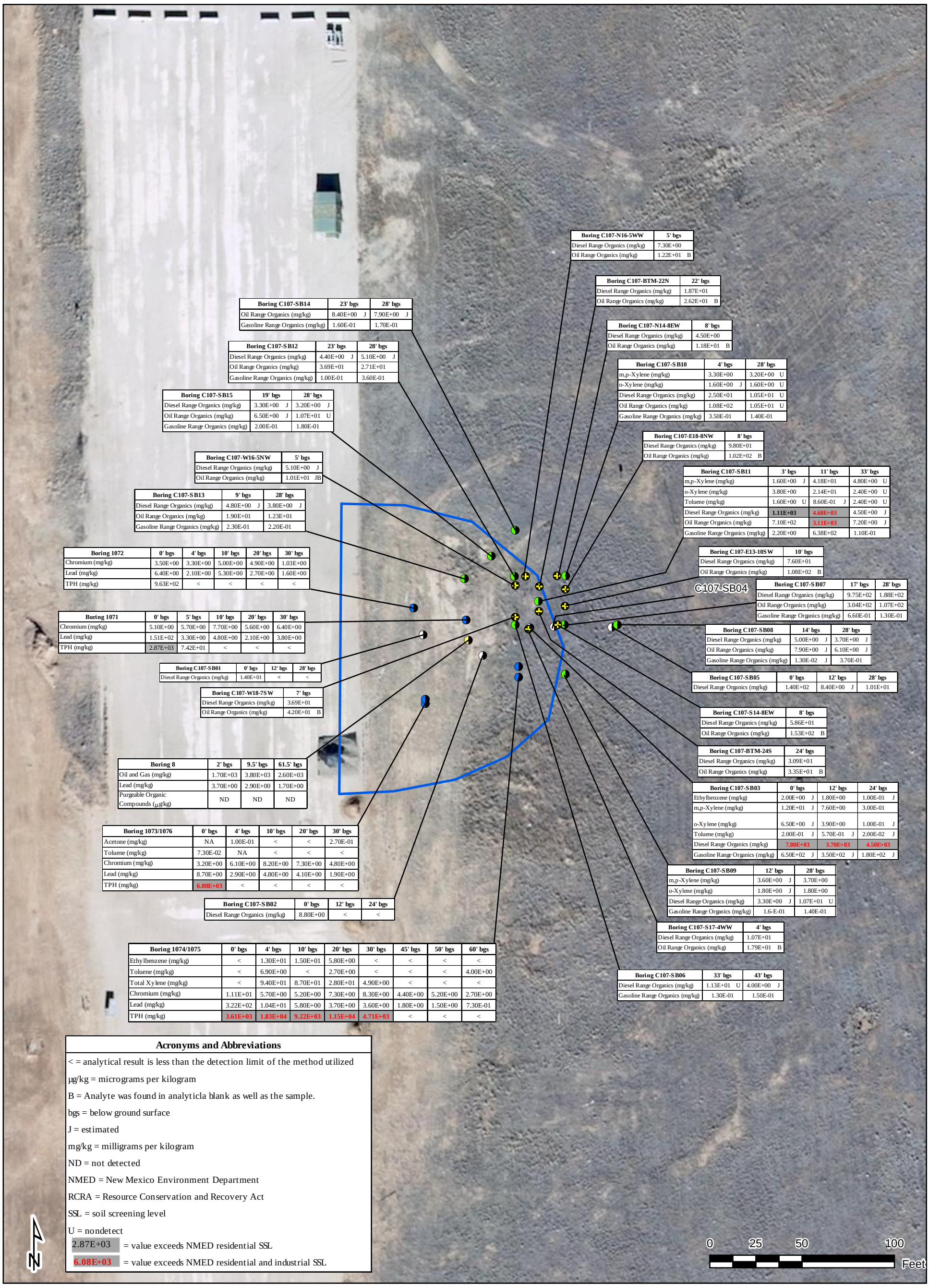
Legend

- 2013 Remediatron (EMR 2013)
- 2012 Remedial Investigation (EMR 2013)
- 2009 RCRA Facility Investigation (URS 2009)
- 1992 Remedial Investaigation (W-C 1992)
- 1986 Phase II Installation Restoration Program (Radian 1986)
- SWMU Boundary
- Installation Boundary

URS

Previous Investigation Sampling Locations
Cannon Air Force Base, New Mexico

Drawn By: JM	Date: 11/19/2015	**Figure 4-1**
Checked By: PW	Project No. 60440693	



Boring C107-N16-5WW	5' bgs
Diesel Range Organics (mg/kg)	7.30E+00
Oil Range Organics (mg/kg)	1.22E+01 B

Boring C107-BTM-22N	22' bgs
Diesel Range Organics (mg/kg)	1.87E+01
Oil Range Organics (mg/kg)	2.62E+01 B

Boring C107-SB14	23' bgs	28' bgs
Oil Range Organics (mg/kg)	8.40E+00 J	7.90E+00 J
Gasoline Range Organics (mg/kg)	1.60E-01	1.70E-01

Boring C107-N14-8EW	8' bgs
Diesel Range Organics (mg/kg)	4.50E+00
Oil Range Organics (mg/kg)	1.18E+01 B

Boring C107-SB12	23' bgs	28' bgs
Diesel Range Organics (mg/kg)	4.40E+00 J	5.10E+00 J
Oil Range Organics (mg/kg)	3.69E+01	2.71E+01
Gasoline Range Organics (mg/kg)	1.00E-01	3.60E-01

Boring C107-SB10	4' bgs	28' bgs
m,p-Xylene (mg/kg)	3.30E+00	3.20E+00 U
o-Xylene (mg/kg)	1.60E+00 J	1.60E+00 U
Diesel Range Organics (mg/kg)	2.50E+01	1.05E+01 U
Oil Range Organics (mg/kg)	1.08E+02	1.05E+01 U
Gasoline Range Organics (mg/kg)	3.50E-01	1.40E-01

Boring C107-SB15	19' bgs	28' bgs
Diesel Range Organics (mg/kg)	3.30E+00 J	3.20E+00 J
Oil Range Organics (mg/kg)	6.50E+00 J	1.07E+01 U
Gasoline Range Organics (mg/kg)	2.00E-01	1.80E-01

Boring C107-E18-8NW	8' bgs
Diesel Range Organics (mg/kg)	9.80E+01
Oil Range Organics (mg/kg)	1.02E+02 B

Boring C107-W16-5NW	5' bgs
Diesel Range Organics (mg/kg)	5.10E+00 J
Oil Range Organics (mg/kg)	1.01E+01 JB

Boring C107-SB11	3' bgs	11' bgs	33' bgs
m,p-Xylene (mg/kg)	1.60E+00 J	4.18E+01	4.80E+00 U
o-Xylene (mg/kg)	3.80E+00	2.14E+01	2.40E+00 U
Toluene (mg/kg)	1.60E+00 U	8.60E-01 J	2.40E+00 U
Diesel Range Organics (mg/kg)	**1.11E+03**	**4.68E+03**	4.50E+00 J
Oil Range Organics (mg/kg)	7.10E+02	**3.11E+03**	7.20E+00 J
Gasoline Range Organics (mg/kg)	2.20E+00	6.38E+02	1.10E-01

Boring C107-SB13	9' bgs	28' bgs
Diesel Range Organics (mg/kg)	4.80E+00 J	3.80E+00 J
Oil Range Organics (mg/kg)	1.90E+01	1.23E+01
Gasoline Range Organics (mg/kg)	2.30E-01	2.20E-01

Boring C107-E13-10SW	10' bgs
Diesel Range Organics (mg/kg)	7.60E+01
Oil Range Organics (mg/kg)	1.08E+02 B

Boring 1072	0' bgs	4' bgs	10' bgs	20' bgs	30' bgs
Chromium (mg/kg)	3.50E+00	3.30E+00	5.00E+00	4.90E+00	1.03E+00
Lead (mg/kg)	6.40E+00	2.10E+00	5.30E+00	2.70E+00	1.60E+00
TPH (mg/kg)	9.63E+02	<	<	<	<

Boring C107-SB07	17' bgs	28' bgs
Diesel Range Organics (mg/kg)	9.75E+02	1.88E+02
Oil Range Organics (mg/kg)	3.04E+02	1.07E+02
Gasoline Range Organics (mg/kg)	6.60E-01	1.30E-01

Boring 1071	0' bgs	5' bgs	10' bgs	20' bgs	30' bgs
Chromium (mg/kg)	5.10E+00	5.70E+00	7.70E+00	5.60E+00	6.40E+00
Lead (mg/kg)	1.51E+02	3.30E+00	4.80E+00	2.10E+00	3.80E+00
TPH (mg/kg)	2.87E+03	7.42E+01	<	<	<

Boring C107-SB08	14' bgs	28' bgs
Diesel Range Organics (mg/kg)	5.00E+00 J	3.70E+00 J
Oil Range Organics (mg/kg)	7.90E+00 J	6.10E+00 J
Gasoline Range Organics (mg/kg)	1.30E-02 J	3.70E-01

Boring C107-SB01	0' bgs	12' bgs	28' bgs
Diesel Range Organics (mg/kg)	1.40E+01	<	<

Boring C107-SB05	0' bgs	12' bgs	28' bgs
Diesel Range Organics (mg/kg)	1.40E+02	8.40E+00 J	1.01E+01

Boring C107-W18-7SW	7' bgs
Diesel Range Organics (mg/kg)	3.69E+01
Oil Range Organics (mg/kg)	4.20E+01 B

Boring C107-S14-8EW	8' bgs
Diesel Range Organics (mg/kg)	5.86E+01
Oil Range Organics (mg/kg)	1.53E+02 B

Boring C107-BTM-24S	24' bgs
Diesel Range Organics (mg/kg)	3.09E+01
Oil Range Organics (mg/kg)	3.35E+01 B

Boring 8	2' bgs	9.5' bgs	61.5' bgs
Oil and Gas (mg/kg)	1.70E+03	3.80E+03	2.60E+03
Lead (mg/kg)	3.70E+00	2.90E+00	1.70E+00
Purgeable Organic Compounds (µg/kg)	ND	ND	ND

Boring C107-SB03	0' bgs	12' bgs	24' bgs
Ethylbenzene (mg/kg)	2.00E+00 J	1.80E+00	1.00E-01 J
m,p-Xylene (mg/kg)	1.20E+01 J	7.60E+00	3.00E-01
o-Xylene (mg/kg)	6.50E+00 J	3.90E+00	1.00E-01 J
Toluene (mg/kg)	2.00E-01 J	5.70E-01 J	2.00E-02 J
Diesel Range Organics (mg/kg)	**7.80E+03**	**3.70E+03**	**4.50E+03**
Gasoline Range Organics (mg/kg)	6.50E+02 J	3.50E+02 J	1.80E+02 J

Boring 1073/1076	0' bgs	4' bgs	10' bgs	20' bgs	30' bgs
Acetone (mg/kg)	NA	1.00E-01	<	<	2.70E-01
Toluene (mg/kg)	7.30E-02	NA	<	<	<
Chromium (mg/kg)	3.20E+00	6.10E+00	8.20E+00	7.30E+00	4.80E+00
Lead (mg/kg)	8.70E+00	2.90E+00	4.80E+00	4.10E+00	1.90E+00
TPH (mg/kg)	**6.08E+03**	<	<	<	<

Boring C107-SB09	12' bgs	28' bgs
m,p-Xylene (mg/kg)	3.60E+00 J	3.70E+00
o-Xylene (mg/kg)	1.80E+00 J	1.80E+00
Diesel Range Organics (mg/kg)	3.30E+00 J	1.07E+01 U
Gasoline Range Organics (mg/kg)	1.6-E-01	1.40E-01

Boring C107-SB02	0' bgs	12' bgs	24' bgs
Diesel Range Organics (mg/kg)	8.80E+00	<	<

Boring C107-S17-4WW	4' bgs
Diesel Range Organics (mg/kg)	1.07E+01
Oil Range Organics (mg/kg)	1.79E+01 B

Boring 1074/1075	0' bgs	4' bgs	10' bgs	20' bgs	30' bgs	45' bgs	50' bgs	60' bgs
Ethylbenzene (mg/kg)	<	1.30E+01	1.50E+01	5.80E+00	<	<	<	<
Toluene (mg/kg)	<	6.90E+00	<	2.70E+00	<	<	<	4.00E+00
Total Xylene (mg/kg)	<	9.40E+01	8.70E+01	2.80E+01	4.90E+00	<	<	<
Chromium (mg/kg)	1.11E+01	5.70E+00	5.20E+00	7.30E+00	8.30E+00	4.40E+00	5.20E+00	2.70E+00
Lead (mg/kg)	3.22E+02	1.04E+01	5.80E+00	3.70E+00	3.60E+00	1.80E+00	1.50E+00	7.30E-01
TPH (mg/kg)	**3.61E+03**	**1.83E+04**	**9.22E+03**	**1.15E+04**	**4.71E+03**	<	<	<

Boring C107-SB06	33' bgs	43' bgs
Diesel Range Organics (mg/kg)	1.13E+01 U	4.00E+00 J
Gasoline Range Organics (mg/kg)	1.30E-01	1.50E-01

Acronyms and Abbreviations

< = analytical result is less than the detection limit of the method utilized

µg/kg = micrograms per kilogram

B = Analyte was found in analyticla blank as well as the sample.

bgs = below ground surface

J = estimated

mg/kg = milligrams per kilogram

ND = not detected

NMED = New Mexico Environment Department

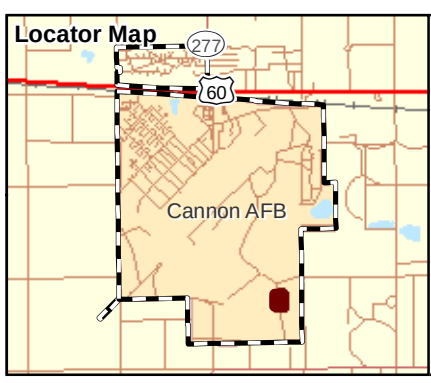
RCRA = Resource Conservation and Recovery Act

SSL = soil screening level

U = nondetect

2.87E+03 = value exceeds NMED residential SSL

6.08E+03 = value exceeds NMED residential and industrial SSL



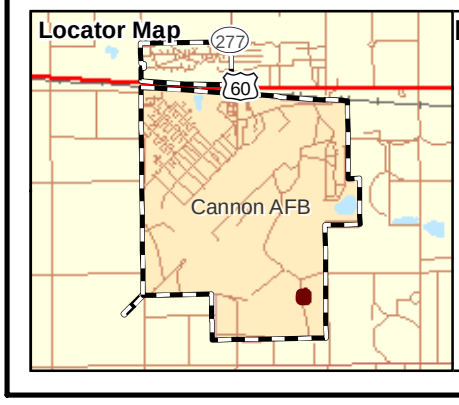
Legend

- 2013 Remediatron (EMR 2013)
- 2012 Remedial Investigation (EMR 2013)
- 2009 RCRA Facility Investigation (URS 2009)
- 1992 Remedial Investaigation (W-C 1992)
- 1986 Phase II Installation Restoration Program (Radian 1986)
- SWMU
- Installation Boundary

URS

Historical Sampling Results Exceeding Detection Limits
Cannon Air Force Base, New Mexico

Drawn By: JM	Date: 12/3/2015	**Figure 4-2**
Checked By: PW	Project No. 60440693	



Legend

- 2013 Remediatron (EMR 2013)
- 2012 Remedial Investigation (EMR 2013)
- 2009 RCRA Facility Investigation (URS 2009)
- 1992 Remedial Investaigation (W-C 1992)
- 1986 Phase II Installation Restoration Program (Radian 1986)
- Proposed Soil Sample Location
- SWMU
- Installation Boundary

URS

Planned Soil Sampling Locations
Cannon Air Force Base,
New Mexico

Drawn By: JM	Date: 11/24/2015	**Figure 4-3**
Checked By: PW	Project No. 60440693	

5.1 MOBILIZATION

Mobilization of equipment and personnel will be completed prior to the start of field activities. The mobilization activities will include, but are not limited to, the tasks described in the following sections.

5.1.1 Acquire Base Passes

Field personnel and subcontractors will coordinate with the Cannon AFB RPM to acquire passes that will allow entry onto Cannon AFB to complete the planned activities.

5.1.1.1 Contractor Identification

Prior to the initiation of each field investigation, AECOM personnel and all subcontractors on-site will be identified to appropriate personnel within the 27th Civil Engineer Squadron's Environmental Flight (27 SOCES/CEIER). 27 SOCES/CEIER will make all arrangements to notify base personnel and security of the pending field investigation. It is likely that on-site AECOM personnel and subcontractors will be issued base visitor passes, which they will be required to have with them at all times while on base. In addition, all AECOM personnel and AECOM subcontractors may be required to attend a safety briefing provided by the Base.

5.1.1.2 Vehicle Passes

All vehicles that enter the Base must be registered at the Main Gate, and obtain and display a vehicle permit tag from base security. The vehicle registration applicant will need to furnish proof of insurance, rental agreement (if applicable), a valid driver's license, and the contract number to register a vehicle. The tag shall be displayed in the lower driver's side corner of the windshield.

5.1.2 Facility Safety Requirements

AECOM will take preventative measures required for safe work activities at Cannon AFB. AECOM will follow all procedures necessary to ensure that the safe practices employed comply with Occupational Safety and Health Administration (OSHA), American National Standards Institute, and Cannon AFB regulations.

AECOM will provide an SSO at all times during completion of the investigations. The SSO, as well as all project personnel, will observe the safety procedures to provide a safe work environment.

Prior to the start of field activities, a site walk will be completed to identify possible safety concerns. Possible safety concerns may include physical hazards (e.g., underground/overhead utilities, holes, or uneven terrain), biological hazards, or explosives hazards (e.g., unexploded ordinance [UXO]). If UXO is encountered during this or any phase of work at Cannon AFB, all work will stop and the AECOM PM, Health and Safety Representative, and the UXO Corporate Safety Manager (Mac Reed, 615-224-2148) will immediately be notified. Cannon AFB and

AFCEC will immediately be notified by the AECOM PM. In general, the following munitions and explosives of concern (MEC) safety protocol will be followed:

- DO NOT touch or move any ordnance items regardless of the markings or apparent condition.
- DO NOT be misled by markings on the MEC item stating "practice bomb," "dummy," or "inert." Even practice bombs have explosive charges that are used to mark and/or spot the point of impact; or the item could be marked incorrectly.
- The age or condition of a MEC item does not decrease the effectiveness. MEC that has been exposed to the elements for an extended period of time becomes more sensitive to shock, movement, and friction because the stabilizing agent in the explosives may be degraded.
- Consider MEC that has been exposed to fire as extremely hazardous. Chemical and physical changes to the contents may have occurred that render it more sensitive than it was in its original state.
- DO NOT use radio or cellular phones in the vicinity of suspect MEC items.
- DO NOT drive vehicles into a suspected MEC area; use clearly marked lanes.
- DO NOT carry matches, cigarettes, lighters or other flame-producing devices into a MEC site.
- Always assume MEC items contain a live charge until determined otherwise.

5.1.3 Locate Utilities

AECOM will obtain utility clearances prior to the start of any intrusive activities. Utility locates will be coordinated with the Cannon AFB RPM. The utility clearances will be requested sufficiently in advance and will be completed by 27 SOCES. All underground utilities identified will be marked with flagging, stakes, and/or paint. All utility location tasks will be documented in the field logbook to aid in subsequent work. No intrusive work using heavy equipment will be completed within 5 feet of an active utility.

Digging permits will be obtained for all subsurface activities prior to initiating the work. Digging permits will be obtained through the appropriate United States Air Force (USAF) representative. When any intrusive work is being performed in the vicinity of utility and/or communication cables/lines, Civil Engineering and/or Communication monitoring personnel, as required, will be present. If a utility and/or communication line is damaged, the designated representative of the USAF shall be notified immediately for further directions.

Notice will be given to the monitoring personnel no later than 24 hours prior to work. No work shall start if the required monitoring personnel are not present.

5.1.4 Surveying of Soil Borings

Soil borings will be recorded in the field using a hand held global positioning system (GPS) unit. The GPS unit will have sub-meter accuracy. The horizontal survey coordinates will reference

the North American Datum of 1983 State Plane Coordinate System (i.e., New Mexico East, Federal Information Processing Standard 3001 [in survey feet]). Prior to the start of field activities, the GPS unit will be calibrated to a known reference point located at Cannon AFB. The results of the calibration will be recorded in the field logbook. Final sampling locations may be adjusted from the planned boring locations depicted on **Figure 4-3** in the field based on site conditions (i.e., underground/overhead utilities, access restrictions, permanent site features, etc.).

5.2 SURFACE SOIL SAMPLE COLLECTION

Surface soil samples (identified as SS) will be collected to determine if potential contamination exists in the upper 0 to 0.5 feet bgs. Surface soil samples will be collected by hand using either stainless-steel hand utensils or hand auger. Surface soil sample collection methods are provided in the following sections.

5.2.1 Surface Soil Sampling Using Hand Utensils

This method of soil sample collection is to be used at Cannon AFB in situations where conditions will not permit the use of auger or drilling methods. Soil samples will be collected from 0 to 0.5 feet bgs using a stainless steel spoon and stainless steel bowl. Before the sampling begins, vegetation or surface debris such as rock, will be cleared as necessary. When collecting surface soil samples, if additional soil is necessary to fill sample jars, the sample area will be expanded without increasing depth.

5.2.2 Surface Soil Sampling Using a Hand Auger

This method of soil sample collection is to be used at Cannon AFB in situations where conditions will not permit the use of hand utensils or drilling methods. Hand auger samples will be collected at the specified depth using a stainless steel hand auger with a minimum 3-inch outer diameter (OD) bucket. Before the augering activities, vegetation and any surface debris such as rocks will be cleared, as necessary. When collecting surface soil samples, if additional soil is necessary to fill sample jars, an additional borehole will be advanced adjacent to the initial borehole, without increasing depth.

5.2.3 Surface Soil Analytical Sample Collection

Surface soil sample collection will begin by recording the boring location on a site map and in the field logbook. Once the sample has been collected at the specified depths, the recovery will be measured and the soil classified. Soil to be analyzed will be collected via a grab sample from a discrete sample interval and transferred to appropriate laboratory-provided sample containers. Laboratory samples will be placed on ice in a cooler immediately following collection, in order to attain a temperature of 4°C. Based on the contaminants identified at FT008 addressed in this RFI by prior investigations, soil samples will be analyzed as follows:

- TPH-DRO and TPH-ORO by USEPA Method 8015C
- VOCs by USEPA Method 8260B

- SVOCs by USEPA Method 8270D
- TAL Metals by USEPA Method 6010C and 7471B
- Pesticides by USEPA Method 8081A

Surface soil samples will be submitted to Test America for analysis. Surface soil samples submitted to Test America will be extracted and analyzed for analytical parameters within maximum hold times. A complete list of maximum hold times for each analyte is provided in **Appendix A**.

Final surface soil sampling locations will be photographed and located using a hand held GPS. Surface soil sample locations will be backfilled with soil. Surface soil samples will be collected at selected sites, as described in the site specific sampling objectives provided in **Section 4**.

5.3 SUBSURFACE DRILLING AND SOIL SAMPLING

Subsurface drilling will be completed using direct push technology. At subsurface sample locations where pavement is present, a core machine with a diamond-tipped core barrel will be used to access the subsurface. Soil borings will be continuously sampled and each boring will be logged by the AECOM field geologist. Direct push technology was selected as the preferred sampling methodology in lieu of hollow stem auger, based on AECOM's previous drilling and sampling experience at Cannon AFB. It is also AECOM's experience that direct push technology is approved by NMED for subsurface soil sampling. The direct push contractor (to be determined [TBD]) will complete the direct push sampling with oversight by the AECOM field manager. If direct push methods are unable to reach required sample depths, then a drilling rig with hollow stem auger and air-rotary capabilities will be used to advance the boring through the caliche layer in order to obtain samples from the required depths. The drilling contractor (TBD) will complete the drill rig sampling, with oversight by the AECOM Field Manager.

Subsurface soil samples (identified as SB) will be collected to determine if potential contamination exists in the subsurface and to help further define the extent of known contamination in the subsurface. Subsurface soil samples will be collected using the Geoprobe Macro-Core sampler with 1.5-inch diameter, 5-foot-long, clear acetate liners. If hollow stem auger methods are employed, then samples will be collected continuously using a 2-foot-long, 2-inch diameter stainless steel, split-barrel sampler. As a last resort, air-rotary drilling methods will be employed in order to advance borings through the caliche layer. Subsurface drilling and soil sampling will be completed using the equipment and field procedures described in the following sub-sections.

5.3.1 Direct Push Sampling Procedures

Direct push sampling will be used to collect continuous or discrete soil samples. Direct push technology involves the use of probing tools that are advanced using a combination of the static weight of the carrier vehicle and hydraulic hammer percussion. Continuous soil samples will be collected with a Dual Tube soil sampler or a Macro-Core® sampler (closed-piston system) or equivalent. Discrete soil samples will be collected with a Macro-Core® sampler or equivalent.

Direct push soil sample will be collected in clear acetate liners. Sample collection methods will be determined by site-specific geological conditions.

5.3.2 Drill Rig Sampling Procedures

If direct push methods are unable to reach required sample depths, then a drilling rig with hollow stem auger and air-rotary capabilities will be used to advance the boring through the caliche layer in order to obtain samples from the required depths. Hollow stem auger drilling will be accomplished using machine-driven hollow stem flight augers with a 4.25-inch minimum inside diameter to accommodate a 2-inch outside diameter stainless-steel split spoon sampler. Where necessary for sample recovery, the sampler will also be equipped with a sample retainer.

As a last resort, air-rotary drilling methods will be employed in order to advance borings through the caliche layer. Air-rotary drilling will be accomplished using a 9-inch diameter wing bit and 4-inch outside diameter rods. Samples will then be collected using a two-inch diameter stainless steel split-spoon.

5.3.3 Subsurface Soil Analytical Sample Collection

Analytical soil samples will be collected using continuous sampling methods. Subsurface soil sample collection will begin by recording the boring location on a site map and in the field logbook. Once the sample has been collected at the specified depths, the recovery will be measured and the soil classified. Soil to be analyzed will be collected via a grab sample from a discrete sample interval and transferred to appropriate laboratory-provided sample containers. Laboratory samples will be placed on ice in a cooler immediately following collection, in order to attain a temperature of 4°C.

Samples submitted for laboratory analysis will generally be selected based on the results of field screening, as summarized below:

- If PID field screening results from a particular interval within a 5-foot-long sample are elevated, then the grab sample will be collected from that interval and the discrete sample interval will be documented.
- If no elevated PID readings are obtained from a 5-foot interval, then the grab sample will be collected based on visual observations (if possible), and the discrete sample interval will be documented.
- If no elevated PID readings are obtained and no visual evidence of possible contamination is encountered, then the grab sample will be collected from the bottom foot of the intervals identified in **Table 4-2**.

Subsurface soil samples will be sent to Test America, located at 4955 Yarrow Street, Arvada, Colorado 80002, via FedEx. Subsurface soil samples submitted to Test America will be extracted and analyzed for analytical parameters within maximum hold times. A complete list of maximum hold times for each analyte is provided in **Appendix A**.

Final subsurface soil sampling locations will be photographed and located using a hand held GPS. Subsurface soil sample locations will be abandoned by backfilling the boreholes with hydrated bentonite. Subsurface soil samples will be collected at selected sites, as described in the site-specific sampling objectives provided in **Section 4**.

5.4 FIELD SCREENING AND HEADSPACE ANALYSIS

Subsurface soil samples collected in 5-foot-long clear acetate lines will be field screened with a MiniRae 2000 PID (or equivalent) for signs of potential contamination. Field screening will involve placing a small portion of soil from the liner or split-barrel sampler into a plastic sample bag for headspace analysis. The plastic bag containing the headspace sample will be sealed and shaken to expose the soil to air trapped in the bag. After a minimum of 5 minutes, a headspace reading will be taken by inserting the probe of the instrument into the bag through a small opening. The highest reading obtained for each 5-foot interval (and the depth at which the reading was obtained) will be recorded on the boring log and in the field logbook. In addition to the field screening with a PID, any odor or discoloration (from potential contamination) will be noted in the boring log. Final soil sample depths will be determined in the field based on headspace results and any odors or discoloration observed.

Headspace analysis will also be completed for every surface and subsurface soil sample collected. The results of field screening and headspace analysis will be recorded on the boring logs and in the field logbook.

5.5 SAMPLE IDENTIFICATION, HANDLING, AND DOCUMENTATION

The following sections briefly describe sample management procedures to be used for the work described in this plan.

5.5.1 Field Documentation

Documentation of observations and data acquired in the field will be of sufficient detail to provide information on the sample acquisition and provide a permanent record of field activities. The observations and data will be recorded with waterproof ink in a permanently bound, weatherproof field logbook with consecutively numbered pages.

5.5.1.1 Field Logbook Modifications and Signatures

Sufficient information will be recorded to allow the sampling event to be reconstructed without relying on the collector's memory. The person making the entry will sign each page in the field book at the end of the day. Changes or deletions in the field logbook will be lined out with a single strike mark and will remain legible. Changes/entries made in another person's field book will be sign and dated.

5.5.1.2 Boring Logs

Boring logs will be completed for each boring by qualified personnel (geologist, geological engineer, or geotechnical engineer). Boring logs will include boring location, boring identification, drilling equipment and method, date started and completed, completion depth, logger, description of lithologies (using Unified Soil Classification System), blow counts (if appropriate), samples collected for laboratory analysis by depth, sample recovery, field screening results, origin of the lithologies (e.g., fill, loess, glacial till, glacial outwash, alluvium or colluvium, etc.), and other remarks or observations.

5.5.1.3 Sample Collection Field Sheets

As part of the field documentation, Sample Collection Field Sheets (SCFSs) will be generated for all soil samples collected for this project. The SCFS will summarize the sample collection data (i.e., parameters), sample identification, time and date collected, container type(s), QA/QC samples, physical description, and name of sampler(s).

5.5.1.4 Sample Chain of Custody

During field sampling activities, sample tracking will be maintained from the time the samples are collected until the time at which the laboratory data are issued. Initial information concerning collection of the sample(s) will be recorded in the field logbook as described above. Information on the custody, transfer, handling, and shipping of samples to an off-site laboratory will be recorded on a chain of custody (CoC) form.

The sampler will be responsible for initiating and filling out the CoC form. The person responsible for packaging samples for delivery to the off-site laboratory will sign the CoC form, retain the last copy of the three-part form, document the method of shipment, and send the original and the second copy of the CoC form with the samples. A custody seal will be placed on each sample cooler prior to transfer of the cooler to the delivery company (i.e., FedEx) or the laboratory. Upon receipt of the cooler by the laboratory, the person receiving the samples will sign the CoC form and return the second copy.

5.5.2 Sample Identification

Samples collected during site activities will have discrete sample identification numbers. These numbers are necessary to identify and track each of the samples collected for analysis during this project. In addition, the sample identification numbers will be used to identify and retrieve the analytical results received from the laboratory.

Each sample will be identified by a unique code that generally indicates the site, sampling location, sample type, and either sampling event or sampling depth. The sample designation for each analytical and QA/QC sample is a three-letter and seven-digit/letter unique identification (C###-YYYY-ZZZ). “C-###” is the facility and site identifier, with “C” for Cannon AFB and “###” representing the SWMU number identifying this site. The sample designation for FT008 will start as “C107-.”

The next four characters (YYYY) identify the sampling method and specific sampled locations. The first two characters will present the method of sampling. “SB” for soil boring will be used as the first two characters. The last two characters will identify the sample location. Samples from the third soil boring at FT008 would be identified as "C107-SB-03-". For those sites where 100 or more samples will be collected, five characters will be utilized instead of four with the last three numbers identifying the sample location.

The last set of three numbers (ZZZ) is the sample identifier. The first number indicates the type of sample:

- 0 for a soil (analytical) sample
- 1 for a soil MS/MSD
- 2 for a field duplicate

The last two numbers correspond to the depth of the sample in feet bgs for all soil samples. Multiple soil samples may be collected from the same boring. The last two digits differentiate among these multiple samples and represent the approximate depth (rounded up to the nearest foot) at which the sample was collected. Should samples be collected at depths of 100 feet bgs or deeper, four characters will be utilized instead of three with the last three numbers identifying the sample depths.

The MS/MSD should also be labeled the same as the original sample but will have “MS/MSD” written on the label.

The following is an example of an identification number and the data it should convey:

> **C107-SB03-001** = Cannon AFB Site FT008, Soil Boring Number 3, a soil analytical sample collected from a depth of 1 foot bgs.

5.5.3 Sample Labeling and Handling

All sample labels will be filled out using waterproof ink, and each label will contain the following information: sampler’s initials, project name, sample identification, date and time of sample collection, method of preservation used, and sample matrix. Samples for constituents will be collected and transferred to the appropriate sampling containers in accordance with the methods described in **Section 5**. The analytical laboratory will provide commercially cleaned containers. After collection, samples will be labeled as described above and placed into iced coolers. Coolers will be sealed with a custody seal and shipped to the contract laboratory. CoC forms will be maintained to document sample handling between the field and the laboratory. The appropriate sample containers, preservation and holding times for the planned samples to be analyzed by the designated laboratory are included in **Appendix A**.

5.6 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

QA/QC samples will be collected according to the following schedule:

- QC blind field duplicates will be collected at a frequency of at least 10 percent of the total field samples. These samples will be submitted to the contract laboratory.
- MS/MSD field samples will be collected at a frequency of at least 5 percent and will be submitted to the contract laboratory.
- Proficiency evaluation (PE) samples will be obtained from a certified provider and submitted to the contract laboratory as a one-time event. PE samples will be obtained and submitted for the full analyte list presented previously. Additional information regarding PE samples is provided in the Uniform Federal Policy–Quality Assurance Project Plan.

The anticipated distribution of the QA/QC samples to be collected is listed in **Table 4-6**.

5.7 EQUIPMENT AND PERSONNEL DECONTAMINATION

All sampling equipment will be decontaminated before starting work and after the collection of each individual sample. Sampling equipment decontamination will be done at the site.

The overall objective of a multimedia sampling program is to obtain samples that accurately depict the chemical, physical, and/or biological conditions at the sampling site. Extraneous contaminants can be brought onto the sampling location and/or introduced into the medium of interest during the sampling program (e.g. using sampling equipment that is not properly or fully decontaminated). Trace quantities of contaminants can consequently be captured in a sample and lead to false positive analytical results and, ultimately, to an incorrect assessment of the contaminant conditions associated with the site. Decontamination of sampling equipment (e.g., all non-disposable equipment that will come in direct contact with samples) and field support equipment (e.g., drill rigs, vehicles) is, therefore, required prior to, between, and after uses at Cannon AFB to ensure that sampling cross-contamination is prevented, and that on-site contaminants are not carried off site.

The following sections present equipment decontamination procedures.

5.7.1 Sampling Equipment

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable safety equipment to reduce personal exposure.
- Gross contamination on equipment will be scraped off at the sampling site.
- Equipment that cannot be damaged by water will be placed in a wash tub containing Alconox or low-sudsing non-phosphate detergent along with potable water and scrubbed with a bristle brush or similar utensil. Equipment will be rinsed with tap water in a second wash tub followed by a de-ionized water rinse.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and rinsed with de-ionized water. Care will be taken to prevent equipment damage.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent contact with contaminated soil. If the equipment is not used immediately after decontamination, the equipment will be covered or wrapped in plastic sheeting, foil, or heavy-duty trash bags to minimize potential contact with contaminants.

5.7.2 Drilling and Heavy Equipment

Drilling rigs and excavating equipment will be decontaminated at the decontamination station located near the staging area. Mobile decontamination trailers may be used to decontaminate heavy equipment at each site. The following steps will be used to decontaminate drilling and heavy equipment:

- Personnel will dress in suitable personal protective equipment (PPE) to reduce personal exposure.
- Personnel will scrape equipment showing gross contamination or having caked-on drill cuttings with a flat-bladed scraper at the sampling or construction site.
- Personnel will wash equipment that cannot be damaged by water, such as drill rigs, augers, drill bits, and shovels, with a hot water, high-pressure sprayer then rinse with potable water. Care will be taken to clean the insides of the hollow stem augers.

Following decontamination, drilling equipment will be placed on the clean drill rig and moved to a clean area. If the equipment is not used immediately, it should be stored in a designated clean area.

5.7.3 Equipment Leaving the Site

Vehicles used for activities in non-contaminated areas will be cleaned on an as-needed basis, as determined by the SSO, using soap and water on the outside and vacuuming the inside. On-site cleaning will be required for very dirty vehicles before leaving the area. Construction equipment such as trucks, drilling rigs, trailer, etc., will be pressure washed in a designated decontamination area at each site before the equipment is removed from the site to limit exposure of off-site personnel to potential contaminants.

5.7.4 Decontamination Solutions

A decontamination solution should be capable of removing, or converting to a harmless substance, the contaminant of concern without harming the object being decontaminated. The preferred solution is a mixture of detergent and water, which is a relatively safe option compared to chemical decontaminants. A solution recommended for decontaminating consists of 1 to 1.5 tablespoons of Alconox per gallon of warm water. Skin surfaces will be decontaminated by washing with hand soap and water. The decontamination solution will be changed when it no longer foams or when it becomes extremely dirty. Rinse water will be changed when it becomes discolored, begins to foam, or when the decontamination solution cannot be removed.

5.7.5 Responsible Authority

Decontamination operations at each hazardous waste site will be supervised by the SSO. The SSO is responsible for ensuring that all personnel follow decontamination procedures and that all contaminated equipment is adequately decontaminated. The SSO is also responsible for maintaining the decontamination zone and managing the wastes generated from the decontamination process.

Site activities will be conducted with the general goal of preventing the contamination of people and equipment. Using remote sampling techniques, bagging monitoring instruments, avoiding contact with obvious contamination, and employing dust suppression methods that would reduce the probability of becoming contaminated and, therefore, reduce the need and extent of decontamination. However, some type of decontamination will always be required on site.

OSHA requires that proper PPE be worn when operating steam or pressure washing equipment. A rain suit, boots, hard hat, and a face shield are recommended. All personnel must be kept out of the path of steam or water spray.

5.7.6 Wastewater

Liquid wastewater from decontamination will be containerized and analyzed for COPCs identified at the site as described in **Section 5.8**.

5.7.7 Documentation

Sampling personnel will be responsible for documenting the decontamination of sampling and drilling equipment. The documentation will be recorded with waterproof ink in the sampler's field logbook with consecutively numbered pages. The information entered in the field logbook concerning decontamination should include the following:

- Decontamination personnel
- Date and start and end times
- Decontamination observations
- Weather conditions
- Investigation-derived waste (IDW) handling

Personnel decontamination is not anticipated due to the nature of the planned soil sample collection activities. It is anticipated that field sampling members will don appropriate PPE during surface soil sampling activities. Level D PPE is anticipated during this investigation, which includes hard hat, safety glasses, steel-toed boots, ear protection, and work gloves and/or chemical-resistant gloves.

5.8 INVESTIGATION-DERIVED WASTE

IDW is expected to include soil, decontamination fluids, and PPE. In general, soil generated during project field activities will be containerized in either 55-gallon steel drums or a roll-off dumpster, properly labeled, and temporarily stored in the assigned laydown area at Cannon AFB. A composite IDW sample will be collected and analyzed for COPCs identified at the sites where the soil originated. Based on the results of the analyses, the soil will be disposed of in accordance with applicable regulations at an approved land farm.

Decontamination fluids generated will be containerized in a 55-gallon drum and temporarily stored on site. A sample from each decontamination fluid container will be collected and analyzed for the COPCs identified at the sites where the decontamination water originated. If the decontamination water is contaminated, it will be disposed of at a licensed off-site facility. If the decontamination water is not contaminated, it will be disposed of at ground surface or in the sanitary sewer system.

PPE will be disposed of on the Base as a solid waste. If IDW storage is required, storage locations will be identified by the 27 SOCES, Environmental Flight personnel.

This section presents the project documentation and reporting for the RFI at FT008.

6.1 PROJECT MONITORING

The RFI at FT008 will be monitored continuously through a variety of mechanisms. AECOM will maintain open lines of communication with AFCEC and Cannon AFB to report progress and to quickly and accurately respond to items requiring clarification. AECOM will prepare monthly CPSMRs to evaluate the overall progress of the project, along with any existing or potential problem areas. The monthly CPSMR will include a current project schedule (i.e., IMS) that will be updated monthly to include actual document review times and field sampling event durations. The CPSMR will also provide field sampling progress during periods of on-going field sampling activities. The CPSMRs may be supplemented with periodic photographic documentation to help document the project's current field sampling status. The CPSMRs will also identify all testing and other QC activities that occurred during the reporting period, along with the QC test results. Examples include sample collection and CoC forms, laboratory test reports, survey data, and disposal records.

Monthly CPSMRs, with attachments, will provide a complete record of all activities completed during the RFI at FT008 and will be sufficiently detailed to re-create each sampling, analytical testing, and monitoring event. The CPSMRs will be submitted monthly to AFCEC and Cannon AFB. Project execution documentation provided in the monthly CPSMRs may be used in a future site closure report.

6.2 FIELD FORM MANAGEMENT

All field forms completed during RFI field activities will be submitted, via fax or as an email attachment, to the AECOM Omaha Office for detail checking to ensure all required information has been collected during site activities.

All field forms will be maintained in a central project file located in the AECOM Omaha Office and will be accessible to all project employees. Electronic scanned copies of all field forms will be maintained in the electronic project file.

6.3 RFI REPORT

The RFI Report will include an Executive Summary, current and previous sampling results for FT008, a HHRA and ecological risk assessment, revised SCEMs, conclusions, and recommendations. At a minimum, this technical report will also include the following:

- Copies of all permits obtained to complete the work (e.g., dig permit)
- Analytical data report package
- Field generated paperwork (i.e., SCFS and boring logs)
- Photographic documentation

- Computer-aided design and drafting drawings
- Draft, Draft Final, and Final versions

In addition, this technical report will include all necessary digital files that are compatible with the existing Cannon AFB Geobase System, and will be suitable for submitting to NMED.

6.4 PROJECT FILE

The Project File for the RFI will be maintained at the AECOM Omaha Office. Information or documents within the project file may be submitted to AFCEC or Cannon AFB upon request.

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APPENDIX A

Analytical Laboratory Information: Reference Limits and Evaluation Tables and Sample Containers, Preservation, and Hold Times

REFERENCE LIMITS AND EVALUATION TABLE

Analyte	CAS Number	LOQ Limit	LOD Limit	DL Limit	Units	NMED Construction	2014 SO NMED DAF=20	2015 SO EPA MCL	Soil Industrial	STD ref	Soil Residential	STD ref
Gasoline Range Organics (GRO)												
Gasoline Range Organics (GRO)-C6-C10	8006-61-9	1.2	1.1	0.325	mg/kg	N/A	N/A	N/A	3,000	SNI	1,000	SNR
Mercury (CVAA)												
Mercury	7439-97-6	17	13.3	5.53	µg/kg	20.7	0.645	2.1	112	SNI	23.8	SNR
Diesel Range Organics (DRO) and Oil Range Organics (ORO)												
Diesel Range Organics (C10-C28)	STL00143	4	2	0.678	mg/kg	N/A	N/A	N/A	3,000	SNI	1,000	SNR
Motor Oil (C20-C38)	STL02073	12	10	3.91	mg/kg	N/A	N/A	N/A	3,000	SNI	1,000	SNR
Metals ICP												
Aluminum	7429-90-5	50	6	1.55	mg/kg	41,400	597,000	N/A	1.29E+06	SNI	78,000	SNR
Antimony	7440-36-0	2	1.5	0.38	mg/kg	142	6.56	N/A	519	SNI	31.3	SNR
Arsenic	7440-38-2	2.5	2.5	0.66	mg/kg	57.4	0.299	5.8	21.5	SNI	4.25	SNR
Barium	7440-39-3	2	0.3	0.076	mg/kg	4,390	2,700	1,700	2.55E+05	SNI	15,600	SNR
Beryllium	7440-41-7	0.5	0.12	0.033	mg/kg	148	196	63	2,580	SNI	156	SNR
Cadmium	7440-43-9	0.5	0.15	0.041	mg/kg	72.1	9.39	7.5	1,110	SNI	70.5	SNR
Calcium	7440-70-2	100	50	14.1	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	7440-47-3	3.5	0.2	0.058	mg/kg	134	201,000	3.60 E+06	505	SNI	96.6	SNR
Cobalt	7440-48-4	1	0.4	0.1	mg/kg	N/A	N/A	N/A	350	SEI	23	SNR
Copper	7440-50-8	5	0.8	0.217	mg/kg	14,200	556	920	51,900	SNI	3,130	SNR
Iron	7439-89-6	80	15	3.8	mg/kg	248,000	6,960	N/A	9.08E+05	SNI	54,800	SNR
Lead	7439-92-1	0.9	0.8	0.27	mg/kg	800	N/A	N/A	800	SNI	400	SNR
Magnesium	7439-95-4	30	14	3.7	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	7439-96-5	4.5	0.4	0.1	mg/kg	464	2,630	N/A	1.6 E6	SNI	10,500	SNR
Nickel	7440-02-0	4	0.45	0.123	mg/kg	753	485	N/A	25,700	SNI	1,560	SNR
Potassium	7440-09-7	300	160	41	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	7782-49-2	3	3	0.86	mg/kg	1,750	10.2	N/A	SNI	SNI	391	SNR
Silver	7440-22-4	1.5	0.6	0.16	mg/kg	1,770	13.8	N/A	SNI	SNI	391	SNR
Sodium	7440-23-5	500	200	59	mg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	7440-28-0	3	2.5	0.65	mg/kg	3.54	0.281	N/A	13	SNI	0.782	SNR
Vanadium	7440-62-2	2	0.35	0.094	mg/kg	614	1260	N/A	6,530	SNI	394	SNR
Zinc	7440-66-6	8	1.5	0.398	mg/kg	106,000	7410	N/A	389,000	SNI	23,500	SNR
Volatile Organic Compounds												
1,1,1,2-Tetrachloroethane	630-20-6	5	1.6	0.56	µg/kg	659,000	35.9	N/A	137,000	SNI	28,100	SNR
1,1,1-Trichloroethane	71-55-6	5	1.6	0.52	µg/kg	1.36E+07	51,100	1,400	7.25E+07	SNI	1.44+E7	SNR
1,1,2,2-Tetrachloroethane	79-34-5	5	1.6	0.61	µg/kg	197,000	4.8	N/A	39,400	SNI	7,980	SNR
1,1,2-Trichloroethane	79-00-5	5	3.2	0.88	µg/kg	2,300	2.23	32	12,400	SNI	2,610	SNR
1,1-Dichloroethane	75-34-3	5	0.8	0.21	µg/kg	1.82+06	136	N/A	383,000	SNI	78,600	SNR
1,1-Dichloroethene	75-35-4	5	1.6	0.59	µg/kg	424,000	1,950	50	2.26+E06	SNI	440,000	SNR
1,1-Dichloropropene	563-58-6	5	1.6	0.54	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3-Trichlorobenzene	87-61-6	5	1.6	0.75	µg/kg	N/A	N/A	N/A	930,000	SEI	63,000	SER
1,2,3-Trichloropropane	96-18-4	5	3.2	0.81	µg/kg	6,310	0.0521	N/A	1,210	SNI	51	SNR
1,2,4-Trichlorobenzene	120-82-1	5	1.6	0.73	µg/kg	79,100	176	4,100	423,000	SNI	82,900	SNR
1,2,4-Trimethylbenzene	95-63-6	5	1.6	0.58	µg/kg	N/A	N/A	N/A	240,000	SEI	58,000	SER
1,2-Dibromo-3-Chloropropane	96-12-8	10	1.6	0.6	µg/kg	5530	0.0234	1.7	1,180	SNI	85.8	SNR
1,2-Dichlorobenzene	95-50-1	5	1.6	0.45	µg/kg	2.50E+06	4,580	12,000	1.30E+07	SNI	2.15E+06	SNR
1,2-Dichloroethane	107-06-2	5	1.6	0.7	µg/kg	53,800	8.14	28	40,700	SNI	8,320	SNR
1,2-Dichloroethene, Total	540-59-0	5	1.6	0.39	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	78-87-5	5	1.6	0.55	µg/kg	25,400	24.3	33	86,800	SNI	17,800	SNR
1,3,5-Trimethylbenzene	108-67-8	5	1.6	0.57	µg/kg	N/A	N/A	N/A	1.20E+07	SEI	780,000	SER

Analyte	CAS Number	LOQ Limit	LOD Limit	DL Limit	Units	NMED Construction	2014 SO NMED DAF=20	2015 SO EPA MCL	Soil Industrial	STD ref	Soil Residential	STD ref
1,3-Dichlorobenzene	541-73-1	5	1.6	0.48	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dichloropropane	142-28-9	5	1.6	0.51	µg/kg	N/A	N/A	N/A	2.30E+07	SEI	1.60E+06	SER
1,4-Dichlorobenzene	106-46-7	5	1.6	0.78	µg/kg	746,000	72	1,400	159,000	SNI	32,800	SNR
2,2-Dichloropropane	594-20-7	5	1.6	0.44	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone (MEK)	78-93-3	20	6.4	1.83	µg/kg	9.17E+07	20,100	N/A	4.11E+08	SNI	3.74E+07	SNR
2-Chlorotoluene	95-49-8	5	1.6	0.51	µg/kg	7.08E+06	3,560	N/A	2.60E+07	SNI	1,560,000	SNR
2-Hexanone	591-78-6	20	12.8	4.89	µg/kg	N/A	N/A	N/A	1.30E+06	SEI	200,000	SER
4-Chlorotoluene	106-43-4	5	1.6	0.78	µg/kg	N/A	N/A	N/A	2.30E+07	SEI	1.60E+06	SER
4-Isopropyltoluene	99-87-6	5	1.6	0.49	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone (MIBK)	108-10-1	20	12.8	4.36	µg/kg	2.02E+07	4,800	N/A	8.16E+07	SNI	5.81E+06	SNR
Acetone	67-64-1	20	12.8	5.38	µg/kg	2.42E+08	49,800	N/A	9.60E+08	SNI	6.63E+07	SNR
Benzene	71-43-2	5	1.6	0.47	µg/kg	142,000	38	51	87,200	SNI	17,800	SNR
Bromobenzene	108-86-1	5	1.6	0.49	µg/kg	N/A	N/A	N/A	1.80E+06	SEI	290,000	SER
Bromoform	75-25-2	5	0.8	0.23	µg/kg	5.38E+06	411	430	3.25E+06	SNI	674,000	SNR
Bromomethane	74-83-9	10	1.6	0.5	µg/kg	17,900	34.3	N/A	94,500	SNI	17,700	SNR
Carbon disulfide	75-15-0	5	1.6	0.42	µg/kg	1.62E+06	4,420	N/A	8.54E+06	SNI	1.55 E+6	SNR
Carbon tetrachloride	56-23-5	5	1.6	0.63	µg/kg	202,000	33.3	39	52,500	SNI	10,700	SNR
Chlorobenzene	108-90-7	5	1.6	0.54	µg/kg	412,000	836	1,400	2.16E+06	SNI	378,000	SNR
Bromochloromethane	74-97-5	5	0.8	0.3	µg/kg	N/A	N/A	N/A	630,000	SEI	150,000	SER
Dibromochloromethane	124-48-1	5	1.6	0.57	µg/kg	340,000	7.54	430	67,400	SNI	13,900	SNR
Chloroethane	75-00-3	10	3.2	0.89	µg/kg	1.66E+07	107,000	N/A	8.95E+07	SNI	1.90E+07	SNR
Chloroform	67-66-3	10	0.8	0.29	µg/kg	134,000	10.9	440	28,700	SNI	5,900	SNR
Chloromethane	74-87-3	10	1.6	0.77	µg/kg	235,000	95.1	N/A	201,000	SNI	41,100	SNR
cis-1,2-Dichloroethene	156-59-2	5	1.6	0.56	µg/kg	708,000	184	410	2.60E+06	SNI	156,000	SNR
cis-1,3-Dichloropropene	10061-01-5	5	3.2	1.29	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibromomethane	74-95-3	5	3.2	0.84	µg/kg	53,900	33.5	N/A	288,000	SNI	57,900	SNR
Bromodichloromethane	75-27-4	5	0.8	0.22	µg/kg	143,000	6.21	430	30,200	SNI	6,190	SNR
Dichlorodifluoromethane	75-71-8	10	1.6	0.52	µg/kg	161,000	7,230	N/A	865,000	SNI	182,000	SNR
Ethylbenzene	100-41-4	5	1.6	0.67	µg/kg	1.77E+06	262	16,000	368,000	SNI	75,100	SNR
Ethylene Dibromide	106-93-4	5	1.6	0.52	µg/kg	16,300	0.352	N/A	3,310	SNI	672	SNR
Hexachlorobutadiene	87-68-3	5	1.6	0.55	µg/kg	269,000	87.9	N/A	53,000	SEI	12,000	SER
Isopropylbenzene	98-82-8	5	1.6	0.59	µg/kg	2.74E+06	11,400	N/A	1.42E+08	SNI	2.36E+06	SNR
Methyl tert-butyl ether	1634-04-4	20	0.8	0.34	µg/kg	2.42E+07	553	N/A	4.82 E+6	SNI	975,000	SNR
Methylene Chloride	75-09-2	5	3.2	1.6	µg/kg	1.21E+06	471	26	5.13E+06	SNI	409,000	SNR
m-Xylene & p-Xylene	179601-23-1	3.2	3.2	1.04	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	91-20-3	5	1.6	0.63	µg/kg	159,000	82.3	N/A	241,000	SNI	49,700	SNR
n-Butylbenzene	104-51-8	5	1.6	0.56	µg/kg	N/A	N/A	N/A	5.80E+07	SEI	3.90E+06	SER
N-Propylbenzene	103-65-1	5	1.6	0.58	µg/kg	N/A	N/A	N/A	2.40E+07	SEI	3.80E+06	SER
o-Xylene	95-47-6	5	1.6	0.61	µg/kg	736,000	2,980	N/A	3.94E+06	SNI	805,000	SNR
sec-Butylbenzene	135-98-8	5	1.6	0.77	µg/kg	N/A	N/A	N/A	1.20E+08	SEI	7.80E+06	SER
Styrene	100-42-5	5	1.6	0.63	µg/kg	1.02E+07	20,600	2,200	5.13E+07	SNI	7.26E+06	SNR
tert-Butylbenzene	98-06-6	5	1.6	0.5	µg/kg	N/A	N/A	N/A	1.20E+07	SEI	7.80E+06	SER
Tetrachloroethene	127-18-4	5	1.6	0.59	µg/kg	120,000	321	46	629,000	SNI	111,000	SNR
Toluene	108-88-3	5	1.6	0.69	µg/kg	1.40E+07	12,100	14,000	6.13E+07	SNI	5.23E+06	SNR
trans-1,2-Dichloroethene	156-60-5	5	0.8	0.39	µg/kg	305,000	469	630	1.61E+06	SNI	295,000	SNR
trans-1,3-Dichloropropene	10061-02-6	5	1.6	0.67	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	79-01-6	5	0.8	0.23	µg/kg	6,900	17.5	36	36,500	SNI	6,770	SNR
Trichlorofluoromethane	75-69-4	10	3.2	1.04	µg/kg	1.13E+06	15,700	N/A	6.03E+06	SNI	1.23E+06	SNR
Vinyl chloride	75-01-4	5	3.2	1.34	µg/kg	161,000	1.35	14	28,400	SNI	742	SNR
Semi - Volatile Organic Compounds												
1,2,4,5-Tetrachlorobenzene	95-94-3	330	133	49	µg/kg	80,700	117	N/A	2.75E+08	SNI	1.85E+07	SNR

Analyte	CAS Number	LOQ Limit	LOD Limit	DL Limit	Units	NMED Construction	2014 SO NMED DAF=20	2015 SO EPA MCL	Soil Industrial	STD ref	Soil Residential	STD ref
1,2,4-Trichlorobenzene	120-82-1	330	67	28	µg/kg	79,100	176	4,100	423,000	SNI	82,900	SNR
1,2-Dichlorobenzene	95-50-1	330	67	22	µg/kg	2.50E+06	4,580	12,000	1.30E+07	SNI	2.15E+06	SNR
1,2-Diphenylhydrazine	122-66-7	330	67	22	µg/kg	234,000	37.6	N/A	3.21E+07	SNI	6.66E+06	SNR
1,3-Dichlorobenzene	541-73-1	330	33	12	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	106-46-7	330	33	13.6	µg/kg	746,000	72	1,400	159,000	SNI	32,800	SNR
2,2'-oxybis[1-chloropropane]	108-60-1	330	67	23	µg/kg	3.54E+06	47.3	N/A	220,000	SEI	49,000	SER
2,4,5-Trichlorophenol	95-95-4	330	33	10	µg/kg	2.69E+07	66,200	N/A	9.16E+07	SNI	6.16E+06	SNR
2,4,6-Trichlorophenol	88-06-2	330	33	10	µg/kg	269,000	674	N/A	916,000	SNI	61,600	SNR
2,4-Dichlorophenol	120-83-2	330	33	10	µg/kg	807,000	825	N/A	2.75E+06	SNI	185,000	SNR
2,4-Dimethylphenol	105-67-9	330	133	66	µg/kg	5.83E+06	6,450	N/A	1.83E+07	SNI	1.23E+06	SNR
2,4-Dinitrophenol	51-28-5	1,600	1,000	333	µg/kg	538,000	671	N/A	1.83E+06	SNI	123,000	SNR
2,4-Dinitrotoluene	121-14-2	330	133	66	µg/kg	536,000	49.1	N/A	82,300	SNI	17,100	SNR
2,6-Dichlorophenol	87-65-0	330	167	69	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	606-20-2	330	67	28	µg/kg	80,900	10.2	N/A	17,200	SNI	3,560	SNR
2-Chloronaphthalene	91-58-7	330	33	10	µg/kg	2.83E+07	57,000	N/A	1.04E+08	SNI	6.26E+06	SNR
2-Chlorophenol	95-57-8	330	67	21	µg/kg	1.77E+06	1,150	N/A	6.49E+06	SNI	391,000	SNR
2-Methylnaphthalene	91-57-6	330	67	19	µg/kg	N/A	N/A	N/A	3.00E+06	SEI	240,000	SER
2-Methylphenol	95-48-7	330	33	13	µg/kg	N/A	N/A	N/A	4.10E+07	SEI	3.20E+06	SER
3 & 4 Methylphenol	15831-10-4	330	67	33	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,3'-Dichlorobenzidine	91-94-1	1,600	267	90	µg/kg	410,000	123	N/A	57,000	SNI	11,800	SNR
3-Nitroaniline	99-09-2	1,600	267	73	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4,6-Dinitro-2-methylphenol	534-52-1	1,600	1,000	330	µg/kg	21,500	39.4	N/A	73,300	SNI	4,930	SNR
4-Chloroaniline	106-47-8	330	267	81.9	µg/kg	N/A	N/A	N/A	110,000	SEI	27,000	SER
4-Chlorophenyl phenyl ether	7005-72-3	330	67	21	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitroaniline	100-01-6	1,600	267	72.5	µg/kg	N/A	N/A	N/A	1.10E+06	SEI	250,000	SER
4-Nitrophenol	100-02-7	1,600	267	97	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acenaphthene	83-32-9	330	33	10.3	µg/kg	1.51E+07	82,500	N/A	5.05E+07	SNI	3.48E+06	SNR
Acenaphthylene	208-96-8	330	67	17	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anthracene	120-12-7	330	67	17	µg/kg	7.53E+06	851,000	N/A	2.53E+08	SNI	1.74E+07	SNR
Benzidine	92-87-5	4,000	2,000	990	µg/kg	812	0.0417	N/A	112	SNI	5.18	SNR
Benzo[a]anthracene	56-55-3	330	67	20	µg/kg	240,000	1,820	N/A	32,300	SNI	1,530	SNR
Benzo[a]pyrene	50-32-8	330	67	20	µg/kg	24,000	605	4,700	3,230	SNI	153	SNR
Benzo[b]fluoranthene	205-99-2	330	67	26.2	µg/kg	240,000	6,170	N/A	32,300	SNI	1,530	SNR
Benzo[g,h,i]perylene	191-24-2	330	33	16	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo[k]fluoranthene	207-08-9	330	133	40	µg/kg	2.31E+06	60,500	N/A	323,000	SNI	15,300	SNR
Benzoic acid	65-85-0	1,600	1,000	330	µg/kg	N/A	N/A	N/A	3.30E+09	SEI	2.50E+08	SER
Benzyl alcohol	100-51-6	330	33	10	µg/kg	N/A	N/A	N/A	8.20E+07	SEI	6.30E+06	SER
Bis(2-chloroethoxy)methane	111-91-1	330	67	23	µg/kg	N/A	N/A	N/A	2.50E+06	SEI	190,000	SER
Bis(2-chloroethyl)ether	111-44-4	330	33	16.6	µg/kg	1,950	0.605	N/A	15,700	SNI	3,110	SNR
Bis(2-ethylhexyl) phthalate	117-81-7	330	133	46	µg/kg	5.38E+06	200,000	29,000	1.83E+06	SNI	380,000	SNR
Butyl benzyl phthalate	85-68-7	330	133	43	µg/kg	N/A	N/A	N/A	1.20E+07	SEI	2.90E+06	SER
Carbazole	86-74-8	330	133	36	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chrysene	218-01-9	330	67	27	µg/kg	2.31E+07	186,000	N/A	3.23E+06	SNI	153,000	SNR
Dibenz(a,h)anthracene	53-70-3	330	67	19	µg/kg	24,000	6,110	N/A	3,230	SNI	153	SNR
Dibenzofuran	132-64-9	330	67	20	µg/kg	N/A	N/A	N/A	1.00E+06	SEI	73,000	SER
Diethyl phthalate	84-66-2	660	67	26	µg/kg	2.15E+08	97,900	N/A	7.33E+08	SNI	4.93E+07	SNR
Dimethyl phthalate	131-11-3	330	67	23	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-butyl phthalate	84-74-2	330	67	29	µg/kg	2.69E+07	33,800	N/A	9.16E+07	SNI	6.16E+06	SNR
Di-n-octyl phthalate	117-84-0	330	66	14.4	µg/kg	N/A	N/A	N/A	8.20E+06	SEI	630,000	SER
Fluoranthene	206-44-0	330	133	36	µg/kg	1.00E+08	1.34E+06	N/A	3.37E+07	SNI	2.32E+06	SNR
Fluorene	86-73-7	330	67	18	µg/kg	1.00E+07	80,000	N/A	3.37E+07	SNI	2.32E+06	SNR
Hexachlorobenzene	118-74-1	330	67	29	µg/kg	117,000	92.2	250	16,000	SNI	3,330	SNR

Analyte	CAS Number	LOQ Limit	LOD Limit	DL Limit	Units	NMED Construction	2014 SO NMED DAF=20	2015 SO EPA MCL	Soil Industrial	STD ref	Soil Residential	STD ref
Hexachlorobutadiene	87-68-3	330	33	10	µg/kg	269,000	87.9	N/A	53,000	SEI	12,000	SER
Hexachlorocyclopentadiene	77-47-4	1700	133	50	µg/kg	867,000	1,340	3,100	5.49E+06	SNI	370,000	SNR
Hexachloroethane	67-72-1	330	67	21.3	µg/kg	188,000	66.2	N/A	641,000	SNI	43,100	SNR
Indeno[1,2,3-cd]pyrene	193-39-5	330	67	22	µg/kg	240,000	20,100	N/A	32,300	SNI	1,530	SNR
Isophorone	78-59-1	330	67	17	µg/kg	5.37E+07	4,220	N/A	2.70E+07	SNI	5.61E+06	SNR
Naphthalene	91-20-3	330	67	31	µg/kg	159,000	82.3	N/A	241,000	SNI	49,700	SNR
Nitrobenzene	98-95-3	330	67	22	µg/kg	353,000	14.4	N/A	293,000	SNI	60,400	SNR
N-Nitrosodimethylamine	62-75-9	520	133	37	µg/kg	2,140	0.0203	N/A	503	SNI	23.4	SNR
N-Nitrosodi-n-propylamine	621-64-7	330	67	31	µg/kg	N/A	N/A	N/A	3,300	SEI	780	SER
N-Nitrosodiphenylamine	86-30-6	330	67	21	µg/kg	3.79E+07	9,950	N/A	5.24E+06	SNI	1.09E+06	SNR
N-Nitrosopyrrolidine	930-55-2	330	167	64	µg/kg	88,900	2.3	N/A	12,200	SNI	2,540	SNR
Pentachlorophenol	87-86-5	1600	1000	330	µg/kg	346,000	60.8	200	44,500	SNI	9,850	SNR
Phenanthrene	85-01-8	330	67	17	µg/kg	7.53E+06	85,900	N/A	2.53E+07	SNI	1.74E+06	SNR
Phenol	108-95-2	330	67	18	µg/kg	7.74+7	52,300	N/A	2.75E+08	SNI	1.85E+07	SNR
Pyrene	129-00-0	400	33	12.1	µg/kg	7.53E+06	192,000	N/A	2.53E+07	SNI	1.74E+06	SNR
Organochlorine Pesticides												
4,4'-DDD	72-54-8	1.7	1.67	0.546	µg/kg	778,000	1,080	N/A	107,000	SNI	22,200	SNR
4,4'-DDE	72-55-9	1.7	0.67	0.238	µg/kg	549,000	8,080	N/A	75,500	SNI	15,700	SNR
4,4'-DDT	50-29-3	2	1.67	0.59	µg/kg	162,000	11,600	N/A	95,000	SNI	18,700	SNR
Aldrin	309-00-2	1.7	0.67	0.251	µg/kg	8,070	112	N/A	1,500	SNI	311	SNR
alpha-BHC	319-84-6	1.7	0.67	0.214	µg/kg	N/A	N/A	N/A	3,600	SEI	860	SER
alpha-Chlordane	5103-71-9	1.7	0.67	0.323	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
beta-BHC	319-85-7	1.7	1.67	0.664	µg/kg	104,000	20.9	N/A	14,300	SNI	2,960	SNR
delta-BHC	319-86-8	1.7	1	0.401	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dieldrin	60-57-1	1.7	0.67	0.21	µg/kg	11,700	10.4	N/A	1,600	SNI	333	SNR
Endosulfan I	959-98-8	1.7	0.67	0.176	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endosulfan II	33213-65-9	1.7	0.67	0.287	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endosulfan sulfate	1031-07-8	1.7	0.67	0.276	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endrin	72-20-8	1.7	0.67	0.306	µg/kg	80,700	1,350	1,600	275,000	SNI	18,500	SNR
Endrin aldehyde	7421-93-4	1.7	0.67	0.171	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
gamma-BHC (Lindane)	58-89-9	1.7	1	0.464	µg/kg	29,700	5.96	23	4,070	SNI	845	SNR
gamma-Chlordane	5103-74-2	1.7	0.67	0.266	µg/kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Heptachlor	76-44-8	1.7	0.67	0.214	µg/kg	41,500	54.5	660	5,700	SNI	1,180	SNR
Heptachlor epoxide	1024-57-3	1.7	1	0.426	µg/kg	N/A	N/A	82	3,300	SEI	700	SER
Methoxychlor	72-43-5	3.3	1	0.45	µg/kg	N/A	N/A	43,000	4.10E+06	SEI	320,000	SER
Toxaphene	8001-35-2	170	33	15.8	µg/kg	170,000	354	9,300	23,300	SNI	4,840	SNR

Notes:
µg/kg = Microgram per Kilogram
CAS = Chemical Abstracts Number
CVAA = Cold Vapor Atomic Adsorption
DL = Detection Limit
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ICP = Inductively Coupled Plasma
LOQ = Limit of Qualification
LOD = Limit of Detection
N/A = Not Available
NMED = New Mexico Environmental Department
ORO = Oil Range Organics
Ref = Reference
SEI = Adjusted EPA Soil Screening Levels (TR = 1E-05; TH = 1) Industrial Soil
SER = Adjusted EPA Soil Screening Levels (TR = 1E-05; TH = 1) Residential Soil
SNI = Table A-1: NMED Soil Screening Levels Industrial/Occupational
SO = Soils
Soil SNR = Table A-1: NMED Soil Screening Levels Residential Soil
STD = Standard

Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	USEPA Method	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation / analysis)
Soil	DRO and ORO	8015C	1, 4oz, glass jar	60 grams	Cool ≤ 6°C	14 days to extract 40 days from extract
Soil	Pesticides	8081A	1, 4oz, glass jar	60 grams	Cool ≤ 6°C	14 days to extract – 40 days from extract
Soil	VOCs	8260B	3, 5g EnCore™ 3, VOA Vials –Terra Core	15 grams 15 grams	DI water/frozen or Methanol or sodium bisulfate; Cool ≤ 6°C	48 hour from sampling to preservation/ 14 days from preservation to analysis
Soil	SVOCs	8270D	1, 4oz, glass jar	60 grams	Cool ≤ 6°C	14 days to extract – 40 days from extract
Soil	Metals - Mercury	7471B	1, 4oz, glass jar	5 grams	Cool ≤ 6°C	28 days
Soil	TAL Metals	6010C	1, 4oz, glass jar	20 grams	Cool ≤ 6°C	180 days

[1] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory Matrix Spike/Matrix Spike Duplicate sample analysis.
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
°C = degrees Celsius
≤ = less than or equal to
DRO = diesel range organics
GC = Gas Chromatography
GRO = gasoline range organics
ORO = oil range organics
oz = ounce
SOP = Standard Operating Procedure
SVOCs = Semi-Volatile Organic Compounds
VOA = Volatile Organic Analysis
VOC = volatile organic compound