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FINAL WORK PLAN, FIELD SAMPLING PLAN, QUALITY ASSURANCE PROJECT PLAN AND  
SITE SAFETY AND HEALTH PLAN FOR REMEDIAL ACTIONS/INVESTIGATIONS AT  
MULTIPLE SITES KANSAS CITY MO  
11/1/1999  
DAMES & MOORE

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

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**WORK PLAN**

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**FIELD SAMPLING PLAN**

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**QUALITY ASSURANCE  
PROJECT PLAN**

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**SITE SAFETY AND  
HEALTH PLAN**

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**Remedial Actions/Investigations at Multiple Sites**

Project Number UEBL 930014



**FINAL**

November, 1999



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**WORK PLAN, FIELD SAMPLING PLAN, AND  
QUALITY ASSURANCE PROJECT PLAN APPROVALS**

This Work Plan, Field Sampling Plan, and Quality Assurance Project Plan was developed to provide guidance for Dames & Moore personnel during the remedial activities, removal activities, and closure activities at Richards-Gebaur AFB, Grandview, Missouri. The signatures below indicate approval of the plan and agreement to following the procedures described therein.

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November, 1999

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November, 1999



# FINAL WORK PLAN

## Remedial Actions/Investigations at Multiple Sites

Project Number UEBL 930014

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

Prepared by:

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November, 1999

## LIST OF ACRONYMS AND ABBREVIATIONS

<b>ADC</b>	Air Defense Command
<b>AFCS</b>	Air Force Communications Service
<b>AFB</b>	Air Force Base
<b>AFBCA</b>	Air Force Base Conversion Agency
<b>AFCEE</b>	Air Force Center for Environmental Excellence
<b>AFRES</b>	Air Force Reserves
<b>ARAR</b>	applicable or relevant and appropriate requirement
<b>AST</b>	aboveground storage tank
<b>BTEX</b>	Benzene, Toluene, Ethylbenzene, and Xylenes
<b>CALM</b>	Cleanup Levels for Missouri
<b>CERCLA</b>	Comprehensive Environmental Response, Compensation, and Liability Act
<b>CFR</b>	Code of Federal Regulation
<b>COC</b>	chain of custody
<b>DBCRA</b>	Defense Base Closure and Realignment Act
<b>DEQPPM</b>	Defense Environmental Quality Program Policy Memorandum
<b>DoD</b>	Department of Defense
<b>DQO</b>	data quality objective
<b>DRO</b>	diesel range organics
<b>EPA</b>	Environmental Protection Agency
<b>ERPIMS</b>	Environmental Resources Program Information Management System
<b>ERPTOOLS</b>	ERPIMS Quality Control Tool
<b>FSP</b>	Field Sampling Plan
<b>G&amp;M</b>	Geraghty & Miller
<b>GRO</b>	gasoline range organics
<b>GSA</b>	General Services Administration
<b>GTARC</b>	Ground Water Target Concentration
<b>GTL</b>	General Testing Laboratories
<b>IRP</b>	Installation Restoration Program
<b>ITIR</b>	Informal Technical Information Report
<b>KCAD</b>	Kansas City Aviation Department
<b>LUST</b>	Leaking Underground Storage Tank
<b>MAC</b>	Military Airlift Command

<b>MDC</b>	Missouri Department of Conservation
<b>MDNR</b>	Missouri Department of Natural Resources
<b>MSL</b>	mean sea level
<b>MTBE</b>	methyl tertiary butyl ether
<b>NCP</b>	National Contingency Plan
<b>NFRAP</b>	No Further Remedial Action Planned
<b>NPDES</b>	National Pollutant Discharge Elimination System
<b>OWS</b>	Oil/water separator
<b>PCB</b>	polychlorinated biphenyl
<b>PID</b>	photoionization detector
<b>POL</b>	petroleum, oil, and lubricants
<b>PVC</b>	polyvinyl chloride
<b>QA</b>	quality assurance
<b>QAPP</b>	quality assurance project plan
<b>QC</b>	quality control
<b>RA</b>	Remedial Action
<b>RCRA</b>	Resource Conservation and Recovery Act
<b>RI</b>	Remedial Investigation
<b>SARA</b>	Superfund Amendments and Reauthorization Act
<b>SET</b>	Shirley Environmental Testing, Inc.
<b>SOW</b>	statement of work
<b>SOP</b>	Standard Operating Procedures
<b>STARC</b>	Soil Target Concentrations
<b>SVOC</b>	semivolatile organic compound
<b>TDS</b>	total dissolved solids
<b>TPH</b>	Total petroleum hydrocarbon
<b>TVH</b>	Total volatile hydrocarbon
<b>TVOC</b>	Total Volatile Organic Compounds
<b>USFWS</b>	United States Fish and Wildlife Service
<b>UST</b>	Underground Storage Tank
<b>VOC</b>	volatile organic compound

## TABLE OF CONTENTS

SECTIONS	PAGE
1.0 Introduction	1-1
1.1 The U.S. Air Force Installation Restoration Program	1-1
1.2 History of Past IRP Work at the Installation	1-2
1.2.1 Base History	1-2
1.2.2 Building 1100 History	1-3
1.2.3 Building 1200 History	1-4
1.2.4 ST007, Former UST Area History	1-4
1.2.5 Fuel Hydrant Line History	1-5
1.2.6 Industrial Waste Line History	1-6
1.2.7 Oil/Water Separators History	1-7
1.2.8 Eight Former UST Sites Histories	1-7
1.2.9 POL Storage Yard History	1-9
1.3 Description of Current Study	1-11
2.0 Summary of Existing Information	2-1
2.1 Installation Environmental Setting	2-1
2.1.1 Demographics	2-1
2.1.2 Physiography	2-1
2.1.3 Surface Water Drainage	2-1
2.1.4 Regional Geology	2-2
2.1.5 Base Geology	2-2
2.1.6 Soils	2-2
2.1.7 Regional Hydrogeology	2-3
2.1.8 Base Hydrogeology and Ground Water Use	2-3
2.1.9 Air	2-3
2.1.10 Biology	2-4
2.2 Site-Specific Environmental Setting	2-6
2.2.1 Contaminant Sources and Contamination	2-6
2.2.2 Potential Contaminants	2-6
2.2.3 Potential Contaminant Release Pathways	2-6
3.0 Project Tasks	3-1
3.1 Conceptual Site Model Development	3-1
3.2 Applicable or Relevant and Appropriate Requirements Identification	3-2
3.3 Characterization of Background Conditions	3-2

SECTIONS	PAGE
3.4 Risk Assessment	3-2
3.5 Data Needs Identification	3-2
3.6 Field Investigation Tasks	3-4
3.6.1 Mobilization	3-4
3.6.2 Field Activities	3-5
3.6.3 Sampling and Analysis Activities	3-11
4.0 Remedial Action	4-1
5.0 Data Assessment, Records, and Reporting Requirements	5-1
5.1 Data Assessment	5-1
5.2 Record Keeping	5-1
5.3 Reporting Requirements	5-2
6.0 Project Schedule and References	6-1
6.1 Project Schedule	6-1
6.2 References	6-1

## LIST OF TABLES

TABLE	PAGE
3.1-1 Conceptual Site Model/Natural Conditions and Contamination	3-1
3.5-1 CALM Tier 1, Category B Target Concentrations	3-3
3.6-1 Project Data Quality Objectives	3-4
3.6.2-1 Field Activities Summary – Building 1100 Area	3-6
3.6.2-2 Field Activities Summary – Building 1200 Area	3-6
3.6.2-3 Field Activities Summary – SST007	3-7
3.6.2-4 Field Activities Summary – Fuel Hydrant Line	3-8
3.6.2-5 Field Activities Summary – Industrial Waste Line	3-8
3.6.2-6 Field Activities Summary – CS003 (Oil/Water Separators)	3-9
3.6.2-7 Field Activities Summary – Four RI Sites	3-10
3.6.2-8 Field Activities Summary – Eight RA Sites	3-10
3.6.2-9 Field Activities Summary – POL Yard	3-11
3.6.3-1 Soil Sample Analysis Summary	3-12
3.6.3-2 Aqueous Sample Analysis Summary	3-13

## 1.0 INTRODUCTION

### 1.1 THE U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force Installation Restoration Program (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation and Recovery Act (RCRA) is one of the primary federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require federal agencies to comply with local and state environmental regulations and provide information to the U.S. Environmental Protection Agency (EPA) concerning past disposal practices at federal sites. The Resource Conservation Recovery Act (RCRA) Section 3012 requires state agencies to inventory past hazardous waste disposal sites and provide information to the EPA concerning those sites.

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (i.e., Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the EPA as the primary policy and enforcement agency regarding contaminated sites.

The 1986 Superfund Amendments and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends the EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of an RI/FS. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various federal agencies, including the Department of Defense (DoD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA, its regulations, and Executive Order 12580, the DoD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated facilities. The DoD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by EPA in 1980 to provide guidance on a process by which (1) contaminant release could be reported, (2) contamination could be identified and quantified, and (3) remedial actions could be selected. The NCP describes the responsibility of federal and state governments and those responsible for contaminant releases.

The DoD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

The IRP is the DoD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for a Remedial Investigation/Feasibility Study (RI/FS) program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DoD compliance with federal laws, such as RCRA, NCP, CERCLA, and SARA, can be met.

## 1.2 HISTORY OF PAST IRP WORK AT THE INSTALLATION

### 1.2.1 Base History

Richards-Gebaur Air Force Base (AFB), under the control of the Air Force Base Conversion Agency (AFBCA), is located in western Missouri, approximately 18 miles south of downtown Kansas City and about three miles east of the Kansas-Missouri state line. Richards-Gebaur AFB is located within the Osage Plains region of the Central Lowland physiographic province. The region is characterized by low relief, wide, maturely dissected uplands, and relatively steep valley slopes. The topography of Richards-Gebaur AFB is gently rolling with an elevation range between 960 and 1075 feet above mean sea level

In 1941, portions of the land now occupied by Richards-Gebaur AFB were acquired by the City of Kansas City, Missouri for use as an auxiliary airport (Grandview Airport). In 1952, the Aerospace Defense Command leased the airport from the city for air defense operations, and in 1953 the property (approximately 2,400 acres) was formally conveyed to the United States government for establishment of an Air Force base. C-46 airlift aircraft were the original Air Force aircraft stationed at the base. Conversion to C-119 and C-124 aircraft occurred in 1957 and 1961, respectively. In 1957, the base was named Richards-Gebaur AFB.

Until 1970, the Air Defense Command (ADC) had the primary mission on base. In 1970, the Air Force Communications Service (AFCS) relocated its headquarters from Scott AFB, Illinois, to Richards-Gebaur AFB and assumed command. In 1971, the C-124 reciprocating engine aircraft were phased out and replaced with C-130 aircraft equipped with turbine-type engines. AFCS moved back to Scott AFB in 1977 and Richards-Gebaur AFB came under the control of the Military Airlift Command (MAC).

Air Force Reserves (AFRES) assumed operational control of the base in October 1980. In 1981, approximately 80 percent of the base property (including runways and taxiways) was excised (transferred) to the General Services Administration (GSA). The GSA then transferred a majority of the airport-related property to the Kansas City Aviation Department (KCAD) as a public benefit transfer, with the condition of continued runway access (for a fee) by the Air Force. Other excised parcels were also transferred by GSA for public and other military uses to Kansas City, the Federal Aviation Administration, the City of Belton, the Department of the Navy, and the Department of the Army.

Richards-Gebaur AFB was recommended for closure by the 1991 Defense Base Closure and Realignment Commission. The Commission's recommendations were accepted by the President and submitted to Congress on July 12, 1991. As Congress did not disapprove the recommendations in the time given under the Defense Base Closure and Realignment Act (DBCRA) of 1990 (Public Law [P.L.] 101-51, Title XXIX), the recommendations have become law. Richards-Gebaur AFB closed in September 1994. Richards-Gebaur AFB no longer supports military aircraft.

### 1.2.2 Building 1100 History

The Building 1100 Area is located in Parcel K at the south side of the base. Building 1100 Area was a receiver communication facility and is currently vacant. Two underground storage tanks (USTs) existed at this facility. Tank 1100A was a 250-gallon UST containing gasoline and 1100B was a 550-gallon UST containing heating oil. These USTs were located at the west to southwest side of the building. Tank 1100A was installed in May of 1953. The installation date of Tank 1100 B was not reported. Tanks 1100A and 1100B were removed in July 1988.

A subsurface assessment (HDB 1996) was conducted at Building 1100 in 1996. Four subsurface soil samples were collected at 3 to 5 feet, 8 to 10 feet (twice) and 10 to 12 feet below ground surface at four boring locations. These borings were located northwest of the building. The samples were analyzed for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The A1 sample from 10 to 12 feet had a detectable concentration of m & p xylene well below the Missouri Department of Natural Resources (MDNR) Cleanup Levels for Missouri (CALM) Tier 1, Category B target concentrations. The A2 sample from 8 to 10 feet had detectable concentrations of VOCs, SVOCs and TPH. The only concentration above the MDNR CALM Tier 1, Category B STARC target concentrations was TPH – diesel range at 1200 milligrams per kilogram (mg/Kg). The B1 sample from 3 to 5 feet also had several detectable concentrations of VOCs, SVOCs and TPH, again with only the TPH – diesel range of 980 mg/Kg exceeding the MDNR CALM Tier 1, Category B STARC target concentrations. The B2 sample from 8 to 10 feet also had several VOCs, naphthalene and TPH in the detectable range but all below the MDNR CALM Tier 1, Category B STARC target concentrations.

TapanAm Associates, Inc. (TapanAm) was tasked by the AFBCA to conduct further environmental sampling activities at Building 1100 in November 1998. Six soil borings, SB1 through SB6 were advanced at 4-foot intervals to a depth of approximately 10 to 11 feet below ground surface (bgs) where refusal on limestone bedrock occurred.

#### TapanAm Building 1100 Area Soil Sampling Data

Sample	Boring Depth (ft.)	Sample Depth
SB1	10.8	6.5 to 7.0
SB2	10.1	1.9 to 4.0
SB3	10.3	1.9 to 4.0
SB4	10.9	4.0 to 5.0
SB5	10.5	8.0 to 9.0
SB6	10.2	3.0 to 4.0

A soil sample and ground water sample were collected from each boring. The soil samples were analyzed for TPH, VOCs and SVOCs. The ground water samples were analyzed for VOCs. The SB-1 soil sample from 6 to 8 feet had several detectable concentrations of VOCs, SVOCs and TPH, with TPH – diesel range at 4,000 mg/Kg being the only compound that exceeded the MDNR CALM Tier 1, Category B STARC target concentrations. The SB-2 soil sample from 2 to 4 feet also had several detectable concentrations of VOCs, SVOCs and TPH but all below the MDNR CALM Tier 1, Category B STARC target concentrations. The SB-3 soil sample from 2 to 4 feet had detectable concentrations of several compounds with only the concentration for TPH – diesel range at 4,900 mg/Kg exceeding the MDNR CALM Tier 1, Category B STARC target concentrations. The SB-4 soil sample from 4 to 5 feet

also had several detectable concentrations of VOCs, naphthalene and TPH but all below the MDNR CALM Tier 1, Category B STARC target concentrations. The SB-5 soil sample from 8 to 9 feet also had several detectable concentrations of VOCs, naphthalene and TPH but all below the MDNR CALM Tier 1, Category B STARC target concentrations. The SB-6 soil sample had detectable concentrations of VOC's, anthracene and TPH at 3 to 4 feet but only the concentration for TPH – diesel range at 4,800 mg/Kg was above the MDNR CALM Tier 1, Category B STARC target concentrations. The only groundwater sample with detectable compounds was the sample from SB-1. The detectable compounds were ethylbenzene at 49 micrograms per kilogram ( $\mu\text{g/L}$ ), naphthalene at 1,100  $\mu\text{g/L}$ , m&p xylene at 59  $\mu\text{g/L}$  and vinyl chloride at 46  $\mu\text{g/L}$ .

### 1.2.3 Building 1200 History

Two buildings, 1201 and 1202, are located at the site referred to as the 1200 Area. These structures were used in support of the weapons and ammunition bunkers located to the south and west. Building 1201 is located in Parcel L. One UST, a 3,000-gallon heating oil tank, was located at this facility. The usage for this UST was consumptive heat. UST 1201A was installed in June 1959 and was removed in March 1992.

Building 1202 is also located in Parcel L. Two USTs existed at this facility. USTs 1202A and 1202B were 1,500-gallon and 1,650-gallon tanks, respectively, and were used for storing heating oil. These USTs were used for consumptive heat. UST 1202A was installed in June 1959. UST 1202A was removed and UST 1202B was installed in February 1982. UST 1202B was removed in March 1992.

A subsurface assessment (HDB, 1996) was conducted at Buildings 1201 and 1202, in 1996. The Building 1201 assessment included two subsurface soil samples collected at 8 to 10 feet and 13 to 15 feet below ground surface at two boring locations. A ground water sample was also collected from one of the borings. The samples were analyzed for TPH, VOCs and SVOCs. The B1 sample from 13 to 15 feet had a detectable concentration of methylene chloride well below the MDNR CALM Tier 1, Category B STARC target concentrations. The B2 sample from 8 to 10 feet had detectable concentrations of VOC, SVOC and TPH compounds. The concentration above the MDNR CALM Tier 1, Category B STARC target concentrations were benzo(a)anthracene at 2,500  $\mu\text{g/Kg}$ , benzo(a)pyrene at 1700  $\mu\text{g/Kg}$  and benzo(b)fluoranthene at 2200  $\mu\text{g/Kg}$ . The ground water sample was collected from B1 and none of the analytes were detected above the detection limit in the sample.

The Building 1202 assessment included two subsurface soil samples collected at 8 to 10 feet and 13 to 15 feet below ground surface at two boring locations. The samples were analyzed for TPH, VOCs and SVOCs. None of the analytes were detected at 13 to 15 feet in the B1 boring. VOCs, SVOCs and TPH were detected at 8 to 10 feet in B2 but none above the MDNR CALM Tier 1, Category B STARC target concentrations.

### 1.2.4 ST007, Former UST Area History

Site ST007, located in Parcel A, is a former UST site where four 25,000-gallon steel USTs were used to store JP-4 fuel for the aircraft hydrant refueling system adjacent to the flight line. The tanks were installed in 1954 and remained in service through 1971. In 1977, the tanks were abandoned in place and filled with water to remove fuel vapors. During the first quarter of 1988 the tanks, pumps, and associated piping were removed.

Additional information on the ST007 can be found in the following documents.

- Geoenvironmental Exploration, Building 902, Richards-Gebaur AFB, MO, General Testing Laboratories, Inc., October 1989.
- Site Inspection, ST007 Leaking Underground Storage Tank (LUST), Building 902, Geraghty and Miller, Inc. Environmental Services, November 1991.
- Draft Report, Former UST Area Site ST007, Richards-Gebaur Air Force Base, Dames & Moore, November 1996.

The following is a summary of each of the investigations of ST007, Former UST Area noted above:

In October 1989, General Testing Laboratories, Inc. (GTL) of Kansas City, Missouri advanced eight soil borings at the site and collected one soil sample per boring for laboratory analysis of benzene, toluene, ethylbenzene, xylenes (BTEX) and TPH. The soil samples were collected at depths ranging from 3 to 12.5 feet and confirmed the presence of petroleum contamination at the site. The analytical results for the soil samples reported no concentrations of benzene or toluene above the method detection limits (MDL). Concentrations of ethylbenzene and xylenes were detected in two borings at 1.4 and 1.8 mg/Kg, respectively. TPH was detected in five borings at concentrations ranging from 62 to 1,618 mg/Kg. The TPH concentration(s) in excess of 500 mg/Kg were the only levels that exceeded the MDNR CALM Tier 1, Category B STARC target concentrations as established later in 1998.

In November 1991, Geraghty & Miller (G&M) of Overland Park, Kansas installed three monitoring wells and eight soil borings at the ST007 site. Standing water had collected in a depression formed in the area of the former UST pit, therefore the monitoring wells and soil borings were installed outside of the perimeter of the tank removal area. The soil borings were drilled to the top of bedrock, approximately 12 to 17 feet below ground surface. Analytical results of the eight soil samples reported TPH ranging from non-detect to 18 mg/Kg and BTEX constituents below the MDL. The analytical results of the groundwater samples reported no TPH above the MDL, but xylenes were detected in MW-1 at 21 micrograms per liter (mg/L). None of the above mentioned concentrations exceed any current clean up guidelines for sites in Missouri.

In April 1996, Dames & Moore of Overland Park, Kansas directed the advancement of nine exploratory borings, the collection of soil samples, and the analysis of selected samples. Soil samples collected by Dames & Moore at locations adjacent to GTL borings reported TPH concentrations equal to or exceeding those reported by GTL in 1989. Additionally, groundwater was sampled from the previously installed monitoring wells in March 1996 and June 1996 and submitted for analysis. Low concentrations of TPH ranging from 1.4 to 2.3 mg/L were reported in the monitoring wells during the March sample testing and a TPH concentration of 0.002 mg/L was found in the up gradient well during the June sample testing. None of the above mentioned concentrations exceed any current clean up guidelines for sites in Missouri.

### 1.2.5 Fuel Hydrant Line History

From 1954 to 1977 the Air Force utilized a buried 4,800-foot eight-inch diameter line to transfer jet fuel from the bulk storage tanks located in the POL Storage Yard to the pumphouse at Building 902 (ST-007). The pumphouse supplied fuel to four adjacent 25,000-gallon USTs. The Air Force used a system of buried six-inch diameter lines to transfer fuel from the ST-007 USTs to the airplane fill stands, six in all, located on the south apron of the airfield. The USTs were abandoned in place in 1977 and ultimately removed in the first quarter of 1988. The fuel hydrant line is located in Parcels A and B.

A "Tracer" soil gas study was performed by Burns and McDonnell in June of 1993. The hydrant line was surveyed utilizing soil gas probes and "Tracer" halon compound. This survey discovered a leak in the vicinity of the adjacent above ground steam line and a significant leak in the fuel line in the embankment behind Building 942. The leaking section was excavated to seal the line and establish a closed system for tracer inoculation and testing of the remainder of the line. The sealing created four pipe sections which were eventually surveyed by Shirley Environmental Testing, Inc. (SET). The SET survey collected soil gas samples approximately every 20 feet along the fuel line. The soil gas samples were sent to Tracer Research Corporation and analyzed for both the tracer compound and total volatile hydrocarbons (TVH). Elevated levels of TVH were found along each of the four pipe sections tested; however, "Tracer" results indicated only one section of pipe had leaks.

The elevated TVH levels were identified in both directions originating from the excavation behind Building 942. An approximate 76-foot section of the line heading away (southwest) from the excavation towards the flight line was determined to have an average concentration of 0.5070 mg/L TVH in four soil gas samples. The highest TVH result (265.5 mg/L) was found near Hangar Road adjacent to Building 918. It should be noted that this section of the line passed the integrity test. Soil gas sampling northeast of the excavation behind Building 942 detected in average concentrations of 0.2150 mg/L in four samples.

Dames & Moore provided oversight for the removal of a section of the eight-inch hydrant line near Building 942 during remedial activities conducted in July of 1995. The cast iron line had numerous holes along the length of pipe that was removed during this project. There was asbestos containing mastic-type material coating the hydrant line. The removal included approximately 76 feet of hydrant line and a portion of the aboveground steam line constructed perpendicular to the hydrant line west of Building 942. Approximately 930 cubic yards of impacted soil were excavated from the site and transported to a local landfill.

In June of 1996, TapanAm Associates, Inc. conducted environmental sampling along the hydrant line in the parking lot east of Building 918 where the SET soil gas survey reported 265.5 mg/L TVH. Seven soil samples were collected for TPH and VOC laboratory analysis. The sampling results indicated no detectable concentrations of TPH or VOCs.

#### 1.2.6 Industrial Waste Line History

Reportedly, the entire industrial waste line is no longer used and will be closed in place. The line measures approximately 5,310-feet in length and is an eight-inch vitrified clay pipe. The industrial waste line at one time received discharged from hangar buildings as well as the current fire station building. The industrial waste line also receives storm water from the flight line. The industrial waste line empties through oil/water separators (OWSs) and ultimately through Outfall "I". The pipe was classified as an industrial waste line due to potential petroleum contamination from maintenance, re-fueling, and/or vehicle washing operations. There is currently some flow through the line but it has not been determined if this flow is from water seepage into the pipe or due to actual discharge to the pipe from on-site buildings.

The inlets (source) to the industrial waste line were identified through a review of as-built drawings followed by a site walk-through of associated buildings by Dames & Moore personnel. The industrial waste line inlets will be plugged with at least five feet of grout and capped with concrete prior to the collapse of the manholes along the length of the line. If flow remains in the line once the inlets have been plugged, the flow will be considered infiltration water. Dames & Moore will not attempt to

determine the source of the infiltration water. The oil/water separator will be removed only after the completion of all other projects in this delivery order.

Closure of the line will leave the line unusable by later tenants of the buildings that once had drains plumbed to the industrial waste line. There is no history of soil or groundwater contamination associated with this site. The industrial waste line is located in Parcels A and B.

### 1.2.7 Oil/Water Separators History

OWS-9470A and OWS-9470B (CS003) are located in Parcel B, approximately 100 feet south of the POL Yard and west of an intermittent drainage ditch. These separators were a part of the industrial waste sewer system, are no longer used and will be removed following MDNR UST Closure guidelines. There is no history of soil or groundwater contamination associated with this site. Both separators are situated on grassy ground with a 15% slope to the northeast. The area north of the site is wooded. OWS-9470A is a 4,500-gallon steel tank anchored to a concrete slab approximately 15 feet below grade. OWS-9470B is approximately 20 feet west of OWS-9470A and consists of two 550-gallon tanks, the separator tank and a holding tank, encased within a concrete vault. Known utilities in the area include an electrical substation 150 feet south of the OWSs, buried and overhead electrical lines, 6- and 8-inch sewer lines, and an abandoned 8-inch POL fuel line. There is currently fluid still present in the separators as well as fluid passing through the separators for the industrial waste line. As with the closure of the industrial waste line, removal of the OWSs will leave this waste handling system unusable to future tenants of the property.

### 1.2.8 Eight Former UST Sites Histories

#### Building 903

Building 903 was the electrical power station building located in Parcel A. One 250-gallon UST containing diesel was located at this facility. According to a drawing, the UST was located south of Building 903. The UST was reportedly used for power generation. The UST was installed in 1961; however, the removal date was not reported.

A subsurface assessment (HDB, 1996) was conducted at Building 903 in 1996. It was reported that the former 250-gallon UST which had contained diesel fuel was no longer present at the facility. Two subsurface soil samples were collected at 3 to 5 feet and 8 to 10 feet below ground surface at two boring locations. The sample from 8 to 10 feet from B-1 had detectable concentrations of metals and VOCs but none above the MDNR CALM Tier 1, Category B STARC target concentrations for the site. VOCs detected included benzene, ethylbenzene, cis-1,2 dichloroethene, trichloroethene and m & p xylenes. The sample from 3 to 5 feet from B-2 also had detectable levels of several contaminants with one exceeding the MDNR CALM Tier 1, Category B STARC target concentrations. The concentration for TPH – diesel range was 730 mg/Kg. At least one SVOC compound and four VOC compounds were also detected in this sample.

#### Building 940

Building 940 was a hangar used for aircraft general purpose maintenance by the Air Force. Two USTs had been located at the facility. Tank 940A was a 500-gallon oil/water separator and Tank 940B had a capacity of 1,075 gallons and reportedly was a holding tank which contained oil and water. These tanks

were installed in February 1965 and removed in 1988. There is no historical information related to soil or groundwater contamination or investigative activities at this site.

#### **Building 942**

Building 942 was a former steam generation plant with two USTs. These USTs, 942A and 942B, were both of 15,000 gallon capacity, contained #2 fuel oil, and were removed in 1988. A subsurface assessment (HDB, 1996) was conducted at the Building 942 UST site in 1996. Four subsurface soil samples and two groundwater samples were collected at four boring locations (A1, A2, B1 and B2) northwest of Building 942. The samples were analyzed for TPH, VOCs and SVOCs. No analytes were detected at locations A1 (13 to 15 feet), B1 (13 to 15 feet), and B2 (ground water sample). Several analytes were detected above the detection limits in sample location A2 (3 to 5 feet), B2 (5 to 8 feet) and the B2 ground water sample. The compounds detected at A2 (3 to 5 feet) that were above the MDNR CALM Tier 1, Category B STARC target concentrations included benzo(a)anthracene at 4900 ug/Kg, benzo(b)fluoranthene at 4600 ug/Kg, benzo(a)pyrene at 4000 ug/Kg and TPH – diesel range at 1500 mg/Kg. The analytes that were detected at B2 included pyrene, bis (2ethylhexyl)phthalate and TPH – diesel range. The concentrations for these compounds were all below the MDNR CALM Tier 1, Category B STARC target concentrations. The only analyte detected in the B2 ground water sample was trichloroethene at 23 micrograms per liter ( $\mu\text{g/L}$ ).

#### **Building 944**

Building 944 was reportedly a communications building located north of building 941. Building 944 was demolished in 1988. Reportedly, two USTs had been located at this site. Tank 944A was a 1,000-gallon heating oil tank and Tank 940B had a capacity of 140 gallons and reportedly contained oil and water. Tank 944B was installed in October 1956. There is no installation date reported for tank 944A. The tanks were removed in 1988. Information present on the "as-built" drawings for the site indicate that there were two USTs. These USTs were listed as a 2,500-gallon fuel storage tank and a 1,000-gallon oil/water separator on as-built drawings obtained from Marine Corps personnel at Richards-Gebaur AFB. No other historical investigative activities have occurred at this building.

#### **Building 948**

Building 948 was used as a maintenance dock for flight systems. There were reportedly two USTs at this building. Tank 948A was a 500-gallon waste oil UST. Tank 948B was a 6,000-gallon heating oil UST. According to the information provided, Tank 948A was installed in August 1963 and removed in July 1988. There were no installation or removal dates provided for Tank 948B. A subsurface assessment (HDB, 1996) was conducted at Building 948 in 1996. Four subsurface soil samples were collected at four boring locations (A1, A2, B1 and B2). Borings A1 and A2 are located at the southeast corner of Building 948. B1 and B2 are located at the southwest side of the building. The samples were analyzed for metals, TPH, VOCs and SVOCs. The A1 sample from 13 to 15 feet had detectable concentrations of four metals, all below the MDNR CALM Tier 1, Category B STARC target concentrations. The A2 sample from 13 to 15 feet had detectable concentrations of several metals, VOCs, SVOCs and TPH, with three SVOC exceeding the MDNR CALM Tier 1, Category B STARC target concentrations. These SVOC compounds included benzo(a)pyrene at 4000 ug/Kg, benzo(a)anthracene at 5000 ug/Kg and benzo(b)fluoranthene at 5600 ug/Kg. TPH was also detected in this sample at 110 mg/Kg. The sample from B1 (5 to 7 feet) had detectable concentrations of trichloroethene at 69 ug/Kg and TPH – diesel range at 89 mg/Kg. The B2 sample from 18 to 20 feet had detectable concentrations of methylene chloride at 11 ug/Kg and trichloroethene at 69 ug/Kg.

### Building 965

Building 965 was previously used for aircraft general purpose maintenance. One 12,000-gallon waste oil UST existed at this facility. The UST was reportedly located between buildings 965 and 966 west of building 965. Tank 965A was installed in April of 1966 and removed in July of 1988.

A subsurface assessment (HDB 1996) was conducted at Building 965 in 1996. Two subsurface soil samples were collected at 8 to 10 feet below ground surface at two boring locations. However, the borings appear to be located east of Building 965 and thus were not taken where the UST was located. The samples were analyzed for metals, TPH, VOCs and SVOCs. Only traces of metals were detected above the detection limits at these soil samples. It is not known if contamination exists at this site.

### Building 1025

Building 1025 was a transmitter communication facility. Three USTs existed at this facility. Tanks 1025A, a 550-gallon tank, and 1025C, a 1,000-gallon tank, contained heating oil. Tank 1025B was a 250-gallon UST containing diesel fuel used for power generation. These USTs were reportedly located east-southeast of Building 1025. Tanks 1025A and 1025B were installed in April of 1953. Tank 1025A was removed and replaced with 1025C in June of 1968. Tanks 1025B and 1025C were removed in July of 1988.

A subsurface assessment (HDB, 1996) was conducted at Building 1025 in 1996. Four subsurface soil samples were collected at 3 to 5 feet (twice), 5 to 6.5 feet, and 8 to 10 feet below ground surface at four boring locations (A1, A2, B1 and B2). These borings are located southeast Building 1025. The samples were analyzed for lead, TPH, VOCs and SVOCs. Two compounds were detected at A1, both well below the MDNR CALM Tier 1, Category B STARC target concentrations. The A2 sample from 3 to 5 feet had detectable concentrations of one metal and five VOCs, all below the MDNR CALM Tier 1, Category B STARC target concentrations. The B1 sample from 5 to 6.5 feet had several detectable concentrations of metals, VOCs, SVOCs and TPH, with only the TPH – diesel range of 1700 mg/Kg exceeding the MDNR CALM Tier 1, Category B STARC target concentrations. The B2 sample from 8 to 10 feet also had several metals, VOCs, SVOCs and TPH in the detectable range but all below the MDNR CALM Tier 1, Category B STARC target concentrations.

### Building 1033

Building 1033 was located on the north portion of the former Fire Training Area at the former burn pit. Two USTs had been located at this site. Tank 1033A was a 425-gallon oil/water separator and tank 1033B had a capacity of 565 gallons and contained used oil. The tanks were installed in March 1972. Tank 1033B was removed in 1988 and 1033A was removed in 1989. No historical investigative activities have occurred at this building.

## **1.2.9 Petroleum, Oil, and Lubricants (POL) Storage Yard History**

The POL Storage Yard consisted of four aboveground bulk fuel storage tanks (954, 955, 956, and 957) tanks ranging in size from 190,000 to 260,000-gallons; three pump houses (Buildings 953, 959 and 960); a boiler building (Building 951); and a truck fill stand (Building 952). Underground transfer lines connected the aboveground storage tanks (ASTs) to the dispensing pump houses. The ASTs were situated on the flank of a hillside and surrounded by asphalt covered earthen berms. The site is approximately 12 acres and is covered primarily with crushed stone or asphalt. The eastern portion of

the POL Storage Yard containing Tank 956 and Pump House 959 is currently owned by the City of Kansas City, Missouri and is not part of this project. The POL Yard is located in Parcel B.

A 1996 removal action included the decontamination and removal of three ASTs (one 260,000-gallon heating oil tank, one 190,000-gallon JP-4 tank, and one 200,000-gallon JP-4 tank); approximately 3,750 linear feet of underground piping, fill stations, valves, rail off-load piping headers and other appurtenances; and a 20- by 40-foot boiler building (Building 951), 16- by 40-foot pump house (Building 953), 6- by 10-foot pump house (Building 960), and 6- by 12-foot truck fill stand (Building 952).

During the 1996 removal action, soil samples were collected along the excavated piping runs and from the building excavations to assess residual soil contamination. A total of 40 soil samples were collected for laboratory analysis. The samples were analyzed for BTEX and TPH. Twenty of the samples were also analyzed for SVOCs and lead.

The nine existing monitoring wells at the site were redeveloped and groundwater samples collected for laboratory analysis. The ground water samples were analyzed for BTEX and TPH. Soil borings were advanced at the site to assess the horizontal and vertical extent of residual soil contamination following removal of the AST, underground fuel piping, and other appurtenances; and the demolition of the boiler building, pump houses, and truck fill stand.

As part of the 1996 Phase II Soil Characterization study of the POL Yard, a total of 355 soil samples were submitted to the laboratory for analysis. The detected compounds included benzo(a)anthracene [4.1 and 14 mg/Kg], benzo(a)pyrene [0.73 to 66 mg/Kg], benzo(b)fluoranthracene [6.6 mg/Kg], dibenzo(a,h)anthracene [3.6 mg/Kg], and indeno(1,2,3,-cd)pyrene [15 mg/Kg]. TPH exceeding 500 mg/Kg was detected in 31 of the analyzed samples at concentrations of 568 to 5,640 mg/Kg. BTEX were below site cleanup goals or method detection limits in the samples.

Seventeen groundwater samples and one duplicate were submitted to the laboratory for analysis. No BTEX or TPH exceeding MDNR groundwater cleanup goals were detected in the groundwater samples collected from the monitoring wells or soil borings. One grab groundwater sample collected from the Building 951 basement prior to demolition had a TPH concentration of 196 mg/L. On-site heated headspace analysis of the grab groundwater sample collected 150 feet south of former Building 953 detected 8,604 ug/L total VOCs, but no BTEX above MDNR groundwater cleanup goals.

In 1997 Dames & Moore installed nine monitoring wells and two soil borings in conjunction with the Phase II Soil Characterization study. One well (MW-1D) was plugged during the field effort due to lack of water. Ten groundwater samples (including two grab samples from soil borings) were submitted for laboratory analysis. No ethylbenzene, SVOCs, or lead were detected in the ten samples submitted. Benzene ranging from 5.1 to 8.6 ug/L was detected in two samples. Toluene ranging from 3.0 to 79.0 ug/L was detected in three samples. Total xylene ranging from 8.7 to 98 ug/L was detected in three samples. TPH (DRO and GRO combined) ranging from 1.0 to 45 mg/L was detected in three samples.

Additional information on the POL Yard can be found in the following documents.

- Installation Restoration Program Phase II, Confirmation/Quantification, Stage 2, Final Report, prepared by Ecology and Environment, Inc., for USAFOEHL/TS, Brooks AFB, Texas, July, 1988. Soil sample results indicate petroleum hydrocarbon contamination; water samples do not indicate contamination.

- U.S. Army Corps of Engineers Report, October 16, 1989. Includes boring logs, sample analysis results for petroleum products in soil, and laboratory quality control documentation.
- Feasibility Study for POL Storage Yard, performed by O'Brien & Gere, October 1991. Includes site history, geology, hydrology, and estimates of extent of contamination and contaminant fate and transport. Provides remedial alternatives analysis.
- Feasibility Study for POL Storage Yard, performed by Burns & McDonnell, November 1992. Defines remediation objectives, alternatives, and evaluations.
- IRP Remedial Investigation, POL Storage Yard, performed by Burns & McDonnell, November 1992. Provides site background, description of field activities, sampling procedures and results, and risk assessment.
- Draft Report POL Yard Phase I/II Soil Characterization, performed by Dames & Moore, December 1996. Characterization of the soil at the POL Yard.

### 1.3 DESCRIPTION OF CURRENT WORK

#### Remediation of the 1100 Area

The objective of the field activities at the 1100 Area is to remove approximately 25 cubic yards of petroleum contaminated soil from a former UST site (see Figure 3). The anticipated depth of the excavation, based on previous soil data, is from 2 to 10 feet. The soil removed from the excavations will be profiled for disposal at an approved off-base landfill. After the removal process is complete, the field personnel will obtain confirmation soil samples from the excavation, collect a sample of any ground water that has entered the excavation, and have the samples analyzed for the parameters presented in Section 3.2 of the Field Sampling Plan (FSP). The excavation will be backfilled with clean soil immediately after the collection of the samples from the excavation. Once the confirmatory soil sample analyses report that the excavations have met MDNR UST Closure Guidance concentrations and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the site.

#### Remediation of the 1200 Area

The objective of the field activities at the 1200 Area is to remove approximately 134 cubic yards of petroleum contaminated soil from the former UST location at Building 1201 (see Figure 4). The anticipated depth of the excavation, based on previous soil data, is from 2 to 15 feet. The soil removed from the excavations will be profiled for disposal at an approved off-base landfill. After the removal process is complete, the field personnel will obtain confirmation soil samples from the excavation, collect a sample of any ground water that has entered the excavation, and have the samples analyzed for the parameters presented in Section 3.2 of the FSP. The excavation will be backfilled with clean soil immediately after the completion of sampling. Once the confirmatory soil sample analyses report that the excavations have met MDNR UST Closure Guidance concentrations and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the site.

An effort will be made to locate heretofore unseen as-built drawings of Building 1202 to find the previous location of piping and vent lines. Should the drawings not be available, effort will be made during the field work to estimate the previous location of the lines in relation to remaining appurtenances (e.g. the boiler, wall fittings for vent pipes, hole in building for piping, etc.) in order to collect samples per the MDNR UST Closure Guidance Document. Additional samples will be collected if necessary in an effort to close this site. Based on that information, a final UST Closure Report will be prepared for Building 1202 without any further subsurface investigation.

### Site ST007, Former UST Area Well Abandonment

The objective of the field activities at the ST007 site is to remove the 18 bio-vent well casings from the area of the former USTs (see Figure 5). The wells will be removed by a State of Missouri licensed well driller. The casings and any soil generated during the removal activities will be disposed of at an approved off-base landfill. The bore holes for the bio-vent wells will then be abandoned in accordance with State of Missouri well abandonment requirements (10 CSR 23-4.080). The former location of each of the bio-vent wells will then be restored to match the surrounding site conditions. A letter report will then be prepared documenting the site activities

### Fuel Hydrant Line Closures

Dames & Moore will close two fuel hydrant lines (8-inch and 6-inch) totaling approximately 5,800 feet (see Figure 6). The objective of the field activities is to perform cleaning, plugging and assessment activities to obtain closure of the fuel hydrant line. The line will initially be accessed by excavation at four locations. Once the excavations have been shored or benched, a six to eight-foot section of the line will be cut out for removal of residual liquids and cleaning/rinsing. Asbestos containing mastic will be abated from the line prior to cutting the pipe. The fluids removed from the fuel hydrant line will be containerized, sampled, analyzed, and disposed of in accordance with MDNR regulations. The flowable grout material will be pressure-pumped into the line until flow is established at the effluent end. The line will then be capped at each access point. After completion of these activities, soil samples will be collected along the line in accordance with MDNR UST Closure Guidance regulations. The soil samples will be collected using direct-push techniques at a depth corresponding to approximately 12-inches below the line invert every 100 feet and/or at elbows. Soil samples will be collected from each of these locations and analyzed for the parameters presented in Section 3.2 of the FSP. The direct push boreholes will be grouted immediately after collecting the soil samples at each location. The borehole locations will be restored to coincide with surrounding site conditions. If the confirmatory soil sample analyses report indicates that the hydrant fuel line meets MDNR UST Closure Guidance concentrations and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the line.

### Industrial Waste Line Closures

The objective of the field activities is to perform cleaning, plugging and assessment activities for closure of the industrial waste line (see Figure 6). The line will initially be accessed at several manhole locations for the removal of residual liquids and cleaning/rinsing. The fluids removed from the industrial waste line will be containerized, sampled, analyzed, and disposed of in accordance with MDNR regulations. After completion of these activities, soil samples will be collected at the manhole locations using direct-push techniques. The soil samples will be collected at a depth corresponding to approximately 12-inches below the line invert at manholes. Soil samples collected from each of these locations will be analyzed for the parameters presented in Section 3.2 of the FSP. The direct-push boreholes will be plugged immediately after collecting the soil samples at each location. The industrial waste line inlets will be plugged with at least five feet of grout and capped with cement (flush with the floor). The surface appurtenance of each manhole will then be collapsed into each manhole concrete box that extends below the ground surface. The remainder of the void space in the concrete box will be backfilled with soil to eliminate access to the line. The surface at the manhole locations will be restored to coincide with surrounding site conditions. If the confirmatory soil sample analysis reports indicate that the sampled locations have met MDNR UST Closure Guidance concentrations and the Air Force is satisfied that cleanup goals have been met, a Closure Report will then be prepared for the Industrial Waste Line.

### Oil/Water Separators (OWS) 9470A and 9470B (CS003)

The objective of the closure activities is to remove the components of OWS-9470A and OWS-9470B. Soil samples and a single ground water sample will be collected adjacent to the separators prior to initiating the removal activities to assess whether a release has occurred (see Figure 7). The soil samples will be collected using direct-push methods. The ground water (if any) will be sampled from two of the down gradient boreholes. After completion of these activities, the contents of OWS-9470A and OWS-9470B will be sampled in accordance with MDNR closure sampling requirements for a UST of equivalent size. The contents from the OWSs will then be removed and disposed at an approved off-base facility.

After review and confirmation of the results from the soil sampling, a subcontractor will remove the fluids from the oil/water separators. The fluids will be containerized and sampled by Dames & Moore field personnel for characterization for disposal at an off-site location. The OWSs will be purged of flammable vapors and cleaned prior to removal activities. A subcontractor will then use an excavator and possibly a crane to remove the separators. The associated vent stacks and piping will also be removed during this operation. Any steel tanks will be transported to a recycling/scrap facility. Concrete will be demolished and placed in roll-off boxes for transport to a landfill. Soil determined to be contaminated during the removal operation will be excavated and placed in roll-off boxes for transport to and disposal at an off-site landfill. After the collection of samples, the excavation will be backfilled immediately with clean soil brought from an off-site location.

It is anticipated that up to 100 cubic yards of contaminated soil may be present at this site. Additional confirmation soil samples from the excavation floor and samples of any ground water entering the excavation will be obtained and analyzed for the parameters presented in Section 3.2 of the FSP. Once the confirmatory soil sample analyses report that the excavations have met MDNR UST Closure Guidance concentrations and the Air Force is satisfied that cleanup goals have been met, a final UST Closure Report will be prepared.

### Remedial Investigation at 4 Former UST Sites

The objective of the field activities is to complete a Remedial Investigation at the former UST location(s) at Buildings 940, 944, 965, and 1033 (see Figures 8 through 11). The investigation activities will include collecting soil and, if encountered, ground water from boreholes advanced using direct-push technology. The samples will be analyzed for the parameters presented in Section 3.2 of the FSP. If it is determined that contamination is present above the MDNR UST Closure Guidance concentrations for any or all the sites, these locations will be addressed under the Removal Action portion of this contract. A UST Closure Report will be generated for each of those sites that do not have contamination exceeding MDNR UST Closure Guidance concentrations.

### Remedial Action at 8 Former UST Sites

The objective of the field activities at the Remedial Action sites is to remove petroleum-contaminated soil from the former UST locations. The buildings where there is known petroleum contamination exceeding the MDNR UST Closure Guidance concentrations are 903, 942, 948, and 1025 (see Figures 12 through 15). As noted above, Buildings 940, 944, 965, and 1033 could be added to this list if petroleum contamination is detected above the clean up guidelines during the Remedial Investigations at these sites. The soil removed from each excavation will be profiled and disposed of at an approved off-base landfill.

After the removal process is complete, the field personnel will obtain confirmation soil samples from these excavations, collect samples of ground water that may have entered the excavations, and have the samples analyzed for the parameters presented in Section 3.2 of the FSP. The excavations will be backfilled with clean soil immediately after the completion of sampling at each location. Once the confirmatory soil sample analyses report that the excavations have met MDNR UST Closure Guidance concentrations and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for each site.

#### **POL Storage Yard (ST005)**

The objective of the field activities at the POL Yard is to backfill a depression remaining from the removal of Buildings 951 and 953 to eliminate a safety concern at the site. The water that has collected in this depression will be pumped out through the oil/water separators. The monitoring well that is present in this depression will be plugged in accordance with State of Missouri well abandonment regulations (10 CSR 23-4.080). Clean fill material will then be brought to the site and placed in the depression. The depression will be backfilled to a level consistent with the surrounding land surface. A letter report summarizing these activities will be provided at the completion of the fieldwork.

## 2.0 SUMMARY OF EXISTING INFORMATION

This section describes the environmental setting at Richards-Gebaur AFB.

### 2.1 INSTALLATION ENVIRONMENTAL SETTING

#### 2.1.1 Demographics

Richards-Gebaur AFB occupies 428 acres within portions of Jackson and Cass Counties in Missouri and is located approximately 18 miles south of downtown Kansas City and approximately three miles east of the Kansas state line.

The base property is comprised of approximately 428 acres in 11 parcels. Associated with this acreage are approximately 421 acres of easements. The Cantonment Area, covering 208 acres, is the largest parcel and contains the main aviation support and administration areas. Nine smaller parcels, ranging from 1 to 3 acres, surround the Cantonment Area. The Belton Training Complex, about 4 miles south of the Cantonment Area, encompasses 184 acres and is largely undeveloped.

#### 2.1.2 Physiography

Richards-Gebaur AFB is located within the Osage Plains physiographic province, in the North American Central Lowlands. The terrain is characterized by a nearly level plain that has been incised by tributaries of the Missouri River, resulting in gently to steeply rolling hills, with relative relief generally around 50 feet, but locally occurring up to about 150 feet. The Cantonment Area and the smaller parcels surrounding it are located on a low ridge that divides the Blue River drainage system (west of the base) from the Little Blue River system (east of the base). The Belton Training Complex is in rolling terrain incised by the secondary drainages of the West Fork of East Creek. Elevations range from about 1,000 feet above MSL to about 1,100 feet above mean sea level (MSL) in the various areas of the base.

#### 2.1.3 Surface Water Drainage

The main base area is within the Missouri River drainage Basin; the Belton Training Complex is within the South Grand portion of the Osage River drainage basin.

The local surface hydrology is dominated by the drainage systems of the Blue and Little Blue Rivers. Scope Creek, the only natural drainage/surface water feature on the base, flows from the south to the northeast, terminating in the Little Blue River. Scope Creek is an intermittent stream that contains water much of the time. A number of impoundments also have been built in the area, creating numerous ponds. None of these ponds are on Richards-Gebaur AFB, although two are adjacent to the base property.

The primary drinking water source in the region is the Missouri River. The Kansas City Water and Pollution Control Department pipe the water from the river.

#### 2.1.4 Regional Geology

The general geology of the area is characterized by thick sequences of gently folded sedimentary rocks of the Paleozoic Era, locally overlain by Pleistocene wind-deposited sediments, associated with glacial activity north of the area.

#### 2.1.5 Base Geology

The two major surface geologic units in the vicinity of Richards-Gebaur AFB are thin (maximum of a few feet) deposits of wind-blown silt (loess) deposited on bedrock and residuum. Residuum is unconsolidated material formed from the surface layer of bedrock. The surface bedrock has been weathered and broken down in places, forming a layer of varying thickness containing clay, silt, sand, and larger fragments on top of unweathered bedrock.

The depth to bedrock on Richards-Gebaur AFB (including the Belton Training Complex) includes one or more of the Iola, Lane and Wyandotte formations (Missourian Series of the Pennsylvanian System). Predominant units identified in soil borings on the base and adjacent to the airfield are the Argentine Member of the Wyandotte Formation, the Lane Formation, and the Raytown Member of the Iola Formation. Lithologies in these formations include fossiliferous limestones, shales, interbedded limestones and shales. Limestones with nodular chert, ribbon (very thinly bedded) limestones, and lesser amounts of siltstones and sandstone. Approximately 2,500 feet of Pennsylvanian and older sediments underlie the base.

Structurally, the Paleozoic sedimentary units are gently folded into a series of north-south trending synclines, anticlines, domes, and basins. The runway is approximately aligned along the axis of the Jost Syncline. The Cantonment Area is on the eastern limb of the syncline, which is also the northeastern side of King Dome (a structural high immediately east of the Jost Syncline). Other parcels are scattered on the northern, western, and southern flanks of the same; the Billeting Complex is located on a slight anticlinal form between the Jaudon Anticline (to the west) and the Main City-Belton Syncline (to the east).

A major structural feature in the vicinity is the Belton Ring-Fault Complex, located south of the Weapons Bunker and north of the Belton Training Complex. The Belton Ring-Fault Complex is a circular area of several square miles in which the rocks have been down-faulted approximately 150 feet relative to the surrounding rock. The structure appears to have been formed by collapse into caverns formed in the Mississippian-age limestones. Erosion and soil development have had sufficient time to remove or conceal fault scarps, deep depressions, etc., indicating that the collapse was not recent, although the specific age of this event has not been determined.

#### 2.1.6 Soils

Soils in the area are formed on the silt and weathered bedrock surfaces; soil textures are primarily silt loams and silty clay loams (U.S. Department of Agriculture, 1984, 1985). In general, the common soil properties of wetness, shrink-swell, frost action, and low strength must be considered in construction activities. The Soil Conservation Service has identified the Macksburg silt loam and the Sharpsburg silt loam as Prime Farmlands.

### 2.1.7 Regional Hydrogeology

With the exception of the Belton Training Complex, drainage from the on-base areas naturally flows towards Scope Creek, which then flows into the Little Blue River. The Little Blue River flows north into the Missouri River. Drainage from the Billeting Complex and the NDI Laboratory flows into two surface water impoundments on Scope Creek tributaries. Drainage flows from the Belton Training Complex southeast into the West Fork of East Creek, which flows into the South Grand River, a source of water for the Harry S. Truman Reservoir.

In September 1992, Richards-Gebaur AFB applied to the MDNR for a National Pollutant Discharge Elimination System (NPDES) permit as a non-point source that discharges into Scope Creek (an unclassified intermittent stream), in compliance with NPDES requirements of the Clean Water Act and Missouri water regulations. Discharges consist primarily of storm water runoff from areas used for industrial and related activities. The application did not include runoff that flows into the two ponds near the base, or any runoff from the Belton Training Complex.

The Little Blue River is listed as a Metropolitan No-Discharge Stream. A No-Discharge Stream is defined as a stream or waterway that shall not receive any discharges other than non-contaminated, non-contact cooling water from power plant facilities and/or agricultural land storm water runoff (MDNR, 1993b). The Truman Reservoir is listed as a Major Reservoir (10 CSR 20) and is classified for levels of water quality protection that allow the water to be suitable for whole-body contact (e.g., swimming).

None of the waterways described are listed as Outstanding National Resource waters or outstanding state resource waters. There are no designated wild and scenic rivers in the area.

### 2.1.8 Base Hydrogeology and Ground Water Use

The base is within the Osage-Salt Plain groundwater area of the Central Nonglacial Plains groundwater region. The Osage-Salt Plains area is characterized by Pennsylvanian and Mississippian sandstone and limestone aquifers that yield water from shallow wells at low rates; wells deeper than 400 feet yield non-potable mineralized water.

The base does not use any groundwater, and there are no operational water wells on base. The base is not located within a sensitive or special water well construction area (as defined by the state of Missouri), in which geologic conditions would necessitate additional well construction requirements.

The available groundwater in the vicinity of the base is non-potable. Total dissolved solids (TDS) content in groundwater exceeds 40,000 ppm, far exceeding the U.S. EPA Secondary sole-source aquifers in the vicinity of Richards-Gebaur AFB.

### 2.1.9 Air

Climate conditions around Richards-Gebaur AFB vary substantially on a seasonal, and at times even daily, basis. Because the surrounding terrain is gently rolling without any significant modifying influences for miles in any direction, the area is often affected by the importation of warm or cold air from source regions many hundreds of miles away. Moist air masses flowing from the Gulf of Mexico, hot and dry air masses from the semiarid southwest, or cold polar continental air masses from the north may at any given time be the dominating influence affecting weather in the area.

Summer in the Richards-Gebaur AFB area is characterized by warm days and mild nights, with mostly moderate relative humidity. July is the warmest month, with a mean high temperature of 89 degrees Fahrenheit and a mean low of 70 degrees Fahrenheit. January is the coldest month, with a mean low temperature 21 degrees Fahrenheit and a mean high of 29 degrees Fahrenheit. Snowfall normally occurs from November to April and averages about 20 inches per year; precipitation averages 37 inches per year, mostly from April to September. Wind speeds average 11 miles per hour and occur from variable directions.

#### 2.1.10 Biology

Richards-Gebaur AFB is situated in a lowland region on the western edge of Missouri. Most of the region has been extensively altered by agricultural activities. Much of the natural vegetation on Richards-Gebaur AFB was formerly moist savanna, tall grass prairie, and lowland forest. Moist savannas are grassland areas with trees present along river bottoms. Typically, these areas are dominated by prairie grasses and herbs, and there are few shrubs, except for young trees. Under natural conditions, savannas are maintained by wildfires; however, with the settlement of man, the number of prairie/savanna fires has been reduced. The prairie has been further altered by landscaping and agricultural activities. Wooded and shrubby areas are now confined to drainage areas and fence lines where mowing and clearing activities are restricted. These disturbances currently maintain the vegetation on and around Richards-Gebaur AFB.

Most of the base parcels and surrounding areas are landscaped with fescues and bluegrass. Planted tree species include Pin oak, honey locust, and blue spruce. Landscaped areas and disturbed grassland are maintained with herbicides, fertilizers, and mowing/pruning.

The wooded, riparian zones contain eastern cottonwood, honey locust, osage orange, and American Elm. Wetland vegetation, including willow, cattails, and sedges, is present along drainages where water pools and where maintenance activities are precluded.

The Belton Training Complex is less disturbed than the other parcels, and contains a tall grass prairie community with moist savanna wooded areas. The tall grass vegetation includes big bluestem and Indian grass, with cord grass growing in the shallow, moist depressions. The entire Belton Training Complex has been mowed at some time, although the western side of the drainage has not been disturbed recently and has reverted to native prairie grassland. Riparian species as described above are also present along the drainages.

Richards-Gebaur AFB lies in a central lowland zone between the Great Plains prairie to the west and the forested Ozark highlands to the south and east. This area exhibits several habitats found in both of these communities, as well as habitats unique to central lowlands. Extensive human activity, including agricultural and urbanization, has altered much of the natural habitat in the region. Several wide-ranging species that once inhabited the area are no longer found in central lowland habitats. Native elk and bison that roamed the great plains and savannas to the west, as well as mountain lion, black bear, and gray wolf that hunted throughout all habitats are no longer present. The white-tailed deer is the only large mammal to inhabit this area, and is preyed on by coyote, bobcat, and man.

Wildlife diversity and activity on base is greatest throughout the wooded areas. Typical mammals of these wooded habitats include gray and red fox, raccoon, fox squirrel, eastern gray squirrel, eastern cottontail, and eastern mole. House mouse, opossum, and domestic dog and cat frequent landscaped and developed areas on base.

A variety of birds are found on base. The common grackle, tufted titmouse, mourning dove, yellow-rumped warbler, house finch, and downy woodpecker inhabit the wooded areas. Northern cardinal and black-capped chickadee are typical species associated with open habitats. These types of species also include the red-winged blackbird and eastern phoebe. Typical species observed on landscaped areas include American robin, European starling, eastern meadowlark, and Canada goose. Killdeer utilize landscaped, standing water, and barren gravel areas on base. Common garter snake and racer are typical reptiles that inhabit all areas on base.

The less-disturbed Belton Training Complex includes several additional species typically associated with moist savanna and open tall grass prairie communities. White-tailed deer, great-horned owl, northern flicker, brown thrasher, and American tree sparrow are observed species associated with the wooded portions of this site. Northern bobwhite, a prairie species, was observed in the native tall grass.

The United States Fish and Wildlife Service (USFWS) has indicated that no federally listed threatened or endangered species (flora and fauna) are known to occur at Richards-Gebaur AFB. The Missouri Department of Conservation (MDC) has conducted a natural features inventory in Jackson and Cass counties, which focused on listed plants and animals, and has indicated that no state-listed species are likely to occur on the base.

Limited populations of greater prairie chicken (*Tympanuchus cupido*), a state-listed rare species, persist on native grasslands south and west of the base. Richards-Gebaur AFB is located outside of the known prairie chicken ranges.

Wetlands are the only sensitive habitat at Richards-Gebaur AFB. Wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (U.S. Army Corps of Engineers, 1987). The majority of jurisdictional wetlands in the United States meet three wetland delineation criteria (hydrophytic vegetation, hydric soils, and wetland hydrology) and are subject to Section 404 of the federal Clean Water Act. Wetlands present on Richards-Gebaur AFB meet the wetland delineation criteria.

There are 0.6 acre of wetlands in the Cantonment Area and 0.2 acre in the Belton Training Complex. These wetland areas occur along the natural drainages that traverse the region.

The wetland in the central portion of the Cantonment Area is wooded with open patches of sedges and cattails. The wetland areas in the northeastern portion of the Cantonment Area are dominated by cattails with intermittent patches of black willow where surface flow is reduced. The wetland areas filter the water that passes through them, settling out sediments and slowing the velocity of storm water runoff that could otherwise erode the drainage channels during periods of high flow. The vegetation within the drainages in the Cantonment Area has been left fairly natural for these reasons, even though the surrounding areas have been landscaped.

The vegetation in the wetland areas in the Belton Training Complex is similar to that in the Cantonment Area wetland areas, which is predominately cattails, honey locust, and cottonwoods. The wetlands in the Belton Training Complex are wooded and support more wildlife species than the wetlands in the Cantonment Area.

## **2.2 SITE-SPECIFIC ENVIRONMENTAL SETTING**

For the purpose of this project, there are sixteen (16) separate sites which include the following: 1100 Area, 1200 Area, ST007, Fuel Hydrant Line, Industrial Waste Line, oil/water separators (CS003), storm sewer line, Building 903, Building 940, Building 942, Building 944, Building 948, Building 965, Building 1025, Building 1033, and the POL Yard (ST005). Relevant information on geology, ground water, surface water, air, biology and demographics is discussed as a single site and is provided in Section 2.1 of this Work Plan.

### **2.2.1 Contaminant Sources and Contamination**

A discussion of contaminant sources and contamination is presented in Section 1.2 of this Work Plan.

### **2.2.2 Potential Contaminants**

Potential contaminants to surface waters include sediment pollution due to land disturbance during excavation activity; discharge of petroleum contaminated liquids due to dewatering of fuel product lines, sewer lines excavations, and surface depression; and petroleum products/residues released from the subcontractor's construction equipment.

### **2.2.3 Potential Contaminant Release Pathways**

The majority of surface water runoff containing a contaminant release would eventually migrate to Scope Creek depending on weather conditions at the time of a spill, however it is unlikely that Scope Creek would be impacted by a spill or release. Most of the areas between the fieldwork and Scope Creek are low-cut, grassy areas and a spill or release would infiltrate prior to reaching Scope Creek. Spill procedures will be implemented and sediment barriers will be installed between the fieldwork areas and Scope Creek as precautionary measures.

### 3.0 PROJECT TASKS

#### 3.1 CONCEPTUAL SITE MODEL DEVELOPMENT

Existing information about the natural conditions and contamination at the Base are discussed in Section 2.1. The site maps are presented as Figures 1 and 2. The conceptual site model depicts the geologic and hydrologic conditions at Richards-Gebaur AFB and is depicted in Table 3.1-1.

**TABLE 3.1-1**  
**Conceptual Site Model/Natural Conditions and Contamination**

Site Identification	Site Description	Contaminants And Contaminated Media	Migration Pathways
1100 Area <sup>1</sup>	Receiver Communication Facility	Primary contaminant of concern is TPH in soil	Soil
Building 1201 <sup>1</sup>	Ammunition Storage	Primary contaminants of concern are PAH's in soil	Soil
	Former Fuel Storage Area	Not Applicable	Not Applicable
Fuel Hydrant Line <sup>1</sup>	Fuel Supply Line that led from former AST's to UST's near fueling manifolds	Primary contaminants of concern are VOCs (including BTEX), SVOCs, and TPH in soil.	Soil
Industrial Waste Line	Line for waste leading from the 900 Area buildings to the Oil/Water Separators	Primary contaminants of concern are VOCs, SVOCs, and TPH in soil.	Soil
CS-003 (Oil/Water Separators)	Oil/Water Separators at the end of the industrial waste line	Primary contaminants of concern are volatile and semi-volatile organics to soil and ground water	Soil
Building 903 <sup>1</sup>	Electric Power Station	Primary contaminants of concern are BTEX/MTBE and TPH (diesel range) in soil	Soil
Building 940	Hangar	No investigation at this site	Soil
Building 942 <sup>1</sup>	Steam Generating Plant	Primary contaminants of concern are TPH (diesel range) and PAH's in soil and volatiles in ground water	Soil
Building 944	Communication building	No Investigation at this site	Soil
Building 948 <sup>1</sup>	Maintenance Building for Flight Systems	Primary contaminants of concern are PAH's in soil	Soil
Building 965	Hangar for Aircraft General Purposes	No Investigation at this site	Soil
Building 1025 <sup>1</sup>	Transmitter Communication Facility	Primary contaminant of concern is TPH (diesel range) in soil	Soil
Building 1033	Burn Pit Area	No Investigation at this site	Soil
POL Yard <sup>2</sup>	Former Fuel Storage Area	Not Applicable	Not Applicable

Note: <sup>1</sup> Other contaminants have been detected at these sites but not at concentrations that exceed MDNR CALM Tier 1, Category B STARC Target Concentrations

<sup>2</sup> The contaminants and migration pathway are not applicable to this work because these tasks only include abandoning wells at ST007 and backfilling a depression and abandoning a well at the POL Yard

### 3.2 APPLICABLE OR RELEVANT & APPROPRIATE REQUIREMENTS IDENTIFICATION

The IRP is the DoD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The applicable or relevant and appropriate requirement (ARAR) for closing the hydrant lines, industrial waste line, oil water separators and all underground storage tank systems addressed as part of this Work Plan is the Missouri Department of Natural Resources Underground Storage Tank Closure Guidance Document, March 1996 (Closure Guidance Document). The Closure Guidance Document will be used to determine the appropriate sampling locations, required analyses and cleanup levels for soil and groundwater at these locations. Cleanup levels will be established for each site using the LUST Soil Cleanup Matrix (Table 4 in the MDNR UST Closure Guidance Document) and approved by the department prior to work beginning. A copy of the Table 4 LUST Soil Cleanup Matrix, scored for each site, is included at the end of this section.

The Cleanup Levels for Missouri (CALM) document as revised in September 1998 may be considered for soil and groundwater cleanup levels for compounds not listed in the Closure Guidance Document.

### 3.3 CHARACTERIZATION OF BACKGROUND CONDITIONS

A summary of available information on the background soil and or groundwater conditions is not relevant to this project. The closure of these sites will be based on the actual conditions present at each site and will be conducted in accordance with guidelines presented in the MDNR UST Closure document dated March 1996.

### 3.4 RISK ASSESSMENT

This section is not applicable to this project. The evaluation of risk for these sites was provided when the CALM Tier 1, Category B Target Concentrations were developed by MDNR. The target concentrations were based on the assessed risk at similar sites.

### 3.5 DATA NEEDS IDENTIFICATION

The data needs specific for this project involves the documentation of the presence or absence of evidence of a release(s) from each site. Impacted soil at the oil/water separators, 1100 Area, 1200 Area and several of the 900 and 1000 buildings that exceeds the MDNR CALM Tier 1, Category B clean up levels will be remediated as part of this project (see Table 3.5-1). Impacts at the fuel hydrant line and industrial waste line will be documented, reported, and addressed at a later date. In order to meet the above mentioned data needs, soil borings and or trenching will be advanced/excavated at each site and soil samples submitted to the laboratory for analyses. Water samples will be collected from excavations, the industrial waste line, from the oil/water separators, and as QA/QC samples for all field activities.

**Table 3.5-1**  
**CALM Tier 1, Category B Clean Up Target Concentrations for Specific Compounds<sup>1</sup>**

Compound	STARC <sup>2</sup>	GTARC <sup>3</sup>	Laboratory Reporting Limit	
			Soil	Water
Acenaphthalene	Not Applicable (N/A)	N/A	N/A	N/A
Acenaphthene	5,900	2	0.7	0.01
Acetone	3,780	4	N/A	N/A
Anthracene	29,500	10	0.7	0.01
Arsenic	11	0.05	40.0	0.03
Barium	3,930	2	1.0	0.005
Benzene	11	0.005	0.01	0.0001
Benzo(b)anthracene	1.5	0.0001	0.01	0.7
Benzo(a)pyrene	0.23	0.0002	0.7	0.01
Benzo(b)fluoranthene	1.4	0.0001	0.7	0.01
Benzo(g,h,i)perylene	N/A	N/A	0.7	0.01
Bis(2-ethylhexyl)phthalate	200	0.006	0.4	0.01
2-Butanone	N/A	N/A	N/A	N/A
n-butylbenzene	N/A	N/A	0.005	0.0011
Sec-butylbenzene	N/A	N/A	0.007	0.0013
Chloroform	3.8	0.1	0.002	0.0003
Chlorotoluene	N/A	N/A	N/A	N/A
Chromium	1,800	0.1	20.0	0.01
Chrysene	52	0.01	0.7	0.01
Cis-1,2-dichloroethylene	400	0.07	0.006	0.0012
Dibenzofuran	N/A	N/A	0.7	0.01
1,2-dichloropropane	14	0.005	0.002	0.0004
Ethylbenzene	1,460	0.32	0.01	0.0005
Fluoranthene	830	1	0.7	0.01
Fluorene	3,900	1	0.7	0.01
Indeno(1,23-cd)pyrene	4.2	0.0001	0.7	0.01
Isopropylbenzene	N/A	N/A	0.008	0.0005
Isopropyltoluene	N/A	N/A	0.006	0.0012
Lead	660	0.015	10.0	0.025
Methylene chloride	71	0.005	0.002	0.0003
Methylnaphthalene	N/A	N/A	N/A	N/A
2-methylnaphthalene	N/A	N/A	N/A	N/A
Naphthalene	1,350	0.02	0.002	0.0004
Phenanthrene	N/A	N/A	0.7	0.01
n-propylbenzene	N/A	N/A	0.002	0.0004
Pyrene	2,950	1	0.7	0.01
Trichloroethylene	52	0.005	0.01	0.001
Trimethylbenzene	N/A	N/A	N/A	N/A
Toluene	890	0.150	0.01	0.0001
Total Petroleum Hydrocarbons	500	10	N/A	N/A
Xylenes	1,510	0.32	0.01	0.0005
Vinyl Chloride	0.34	0.002	0.009	0.0011

Notes:

<sup>1</sup> List only includes compounds detected during previous work at the RGB sites.<sup>2</sup> STARC = Soil target concentrations in mg/Kg<sup>3</sup> GTARC = Ground water target concentrations in mg/L.

### 3.6 FIELD INVESTIGATION TASKS

The primary method for achieving the goals of this project is through the establishment of Data Quality Objectives (DQO). DQOs specify the data type, quantity, and uses and are the basis for determining the data collection activities required for the project. The project DQOs are as follows:

**TABLE 3.6-1  
Project Data Quality Objectives**

DATA TYPE	DATA QUALITY	DATA QUANTITY	DATA USE
Ground Water Sample Analyses (Screening Data)	See Table 6.2-1 of the QAPP for turbidity, pH, conductivity, temperature Calibration and QC Procedures	See WP Tables 3.6.2-7 for number of samples to be collected	Assess Ground Water Quality
Ground Water Sample Analyses (Definitive Data)	See Section 7.0 of the QAPP, QC Acceptance Criteria	See WP Tables 3.6.2-1 through 3.6.2-10 and FSP Tables 3.2-1 through 3.2-19 for number of samples to be collected	Assess Ground Water Quality
Soil Sample Analyses (Screening Data)	See Table 6.2.2 Of the QAPP for Calibration and QC Procedures	Number of samples to be screened will be based on the yardage removed and on the appearance of the soil at each location	Assess Soil Quality
Soil Sample Analyses (Definitive Data)	See Section 7 of the QAPP, QC Acceptance Criteria	See WP Tables 3.6.2-1 through 3.6.2-10 and FSP Tables 3.2-1 through 3.2-19 for number of samples to be collected	Assess Soil Quality

The following is a summary of the field activities associated with closure of several sites at Richard-Gebaur AFB. The fieldwork is tentatively scheduled to begin in early November 1999.

The field activities to be completed at each building or site are described in detail in Section 3.6.2 of this Work Plan.

#### 3.6.1 Mobilization

Preparation will be necessary prior to initiation of field activities. These preparations include coordination with AFBCA for site access, utility clearance, and security, mobilization to the site, location of underground utilities, and identification of work areas. The Dames & Moore field team will mobilize from the Kansas City.

On-site coordination with the Kansas City Aviation Department (KCAD) will be required to ensure work will begin and progress in a safe, efficient manner. Dames & Moore will coordinate with the KCAD to secure access to the sites and for the storage of materials (e.g., heavy equipment, soil cuttings, decontamination water, barrels, excavation water, etc.) at the base.

Security issues will be discussed with the Contracting Officer's Representative (COR) and AFBCA personnel prior to beginning field activities. Procedures will be established to identify personnel that require access to the site, and to record the name and purpose of any site visitors in the daily logbook. Any unauthorized access will be reported immediately to the COR and AFBCA personnel, and will be so noted in the daily logbook.

The work areas at the site will be secured during the closure activities. The work area is defined as the specific locations (i.e., former UST site, excavations, etc.) where field activities are in progress. The boundary of the work area will be identified and marked during site preparation. The work area will be activated and deactivated and the boundary relocated, as appropriate, during the course of the remediation activities. An exclusion zone will delineate the work area during the field activities. The exclusion zone will extend a minimum of 30 feet from active work areas and will be delineated using cones and/or barrier tape. The exclusion zone will remain in effect 24 hours a day until the completion of the field activities at each location. Only authorized Dames & Moore personnel, Dames & Moore subcontractor personnel, or authorized visitors who have the necessary documentation as described in the General Health and Safety Plan will be allowed within the exclusion zone.

Existing underground and aboveground utilities in the vicinity of the proposed excavations will be field located and marked. Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of closure activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE. AFBCA will provide as-built drawings of utilities and references of personnel that have historical knowledge of the location and condition of existing utilities. The location of utilities will also be based on existing conditions indicated on the drawings titled "Detail Utilities Map", prepared for the Air Force by Burns & McDonnell of Kansas City, Missouri, dated January 1974, latest revision February 1994.

### **3.6.2 Field Activities**

#### **Remedial Action at Building 1100 Area**

The 1100 Area is an inactive site that previously had a 275-gallon diesel UST and a 550-gallon fuel oil UST (see Figure 3). Subsurface soil sampling performed in 1996 and 1998 indicated the presence of contaminated soils in excess of 500 mg/Kg TPH. Remediation activities will be conducted to remove and dispose of approximately 25 cubic yards of petroleum contaminated soils and confirmatory sampling will be performed to verify clean-up. The removal process will include the following: excavation of contaminated soil; stockpiling the contaminated soil in a roll-off box; sampling any ground water that enters the excavation(s), Geoprobe screening of ground water at six to eight locations for total volatile organic compounds (TVOC) (four of the screening locations will be sampled for off-site laboratory analysis of VOCs and SVOCs), sampling of the contaminated soil for disposal profiling; confirmatory soil sampling from the excavation; disposal of the contaminated soil at an approved off-Base landfill; backfilling the excavation; and site restoration. A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.6.2-1  
Field Activities Summary-Building 1100 Area**

Activity	Number
Excavation locations approved by AFCEE	1
Utility Clearance and excavation permits (if any)	1
Excavation of the contaminated soil	25 cu. Yd.
Soil samples for disposal profiling	1
Confirmation soil sample	5
QA/QC Soil sampling (duplicates MS/MSD)	2
Ground Water samples, if encountered	1
Ground Water screening for TVOC	6 to 8
Ground Water sampling for VOCs and SVOCs	4
QA/QC Water sampling (trip blanks)	2
QA/QC Water sampling (equipment blanks, duplicates, and MS/MSD)	4
Soil disposal	25 cu. Yd
Backfilling	25 cu. Yd.
Site Restoration	1

#### **Remedial Action at Building 1201**

The Building 1201 Area is an inactive site that previously had a 3,000-gallon fuel oil UST (see Figure 4). Subsurface soil sampling performed in 1996 indicated the presence of PAH contaminated soils in excess of the MDNR CALM Tier 1, Category B STARC target concentrations. Remediation activities will be conducted to remove and dispose of petroleum contaminated soils and confirmatory sampling will be performed to verify clean-up. The removal process will include the following: excavation of an estimated 134 cubic yards of contaminated soil; stockpiling the contaminated soil in a roll-off box; sampling any ground water that enters the excavation(s), Geoprobe screening of ground water at six to eight locations for total volatile organic compounds (TVOC) (four of the screening locations will be sampled for off-site laboratory analysis of VOCs and SVOCs), sampling of the contaminated soil for disposal profiling; confirmatory soil sampling from the excavation; disposal of the contaminated soil at an approved off-Base landfill; backfilling the excavation; and site restoration. A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.6.2-2  
Field Activities Summary- Building 1201 Area**

Activity	Number
Excavation locations approved by AFCEE	1
Utility Clearance and excavation permits (if any)	1
Excavation of the contaminated soil	134 cu. Yd.
Soil samples for disposal profiling	1
Confirmation soil sampling	6
QA/QC Soil sampling (duplicates MS/MSD)	2
Ground Water sampling, if encountered)	1
Ground Water screening for TVOC	6 to 8
Ground Water sampling for VOCs and SVOCs	4

QA/QC Water sampling (equipment blanks, duplicates and MS/MSD)	4
QA/QC Water sampling (trip blanks)	2
Soil disposal	134 cu. Yd.
Backfilling	134 cu. Yd.
Site Restoration	1

#### **Site ST007, Former UST Area Closure**

Objectives for this phase of work include removal of the 18 bio-vents and disposal of the polyvinyl chloride (PVC) pipe and the cuttings generated during the field activities (see Figure 5). The boreholes for the 18 bio-vents will be plugged in accordance with State of Missouri guidelines for abandoning monitoring well (10 CSR 23-4.080). The area where the bio-vents were located will then be reseeded or repaired to match the surrounding site conditions.

**Table 3.6.2-3  
Field Activities Summary – ST007**

<b>Activity</b>	<b>Number</b>
Pull Bio-vents	18
Plug Bio-vent boreholes	18
Waste profile soil sample	1
QA/QC Water sample (trip blank)	1
Seed/repair well areas	18
Dispose of soil cuttings/PVC casings	1

#### **Fuel Hydrant Closure**

The entire length of hydrant line will initially be accessed at four points for removal of any residual liquids and rinsing (see Figure 6). Asbestos containing material will be removed prior to cutting the pipe. The fluids removed from the fuel hydrant line will be containerized, sampled, analyzed, and disposed of in accordance with MDNR regulations. The line will be pigged clean. This method is accomplished by manually pulling an abrasive, rubber, "swab" and degreaser (citrus-based) through the line attached to a wire. Using the wire, the pig can be pulled in two directions to swab the line clean. Once the line is rinsed clean, grout will be pressure-pumped into the sections of open line and capped at each access point. After completion of these activities, soil samples will be collected along the line (every 100 feet) in accordance with MDNR UST regulations. The soil samples will be collected at a depth of approximately 1-foot below the invert of the line using direct-push sampling technology.

(Note: Utility map shows two lines, fueling and defueling, routed from the former tank site out to the fuel stand headers). Samples will be collected according to MDNR UST Closure Guidance.

**Table 3.6.2-4  
Field Activities Summary – Fuel Hydrant Line**

Activity	Number
Utility clearance	1
Perform survey to locate hydrant line	1
Excavation to access line for cleaning and plugging	4
Clean fuel hydrant line	1
Containerize fluids generated during cleaning	1
Sample fluids for disposal	1
Dispose of the fluids	1
Grout the fuel hydrant line	1
Cap line with expandable plugs	1
Direct push soil sampling locations (every 100 feet) and at elbows	58
Plugging each direct push borehole	58
QA/QC Soil Sampling (duplicates and matrix spike/matrix spike duplicate)	12
QA/QC Water Sampling (trip and equipment blanks)	10
Site restoration (access points for grouting and soil sample locations)	62

#### **Industrial Waste Line Closures**

Closure activities for the industrial waste line are listed as follows: sample the liquid flowing through the line prior to cleaning; clean the line by pigging or jetting methods; containerize and sample the fluids from the line; dispose of the fluids based on the analyses; collect soil samples using direct-push technology at the manholes, collapse the lid into the manhole and backfill the manhole with dirt; and restore the site to pre-field activity conditions (see Figure 6).

**Table 3.6.2-5  
Field Activities Summary – Industrial Waste Line**

Activity	Number
Utility clearance	1
Survey location of line	1
Collect water samples	5
QA/QC samples (equipment blanks, duplicates, and matrix spike/matrix spike duplicates)	4
QA/QC trip blanks	2
Clean the line	1
Containerize fluids generated during cleaning	1
Sample the fluids	1
Dispose of the fluids	1
Direct push soil sampling at manholes	24
QA/QC soil sampling (duplicates and MS/MSD)	4
Backfill each soil boring	24
Backfill the manholes	24
Site Restoration	24

Oil/water separators 9470A and 9470B (CS003)

The closure sampling will assess whether a release has occurred from the OWSs prior to their removal (see Figure 7). OWS-9470A and OWS-9470B will be sampled in accordance with MDNR closure sampling requirements for a UST of equivalent size. For each OWS, four soil borings will be advanced adjacent to each side of the OWS to a depth approximately two feet below the bottom of the concrete pad. One down gradient sample will be taken adjacent to the vertical midpoint of the OWS. In addition, one sample exhibiting the highest contamination, or from the bottom of the boring if there is no apparent contamination, will be taken from each of the four borings. Also, a ground water sample will be collected from the downgradient borehole at each OWS.

After review and confirmation of the results from the soil sampling, a subcontractor will remove the fluids from the oil/water separators. The fluids will be containerized and sampled by Dames & Moore field personnel for characterization for disposal at an off-site location. The OWSs will be purged of flammable vapors and cleaned prior to removal activities. A subcontractor will then use an excavator and possibly a crane to remove the separators. The associated vent stacks and piping will also be removed during this operation. Any steel tanks will be transported to a recycling/scrap facility. Concrete will be demolished and placed in roll-off boxes for transport to a landfill. Soil determined to be contaminated during the removal operation will be excavated and placed in roll-off boxes for transport to and disposal at an off-site landfill. After the collection of samples, the excavation will be backfilled immediately with clean soil brought from an off-site location.

The cleanup goal is the reduction of contaminants in the soil and groundwater to action levels acceptable to the Air Force and to MDNR. The levels of allowable residual contamination following the OWS removals and closure of the site are based on the MDNR UST Closure Guidance Document. A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.6.2-6**  
**Field Activities Summary – CS003 (Oil/Water Separators)**

Activity	Number
Utility Clearance	1
Direct-push soil sampling	1
Water samples (direct push technology)	2
OWS contents sampling	2
OWS fluids removal	1
OWS fluids disposal	1
OWS cleaning/purging	2
OWS removal	2
OWS disposal	2
Waste profile soil sample	1
Direct-push soil samples	10
Confirmation soil samples	10
QA/QC water samples (duplicates, equipment blanks and matrix spike/matrix spike duplicates)	3
QA/QC water samples (trip blanks)	2
QA/QC soil sampling (duplicates and matrix spike/matrix spike duplicates)	4
Backfill the excavations	2
Site Restoration	2

### Remedial Investigation at Four Former UST Sites

The Remedial Investigations will be conducted at Buildings 940, 944, 965, and 1033 (see Figures 8 through 11). The remedial investigations will involve the advancement of direct-push borings at each site. Soil samples and ground water samples (if present) will be collected and submitted to the laboratory for analyses. Based on these analytical data, the site(s) will be either remediated by means of a removal action or closed in accordance with the MDNR UST Closure Guidance Document.

**Table 3.6.2-7**  
**Field Activities Summary – Four RI Sites**

Activity	Number
Utility clearance	4
Direct-push soil sample	46
Ground water sampling	8
QA/QC water sampling (trip blanks)	7
QA/QC water sampling (duplicates, equipment blanks, and MS/MSD)	14
QA/QC soil sampling (duplicates and matrix spike/matrix spike duplicates)	12
Borehole Plugging	46
Site Restoration	46

### Remedial Action at Eight Former UST Sites

Remediation of petroleum contaminated soils shall be conducted at former UST sites at Buildings 903, 942, 948, and 1025 by removal and off-site disposal (see Figures 12 through 15). The buildings addressed in the remedial investigation phase (940,944,965, and 1033) may also be addressed in the removal phase if contamination is in excess of MDNR UST Closure Guidance Document concentrations. An estimated 590 yards of contaminated soil will be excavated, placed into roll-off boxes and subsequently disposed of in accordance with MDNR regulations. Samples of the ground water will be collected from excavations were it is encountered during the removal process. At sites 903, 942, 948 and 1025, ground water will be screened using a Geoprobe unit at six to eight locations for total volatile organic compounds (TVOC). Four of the screening locations will be sampled for off-site laboratory analysis of VOCs and SVOCs) Closure reports will be generated for each of the RA sites (if not already completed in the RI phase) that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.6.2-8**  
**Field Activities Summary- Eight RA Sites**

Activity	Number
Excavation locations approved by AFCEE	1
Utility Clearance and excavation permits (if any)	8
Excavation of the contaminated soil	590 Cu. Yd.
Confirmation soil sampling	46
Ground Water Sampling	9
Ground Water screening for TVOC	24 to 32
Ground Water sampling for VOCs and SVOCs	16
QA/QC Water sampling (trip blanks)	16

QA/QC Water Sampling (duplicates, equipment blanks, MS/MSD)	48
QA/QC Soil Sampling (duplicates and matrix spike/matrix spike duplicates)	16
Soil Profiling samples	8
Soil disposal	590 cu. Yd.
Backfilling	590 cu. Yd.
Site Restoration	8

### POL Storage Yard

The depression remaining from the demolition of Buildings 951 and 953 will be backfilled to eliminate a safety concern at the site. The water that has collected in this depression will be pumped into the oil/water separator immediately south of the POL Yard. The existing monitoring well (MW-1208) located in the depression will be abandoned by a State of Missouri licensed well driller in accordance with MDNR criteria for abandoning monitoring wells (10 CSR 23-4.080). A letter report will be generated for these activities.

**Table 3.6.2-9**  
**Field Activities Summary – POL Yard**

Activity	Number
Sample backfill material	1
Sample water in the depression	1
Pump water from depression	1
Abandon the monitoring well in the depression	1
Backfill the depression	1
Seed the area	1

### **3.6.3 Sampling and Analyses Activities**

Soil and ground water samples will be collected from various locations at the 1100 Area, 1200 Area, ST-007, Fuel Hydrant Line, Industrial Waste Line, Storm Sewer, Oil/Water Separators, four (4) RI sites, and eight (8) RA sites. The Sample Analysis Summary Tables 3.6.3-1 and 3.6.3-2. list the matrices, parameters, number of samples, and the number of quality control samples that will be completed for the site.

The categories of data to be collected during this field investigation include (1) screening data and (2) definitive laboratory data. Screening data includes data produced by rapid field screening methods and are generally less precise than standard analytical methods. Screening level methods produce analyte or class of analyte identification at generally elevated detection levels. This type of data will be generated during screening of soil sample headspace with a photoionization detector (PID), ground water dissolved phase hydrocarbons utilizing a ChemSensor® instrument, ground water field screening utilizing a van-mounted gas chromatograph, and the measurement of pH, temperature, conductance, turbidity, and filterable residue during monitoring well development and purging.

Definitive laboratory data are produced using standard U.S. EPA or other reference methods, usually in an off-site laboratory. The data are analyte-specific and have the standardized quality control (QC) and documentation requirements necessary to verify all results. Definitive data are not restricted in their use

unless quality control problems are encountered which require the data to be qualified. This type of data will be generated to identify the type and concentration of contaminants at the site.

A Quality Assurance/Quality Control (QA/QC) program will be implemented to ensure that the above objectives are met. Sample collection data quality will be controlled through the use of standard collection methods and field logbooks. Selected field sampling procedures are discussed in Section 6.0 of the FSP. Adherence to these field procedures will ensure sample representativeness and minimal potential for sample contamination.

**Table 3.6.3-1  
Soil Sample Analysis Summary**

Analyte	Method	No. Confirmatory Samples	Waste Profile Samples	Number Duplicates	No. Trip Blanks	No. Equipment Blanks	No. MS/MSD Sample	Total Number. Samples
TPH-GRO	8015M	207	12	26	0	0	26	271
TPH-DRO	8015M	207	12	26	0	0	26	271
BTEX/MTBE	8260	5	1	1	0	0	1	8
VOCs	8260	202	11	25	0	0	26	263
SVOCs	8270	202	11	25	0	0	26	263
PCB	8082	102	5	13	0	0	13	133
Pesticides	8081	102	0	13	0	0	13	128
Ethylene Glycol	8015M	44	0	4	0	0	4	52
Total Metals	6010	39	8	4	0	0	6	57
TCLP Metals	1311/6010	78	5	11	0	0	11	105
Open Cup Flash Point	846/1010	0	13	0	0	0	0	13
Paint Filter	846/9095	0	13	0	0	0	0	13
Percent Chlorine	ASTM # D808-87	0	8	0	0	0	0	8

**Table 3.6.3-2  
Aqueous Sample Analysis Summary**

Analyte	Method	No. Confirmatory Samples	Waste Profile Samples	Number Duplicates	No. Trip Blanks	No. Equipment Blanks	No. MS/MSD Sample	Total Number. Samples
TPH-GRO	8015M	28	1	16	0	40	16	101
TPH-DRO	8015M	28	1	15	0	41	16	101
BTEX/MTBE	8260	1	0	1	2	2	1	7
VOCs	8260	43	1	17	45	46	15	167
SVOCs	8310	43	1	17	0	46	15	122
PCB	8082	22	1	10	0	17	10	60
Ethylene Glycol	8015M	9	0	2	0	4	2	17
Pesticide	8081	22	1	10	0	17	10	60
Metals	6010	22	1	10	0	17	10	60

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**Table 4  
LUST Soil Cleanup Guidelines for Undisturbed Soil  
Building 1025**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.	
Man-made horizontal conduits?	> 250 ft.	15	250-101 ft.		100-50 ft.		< 50 ft.	
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>		120		40		5		0
<b>Total Score =</b>							<b>145</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>		280			140		60	

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 1033**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.		500-251 ft.		250-100 ft.		< 100 ft.	0
Man-made horizontal conduits?	> 250 ft.	15	250-101 ft.		100-50 ft.		< 50 ft.	
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	105		20		5		0	
<b>Total Score =</b>							<b>130</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140			60		

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 1100 Area**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 - 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.		2,000-1,001 ft.	10	1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.	
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		30		5		0	
<b>Total Score =</b>							<b>125</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140			60		

**Table 4**  
**UST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 1200 Area**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.	10	2,500 - 1,000 ft.		< 1,000 ft.	
Geologic features present?	> 2,000 ft.		2,000-1,001 ft.	10	1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.	
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		40		0		0	
<b>Total Score =</b>							<b>130</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140				60	

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 903**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.	10	2,500 – 1,000 ft.		< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.		500-251 ft.		250-100 ft.		< 100 ft.	0
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		30		0		0	
<b>Total Score =</b>							<b>120</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140			60		

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 940**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True		
	Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes		
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away		
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.	10	2,500 – 1,000 ft.		< 1,000 ft.		
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.		
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.		
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0	
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High		
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0	
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.		
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away		
Future land use?	Industrial		Commercial	10			Residential		
Off-site impact?	No	15					Yes		
<b>Subtotals</b>		105		30		0		0	
<b>Total Score =</b>							<b>135</b>		
<b>SOIL Cleanup Levels (ppm)</b>									
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less		
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2		
<b>TPH</b>	1000	500	200		100		50		
<b>MTBE</b>		280			140		60		

**Table 4  
LUST Soil Cleanup Guidelines for Undisturbed Soil  
Building 942**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.	10	2,500 – 1,000 ft.		< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.		500-251 ft.		250-100 ft.		< 100 ft.	0
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		30		0		0	
<b>Total Score =</b>							<b>120</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140			60		

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 944**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 -- 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.	
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.	5	< 50 ft.	
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	105		20		10		0	
<b>Total Score =</b>							<b>135</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80	79-50	49 or less			
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10	0.5/1/2/2	B+T+E <2			
<b>TPH</b>	1000	500	200	100	50			
<b>MTBE</b>	280		140		60			

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Building 948**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.	
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>		105		20		5		0
<b>Total Score =</b>							<b>130</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>		280			140		60	

**Table 4  
LUST Soil Cleanup Guidelines for Undisturbed Soil  
Building 965**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
	Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.	15	500-251 ft.		250-100 ft.		< 100 ft.	
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>		105		20		5		0
<b>Total Score =</b>								<b>130</b>
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>		280			140		60	

**Table 4  
LUST Soil Cleanup Guidelines for Undisturbed Soil  
Fuel Hydrant Line**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.	5	< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.		500-251 ft.		250-100 ft.	5	< 100 ft.	
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		20		10		0	
<b>Total Score =</b>							<b>120</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140			60		

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Industrial Waste Line**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
	Depth to groundwater?	> 100 ft.		100-51 ft.		50-25 ft.		< 25 ft.
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.		< 1,000 ft.	
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.		500-251 ft.		250-100 ft.		< 100 ft.	0
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		20		0		0	
<b>Total Score =</b>							<b>110</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80	79-50	49 or less			
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10	0.5/1/2/2	B+T+E <2			
<b>TPH</b>	1000	500	200	100	50			
<b>MTBE</b>	280		140			60		

**Table 4**  
**LUST Soil Cleanup Guidelines for Undisturbed Soil**  
**Oil/Water Separator 9470 A/B Site**

Site Features	Score 15 if True		Score 10 If True		Score 5 If True		Score 0 If True	
Depth to groundwater?	> 100 ft.		100-51 ft		50-25 ft.		< 25 ft.	0
Groundwater potable?	No	15					Yes	
Drinking water supply proximity?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Distance to surface waters?	> 5,000 ft.		5,000-2,501 ft.		2,500 – 1,000 ft.		< 1,000 ft.	0
Geologic features present?	> 2,000 ft.	15	2,000-1,001 ft.		1,000-500 ft.		< 500 ft.	
Man-made vertical conduits?	> 500 ft.		500-251 ft.		250-100 ft.		< 100 ft.	0
Man-made horizontal conduits?	> 250 ft.		250-101 ft.		100-50 ft.		< 50 ft.	0
Soil permeability? (see definitions)	Low		Low-Moderate	10	Moderate-High		High	
Soil thickness? (see overburden map)	> 50 ft.		50-41 ft.		40-20 ft.		< 20 ft.	0
Environmentally sensitive receptors?	> 5,000 ft.	15	5,000-2,501 ft.		2,500-1,000 ft.		< 1,000 ft.	
Surrounding land use?	> 1,000 ft. away	15	1,000-501 ft. away		500-100 ft. away		< 100 ft. away	
Future land use?	Industrial		Commercial	10			Residential	
Off-site impact?	No	15					Yes	
<b>Subtotals</b>	90		20		0		0	
<b>Total Score =</b>							<b>110</b>	
<b>SOIL Cleanup Levels (ppm)</b>								
<b>Total Score</b>	195-150	149-120	119-80		79-50		49 or less	
<b>BTEX</b>	4/20/100/100	2/10/50/50	1/5/10/10		0.5/1/2/2		B+T+E <2	
<b>TPH</b>	1000	500	200		100		50	
<b>MTBE</b>	280		140			60		

#### 4.0 REMEDIAL ACTION

As previously noted, this project involves soil contamination remediation at the 1100 Area and Buildings 903, 942, 948, 1025, and 1201. This project could also include soil contamination remediation at Buildings 940, 944, 965, and 1033, depending on the outcome of Remedial Investigations at this sites. The soil remediation will involve the removal of the soil and disposal of the soil at a landfill. The soil from the excavations where the soil is removed will be sampled to insure that the removal action is complete. If soil contamination is still present above the MDNR CALM Tier 1, Category B STARC target concentrations, the excavation process will be continued until the project goals have been met. There is no ground water remediation task in this project.

211 57

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## 5.0 DATA ASSESSMENT, RECORDS, AND REPORTING REQUIREMENTS

### 5.1 DATA ASSESSMENT

The data reduction, review, reporting, and validation procedures described in Section 8.0 of the Quality Assurance Project Plan (QAPP) will be followed to ensure that: (1) complete documentation is maintained, (2) transcription and data reduction errors are minimized, (3) the data are reviewed and documented, and (4) the reported results are qualified if necessary. Laboratory data reduction and verification procedures are required to ensure the overall objectives of analysis and reporting meet method and project specifications.

### 5.2 RECORD KEEPING

Dames & Moore shall maintain field records sufficient to recreate sampling and measurement activities and to meet Environmental Resources Program Information Management System (ERPIMS) data loading requirements. The requirements apply to all measuring and sampling activities. The AFCEE forms to be completed by Dames & Moore during the implementation of this project are presented in Appendix A of the FSP. The information shall be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages. These records shall also be archived in an easily accessible form and made available to the Air Force upon request.

The following information shall be recorded for all field activities: (1) location, (2) date and time, (3) identity of people performing activity, and (4) weather conditions. For field measurements: (1) the numerical value and units of each measurement, and (2) the identity of and calibration results for each field instrument, shall be recorded.

The following additional information shall be recorded for all sampling activities: (1) sample type and sampling method, (2) the identity of each sample and depth(s), where applicable, from which it was collected, (3) the amount of each sample, (4) sample description (e.g., color, odor, clarity), (5) identification of sampling devices, and (6) identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

The laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted pursuant to the Scope of Work (SOW). The minimum records the laboratory shall keep contain the following: (1) Chain-of Custody (COC) forms, (2) initial and continuing calibration records including standards preparation traceable to the original material and lot number, (3) instrument tuning records (as applicable), (3) method blank results, (4) internal standards results, (5) surrogate spiking records and results (as applicable), (6) spike and spike duplicate records and results, (7) laboratory records, (8) raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports, (9) corrective action reports, (10) other method and project required QC samples and results, and (11) laboratory-specific written Standard Operating Procedures (SOPs) for each analytical method and QA/QC function in place at the time of analysis of project samples. Examples of the data reports to be maintained by the laboratory are presented in Section 8.0 of the QAPP.

### 5.3 REPORTING REQUIREMENTS

Dames & Moore will meet the data deliverable requirements of the ERPIMS. Field and laboratory data will be recorded into a computerized format as required by the most current version of the ERPIMS Data Loading Handbook. This task will be performed using the latest version of the ERPIMS Quality Control Tool (ERPTOOLS), a personal computer software utility, to quality check ASCII data files and to check all data files for compliance with requirements in the ERPIMS Data Loading Handbook. An Informal Technical Information Report (ITIR), consisting of the forms required by the AFCEE QAPP, will be generated and submitted to AFCEE prior to the issuance of the final report.

## 6.0 PROJECT SCHEDULE AND REFERENCES

### 6.1 PROJECT SCHEDULE

Pending approval of the work plans, the fieldwork for this project is scheduled to begin in early November 1999. Schedule is attached at the end of Section 6.0

### 6.2 REFERENCES

The references for the Work Plan are presented in the Field Sampling Plan.

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1.1.

# TAB

FSP

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# **FINAL FIELD SAMPLING PLAN**

## **Remedial Actions/Investigations at Multiple Sites**

Project Number UEBL 930014

Prepared for:

**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE**

Prepared by:

Dames & Moore  
6310 Lamar Avenue  
Overland Park, Kansas 66202



November, 1999

## PREFACE

This Field Sampling Plan provides for Remedial Action at Building 1100 Area; Remedial Investigation at Building 1200 Area; Removal of the 18 bio-vent wells at ST-007; Closure of the Fuel Hydrant Line; Closure of the Industrial Waste Line; Closure at ST005 (Oil/Water Separators); Remedial Investigations at four Former UST Sites; Remedial Action at eight Former UST Sites; and backfilling a depression at the POL Yard. The fieldwork that is to be accomplished during this project will be conducted from November 1999 through January 2000.

Key responsibilities have been assigned to the following Dames & Moore personnel:

Mr. Gary Alkire	San Antonio, TX	Program Manager	(210) 496-7911
Mr. John Plevniak	Overland Park, KS	Senior Project Manager	(913) 677-1490
Mr. Kris Moore	Overland Park, KS	Technical Project Manager	(913) 677-1490
Ms. Terri Hecht	Overland Park, KS	Field Team Leader	(913) 677-1490
Mr. John Kearns	Baltimore, MD	Laboratory Quality Assurance	(410) 859-5049
Mr. Bill Berlett	Chicago, IL	Regional Health & Safety Officer	

Ms. Kay Grosinske will act as the Contracting Officer's Representative (COR) and Team Chief for this Delivery Order. She may be reached at (210) 536-6451.

Mr. Mike Nicklow, the Richards-Gebaur AFB Point of Contact (POC), can be reached at (614) 492-8065 ext. 27.

## LIST OF ACRONYMS AND ABBREVIATIONS

<b>AA</b>	atomic absorption
<b>ACM</b>	Asbestos Containing Material
<b>ADC</b>	Air Defense Command
<b>AFB</b>	Air Force Base
<b>AFBCA</b>	Air Force Base Conversion Agency
<b>AFCEE</b>	Air Force Center for Environmental Excellence
<b>AFCS</b>	Air Force Communications Service
<b>AFRES</b>	Air Force Reserves
<b>ARAR</b>	applicable or relevant and appropriate requirement
<b>AST</b>	Above Ground Storage Tank
<b>ASTM</b>	American Society for Testing and Materials
<b>bgs</b>	below ground surface
<b>Br</b>	bromide
<b>BTEX</b>	Benzene, toluene, ethylbenzene, xylene
<b>°C</b>	degrees Celsius
<b>CERCLA</b>	Comprehensive Environmental Response, Compensation, and Liability Act
<b>CFR</b>	Code of Federal Regulation
<b>Cl</b>	chloride
<b>cm/sec</b>	centimeters per second
<b>COC</b>	chain of custody
<b>COR</b>	contracting officer representative
<b>DBCRA</b>	Defense Base Closure and Realignment Act
<b>DEQPPM</b>	Defense Environmental Quality Program Policy Memorandum
<b>DOD</b>	Department of Defense
<b>DOT</b>	Department of Transportation
<b>DNAPL</b>	dense non-aqueous phase liquid
<b>DQO</b>	data quality objective
<b>DRO</b>	Diesel Range Organics
<b>EC</b>	electrical conductivity
<b>EDB</b>	ethylene dibromide
<b>EPA</b>	Environmental Protection Agency
<b>ERPIMS</b>	Environmental Resources Program Information Management System
<b>F</b>	fluoride
<b>FID</b>	flame ionization detector
<b>FSP</b>	Field Sampling Plan
<b>ft</b>	foot or feet
<b>FTL</b>	Field Team Leader

<b>g/cm<sup>3</sup></b>	grams per cubic centimeter
<b>G</b>	glass
<b>gal/ft<sup>3</sup></b>	gallons per cubic foot
<b>GPR</b>	ground penetrating radar
<b>GRO</b>	Gasoline Range Organics
<b>GSA</b>	General Services Administration
<b>H<sub>2</sub>SO<sub>4</sub></b>	sulfuric acid
<b>HCl</b>	hydrochloric acid
<b>HNO<sub>3</sub></b>	nitric acid
<b>HSP</b>	Health and Safety Plan
<b>IAW</b>	in accordance with
<b>IDW</b>	Investigation Derived Waste
<b>IRP</b>	Installation Restoration Program
<b>IRPIMS</b>	Installation Restoration Program Information Management System
<b>ITIR</b>	Informal Technical Information Report
<b>KCAD</b>	Kansas City Aviation Department
<b>lbs/gal</b>	pounds per gallon
<b>LNAPL</b>	light non-aqueous phase liquid
<b>LQAM</b>	Laboratory Quality Assurance Manager
<b>MAC</b>	Military Airlift Command
<b>MDL</b>	method detection limit
<b>MDNR</b>	Missouri Department of Natural Resources
<b>mL</b>	milliliter
<b>mL/L</b>	milliliters per liter
<b>MS/MSD</b>	matrix spike/matrix spike duplicate
<b>MTBE</b>	Methyl Tertiary Butyl Ether
<b>Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub></b>	sodium thiosulfate
<b>NCP</b>	National Contingency Plan
<b>NFRAP</b>	No Further Response Action Planned
<b>NO<sub>2</sub><sup>-</sup></b>	nitrite
<b>NO<sub>3</sub><sup>-</sup></b>	nitrate
<b>NTU</b>	nephelometric turbidity unit
<b>OD</b>	outside diameter
<b>OSHA</b>	Occupational Safety and Health Administration
<b>OVA</b>	organic vapor analyzer
<b>OVS</b>	Oil/Water Separator
<b>P</b>	polyethylene
<b>PAH</b>	polynuclear aromatic hydrocarbon

<b>PCB</b>	polychlorinated biphenyl
<b>PID</b>	photoionization detector
<b>PM</b>	Project Manager
<b>PO<sub>4</sub><sup>-3</sup></b>	phosphate
<b>POL</b>	Petroleum Oil and Lubricant
<b>PPE</b>	personal protective equipment
<b>ppm</b>	parts per million
<b>ppb</b>	parts per billion
<b>PVC</b>	polyvinyl chloride
<b>QA</b>	quality assurance
<b>QAPP</b>	quality assurance project plan
<b>QC</b>	quality control
<b>RCRA</b>	Resource Conservation and Recovery Act
<b>RI/FS</b>	remedial investigation/feasibility study
<b>SAP</b>	Sampling and Analysis Plan
<b>SARA</b>	Superfund Amendments and Reauthorization Act
<b>SET</b>	Shirley Environmental Testing, Inc.
<b>SO<sub>4</sub><sup>-2</sup></b>	sulfate
<b>SOW</b>	statement of work
<b>SP</b>	spontaneous potential
<b>SPM</b>	Senior Project Manager
<b>SSO</b>	Site Safety Officer
<b>SVOC</b>	semivolatile organic compound
<b>T</b>	California brass
<b>TCLP</b>	toxicity characteristic leaching procedure
<b>TPH</b>	total petroleum hydrocarbon
<b>TPM</b>	Technical Project Manager
<b>TVH</b>	Total Volatile Hydrocarbons
<b>USCS</b>	Unified Soil Classification System
<b>USGS</b>	U.S. Geological Survey
<b>UST</b>	Underground Storage Tank
<b>VOC</b>	volatile organic compound
<b>WP</b>	work plan
<b>µg</b>	microgram
<b>3-D</b>	three-dimensional

## TABLE OF CONTENTS

SECTION	PAGE
1 0 Introduction	1-1
2.0 Project Background	2-1
2.1 The U.S. Air Force Installation Restoration Program	2-1
2.2 Project Purpose and Scope	2-2
2.3 Project Site Description	2-2
2.3.1 Building 1100 Area	2-3
2.3.2 1200 Area	2-3
2.3.3 Site ST007	2-4
2.3.4 Hydrant Fuel Line Closure	2-4
2.3.5 Industrial Waste Line Closure	2-5
2.3.6 Oil/Water Separators	2-5
2.3.7 Building 903	2-6
2.3.8 Building 940	2-6
2.3.9 Building 942	2-6
2.3.10 Building 944	2-6
2.3.11 Building 948	2-7
2.3.12 Building 965	2-7
2.3.13 Building 1025	2-7
2.3.14 Building 1033	2-8
2.3.15 POL Yard	2-8
2.4 Project Site Contamination History	2-9
2.5 Potential Contaminants	2-9
2.6 Potential Contaminant Release Pathways	2-9
3.0 Project Scope and Objectives	3-1
3.1 Objectives	3-1
3.1.1 Remedial Action at Building 1100 Area	3-1
3.1.2 Remedial Investigation at 1200 Area	3-1
3.1.3 Site ST007	3-2
3.1.4 Fuel Hydrant Line Closures	3-2
3.1.5 Industrial Waste Line Closures	3-2
3.1.6 Removal of Oil/Water Separators 9470A and 9470B	3-3
3.1.7 Remedial Investigation at 4 Former UST Sites	3-3
3.1.8 Remedial Action at 8 Former UST Sites	3-3
3.1.9 POL Yard	3-4
3.2 Sample Analysis Summary	3-4
3.3 Field Activities	3-24
3.3.1 Remedial Action at Building 1100 Area	3-24
3.3.2 Remedial Investigation at 1200 Area	3-25
3.3.3 Site ST007	3-27
3.3.4 Hydrant Line Closures	3-27
3.3.5 Industrial Waste Line Closures	3-29
3.3.6 Closure of CS-003 (Oil/Water Separators)	3-31

3.3.7	Remedial Investigation at 4 Former UST Sites	3-32
3.3.8	Remedial Action at 8 Former UST Sites	3-33
3.3.9	POL Yard	3-34
4.0	Project Organization and Responsibility	4-1
4.1	Subcontractors	4-2
5.0	Field Operations	5-1
5.1	Geologic Standards	5-1
5.2	Site Reconnaissance, Preparation, and Restoration Procedures	5-4
5.3	Borehole Drilling, Lithologic Sampling, Logging, and Abandonment	5-4
5.3.1	General Drilling Procedures	5-4
5.3.2	Sampling and Logging	5-5
5.3.3	Abandonment	5-6
5.4	Test Pit Excavation	5-6
5.5	Surveying	5-7
5.6	Equipment Decontamination	5-8
5-7	Waste Handling	5-8
5.7.1	General Waste Handling Procedures	5-8
6.0	Environmental Sampling	6-1
6.1	Sampling Procedures	6-1
6.1.1	Subsurface Soil Sampling	6-1
6.1.1.1	Direct Push Sampling	6-1
6.1.1.2	Sampling of Excavation Walls/Floors	6-1
6.1.2	Ground Water Sampling	6-1
6.1.2.1	Direct-Push Ground Water Sampling	6-1
6.1.2.1.1	Water Level Measurement	6-2
6.2	Sample Handling	6-2
6.2.1	Sample Containers	6-2
6.2.2	Sample Volumes, Container Types, and Preservation Requirements	6-2
6.2.3	Sample Identification	6-5
6.3	Sample Custody	6-5
6.4	Field Quality Control Samples	6-5
6.4.1	Equipment Blank	6-5
6.4.2	Trip Blank	6-6
6.4.3	Field Duplicates	6-6
7.0	Field Measurements	7-1
7.1	Parameters	7-1
7.2	Equipment Calibration and Quality Control	7-1
7.3	Equipment Maintenance and Decontamination	7-1
7.4	Field Performance and System Audits	7-1
8.0	Record Keeping	8-1

## LIST OF TABLES

TABLE	PAGE
3.2-1 Remedial Action at 1100 Area: Laboratory Analysis	3-5
3.2-2 Remedial Action at 1200 Area: Laboratory Analysis	3-6
3.2-3 ST007: Laboratory Analysis	3-7
3.2-4 Fuel Hydrant Line Closure: Laboratory Analysis	3-8
3.2-5 Industrial Waste Line Closure: Laboratory Analysis	3-9
3.2-6 Closure of Oil/Water Separators: Laboratory Analysis	3-10
3.2-7 Remedial Investigation at Building 940: Laboratory Analysis	3-11
3.2-8 Remedial Investigation at Building 944: Laboratory Analysis	3-12
3.2-9 Remedial Investigation at Building 965: Laboratory Analysis	3-13
3.2-10 Remedial Investigation at Building 1033: Laboratory Analysis	3-14
3.2-11 Remedial Action at Building 903: Laboratory Analysis	3-15
3.2-12 Remedial Action at Building 940: Laboratory Analysis	3-16
3.2-13 Remedial Action at Building 942: Laboratory Analysis	3-17
3.2-14 Remedial Action at Building 944: Laboratory Analysis	3-18
3.2-15 Remedial Action at Building 948: Laboratory Analysis	3-19
3.2-16 Remedial Action at Building 965: Laboratory Analysis	3-20
3.2-17 Remedial Action at Building 1025: Laboratory Analysis	3-21
3.2-18 Remedial Action at Building 1033: Laboratory Analysis	3-22
3.2-19 POL Yard: Laboratory Analysis	3-23
3.3.1 Field Activities Summary – 1100 Area	3-25
3.3.2 Field Activities Summary – 1200 Area	3-26
3.3.3 Field Activities Summary – SST-007	3-27
3.3-3 Field Activities Summary – SST-007	3-28
3.3.4 Field Activities Summary – Fuel Hydrant Line	3-29
3.3.5 Field Activities Summary – Industrial Waste Line	3-30
3.3.6 Field Activities Summary – CS003 (Oil/Water Separators)	3-32
3.3.7 Field Activities Summary – Four RI Sites	3-33
3.3.8 Field Activities Summary – Eight RA Sites	3-34
3.3.9 Field Activities Summary – POL Yard	3-35
6.2 2-1 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times	 6-3

## LIST OF FIGURES

FIGURE		PAGE
5-1	Lithology Patterns for Illustration	5-2
1	Building Location Map	All Figures Located at End of Report
2	Site Layout Map	
3	Site Layout Plan – Building 1100 Area	
4	Site Layout Plan – Building 1200 Area	
5	Site Layout Plan – ST007 Area	
6	Site Layout Plan – Hydrant Fuel and Industrial Waste Lines	
7	Site Layout Plan – Oil/Water Separators	
8	Site Layout Plan – Building 940	
13	Site Layout Plan – Building 942	
9	Site Layout Plan – Building 944	
14	Site Layout Plan – Building 948	
10	Site Layout Plan – Building 965	
15	Site Layout Plan – Building 1025	
11	Site Layout Plan – Building 1033	
12	Site Layout Plan – Building 903	

## 1.0 INTRODUCTION

The Field Sampling Plan (FSP) presents, in specific terms, the requirements and procedures for conducting field operations and investigations. This project specific FSP has been prepared to ensure (1) the data quality objectives specified for this project are met, (2) the field sampling protocols are documented and reviewed in a consistent manner, and (3) the data collected are scientifically valid and defensible. This site specific FSP and the Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 3.0, 1998, shall constitute, by definition, an AFCEE Sampling and Analysis Plan (SAP).

The National Contingency Plan (NCP) specifies circumstances under which a FSP is necessary for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions. For cleanup actions at the remedial investigation/feasibility study (RI/FS) stage, the NCP requires lead agents to develop sampling and analysis plans which provide a process for obtaining data of sufficient quality and quantity to satisfy data needs. Such sampling and analysis plans must include a field sampling plan. 40 CFR 300.430 (b)(8)(i).

Guidelines followed in the preparation of this plan are set out in the: *Data Quality Objectives Process for Superfund, Interim Final Guidance* (U.S. Environmental Protection Agency [EPA], 1993). In addition, reference was made to the *Missouri Department of Natural Resources (MDNR) Underground Storage Tank (UST) Closure Guidance Document* (MDNR, 1996) and the *MDNR Cleanup Levels for Missouri (CALM)* (MDNR, 1998).

This FSP is required reading for all staff participating in the work effort. The FSP shall be in the possession of the field teams collecting the samples. All contractors and subcontractors shall be required to comply with the procedures documented in this FSP in order to maintain comparability and representativeness of the collected and generated data.

Controlled distribution of the FSP shall be implemented by the prime contractor to ensure the current approved version is being used. A sequential numbering system shall be used to identify controlled copies of the FSP. Controlled copies shall be provided to applicable Air Force managers, regulatory agencies, remedial project managers, project managers, and quality assurance (QA) coordinators. Whenever Air Force revisions are made or addenda added to the FSP, a document control system shall be put into place to assure (1) all parties holding a controlled copy of the FSP shall receive the revisions/addenda and (2) outdated material is removed from circulation. The document control system does not preclude making and using copies of the FSP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations. The distribution list for controlled copies shall be maintained by the prime contractor.

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## 2.0 PROJECT BACKGROUND

### 2.1 THE U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force Installation Restoration Project (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and to develop remedial actions consistent with the NCP for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation Recovery Act (RCRA) is one of the primary federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require federal agencies to comply with local and state environmental regulations and provide information to the EPA concerning past disposal practices at federal sites. RCRA Section 3012 requires state agencies to inventory past hazardous waste disposal sites and provide information to the EPA concerning those sites.

In 1980, Congress enacted CERCLA (Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the EPA as the primary policy and enforcement agency regarding contaminated sites.

The 1986 Superfund Amendments and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends the EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of an RI/FS. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various federal agencies, including the Department of Defense (DOD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA, its regulations, and Executive Order 12580, the DOD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated facilities. The DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by EPA in 1980 to provide guidance on a process by which (1) contaminant release could be reported, (2) contamination could be identified and quantified, and (3) remedial actions could be selected. The NCP describes the responsibility of federal and state governments and those responsible for contaminant releases.

The DOD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

The IRP is the DOD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DOD compliance with federal laws, such as RCRA, NCP, CERCLA, and SARA, can be met.

## 2.2 PROJECT PURPOSE AND SCOPE

This FSP outlines the work that will be conducted to meet the requirements of the Statement of Work (SOW) issued by AFCEE on April 21, 1999 to Dames & Moore under the Contract F4624-94-D-8102 Delivery Order 0004-12.

The scope includes closures for the fuel hydrant; closure of the industrial waste line; removal of biovents at UST Site ST007; closure of the oil/water separators at site CS003; remedial action at the Building 1100 Area; remedial action at the 1200 Area and remedial action at up to eight former UST sites. This SOW also includes investigation of four former UST sites. Incidental work includes the assessment, sampling, analysis and reporting of contaminants at these sites. Dames & Moore will prepare an Informal Technical Information Report (ITIR) and submit it to AFCEE for approval prior to submission of the Technical Report.

## 2.3 PROJECT SITE DESCRIPTION

Richards-Gebaur AFB is within portions of Jackson and Cass Counties in Missouri and is located approximately 18 miles south of downtown Kansas City and approximately 3 miles east of the Kansas state line. The base property is comprised of approximately 428 acres in 11 parcels. Associated with this acreage are approximately 421 acres of easements. The Cantonment Area, covering 208 acres, is the largest parcel and contains the main aviation support and administration areas. Nine smaller parcels, ranging from 1 to 3 acres, surround the Cantonment Area. The Belton Training Complex, about four miles south of the Cantonment Area, encompasses 184 acres and is largely undeveloped.

In 1941, the City of Kansas City, Missouri acquired portions of the land now occupied by Richards-Gebaur AFB for use as an auxiliary airport (Grandview Airport). In 1952, the Aerospace Defense Command leased the airport from the city for air defense operations, and in 1953 the property (approximately 2,400 acres) was formally conveyed to the United States Government for establishment of an Air Force Base. C-46 airlift aircraft were the original Air Force aircraft stationed at the base. Conversion to C-119 and C-124 aircraft occurred in 1957 and 1961, respectively. In 1957, the base was named Richards-Gebaur AFB.

Until 1970, the Air Defense command (ADC) had the primary mission on base. In 1970, the Air Force Communications Service (AFCS) relocated its headquarters from Scott AFB, Illinois, to Richards-Gebaur AFB and assumed command. In 1971, the C-124 reciprocating engine aircraft were phased out and replaced with C-130 aircraft equipped with turbine-type engines. AFCS moved back to Scott AFB in 1977 and Richards-Gebaur AFB came under the control of the Military Airlift Command (MAC).

Air Force Reserves (AFRES) assumed operational control of the base in October 1980. In 1981, approximately 80 percent of the base property (including runways and taxiways) was excised (transferred) to the General Services Administration (GSA). The GSA then transferred a majority of the airport-related property to the Kansas City Aviation Department (KCAD) as a public benefit transfer, with the condition of continued runway access (for a fee) by the Air Force. Other excised parcels were also transferred by GSA for public and other military uses to Kansas City, the Federal Aviation Administration, the City of Belton, the Department of the Navy, and the Department of the Army.

Richards-Gebaur AFB was recommended for closure by the 1991 Defense Base Closure and Realignment commission. The Commission's recommendations were accepted by the President and submitted to Congress on July 12, 1991. As Congress did not disapprove the recommendations in the time given under the Defense Base Closure and Realignment Act (DBCRA) of 1990 (Public Law [P.L.] 101-51, Title XXIX), the recommendations have become law. Richards-Gebaur AFB closed in September 1994 and no longer supports military aircraft.

### 2.3.1 Building 1100 Area

The Building 1100 Area is located in Parcel K at the south side of the base. Building 1100 Area was a receiver communication facility and is currently vacant. Two USTs existed at this facility: 1100A was a 250-gallon UST containing gasoline and 1100B was a 550-gallon UST containing heating oil. These USTs were located at the southwest side of the building. Tank 1100A was installed in May of 1953. The installation date of Tank 1100B was not reported. Tanks 1100A and 1100B were removed in July 1988.

Release(s) from these tanks are known to have impacted the surrounding soil and ground water. Subsurface soil sampling performed September 1998 indicated the presence of petroleum contaminated soils at concentrations in excess 4,000 milligrams per kilogram (mg/Kg) total petroleum hydrocarbons (TPH).

### 2.3.2 1200 Area

Two buildings are located at the site referred to as the 1200 Area. Building 1201 is located in Parcel L. One UST, a 3,000-gallon heating oil tank, was located at this facility. The usage for this UST was consumptive heat. UST 1201A was installed in June 1959 and was removed in March 1992.

Building 1202 is also located in Parcel L. Two USTs existed at this facility. USTs 1202A and 1202B were 1,500-gallons and 1,650-gallons, respectively, and were used for storing heating oil. These USTs were used for consumptive heat. UST 1202A was installed in June 1959. UST 1202A was removed and UST 1202B was installed in February 1982. UST 1202B was removed in March 1992.

A subsurface assessment (HDB, 1996) was conducted at each building, Building 1201 and Building 1202, in 1996. The Building 1201 assessment included two subsurface soil samples collected at 8 to 10 feet and 13 to 15 feet below ground surface at two boring locations. A ground water sample was also collected from one of the borings. The samples were analyzed for TPH, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The B1 sample from 13 to 15 feet had a detectable concentration of methylene chloride well below the MDNR CALM Tier 1, Category B target concentrations. The B2 sample from 8 to 10 feet had detectable concentrations of VOC, SVOC and TPH

compounds. The concentration above the MDNR CALM Tier 1, Category B target concentrations were benzo(a)anthracene at 2,500 micrograms per kilogram (ug/Kg), benzo(a)pyrene at 1700 ug/Kg and benzo(b)fluoranthene at 2200 ug/Kg. The ground water sample was collected from B1 and none of the analytes were detected above the detection limit in the sample.

The Building 1202 assessment included two subsurface soil samples collected at 8 to 10 feet and 13 to 15 feet below ground surface at two boring locations. The samples were analyzed for TPH, VOCs and SVOCs. None of the analytes were detected at 13 to 15 feet in the B1 boring. Several VOCs, SVOCs and TPH were detected at 8 to 10 feet in B2, all well below the MDNR CALM Tier 1, Category B target concentrations.

### 2.3.3 Site ST007

Site ST007, located in Parcel A, is a former UST site where four 25,000-gallon steel USTs were used to store JP-4 fuel for the aircraft hydrant refueling system adjacent to the flight line. The tanks were installed in 1954 and remained in service through 1971. In 1977, the tanks were abandoned in place and filled with water to remove fuel vapors. During the first quarter of 1988 the tanks, pumps, and associated piping were removed.

During removal of the tanks, pumps, and associated piping in the first quarter of 1988, fuel-contaminated soil was observed in the excavation. Eight soil borings were advanced in the area of the tankpit in 1989 that confirmed petroleum contamination at the site. Eighteen bio-vents, constructed of 6-inch PVC casing, were installed in the former UST tankpit by the Air Force later that same year as an initial remediation effort.

In November 1991, Geraghty & Miller installed three monitoring wells and eight soil borings outside of the perimeter of the tank removal area. Analytical results of the eight soil samples reported no benzene, ethylbenzene, toluene, and xylenes (BETX), and TPH ranging from non-detect to 18 mg/Kg. The analytical results of the water samples reported no TPH above the method detection limit (MDL), but xylene was detected in MW-1 at 21 micrograms per liter ( $\mu\text{g/L}$ ).

Dames & Moore installed five additional borings to further delineate the extent of contaminated soil in 1996. The analytical results reported no concentrations of benzene, toluene, xylene, or gasoline range organics (GRO) above the MDL. The analytical results for the soil samples reported no concentrations of ethylbenzene or diesel range organics (DRO) above MDNR CALM Tier 1, Category B STARC target concentrations.

One grab water sample was collected from inside a bio-vent located at the northeast corner of the vent grid. The water sample was collected with a disposable Teflon bailer and submitted for BETX and TPH (GRO, DRO) analysis. The analytical results reported no BETX or GRO concentrations above the MDL. DRO were detected at 1,500 ug/L.

### 2.3.4 Hydrant Fuel Line Closure

From 1954 to 1977 the Air Force utilized a buried 5,800-foot eight-inch diameter line to transfer jet fuel from the bulk storage tanks located in the POL Storage Yard to the pump house at Building 902 (ST007). The pump house supplied fuel to four adjacent 25,000-gallon USTs used to store JP-4 fuel for the aircraft hydrant refueling system adjacent to the flight line. A buried six-inch diameter line to transfer fuel from the ST-007 USTs to the airplane fill stands, six in all, located on the south apron of the airfield. The

USTs were abandoned in place in 1977 and ultimately removed in the first quarter of 1988. In 1995, a 76-foot section of the pipeline was removed during remedial activities at Building 942. The hydrant fuel line is located in Parcels A and B.

A "Tracer" soil gas study was performed by Burns and McDonnell in June of 1993. The hydrant line was surveyed utilizing soil gas probes and "Tracer" halon compound. This survey discovered a leak in the vicinity of the adjacent above ground steam line and a significant leak in the fuel line in the embankment behind Building 942. The leaking section was excavated to seal the line and establish a closed system for tracer inoculation and testing of the remainder of the line. The sealing created four pipe sections which were eventually surveyed by Shirley Environmental Testing, Inc. (SET). The SET survey collected soil gas samples approximately every 20 feet along the fuel line. The soil gas samples were sent to Tracer Research Corporation and analyzed for both the tracer compound and total volatile hydrocarbons (TVH). Elevated levels of TVH were found along each of the four pipe sections tested; however, "Tracer" results indicated only one section of pipe had leaks.

The elevated TVH levels were identified in both directions originating from the excavation behind Building 942. An approximate 76-foot section of the line heading away (southwest) from the excavation towards the flight line was determined to have an average concentration of 0.5070 milligrams per liter (mg/L) TVH in four soil gas samples. The highest TVH result (265.5 mg/L) was found near Hangar Road adjacent to Building 918. It should be noted that this section of the line passed the integrity test. Soil gas sampling northeast of the excavation behind Building 942 detected in average concentrations of 0.2150 mg/L in four samples.

Dames & Moore oversaw the removal of a section of the eight-inch hydrant line near Building 942 during remedial activities conducted in July of 1995. The removal included approximately 76 feet of hydrant line and a portion of the aboveground steam line constructed perpendicular to the hydrant line west of Building 942. Approximately 930 cubic yards of impacted soil was excavated from the site and transported to a local landfill.

In June of 1996, TapanAm Associates, Inc. conducted environmental sampling along the hydrant line in the parking lot east of Building 918 where the SET soil gas survey reported 265.5 mg/L TVH. Seven soil samples were collected for TPH and VOC laboratory analysis. The sampling results indicated no detectable concentrations of TPH or VOCs.

### **2.3.5 Industrial Waste Line Closure**

The industrial waste line to be closed is eight-inch vitrified clay, receives storm water from the flight line and drains in the majority of the buildings along Hangar Road, and empties through an OWS and ultimately Outfall "I". The pipe was classified as an industrial waste line due to potential petroleum contamination from maintenance, re-fueling, and/or vehicle washing operations. The industrial waste line is located in Parcels A and B.

There is no history of soil or ground water contamination associated with this site. The Industrial Waste Line is no longer used and will be closed in place.

### **2.3.6 Oil/Water Separators**

Oil/Water Separators OWS-9470A and OWS-9470B are located in Parcel B, approximately 100 feet south of the POL Yard and west of an intermittent drainage ditch. Both separators are situated on grassy

ground with a 15% slope to the northeast. The area north of the site is wooded. OWS-9470A is a 4,500-gallon steel tank anchored to a concrete slab approximately 15 feet below grade. OWS-9470B is approximately 20 feet west of OWS-9470A and consists of two 550-gallon tanks, the separator tank and a holding tank, encased within a concrete vault. Known utilities in the area include an electrical substation 150 feet south of the OWSs, buried and overhead electrical lines, 6- and 8-inch sewer lines, and an abandoned 8-inch POL fuel line.

There is no history of soil or ground water contamination associated with this site. This site will be closed in conjunction with closure of the Industrial Waste Line and in accordance with MDNR UST regulations.

### **2.3.7 Building 903**

Building 903 was the electrical power station building located in Parcel A. One 250-gallon UST containing diesel was located at this facility. According to a drawing, the UST was located south of Building 903. The UST was reportedly used for power generation. The UST was installed in 1961; however, the removal date was not reported.

A subsurface assessment (HDB, 1996) was conducted at Building 903 in 1996. It was reported that the tank was no longer present at the facility. Two subsurface soil samples were collected at 3 to 5 feet and 8 to 10 feet below ground surface at two boring locations. Sample B-2 revealed a detectable level of TPH.

### **2.3.8 Building 940**

Building 940 was a hangar used for aircraft general-purpose maintenance by the Air Force. Two USTs had been located at the facility. Tank 940A was a 500-gallon oil/water separator and Tank 940B had a capacity of 1,075 gallons and reportedly contained oil and water (holding tank). These tanks were installed in February 1965 and removed in 1988. No other historical investigative activities have occurred at this building.

### **2.3.9 Building 942**

Building 942 was the location of two USTs, 942A and 942B. These 15,000-gallons USTs contained #2 fuel oil. Both tanks were installed in April 1955 and removed in July of 1988.

A subsurface assessment (HDB, 1996) was conducted at Building 942 in 1996. Four subsurface soil samples and two ground water samples were collected at four boring locations (A1, A2, B1, and B2) northwest of Building 942. The samples were analyzed for TPH, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). No analytes were detected at locations A1, B1, and B2. Several analytes were reported above the detection limits in sample location A2.

### **2.3.10 Building 944**

Building 944 was reportedly a communications building located north of building 941. Building 944 was demolished in 1988. Reportedly, two USTs had been located at this site. Tank 944A was a 1,000-gallon heating oil tank and Tank 940B had a capacity of 140 gallons and reportedly contained oil and water. Tank 944B was installed in October 1956. There is no installation date reported for tank 944A. The tanks were removed in 1988. Information present on the "as-built" drawings for the site indicate

that there were two USTs. These USTs were listed as a 2,500-gallon fuel storage tank and a 1,000-gallon oil/water separator on as-built drawings obtained from Marine Corps personnel at Richards-Gebaur AFB. No other historical investigative activities have occurred at this building.

### 2.3.11 Building 948

Building 948 was used as the maintenance dock for flight systems and for equipment storage. Two USTs existed at this facility. Tank 948A was a 500-gallon UST containing waste oil and 948B was a 6,000-gallon UST containing heating oil. The USTs were reportedly located at the southeast corner and southwest side of Building 948. Tank 948A was installed in August of 1963. The installation date of tank 948B was not reported. Both tanks were removed in July of 1988.

A subsurface assessment (HDB, 1996) was conducted at Building 948 in 1996. Four subsurface soil samples were collected at four boring locations (A1, A2, B1, and B2). A1 and A2 are located at the southeast corner of Building 948. B1 and B2 are located at the southwest side of the building. The samples were analyzed for metals, TPH, VOCs and SVOCs. At A1 (13 to 15 feet), arsenic, barium, lead and chromium were reported above the detection limits. At A2 (13 to 15 feet), arsenic, barium, lead, chromium, trichloroethene, naphthalene, phenanthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, TPH-Diesel Range were reported above the detection limits. At B1 (5 to 7 feet) and B2 (18 to 20 feet), no analytes were reported to be above the detection limits.

### 2.3.12 Building 965

Building 965 was previously used for aircraft general purpose maintenance. One 12,000-gallon UST containing waste oil existed at this facility. The UST was located between Buildings 965 and 966 west of Building 965. Tank 965A was installed in April of 1966 and removed in July of 1988.

A subsurface assessment (HDB, 1996) was conducted at Building 965 in 1996. Two subsurface soil samples were collected at 8 to 10 feet below ground surface at two boring locations. However, the borings appear to be located east of Building 965 and thus were not taken where the UST was located. The samples were analyzed for metals, TPH, VOCs and SVOCs. Only traces of metals were detected above the detection limits at these soil samples. Later it was determined that these borings were not located in the area of the former UST. No contamination history exists for this location.

### 2.3.13 Building 1025

Building 1025 was a transmitter communication facility. Three USTs existed at this facility. Tanks 1025A, a 550-gallon tank, and 1025C, a 1,000-gallon tank, contained heating oil. Tank 1025B was a 250-gallon UST containing diesel fuel used for power generation. These USTs were reportedly located east and southeast of Building 1025. Tanks 1025A and 1025B were installed in April of 1953. Tank 1025A was removed and replaced with 1025C in June of 1968. Tanks 1025B and 1025C were removed in July of 1988.

A subsurface assessment (HDB, 1996) was conducted at Building 1025 in 1996. Four subsurface soil samples were collected at 3 to 5 feet (twice), 6 to 6.5 feet, and 8 to 10 feet below ground surface at four boring locations (A1, A2, B1 and B2). These borings are located east and southeast of Building 1025. The samples were analyzed for lead, TPH, VOCs and SVOCs. Several analytes were detected above detection limits in all of the samples.

### 2.3.14 Building 1033

Two USTs existed at this location. Tank 1033A was a 425-gallon oil/water separator and 1033B was a 565-gallon UST containing used oil. The USTs reportedly were located 146 feet east of the center of the fire training pit. USTs 1033A and 1033B were installed in March of 1972. Tank 1033B was removed in July of 1988 and UST 1033A was removed in June of 1989.

No contamination history exists for this location.

### 2.3.15 POL Yard

The POL Storage Yard consisted of four aboveground bulk fuel storage tanks (954, 955, 956, and 957) tanks ranging in size from 190,000 to 260,000-gallons; three pump houses (Buildings 953, 959 and 960); a boiler building (Building 951); and a truck fill stand (Building 952). Underground transfer lines connected the aboveground storage tanks (ASTs) to the dispensing pump houses. The ASTs were situated on the flank of a hillside and surrounded by asphalt covered earthen berms. The site is approximately 12 acres and is covered primarily with crushed stone or asphalt. The eastern portion of the POL Storage Yard containing Tank 956 and Pump House 959 is currently owned by the City of Kansas City, Missouri and is not part of this project. The POL Yard is located in Parcel B.

A 1995 removal action included the decontamination and removal of three ASTs (one 260,000-gallon heating oil tank, one 190,000-gallon JP-4 tank, and one 200,000-gallon JP-4 tank); approximately 3,750 linear feet of underground piping, fill stations, valves, rail off-load piping headers and other appurtenances; and a 20- by 40-foot boiler building (Building 951), 16- by 40-foot pump house (Building 953), 6- by 10-foot pump house (Building 960), and 6- by 12-foot truck fill stand (Building 952). The boiler building contained asbestos which was removed prior to demolition. Lead paint was present on the ASTs, boiler building, pump house and truck fill stand but was not removed prior to demolition. Approximately 200 cubic yards of petroleum-contaminated soil excavated during the removal action is stockpiled on site pending a decision on the final disposition of contaminated soil.

During the 1995 removal action, soil samples were collected along the excavated piping runs and from the building excavations to assess residual soil contamination. A total of 40 soil samples were collected for laboratory analysis. The samples were analyzed for BETX and TPH. Twenty of the samples were also analyzed for SVOCs and lead.

The nine existing monitoring wells at the site were redeveloped and ground water samples collected for laboratory analysis. The ground water samples were analyzed for BETX and TPH. Soil borings were advanced at the site to assess the horizontal and vertical extent of residual soil contamination following removal of the AST, underground fuel piping, and other appurtenances; and the demolition of the boiler building, pump houses, and truck fill stand.

A total of 355 soil samples were submitted to the laboratory for analysis. The detected compounds included benzo(a)anthracene [4.1 and 14 mg/Kg], benzo(a)pyrene [0.73 to 66 mg/Kg], benzo(b)fluoranthracene [6.6 mg/Kg], dibenzo(a,h)anthracene [3.6 mg/Kg], and indeno(1,2,3,-cd)pyrene [15 mg/Kg]. TPH exceeding 500 mg/Kg was detected in 31 of the analyzed samples at concentrations of 568 to 5,640 mg/Kg. BETX were below site cleanup goals or method detection limits in the samples.

Seventeen ground water samples and one duplicate were submitted to the laboratory for analysis. No BETX or TPH exceeding MDNR ground water cleanup goals were detected in the ground water samples collected from the monitoring wells or soil borings. One grab ground water sample collected from the Building 951 basement prior to demolition had a TPH concentration of 196 mg/L. On-site heated headspace analysis of the grab ground water sample collected 150 feet south of former Building 953 detected 8,604 ug/L total VOCs, but no BETX above MDNR ground water cleanup goals.

#### **2.4 PROJECT SITE CONTAMINATION HISTORY**

The contaminant history for each site is presented in Section 2.3.

#### **2.5 POTENTIAL CONTAMINANTS**

Potential contaminants to surface waters include: sediment pollution due to land disturbance and biovent excavation activity; discharge of potentially petroleum contaminated liquids due to dewatering of the POL Yard depression; removal of fluids from pipelines and excavations; and petroleum products/residues released from the subcontractor's construction equipment.

#### **2.6 POTENTIAL CONTAMINANT RELEASE PATHWAYS**

The majority of surface water runoff containing a contaminant release would eventually migrate to Scope Creek depending on weather conditions at the time of a spill; however, it is unlikely that Scope Creek would be impacted by a spill or release. Most of the areas between the fieldwork and Scope Creek are low-cut, grassy areas and a spill or release would infiltrate prior to reaching Scope Creek. Spill procedures will be implemented and sediment barriers will be installed between the fieldwork areas and Scope Creek as precautionary measures.

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### 3.0 PROJECT SCOPE AND OBJECTIVES

#### 3.1 OBJECTIVES

The following is a summary of the field activities associated with the Remedial Action at Building 1100 Area, Remedial Action at Building 1200 Area, Removal of the 18 bio-vent wells at ST-007, Closure of the Fuel Hydrant Line, Closure of the Industrial Waste Line, Closure at CS003 (Oil/Water Separators), Remedial Investigations at four Former UST Sites, Remedial Action at eight Former UST Sites, and backfilling a depression at the POL Yard. The field work is tentatively scheduled to commence during November 1999 and be completed in January of 2000. General site plans are shown on Figures 1 and 2.

The planned field activities will be conducted in accordance with the procedures set forth in this FSP. The field investigation will be performed in strict adherence to the site-specific Health and Safety Plan (HSP). Fieldwork will initially be conducted in Level D protection, however, if conditions warrant, an upgrade to Level C will occur.

##### 3.1.1 Remedial Action at Building 1100 Area

The objective of the field activities at the 1100 Area is to remove approximately 25 cubic yards of petroleum contaminated soil from a former UST site (see Figure 3). The soil removed from the excavations will be profiled and disposed of at an approved off-base landfill. After the removal process is complete, the field personnel will obtain confirmation soil samples from the excavation utilizing the bucket of the track excavator or 4x4 backhoe, and have the samples analyzed for the parameters presented in Section 3.2 of this FSP. The excavation will be backfilled with clean soil immediately after the completion of sampling.

A Geoprobe unit will be utilized to initiate a site characterization at Building 1100. The Geoprobe will collect six to eight ground water samples for on-site screening of total volatile organic compounds (TVOC). Four samples (one up gradient and three down gradient) will be selected for laboratory analysis of VOCs and SVOCs depending on the volume of water available at each probe location.

A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

##### 3.1.2 Remedial Investigation at Building 1200 Area

The Building 1201 Area is an inactive site that previously had a 3,000-gallon fuel oil UST (see Figure 4). Subsurface soil sampling performed in 1996 indicated the presence of PAH contaminated soils in excess of the MDNR CALM Tier 1, Category B STARC target concentrations. Remediation activities will be conducted to remove and dispose of petroleum contaminated soils and confirmatory sampling will be performed to verify clean-up. The removal process will include the following: excavation of contaminated soil; stockpiling the contaminated soil in a roll-off box; sampling any ground water that enters the excavation(s), Geoprobe screening of ground water at six to eight locations for total volatile organic compounds (TVOC) (four of the screening locations will be sampled for off-site laboratory analysis of VOCs and SVOCs), sampling of the contaminated soil for disposal profiling; confirmatory soil sampling from the excavation, disposal of the contaminated soil at an approved off-base landfill; backfilling the excavation; and site restoration. The excavation will be backfilled with clean soil immediately after the completion of sampling. A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

It should be noted that contamination was not detected in excess of the MDNR CALM Tier, Category B STARC target concentrations during a 1996 subsurface at Building 1202. An effort will be made to locate heretofore unseen as-built drawings of the Building 1200 Area to find the previous location of piping and vent lines. Should the drawings not be available, effort will be made during the field work to estimate the previous location of the lines in relation to remaining appurtenances (e.g. the boiler, wall fittings for vent pipes, hole in building for piping, etc.) in order to collect samples per the Closure Document. Additional samples will be collected if necessary in an effort to close this site per the MDNR UST Closure Guidance.

### 3.1.3 Site ST007

The objective of the field activities at the ST007 site is to remove the 18 bio-vent wells from the area of the former USTs (see Figure 5). The wells will be removed by a State of Missouri licensed well driller. The piping and any soil generated during the removal activities will be disposed of at of an approved off-base landfill. The bore holes for the bio-vent wells will be abandoned in accordance with State of Missouri well abandonment requirements (10 CSR 23-4.080). The former location of each of the bio-vent wells will be restored to match the surrounding site conditions. A letter report will be prepared documenting the site activities

### 3.1.4 Fuel Hydrant Line Closures

Dames & Moore will close the fuel hydrant lines (8-inch and 6-inch) totaling approximately 5,800 feet (see Figure 6). The objective of the field activities is to perform cleaning, plugging and assessment activities to obtain closure of the fuel hydrant line. The line will initially be accessed by excavation at four locations. Once the excavations have been shored or benched, a six to eight-foot section of the line will be cut out for removal of residual liquids and cleaning/rinsing. Asbestos containing mastic will be abated from the line prior to cutting the pipe. The fluids removed from the fuel hydrant line will be containerized, sampled, analyzed, and disposed of in accordance with MDNR regulations. The line will be pigged clean. This method is accomplished by manually pulling an abrasive, rubber, "swab" and degreaser (citrus-based) through the line attached to a wire. Using the wire, the pig can be pulled in two directions to swab the line clean. Once the line is rinsed clean, grout will be pressure-pumped into the sections of open line and capped at each access point. After completion of these activities, soil samples will be collected along the line in accordance with MDNR UST regulations. The soil samples will be collected using direct-push techniques at a depth corresponding to approximately 12-inches below the line invert every 100 feet and/or at elbows. Soil samples will be collected from each of these locations and analyzed for the parameters presented in Section 3.2 of the FSP. The direct push boreholes will be grouted immediately after collecting the soil samples at each location. The borehole locations will be restored to coincide with surrounding site conditions. If the confirmatory soil sample analyses report indicates that the hydrant fuel line meets MDNR UST Closure Guidance Document criteria and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the line.

### 3.1.5 Industrial Waste Line Closures

The objective of the field activities is to perform cleaning, plugging and assessment activities for closure of the industrial waste line (see Figure 6). The line will initially be accessed at several manhole locations for the removal of residual liquids and cleaning/rinsing. The fluids removed from the industrial waste line will be containerized, sampled, analyzed, and disposed of in accordance with MDNR regulations. After completion of these activities, soil samples will be collected at the manhole locations using direct-

push techniques. The soil samples will be collected at a depth corresponding to approximately 12-inches below the line invert at manholes/elbows. Soil samples collected from each of these locations will be analyzed for the parameters presented in Section 3.2 of the FSP. The direct-push boreholes will be plugged immediately after collecting the soil samples at each location. The surface appurtenance of each manhole will then be collapsed into each manhole concrete box that extends below the ground surface. The remainder of the void space in the concrete box will be backfilled with soil to eliminate access to the line. The manhole locations will be restored to coincide with surrounding site conditions. If the confirmatory soil sample analysis reports indicate that the excavations have met MDNR UST Closure Guidance Document criteria and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will then be prepared for the Industrial Waste Line.

### **3.1.6 Removal of Oil/Water Separators 9470A and 9470B**

The objective of the closure activities is to remove the components of OWS-9470A and OWS-9470B and any associated contaminated soil in accordance with the MDNR UST Closure Guidance Document. Closure of OWS-9470A and OWS-9470B will not be initiated until the remedial actions are completed at the other sites discussed in this FSP.

Soil and ground water samples will be collected adjacent to the OWSs prior to initiating the removal activities to assess whether a release has occurred (see Figure 7). The soil samples will be collected using direct-push methods. The ground water (if any) will be sampled from two of the down gradient boreholes. After completion of these activities, the contents of OWS-9470A and OWS-9470B will be sampled in accordance with MDNR closure sampling requirements for a UST of equivalent size. The contents from the OWSs will then be removed and disposed of at an approved off-base facility.

The OWSs will be purged of flammable vapors and cleaned prior to removal activities. The OWSs and surrounding concrete will then be removed and disposed of an approved off-base landfill. Confirmation soil samples will be obtained from the excavation utilizing the bucket of the track excavator or 4x4 backhoe and analyzed for the parameters presented in Section 3.2 of this FSP. Once the confirmatory soil sample analyses report indicates that the excavations have met MDNR UST Closure Guidance Document criteria and the Air Force is satisfied that cleanup goals have been met, a final UST Closure Report will be prepared.

### **3.1.7 Remedial Investigation at Four Former UST Sites**

The objective of the field activities is to complete a Remedial Investigation at the former UST locations at Buildings 940, 944, 965, and 1033 (see Figures 8, 9, 10, and 11). The investigation activities will include collecting soil and, if encountered, ground water from boreholes advanced using direct-push technology. The samples will be analyzed for the parameters listed in Section 3.2 of this FSP. If it is determined that contamination is present above the MDNR UST Closure Guidance Document criteria for any or all the sites, these locations will be addressed under the Removal Action portion of this contract (see Section 3.1.9). UST Closure Reports will be generated for those sites that do not have contamination that exceeds the MDNR UST Closure Guidance Document criteria.

### **3.1.8 Remedial Action at Eight Former UST Sites**

The objective of the field activities at the Remedial Action sites is to remove petroleum contaminated soil from former UST locations to obtain site closure. The buildings where there is known petroleum contamination exceeding the MDNR CALM Tier I, Category B STARC target concentrations are 903,

942, 948, and 1025 (see Figures 12, 13, 14, and 15). As noted above, Buildings 940, 944, 965, and 1033 could be added to this list if petroleum contamination is detected above the clean up guidelines during the Remedial Investigations at these sites. The soil removed from each excavation will be profiled and disposed of at an approved off-base landfill. After the removal process is complete, the field personnel will obtain confirmation soil samples from these excavations utilizing the bucket of the track excavator or the 4x4 backhoe and have the samples analyzed for the parameters presented in Section 3.2 of this FSP. The excavation will be backfilled with clean soil immediately after the completion of sampling.

At sites 903, 942, 948, and 1025, ground water will be screened using a Geoprobe unit at six to eight locations for total volatile organic compounds (TVOC). Four of the screening locations will be sampled for off-site laboratory analysis of VOCs and SVOCs)

Closure reports will be generated for each of the RA sites (if not already completed in the RI phase) that satisfy both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

### 3.1.9 POL Yard

The objective of the field activities at the POL Yard is to backfill a depression remaining from the removal of Buildings 951 and 953 to eliminate a safety concern at the site. The water that has collected in this depression will be sampled and then pumped out through the oil/water separators. A monitoring well that is present in this depression will be abandoned in accordance with State of Missouri regulations (10 CSR 23-4.080). Clean fill material will then be brought to the site and placed in the depression. The depression will be backfilled to a level consistent with the surrounding land surface. A letter report summarizing these activities will be provided at the completion of the fieldwork.

## 3.2 SAMPLE ANALYSIS SUMMARY

Field samples and QA/QC samples will be analyzed for the parameters defined in the Statement of Work and those specified by MDNR *UST Closure Guidance Document* (MDNR, 1996). A complete description of the field and laboratory analytical parameters is provided in the QAPP. The Sample Analysis Summary Tables 3.2-1 through 3.2-19 list the laboratory analyses, and the number and type (matrices) of field and quality control samples that will be completed for each site.

**Table 3.2-1  
Remedial Action at 1100 Area: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
Soil Analysis								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260							
VOCs	8260	5	1	1			1	8
SVOCs	8270	5	1	1			1	8
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010		1					1
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87		1					1

Aqueous Analysis								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	5		1	3	3	1	13
SVOCs	8310	5		1		3	1	10
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-2  
Remedial Action at 1200 Area: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	6	1	1			1	9
TPH-DRO	8015M	6	1	1			1	9
BTEX/MTBE	8260							
VOCs	8260	6	1	1			1	9
SVOCs	8270	6	1	1			1	9
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010		1					1
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87		1					1
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	5		1	3	3	1	13
SVOCs	8310	5		1		3	1	10
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-3  
ST007: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	1						1
TPH-DRO	8015M	1						1
BTEX/MTBE	8260							
VOCs	8260	1						1
SVOCs	8270	1						1
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010		1					1
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87		1					1
<b>Aqueous Analysis</b>								
TPH-GRO	8015M							
TPH-DRO	8015M							
BTEX/MTBE	8260							
VOCs	8260				1			
SVOCs	8310							
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-4  
Fuel Hydrant Line Closure: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	58		6			6	70
TPH-DRO	8015M	58		6			6	70
BTEX/MTBE	8260							
VOCs	8260	58		6			6	70
SVOCs	8270	58		6			6	70
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							
<b>Aqueous Analysis</b>								
TPH-GRO	8015M					10		10
TPH-DRO	8015M					10		10
BTEX/MTBE	8260							
VOCs	8260				10	10		20
SVOCs	8310					10		10
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-5  
Industrial Waste Line Closure: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	24		2			2	28
TPH-DRO	8015M	24		2			2	28
BTEX/MTBE	8260							
VOCs	8260	24		2			2	28
SVOCs	8270	24		2			2	28
PCB	8082	24		2			2	28
Pesticides	8081	24		2			2	28
Ethylene Glycol	8015M	24		2			2	28
Total Metals	6010	24		2			2	28
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	5		1		2	1	9
TPH-DRO	8015M	5		1		2	1	9
BTEX/MTBE	8260							
VOCs	8260	5		1	2	2	1	11
SVOCs	8310	5		1		2	1	9
PCB	8082	5		1		2	1	9
Ethylene Glycol	8015M	5		1		2	1	9
Pesticide	8081	5		1		2	1	9
Metals	6010	5		1		2	1	9

**Table 3.2-6  
Closure of Oil/Water Separators: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	20	1	2			2	25
TPH-DRO	8015M	20	1	2			2	25
BTEX/MTBE	8260							
VOCs	8260	20	1	2			2	25
SVOCs	8270	20	1	2			2	25
PCB	8082	20	1	2			2	25
Pesticides	8081	20		2			2	24
Ethylene Glycol	8015M	20		2			2	24
Total Metals	6010						2	25
TCLP Metals	1311/6010	20	1	2			2	25
Open Cup Flash Point	846/1010		1					
Paint Filter	846/9095		1					
Percent Chlorine	ASTM # D808-87		1					

Aqueous Analysis								
TPH-GRO	8015M	4		1		2	1	8
TPH-DRO	8015M	4		1		2	1	8
BTEX/MTBE	8260							
VOCs	8260	4		1	2	2	1	10
SVOCs	8310	4		1		2	1	8
PCB	8082	4		1		2	1	8
Ethylene Glycol	8015M	4		1		2	1	8
Pesticide	8081	4		1		2	1	8
Metals	6010	4		1		2	1	8

**Table 3.2-7  
Remedial Investigation at Building 940: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	8		1			1	10
TPH-DRO	8015M	8		1			1	10
BTEX/MTBE	8260							
VOCs	8260	8		1			1	10
SVOCs	8270	8		1			1	10
PCB	8082	8		1			1	10
Pesticides	8081	8		1			1	10
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	8		1			1	10
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	2		1		1	1	5
TPH-DRO	8015M	2		1		1	1	5
BTEX/MTBE	8260							
VOCs	8260	2		1	2	1	1	7
SVOCs	8310	2		1		1	1	5
PCB	8082	2		1		1	1	5
Ethylene Glycol	8015M							
Pesticide	8081	2		1		1	1	5
Metals	6010	2		1		1	1	5

**Table 3.2-8  
Remedial Investigation at Building 944: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	20		2			2	24
TPH-DRO	8015M	20		2			2	24
BTEX/MTBE	8260							
VOCs	8260	20		2			2	24
SVOCs	8270	20		2			2	24
PCB	8082	10		1			1	12
Pesticides	8081	10		1			1	12
Ethylene Glycol	8015M							
Total Metals	6010	10		1			1	12
TCLP Metals	1311/6010	10		1			1	12
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							

Aqueous Analysis								
TPH-GRO	8015M	3		1		2	1	7
TPH-DRO	8015M	3		1		2	1	7
BTEX/MTBE	8260							
VOCs	8260	3		1	2	2	1	9
SVOCs	8310	3		1		2	1	7
PCB	8082	3		1		2	1	7
Ethylene Glycol	8015M							
Pesticide	8081	3		1		2	1	7
Metals	6010	3		1		2	1	7

Table 3.2-9  
Remedial Investigation at Building 965: Laboratory Analysis

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	8		1			1	10
TPH-DRO	8015M	8		1			1	10
BTEX/MTBE	8260							
VOCs	8260	8		1			1	10
SVOCs	8270	8		1			1	10
PCB	8082	8		1			1	10
Pesticides	8081	8		1			1	10
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	8		1			1	10
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	1		1		1	1	4
TPH-DRO	8015M	1		1		1	1	4
BTEX/MTBE	8260							
VOCs	8260	1		1	1	1	1	5
SVOCs	8310	1		1		1	1	4
PCB	8082	1		1		1	1	4
Ethylene Glycol	8015M							
Pesticide	8081	1		1		1	1	4
Metals	6010	1		1		1	1	4

**Table 3.2-10  
Remedial Investigation at Building 1033: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	10		2			2	14
TPH-DRO	8015M	10		2			2	14
BTEX/MTBE	8260							
VOCs	8260	10		2			2	14
SVOCs	8270	10		2			2	14
PCB	8082	10		2			2	14
Pesticides	8081	10		2			2	14
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	10		2			2	14
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							

Aqueous Analysis								
TPH-GRO	8015M	2		1		2	1	6
TPH-DRO	8015M	2				2	1	6
BTEX/MTBE	8260							
VOCs	8260	2		1	2	2	1	8
SVOCs	8310	2		1		2	1	6
PCB	8082	2		1		2	1	6
Ethylene Glycol	8015M							
Pesticide	8081	2		1		2	1	6
Metals	6010	2		1		2	1	6

**Table 3.2-11  
Remedial Action at Building 903: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260	5	1	1			1	8
VOCs	8260							
SVOCs	8270							
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010		1					1
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87							

Aqueous Analysis								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	5		1	3	2	1	11
SVOCs	8310	5		1		2	1	9
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-12  
Remedial Action at Building 940: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260							
VOCs	8260	5	1	1			1	8
SVOCs	8270	5	1	1			1	8
PCB	8082	5	1	1			1	8
Pesticides	8081	5		1			1	7
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	5	1	1			1	8
Open Cup Flash Point	846/1010		1					
Paint Filter	846/9095		1					
Percent Chlorone	ASTM # D808-87		1					

Aqueous Analysis								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	1		1	2	2	1	7
SVOCs	8310	1		1		2	1	5
PCB	8082	1		1		2	1	5
Ethylene Glycol	8015M							
Pesticide	8081	1		1		2	1	5
Metals	6010	1		1		2	1	5

**Table 3.2-13  
Remedial Action at Building 942: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260							
VOCs	8260	5	1	1			1	8
SVOCs	8270	5	1	1			1	8
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010		1					1
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87							
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	5		1	3	3	1	13
SVOCs	8310	5		1		3	1	10
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-14  
Remedial Action at Building 944: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	10	2	1			1	14
TPH-DRO	8015M	10	2	1			1	14
BTEX/MTBE	8260							
VOCs	8260	10	2	1			1	14
SVOCs	8270	10	2	1			1	14
PCB	8082	5	1	1			1	8
Pesticides	8081	5		1			1	7
Ethylene Glycol	8015M							
Total Metals	6010	5	1	1			1	8
TCLP Metals	1311/6010	5	1	1			1	8
Open Cup Flash Point	846/1010		2					
Paint Filter	846/9095		2					
Percent Chlorine	ASTM # D808-87		1					
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	2		1		2	1	6
TPH-DRO	8015M	2		1		2	1	6
BTEX/MTBE	8260							
VOCs	8260	2		1	2	2	1	8
SVOCs	8310	2		1		2	1	6
PCB	8082	2		1		1	1	5
Ethylene Glycol	8015M							
Pesticide	8081	2		1		1	1	5
Metals	6010	2		1		2	1	6

**Table 3.2-15  
Remedial Action at Building 948: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260							
VOCs	8260	5	1	1			1	8
SVOCs	8270	5	1	1			1	8
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010		1					1
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87							

Aqueous Analysis								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	5		1	3	3	1	13
SVOCs	8310	5		1		3	1	10
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-16  
Remedial Action at Building 965: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	6	1	1			1	9
TPH-DRO	8015M	6	1	1			1	9
BTEX/MTBE	8260							
VOCs	8260	6	1	1			1	9
SVOCs	8270	6	1	1			1	9
PCB	8082	6	1	1			1	9
Pesticides	8081	6		1			1	8
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	6	1	1			1	9
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87		1					1

Aqueous Analysis								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	1		1	2	2	1	7
SVOCs	8310	1		1		2	1	5
PCB	8082	1		1		2	1	5
Ethylene Glycol	8015M							
Pesticide	8081	1		1		2	1	5
Metals	6010	1		1		2	1	5

**Table 3.2-17  
Remedial Action at Building 1025: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
<b>Soil Analysis</b>								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260							
VOCs	8260	5	1	1			1	8
SVOCs	8270	5	1	1			1	8
PCB	8082							
Pesticides	8081							
Ethylene Glycol	8015M							
Total Metals	6010		1					1
TCLP Metals	1311/6010							
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87							
<b>Aqueous Analysis</b>								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	5		1	3	3	1	13
SVOCs	8310	5		1		3	1	10
PCB	8082							
Ethylene Glycol	8015M							
Pesticide	8081							
Metals	6010							

**Table 3.2-18  
Remedial Action at Building 1033: Laboratory Analysis**

Analyte	Method	Number Confirmatory Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	5	1	1			1	8
TPH-DRO	8015M	5	1	1			1	8
BTEX/MTBE	8260							
VOCs	8260	5	1	1			1	8
SVOCs	8270	5	1	1			1	8
PCB	8082	5	1	1			1	8
Pesticides	8081	5		1			1	7
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	5	1	1			1	8
Open Cup Flash Point	846/1010		1					1
Paint Filter	846/9095		1					1
Percent Chlorine	ASTM # D808-87		1					1

Aqueous Analysis								
TPH-GRO	8015M	1		1		2	1	5
TPH-DRO	8015M	1		1		2	1	5
BTEX/MTBE	8260							
VOCs	8260	1		1	2	2	1	7
SVOCs	8310	1		1		2	1	5
PCB	8082	1		1		2	1	5
Ethylene Glycol	8015M							
Pesticide	8081	1		1		2	1	5
Metals	6010	1		1		2	1	5

Table 3.2-19  
POL Yard: Laboratory Analysis

Analyte	Method	Number Backfill Samples	Waste Profile Samples	Number Duplicates	Number Trip Blanks	Number Equipment Blanks	Number MS/MSD Sample	Total Number Samples
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Soil Analysis								
TPH-GRO	8015M	1						1
TPH-DRO	8015M	1						1
BTEX/MTBE	8260							
VOCs	8260	1						1
SVOCs	8270	1						1
PCB	8082	1						1
Pesticides	8081	1						1
Ethylene Glycol	8015M							
Total Metals	6010							
TCLP Metals	1311/6010	1						1
Open Cup Flash Point	846/1010							
Paint Filter	846/9095							
Percent Chlorine	ASTM # D808-87							

Aqueous Analysis								
TPH-GRO	8015M		1					1
TPH-DRO	8015M		1					1
BTEX/MTBE	8260							
VOCs	8260		1		1			2
SVOCs	8310		1					1
PCB	8082		1					1
Ethylene Glycol	8015M							
Pesticide	8081		1					1
Metals	6010		1					1

### 3.3 FIELD ACTIVITIES

Tables 3.3.1 through 3.3.10 summarize the field activities that will take place during the remedial investigations and remedial actions. The disposal facility for the soil exhibiting contamination in excess of the MDNR UST Closure Guidance Document concentrations is Deffenbaugh Landfill in Shawnee, Kansas. One waste profile sample will be collected for each removal action site and submitted for parameters listed in Tables 3.2-1 through 3.2-19.

#### 3.3.1 Remedial Action at Building 1100 Area

Prior to the start of field activities, Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of excavation activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE.

Dames & Moore will utilize a track excavator, front loader, and/or 4x4 backhoe to remove contaminated soil from the Building 1100 area and to load the soil into roll-off boxes (see Figure 3). During excavating activities, a Dames & Moore geologist will inspect soil from the floor of the excavation for indications (staining/odor) of petroleum contamination and field screen it for volatile TPH using a PID or detector tubes. When obvious signs of petroleum contamination are no longer present, confirmatory samples will be collected from the excavation according to the tank volume per the MDNR UST Closure Guidance Document. One confirmatory sample will also be collected from the down gradient (topographic) wall of the excavation. Dames & Moore anticipates no more than five samples will be collected for laboratory analysis to confirm closure of the site. Additional soil samples will be submitted for QA/QC analyses and waste profiling. The samples will be analyzed for the parameters specified in Table 3.2-1. The excavation will be backfilled with clean soil immediately after the completion of sampling.

If water is encountered in the excavation, the water will be removed and placed into the oil/water separator. The water, if encountered, will be sampled one time and will be analyzed for the parameters specified in Table 3.2-1. Once the water has been sampled, further accumulations of water in the excavation will be collected by vacuum truck and transported to the oil/water separator. A Geoprobe unit will be utilized to initiate a site characterization at Building 1100. The Geoprobe will collect six to eight ground water samples for on-site screening of total volatile organic compounds (TVOC). Four samples (one up gradient and three down gradient) will be selected for laboratory analysis of VOCs and SVOCs depending on the volume of water available at each probe location. All samples will be handled under proper chain-of-custody protocols, packed on ice in a cooler, and shipped via Federal Express to the laboratory.

A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.3.1**  
**Field Activities Summary-Building 1100 Area**

Activity	Number
Excavation locations approved by AFCEE	1
Utility Clearance and excavation permits (if any)	1
Excavation of the contaminated soil	25 cu. Yd.
Soil samples for disposal profiling	1
Confirmation soil sample	5
QA/QC Soil sampling (duplicates MS/MSD)	2
Ground Water samples, if encountered	1
Ground Water Screening for TVOCs	6 to 8
Ground Water Sampling for VOCs and SVOCs	4
QA/QC Water sampling (trip blanks)	2
QA/QC Water sampling (equipment blanks, duplicates, and MS/MSD)	4
Soil disposal	25 cu. Yd
Backfilling	25 cu. Yd.
Site Restoration	1

### 3.3.2 Remedial Investigation at Building 1200 Area

Prior to the start of field work, Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of excavation activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE.

A subcontractor will excavate the area of expected contamination at Building 1201 (see Figure 4). Remediation activities will be conducted to remove and dispose of petroleum contaminated soils and confirmatory sampling will be performed to verify clean-up. A Dames & Moore geologist will be present to direct the field investigation and to conduct the soil sampling activities. The geologist will collect soil samples for screening purposes at two foot intervals to the bottom of the excavation. During excavating activities, soil from the excavations will be inspected for indications (staining/odor) of petroleum contamination and field screened for volatile TPH using a PID or detector tubes. If the samples exhibit field screening readings indicating contamination, that area will be over excavated and resampled. When obvious signs of petroleum contamination are no longer, confirmatory samples will be collected from the excavation according to tank volume per MDNR Closure Guidance Document. One confirmatory sample will also be collected from the down gradient (topographic) wall of each excavation.

The removal process will include the following. excavation of contaminated soil; stockpiling the contaminated soil in a roll-off box; sampling any ground water that enters the excavation(s), sampling of the contaminated soil for disposal profiling; confirmatory soil sampling from the excavation; and disposal of the contaminated soil at an approved off-base landfill.

Dames & Moore anticipates no more than six samples will be collected for laboratory analysis to confirm closure of the site. Additional soil samples will be submitted for QA/QC analyses and waste profiling. The samples will be analyzed for the parameters specified in Table 3.2-2. The excavation will be backfilled with clean soil immediately after the completion of sampling.

If water is encountered in the excavation, the water will be removed and placed into the oil/water separator. The water, if encountered, will be analyzed for the parameters specified in Table 3.2-2. Once the water has been sampled, further accumulations of water in that excavation will be collected by vacuum truck and transported to the oil/water separator. The Geoprobe will collect six to eight ground water samples for on-site screening of total volatile organic compounds (TVOC). Four samples (one up gradient and three down gradient) will be selected for laboratory analysis of VOCs and SVOCs depending on the volume of water available at each probe location. All samples will be handled under proper chain-of-custody protocols, packed on ice in a cooler, and shipped via Federal Express to the laboratory.

A closure report of field activities will be generated that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.3.2.**  
**Field Activities Summary-1201 Area**

<b>Activity</b>	<b>Number</b>
Excavation locations approved by AFCEE	1
Utility Clearance and excavation permits (if any)	1
Excavation of the contaminated soil	134 cu. Yd.
Soil samples for disposal profiling	1
Confirmation soil sampling	6
QA/QC Soil sampling (duplicates MS/MSD)	2
Ground Water sampling, if encountered)	1
Ground Water Screening for TVOCs	6 to 8
Ground Water Sampling for VOCs and SVOCs	4
QA/QC Water sampling (equipment blanks, duplicates and MS/MSD)	4
QA/QC Water sampling (trip blanks)	2
Soil disposal	134 cu. Yd.
Backfilling	134 cu. Yd.
Site Restoration	1

### 3.3.3 Site ST007

The 18 bio-vent casings will be removed by by a State of Missouri licensed well driller according to MDNR established criteria for abandoning wells (see Figure 5). This includes: removal of the entire well casing if possible or the top three-feet of casing (requires MDNR approval); placing a bentonite grout plug the full length of the well and grouting into the excavated area; and submitting the Abandonment Registration Record Form MO 780-1414 (see Appendix B) to the MDNR Division of Geology and Land Survey. Dames & Moore will complete and submit the Registration Record to MDNR. The drilling contractor will place the cuttings and casings in a landfill provided roll-off box for disposal. The landfill contractor will provide and transport a roll-off box for the transport of the bio-vent casings and soil cuttings to an off-base landfill for disposal.

A Dames & Moore Staff Geologist will collect one composite soil sample of the soil cuttings generated by the driller to satisfy profiling requirements prior to disposal at the selected landfill. One composite soil sample and one trip blank will be analyzed for the parameters specified in Table 3 2-3.

The site will be regraded and reseeded if necessary once the bio-vent casings are removed

**Table 3.3.3.**  
**Field Activities Summary – SST-007**

Activity	Number
Pull Bio-vents	18
Plug Bio-vent boreholes	18
Waste profile soil sample	1
QA/QC Water sample (trip blank)	1
Seed/repair well areas	18
Dispose of soil cuttings/PVC casings	1

### 3.3.4 Hydrant Line Closures

Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of excavation activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE.

An estimated 5,800 linear feet of 6-inch and 8-inch fuel hydrant line extending from the POL Yard to the flightline apron will be closed in place (see Figure 6). The initial task will be to gravity drain as much standing fuel as possible and containerize it for proper disposal. Dames & Moore assumed that no more than four cuts (excavations) would be required for proper cleaning and plugging of the line. Each excavation will be safely shored or benched and then lined with plastic sheeting (6 mil) in preparation for the next stage of work.

After the excavations has been completed, shored, and lined, a subcontractor will test the exposed fuel line for the presence of an asbestos mastic; if present, the asbestos containing material (ACM) will be abated from the portions of the exposed lines to be cut according to State and Federal regulations. Once

the ACM has been removed, the subcontractor will remove a section of the line (large enough to facilitate plugging). The section of pipe will be cut out using a low RPM saw. Residual fluid that may be trapped inside the fuel line will be collected and disposed of according to State and federal guidelines. The subcontractor will purge the line of flammable vapors prior to cleaning. The subcontractor will clean the full pipe interior surface by flushing, swab "pigging", or other approved method and collect the rinsate/residue and dispose of per State and Federal regulations. The pipe volume will then be filled with pressure-injected inert material such as a cement grout and the pipe ends plugged and capped. Piping, concrete, and soils will be excavated and removed only to the extent necessary to effect in-place closure of the piping system.

Once the line cleaning has been completed, the buried 6- and 8-inch POL lines will be located by a surveyor using existing structures and as-built drawings. The location of the line will be marked in the field and a subcontractor, along with Dames & Moore personnel, will then collect soil samples along the line using direct push sampling technology. The soil samples will be collected from a depth of approximately one foot below the invert of the pipe. The samples will be collected every 100 feet or at elbows in the line.

Dames & Moore will provide a Staff Geologist to conduct the soil sampling. Dames & Moore will provide air monitoring during the soil sampling using a PID. One soil sample will be collected from each location to determine if a release has occurred from the line. The samples will be inspected for indications (staining/odor) of petroleum contamination and field screened for volatile TPH using a PID or detector tubes. A portion of each sample will be placed in a laboratory-provided jar for shipment to an off-site laboratory for chemical analysis. Up to 58 soil samples will be collected from the excavations. Additional soil samples will be submitted for QA/QC analyses. The samples will be analyzed for the parameters specified in Table 3.2-4.

No remediation of impacted soil will be performed. However, a report will be issued describing the work performed and identifying contaminants of concern detected in the soil samples. If the confirmatory soil sample analyses report that the excavations have met UST Closure Guidance Document concentrations, and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the site.

**Table 3.3.4**  
**Field Activities Summary – Fuel Hydrant Line**

Activity	Number
Utility clearance	1
Perform survey to locate hydrant line	1
Excavation to access line for cleaning and plugging	4
Clean fuel hydrant line	1
Containerize fluids generated during cleaning	1
Sample fluids for disposal	1
Dispose of the fluids	1
Grout the fuel hydrant line	1
Cap line with expandable plugs	1
Direct push soil sampling locations (every 100 feet) and at elbows	58
Plugging each direct push borehole	58
QA/QC Soil Sampling (duplicates and matrix spike/matrix spike duplicate)	12
QA/QC Water Sampling (trip and equipment blanks)	10
Site restoration (access points for grouting and soil sample locations)	62

### 3.3.5 Industrial Waste Line Closures

Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of excavation activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE.

A pipe-cleaning contractor will close two sections of Industrial Waste(see Figure 6). The main section to be closed extends southwest from the oil/water separators (CS003) out along Hangar Road and includes 21 manholes. The other section extends to the west from the oil/water separators to the runway apron and includes three manholes.

Prior to pipe cleaning activities, Dames & Moore will provide field personnel to sample the influent and effluent water in the pipelines. Water samples will be collected with Teflon bailers lowered into a manhole with nylon cord and placed directly into the water stream. A Dames & Moore Staff Geologist will collect four water samples (and one duplicate sample) for off-site analysis. The four water samples (and one duplicate sample) will be analyzed for the parameters specified in Table 3.2-5.

The contractor will clean the full pipe interior surface by flushing, swab "pigging", or other approved method and dispose of rinsate residues. The residue/rinsate from both lines will be containerized and disposed of according to State and Federal regulations.

Once the line cleaning has been completed, a subcontractor will provide equipment and an operator to collect soil samples at each manhole. The samples will be collected using direct-push technology. Soil samples will also be collected at any elbows in the line. The samples will be collected at a depth of approximately one foot below where the lines is plumbed to the down gradient side of the manhole.

Dames & Moore will provide a Staff Geologist to conduct the soil sampling in each of the locations. Dames & Moore will provide air monitoring during the sampling of the soil using a PID. One soil sample will be collected from each location. The sample will be inspected for indications (staining/odor) of petroleum contamination and field screened for volatiles using a PID or detector tubes. A portion of the sample will be placed in a laboratory--provided jar for shipment to an off-site laboratory for chemical analysis. Up to 24 soil samples will be collected from the manhole locations. Additional samples will be submitted for QA/QC analyses. The samples will be analyzed for the parameters specified in Table 3.2-5.

Once the confirmatory soil samples have been collected along the Industrial Waste line, the surface appurtenance of each manhole will be collapsed into the concrete box that extends below the ground surface. The remainder of the void space in the concrete box will be backfilled with soil to eliminate access to the line. The manhole locations will then be restored to coincide with surrounding site conditions.

No remediation of impacted soil will be performed. However, a report will be issued describing the work performed and identifying contaminants of concern detected in the soil samples. If the confirmatory soil sample analyses report that the excavations have met UST Closure Guidance Document concentrations, and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the site.

**Table 3.3.5**  
**Field Activities Summary – Industrial Waste Line**

Activity	Number
Utility clearance	1
Survey location of line	1
Collect water samples	5
QA/QC samples (equipment blanks, duplicates, and matrix spike/matrix spike duplicates)	4
QA/QC trip blanks	2
Clean the line	1
Containerize fluids generated during cleaning	1
Sample the fluids	1
Dispose of the fluids	1
Direct push soil sampling at manholes	24
QA/QC soil sampling (duplicates and MS/MSD)	4
Backfill each soil boring	24
Backfill the manholes	24
Site Restoration	24

### 3.3.6 Closure of CS003 (Oil/Water Separators)

The closure of the oil/water separators will involve three tasks. These tasks include soil sampling using direct-push method; collection of ground water direct-push bore holes; and removal of the oil/water separators (see Figure 7).

For each OWS, four soil borings will be advanced adjacent to each side of the OWS to a depth approximately two feet below the bottom of the concrete pad. One down gradient (topographic) sample will be taken adjacent to the vertical midpoint of the OWS. In addition, one sample exhibiting the highest apparent contamination, or from the bottom of the boring if there is no apparent contamination, will be taken from each of the four borings. The samples will be inspected for indications (staining/odor) of petroleum contamination and field screened for volatiles using a PID or detector tubes. A portion of each sample will be placed in a laboratory-provided jar for shipment to an off-site laboratory for chemical analysis. A total of 10 soil samples will be collected from the boring locations. Additional samples will be submitted for QA/QC analyses. The samples will be analyzed for the parameters specified in Table 3.2-6.

If water is present in the down gradient (topographic) borings, one grab water sample will be collected from each and analyzed for the parameters specified in Table 3.2-6.

Sampling the contents of both OWSs will be performed by Dames & Moore using a disposable plastic bailer. One sample will be collected from each OWS and analyzed for the parameters specified in Table 3.2-6.

The following tasks will be performed to complete the removal of OWS-9470A and OWS-9470B. Prior to removal, the liquid in the tanks will be drained, vapors purged, and sludge removed according to American Petroleum Institute Document 1604. A subcontractor will then use an excavator and possibly a crane to remove the separators. The associated piping and vent stacks will be disconnected, removed, and properly disposed of along with the tanks. The discharge lines will be permanently closed and sealed. During the removal activities, a Dames & Moore Staff Geologist will monitor the vapors in the workspace and in the excavation utilizing a PID. The concrete vault surrounding OWS-9470B will be demolished, removed, and transported to an approved landfill.

Contaminated soil encountered during the removal operation will be excavated. An estimated 100 cubic yards of contaminated soil will be loaded into site-specific roll off boxes for transport as a special waste to an approved off-base landfill. It is anticipated that subcontractor will utilize track hoe excavating equipment during these activities. During excavating activities, a Dames & Moore geologist will inspect soil from the floor of each excavation for indications (staining/odor) of petroleum contamination and field screen it for volatile TPH using a PID or detector tubes. When obvious signs of petroleum contamination are no longer present, confirmatory samples will be collected from the excavation according to tank volume per the MDNR UST Closure Guidance Document. One confirmatory sample will also be collected from the down gradient (topographic) wall of each excavation. Up to 10 confirmation soil samples will be collected from the excavations. Additional samples will be submitted for QA/QC analyses and waste profiling. The samples will be analyzed for the parameters specified in Table 3.2-6.

The excavation will be backfilled with clean soil immediately after the completion of sampling. Once the confirmatory soil sample analyses report that the excavations have met MDNR Closure Guidance Document concentrations, and the Air Force is satisfied that cleanup goals have been met, a UST Closure Report will be prepared for the site.

**Table 3.3.6.**  
**Field Activities Summary – CS003 (Oil/Water Separators)**

Activity	Number
Utility Clearance	1
Direct-push soil sampling	1
Water samples (direct push technology)	2
OWS contents sampling	2
OWS fluids removal	1
OWS fluids disposal	1
OWS cleaning/purging	2
OWS removal	2
OWS disposal	2
Waste profile soil sample	1
Direct-push soil samples	10
Confirmation soil samples	10
QA/QC water samples (duplicates, equipment blanks and matrix spike/matrix spike duplicates)	3
QA/QC water samples (trip blanks)	2
QA/QC soil sampling (duplicates and matrix spike/matrix spike duplicates)	4
Backfill the excavations	2
Site restoration (two excavations)	2

### 3.3.7 Remedial Investigation at Four Former UST Sites

Prior to the start of field activities, Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of investigation activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE.

Subsurface Investigations shall be conducted at Buildings 940, 944, 965, and 1033 to characterize the extent of contamination, if present, at the above referenced sites (see Figures 8, 9, 10, and 11). Soil samples, and if encountered ground water samples, will be collected in accordance with MDNR criteria.

A Geoprobe contractor will perform the direct push sampling at each of the former UST sites. Dames & Moore will provide a Staff Geologist to direct the field investigation and to conduct the sampling activities. The soil samples will be collected from a depth corresponding to approximately one-foot below the bottom of the former UST. Soil samples will be collected continuously to the bottom of the boring. Similarly, samples will be collected along fuel product lines from a depth 3 feet (approximately one foot below the former piping). One sample exhibiting the highest apparent contamination, or from the bottom of the boring if there is no apparent contamination, will be taken from each of the borings.

The samples will be inspected for indications (staining/odor) of petroleum contamination and field screened for volatiles using a PID or detector tubes. A portion of each sample will be placed in a laboratory-provided jar for shipment to an off-site laboratory for chemical analysis. Additional soil samples will be submitted for QA/QC analyses. The samples will be analyzed for the parameters specified in Tables 3.2-7 through 3.2.10.

All samples will be handled under proper chain-of-custody protocols, packed on ice in a cooler, and shipped via Federal Express to the laboratory.

**Table 3.3.7**  
**Field Activities Summary – Four RI Sites**

Activity	Number
Utility clearance	4
Direct-push soil sample	46
Ground water sampling	8
QA/QC water sampling (trip blanks)	7
QA/QC water sampling (duplicates, equipment blanks, and MS/MSD)	14
QA/QC soil sampling (duplicates and matrix spike/matrix spike duplicates)	12
Borehole Plugging	46
Site Restoration	46

### 3.3.8 Remedial Action at Eight Former UST Sites

Prior to the start of field activities, Dames & Moore will contact the Missouri underground utility locating service (1-800-"DIG-RITE") to mark the work area prior to the commencement of excavation activities. DIG-RITE will issue Dames & Moore a confirmation serial number for the job. Dames & Moore will also request a Digging Permit from the City of Kansas City, Missouri to locate utilities not handled by DIG-RITE.

Remediation of potential petroleum contaminated soils shall be conducted at former UST sites at Buildings 903, 940, 942, 944, 948, 965, 1025, and 1033 by removal and off-site disposal (see Figures 5 and 8 through 14). Using data obtained from previous investigations, contaminated soils that exceeds MDNR CALM Tier 1, Category B STARC target concentrations, will be excavated and disposed of in accordance with MDNR regulations.

Dames & Moore will remove approximately 590 yards of contaminated soil from the eight former UST sites and load the soil into site-specific roll off boxes for transport as a special waste to an approved off-base landfill. It is anticipated that a track hoe excavating equipment will be used during these activities.

During excavating activities, soil from the excavations will be inspected for indications (staining/odor) of petroleum contamination and field screened for volatile TPH using a PID or detector tubes. If the samples exhibit field-screening readings indicating contamination, that area will be over excavated and resampled. When obvious signs of petroleum contamination are no longer present, confirmatory samples will be collected from the excavation according to tank volume per MDNR Closure Guidance Document.

One confirmatory sample will also be collected from the down gradient (topographic) wall of each excavation. Additional soil samples will be submitted for QA/QC analyses and waste profiling. The samples will be analyzed for the parameters specified in Tables 3.2-11 through 3.2-18. The excavation will be backfilled with clean soil immediately after the completion of sampling.

If water is encountered in an excavation, the water will be removed and placed into the oil/water separator. The water, if encountered, will be analyzed for the parameters specified in Table 3.2-11 through 3.2-18. Once the water has been sampled, further accumulations of water in that excavation will be collected by vacuum truck and transported to the oil/water separator. At sites 903, 942, 948, and 1025, the Geoprobe will collect six to eight ground water samples for on-site screening of total volatile organic compounds (TVOC). Four samples (one up gradient and three down gradient) will be selected for laboratory analysis of VOCs and SVOCs depending on the volume of water available at each probe location. All samples will be handled under proper chain-of-custody protocols, packed on ice in a cooler, and shipped via Federal Express to the laboratory.

A closure report of field activities will be generated for each site that satisfies both AFCEE and the MDNR UST Closure Guidance Document at the completion of the project.

**Table 3.3.8**  
**Field Activities Summary- Eight RA Sites**

Activity	Number
Excavation locations approved by AFCEE	1
Utility Clearance and excavation permits (if any)	8
Excavation of the contaminated soil	590 Cu. Yd.
Confirmation soil sampling	46
Ground Water Sampling	9
Ground Water Screening for TVOC	24 to 32
Ground Water Sampling for VOCs and SVOCs	16
QA/QC Water sampling (trip blanks)	16
QA/QC Water Sampling (duplicates, equipment blanks, MS/MSD)	32
QA/QC Soil Sampling (duplicates and matrix spike/matrix spike duplicates)	16
Soil Profiling samples	8
Soil disposal	590 cu. Yd.
Backfilling	590 cu. Yd.
Site Restoration	8

### 3.3.9 POL Yard

Dames & Moore will backfill a depression remaining from the removal of Buildings 951 and 953 to eliminate a safety concern at the site. The water that has collected in this depression will be analyzed for the parameters specified in Table 3.2-19. If the water complies with the bases National Pollutant Discharge Elimination System (NPDES) permit requirements, it will be placed into the oil/water separator (CS003). Once the water has been sampled, further accumulations of water in that excavation will be collected by vacuum truck and transported to the oil/water separator.

The monitoring well present in the depression will be abandoned by a State of Missouri licensed well driller in accordance with MDNR criteria for abandoning wells (10 CSR 23-4.080). This includes: removal of the top three-feet of casing (requires MDNR approval); placing a bentonite grout plug the full length of the well and grouting into the excavated area; and submitting the Registration Record (Form MO 780-1414) to the MDNR Division of Geology and Land Survey. Dames & Moore will complete and submit the Registration Record to MDNR. The drilling contractor will place the cuttings and casings in a landfill provided roll-off box for off-base disposal.

Clean fill material will then be brought to the site and placed in the depression. A sample of the backfill material will be analyzed for the parameters specified in Table 3.2-19 to confirm it contains not contaminants of concern. The depression will be backfilled to a level consistent with the surrounding land surface. The fill material will be compacted using the tracks of the backfilling equipment.

**Table 3.3.9**  
**Field Activities Summary – POL Yard**

Activity	Number
Sample backfill material	1
Sample water in the depression	1
Pump water from depression	1
Abandon the monitoring well in the depression	1
Backfill the depression	1
Seed the area	1

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#### 4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Key responsibilities have been assigned to the following Dames & Moore personnel:

Mr. Gary Alkire	San Antonio, TX	Program Manager	(210) 496-7911
Mr. John Plevniak	Overland Park, KS	Senior Project Manager	(913) 677-1490
Mr. Kris Moore	Overland Park, KS	Technical Project Manager	(913) 677-1490
Ms. Terri Hecht	Overland Park, KS	Field Team Leader	(913) 677-1490
Mr. John Kearns	Baltimore, MD	Laboratory Quality Assurance	(410) 859-5049
Mr. Bill Berlett	Chicago, IL	Regional Health & Safety Officer	(847) 228-0707

Ms. Kay Grosinske, will act as the *Contracting Officer's Representative* (COR) and Team Chief for this Delivery Order. She may be reached at (210) 536-6451.

Mr. Mike Nicklow, the Richards-Gebaur AFB Base Environmental Coordinator (BEC) can be reached at (614) 492-8065 ext. 27.

The project organization presented in Figure 4-1 shows the lines of communication that will be adhered to during the Project.

##### Program Manager (PM)

The Dames & Moore Program Manager, Mr. Gary Alkire, is located in the Dames & Moore San Antonio, Texas office and will provide senior level oversight, assure quality, review and approve deliverables, and insure conformance to cost and schedule.

##### Senior Project Manager (SPM)

The Dames & Moore Senior Project Manager, Mr. John Plevniak, is located in the Dames & Moore Kansas City office and will be responsible for all phases of delivery order execution, including compliance with regulatory requirements, assignment of personnel, meetings, insuring that Government property is properly protected, technical review of deliverables, logistics support, preparation of reports, and compliance with cost and schedule requirements. Mr. Plevniak will serve as the contact person for the AFCEE CO.

##### Technical Project Manager (TPM)

The TPM, Mr. Kris Moore, is located in the Dames & Moore Kansas City office and is responsible for all technical and administrative aspects of this project, and has the primary responsibility and authority for implementing and executing the sampling and remedial activities. The TPM will monitor progress to ensure adequate resources are available by reviewing the budget, schedule, and technical status of the work assignment.

Field Team Leader (FTL)

The FTL, Ms. Terri Hecht, will assign specific duties to team members, will be responsible for the mobilization and demobilization of the field team, and will direct the field activities of the project subcontractors on site. Any logistical problems hindering field activities, such as weather dependent working conditions, will be relayed to and resolved by the SPM. The FTL will also coordinate subcontractors, maintain a sufficient supply of all necessary field equipment, receive supplies for field activities, and inform the TPM of daily activities. The FTL will also be responsible for keeping the SPM and the TPM informed on a weekly basis of all weekly field tasks to be performed the following week and to update them on any deviations in the projected schedule once work has begun. The FTL reports directly to the TPM.

Site Safety Officer (SSO)

Ms. Terri Hecht will serve as the SSO, and will be present on-site during all field operations and will be responsible for all health and safety activities and delegation of duties to the health and safety staff in the field. The SSO will be responsible for implementing the Health & Safety Plan (HSP). The SSO has stop work authorization, which can be executed upon his determination of an imminent safety hazard, emergency condition, or other dangerous safety situations, such as detrimental weather conditions.

Laboratory Quality Assurance (LQA) Manager

Mr. John Kearns will serve as the LQA Manager and will be responsible for the laboratory audit and data validation.

Regional Health and Safety Officer

Mr. Bill Berlett will serve as the Regional Health and Safety Officer and will be responsible for supporting the divisional health and safety program and conducting local assessments of health safety performance.

**4.1 SUBCONTRACTORS**

The following subcontractors have been selected to execute the SOW for this project:

Direct-Push Drilling

PSA Environmental  
806 North Main  
Lees Summit, MO  
(816) 525-7483  
Contact: Mr. Roger Sense

Licensing

The drilling contractor will possess all valid licenses needed to operate in the State of Missouri.

General

The general scope of work for the drilling crew is to advance borings utilizing a direct-push method to collect soil samples at and adjacent to the locations of the oil/water separators, former UST Sites, and fuel hydrants on the airfield apron.

Machinery and Equipment

PSA will provide all equipment, materials, and machinery necessary to complete this scope of work.

### Site Restoration

The drilling contractor will be responsible for returning the boring locations to as near pre-drilling conditions as possible. Reseeding is not required, but care should be taken to cause minimal ecological damage as possible during site activities.

### Health & Safety

The drilling contractor installing the borings is responsible for the safe means and methods of operations associated with on-site equipment and tools; and for providing a HASP and a SSO who will be responsible for adhering to safety requirements set forth in the site safety plan implemented by Dames & Moore. A copy of this plan will be made available to PSA and can be used as a guide in preparing a HASP. Work is anticipated to proceed in Level D personal protective clothing, but PSA will be responsible for providing Level C equipment upon request by Dames & Moore.

### Regulatory Documentation

Applicable State of Missouri soil boring and soil boring plugging forms will be completed by the drilling contractor for submittal to the State.

### Analytical Laboratory

O'Brian-Gere  
(315)437-0200  
Contact: Jeff Yeoumans

### General

The scope of work for the primary analytical laboratory is to provide definite level analyses according to the AFCEE QAPP Version 3.0 (March 1998) with laboratory specific variances, additions and modifications specified in Appendix A: Addendum to the AFCEE QAPP Version 3.0, Plan D of the Quality Assurance Plan.

### Well Abandonment for ST007 and Well Repair for POL Yard

Layne-Western, Inc.  
G20 South 38<sup>th</sup>  
Kansas City, KS 66106  
(913) 321-5000 (office)  
(913)321-5012(fax)

### Licensing

The drilling contractor will possess all valid licenses needed to operate in the State of Missouri.

### General

The general scope of work for the drilling crew is to remove the soil-vent wells at ST-007 and one monitoring well at the POL Yard. Layne-Western will then plug the borings, from which the wells were removed, and plug in accordance with the State of Missouri guidelines.

Machinery and Equipment

Layne-Western, Inc. will provide all equipment, materials, and machinery necessary to complete this scope of work.

Site Restoration

The drilling contractor will be responsible for returning the boring locations to as near pre-drilling conditions as possible. Reseeding is required, and care should be taken to cause minimal ecological damage as possible during site activities.

Health & Safety

The drilling contractor abandoning the bio-vents and monitoring well is responsible for the safe means and methods of operations associated with on-site equipment and tools; and for providing a HASP and a SSO who will be responsible for adhering to safety requirements set forth in the site safety plan implemented by Dames & Moore. A copy of this plan will be made available to Layne-Western, Inc. and can be used as a guide in preparing a HASP. Work is anticipated to proceed in Level D personal protective clothing, but Layne-Western, Inc. will be responsible for providing Level C equipment upon request by Dames & Moore.

Regulatory Documentation

Applicable State of Missouri well plugging forms will be completed by the drilling contractor for submittal to the State.

Line Cleaning/Grouting

Kingston Environmental  
1600 SW Market Street  
Lee's Summit, MO 64801  
(816) 524-8811 (office)  
Contact: Tom Cason

General

The general scope of work for the line cleaning/grouting crew is to clean the inside of the fuel hydrant and industrial waste lines; rinse the lines; containerize and dispose of all fluids; fill the fuel hydrant line with grout; and cap the line where open.

Machinery and Equipment

Kingston will provide all equipment, materials, and machinery necessary to complete this scope of work.

Health and Safety

The line cleaning/grouting contractor is responsible for the safe means and methods of operations associated with on-site equipment and tools; and for providing a HASP and a SSO who will be responsible for adhering to safety requirements set forth in the site safety plan implemented by Dames & Moore. A copy of this plan will be made available to Kingston and can be used as a guide in preparing a HASP. Work is anticipated to proceed in Level D personal protective clothing, but Kingston will be responsible for providing Level C equipment upon request by Dames & Moore.

Surveying

Anderson Survey Co.  
203 N.W. Executive Way  
Lee's Summit, Missouri 64063  
(816) 246-5050 (office)  
Contact: James Anderson

General

The general scope of work for the surveyor will be to stake out the location of the former USTs at the former Building 944 and the former location of the hydrant fuel lines (if removed) between Site ST007 and the tarmac area. Dames & Moore will provide the surveyor as-built drawings for reference via the Marine Corps at Richards-Gebaur.

Machinery and Equipment

Anderson will provide all equipment, materials, and machinery necessary to complete this scope of work.

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## 5.0 FIELD OPERATIONS

### 5.1 GEOLOGIC STANDARDS

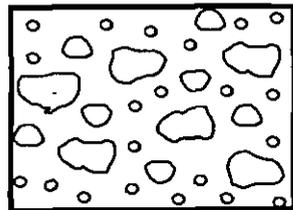
The lithologic descriptions for consolidated materials (igneous, metamorphic, and sedimentary rocks) shall follow the standard professional nomenclature (cf. Tennissen, A.C., 1983, *Nature of Earth Materials*, 2nd Edition, p. 204-348), with special attention given to describing fractures, vugs, solution cavities and their fillings or coatings, and any other characteristics affecting permeability. Colors shall be designated by the Munsell Color System.

The lithologic descriptions for unconsolidated materials (soils [engineering usage] or deposits) shall use the name of the predominant particle size (e.g., silt, fine sand, etc.). The dimensions of the predominant and secondary sizes shall be recorded using the metric system. The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, particle angularity, and any other characteristics. The clastic deposit descriptions shall include, as a supplement, symbols of the Unified Soil Classification System. The color descriptions shall be designated by the Munsell Color System.

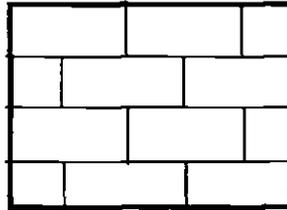
The sedimentary, igneous, and metamorphic rocks and deposits shall be represented graphically by the patterns shown in Figure 5-1. Columnar sections, well and boring logs, well construction diagrams, cross-sections, and three-dimensional (3-D) diagrams shall use these patterns. Supplementary patterns shall follow Swanson, R. G., 1981, *Sample Examination Manual*, American Association of Petroleum Geologists, p IV-41 and 43. Geologic structure symbols shall follow *American Geological Institute Data Sheets*, 3d Edition, 1989, sheets 3.1 through 3.8.

Figure 5-1  
Lithologic Patterns for Illustration

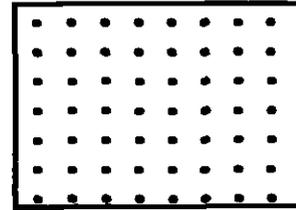
Sediments and Sedimentary Rocks



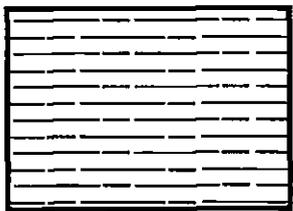
Gravel and Conglomerate



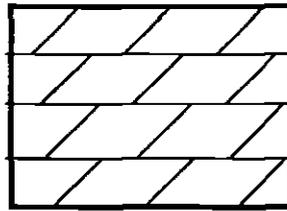
Limestone



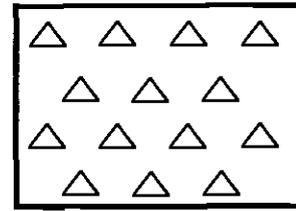
Sand and Sandstone



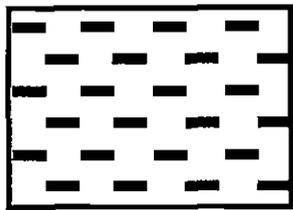
Silt and Siltstone



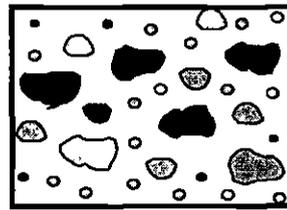
Dolomite



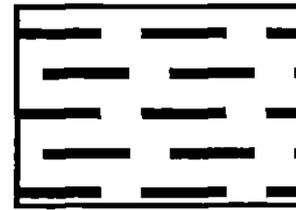
Chert



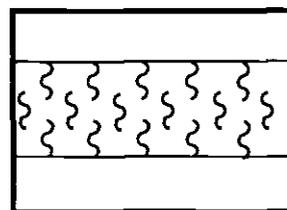
Clay



Glacial Till



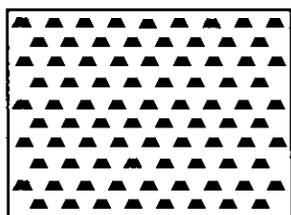
Shale



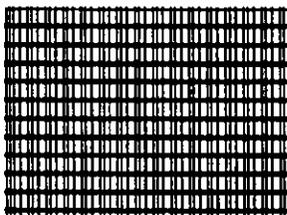
Loess

Figure 5-1  
Lithologic Patterns for Illustration

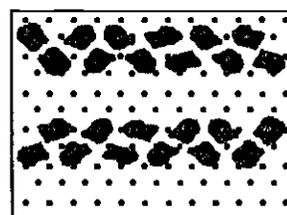
### Igneous Rocks



Undifferentiated  
Intrusive

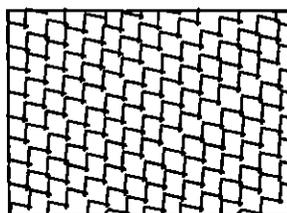


Basalt



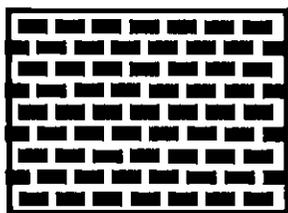
Volcanic Breccia  
and Tuff

### Metamorphic Rocks

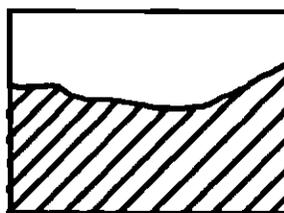


Undifferentiated

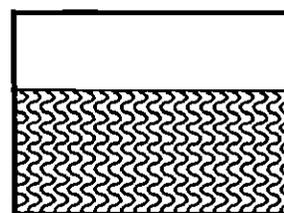
### Miscellaneous



Fill



Undifferentiated  
Bedrock



Residium

The scales for maps, cross-sections, or 3-D diagrams shall be selected in accordance with the geologic and hydrologic complexity of the area and the purposes of the illustrations. Geophysical logs shall be run at a constant vertical scale of 1 inch equals 20 feet. When geophysical logs are superimposed on geologic logs, cross-sections, or 3-D diagrams, the scales shall be the same. If defining geological conditions requires other scales, additional logs at those scales shall be provided.

For orientation, the cross-sections shall show the Northern end on the viewer's right. If the line of cross-section is predominantly East-West, the Eastern end is on the right. Maps shall be oriented with North toward the top, unless the shape of the area dictates otherwise. Indicate orientation with a North arrow.

## 5.2 SITE RECONNAISSANCE, PREPARATION, AND RESTORATION PROCEDURES

Areas designated for intrusive sampling shall be surveyed for the presence of underground utilities. Utility locations are determined using existing utility maps, and in the field, are verified using a hand-held magnetometer or utility probe. Vehicle access routes to sampling locations shall be determined prior to any field activity.

A centralized decontamination area shall be provided for drilling rigs and heavy equipment. The decontamination area shall be large enough to allow storage of cleaned equipment and materials prior to use, as well as to stage drums of decontamination waste. The decontamination area shall be lined with a heavy gauge plastic sheeting, and designed with a collection system to capture decontamination waters. Solid wastes shall be accumulated in 55-gallon drums and subsequently transported to a waste storage area designated by the Air Force. Smaller decontamination areas for personnel and portable equipment shall be provided as necessary. These locations shall include basins or tubs to capture decontamination fluids, which shall be transferred to a large accumulation tank as necessary.

Each work site or sampling location shall be returned to its original condition when possible. Efforts shall be made to minimize impacts to work sites and sampling locations, particularly those in or near sensitive environments such as wetlands. Following the completion of work at a site, all drums, trash, and other waste shall be removed. Decontamination and/or purge water shall be disposed of in the oil/water separator. Soil cuttings shall be transported to the designated off-base locations for disposal.

## 5.3 BOREHOLE DRILLING, LITHOLOGIC SAMPLING, LOGGING, AND ABANDONMENT

Boreholes will be advanced using direct-push drilling methods. This method involves the advancements of stainless steel drill pipe into the subsurface using the hydraulics at a geoprobe-type drilling unit. Soil samples will be obtained continuously by means of the advancement of acetate sample tubes within the stainless steel drill pipe. The tubes will be removed at the completion of each sample interval. The soil will be removed from the tubes for logging, field screening, and if, necessary, preparation for shipment to the laboratory for analyses. The direct push technology will be used at the oil/water separator site, along the fuel hydrant line, along the industrial waste line, and the former UST sites.

### 5.3.1 General Drilling Procedures

All drilling activities shall conform with state and local regulations and shall be supervised by a state licensed geologist or state licensed engineer. The contractor shall obtain and pay for all permits, applications, and other documents required by state and local authorities.

The location of all borings shall be coordinated, in writing, with the base civil engineer or equivalent before drilling commences. When drilling boreholes through more than one water bearing zone or

aquifer, the contractor shall take measures to prevent cross-connection or cross-contamination of the zones or aquifers.

The drill rig shall be cleaned and decontaminated in accordance with (IAW) the procedure in Section 5.6. The drill rig shall not leak any fluids that may enter the borehole or contaminate equipment placed in the hole. The use of rags or absorbent materials to absorb leaking fluids is unacceptable.

There will not be any drilling fluids used during this project.

Lubricants shall not introduce or mask contaminants. The contractor shall provide chemical analyses of all lubricants proposed for downhole use. Chemical detection limits shall be equivalent to those used in analyzing project ground-water samples. Lubricants with constituents that are toxic or that increase, decrease, or mask the target chemical species of the investigation shall not be permitted. The contractor shall provide the analysis results to the AFCEE prior to drilling mobilization.

A log of drilling activities shall be kept in a bound field notebook. Information in the log book shall include location, time on site, personnel and equipment present, down time, materials used, samples collected, measurements taken, and any other observations or information that would be necessary to reconstruct field activities at a later date. At the end of each day of drilling the drilling supervisor shall complete a Daily Drilling Log. An example of the Daily Drilling Log is shown in Appendix A. All items on the log must be completed, if known.

The contractor shall dispose of all trash, waste grout, cuttings, and drilling fluids as coordinated with the base civil engineer or representative

### **5.3.2 Sampling and Logging**

The lithology in all boreholes shall be logged. The boring log form, in Section 8.0, shall be used for recording the lithologic logging information. Information on the boring log sheet includes the borehole location; drilling information; sampling information such as sample intervals, recovery, and sample description information.

Unconsolidated samples for lithologic description shall be obtained continuously throughout the vertical extent of the borehole. Lithologic descriptions of unconsolidated materials encountered in the boreholes shall generally be described in accordance with American Society for Testing and Materials (ASTM) D-2488-90 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM, 1990). Descriptive information to be recorded in the field shall include: (1) identification of the predominant particles size and range of particle sizes, (2) percent of gravel, sand, fines, or all three, (3) description of grading and sorting of coarse particles, (4) particle angularity and shape, and (5) maximum particle size or dimension.

Plasticity of fines description include: (1) color using Munsell Color System, (2) moisture (dry, wet, or moist), (3) consistency of fine grained soils, (4) structure of consolidated materials, and (4) cementation (weak, moderate, or strong).

Identification of the Unified Soil Classification System (USCS) group symbol shall be used. Additional information to be recorded includes the depth to the water table, caving or sloughing of the borehole, changes in drilling rate, depths of laboratory samples, presence of organic materials, and other noteworthy observations or conditions, such as the locations of geologic boundaries.

All samples shall be monitored with detector tubes or an organic vapor monitor (e.g., PID, organic vapor analyzer [OVA]). The samples shall be handled in such a way as to minimize the loss of volatiles, and these procedures shall be described in Section 6.0. Cuttings shall be examined for their hazardous characteristics. Materials suspected to be hazardous because of abnormal color, odor, or organic vapor monitor readings shall be containerized in conformance with the Resource Conservation and Recovery Act (RCRA) and the state and local requirements.

Lithologic descriptions of consolidated materials shall follow the specifications in Section 5.1.

### 5.3.3 Abandonment

Boreholes that are to be abandoned at Richards-Gebaur include all direct-push drilling/sampling locations, 18 bio-vent wells at ST-007, and MW-1208 at Site ST005-POL Yard. The direct-push drilling/sampling locations will involve plugging a 2-inch O.D. borehole with bentonite. The ST-007 bio-vent wells and the ST005 well will involve the use of a drill rig to pull the PVC casing from each borehole and plug the remaining borehole according to MDNR Regulations.

Boreholes that are not converted to monitor wells shall be abandoned in accordance with applicable federal, state or local requirements. If a slurry is used, a mud balance and/or Marsh Funnel shall be used to ensure the density (lbs/gal) of the abandonment mud mixture conforms with the manufacturer's specifications. The slurry shall be emplaced from the bottom to the top of the hole using a tremie pipe. If bentonite chips are used, the chips will be allowed to free fall to the bottom of the boreholes and compacted with probe rods.

All abandoned boreholes shall be checked 24 to 48 hours after mud/solid bentonite emplacement to determine whether curing is occurring properly. More specific curing specifications may be recommended by the manufacturer and shall be followed. If settling has occurred, a sufficient amount of mud/solid bentonite shall be added to fill the hole to the ground surface. These curing checks and any addition of mud/solid bentonite shall be recorded in the field log.

### 5.4 TEST PIT EXCAVATION

Test pits will be excavated at the 1200 Area; at 100 foot intervals or at elbows along the fuel hydrant line; at 400 foot intervals, manholes or elbows along the industrial waste line; during removal of the oil/water separators, at former UST sites where there is contaminated soil that is to be removed for off-site disposal. The excavation equipment will include trackhoes (excavators) and backhoes. It is anticipated that no shoring will be needed because there is no planned entry by field personnel into these excavations. The exact dimensions of each excavation are not known at this time.

A test pit is an opening in soil, unconsolidated deposit, or bedrock having at least one lateral dimension greater than the depth of the opening, which is used for scientific purposes. The location of each test pit shall be coordinated in writing with the base civil engineer before digging begins. The contractor shall follow Occupational Safety and Health Administration (OSHA) rules for excavation and confined space entry. The excavated material shall be screened for hazardous properties. Nonhazardous excavated material shall be backfilled immediately after soil sampling and analyses have been received for each specific location. The first soils out shall be the last in when filling the pit. No test pit shall be left open overnight unless adequate safety precautions are employed. In vegetated areas, backfilled test pits shall be reseeded with native grasses. In addition to the general information required for all field activities listed in Section 8.0, the following shall be recorded for each test pit: (1) the total depth, length, and width, (2) the depth and thickness of distinct soil or lithologic units, (3) a lithologic description of each unit, and (4) a description of any man-made materials or apparent contamination encountered, and (5) soil sample locations.

Excavation shall occur by using either a backhoe or trackhoe. Decontamination of all equipment shall occur after an excavation is completed or daily following the procedures described in Section 5.6. If shoring is required, it shall be described and documented.

## 5.5 SURVEYING

Surveying is anticipated to be limited to locating the fuel hydrant line and identifying the former location of Building 944. The buried 6- and 8-inch hydrant fuel line will be located by the surveyor using existing structures and as-built drawings. Building 944 was demolished in 1988. The surveyor will be contracted to locate the former building corners as well as the locations of former USTs and an oil/water separator. In all cases, locations will be flagged and marked prior to the initiation of field activities at these sites.

The locations of the excavations and sampling points will be measured from existing buildings or other permanent fixtures within the area of the site. A hand held GPS receiver will be used to mark the center of the excavation (accuracy of 5 to 10 meters). A three foot long steel rod will be driven into the soil to mark the center of the former excavation.

All surveying locations of field activities shall be measured by a certified land surveyor as the distance in feet from a reference location that is tied to the state plane system. The surveys shall be third order (cf. Urquhart, L.C., *1962 Civil Engineering Handbook*, 4th Edition, p. 96 and 97). An XY-coordinate system shall be used to identify locations. The X-coordinate shall be the East-West axis; the Y-coordinate shall be the North-South axis. The reference location is the origin. All surveyed locations shall be reported using the state plane coordinate system. The surveyed control information for all data collection points shall be recorded and displayed in a table. The table shall give the X and Y coordinates in state plane coordinate values, the ground elevation, and the measuring point elevation. The accuracy of the horizontal measurements shall be within 0.10 feet and vertical measurements shall be within 0.01 feet.

## 5.6 EQUIPMENT DECONTAMINATION

All equipment that may directly or indirectly contact samples or contaminated media shall be decontaminated in a designated decontamination area. This includes casing, drill bits, auger flights, the portions of drill rigs that stand above boreholes, sampling devices, and instruments, such as slugs and sounders. In addition, the contractor shall take care to prevent the sample from coming into contact with potentially contaminating substances, such as tape, oil, engine exhaust, corroded surfaces, and dirt.

The following procedure shall be used to decontaminate large pieces of equipment, such as casings, auger flights, pipe and rods, those portions of the drill rig that may stand directly over a boring or well location or that come into contact with casing, auger flights, pipe, or rods and heavy equipment. The external surfaces of equipment shall be washed with high-pressure hot water and Alconox, or equivalent laboratory-grade detergent, and if necessary, scrubbed until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., have been removed. The equipment shall then be rinsed with potable water. The inside surfaces of casing, drill rod, and auger flights shall also be washed as described.

The following procedure shall be used to decontaminate sampling and drilling devices, such as split spoons, bailers, and augers, which can be hand-manipulated. For sampling and smaller drilling devices, scrub the equipment with a solution of potable water and Alconox, or equivalent laboratory-grade detergent. Then rinse the equipment with copious quantities of potable water followed by a ASTM Type II Reagent Water. High-pressure liquid chromatograph-grade water and distilled water purchased in stores are not acceptable substitutes for ASTM Type II Reagent-Grade Water. (If equipment has come in contact with oil or grease, rinse the equipment with pesticide-grade methanol followed by with pesticide-grade hexane.) Air dry the equipment on a clean surface or rack, such as Teflon<sup>®</sup>, stainless steel, or oil-free aluminum elevated at least two feet above ground. If the sampling device shall not be used immediately after being decontaminated, it shall be wrapped in oil-free aluminum foil, or placed it in a closed stainless steel, glass, or Teflon<sup>®</sup> container.

Reagent-Grade II Water, methanol, and hexane shall be purchased, stored, and dispensed only in glass, stainless steel, or Teflon<sup>®</sup> containers. These containers shall have Teflon<sup>®</sup> caps or cap liners. It is the contractor's responsibility to assure these materials remain free of contaminants. If any question of purity exists, new materials shall be used.

## 5.7 WASTE HANDLING

### 5.7.1 General Waste Handling Procedures

Waste handling shall be dealt with on a site-by-site basis. Waste may be classified as noninvestigative waste or investigative waste

Noninvestigative waste, such as litter and household garbage, shall be collected on an as-needed basis to maintain each site in a clean and orderly manner. This waste shall be containerized and transported to the designated sanitary landfill or collection bin. Acceptable containers shall be sealed boxes or plastic garbage bags.

Investigation derived waste shall be properly containerized and temporarily stored at each site, prior to transportation. Depending on the constituents of concern, fencing or other special marking may be required. The number of containers shall be estimated on an as-needed basis. Acceptable containers shall be sealed, U.S. Department of Transportation (DOT)-approved steel 55-gallon drums or small dumping bins with lids. The containers shall be transported in such a manner to prevent spillage or particulate loss to the atmosphere. To facilitate handling, the containers shall be no more than half full when moved.

Soils classified as Investigative Derived Waste (IDW) that are not placed in roll-off boxes for disposal, shall be sampled, properly containerized in DOT-approved drums, and stored on pallets. One composite sample will be collected for every 10 barrels of IDW generated (or per landfill requirements). If soils are contaminated, they will be disposed of in accordance with State and Federal regulations.

Rinsate IDW generated from the cleaning of the industrial waste and fuel hydrant lines shall be properly containerized in DOT-approved drums and sampled by the subcontractor performing the work. The rinsate will then be disposed of in accordance with State and Federal regulations.

Each container of drummed IDW will display (at a minimum) the following information: Content, Base POC, Contractor, Driller/Sub, IRP Site location, Well/Boring Number, Sample Number, and Drum Status. Other pertinent information may be added if necessary for handling purposes. The drums shall be transported in such a manner as to prevent spillage or particulated loss to the atmosphere and stored at a secured location at the Base.

The investigative derived waste shall be segregated at the site according to matrix (solid or liquid) and as to how it was derived (drill cuttings, drilling fluid, decontamination fluids, and purged ground water). Each container shall be properly labeled with site identification, sampling point, depth, matrix, constituents of concern, and other pertinent information for handling.

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## 6.0 ENVIRONMENTAL SAMPLING

### 6.1 SAMPLING PROCEDURES

The construction material of the sampling devices (e.g., plastic, PVC, metal) discussed below shall be appropriate for the contaminant of concern and shall not interfere with the chemical analyses being performed.

All purging and sampling equipment shall be decontaminated according to the specifications in Section 5.6 prior to any sampling activities and shall be protected from contamination until ready for use.

#### 6.1.1 Subsurface Soil Sampling

Soil samples shall be collected based on odors, discoloration, detection tube measurements, organic vapor meter readings and any other field screening methods.

##### 6.1.1.1 Direct Push Sampling

Direct push sampling involves advancing a sampling probe by direct hydraulic pressure or by using a slide or rotary hammer. Samples may be collected continuously or at specific depths. The samples are collected in acetate sample tubes within the stainless steel drill pipe. The sleeve shall be capped with Teflon tape and end caps. The ends of the capped sleeve shall then also be wrapped with Teflon tape. Care shall be taken not to touch the ends of the sleeves prior to capping. Custody seals shall be placed across the capped ends of the sleeve. Once the container has been filled, the appropriate information shall be recorded in the field logbook.

##### 6.1.1.2 Sampling of Excavation Walls/Floors

Dames & Moore field personnel will not enter excavations to collect soil samples. Instead, the operator of the track excavator or 4x4 backhoe will be directed by Dames & Moore field personnel to collect soil samples in the bucket of the equipment, from appropriate areas of the excavation. Once the bucket of the track excavator or backhoe is secured outside the excavation, field personnel will utilize a stainless steel trowel to collect the soil sample from the bucket. The soil sample will then be placed into the appropriate laboratory provided container and sealed and the appropriate information shall be recorded in the field logbook.

#### 6.1.2 Ground Water Sampling

##### 6.1.2.1 Direct-Push Ground Water Sampling

The in situ ground water samples will be collected using the Geoprobe® to advance a ¾-inch diameter perforated galvanized pipe fitted with an expendable probe point to the desired sampling depth. At the desired sampling depth the rod chain is withdrawn six inches from the expendable point to allow water to enter. A length of 3/8-inch Teflon® tubing equipped with a stainless steel ball foot-valve is inserted into the probe rods from the ground surface to the bottom of the rods. The tubing will be oscillated up and down below the water level to obtain the sample.

All ground water sampling activities shall be recorded in the field logbook. Before the start of sampling activities, plastic sheeting shall be placed on the ground surrounding the borehole. The plastic sheeting shall be used to provide a clean working area around the borehole, and prevent any soil contaminants from contacting sampling equipment. The air in the breathing zone shall be checked with an organic vapor meter and the air in the well bore shall be checked with an explosimeter. Procedures in the Health and Safety Plan (HSP) shall be followed when high concentrations of organic vapors or explosive gases are detected. Air monitoring data shall be recorded in the field notebook.

Purge pump intakes shall be equipped with a positive foot check valve to prevent purged water from flowing back into the well. Purging and sampling shall be performed in a manner that minimizes aeration in the well bore and the agitation of sediments in the well and formation. Equipment shall not be allowed to free-fall into a well.

#### 6.1.2.1.1 Water Level Measurement

The ground water level shall be measured to the nearest 0.01 foot using an electric water level indicator. Water levels shall be measured from the ground surface adjacent the borehole and recorded in the field notebook.

## 6.2 SAMPLE HANDLING

### 6.2.1 Sample Containers

Sample containers are purchased precleaned and treated according to EPA specifications for the methods. Sampling containers that are reused are decontaminated between uses by the EPA-recommended procedures (i.e., EPA 540/R-93/051). Containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

### 6.2.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 6.2.2-1.

Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods required routinely for AFCEE work are specified in Table 6.2.2-1. **Samples not preserved or analyzed in accordance with these requirements shall be resampled and analyzed, at no additional cost to AFCEE.**

Table 6.2.2-1. Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Name	Analytical Methods	Container <sup>a</sup>	Preservation <sup>b,c</sup>	Minimum Sample Volume or Weight	Maximum Holding Time
Mercury	SW7470A SW7471A	P, G, T	HNO <sub>3</sub> to pH < 2, 4°C	500 mL or 8 ounces	28 days (water and soil)
Metals (except chromium (VI) and mercury)	SW6010B SW6020 and SW-846 AA methods	P, G, T	HNO <sub>3</sub> to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)
Total petroleum hydrocarbons (TPH)-volatile	SW8015 (modified)	G, Teflon®-lined septum, T	4°C, HCl to pH < 2	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
Total petroleum hydrocarbons (TPH)-extractable	SW8015 (modified)	G, amber, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Ethylene Glycol	SW8015M	G, Teflon-lined cap, T	4°C	2 x 40 mL or 4 ounces	14 days (water and soil)
Organochlorine pesticides	SW8081A	G, Teflon®-lined cap, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Polychlorinated biphenyls (PCBs)	SW8082	G, Teflon®-lined cap, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Semivolatile organics	SW8270C	G, Teflon®-lined cap, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water), 14 days until extraction and 40 days after extraction (soil)

- Polyethylene (P), glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).
- No pH adjustment for soil.
- Preservation with 0.008 percent Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> is only required when residual chlorine is present.
- The maximum recommended holding time for completion of extraction into water is 48 hours. The extract shall be analyzed within 24 hours of completion of extraction.

Table 6.2.2-1. Continued

Name	Analytical Methods	Container	Preservation	Minimum Sample Volume or Weight	Maximum Holding Time
Volatile organics (Including BTEX and MTBE)	SW8260B, SW8021	G, Teflon®-lined septum, T	4°C, (HCl to pH < 2 for volatile aromatics) <sup>b</sup>	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
TCLP	SW1311	G, Teflon®-lined cap, T	Cool, 4°C	1 liter or 8 ounces	14 days to TCLP extraction and 14 days after extraction (volatiles); 14 days to TCLP extraction, 7 days to prep extraction and 40 days after prep extraction (semivolatiles); 28 days to TCLP extraction and 28 days after extraction (mercury); 180 days to TCLP extraction and 180 days after extraction (metals)

- a. Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).
- b. No pH adjustment for soil.
- c. Preservation with 0.008 percent  $\text{Na}_2\text{S}_2\text{O}_3$  is only required when residual chlorine is present.
- d. The maximum recommended holding time for completion of extraction into water is 48 hours. The extract shall be analyzed within 24 hours of completion of extraction.

### 6.2.3 Sample Identification

The sample numbering system for soil sampling will be composed of three parts: building number or utility identification will be used as a prefix followed by U-boring or trench number XX which will represent the bottom sample depth and yyy is any required modifier, such as a QA/QC modifier (i.e., MS, MSD, EB).

Examples: 903B110EB – which is a soil sample collected at building 903, boring B1, at a depth of 10 feet, and is an equipment blank.

1201T112MS/MSD – which is a soil sample collected at building 1201, trench T1, at a depth of 12 feet, and is a matrix spike/matrix spike duplicate.

The sample numbering system for liquids other than ground water will be composed of three parts: utility identification or Air Force number: XX is the station number and yyy is any required modifier, such as QA/QC qualifier (i.e., MS, MSD, EB).

Example: IWLA-9MS/MSD which is a liquid sample collected from the Industrial Waste Line at manhole A-9 and is a matrix spike/matrix spike duplicate sample.

## 6.3 SAMPLE CUSTODY

All samples shall be uniquely identified, labeled, and documented in the field at the time of collection IAW Section 6.2.3 of the FSP.

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible. When a 4°C requirement for preserving the sample is indicated, the samples shall be packed in ice or chemical refrigerant to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a volatile organics compounds sampling vial filled with water) shall be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory.

## 6.4 FIELD QUALITY CONTROL SAMPLES

### 6.4.1 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent grade water poured into or over or pumped through the sampling device, collected in a sample container, and transported to the laboratory for

analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures. The frequency of collection for equipment blanks is one per day per sampling crew when reusable sampling equipment is in use. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site.

#### 6.4.2 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes. Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. One trip blank shall accompany each cooler of samples sent to the laboratory for analysis of VOCs.

#### 6.4.3 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest. The frequency of collection for field duplicates will be at least 10% of the total samples.

## 7.0 FIELD MEASUREMENTS

### 7.1 PARAMETERS

The following parameters will be measured on site during the field investigation:

- Air monitoring for VOCs using a PID
- Screening of soil samples for VOCs using a PID.

### 7.2 EQUIPMENT CALIBRATION AND QUALITY CONTROL

A PID is a quantitative instrument that measures the total concentration of numerous organic vapors in air. The instrument is calibrated by introducing pressurized gas from a cylinder with a known organic vapor concentration into the detector. Once the reading has stabilized, the display of the instrument is adjusted to match the known concentration. A calibration of this type is performed each day prior to using the instrument.

If the output differs greatly from the known concentration of the calibration gas, the initial procedure to remedy the problem is a thorough cleaning of the instrument. The cleaning process normally removes foreign materials (i.e., dust, moisture) that affect the calibration of the instrument. If this procedure does not rectify the problem, further troubleshooting is performed until the problem is resolved. If the problem cannot be resolved by the field personnel, the instrument will be returned to the manufacturer for repair and a replacement unit shipped to the site immediately. The manufacturer's manual will accompany the instrument.

### 7.3 EQUIPMENT MAINTENANCE AND DECONTAMINATION

All field equipment will be cleaned, inspected, and calibrated prior to the start of each work day and thereafter, as recommended by the manufacturer and the field experience under on-gong site conditions.

All field measurement equipment shall be decontaminated according to the specifications in Section 5.6 prior to any measurement activities and shall be protected from contamination until ready for use.

### 7.4 FIELD PERFORMANCE AND SYSTEM AUDITS

Internal audits of field activities (sampling and measurements) will be conducted by the Dames & Moore Technical Project Manager and/or the Dames & Moore Laboratory Quality Assurance Manager. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of the QA procedures, chain-of-custody forms, etc. The audits will occur at the onset of the project to verify that all established procedures are followed. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the field investigation activities. The audits will involve review of field measurement records, instrument calibration records, and sample documentation.

211 143

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## 8.0 RECORD KEEPING

Dames & Moore shall maintain field records sufficient to recreate all sampling and measurement activities and to meet all ERPIMS data loading requirements. The requirements listed in this section apply to all measuring and sampling activities. Requirements specific to individual activities are listed in the section that addresses each activity. The information shall be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages. These records shall be archived in an easily accessible form and made available to the Air Force upon request.

The following information shall be recorded for all field activities: (1) location, (2) date and time, (3) identity of people performing activity, and (4) weather conditions. For field measurements: (1) the numerical value and units of each measurement, and (2) the identity of and calibration results for each field instrument, shall also be recorded.

The following additional information shall be recorded for all sampling activities: (1) sample type and sampling method, (2) the identity of each sample and depth(s), where applicable, from which it was collected, (3) the amount of each sample, (4) sample description (e.g., color, odor, clarity), (5) identification of sampling devices, and (6) identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

The forms to be used by Dames & Moore during the field activities are presented in Appendix A of this section.

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*Appendix A*

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BORING LOG

Borehole ID \_\_\_\_\_  
 Sheet \_\_\_\_ of \_\_\_\_

				Location					
Project Name		Project Number		LTCCODE (IRPIMS)		Site ID	LPRCODE (IRPIMS)		
Drilling Company		Driller		Ground Elevation		Total Drilled Depth			
Drilling Equipment	Drilling Method	Borehole Diameter	Date/Time Drilling Started		Date/Time Total Depth Reached				
Type of Sampling Device				Water Level (bgs)					
				First		Final			
Sample Hammer				Hydrogeologist		Checked by/Date			
Type	Driving Wt	Drop							
Location Description (include sketch in field logbook)									
Depth	Interval	Recovery	Blow Counts	Description <small>(Include lithology, grain size, sorting, angularity, Munsell color name &amp; notation, mineralogy, bedding, plasticity, density, consistency, etc., as applicable)</small>		USCS Symbol	Lithology	Water Content	Remarks <small>(Include all sample types &amp; depth, odor, organic vapor measurements, etc.)</small>



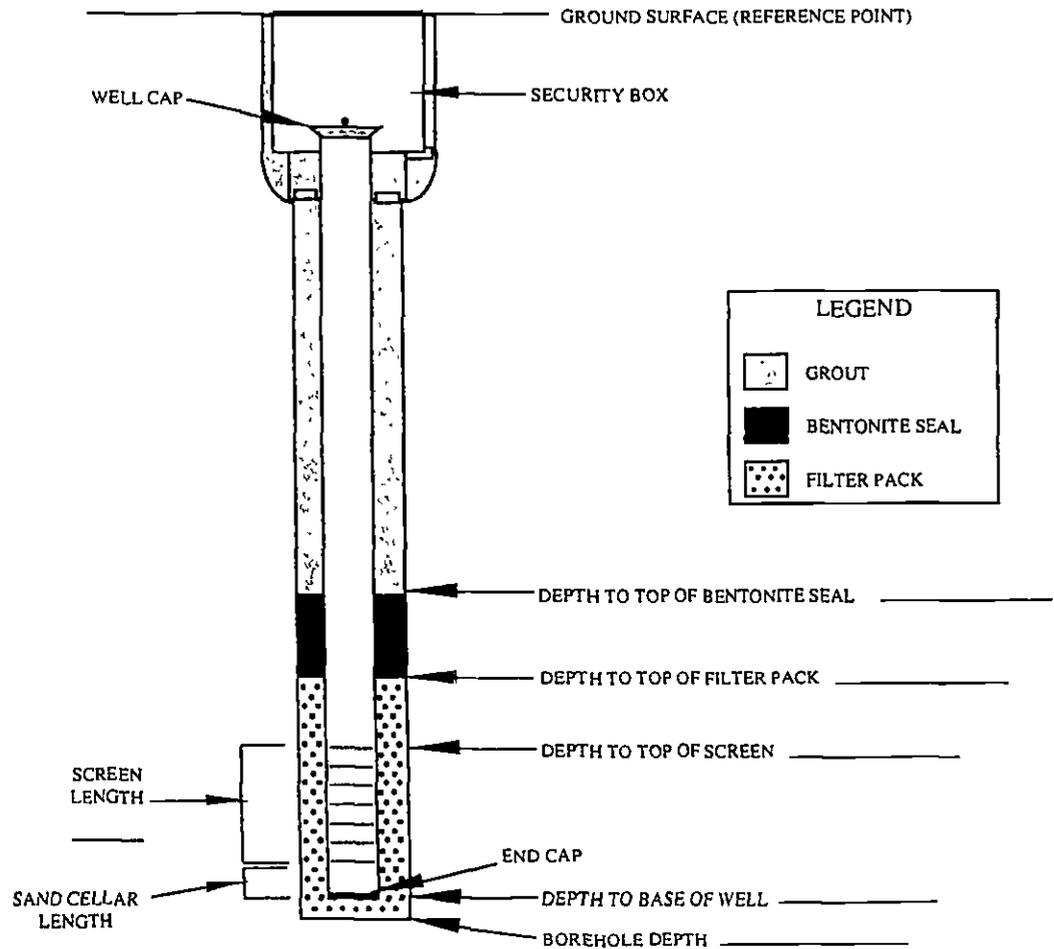
## FIELD SAMPLING REPORT

LOCATION: _____		PROJECT _____		
SITE: _____				
SAMPLE INFORMATION				
MATRIX _____		SAMPLE ID _____		
SAMPLING METHOD _____		DUP /REP. OF _____		
BEGINNING DEPTH _____		MATRIX SPIKE/MATRIX SPIKE DUPLICATE YES ( ) NO ( )		
END DEPTH _____				
GRAB ( ) COMPOSITE ( )		DATE: _____ TIME: _____		
CONTAINER	PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS
SIZE/TYPE #				
NOTABLE OBSERVATIONS				
PID READINGS	SAMPLE CHARACTERISTICS		MISCELLANEOUS	
1st	COLOR:			
2nd	ODOR:			
	OTHER:			
pH _____	Temperature _____	Dissolved oxygen _____	Specific Conductivity _____	
GENERAL INFORMATION				
WEATHER: SUN/CLEAR _____ OVERCAST/RAIN _____ WIND DIRECTION _____ AMBIENT TEMP _____				
SHIPMENT VIA: FED-X _____ HAND DELIVER _____ COURIER _____ OTHER _____				
SHIPPED TO: _____				
COMMENTS: _____				
SAMPLER: _____		OBSERVER: _____		
MATRIX TYPE CODES			SAMPLING METHOD CODES	
DC=DRILL CUTTINGS	SL=SLUDGE	B=BAILER	G=GRAB	
WG=GROUND WATER	SO=SOIL	BR=BRASS RING	HA=HAND AUGER	
1H=HAZARDOUS LIQUID WASTE	GS=SOIL GAS	CS=COMPOSITE SAMPLE	H=HOLLOW STEM AUGER	
SH=HAZARDOUS SOLID WASTE	WS=SURFACE WATER	C=CONTINUOUS FLIGHT AUGER	HP=HYDRO PUNCH	
SE=SEDIMENT	SW=SWAB/WIPE	DT=DRIVEN TUBE	SS=SPLIT SPOON	
		W=SWAB/WIPE	SP=SUBMERSIBLE PUMP	

## WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

FIELD REPRESENTATIVE _____ DRILLING CONTRACTOR _____ DRILLING TECHNIQUE _____ AUGER SIZE AND TYPE _____ BOREHOLE IDENTIFICATION _____ BOREHOLE DIAMETER _____ WELL IDENTIFICATION _____ WELL CONSTRUCTION START DATE _____ WELL CONSTRUCTION COMPLETE DATE _____ SCREEN MATERIAL _____ SCREEN DIAMETER _____ STRATUM-SCREENED INTERVAL (FT) _____ CASING MATERIAL _____ CASING DIAMETER _____	TYPE OF FILTER PACK _____ GRADIATION _____ AMOUNT OF FILTER PACK USED _____ TYPE OF BENTONITE _____ AMOUNT BENTONITE USED _____ TYPE OF CEMENT _____ AMOUNT CEMENT USED _____ GROUT MATERIALS USED _____ DIMENSIONS OF SECURITY BOX _____ TYPE OF WELL CAP _____ TYPE OF END CAP _____ COMMENTS: _____
--	---

SPECIAL CONDITIONS  
(describe and draw)



NOT TO SCALE

INSTALLED BY \_\_\_\_\_ INSTALLATION OBSERVED BY \_\_\_\_\_

DISCREPANCIES \_\_\_\_\_





# TAB

*Appendix B*

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MISSOURI DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF GEOLOGY AND LAND SURVEY

(573) 368-2165

**ABANDONMENT  
REGISTRATION RECORD**

<b>OFFICE USE ONLY</b>		DATE RECEIVED	
REF NO	201555		CHECK NO
C/R NO.	STATEWELL NUMBER		TRANSMITTAL NO
ENTERED Ph 1	Ph 2	Ph 3	APPROVED BY
			ROUTE

**INFORMATION SUPPLIED BY WELL OR PUMP INSTALLATION CONTRACTOR**

OWNER NAME		TELEPHONE		VARIANCE NUMBER (IF APPLICABLE)	
OWNER ADDRESS		CITY	STATE	ZIP CODE	
ADDRESS OF WELL SITE (IF DIFFERENT THAN ABOVE)		CITY	STATE	ZIP CODE	
SITE NAME	WELL NUMBER	INFORMATION VERIFIED BY OWNER SIGNATURE (WELL OWNER) X			DATE
SKETCH THE LOCATION TO THE WELL INCLUDING MILEAGE ON ALL ROADS TRAVELED FROM NEAREST TOWNS OR HIGHWAYS			LOCATION OF WELL		AREA _____
			LAT _____		ELEV _____
			LONG. _____		COUNTY _____
			SMALLEST _____		LARGEST _____
			SEC. _____		TWN. _____ N RNG. _____ E OR W
DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT THE WELL SITE			DRILLER NOTES:		

**ABANDONMENT INFORMATION**

FORMER USE OF WELL		ORIGINAL DRILLER (IF KNOWN)		DATE ORIGINALLY DRILLED (IF KNOWN)		STATIC WATER LEVEL		
<input type="checkbox"/> HAND DUG	<input type="checkbox"/> IRRIGATION							
<input type="checkbox"/> DOMESTIC	<input type="checkbox"/> SOIL BORING	DEPTH OF THE WELL		LENGTH OF CASING		CASING DIAMETER		
<input type="checkbox"/> MULTI-FAMILY	<input type="checkbox"/> MONITORING					DRILL HOLE DIAMETER (IF KNOWN)		
<input type="checkbox"/> PUBLIC WATER SUPPLY	<input type="checkbox"/> MINERAL EXPLORATORY TEST HOLE	PUMP REMOVED FROM WELL?		WAS THE CASING CUT OFF THREE FEET BELOW GROUND SURFACE?		TYPE OF CASING		
<input type="checkbox"/> HEAT PUMP	<input type="checkbox"/> OTHER _____	<input type="checkbox"/> YES <input type="checkbox"/> NO		<input type="checkbox"/> YES <input type="checkbox"/> NO		<input type="checkbox"/> PLASTIC <input type="checkbox"/> CONCRETE <input type="checkbox"/> STEEL <input type="checkbox"/> OTHER _____		
GROUT INSTALLATION METHOD		GROUT MATERIAL USED		HOW MANY GALLONS OF WATER MIXED PER BAG OF CEMENT OR BENTONITE?		NUMBER OF BAGS OF GROUT USED		
<input type="checkbox"/> GRAVITY	<input type="checkbox"/> NEAT CEMENT	<input type="checkbox"/> BENTONITE						
<input type="checkbox"/> TREME	<input type="checkbox"/> HI-EARLY	<input type="checkbox"/> SLURRY	<input type="checkbox"/> GRANULAR			POUNDS OF GROUT PER BAG		
	<input type="checkbox"/> TYPE 1	<input type="checkbox"/> CHIPS	<input type="checkbox"/> PELLETS					
TYPE OF FILL MATERIAL USED		AMOUNT OF FILL MATERIAL USED		CIRCLE ONE		DEPTH TO TOP OF FILL MATERIAL FROM THE SURFACE		
<input type="checkbox"/> GRAVEL	<input type="checkbox"/> AG-LIME			CU. YDS./TONS				
<input type="checkbox"/> SAND	<input type="checkbox"/> OTHER _____							
WAS THE WELL ABANDONED BECAUSE OF HOOKING UP TO A PUBLIC OR RURAL WATER SUPPLY DISTRICT?			WELL CHLORINATED BEFORE PLUGGING?		AMOUNT USED FOR THE CHLORINATION		DATE WELL WAS PLUGGED	
<input type="checkbox"/> YES <input type="checkbox"/> NO			<input type="checkbox"/> YES <input type="checkbox"/> NO		_____ GALLONS OF CHLORINE			
IF YES, WHAT IS THE NAME OF THE WATER DISTRICT:					_____ POUNDS OF CHLORINE			
					_____ TABLETS OF CHLORINE			
REMARKS				REASON WELL WAS PLUGGED				

HEREBY CERTIFY THAT THE WELL HEREIN DESCRIBED WAS PLUGGED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE PLUGGING OF WELLS

SIGNATURE (PRIMARY CONTRACTOR)	PERMIT NUMBER	SIGNATURE (CONTRACTOR)	PERMIT NUMBER	DATE
X		X		

# TAB

*GAPP*

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# FINAL QUALITY ASSURANCE PROJECT PLAN

**Remedial Actions/Investigations at Multiple Sites**

Project Number UEBL 930014

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

Prepared by:

Dames & Moore  
6310 Lamar Avenue  
Overland Park, Kansas 66202



November, 1999

Final Quality Assurance Project Plan  
Richards-Gebaur Air Force Base  
Project Numbers UEBL 930014  
November 1999

Variances

to the

AFCEE QAPP Version 3.0

March 1998

**Method/Analysis Specific conditions**

The following are the variances to the AFCEE QAPP Version 3.0, dated March 1998. These variances are draft and the final document could contain additional requested variances.

**METHOD DETECTION LIMITS:**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
4.3.1(6) Method Detection Limits, page 4-5	Allow MDL study where the spiking concentration for some parameters is greater than the 5X limit but less than 10X given in section 4.3.1(6).	Under laboratory specific conditions of analysis, compliance with section 4.3.1(6) would result in violation of section 4.3.1(1). Also, the spike level used is below the QAPP RL.

**REPORTING LIMITS:**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
7.2.15-1 Reporting Limits for Method SW6010B, page 7-106	Lab can meet the required soil RL's, with the following exception: Zinc 2.0 mg/kg	The RL should be elevated slightly, due to its variability as observed through various MDL studies.
7.2.9-1 Reporting Limits for Method SW8260B, page 7-59, 60	Lab can meet the required aqueous RL's, with the following exception: 1,1,2,2-Tetrachloroethane 0.5 ug/l Methylene chloride 2.0 ug/l Naphthalene 1.0 ug/l Styrene 0.5 ug/l	<b>1,1,2,2-Tetrachloroethane:</b> A reactive compound and the low standards can have poor response, affecting the linearity. <b>Styrene:</b> A reactive compound and the low standards can have poor response, affecting the linearity. <b>Naphthalene:</b> Moderate concentrations in analytical samples and standards are prone to cross-contamination in ensuing samples. Higher RL reduces the possibility of a false positive being reported. <b>Methylene chloride:</b> A common laboratory contaminant. If the RL is too low, laboratory background may elevate the low standard response and result in poor linearity.
7.2.9-1 Reporting Limits for Method SW8260B, page 7-59, 60	Lab can meet the required soil RL's, with the following exception: 1,1,2,2-Tetrachloroethane 0.0025 mg/kg Methylene chloride 0.005 mg/kg Naphthalene 0.005 mg/kg Styrene 0.0025 mg/kg	<b>1,1,2,2-Tetrachloroethane:</b> A reactive compound and the low standards can have poor response, affecting the linearity. <b>Styrene:</b> A reactive compound and the low standards can have poor response, affecting the linearity. <b>Naphthalene:</b> Moderate concentrations in analytical samples and standards are prone to cross-contamination in ensuing samples.

		Higher RL reduces the possibility of a false positive being reported. Methylene chloride: A common laboratory contaminant. If the RL is too low, laboratory background may elevate the low standard response and result in poor linearity.
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**METHOD QC PROCEDURES: Method 8260B**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
Table 7.2.9-1. RLs for Method SW8260B, page 7-60.	m and p-Xylene will be reported together as (m+p)-Xylene with an RL of: waters 0.6 ug/l. soils 0.004 mg/kg	m and p-Xylene can not be resolved on capillary columns commonly utilized for 8260 methods.
Table 7.2.9-3. Summary of Calibration and QC Procedures for Method SW8260B. Method blank, page 7-65.	Increase the method blank acceptance criteria of methylene chloride to 2.0 ppb.	This is a common laboratory contaminant.
Table 7.2.9-3. Summary of Calibration and QC Procedures for Method SW8260B: Surrogate spike, page 7-67.	Medium-level soil samples will not be re-extracted when the failure of surrogates is attributable to matrix effects parenthetical by consensus. The sample extract will be re-injected only.	The evidence of passing surrogates in the prep blank is an indication that the extraction procedure and system is not malfunctioning and therefore the failing surrogates are attributed to matrix effects. The batch run will also be evaluated to determine that the failure is project related and not sample specific. If the failure is isolated to a specific sample then the sample will be reextracted and reanalyzed. This will be noted and documented in the case file. Otherwise, the sample extract will be re-injected only and flagged according to the AFCEE flags.

**METHOD QC PROCEDURES: Method 8270C**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
Table 7.2.10-3. Summary of Calibration and QC Procedures for Method SW8270C: Surrogate spike, page 7-78.	The sample will not be re-extracted for the failure of surrogates when the chromatogram or level of target compounds indicate matrix interference. The sample extract will be re-injected only. When there is no indication of matrix interference, then the sample will be re-extracted.	The evidence of passing surrogates in the prep blank or instrument blank is an indication that the extraction procedure and system is not malfunctioning and therefore the failing surrogates are attributed to matrix effects. If we can clearly identify matrix interference by review of chromatographic output, this justification will be documented in the case narrative and the sample flagged according to the AFCEE flags.

**METHOD QC PROCEDURES: Method 8015 (Modified)-Volatile and Extractable Total Petroleum Hydrocarbons**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
Table 7.2.2-3. Summary of Calibration and QC Procedures for Method SW8015: TPH (DRO) Calibration and LCS, page 7-14 thru 18.	The instrument will be calibrated with either a Diesel fuel or Jet fuel standard, which ever the client requests. This information will be communicated to the laboratory on the chain of custody	The nature of the sample and the client will determine the best approach to meet the DQO's of this project.

**METHOD QC PROCEDURES: Method 8081A**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
Table 7.2.5-3. Summary of Calibration and QC Procedures for Method SW8081A: Surrogate Spikes, page 7-38.	The sample will not be re-extracted for the failure of surrogates when the failure of surrogates is attributable to matrix effects parentethical by consensus. The sample extract will be re-injected only.	The evidence of passing surrogates in the prep blank or instrument blank is an indication that the extraction procedure and system is not malfunctioning and therefore the failing surrogates are attributed to matrix effects. The batch run will also be evaluated to determine that the failure is project related and not sample specific. If the failure is isolated to a specific sample then the sample will be reextracted and reanalyzed. This will be noted and documented in the case narrative. Otherwise, the sample extract will be re-injected only and flagged according to the AFCEE flags.

**METHOD QC PROCEDURES: Method 8082**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
<p>Table 7.2.6-3. Summary of Calibration and QC Procedures for Method SW8082: Surrogate Spikes, page 7-45.</p>	<p>The inclusion of surrogate "TCMX" will be added upon extraction. The sample will not be re-extracted for the failure of surrogates when the failure of surrogates is attributable to matrix effects parenthetical by consensus. The sample extract will be re-injected only. When there is no indication of matrix interference, then the sample will be re-extracted.</p>	<p>The evidence of passing surrogates in the prep blank or instrument blank is an indication that the extraction procedure and system is not malfunctioning and therefore the failing surrogates are attributed to matrix effects. The batch run will also be evaluated to determine that the failure is project related and not sample specific. If the failure is isolated to a specific sample then the sample will be reextracted and reanalyzed. This will be noted and documented in the case file. Otherwise, the sample extract will be re-injected only and flagged according to the AFCEE flags.</p>

**METHOD QC PROCEDURES: Method 6010B**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
<p>4.3.2 Reporting Limits-The laboratories shall also verify RLs by including a standard at or below the RL as the lowest point on the calibration curve.</p>	<p>The RL will be verified by analyzing a standard at or below the RL after the calibration curve. Control limits of 50-150 %R will be used.</p>	<p>The method states to calibrate using a 2-point curve (1 standard and a blank).</p>

**REPORTING REQUIREMENTS:**

Section and Page in AFCEE QAPP-3.0	Variance	Justification
<p>8.2 Data Review, Validation, and Reporting Requirements for Definitive Data, p. 8-2 [A wet weight aliquot of sample equivalent to the method specified dry weight aliquot of sample shall be taken for analysis (i.e., RLs and MDLs are not adjusted for dry weight)].</p>	<p>A wet weight aliquot of sample, as specified by the method, will be used for analysis. The sample results will be dry weight adjusted. The MDLs and RLs will be reported on a <u>dry weight</u> basis.</p>	<p>The industry standard is to take a wet weight aliquot of soil sample. The majority of soil samples contain less than 25% moisture which does not increase the RL very significantly.</p>
<p>8.2 Data Review, Validation, and Reporting Requirements for Definitive Data, p. 8-2 [MDLs and results shall be reported to one decimal place more than the corresponding RL].</p>	<p>The MDL may be reported to more than one decimal place beyond the corresponding RL.</p>	<p>On a laboratory specific basis, some MDLs are more sensitive by a factor of 10 or greater, than the requested RL. Thus, more decimal places may be required in order for the reported MDL to be meaningful (i.e. to report an MDL greater than 0.00).</p>
<p>8.8 Hardcopy data reports for screening and definitive data. The hardcopy data reports shall conform to the formats identified in the section, p. 8-9</p>	<p>All results and QA/QC will be reported on AFCEE report forms with the exception of calibrations, which will be provided in the form of an equivalent calibration summary with AFCEE header information attached. The following forms are affected: I-3, I-3A, I-3B, O-3A, O-3, O-5A, O-5, O-11 and W-3.</p>	<p>The laboratory does not have the ability to provide instrument calibration data on the AFCEE requested report format. However, all the calibration data will be summarized in an equivalent format.</p>
<p>TICs will be flagged with a "T", p. 8-2</p>	<p>TICs, when required, will be provided by hardcopy only on a separate result form from the "TCL" results.</p>	<p>Currently our instrument software does not electronically transfer this information into our LIMS system.</p>
<p><b>Electronic deliverables</b>                      Electronic deliverables will be provided as described in the "Environmental Resources program Information Management System-ERPIMS '98 DATA LOADING HANDBOOK- ERPIMS Version 4.0, TESTS and RESULTS files. TICs, when required, are reported by hardcopy only.</p>		

## LIST OF ACRONYMS AND ABBREVIATIONS

<b>A2LA</b>	American Association of Laboratory Accreditation
<b>AA</b>	atomic absorption
<b>AFCEE</b>	Air Force Center for Environmental Excellence
<b>ARAR</b>	applicable or relevant and appropriate requirement
<b>°C</b>	degrees Celsius
<b>CERCLA</b>	Comprehensive Environmental Response, Compensation, and Liability Act
<b>COC</b>	chain of custody
<b>DEQPPM</b>	Defense Environmental Quality Program Policy Memorandum
<b>DOD</b>	Department of Defense
<b>DQO</b>	data quality objective
<b>EPA</b>	Environmental Protection Agency
<b>ERPIMS</b>	Environmental Resources Program Information Management System
<b>FID</b>	flame ionization detector
<b>FSP</b>	Field Sampling Plan
<b>G</b>	glass
<b>GC/MS</b>	gas chromatography/mass spectroscopy
<b>GFAA</b>	graphite furnace atomic absorption
<b>HECD</b>	electrolytic conductivity detector
<b>ICS</b>	interference check sample
<b>ICP</b>	inductively coupled plasma
<b>ICPES</b>	inductively coupled plasma atomic emission spectroscopy
<b>IS</b>	internal standards
<b>LCS</b>	laboratory control sample

<b>MDL</b>	method detection limit
<b>mL</b>	milliliter
<b>Mg/L</b>	milligrams per liter
<b>MS/MSD</b>	matrix spike/matrix spike duplicate
<b>MTBE</b>	methyl tertiary butyl ether
<b>NCP</b>	National Contingency Plan
<b>NIST</b>	National Institute of Standards and Technology
<b>NTU</b>	nephelometric turbidity unit
<b>OVA</b>	organic vapor analyzer
<b>P</b>	polyethylene
<b>PCB</b>	polychlorinated biphenyl
<b>PE</b>	performance evaluation
<b>PID</b>	photoionization detector
<b>ppm</b>	parts per million
<b>ppb</b>	parts per billion
<b>QA</b>	quality assurance
<b>QAPP</b>	quality assurance project plan
<b>QC</b>	quality control
<b>RCRA</b>	Resource Conservation and Recovery Act
<b>RCA</b>	recommendations for corrective action
<b>RI/FS</b>	remedial investigation/feasibility study
<b>RL</b>	reporting limit
<b>RSD</b>	relative standard deviation
<b>SAP</b>	Sampling and Analysis Plan
<b>SARA</b>	Superfund Amendments and Reauthorization Act
<b>SOP</b>	Standard Operating Procedures
<b>SVOC</b>	semivolatile organic compound
<b>T</b>	California brass
<b>TCLP</b>	toxicity characteristic leaching program
<b>TIC</b>	tentatively identified compounds
<b>TPH</b>	total petroleum hydrocarbon

VOC            volatile organic compound  
μm            micrometer  
3-D            three-dimensional  
%R            percent recovery

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## TABLE OF CONTENTS

1.0	Introduction	1-1
2.0	Project Description	2-1
2.1	The U.S. Air Force Installation Restoration Program	2-1
2.2	Purpose and Scope	2-2
2.3	Project Background	2-2
2.4	Project Scope and Objectives	2-2
3.0	Project Organization and Responsibility	3-1
4.0	Quality Program and Data Quality Objectives	4-1
4.1	Data Categories	4-1
4.2	Precision, Accuracy, Representativeness, Completeness, & Comparability	4-1
4.2.1	Precision	4-2
4.2.2	Accuracy	4-2
4.2.3	Representativeness	4-2
4.2.4	Completeness	4-3
4.2.5	Comparability	4-3
4.3	Method Detection Limits, Reporting Limits, & Instrument Calibration Requirements	4-5
4.3.1	Method Detection Limits	4-5
4.3.2	Reporting Limits	4-6
4.3.3	Instrument Calibration	4-6
4.4	Elements of Quality Control	4-7
4.4.1	Laboratory Control Sample	4-8
4.4.2	Matrix Spike/Matrix Spike Duplicate	4-8
4.4.3	Surrogates	4-9
4.4.4	Internal Standards	4-9
4.4.5	Retention Time Windows	4-9
4.4.6	Interference Check Sample	4-10
4.4.7	Method Blank	4-10
4.4.8	Ambient Blank	4-11
4.4.9	Equipment Blank	4-11
4.4.10	Trip Blank	4-11
4.4.11	Field Duplicates	4-11
4.4.12	Field Replicates	4-12
4.5	Quality Control Procedures	4-12
4.5.1	Holding Time Compliance	4-12
4.5.2	Confirmation	4-13
4.5.3	Standard Materials	4-13
4.5.4	Supplies and Consumables	4-13
5.0	Sampling Procedures	5-1
5.1	Field Sampling	5-1
5.1.1	Sample Containers	5-1
5.1.2	Sample Volumes, Container Types, and Preservation Requirements	5-1
5.2	Sample Handling and Custody	5-4

6.0	Screening Analytical Methods	6-1
6.1	Analytical Screening Method Descriptions	6-1
6.1.1	EPA Method SW9040B (Water)/SW9045C (Soil)—pH	6-1
6.1.2	EPA Method SW9050A—Conductance	6-1
6.1.3	EPA Method 170.1—Temperature	6-2
6.1.4	EPA Method 180.1—Turbidity	6-2
6.1.5	EPA Method 360.1—Dissolved Oxygen	6-2
6.1.6	SW-846 (Described in Method SW3550)—Percent Moisture	6-2
6.1.7	Real-Time Portable Organic Vapor Analyzers	6-2
6.1.8	Total Volatile Organics	6-3
6.2	Calibration and QC Procedures for Screening Methods	6-4
7.0	Definitive Data Analytical Methods and Procedures	7-1
7.1	Preparation Methods	7-1
7.1.1	Method SW1311—Toxicity Characteristic Leaching Procedure	7-2
7.1.2	Method SW3005A— Acid Digestion of Water Samples for Metals Analysis	7-2
7.1.3	Method SW3020A— Acid Digestion of Aqueous Samples and Extracts for Metals Analysis	7-2
7.1.4	Method SW3050B— Acid Digestion of Solids, Sediments, and Sludges for Metals Analysis	7-3
7.1.5	Method SW3520C—Continuous Liquid-Liquid Extraction	7-3
7.1.6	Method SW3540C/SW3541—Soxhlet Extraction	7-3
7.1.7	Method SW3550B—Ultrasonic Extraction	7-3
7.1.8	Method SW5030B—Purge and Trap	7-3
7.1.9	Method SW5035—Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples	7-4
7.2	Analytical Procedures	7-4
7.2.1	Method SW8015 (Modified)—Ethylene Glycol	7-6
7.2.2	Method SW8015 (Modified)—Volatile and Extractable Total Petroleum Hydrocarbons	7-10
7.2.3	Method SW8081A-Organochlorine Pesticides	7-14
7.2.4	Method SW8082-Polychlorinated Biphenyls	7-20
7.2.5	Method SW8260B—Volatile Organics	7-24
7.2.6	Method SW8270C—Semivolatile Organics	7-32
7.2.7	Method SW6010B—Trace Elements (Metals) by Inductively Coupled Plasma Atomic Emission Spectroscopy for Water and Soil	7-41
7.2.8	Method SW7421—Graphite Furnace Atomic Absorption (Lead)	7-46
7.2.9	Method SW7470A/SW7471A—Mercury Manual Cold-Vapor Technique	7-51
8.0	Data Reduction, Review, Verification, Reporting, Validation, and Recordkeeping	8-1
8.1	Data Review, Validation, and Reporting Requirements for Screening Data	8-1
8.2	Data Review, Validation, and Reporting Requirements for Definitive Data	8-2
8.3	Quality Assurance Reports	8-8
8.4	ERPIMS Electronic Data Reports	8-8
8.5	Archiving	8-8

8.6	Project Data Flow and Transfer	8-8
8.7	Recordkeeping	8-8
8.8	Hardcopy Data Reports for Screening and Definitive Data	8-9
9.0	Systems and Performance Audits, Performance Evaluation Programs, Magnetic Tape Audits, and Training	9-1
9.1	Project Audits	9-1
9.1.1	State/Federal Project Audits	9-1
9.1.2	Technical Systems Audits	9-1
9.1.3	Project-Specific Performance Evaluation Audits	9-2
9.1.4	Magnetic Tape Audits	9-3
9.1.5	Performance Evaluation Sample Programs	9-3
9.2	Training	9-3
10.0	Preventive Maintenance	10-1
10.1	Maintenance Responsibilities	10-1
10.2	Maintenance Schedules	10-1
10.3	Spare Parts	10-1
10.4	Maintenance Records	10-2
11.0	Corrective Action	11-1
11.1	Corrective Action Report	11-1
11.2	Corrective Action System	11-1
12.0	Quality Assurance Reports to Management	12-1

211 170

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## LIST OF TABLES

TABLE		PAGE
4.2.1-1	Statistical Calculations	4-4
5.1.2-1	Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times	5-2
6-1	Screening Analytical Methods	6-1
6.2-1	Summary of Calibration and QC Procedures for Screening Methods	6-5
7.1-1	Extraction and Digestion Procedures	7-2
7.2-1	Analytical Procedures	7-5
7.2.1-1	RL for Ethylene Glycol by Method SW8015 (Modified)	7-6
7.2.1-2	QC Acceptance Criteria for Ethyl Glycol by Method SW8015 (Modified)	7-6
7.2.1-3	Summary of Calibration and QC Procedures for Ethylene Glycol by Method SW8015 (Modified)	7-7
7.2.2-1	RLs for Method SW8015 (Modified)	7-11
7.2.2-2	QC Acceptance Criteria for Method SW8015 (Modified)	7-11
7.2.2-3	Summary of Calibration and QC Procedures for Method SW8015 (Modified)	7-12
7.2.3-1	RLs for Method SW8081A	7-15
7.2.3-2	QC Acceptance Criteria for Method SW8021B	7-13
7.2.3-3	Summary of Calibration and QC Procedures for Method SW8081A	7-17
7.2.4-1	RLs for Method SW8082	7-20
7.2.4-2	QC Acceptance Criteria for Method SW8082	7-20
7.2.4-3	Summary of Calibration and QC Procedures for Method SW8081A	7-19
7.2.5-1	RLs for Method SW8260B	7-25
7.2.5-2	QC Acceptance Criteria for Method SW8082	7-22
7.2.5-3	Summary of Calibration and QC Procedures for Method SW8260B	7-29
7.2.6-1	RLs for Method SW8270C	7-33
7.2.6-2	QC Acceptance Criteria for Method SW8270C	7-35
7.2.6-3	Summary of Calibration and QC Procedures for Method SW8270C	7-38
7.2.7-1	RLs for Method SW6010B	7-42
7.2.7-2	QC Acceptance Criteria for Method SW6010B	7-42
7.2.7-3	Summary of Calibration and QC Procedures for Method SW6010B	7-43
7.2.8-1	RLs for Method SW7421	7-47
7.2.8-2	QC Acceptance Criteria for Method SW7421	7-47
7.2.8-3	Summary of Calibration and QC Procedures for Method SW7421	7-48
7.2.9-1	RLs for Method SW7470A/SW7471A	7-52

7.2.9-2	QC Acceptance Criteria for Method SW7470A/7471A	7-52
7.2.9-3	Summary of Calibration and QC Procedures for Method SW7470A/ SW7471A	7-53
8.2-1	Data Qualifiers	8-3
8.2-2	General Flagging Conventions	8-4
8.2-3	Flagging Conventions Specific to Organic Methods	8-5
8.2-4	Flagging Conventions Specific to Inorganic Methods	8-7

## 1.0 INTRODUCTION

The Quality Assurance Project Plan (QAPP) presents in specific terms the policies, organization, functions, and Quality Assurance/Quality Control (QA/QC) requirements designed to achieve the data quality goals described in the approved Sampling and Analysis Plan (SAP) for the project. This detailed QAPP, (1) has been prepared for use by contractors who perform environmental services to ensure the data are scientifically valid and defensible, and (2) establishes the analytical protocols and documentation requirements to ensure the data are collected, reviewed, and analyzed in a consistent manner. This QAPP and a site specific Field Sampling Plan (FSP) shall constitute, by definition, an AFCEE Sampling and Analysis Plan (SAP).

The National Contingency Plan (NCP) specifies circumstances under which a QAPP is necessary for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions. For cleanup actions at the remedial investigation/feasibility study (RI/FS) stage, the NCP requires lead agents to develop sampling and analysis plans which provide a process for obtaining data of sufficient quality and quantity to satisfy data needs. Such sampling and analysis plans must include a quality assurance project plan "which describes policy, organization, and functional activities and the data quality objectives and measures necessary to achieve adequate data for use in selecting the appropriate remedy." 40 CFR 300.430 (b)(8)(ii).

The U.S. Environmental Protection Agency (EPA) QA policy requires a QAPP for every monitoring and measurement project mandated or supported by the EPA through regulations, contracts, or other formalized means not currently covered by regulation. Guidelines followed in the preparation of this plan are set out in *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (U.S. EPA, 1983a) and *U.S. EPA Region IX QAPP: Guidance for Preparing QAPPs for Superfund Remedial Projects* (U.S. EPA, 1989). Other documents that have been referenced for this plan include *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (U.S. EPA, 1988); *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Draft Final, EPA QA/R-5* (U.S. EPA, 1993), *Compendium of Superfund Field Operations Methods* (U.S. EPA, 1987a); *Data Quality Objectives Process for Superfund, Interim Final Guidance* (U.S. EPA, 1993); *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA, 1994), *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (U.S. EPA, 1994), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition and its first, second and third update), and the *Handbook for Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)* (Handbook), September 1993.

This QAPP is required reading for all staff participating in the work effort. The QAPP shall be in the possession of the field teams and in the laboratories performing all analytical methods. All contractors and subcontractors shall be required to comply with the procedures documented in this QAPP in order to maintain comparability and representativeness of the data produced.

Controlled distribution of the QAPP shall be implemented by the prime contractor to ensure the current version is being used. A sequential numbering system shall be used to identify controlled copies of the QAPP. Controlled copies shall be provided to applicable Air Force managers, regulatory agencies, remedial project managers, project managers, and QA coordinators. Whenever Air Force revisions are made or addenda added to the QAPP, a document control system shall be put into place to assure (1) all parties holding a controlled copy of the QAPP shall receive the revisions/addenda and (2) outdated material is removed from circulation. The document control system does not preclude making and using copies of the QAPP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations. The distribution list for controlled copies shall be maintained by the prime contractor.

## 2.0 PROJECT DESCRIPTION

### 2.1 THE U.S. AIR FORCE INSTALLATION RESTORATION PROGRAM

The objective of the U.S. Air Force Installation Restoration Project (IRP) is to assess past hazardous waste disposal and spill sites at U.S. Air Force installations and to develop remedial actions consistent with the NCP for sites that pose a threat to human health and welfare or the environment. This section presents information on the program origins, objectives, and organization.

The 1976 Resource Conservation Recovery Act (RCRA) is one of the primary federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require federal agencies to comply with local and state environmental regulations and provide information to the EPA concerning past disposal practices at federal sites. RCRA Section 3012 requires state agencies to inventory past hazardous waste disposal sites and provide information to the EPA concerning those sites.

In 1980, Congress enacted CERCLA (Superfund). CERCLA outlines the responsibility for identifying and remediating contaminated sites in the United States and its possessions. The CERCLA legislation identifies the EPA as the primary policy and enforcement agency regarding contaminated sites.

The 1986 Superfund Amendments and Reauthorization Act (SARA) extends the requirements of CERCLA and modifies CERCLA with respect to goals for remediation and the steps that lead to the selection of a remedial process. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends the EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and the consideration of potential remediation alternatives is recommended at the initiation of an RI/FS. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Executive Order 12580, adopted in 1987, gave various federal agencies, including the Department of Defense (DOD), the responsibility to act as lead agencies for conducting investigations and implementing remediation efforts when they are the sole or co-contributor to contamination on or off their properties.

To ensure compliance with CERCLA, its regulations, and Executive Order 12580, the DOD developed the IRP, under the Defense Environmental Restoration Program, to identify potentially

contaminated sites, investigate these sites, and evaluate and select remedial actions for potentially contaminated facilities. The DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP program in June 1980, and implemented the policies outlined in this memorandum in December 1980. The NCP was issued by EPA in 1980 to provide guidance on a process by which (1) contaminant release could be reported, (2) contamination could be identified and quantified, and (3) remedial actions could be selected. The NCP describes the responsibility of federal and state governments and those responsible for contaminant releases.

The DOD formally revised and expanded the existing IRP directives and amplified all previous directives and memoranda concerning the IRP through DEQPPM 81-5, dated 11 December 1981. The memorandum was implemented by a U.S. Air Force message dated 21 January 1982.

The IRP is the DOD's primary mechanism for response actions on U.S. Air Force installations affected by the provisions of SARA. In November 1986, in response to SARA and other EPA interim guidance, the U.S. Air Force modified the IRP to provide for an RI/FS program. The IRP was modified so that RI/FS studies could be conducted as parallel activities rather than serial activities. The program now includes ARAR determinations, identification and screening of technologies, and development of alternatives. The IRP may include multiple field activities and pilot studies prior to a detailed final analysis of alternatives. Over the years, requirements of the IRP have been developed and modified to ensure that DOD compliance with federal laws, such as RCRA, NCP, CERCLA, and SARA, can be met.

## **2.2 PURPOSE AND SCOPE**

The purpose, scope, and use of this work effort shall be briefly discussed in Section 2.2 of the FSP.

## **2.3 PROJECT BACKGROUND**

A project background description, including (1) the locations of sites at the base or facility, (2) a summary of the contamination history at each site and (3) the findings from previous investigations shall be included in Section 2.3 and Section 2.4 of the FSP.

## **2.4 PROJECT SCOPE AND OBJECTIVES**

A summary of the objectives and the proposed work for each site shall be included in Section 3.1, Section 3.2 and Section 3.3 of the FSP. The intended use of the data acquired during this project, the data quality objective process and a discussion of how the process specific decision rules were derived shall also be described in Section 3.1 of the FSP.

### 3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The project organization and responsibility discussion including (1) a project organizational chart identifying task managers and individuals responsible for performance of the project, (2) a list of names of all key participants, including organization names and telephone numbers for project, field, and laboratory QA officers, (3) a description of the authority given to each key participant with an emphasis on the authority of the key individuals to initiate and approve corrective actions, and (4) the role of regulatory representatives shall be included in Section 4.0 of the FSP.

All contractors and subcontractors shall be identified and the scope of their performance in the project shall be clearly defined. Subcontractors proposed to provide backup services shall be identified. An organizational chart, a list of key personnel, and the previously described descriptive text shall be included for each subcontractor in Section 4.1 of the FSP.

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#### 4.0 QUALITY PROGRAM AND DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) specify the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. The DQOs for the project are specified in the FSP in Section 3.1.

#### 4.1 DATA CATEGORIES

The two general categories of data used by the Air Force Center for Environmental Excellence (AFCEE) are defined as: (1) screening data and (2) definitive data.

Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration and/or QC requirements than are necessary to produce definitive data. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data may provide analyte identification and quantitation, although the quantitation may be relatively imprecise. Physical test methods, e.g., dissolved oxygen measurements, temperature and pH measurements, moisture content, turbidity, conductance, etc., have been designated by definition as screening methods (see Section 6).

Screening methods shall be confirmed, as required in Section 3.2 of the FSP, by analyses that generate definitive data. Confirmation samples shall be selected to include both detected and nondetected results from the screening method.

Definitive data are generated using rigorous analytical methods (see Section 7), such as approved EPA reference methods. The data can be generated in a mobile or off-site laboratory. Data are analyte-specific, and both identification and quantitation are confirmed. These methods have standardized QC and documentation requirements (Sections 7 and 8). Definitive data are not restricted in their use unless quality problems require data qualification.

#### 4.2 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

The basis for assessing each of these elements of data quality is discussed in the following subsections. Precision and accuracy QC limits for each method and matrix are identified in Sections 6 and 7.

#### 4.2.1 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. *Analytical* precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. AFCEE uses the laboratory control sample (LCS) to determine the precision of the analytical method. If the recoveries of analytes in the LCS are within established control limits, then precision is within limits. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, rather the comparison is between the sample and samples analyzed in previous batches. *Total* precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in Table 4.2.1-1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for the calculation of RSD is provided in Table 4.2.1-1.

#### 4.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit. For volatile and semivolatile organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Analysis of performance evaluation (PE) samples shall also be used to provide additional information for assessing the accuracy of the analytical data being produced.

Both accuracy and precision are calculated for each AFCEE analytical batch, and the associated sample results are interpreted by considering these specific measurements. The formula for calculation of accuracy is included in Table 4.2.1-1 as percent recovery (%R) from pure and sample matrices.

#### 4.2.3 Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Representativeness is also determined by appropriate program design, with consideration of elements such as proper well locations, drilling and installation procedures, and sampling locations. Decisions regarding sample/well/

boring locations and numbers and the statistical sampling design are documented in Section 3.3 of the FSP.

#### 4.2.4 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an "R" flag (see Section 8 for an explanation of flagging criteria). The requirement for completeness is 95 percent for aqueous samples and 90 percent for soil samples. For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of valid results minus the number of possible results not reported.

The formula for calculation of completeness is presented below:

$$\% \text{ completeness} = \frac{\text{number of valid (i.e., non-R flagged) results}}{\text{number of possible results}}$$

#### 4.2.5 Comparability

Comparability is the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of comparability. Analysis of performance evaluation (PE) samples and reports from audits shall also be used to provide additional information for assessing the comparability of analytical data produced among subcontracting laboratories. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project.

Table 4.2.1-1 Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\bar{X}$	$\left( \frac{\sum_{i=1}^n x_i}{n} \right)$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left( \frac{\sum(x_i - \bar{x})^2}{(n-1)} \right)^{1/2}$	Measure of relative scatter of the data	Used in calculating variation of measurements
Relative Standard Deviation	RSD	$(S / \bar{X}) \times 100$	Relative standard deviation, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\frac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of 2 observations	Used to assess accuracy
Relative Percent Difference	RPD	$\left( \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	%R	$\left( \frac{X_{\text{meas}}}{X_{\text{true}}} \right) \times 100$	Recovery of spiked compound in pure matrix	Used to assess accuracy
Percent Recovery	%R	$\left( \frac{\text{value of spiked sample} - \text{value of unspiked sample}}{\text{Value of added spike}} \right) \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision
Correlation Coefficient	r	see SW8000B section 7.5.3		Evaluation of "goodness of fit" of a regression line
Coefficient of Determination	COD	see SW8000B section 7.5.3		Evaluation of "goodness of fit" of a polynomial equation

x = Observation (concentration)  
n = Number of observations

### 4.3 METHOD DETECTION LIMITS, AFCEE REPORTING LIMITS, AND INSTRUMENT CALIBRATION REQUIREMENTS

#### 4.3.1 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory shall establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory shall revalidate these MDLs at least once per twelve month period. The laboratory shall provide the MDL demonstrations to AFCEE at the beginning of the project (i.e., before project samples are analyzed) and upon request in the format specified in Section 8. Results less than or equal to the MDL shall be reported as the MDL value and flagged with a "U" (see Section 8).

Laboratories participating in this work effort shall demonstrate the MDLs for each instrument, including confirmatory columns, method of analysis, analyte, and matrix (i.e., water and soil) using the following instructions:

- (1) Estimate the MDL using one of the following:
  - a) the concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5, or
  - b) the concentration equivalent of 3 times the standard deviation of replicate measurement of the analyte in reagent water, or
  - c) the region of the standard curve where there is a significant change in sensitivity (i.e., a break in the slope of the standard curve).
- (2) Prepare (i.e., extract, digest, etc.) and analyze seven samples of a matrix spike (ASTM Type II water for aqueous methods, Ottawa sand for soil methods, glass beads of 1 mm diameter or smaller for metals) containing the analyte of interest at a concentration three to five times the estimated MDL.
- (3) Determine the variance ( $S^2$ ) for each analyte as follows:

$$S^2 = \frac{1}{n-1} \left[ \sum_{i=1}^n x_i - \bar{x}^2 \right]$$

where  $x_i$  = the  $i$ th measurement of the variable  $x$  and  $\bar{x}$  = the average value of  $x$

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n x_i$$

(4) Determine the standard deviation (s) for each analyte as follows:

$$s = (S^2)^{1/2}$$

(5) Determine the MDL for each analyte as follows:

$$\text{MDL} = 3.14(s)$$

(note: 3.14 is the one-sided t-statistic at the 99 percent confidence level appropriate for determining the MDL using 7 samples)

(6) If the spike level used in step 2 is more than 5 times the calculated MDL, repeat the process using a smaller spiking level.

Where multiple instruments are used, the MDL used for reporting purposes shall represent the least sensitive instrument.

#### 4.3.2 Reporting Limits

The laboratories participating in this work effort shall compare the results of the MDL demonstrations to the reporting limits (RLs) for each method that is listed in Section 7. The MDL may not be more than one-half the corresponding RL. The laboratories shall also verify RLs by including a standard at or below the RL as the lowest point on the calibration curve. All results shall be reported at or above the MDL values, however, for those results falling between the MDL and the RL, an "F" flag shall be applied to the results indicating the variability associated with the result (see Section 8.0). No results shall be reported below the MDL.

#### 4.3.3 Instrument Calibration

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations, and these calibrations shall meet the acceptance criteria specified in Section 7. All results reported shall be within the calibration range. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to standard materials.

Instrument calibration shall be checked using all of the analytes listed in the QC acceptance criteria table in Section 7 for the method. This applies equally to multiresponse analytes (except as noted in Section 7). All calibration criteria shall satisfy SW-846 requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Multipoint calibrations shall contain the minimum number of calibration points specified in the method with all points used for the calibration being contiguous. If more than the minimum number of standards is analyzed for the initial calibration, all of the standards analyzed shall be included in the initial calibration. The only exception to this rule is a standard that has been statistically determined as being an outlier can be dropped from the calibration, providing the requirement for the minimum number of standards is met. Acceptance criteria for the calibration check are presented in Section 7. Analyte concentrations are determined with either calibration curves or response factors (RFs). For gas chromatography (GC) and gas chromatography/mass spectroscopy (GC/MS) methods, when using RFs to determine analyte concentrations, the average RF from the initial five point calibration shall be used. The continuing calibration shall not be used to update the RFs from the initial five point calibration. The continuing calibration verification cannot be used as the laboratory control sample (LCS).

#### 4.4 ELEMENTS OF QUALITY CONTROL

QC elements relevant to screening data are presented in Section 6.0. This section presents QC requirements relevant to analysis of environmental samples that shall be followed during all analytical activities for fixed-base, mobile, and field laboratories producing definitive data. The purpose of this QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

Laboratory QC samples (e.g., blanks and laboratory control samples) shall be included in the preparation batch with the field samples. An AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of reagents. Matrix spikes and matrix spike duplicates count as environmental samples. The term AFCEE analytical batch also extends to cover samples that do not need separate extraction or digestion (e.g., volatile analyses by purge and trap). This AFCEE analytical batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and analyzed sequentially. The identity of each AFCEE analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples. All references to the analytical batch in the following sections and tables in this QAPP refer to the AFCEE analytical batch.

The type of QC samples and the frequency of use of these samples are discussed below and in the method-specific subsections of Section 7.

#### 4.4.1 Laboratory Control Sample

The laboratory control sample (LCS) is analyte-free water for aqueous analyses or Ottawa sand for soil analyses (except metals where glass beads of 1mm diameter or smaller may be used) spiked with all analytes listed in the QC acceptance criteria table in Section 7 for the method. Each analyte in the LCS shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. The LCS shall be carried through the complete sample preparation and analysis procedure.

The LCS is used to evaluate each AFCEE analytical batch and to determine if the method is in control. The LCS cannot be used as the continuing calibration verification.

One LCS shall be included in every AFCEE analytical batch. If more than one LCS is analyzed in an AFCEE analytical batch, results from all LCSs analyzed shall be reported. A QC failure of an analyte in any of the LCSs shall require appropriate corrective action including qualification of the failed analyte in all of the samples as required.

The performance of the LCS is evaluated against the QC acceptance limits given in the tables in Section 7.

Whenever an analyte in an LCS is outside the acceptance limit, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, all samples in the AFCEE analytical batch shall be reanalyzed for the out-of-control analyte(s). When an analyte in an LCS exceeds the upper or lower control limit and no corrective action is performed or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7 and 8, shall be applied to all affected results.

#### 4.4.2 Matrix Spike/Matrix Spike Duplicate

A matrix spike (MS) and matrix spike duplicate (MSD) is an aliquot of sample spiked with known concentrations of all analytes listed in the QC acceptance criteria table in Section 7 for the method. The spiking occurs prior to sample preparation and analysis. Each analyte in the MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. Only AFCEE samples shall be used for spiking. The MS/MSD shall be designated on the chain of custody.

The MS/MSD is used to document the bias of a method due to sample matrix. AFCEE does not use MSs and MSDs to control the analytical process.

A minimum of one MS and one MSD sample shall be analyzed for every 20 AFCEE samples.

The performance of the MS and MSD is evaluated against the QC acceptance limits given in the tables in Section 7. If either the MS or the MSD is outside the QC acceptance limits, the analytes in all related samples shall be qualified according to the data flagging criteria in Sections 7 and 8.

#### 4.4.3 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples.

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency.

Surrogates shall be added to environmental samples, controls, and blanks, in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limit, corrective action must be performed. After the system problems have been resolved and system control has been reestablished, reprep and reanalyze the sample. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7 and 8, shall be applied to the sample results.

#### 4.4.4 Internal Standards

Internal standards (ISs) are measured amounts of certain compounds added after preparation or extraction of a sample.

They are used in an IS calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects.

ISs shall be added to environmental samples, controls, and blanks, in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions shall be performed.

After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7 and 8, shall be applied to the sample results.

#### 4.4.5 Retention Time Windows

Retention time windows are used in GC and high performance liquid chromatography (HPLC) analysis for qualitative identification of analytes. They are calculated from replicate analyses of

a standard on multiple days. The procedure and calculation method are given in SW-846 Method 8000B.

When the retention time is outside of the acceptance limits, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, reanalyze all samples analyzed since the last acceptable retention time check. If corrective actions are not performed, the appropriate validation flag, as described in Sections 7 and 8, shall be applied to the sample results.

#### **4.4.6 Interference Check Sample**

The interference check sample (ICS), used in inductively coupled plasma (ICP) analyses only, contains both interfering and analyte elements of known concentrations.

The ICS is used to verify background and interelement correction factors.

The ICS is run at the beginning and end of each run sequence.

When the interference check sample results are outside of the acceptance limits stated in the method, corrective action shall be performed. After the system problems have been resolved and system control has been reestablished, reanalyze the ICS. If the ICS result is acceptable, reanalyze all affected samples. If corrective action is not performed or the corrective action was ineffective, the appropriate validation flag, as described in Sections 7 and 8, shall be applied to all affected results.

#### **4.4.7 Method Blank**

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank shall be carried through the complete sample preparation and analytical procedure.

The method blank is used to document contamination resulting from the analytical process.

A method blank shall be included in every AFCEE analytical batch.

The presence of analytes in a method blank at concentrations equal to or greater than the RL indicates a need for corrective action. Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the analytical batch shall be reprep and reanalyzed. No analytical data shall be corrected for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the appropriate validation flag, as described in Sections 7 and 8, shall be applied to the sample results.

#### 4.4.8 Ambient Blank

Ambient blanks will not be collected as a part of this program.

#### 4.4.9 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent grade water poured into or over or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis.

Equipment blanks are used to assess the effectiveness of equipment decontamination procedures.

The frequency of collection for equipment blanks is specified in Section 3.2 of the FSP. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site.

When an analyte is detected in the equipment blank the appropriate validation flag, as described in Section 8, shall be applied to all sample results from samples collected with the affected equipment.

#### 4.4.10 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent grade water, transported to the sampling site, handled like an environmental sample and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes.

Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures.

When an analyte is detected in the trip blank the appropriate validation flag, as described in Section 8, shall be applied to all sample results from samples in the cooler with the affected trip blank.

One trip blank shall accompany each cooler of samples sent to the laboratory for analysis of VOCs.

#### 4.4.11 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and

analysis. The sample containers are assigned an identification number in the field such that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest.

The frequency of collection for field duplicates is specified in Section 3.2 of the FSP.

#### **4.4.12 Field Replicates**

A field replicate sample, also called a split, is a single sample divided into two equal parts for analysis. The sample containers are assigned an identification number in the field such that they cannot be identified as replicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field replicate samples prior to the beginning of sample collection.

Replicate sample results are used to assess precision.

The frequency of collection for field replicates is specified in Section 3.2 of the FSP.

### **4.5 QUALITY CONTROL PROCEDURES**

#### **4.5.1 Holding Time Compliance**

All sample preparation and analysis shall be completed within the method-required holding times. The holding time for a sample begins at the time of sample collection. Some methods have more than one holding time requirement (e.g., methods SW8081A, SW8270C, etc.). The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required reanalyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required reanalyses.

If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section 8.

#### 4.5.2 Confirmation

Quantitative confirmation of results at or above the RL for samples analyzed by GC or HPLC shall be required, unless otherwise specified for the method in Section 7, and shall be completed within the method-required holding times. For GC methods, a second column is used for confirmation. For HPLC methods, a second column or a different detector is used. The result of the first column/detector shall be the result reported. If holding times are exceeded and the analyses are performed, the results shall be flagged according to the procedures as described in Section 8.

#### 4.5.3 Standard Materials

Standard materials, including second source materials, used in calibration and to prepare samples shall be traceable to National Institute Standards and Technology (NIST), EPA, American Association of Laboratory Accreditation (A2LA) or other equivalent AFCEE approved source, if available. If an NIST, EPA or A2LA standard material is not available, the standard material proposed for use shall be included in an addendum to the SAP and approved before use. The standard materials shall be current, and the following expiration policy shall be followed: The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date or one year from the date of receipt, whichever comes first. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be either revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory shall label standard and QC materials with expiration dates.

A second source standard is used to independently confirm initial calibration. A second source standard is a standard purchased from a different vendor than the vendor supplying the material used in the initial calibration standards. The second source material can be used for the continuing calibration standards or for the LCS (but shall be used for one of the two). Two different lot numbers from the same vendor do not constitute a second source.

#### 4.5.4 Supplies and Consumables

The laboratory shall inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents shall be monitored by analysis of LCSs. An inventory and storage system for these materials shall assure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

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## 5.0 SAMPLING PROCEDURES

### 5.1 FIELD SAMPLING

The field sampling procedures for collecting samples and sampling methods shall be included in Section 6.0 of the FSP.

#### 5.1.1 Sample Containers

Sample containers are purchased precleaned and treated according to EPA specifications for the methods. Sampling containers that are reused are decontaminated between uses by the EPA-recommended procedures (i.e., EPA 540/R-93/051). Containers are stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

#### 5.1.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 5.1.2-1. The required sample volumes, container types, and preservation requirements for analytical methods proposed for project work not listed in Table 5.1.2-1 shall be included in an addendum to the FSP and approved by AFCEE before use.

**Table 5.1.2-1. Requirements for Containers, Preservation Techniques,  
Sample Volumes, and Holding Times**

Name	Analytical Methods	Container <sup>a</sup>	Preservation <sup>b,c</sup>	Minimum Sample Volume or Weight	Maximum Holding Time
Hydrogen ion (pH) (W, S)	SW9040B/ SW9045C	P, G	None required	N/A	Analyze immediately
Conductance	SW9050A	P, G	None required	N/A	Analyze immediately
Temperature	E170.1	P, G	None required	N/A	Analyze immediately
Dissolved oxygen	E360.1	G	None required	500 mL	Analyze immediately
Turbidity	E180.1	P, G	4°C	N/A	48 hours
Mercury	SW7470A SW7471A	P, G, T	HNO <sub>3</sub> to pH < 2, 4°C	500 mL or 8 ounces	28 days (water and soil)
Metals (except chromium (VI) and mercury)	SW6010B SW6020 and SW-846 AA methods	P, G, T	HNO <sub>3</sub> to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)
Total petroleum hydrocarbons (TPH)-volatile	SW8015 (modified)	G, Teflon-lined septum, T	4°C, HCl to pH < 2 (water)	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if water unpreserved by acid
Total petroleum hydrocarbons (TPH)-extractable	SW8015 (modified)	G, amber, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Ethylene Glycol	SW8015 (modified)	G, Teflon-lined septum, T	4°C	2 x 40 mL or 4 ounces	14 days (water and soil)
Organochlorine pesticides	SW8081A	G, Teflon-lined cap, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Polychlorinated biphenyls (PCBs)	SW8082	G, Teflon-lined cap, T	4°C	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)

Name	Analytical Methods	Container <sup>a</sup>	Preservation <sup>b,c</sup>	Minimum Sample Volume or Weight	Maximum Holding Time
Semivolatile organics	SW8270C	G, Teflon-lined cap, T	4°C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Volatile organics (Including BTEX and MTBE)	SW8260B	G, Teflon-lined septum, T	4°C, HCl to pH < 2 for volatile aromatics <sup>b</sup> (water); sodium bisulfate and/or methanol (soils)	2 x 40 mL or 4 ounces	14 days (water and soil); 7 days if unpreserved by acid
TCLP	SW1311	G, Teflon-lined cap, T	Cool, 4°C	1 liter or 8 ounces	14 days to TCLP extraction and 14 days after extraction (volatiles); 14 days to TCLP extraction, 7 days to prep extraction and 40 days after prep extraction (semivolatiles); 28 days to TCLP extraction and 28 days after extraction (mercury); 180 days to TCLP extraction and 180 days after extraction (metals)

- a. Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T).  
b. No pH adjustment for soil.  
c. Preservation with 0.008 percent Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> is only required when residual chlorine is present.

## 5.2 SAMPLE HANDLING AND CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

The contractor shall maintain chain-of-custody records for all field and field Quality Control (QC) samples. A sample is defined as being under a person's custody if any of the following conditions exist: (1) it is in their possession, (2) it is in their view, after being in their possession, (3) it was in their possession and they locked it up or, (4) it is in a designated secure area.

The following information concerning the sample shall be documented on the AFCEE chain of custody (COC) form (as illustrated in Section 8):

- Unique sample identification
- Date and time of sample collection
- Source of sample (including name, location, and sample type)
- Designation of MS/MSD
- Preservative used
- Analyses required
- Name of collector(s)
- Pertinent field data (pH, temperature, etc.)
- Serial numbers of custody seals and transportation cases (if used)
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Bill of lading or transporter tracking number (if applicable)

All samples shall be uniquely identified, labeled, and documented in the field at the time of collection in accordance with (IAW) Section 6.2 of the FSP.

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible. When a 4°C requirement for preserving the sample is indicated, the samples shall be packed in ice or chemical refrigerant to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a volatile organics compounds sampling vial filled with tap water) shall be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory. If the temperature of the samples upon receipt exceeds the temperature requirements, the exceedance shall be documented in laboratory records and discussed with AFCEE. The decision regarding the potentially affected samples shall also be documented.

Once the samples reach the laboratory, they shall be checked against information on the COC form for anomalies. The condition, temperature, and appropriate preservation of samples shall be checked and documented on the COC form. Checking an aliquot of the sample using pH paper is an acceptable procedure except for VOCs where an additional sample is required to check preservation. The occurrence of any anomalies in the received samples and their resolution shall be documented in laboratory records. All sample information shall then be entered into a tracking system, and unique analytical sample identifiers shall be assigned. A copy of this information shall be reviewed by the laboratory for accuracy. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods required routinely for AFCEE work are specified in Table 5.1.2-1. **Samples not preserved or analyzed in accordance with these requirements shall be resampled and analyzed, at no additional cost to AFCEE.** Subcontracted analyses shall be documented with the AFCEE COC form. Procedures ensuring internal laboratory COC shall also be implemented and documented by the laboratory. Specific instructions concerning the analysis specified for each sample shall be communicated to the analysts. Analytical batches shall be created, and laboratory QC samples shall be introduced into each batch.

While in the laboratory, samples shall be stored in limited-access, temperature-controlled areas. Refrigerators, coolers and freezers shall be monitored for temperature seven days a week. Acceptance criterion for the temperatures of the refrigerators and coolers is  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Acceptance criterion for the temperatures of the freezers shall be less than  $0^{\circ}\text{C}$ . All of the cold storage areas shall be monitored by thermometers that have been calibrated with a NIST-traceable thermometer. As indicated by the findings of the calibration, correction factors shall be applied to each thermometer. Records that include acceptance criteria shall be maintained. Samples for volatile organics determination shall be stored separately from other samples, standards, and sample extracts. Samples shall be stored after analysis until disposed of IAW applicable local, state, and federal regulations. Disposal records shall be maintained by the laboratory.

Standard operating procedures (SOPs) describing sample control and custody shall be maintained by the laboratory.

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## 6.0 SCREENING ANALYTICAL METHODS

The analytical screening methods contained in this section are shown in Table 6-1. This section includes brief descriptions of the methods and QC required for screening procedures commonly used to conduct work efforts. The methods and QC procedures were taken from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition, and its first, second and third update), *Methods for Chemical Analysis of Water and Waste* (U.S. EPA 1979), *ASTM Annual Book of Standards* (1993), and from manufacturers' literature.

**Table 6-1. Screening Analytical Methods**

Method	Parameter
SW846 (3550)	Moisture
SW9040B	pH (water)
SW9050A	Conductance
E170.1	Temperature
E180 1	Turbidity
E360.1	Dissolved oxygen
Vendor SOP	Total volatile organics
Organic Vapor (FID and PID)	Soil gas screening-halogenated, aromatic, and petroleum hydrocarbons

## 6.1 ANALYTICAL SCREENING METHOD DESCRIPTIONS

Section 6.1 contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description
- The RL (if applicable)

### 6.1.1 EPA Method SW9040B (Water) -pH

pH measurements shall be performed for water samples using method SW9040. pH measurements of soil samples are performed using method SW9045C. Measurements are determined electrometrically using either a glass electrode in combination with a reference potential, or a combination electrode.

### 6.1.2 EPA Method SW9050A—Conductance

Standard conductivity meters are used. Temperature is also reported.

### 6.1.3 EPA Method 170.1—Temperature

Temperature measurements are made with a mercury-filled or dial type centigrade thermometer, or a thermistor.

### 6.1.4 EPA Method 180.1—Turbidity

This method is based on a comparison of the light scattered by the sample under defined conditions with the light intensity scattered by a standard reference suspension. The higher the intensity, the greater the turbidity. Turbidity measurements are made in a nephelometer and are reported in terms of nephelometric turbidity units (NTUs). The working range for the method is from 0–40 NTU. Higher levels of turbidity can be measured by diluting the sample with turbidity-free deionized water.

### 6.1.5 EPA Method 360.1—Dissolved Oxygen

An instrumental probe, usually dependent upon an electrochemical reaction, is used for determination of dissolved oxygen in water. Under steady-state conditions, the current or potential can be correlated with dissolved oxygen concentrations.

### 6.1.6 SW-846 (Described in Method SW3550)—Percent Moisture

Percent moisture is determined for solid samples undergoing analysis for inorganic and organic analytes. The sample is weighed, dried, and then reweighed. Percent moisture is calculated as:

$$\frac{\text{Initial Weight} - \text{Dried Weight}}{\text{Initial Weight}} \times 100 = \% \text{ moisture}$$

The moisture content is used to calculate results for soil samples on a dry weight basis using the calculation presented below:

$$\frac{\text{Result of analysis on wet weight basis}}{1 - (\% \text{ Moisture}/100)} = \text{Result of analysis on a dry weight basis}$$

All soil or sediment results and MDLs shall be reported on a dry weight basis.

### 6.1.7 Real-Time Portable Organic Vapor Analyzers

Two types of portable analyzers shall be used to perform real-time nonspecific analyses of hydrocarbon vapors. The instruments include an FID (e.g., Foxboro Century OVA) and a photoionization detector (PID) (e.g., HNu® Systems [HNu®] trace gas analyzer) organic vapor

monitor. One or more of these instruments may be used at a specific site, depending on the contaminant species of interest. When used together, the instruments provide complementary information because they are sensitive to different types of hydrocarbon vapors.

The portable analyzers shall be used as a screening tool to help determine the optimum locations for the collection of samples. Field data recorded on the COC forms give the laboratory analysts an indication of the approximate concentration of contaminants and aid in calculating dilution factors before analysis. Additionally, the real-time instruments are used to aid in selecting the proper level of personal protective equipment and monitoring air emissions during sampling activities. The comparability of results obtained from the PID and FID instruments can be considered only to be within the variability of this type of screening instrument. Comparability is greatest when the instruments are calibrated with the same standards and operated within similar concentration ranges.

The FID uses the principle of hydrogen flame ionization to detect and measure total hydrocarbon vapors. The FID has a dynamic operating range from 1 ppmv to 10 ppmv or 1 ppmv to 100,000 ppmv, depending on the instrument, and provides a nonspecific response to total hydrocarbons. If concentrations exceed the range of the instrument, a dilution probe shall be attached to the FID to allow elevated vapor concentrations to be measured. The instrument is highly sensitive to compounds such as methane, benzene, and acetone, but is less sensitive to alcohols and halogenated compounds.

During operation, a sample is drawn into the probe and transmitted to the detection chamber by an internal pumping system. Inside the chamber, the sample is exposed to a hydrogen flame that ionizes the organic vapors. As the organic vapors burn, the ions produced are collected on an electrode in the chamber, and a current proportional to the hydrocarbon concentration is generated. This current is measured and displayed on the meter.

The PID uses a photoionization detector to detect and measure total hydrocarbon vapors. The instrument has an operating range of 0-2,000 ppm. During operation, a gas sample is drawn into the probe and past an ultraviolet light source by an internal pumping system. Contaminants in the sample are ionized, producing an instrument response if their ionization potential is equal to or less than the ionizing energy supplied by the lamp. The radiation produces a free electron for each molecule of ionized contaminant, which generates a current directly proportional to the number of ions produced. This current is measured and displayed on the meter. The PID measures the *total* value for all species present with ionization potentials less than or equal to that of the lamp.

### 6.1.8 Total Volatile Organics

A field portable gas chromatograph is employed to generate a chromatogram that is integrated across the entire volatile organic range. Results are reported as Total VOCs/L.

## 6.2 CALIBRATION AND QC PROCEDURES FOR SCREENING METHODS

All screening data shall be flagged with an "S" data qualifier to show the reported data are screening data (see Section 8). The other data qualifiers that shall be used with screening data are also shown in Table 6.2-1 and Section 8. Flagging criteria are applied (except for the "S" flag) when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Table 6.2-1 presents the calibration and QC procedures for each method. These requirements as well as the corrective actions and data flagging criteria are included. In this table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that must be applied in the event that the method-required calibration and QC acceptance criteria are not met.

Table 6.2-1. Summary of Calibration and QC Procedures for Screening Methods

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Data Flagging Criteria <sup>b</sup>
SW-846 <sup>c</sup>	Moisture	Duplicate sample	1 per 20 samples	% solid RPD $\leq$ 15%	Correct problem, repeat measurement. If still out, flag data	J if RPD > 15% and $\leq$ 30%  R if RPD > 30%
SW9050A	Conductance	Calibration with KCl standard	Once per day at beginning of testing	$\pm$ 5%	If calibration is not achieved, check meter, standards, and probe; recalibrate	R
		Field duplicate	10% of field samples	$\pm$ 5%	Correct problem, repeat measurement	J
SW9040B	pH (water)	2-point calibration with pH buffers	Once per day	$\pm$ 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	R
		pH 7 buffer	At each sample location	$\pm$ 0.1 pH units	Correct problem, recalibrate	R
		Field duplicate	10% of field samples	$\pm$ 0.1 pH units	Correct problem, repeat measurement	J
E170.1	Temperature	Field duplicate	10% of field samples	$\pm$ 1 $^{\circ}$ C	Correct problem, repeat measurement	J
E180.1	Turbidity	Calibration with one formazin standard per instrument range used	Once per day at beginning of testing	$\pm$ 5 units, 0-100 range $\pm$ 0.5 units, 0-0.2 range $\pm$ 0.2 units, 0-1 range	If calibration is not achieved, check meter; replace if necessary, recalibrate	R
		Field duplicate	10% of field samples	RPD $\leq$ 20%	Correct problem, repeat measurement	J
None	Organic vapor concentrations (FID and PID)	3 point calibration	Monthly	correlation coefficient $\geq$ 0.995	Recalibrate; check instrument and replace if necessary	R
		Calibration verification and check	Daily at beginning and end of day	Response $\pm$ 20% of expected value	Correct problem, recalibrate	R

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Data Flagging Criteria <sup>b</sup>
E360 1	Dissolved oxygen	Field duplicate	10% of field samples	RPD < 20%	Correct problem, repeat measurement	J
Vendor SOP	Total VOCs	Initial calibrations	Initially at three points and when continuing calibrations fail	%RSD < 30% or r < 0.990	Recalibrate; check instrument and replace if necessary	R
		Continuing calibration	3X per day, morning, noon, end of shift	%D < 25%	Correct problem, recalibrate	R
		LCS	1 per day	70 – 130 %R	Correct problem, reanalyze	R
		Blank	1 per day	Result < RL	Correct problem, reanalyze	R

- a. All corrective actions shall be documented, and the records shall be maintained by the prime contractor
- b. All screening results shall first be flagged with an "S" and also any other appropriate validation flags identified in the Data Flagging Criteria column of the table. For example "SJ", "SB", "SR".
- c. As described in SW3550.

## 7.0 DEFINITIVE DATA ANALYTICAL METHODS AND PROCEDURES

Section 7.1 contains brief descriptions of preparation methods. Section 7.2 contains subsections for each analytical procedure. Each subsection contains the following information:

- A brief method description
- A table of RLs
- A table of QC acceptance criteria
- A table of calibration procedures, QC procedures, and data validation guidelines

This information was obtained from the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (U.S. EPA SW-846, Third Edition, and its first, second and third update); *Handbook for the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)* (Handbook), September 1993; *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9240.1-05-01, EPA-540/R-94-013, PB94-963502, February 1994; and *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9240.1-05, EPA-540/R-94-012, PB94-963501, February 1994. Definitions of terms are given in Section 4.0, and data validation procedures are presented in Section 8.0.

### 7.1 PREPARATION METHODS

Extraction and digestion procedures for liquid and solid matrices presented in this section are outlined in Table 7.1-1. The appropriate preparation method to be used (if applicable) for each analytical method is given in the RL tables.

Table 7.1-1. Extraction and Digestion Procedures

Method	Parameter
SW1311	Toxicity Characteristic Leaching Procedure
SW3005A	Acid Digestion of Water Samples for Metals Analysis
SW3020A	Acid Digestion of Aqueous Samples and Extracts for Metals Analysis
SW3050B	Acid Digestion of Solids, Sediments, and Sludges for Metals Analysis
SW3520C	Continuous Liquid-Liquid Extraction
SW3550B	Ultrasonic Extraction
SW3540C	Soxhlet Extraction
SW5030B	Purge and Trap
SW5035	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

### 7.1.1 Method SW1311–Toxicity Characteristic Leaching Procedure

Method SW1311 is used to prepare samples for determination of the concentration of organic (semivolatile and volatile) and inorganic constituents that are leachable from waste or other material.

QC is accomplished by preparing a toxicity characteristic leaching procedure (TCLP) blank at a rate of one blank for every 20 extractions conducted in the extraction vessel. Additional extract is prepared so one MS is performed for each waste type (samples of similar waste types shall be batched together). One MS must be analyzed in each AFCEE analytical batch. These QA measures are in accordance with the requirements of EPA method SW1311, Section 8.0.

### 7.1.2 Method SW3005A–Acid Digestion of Water Samples for Metals Analysis

This method is an acid digestion procedure used to prepare water samples for metals analysis. The digested samples are analyzed for total recoverable and dissolved metals determination by inductively coupled plasma (ICP).

For analysis of total recoverable metals, the entire sample is acidified at collection time. For analysis of dissolved metals, upon collection the samples are filtered then acidified.

### 7.1.3 Method SW3020A–Acid Digestion of Aqueous Samples and Extracts for Metals Analysis

Method SW3020A prepares aqueous or waste samples for total metals determination by GFAA or ICP. The samples are vigorously digested with acid and then diluted.

#### **7.1.4 Method SW3050B–Acid Digestion of Solids, Sediments, and Sludges for Metals Analysis**

Method SW3050B is applicable to the preparation of sediment, sludge, and soil samples for metals analysis by ICP or, for some metals, by GFAA. A sample is digested then refluxed with acid. A separate aliquot of the sample is dried for a total solids and/or percent moisture determination.

#### **7.1.5 Method SW3520C-Continuous Liquid-Liquid Extraction**

Method SW3520C is a procedure for isolating organic compounds from aqueous samples and is designed for extraction solvents with greater density than the sample.

#### **7.1.6 Method SW3540C/SW3541-Soxhlet Extraction**

Method SW3540C is a procedure for extracting nonvolatile and semivolatile organic compounds from solids such as soils and sludges. Method SW3541 is an automated Soxhlet extraction. The Soxhlet extraction process ensures intimate contact of the sample matrix with the extraction solvent.

#### **7.1.7 Method SW3550B-Ultrasonic Extraction**

Method SW3550B is a procedure for extracting nonvolatile and SVOCs from solids such as soils and sludges. The sonication process ensures intimate contact of the sample matrix with the extraction solvent.

#### **7.1.8 Method SW5030B-Purge and Trap**

Method SW5030B describes sample preparation and extraction for the analysis of VOCs. The method is applicable to nearly all types of samples, including aqueous sludges, caustic liquors, acid liquors, waste solvents, oily wastes, water, tars, fibrous wastes, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments. The success of this method depends on the level of interferences in the sample. Results may vary due to the large variability and complexity of matrices of solid waste samples.

An inert gas is then bubbled through the sample solution at ambient temperature to transfer the volatile components to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column is heated and backflushed with inert gas to desorb the components onto a GC column.

### 7.1.9 Method SW5035-Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

Method SW5035 is a method for analyzing VOCs in solid matrices.

## 7.2 ANALYTICAL PROCEDURES

The analytical procedures presented in this section are outlined in Table 7.2-1.

A brief description and three tables for each method are included in the following subsections. The first table presents the RLs for each analyte in the method. The RLs are presented for both soil and water matrices. The second table presents the acceptance criteria for the accuracy of spiked analyte and surrogate recoveries. This table also presents the acceptance criteria for the precision of matrix, field, and laboratory duplicate recoveries. The third table presents the calibration and QC procedures for each method. Corrective actions and data flagging criteria are also included in this table.

In the third table, the first two columns designate the method number and the class of analytes that may be determined by the method. The third column lists the method-required calibration and QC elements. The fourth column designates the minimum frequency for performing each calibration and QC element. The fifth column designates the acceptance criteria for each calibration and QC element. The sixth column designates the corrective action in the event that a calibration or QC element does not meet the acceptance criteria. The last column designates the data flagging criteria that shall be applied in the event that the method-required calibration and QC acceptance criteria are not met.

Table 7.2-1. Analytical Procedures

Analytical Method	Parameter	Preparatory Methods
8015 (modified)	Ethylene Glycol	Direct Aqueous Injection
8015 (modified)	TPH volatile and extractable (water and soil)	(volatiles) 5030B, 5035 (extractables) 3520C, 3550B
8081A	Organochlorine pesticides (water and soil)	3520C, 3550B
8082	PCBs (water and soil)	3520C, 3540C
8260B	Volatile organics (water and soil)	5030B, 5035
8270C	Semivolatile organics (water and soil)	3520C, 3550B
6010B	Trace metals by ICPEs (water and soil)	3005A, 3050B,
7421	Lead (water and soil)	3020A, 3050B
7470A	Mercury (water)	(see analytical method)
7471A	Mercury (soil)	(see analytical method)

### 7.2.1 Method SW8015 (Modified) - Ethylene Glycol

Ethylene glycol in water or soil may be analyzed using method SW8015. For soil samples the sample is extracted with deionized water prior to direct aqueous injection. The extract is injected into a GC with a flame ionization detector for separation and analysis. The RL is presented in Table 7.2.1-1.

This method provides for the use of a second GC column of dissimilar phase to resolve compounds of interest from interferences that may occur. When second-column analysis is performed, retention times for the analyte must match those established for each column. Otherwise, the chromatographic peaks are considered interferences, and the analyte is not considered to be present in the sample. Requirements for confirmation of the analyte are described in Section 4.5.2. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.1-2 and 7.2.1-3.

**Table 7.2.1-1. RL for Ethylene Glycol by Method SW8015 (Modified)**

Parameter/Method	Analyte	RL	Unit
SW8015	Ethylene Glycol (water)	5000	µg/L
SW8015	Ethylene Glycol (soil)	5000	µg/Kg

**Table 7.2.1-2. QC Acceptance Criteria for Ethylene Glycol by Method SW8015 (Modified)**

Method	Analyte	Accuracy Water (% R)	Precision Water (RPD)	Accuracy Soil (% R)	Precision Soil (RPD)
SW8015	Ethylene glycol	50-150	≤ 30	50-150	≤ 50

Table 7.2.1-3. Summary of Calibration and QC Procedures for Ethylene Glycol by Method SW8015 (Modified)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8015(M)	Ethylene Glycol	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	linear - mean RSD for all analytes $\leq 20\%$ with no individual analyte RSD $> 30\%$ linear - least squares regression $r > 0.995$ non-linear - COD $\geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration	Apply R to the result for EDB for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to the result for EDB for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	$\pm 3$ times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to the result for EDB in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to the result for EDB for all samples associated with the calibration
		Calibration blank	Once per initial daily multipoint calibration	No analyte detected $\geq$ RL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for the specific analyte in all samples associated with the blank
		Calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to the result for EDB in all samples since the last acceptable calibration verification

Table 7.2.1-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*	Flagging Criteria <sup>b</sup>
SW8015(M)	Ethylene Glycol	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.1-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to the EDB result for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to the result for EDB in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.1-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For EDB in all samples in the associated analytical batch;  if the LCS %R > UCL, apply J to all positive results  if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.1-2	Correct problem then reextract and analyze sample	For the samples; if the %R > UCL for any surrogate, apply J to all positive results  if the %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects  If any surrogate recovery is < 10%, apply R to all results

Table 7.2.1-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8015(M)	Ethylene Glycol	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7 2 1-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Second-column confirmation	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis	Apply R to the result for the specific analyte(s) in the sample not confirmed.  Apply J if RPD >40% from first column result
		MDL study	Once per 12 month period	Detection limits established shall be $\leq$ $\frac{1}{2}$ the RLs in Table 7 2.1-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

### 7.2.2 Method SW8015 (Modified)-Volatile and Extractable Total Petroleum Hydrocarbons

Volatile petroleum hydrocarbon components, such as gasoline, jet fuel, and other low molecular weight petroleum products, are analyzed by the direct purge and trap technique described in method SW5030B followed by a modified approach to method SW8015. Extractable TPH components are analyzed by extraction method SW3520C or SW3550B followed by a modified method SW8015.

For volatile TPH, the sample is placed in the purge and trap sparge vessel and analysis is conducted using a GC equipped with a FID.

Extractable TPH components, such as kerosene, diesel, motor oil, and other high molecular weight extractable petroleum products, are analyzed by method SW3520C (continuous liquid/liquid extraction) for water-based matrices or by method SW3550B (sonication extraction) for soil/sludge matrices. The sample is extracted and analysis is accomplished on a GC equipped with a capillary or megabore column and a FID. RLs for volatile TPH and extractable TPH are provided in Table 7.2.2-1.

Identification and quantitation of TPH components require more analytical judgment than other GC methods. The TPH chromatograms consist of groups of peaks that fall within a noted carbon retention time range (i.e., number of carbon atoms in the molecule). Standard fuel components are used to calibrate the instruments. The total petroleum hydrocarbons results are reported in mg/kg or mg/L based on quantitation of the total area count for the gasoline range organics (i.e., C6-C10) or the diesel range organics (i.e., C10-C28). The retention time window shall be set such that the window encompasses only the C6 through C28 range of organics. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.2-2 and 7.2.2-3. Second column confirmation is not required.

Table 7.2.2-1. RLs for Method SW8015 (Modified)

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
Petroleum Hydrocarbons SW8015 (Mod)	Gasoline	0.1	mg/L	10	mg/kg
	Diesel	1.0	mg/L	10.0	mg/kg
	Jet Fuel	1.0	mg/L	10.0	mg/kg

Table 7.2.2-2. QC Acceptance Criteria for Method SW8015 (Modified)

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8015 (Modified) GRO	TPH-Gasoline	67-136	≤ 30	57-146	≤ 50
	<i>Surrogate:</i> Chlorobenzene	74-138		64-148	
SW8015 (Modified) DRO	TPH-Diesel	61-143	≤ 30	51-153	≤ 50
	TPH-Jet Fuel	61-143	≤ 30	51-153	≤ 50
	<i>Surrogates (choose 2):</i>				
	Octacosane	26-152		25-162	
	Ortho-Terphenyl	57-132		47-142	
	Fluorobenzene	75-125		65-135	
	Tricontane	40-140		30-150	

Table 7.2.2-3. Summary of Calibration and QC Procedures for Method SW8015 (Modified)

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	linear - mean RSD for all analytes $\leq 20\%$ with no individual analyte RSD $> 30\%$	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
				linear - least squares regression $r > 0.995$		
				non-linear - COD $\geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)		
		Initial calibration verification	Daily, before sample analysis	All concentration levels of GRO within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Calibration verification	After every 10 samples and at the end of the analysis sequence	All concentration levels within $\pm 15\%$ of initial calibration	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification		
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.2-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst		

Table 7.2.2-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	Method blank	One per analytical batch	No TPH detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.2-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch,  if the LCS %R > UCL, apply J to all positive results  if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.2-2	Correct problem then reextract and analyze sample	For the samples; if the %R > UCL for any surrogate, apply J to all positive results  if the %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects  If any surrogate recovery is < 10%, apply R to all results

Table 7.2.2-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8015 (mod)	Volatile and Extractable Total Petroleum Hydrocarbons	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7 2 2-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Retention time window calculated	Each initial calibration	GRO -- calculate retention time based on 2-methylpentane and 1,2,4-trimethylbenzene (see 7 4 2 in method) DRO - calculate retention time based on C10 and C28 alkanes (see 7 4.3 in method)	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to the result for EDB in the sample
		MDL study	Once per 12 month period	Detection limits established shall be $\leq \frac{1}{2}$ the RLs in Table 7 2 2-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

7.2.3 Method SW8081A-Organochlorine Pesticides

Organochlorine pesticides in water and soil samples are analyzed using method SW8081A. This analytical method involves the extraction of the samples. The pesticides are then separated and quantified by GC using electron capture detection. Reporting limits (RLs) for this method are presented in Table 7.2.3-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.3-2 and 7.2.3-3.

A second-column confirmation is not required for the analysis of toxaphene or chlordane.

Table 7.2.3-1. RLs for Method SW8081A

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
Organochlorine Pesticides SW8081A	$\alpha$ -BHC	0.35	$\mu\text{g/L}$	0.019	mg/kg
	$\beta$ -BHC	0.23	$\mu\text{g/L}$	0.033	mg/kg
	$\delta$ -BHC	0.24	$\mu\text{g/L}$	0.011	mg/kg
	$\gamma$ -BHC (Lindane)	0.25	$\mu\text{g/L}$	0.020	mg/kg
	$\alpha$ -Chlordane	0.80	$\mu\text{g/L}$	0.015	mg/kg
	$\gamma$ -Chlordane	0.37	$\mu\text{g/L}$	0.015	mg/kg
	4,4'-DDD	0.50	$\mu\text{g/L}$	0.042	mg/kg
	4,4'-DDE	0.58	$\mu\text{g/L}$	0.025	mg/kg
	4,4'-DDT	0.81	$\mu\text{g/L}$	0.036	mg/kg
	Aldrin	0.34	$\mu\text{g/L}$	0.022	mg/kg
	Dieldrin	0.44	$\mu\text{g/L}$	0.035	mg/kg
	Endosulfan I	0.30	$\mu\text{g/L}$	0.021	mg/kg
	Endosulfan II	0.40	$\mu\text{g/L}$	0.024	mg/kg
	Endosulfan Sulfate	0.35	$\mu\text{g/L}$	0.036	mg/kg
	Endrin	0.39	$\mu\text{g/L}$	0.036	mg/kg
	Endrin Aldehyde	0.50	$\mu\text{g/L}$	0.016	mg/kg
	Heptachlor	0.40	$\mu\text{g/L}$	0.020	mg/kg
	Heptachlor Epoxide	0.32	$\mu\text{g/L}$	0.021	mg/kg
Methoxychlor	0.86	$\mu\text{g/L}$	0.057	mg/kg	
Toxaphene	0.50	$\mu\text{g/L}$	0.57	mg/kg	

Table 7.2.3-2. QC Acceptance Criteria for Method SW8081A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	
SW8081A	$\alpha$ -BHC	75-125	$\leq 30$	65-135	$\leq 50$	
	$\beta$ -BHC	51-125	$\leq 30$	41-133	$\leq 50$	
	$\delta$ -BHC	75-126	$\leq 30$	65-136	$\leq 50$	
	$\gamma$ -BHC (Lindane)	73-125	$\leq 30$	63-130	$\leq 50$	
	$\alpha$ -Chlordane	41-125	$\leq 30$	31-135	$\leq 50$	
	$\gamma$ -Chlordane	41-125	$\leq 30$	31-133	$\leq 50$	
	4,4-DDD	48-136	$\leq 30$	38-146	$\leq 50$	
	4,4-DDE	45-139	$\leq 30$	35-149	$\leq 50$	
	4,4-DDT	34-143	$\leq 30$	25-153	$\leq 50$	
	Aldrin	47-125	$\leq 30$	37-126	$\leq 50$	
	Dieldrin	42-132	$\leq 30$	32-142	$\leq 50$	
	Endosulfan I	49-143	$\leq 30$	39-153	$\leq 50$	
	Endosulfan II	75-159	$\leq 30$	65-169	$\leq 50$	
	Endosulfan Sulfate	46-141	$\leq 30$	36-151	$\leq 50$	
	Endrin	43-134	$\leq 30$	33-144	$\leq 50$	
	Endrin Aldehyde	75-150	$\leq 30$	65-160	$\leq 50$	
	Heptachlor	45-128	$\leq 30$	35-138	$\leq 50$	
	Heptachlor Epoxide	53-134	$\leq 30$	43-144	$\leq 50$	
	Methoxychlor	73-142	$\leq 30$	63-152	$\leq 50$	
	Toxaphene	41-126	$\leq 30$	31-136	$\leq 50$	
	<i>Surrogates:</i>					
		DCBP	34-133		25-143	
	TCMX	45-125		35-135		

Table 7.2.3-3. Summary of Calibration and QC Procedures for Method SW8081A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8081A	Organo-chlorine pesticides	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	linear - mean RSD for all analytes $\leq 20\%$ with no individual analyte RSD $> 30\%$	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
				linear - least squares regression $r > 0.995$		
				non-linear - COD $\geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)		
		Second-source calibration verification for all analytes	Once per five-point initial calibration	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each initial calibration and calibration verifications	$\pm 3$ times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Calibration verification	After every 10 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification		

Table 7.2.3-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8081A	Organo-chlorine pesticides	Breakdown check (Endrin and DDT)	Daily prior to analysis of samples	Degradation $\leq 15\%$	Repeat breakdown check	Apply J to all positive DDT, DDE, DDD, endrin, endrin ketone and endrin aldehyde results, apply R to the analytes listed above if minimum frequency is not met
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7 2 5-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7 2 5-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch,  if the LCS %R > UCL, apply J to all positive results  if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects

Table 7.2.3-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8081A	Organo-chlorine pesticides	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7 2 5-2	Correct problem then reextract and analyze sample	For the samples, if the %R > UCL for any surrogate, apply J to all positive results  if the %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects  If any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7 2 5-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if; (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		Second-column confirmation (excluding toxaphene and chlordane)	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis	Apply R to the result for the specific analyte(s) in the sample not confirmed.  Apply J if RPD >40% from first column result
		MDL study	Once per 12 month period	Detection limits established shall be $\leq \frac{1}{2}$ the RLs in Table 7 2 5-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

#### 7.2.4 Method SW8082-Polychlorinated Biphenyls (PCBs)

PCBs in water and soil samples are analyzed using method SW8082. This analytical method involves the extraction of the samples. The PCBs are then separated and quantified by GC using electron capture detection or electrolytic conductivity detection. Practical quantitation limits (RLs) for this method are presented in Table 7.2.4-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.4-2 and 7.2.4-3.

For analysis of PCBs, the initial five-point calibration and second source calibration verification shall contain all PCBs. Retention times shall be verified for all analytes during the initial five point calibration. The daily calibration, initial calibration verification and the calibration verification may be done using only a mixture of PCB-1016 and PCB-1260. If a PCB is present (i.e., above the MDL), report the result of the PCB using the response factors from the initial five-point calibration. The LCS and MS/MSD may only be spiked with the 1016/1260 mix. A second-column confirmation is not required.

**Table 7.2.4-1. RLs for Method SW8082**

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
PCBs	PCB-1016	1.00	µg/L	0.70	mg/kg
	PCB-1221	1.00	µg/L	0.70	mg/kg
	PCB-1232	1.00	µg/L	0.70	mg/kg
	PCB-1242	1.00	µg/L	0.70	mg/kg
	PCB-1248	1.00	µg/L	0.70	mg/kg
	PCB-1254	1.00	µg/L	0.70	mg/kg
	PCB-1260	1.00	µg/L	0.70	mg/kg

**Table 7.2.4-2. QC Acceptance Criteria for Method SW8082**

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW8082	PCB-1016	54-125	≤ 30	44-127	≤ 50
	PCB-1221	41-126	≤ 30	31-136	≤ 50
	PCB-1232	41-126	≤ 30	31-136	≤ 50
	PCB-1242	39-150	≤ 30	29-160	≤ 50
	PCB-1248	41-126	≤ 30	31-136	≤ 50
	PCB-1254	29-131	≤ 30	25-141	≤ 50
	PCB-1260	41-126	≤ 30	31-136	≤ 50
	<i>Surrogate:</i> DCBP	34-133		25-143	

Table 7.2.4-3. Summary of Calibration and QC Procedures for Method SW8082

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*	Flagging Criteria*
SW8082	PCBs	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	linear - mean RSD for all analytes $\leq 20\%$ with no individual analyte RSD $> 30\%$	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
				linear - least squares regression $r > 0.995$		
				non-linear - COD $\geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)		
		Second-source calibration verification for PCB 1016/1260 mix	Once per five-point initial calibration	Mix within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for PCB 1016/1260 mix	Each initial calibration and calibration verifications	$\pm 3$ times standard deviation for each analyte retention time from 72-hour study	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Initial calibration verification for PCB 1016/1260 mix	Daily, before sample analysis	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Calibration verification for PCB 1016/1260 mix	After every 20 samples and at the end of the analysis sequence	All analytes within $\pm 15\%$ of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification		

Table 7.2.4-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8082	PCBs	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7 2 6-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS (1016/1260 mix)	One LCS per analytical batch	QC acceptance criteria, Table 7 2 6-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch;  if the LCS %R > UCL, apply J to all positive results  if the LCS %R $\leq$ LCL, apply J to all positive results, apply R to all non-detects

Table 7.2.4-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8082	PCBs	Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.6-2	Correct problem then reextract and analyze sample	For the samples; if the %R > UCL for the surrogate apply J to all positive results  if the %R < LCL for the surrogate, apply J to all positive results, apply R to all non-detects  If the surrogate recovery is < 10%, apply R to all results
		MS/MSD (1016/1260 mix)	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.6-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per 12 month period	Detection limits established shall be $\leq$ $\frac{1}{2}$ the RLS in Table 7.2.6-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

### 7.2.5 Method SW8260B-Volatile Organics

Volatile (or purgeable) organics in water and soil samples are analyzed using method SW8260B. This method uses a capillary column GC/mass spectrometry technique. Volatile compounds are introduced into the GC by purge and trap (SW5030B). An inert gas is bubbled through the water samples (or a soil-water slurry for soil samples) to transfer the purgeable organic compounds from the liquid to vapor phase. Soil samples with higher contaminant levels are extracted using methanol before purging. The vapor is then swept through a sorbent trap where the purgeable organics are trapped. The trap is backflushed and heated to desorb the purgeable organics onto a capillary GC column where they are separated and then detected with a mass spectrometer. The analytes detected and RLs (using a 25 mL purge) for this method are listed in Table 7.2.5-1.

Calibration—The mass spectrometer is tuned daily to give an acceptable spectrum for BFB. The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- mass 50      15 percent to 40 percent of mass 95
- mass 75      30 percent to 60 percent of mass 95
- mass 95      base peak, 100 percent relative abundance
- mass 96      5 percent to 9 percent of mass 95
- mass 173     less than 2 percent of mass 174
- mass 174     greater than 50 percent of mass 95
- mass 175     5 percent to 9 percent of mass 174
- mass 176     greater than 95 percent, but less than 101 percent of mass 174
- mass 177     5 percent to 9 percent of mass 176

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.5-2 and 7.2.5-3.

Table 7.2.5-1. RLs for Method SW8260B

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
VOCs SW8260B	1,1,1,2-Tetrachloroethane	0.5	µg/L	0.003	mg/kg
	1,1,1-TCA	0.8	µg/L	0.004	mg/kg
	1,1,2,2-Tetrachloroethane	0.4	µg/L	0.002	mg/kg
	1,1,2-TCA	1.0	µg/L	0.005	mg/kg
	1,1-DCA	0.4	µg/L	0.002	mg/kg
	1,1-DCE	1.2	µg/L	0.006	mg/kg
	1,1-Dichloropropene	1.0	µg/L	0.005	mg/kg
	1,2,3-Trichlorobenzene	0.3	µg/L	0.002	mg/kg
	1,2,3-Trichloropropane	3.2	µg/L	0.02	mg/kg
	1,2,4-Trichlorobenzene	0.4	µg/L	0.002	mg/kg
	1,2,4-Trimethylbenzene	1.3	µg/L	0.007	mg/kg
	1,2-DCA	0.6	µg/L	0.003	mg/kg
	1,2-DCB	0.3	µg/L	0.002	mg/kg
	1,2-Dibromo-3-chloropropane	2.6	µg/L	0.01	mg/kg
	1,2-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,2-EDB	0.6	µg/L	0.003	mg/kg
	1,3,5-Trimethylbenzene	0.5	µg/L	0.003	mg/kg
	1,3-DCB	1.2	µg/L	0.006	mg/kg
	1,3-Dichloropropane	0.4	µg/L	0.002	mg/kg
	1,4-DCB	0.3	µg/L	0.002	mg/kg
	1-Chlorohexane	0.5	µg/L	0.003	mg/kg
	2,2-Dichloropropane	3.5	µg/L	0.02	mg/kg
	2-Chlorotoluene	0.4	µg/L	0.002	mg/kg
	4-Chlorotoluene	0.6	µg/L	0.003	mg/kg
	Benzene	0.4	µg/L	0.002	mg/kg
	Bromobenzene	0.3	µg/L	0.002	mg/kg
	Bromochloromethane	0.4	µg/L	0.002	mg/kg
	Bromodichloromethane	0.8	µg/L	0.004	mg/kg
	Bromoform	1.2	µg/L	0.006	mg/kg
	Bromomethane	1.1	µg/L	0.005	mg/kg
	Carbon tetrachloride	2.1	µg/L	0.01	mg/kg
	Chlorobenzene	0.4	µg/L	0.002	mg/kg
	Chloroethane	1.0	µg/L	0.005	mg/kg
Chloroform	0.3	µg/L	0.002	mg/kg	
Chloromethane	1.3	µg/L	0.007	mg/kg	
Cis-1,2-DCE	1.2	µg/L	0.006	mg/kg	
Cis-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg	
Dibromochloromethane	0.5	µg/L	0.003	mg/kg	
Dibromomethane	2.4	µg/L	0.01	mg/kg	
Dichlorodifluoromethane	1.0	µg/L	0.005	mg/kg	
Ethylbenzene	0.6	µg/L	0.003	mg/kg	
Hexachlorobutadiene	1.1	µg/L	0.005	mg/kg	

Table 7.2.5-1. Concluded

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
VOCs SW8260B (concluded)	Isopropylbenzene	0.5	µg/L	0.008	mg/kg
	m-Xylene	0.5	µg/L	0.003	mg/kg
	Methylene chloride	0.3	µg/L	0.002	mg/kg
	n-Butylbenzene	1.1	µg/L	0.005	mg/kg
	n-Propylbenzene	0.4	µg/L	0.002	mg/kg
	Naphthalene	0.4	µg/L	0.002	mg/kg
	o-Xylene	1.1	µg/L	0.005	mg/kg
	p-Isopropyltoluene	1.2	µg/L	0.006	mg/kg
	p-Xylene	1.3	µg/L	0.007	mg/kg
	Sec-Butylbenzene	1.3	µg/L	0.007	mg/kg
	Styrene	0.4	µg/L	0.002	mg/kg
	TCE	1.0	µg/L	0.01	mg/kg
	Tert-Butylbenzene	1.4	µg/L	0.007	mg/kg
	Tetrachloroethene	1.4	µg/L	0.007	mg/kg
	Toluene	1.1	µg/L	0.005	mg/kg
	Trans-1,2-DCE	0.6	µg/L	0.003	mg/kg
	Trans-1,3-Dichloropropene	1.0	µg/L	0.005	mg/kg
Trichlorofluoromethane	0.8	µg/L	0.004	mg/kg	
Vinyl chloride	1.1	µg/L	0.009	mg/kg	

Table 7.2.5-2. QC Acceptance Criteria for Method SW8260B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS
SW8260B	1,1,1,2-Tetrachloroethane	72-125	≤ 20	62-108	≤ 30	2
	1,1,1-TCA	75-125	≤ 20	65-135	≤ 30	1
	1,1,2,2-Tetrachloroethane	74-125	≤ 20	64-135	≤ 30	3
	1,1,2-TCA	75-127	≤ 20	65-135	≤ 30	1
	1,1-DCA	72-125	≤ 20	62-135	≤ 30	1
	1,1-DCE	75-125	≤ 20	65-135	≤ 30	1
	1,1-Dichloropropene	75-125	≤ 20	65-135	≤ 30	1
	1,2,3-Trichlorobenzene	75-137	≤ 20	65-147	≤ 30	3
	1,2,3-Trichloropropane	75-125	≤ 20	65-135	≤ 30	3
	1,2,4-Trichlorobenzene	75-135	≤ 20	65-145	≤ 30	3
	1,2,4-Trimethylbenzene	75-125	≤ 20	65-135	≤ 30	3
	1,2-DCA	68-127	≤ 20	58-137	≤ 30	1
	1,2-DCB	75-125	≤ 20	65-135	≤ 30	3
	1,2-Dibromo-3-chloropropane	59-125	≤ 20	49-135	≤ 30	3
	1,2-Dichloropropane	70-125	≤ 20	60-135	≤ 30	1
	1,2-EDB	75-125	≤ 20	65-135	≤ 30	2
	1,3,5-Trimethylbenzene	72-112	≤ 20	62-135	≤ 30	3
	1,3-DCB	75-125	≤ 20	65-135	≤ 30	3
	1,3-Dichloropropane	75-125	≤ 20	65-135	≤ 30	2
	1,4-DCB	75-125	≤ 20	65-135	≤ 30	3
	1-Chlorohexane	75-125	≤ 20	65-135	≤ 30	2
	2,2-Dichloropropane	75-125	≤ 20	65-135	≤ 30	1
	2-Chlorotoluene	73-125	≤ 20	63-135	≤ 30	3
	4-Chlorotoluene	74-125	≤ 20	64-135	≤ 30	3
	Benzene	75-125	≤ 20	65-135	≤ 30	1
	Bromobenzene	75-125	≤ 20	65-135	≤ 30	3
	Bromochloromethane	73-125	≤ 20	63-135	≤ 30	1
	Bromodichloromethane	75-125	≤ 20	65-135	≤ 30	1
	Bromoform	75-125	≤ 20	65-135	≤ 30	2
	Bromomethane	72-125	≤ 20	62-135	≤ 30	1
	Carbon Tetrachloride	62-125	≤ 20	52-135	≤ 30	1
	Chlorobenzene	75-125	≤ 20	65-135	≤ 30	2
	Chloroethane	65-125	≤ 20	55-135	≤ 30	1
	Chloroform	74-125	≤ 20	64-135	≤ 30	1
	Chloromethane	75-125	≤ 20	65-135	≤ 30	1
	Cis-1,2-DCE	75-125	≤ 20	65-135	≤ 30	1
	Cis-1,3-Dichloropropene	74-125	≤ 20	64-135	≤ 30	1
	Dibromochloromethane	73-125	≤ 20	63-135	≤ 30	2
	Dibromomethane	69-127	≤ 20	59-137	≤ 30	1
	Dichlorodifluoromethane	75-125	≤ 20	65-135	≤ 30	1

Table 7.2.5-2. Concluded

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS	
SW8260B (Concluded)	Ethylbenzene	75-125	≤ 20	65-135	≤ 30	2	
	Hexachlorobutadiene	75-125	≤ 20	65-135	≤ 30	3	
	Isopropylbenzene	75-125	≤ 20	65-135	≤ 30	3	
	m-Xylene	75-125	≤ 20	65-135	≤ 30	2	
	Methylene chloride	75-125	≤ 20	65-135	≤ 30	1	
	n-Butylbenzene	75-125	≤ 20	65-135	≤ 30	3	
	n-Propylbenzene	75-125	≤ 20	65-135	≤ 30	3	
	Naphthalene	75-125	≤ 20	65-135	≤ 30	3	
	o-Xylene	75-125	≤ 20	65-135	≤ 30	2	
	p-Isopropyltoluene	75-125	≤ 20	65-135	≤ 30	3	
	p-Xylene	75-125	≤ 20	65-135	≤ 30	2	
	Sec-Butylbenzene	75-125	≤ 20	65-135	≤ 30	3	
	Styrene	75-125	≤ 20	65-135	≤ 30	2	
	TCE	71-125	≤ 20	61-135	≤ 30	1	
	Tert-butylbenzene	75-125	≤ 20	65-135	≤ 30	3	
	Tetrachloroethene	71-125	≤ 20	61-135	≤ 30	2	
	Toluene	74-125	≤ 20	64-135	≤ 30	1	
	Trans-1,2-DCE	75-125	≤ 20	65-135	≤ 30	1	
	Trans-1,3-Dichloropropene	66-125	≤ 20	56-135	≤ 30	1	
	Trichlorofluoromethane	67-125	≤ 20	57-135	≤ 30	1	
	Vinyl Chloride	46-134	≤ 20	36-144	≤ 30	1	
	<i>Surrogates:</i>						
		Dibromofluoromethane	75-125		65-135		
		Toluene-D8	75-125		65-135		
		4-Bromofluorobenzene	75-125		65-135		
		1,2-DCA-D4	62-139		52-149		
<i>Internal Standards:</i>							
	Fluorobenzene					1	
	Chlorobenzene-D5					2	
	1,4-Dichlorobenzend-D					3	

Table 7.2.5-3. Summary of Calibration and QC Procedures for Method SW8260B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8260B	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF $\geq 0.30^c$ and %RSD for RFs for CCCs $\leq 30\%$ and one option below	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration
				<i>option 1 linear</i> - mean RSD for all analytes $\leq 15\%$ with no individual analyte RSD $> 30\%$		
				<i>option 2 linear</i> - least squares regression $r > 0.995$		
				<i>option 3 non-linear</i> - COD $\geq 0.990$ (6 points shall be used for second order, 7 points shall be used for third order)		
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm 25\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each sample	Relative retention time (RRT) of the analyte within $\pm 0.06$ RRT units of the RRT	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF $\geq 0.30^c$ , and CCCs $\leq 20\%$ difference (when using RFs) or drift (when using least squares regression or non-linear calibration)	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration verification
All calibration analytes within $\pm 20\%$ of expected value	Apply R to all results for specific analyte(s) for all samples associated with the Cal. verification					

Table 7.2.5-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8260B	Volatile Organics	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.9-2	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		ISs	Immediately after or during data acquisition for each sample	Retention time $\pm 30$ seconds from retention time of the mid-point std in the ICAL  EICP area within -50% to +100% of ICAL mid-point std.	Inspect mass spectrometer and GC for malfunctions, mandatory reanalysis of samples analyzed while system was malfunctioning	Apply R to all results for analytes associated with the IS
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7.2.9-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the batch, if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.9-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL

Table 7.2.5-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8260B	Volatile Organics	Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 7.2.9)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.9-2	Correct problem then reextract and analyze sample	For the samples,  if the %R > UCL for a surrogate, apply J to all positive results  if the %R < LCL for a surrogate, apply J to all positive results, apply R to all non-detect results  If any surrogate recovery is <10%, apply R to all results
		MDL study	Once per 12 month period	Detection limits established shall be $\leq \frac{1}{2}$ the RLs in Table 7.2.9-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.
- c. Except > 0.10 for bromoform, and > 0.10 for chloromethane and 1,1-dichloroethane

### 7.2.6 Method SW8270C-Semivolatile Organics

Semivolatile organics (also known as base/neutral and acid extractables) in water and soil samples are analyzed using method SW8270C. This technique determines quantitatively the concentration of a number of SVOCs. Samples are extracted and both base/neutral and acid extracts are then concentrated through evaporation. Compounds of interest are separated and quantified using a capillary column GC/mass spectrometer. The RLs are listed in Table 7.2.6.

The mass spectrometer is tuned every 12 hours to give an acceptable spectrum for decafluorotriphenylphosphine (DFTPP). The tuning acceptance criteria are given in the following list as an ion abundance for each specified mass:

- mass 51-30 percent to 60 percent of mass 198
- mass 68 less than 2 percent of mass 69
- mass 70 less than 2 percent of mass 69
- mass 127 40 percent to 60 percent of mass 198
- mass 197 less than 1 percent of mass 198
- mass 198 base peak, 100 percent relative abundance
- mass 199 5 percent to 9 percent of mass 198
- mass 275 10 percent to 30 percent of mass 198
- mass 365 greater than 1 percent of mass 198
- mass 441 present, but less than mass 443
- mass 442 greater than 40 percent of mass 198
- mass 443 17 percent to 23 percent of mass 442

The IS method is used for quantitation of analytes of interest. For quantitation, RFs are calculated from the base ion peak of a specific IS that is added to each calibration standard, blank, QC sample, and sample. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.6.2 and 7.2.6.3.

Table 7.2.6-1. RLs for Method SW8270C

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
Semivolatile organics Base/Neutral Extractables SW8270C	1,2,4-Trichlorobenzene	10.0	µg/L	0.7	mg/kg
	1,2-DCB	10.0	µg/L	0.7	mg/kg
	1,3-DCB	10.0	µg/L	0.7	mg/kg
	1,4-DCB	10.0	µg/L	0.7	mg/kg
	2,4-DNT	10.0	µg/L	0.7	mg/kg
	2,6-DNT	10.0	µg/L	0.7	mg/kg
	2-Chloronaphthalene	10.0	µg/L	0.7	mg/kg
	2-Methylnaphthalene	10.0	µg/L	0.7	mg/kg
	2-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3-Nitroaniline	50.0	µg/L	3.3	mg/kg
	3,3'-Dichlorobenzidine	20.0	µg/L	1.3	mg/kg
	4-Bromophenyl phenyl ether	10.0	µg/L	0.7	mg/kg
	4-Chloroaniline	20.0	µg/L	1.3	mg/kg
	4-Chlorophenyl phenyl ether	10.0	µg/L	0.7	mg/kg
	4-Nitroaniline	50.0	µg/L	3.3	mg/kg
	Acenaphthylene	10.0	µg/L	0.7	mg/kg
	Acenaphthene	10.0	µg/L	0.7	mg/kg
	Anthracene	10.0	µg/L	0.7	mg/kg
	Benz (a) anthracene	10.0	µg/L	0.7	mg/kg
	Benzo (a) pyrene	10.0	µg/L	0.7	mg/kg
	Benzo (b) fluoranthene	10.0	µg/L	0.7	mg/kg
	Benzo (g,h,i) perylene	10.0	µg/L	0.7	mg/kg
	Benzyl alcohol	20.0	µg/L	1.3	mg/kg
	Bis (2-chloroethoxy) methane	10.0	µg/L	0.7	mg/kg
	Bis (2-chlorethyl) ether	10.0	µg/L	0.7	mg/kg
	Bis (2-chloroisopropyl) ether	10.0	µg/L	0.7	mg/kg
	Bis (2-ethylhexyl) phthalate	10.0	µg/L	0.7	mg/kg
	Butyl benzylphthalate	10.0	µg/L	0.7	mg/kg
	Chrysene	10.0	µg/L	0.7	mg/kg
	Di-n-butylphthalate	10.0	µg/L	0.7	mg/kg
	Di-n-octylphthalate	10.0	µg/L	0.7	mg/kg
	Dibenz (a,h) anthracene	10.0	µg/L	0.7	mg/kg
	Dibenzofuran	10.0	µg/L	0.7	mg/kg
	Diethyl phthalate	10.0	µg/L	0.7	mg/kg
	Dimethyl phthalate	10.0	µg/L	0.7	mg/kg
	Fluoranthene	10.0	µg/L	0.7	mg/kg
	Fluorene	10.0	µg/L	0.7	mg/kg
	Hexachlorobenzene	10.0	µg/L	0.7	mg/kg
	Hexachlorobutadiene	10.0	µg/L	0.7	mg/kg
	Hexachlorocyclopentadiene	10.0	µg/L	0.7	mg/kg
	Hexachloroethane	10.0	µg/L	0.7	mg/kg
Indeno (1,2,3-cd) pyrene	10.0	µg/L	0.7	mg/kg	
Isophorone	10.0	µg/L	0.7	mg/kg	

Table 7.2.6-1. Concluded

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
Semivolatile organics Base/Neutral Extractables SW8270C (concluded)	n-Nitrosodiphenylamine	10.0	µg/L	0.7	mg/kg
	n-Nitrosodi-n-propylamine	10.0	µg/L	0.7	mg/kg
	Naphthalene	10.0	µg/L	0.7	mg/kg
	Nitrobenzene	10.0	µg/L	0.7	mg/kg
	Phenanthrene	10.0	µg/L	0.7	mg/kg
	Pyrene	10.0	µg/L	0.7	mg/kg
Semivolatile organics Acid Extractables SW8270C	2,4,5-Trichlorophenol	50.0	µg/L	3.3	mg/kg
	2,4,6-Trichlorophenol	10.0	µg/L	0.3	mg/kg
	2,4-Dichlorophenol	10.0	µg/L	0.3	mg/kg
	2,4-Dimethylphenol	10.0	µg/L	0.3	mg/kg
	2,4-Dinitrophenol	50.0	µg/L	3.3	mg/kg
	2-Chlorophenol	10.0	µg/L	0.3	mg/kg
	2-Methylphenol	10.0	µg/L	0.3	mg/kg
	2-Nitrophenol	10.0	µg/L	0.3	mg/kg
	4,6-Dinitro-2-methylphenol	50.0	µg/L	3.3	mg/kg
	4-Chloro-3-methylphenol	20.0	µg/L	1.3	mg/kg
	4-Methylphenol	10.0	µg/L	0.3	mg/kg
	4-Nitrophenol	50.0	µg/L	1.6	mg/kg
	Benzoic acid	50.0	µg/L	1.6	mg/kg
	Pentachlorophenol	50.0	µg/L	3.3	mg/kg
Phenol	10.0	µg/L	0.3	mg/kg	

Table 7.2.6-2. QC Acceptance Criteria for Method SW8270C

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS	Assoc. Sur.
SW8270C	1,2,4-Trichlorobenzene	44-142	≤ 20	34-152	≤ 30	2	4
	1,2-DCB	42-155	≤ 20	32-135	≤ 30	1	3
	1,3-DCB	36-125	≤ 20	26-135	≤ 30	1	3
	1,4-DCB	30-125	≤ 20	25-135	≤ 30	1	3
	2,4-DNT	39-139	≤ 20	29-149	≤ 30	3	4
	2,6-DNT	51-125	≤ 20	41-135	≤ 30	3	4
	2-Chloronaphthalene	60-125	≤ 20	50-135	≤ 30	3	4
	2-Methylnaphthalene	41-125	≤ 20	31-135	≤ 30	2	5
	2-Nitroaniline	50-125	≤ 20	40-135	≤ 30	3	2
	3,3'-Dichlorobenzidine	29-175	≤ 20	25-175	≤ 30	5	6
	3-Nitroaniline	51-125	≤ 20	41-135	≤ 30	3	2
	4-Bromophenyl phenyl ether	53-127	≤ 20	43-137	≤ 30	4	1
	4-Chloroaniline	45-136	≤ 20	35-146	≤ 30	2	5
	4-Chlorophenyl phenyl ether	51-132	≤ 20	41-142	≤ 30	3	4
	4-Nitroaniline	40-143	≤ 20	30-153	≤ 30	3	2
	Acenaphthylene	47-125	≤ 20	37-135	≤ 30	3	4
	Acenaphthene	49-125	≤ 20	39-135	≤ 30	3	4
	Anthracene	45-165	≤ 20	35-175	≤ 30	4	1
	Benz (a) anthracene	51-133	≤ 20	41-143	≤ 30	5	6
	Benzo (a) pyrene	41-125	≤ 20	31-135	≤ 30	6	6
	Benzo (b) fluoranthene	37-125	≤ 20	27-135	≤ 30	6	6
	Benzo (g,h,i) perylene	34-149	≤ 20	25-159	≤ 30	6	6
	Benzyl alcohol	35-125	≤ 20	25-135	≤ 30	1	3
	Bis (2-chloroethoxy) methane	49-125	≤ 20	39-135	≤ 30	2	5
	Bis (2-chloroethyl) ether	44-125	≤ 20	34-135	≤ 30	1	3
	Bis (2-chloroisopropyl) ether	36-166	≤ 20	26-175	≤ 30	1	3
	Bis (2-ethylhexyl) phthalate	33-129	≤ 20	25-139	≤ 30	5	6
	Butyl benzyl phthalate	26-125	≤ 20	25-135	≤ 30	5	6
	Chrysene	55-133	≤ 20	45-143	≤ 30	5	6
	Di-n-butyl phthalate	34-126	≤ 20	25-136	≤ 30	4	1
	Di-n-octyl phthalate	38-127	≤ 20	28-137	≤ 30	5	6
	Dibenz (a,h) anthracene	50-125	≤ 20	40-135	≤ 30	6	6
	Dibenzofuran	52-125	≤ 20	42-135	≤ 30	3	4
	Diethyl phthalate	37-125	≤ 20	27-135	≤ 30	3	4
	Dimethyl phthalate	25-175	≤ 20	25-175	≤ 30	3	4
	Fluoranthene	47-125	≤ 20	37-135	≤ 30	4	1
	Fluorene	48-139	≤ 20	38-149	≤ 30	3	2

Table 7.2.6-2. Continued

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Assoc. IS	Assoc. Sur.
SW8270C (Continued)	Hexachlorobenzene	46-133	≤ 20	36-143	≤ 30	4	1
	Hexachlorobutadiene	25-125	≤ 20	25-135	≤ 30	2	5
	Hexachlorocyclopentadiene	41-125	≤ 20	31-135	≤ 30	3	2
	Hexachloroethane	25-153	≤ 20	25-163	≤ 30	1	3
	Indeno (1,2,3-c,d) pyrene	27-160	≤ 20	25-170	≤ 30	6	6
	Isophorone	26-175	≤ 20	25-175	≤ 30	2	5
	n-Nitrosodi-n-propylamine	37-125	≤ 20	27-135	≤ 30	1	3
	n-Nitrosodiphenylamine	27-125	≤ 20	25-135	≤ 30	4	1
	Naphthalene	50-125	≤ 20	40-135	≤ 30	2	5
	Nitrobenzene	46-133	≤ 20	36-143	≤ 30	2	4
	Phenanthrene	54-125	≤ 20	44-135	≤ 30	4	1
	Pyrene	47-136	≤ 20	37-146	≤ 30	5	6
	2,4,5-Trichlorophenol	25-175	≤ 20	25-175	≤ 30	3	1
	2,4,6-Trichlorophenol	39-128	≤ 20	29-138	≤ 30	3	1
	2,4-Dichlorophenol	46-125	≤ 20	36-135	≤ 30	2	5
	2,4-Dimethylphenol	45-139	≤ 20	35-149	≤ 30	2	5
	2,4-Dinitrophenol	30-151	≤ 20	25-161	≤ 30	3	4
	2-Chlorophenol	41-125	≤ 20	31-135	≤ 30	1	3
	2-Methylphenol	25-125	≤ 20	25-135	≤ 30	1	3
	2-Nitrophenol	44-125	≤ 20	34-135	≤ 30	2	4
	4,6-Dinitro-2-Methyl Phenol	26-134	≤ 20	25-144	≤ 30	4	1
	4-Chloro-3-Methyl Phenol	44-125	≤ 20	34-135	≤ 30	2	5
	4-Methylphenol	33-125	≤ 20	25-135	≤ 30	1	3
	4-Nitrophenol	25-131	≤ 20	25-141	≤ 30	3	2
	Benzoic Acid	25-162	≤ 20	25-172	≤ 30	2	5
	Pentachlorophenol	28-136	≤ 20	38-146	≤ 30	4	1
	Phenol	25-125	≤ 20	25-135	≤ 30	1	5

Table 7.2.6-2. Concluded

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)	Number
SW8270C (Concluded)	<i>Surrogates:</i>					
	2,4,6-Tribromophenol	25-134		25-144		1
	2-Fluorobiphenyl	43-125		34-135		2
	2-Fluorophenol	25-125		25-135		3
	Nitrobenzene-D5	32-125		25-135		4
	Phenol-D5	25-125		25-135		5
	Terphenyl-D14	42-126		32-136		6
	<i>Internal Standards:</i>					
	1,4-Dichlorobenzene-D4					1
	Naphthalene-D8					2
	Acenaphthalene-D8					3
	Phenanthrene-D10					4
	Chrysene-D12					5
	Perylene-D12					6

Table 7.2.6-3. Summary of Calibration and QC Procedures for Method SW8270C

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*	Flagging Criteria <sup>b</sup>
SW8270C	Volatile Organics	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	SPCCs average RF $\geq$ 0.050 and %RSD for RFs for CCCs $\leq$ 30% and one option below	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration
				<i>option 1 linear</i> - mean RSD for all analytes $\leq$ 15% with no individual analyte RSD > 30%		
				<i>option 2 linear</i> - least squares regression $r >$ 0.995		
				<i>option 3 non-linear</i> - COD $\geq$ 0.990 (6 points shall be used for second order, 7 points shall be used for third order)		
		Second-source calibration verification	Once per five-point initial calibration	All analytes within $\pm$ 25% of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Retention time window calculated for each analyte	Each sample	Relative retention time (RRT) of the analyte within $\pm$ 0.06 RRT units of the RRT	Correct problem then reanalyze all samples analyzed since the last retention time check	Apply R to all results for the specific analyte(s) in the sample
		Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	SPCCs average RF $\geq$ 0.050, and CCCs $\leq$ 20% difference (when using RFs) or drift (when using least squares regression or non-linear calibration)	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration verification
All calibration analytes within $\pm$ 20% of expected value	Apply R to all results for specific analyte(s) for all samples associated with the cal. verification					

Table 7.2.6-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8270C	Volatile Organics	Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7 2 10-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		ISs	Immediately after or during data acquisition for each sample	Retention time $\pm 30$ seconds from retention time of the mid-point std in the ICAL  EICP area within -50% to +100% of ICAL mid-point std	Inspect mass spectrometer and GC for malfunctions, mandatory reanalysis of samples analyzed while system was malfunctioning	Apply R to all results for analytes associated with the IS
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 7 2 10-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the batch, if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7 2 10-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3) MS/MSD RPD > CL

Table 7.2.6-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW8270C	Volatile Organics	Check of mass spectral ion intensities using DFTPP	Prior to initial calibration and calibration verification	Refer to criteria listed in the method description (section 7.2.10)	Retune instrument and verify	Apply R to all results for all samples associated with the tune
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 7.2.10-2	Correct problem then reextract and analyze sample	For the samples, if the %R > UCL for a surrogate, apply J to all positive results of analytes associated with the surrogate  if the %R < LCL for a surrogate, apply J to all positive results of analytes associated with the surrogate, apply R to all non-detect results of analytes associated with the surrogate  If any surrogate recovery is < 10%, apply R to all results of analytes associated with the surrogate
		MDL study	Once per 12 month period	Detection limits established shall be $\leq$ 1/2 the RLs in Table 7.2.10-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

a. All corrective actions associated with AFCBE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

### **7.2.7 Method SW6010B-Trace Elements (Metals) by Inductively Coupled Plasma Atomic Emission Spectroscopy for Water and Soil**

Samples are analyzed for trace elements or metals using method SW6010B for water and soils. Analysis for most metals requires digestion of the sample. Following digestion, the trace elements are determined simultaneously or sequentially using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPES). The elements and corresponding RLs for this method are listed in Table 7.2.7-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.7-2 and 7.2.7-3.

Table 7.2.7-1. RLs for Method SW6010B

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
ICP Screen for Metals SW6010B	Arsenic	0.03	mg/L	40.0	mg/kg
	Barium	0.005	mg/L	1.0	mg/kg
	Cadmium	0.007	mg/L	0.50	mg/kg
	Chromium	0.01	mg/L	20	mg/kg
	Lead	0.025	mg/L	10.0	mg/kg
	Selenium	0.03	mg/L	3.0	mg/kg
	Silver	0.01	mg/L	1.0	mg/kg

Table 7.2.7-2. QC Acceptance Criteria for Method SW6010B

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW6010B	Arsenic	75-125	≤ 20	75-125	≤ 20
	Barium	75-125	≤ 20	75-125	≤ 20
	Cadmium	75-125	≤ 20	75-125	≤ 20
	Chromium	75-125	≤ 20	75-125	≤ 20
	Lead	75-125	≤ 20	75-125	≤ 20
	Selenium	75-125	≤ 20	75-125	≤ 20
	Silver	75-125	≤ 20	75-125	≤ 20

Table 7.2.7-3. Summary of Calibration and QC Procedures for Method SW6010B

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action*	Flagging Criteria <sup>b</sup>
SW6010B	ICP Metals	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis	N/A	N/A	Apply R to all results for specific analyte(s) for all samples associated with the calibration if calibration not done
		Initial calibration verification (second source)	Daily after initial calibration	All analytes within $\pm 10\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Calibration blank	After every calibration verification	No analytes detected $\geq$ RL	Correct problem then analyze calibration blank and previous 10 samples	Apply B to all results for specific analyte(s) in all samples associated with the blank
		Calibration verification (Instrument Check Standard)	After every 10 samples and at the end of the analysis sequence	All analyte(s) within $\pm 10\%$ of expected value and RSD of replicate integrations $< 5\%$	Repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.15-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Table 7.2.7-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW6010B	ICP Metals	Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
		Interference check solution (ICS)	At the beginning of an analytical run	Within $\pm 20\%$ of expected value	Terminate analysis, correct problem, reanalyze ICS, reanalyze all affected samples	Apply R to all results for specific analyte(s) in all samples associated with the ICS
		LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.15-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch,  if the LCS %R > UCL, apply J to all positive results  if the LCS %R < LCL, apply J to positive results apply R to all non-detects
		Dilution test	Each new sample matrix	1:5 dilution must agree within $\pm 10\%$ of the original determination	Perform post digestion spike addition	Apply J to all sample results if either of following exist (1) dilution test not run (2) RPD $\geq 10\%$

Table 7.2.7-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW6010B	ICP Metals	Post digestion spike addition	When dilution test fails	Recovery within 75-125% of expected results	Correct problem then reanalyze post digestion spike addition	Apply J to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post digestion spike addition  If post digestion spike addition recovery is < 10%, apply R to all sample results (for same matrix) for specific analyte(s) for all samples associated with the post digestion spike addition
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.15-2	none	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per 12 month period	Detection limits established shall be $\leq \frac{1}{2}$ the RLs in Table 7.2.15-1	none	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

### 7.2.8 Method SW7421–Graphite Furnace Atomic Absorption (Lead)

GFAA is used to measure low concentrations of metals in water and soil samples. The samples are extracted as appropriate. Discrete aliquots of sample extract are deposited in a graphite tube furnace in microliter amounts. The graphite tube is heated resistively by an electrical current. The sample solution is dried and charred to remove sample matrix components and then atomized at temperatures sufficient to vaporize the Lead. Matrix modification is used to eliminate interference effects and may also enhance the vaporization efficiency and allow lower detection limits. RLs for this analysis are listed in Table 7.2.8-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.8-2 and 7.2.8-3.

Table 7.2.8-1. RLs for Method SW7421

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
SW7421	Lead	0.005	mg/L	0.5	mg/kg

Table 7.2.8-2. QC Acceptance Criteria for Method SW7421

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW7421	Lead	74-124	≤ 15	74-124	≤ 25

Table 7.2.8-3. Summary of Calibration and QC Procedures for Method SW7421

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW7421	Lead	Initial multipoint calibration (minimum 3 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient $\geq 0.995$ for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within $\pm 10\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Calibration blank	Once per initial daily multipoint calibration	No analyte detected $\geq$ RL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for the specific analyte in all samples associated with the blank
		Calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within $\pm 20\%$ of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.22-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte in all samples in the associated analytical batch

Table 7.2.8-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action†	Flagging Criteria <sup>b</sup>
SW7421	Lead	LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.22-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte in all samples in the associated analytical batch,  if the LCS %R > UCL, apply J to all positive results  if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Dilution test, five-fold dilution test	Each preparatory batch	Five times dilution sample result must be $\pm 10\%$ of the undiluted sample result	Perform recovery test	Apply J to all sample results if either of following exist. (1) dilution test not run (2) RPD $\geq 10\%$
		Recovery test	When dilution test fails	Recovery within 85-115% of expected results	Run all samples by the method of standard addition	Apply J to all sample results (for same matrix) in which method of standard addition was not run when recovery outside of 85-115% range

Table 7.2.8-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW7421	Lead	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7 2 22-2	none	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per 12 month period	Detection limits established shall be $\leq$ $\frac{1}{2}$ the RLs in Table 7 2 22-1	none	Apply R to all results for the specific analyte in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

- a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.
- b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

### 7.2.9 Method SW7470A/SW7471A—Mercury Manual Cold-Vapor Technique

Water and soil samples are analyzed for mercury using methods SW7470A and SW7471A, respectively. This method is a cold-vapor, flameless atomic absorption (AA) technique based on the absorption of radiation by mercury vapor. Mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an AA spectrophotometer. Mercury concentration is measured as a function of absorbance. The RLs for these methods are listed in Table 7.2.9-1. The calibration, QC, corrective action, and data flagging requirements are given in Tables 7.2.9-2 and 7.2.9-3.

Table 7.2.9-1. RLs for Method SW7470A/SW7471A

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
SW7470A (W) SW7471A (S)	Mercury	0.001	mg/L	0.1	mg/kg

Table 7.2.9-2. QC Acceptance Criteria for Method SW7470A/SW7471A

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
SW7470A/SW7471A	Mercury	77-120	≤ 15	77-120	≤ 25

Table 7.2.9-3. Summary of Calibration and QC Procedures for Method  
SW7470A/SW7471A

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW7470A SW7471A	Mercury	Initial multipoint calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis	Correlation coefficient $\geq 0.995$ for linear regression	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Second-source calibration check standard	Once per initial daily multipoint calibration	Analyte within $\pm 10\%$ of expected value	Correct problem then repeat initial calibration	Apply R to all results for specific analyte for all samples associated with the calibration
		Calibration blank	Once per initial daily multipoint calibration	No analyte detected $\geq$ RL	Correct problem then reanalyze calibration blank and all samples associated with blank	Apply B to all results for the specific analyte in all samples associated with the blank
		Calibration verification	After every 10 samples and at the end of the analysis sequence	The analyte within $\pm 20\%$ of expected value	Correct problem then repeat calibration and reanalyze all samples since last successful calibration	Apply R to all results for the specific analyte in all samples since the last acceptable calibration
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.2.23-2	Recalculate results, locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No analytes detected $\geq$ RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte in all samples in the associated analytical batch

Table 7.2.9-3. Continued

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW7470A SW7471A	Mercury	LCS for the analyte	One LCS per analytical batch	QC acceptance criteria, Table 7.2.23-2	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte in all samples in the associated analytical batch,  if the LCS %R > UCL, apply J to all positive results  if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Dilution test, five-fold dilution test	Each preparatory batch	Five times dilution sample result must be $\pm 10\%$ of the undiluted sample result	Perform recovery test	Apply J to all sample results if either of following exist (1) dilution test not run (2) RPD $\geq 10\%$
		Recovery test	When dilution test fails	Recovery within 85-115% of expected results	Run all samples by the method of standard addition	Apply J to all sample results (for same matrix) in which method of standard addition was not run when recovery outside of 85-115% range

Table 7.2.9-3. Concluded

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action <sup>a</sup>	Flagging Criteria <sup>b</sup>
SW7470A SW7471A	Mercury	MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 7.2.23-2	none	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if, (1)%R for MS or MSD > UCL or (2)%R for MS or MSD < LCL or (3)MS/MSD RPD > CL
		MDL study	Once per 12 month period	Detection limits established shall be $\leq$ $\frac{1}{2}$ the RLs in Table 7.2.23-1	none	Apply R to all results for the specific analyte in all samples analyzed
		Results reported between MDL and RL	none	none	none	Apply F to all results between MDL and RL

a. All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

b. Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

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## 8.0 DATA REDUCTION, REVIEW, VERIFICATION, REPORTING, VALIDATION, AND RECORDKEEPING

The data reduction, review, reporting, and validation procedures described in this section will ensure; (1) complete documentation is maintained, (2) transcription and data reduction errors are minimized, (3) the data are reviewed and documented, and (4) the reported results are qualified if necessary. Laboratory data reduction and verification procedures are required to ensure the overall objectives of analysis and reporting meet method and project specifications.

### 8.1 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR SCREENING DATA

The analysts shall perform a 100 percent review of the screening data. The screening data methods are identified in Table 6-1 of Section 6. All screening data shall be qualified with an *S* flag and shall be further qualified if critical calibration and QC requirements are not acceptable. The calibration, QC requirements, corrective action requirements, and flagging criteria required are shown in Table 6.2-1 in Section 6. The flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed. "S" designator flags shall be maintained in the final data qualification. When the data are reviewed and qualified, the analyst shall apply a final qualifier to any data that has been affected by multiple qualifiers. This final qualifier shall reflect the most severe qualifier that was applied to the data. The allowable final data qualifiers for screening data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are *SR*, *SJ*, *SB*, and *SU*. Therefore, the allowable final data qualifiers for screening data are *SR*, *SJ*, *SB*, *SU*, and *S*.

The definitions of the data qualifiers are shown in Table 8.2-1. A summary of the flagging conventions of field screening methods is given in Table 6.2-1.

Screening data report packages shall be prepared for all field analyses as described in Section 8.8. The screening data shall be reported on the AFCEE screening data report forms (AFCEE Forms S-1 through S-3), as illustrated in Section 8.8. The prime contractor's project manager shall review the entire screening data report package with the field records. The prime contractor (1) shall determine if the data quality objectives have been met, and (2) shall calculate the data completeness for the project. These results shall be included in the data package deliverable.

## 8.2 DATA REVIEW, VALIDATION, AND REPORTING REQUIREMENTS FOR DEFINITIVE DATA

MDLs and results shall be reported to one decimal place more than the corresponding RL. Soil/sediment samples shall have results reported on a dry weight basis. A wet weight aliquot of sample equivalent to the method specified dry weight aliquot of sample shall be taken for analysis (i.e., RLs and MDLs are NOT adjusted for dry weight). RLs and MDLs are adjusted for dilutions.

In each laboratory analytical section, the analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the supervisor of the respective analytical section using the same criteria.

The definitive data methods are identified in Section 7.2. The calibration, QC requirements, corrective action requirements, and flagging criteria required for definitive data are shown in the tables in Section 7.2, and in summary Tables 8.2-2, 8.2-3, and 8.2-4. The flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Data qualifiers shall be added or, if applied by a software package, reviewed by the laboratory supervisor of the respective analytical section, after the first and second level of laboratory data reviews have been performed. Analytical batch comments shall be added to the first page of the definitive data report packages to explain any nonconformance or other issues. When data are qualified, the laboratory supervisor shall apply a final qualifier to any data that have been affected by multiple qualifiers. This final qualifier shall reflect the most severe qualifier that was applied to the data, i.e., all data will have only one data qualifying flag associate with it. The allowable final data qualifiers for definitive data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are *R*, *M*, *F*, *J*, *B*, and *U*. The definitions of the data qualifiers are shown in Table 8.2-1.

The one exception to these data flagging criteria rules applies to the tentatively identified compounds (TICs) that are identified only in the GC/MS methods. These TICs numerical results will always be qualified with one and only one flag for any reason, and that is the "T" flag.

The laboratory QA section shall perform a 100 percent review of 10 percent of the completed data packages, and the laboratory project manager shall perform a sanity check review on all the completed data packages.

The prime contractor's project manager shall review the entire definitive data report package, and with the field records, apply the final data qualifiers for the definitive data. The laboratory shall apply data qualifying flags to each environmental field QC sample, i.e., ambient blanks, equipment blanks, trip blanks, field duplicates, matrix spike (MS) samples, and matrix spike duplicate (MSD) samples. The prime contractor shall review the field QC samples and field logs, and shall then appropriately flag any of the associated samples identified with the field QC sample, as explained in Table 8.2-2 and 8.2-3. Each matrix spike sample shall only be qualified by the laboratory, while the prime contractor shall apply the final qualifying flag for a matrix effect to all samples collected from the same site as the parent sample or all samples showing the same lithologic characteristics as the MS/MSD.

The prime contractor (1) shall determine if the data quality objectives have been met, and (2) shall calculate the data completeness for the project. These results shall be included in the data package deliverable as described in Section 8.8.

**Table 8.2-1 Data Qualifiers**

<b>Qualifier</b>	<b>Description</b>
J	The analyte was positively identified, the quantitation is an estimation.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F	The analyte was positively identified but the associated numerical value is below the RL.
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
B	The analyte was found in an associated blank, as well as in the sample.
M	A matrix effect was present.
S	To be applied to all field screening data.
T	Tentatively identified compound (using GC/MS)

Table 8.2-2. General Flagging Conventions

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	R	All analytes in the sample
LCS	% R > UCL %R < LCL	J for the positive results J for the positive results, R for the nondetects	The specific analyte(s) in all samples in the associated AAB
Method Blank	Analyte(s) detected $\geq$ RL	B	The specific analyte(s) in all samples in the associated AAB
Equipment Blank	Analyte(s) detected $\geq$ RL	B	The specific analyte(s) in all samples with the same sampling date as the equipment blank
Field duplicates	Field duplicates > RLs AND RPD outside CL	J for the positive results R for the nondetects	The specific analyte(s) in all samples collected on the same sampling date
MS/MSD	MS or MSD % R > UCL OR MS or MSD % R < LCL OR MS/MSD RPD > CL	M for all results	The specific analyte(s) in all samples collected from the same site as the parent sample
Sample Preservation/ Collection	Preservation/collection requirements not met	R for all results	All analytes in the sample
Sample Storage	< 2°C or > 6°C	J for the positive results R for the nondetects	All analytes in the sample

UCL = upper control limit    LCL = lower control limit    CL = control limit

	Criteria	Flag*
Quantitation	$\leq$ MDL	U
	> MDL < RL	F
	$\geq$ RL	as needed

- \* Example 1: if the MDL is 0.04, the RL is 0.9 and the result is 0.03, the concentration reported on the result form would be 0.04 (the MDL) and the qualifier flag would be U.
- \* Example 2: if the MDL is 0.04, the RL is 0.9 and the result is 0.07, the concentration reported on the result form would be 0.07 and the qualifier flag would be F.
- \* Example 3: if the MDL is 0.04, the RL is 0.9 and the result is 1.2, the concentration reported on the result form would be 1.2 and the qualifier would be any flag needed because of a data quality problem (e.g., R, J, B, etc.).

Table 8.2-3. Flagging Conventions Specific to Organic Methods

QC Requirement	Criteria	Flag	Flag Applied To
Ambient Blank (VOC samples only)	Analyte(s) detected $\geq$ RL	B	The specific analyte(s) in all samples with the same matrix and sampling date
Trip Blank (VOC samples only)	Analyte(s) detected $\geq$ RL	B	The specific analyte(s) in all samples shipped in the same cooler as the blank
Initial Five Point Calibration (GC & HPLC methods)	Linearity criterion not met	R	The specific analyte(s) in all samples associated with the initial calibration
Initial Five Point Calibration (GC/MS methods)	SPCC or CCC criteria not met	R	All analytes in all samples associated with the initial calibration
	Linearity criterion not met	R	The specific analyte(s) in all samples associated with the initial calibration
Second Source Calibration Verification	CL exceeded	R	The specific analyte(s) in all samples associated with the second source calibration verification
Initial Daily Calibration Verification (GC & HPLC methods)	CL exceeded	R	The specific analyte(s) in all samples associated with the initial calibration verification
Calibration Verification (GC/MS methods)	SPCC or CCC criteria not met	R	All analytes in all samples associated with the calibration verification
	CL exceeded	R	The specific analyte(s) in all samples associated with the calibration verification
Calibration Verification (GC & HPLC methods)	CL exceeded	R	The specific analyte(s) in the sample associated with the continuing calibration verification
Retention time	Retention time of analyte outside of established retention time window	R	The specific analyte(s) in the sample
Surrogates	surrogate % R > UCL	J for the positive results	All analytes in the sample associated with the surrogate
	OR surrogate % R < LCL	J for the positive results R for the nondetects	
	OR surrogate recovery < 10%	R for all results	
Mass Spectrometer Tune	Ion abundance criteria not met	R for all results	All analytes in all samples associated with the tune

UCL = upper control limit    LCL = lower control limit    CL = control limit

Table 8.2-3. Concluded

QC Requirement	Criteria	Flag	Flag Applied To
Second Column/Second Detector Confirmation (GC & HPLC methods)	Not performed	R	All analytes $\geq$ RL
	Agreement between results not within $\pm 40\%$	J	All affected analytes
Internal Standard	Retention time not within $\pm 30$ seconds: EICP area not within $-50\%$ to $+100\%$ of last calibration verification	R	Apply R to all results for specific analytes associated with the IS
Lowest Calibration Standard	At or below RL in Initial Calibration	R	All results below the lowest calibration standard used
Tentatively Identified Compounds (TICs)		T	All TICs

Table 8.2-4. Flagging Conventions Specific to Inorganic Methods

QC Requirement	Criteria	Flag	Flag Applied To
Initial multipoint calibration	Correlation coefficient < 0.995	R	All results for specific analyte(s) for all samples associated with the initial calibration
Initial calibration verification/second source standard	CL exceeded	R	All results for specific analyte(s) for all samples associated with the calibration verification
Calibration blank	Analyte detected $\geq$ RL	B	All results for specific analyte(s) in all samples associated with the blank
Calibration verification (Instrument Check Standard)	CL exceeded	R	All results for specific analyte(s) in all samples since the last acceptable calibration verification
Interference check solution (ICS)	CL exceeded	R	All results for specific analyte(s) in all samples associated with the ICS
Dilution test	CL exceeded	J	Apply to all sample results if the new matrix check was not run or RPD $\geq$ 10%
Recovery test (GFAA methods)	CL exceeded	J	All samples in digestion batch if method of standard addition is not performed
Post digestion spike addition (ICP method)	CL exceeded	J	All sample results (for same matrix) for specific analyte(s) for all samples associated with the post digestion spike addition
	% R < 10%	R	
Method of standard addition (GFAA methods)	Method of standard addition not done OR method of standard addition spike levels inappropriate OR correlation coefficient < 0.995	J	All positive sample results for specific analyte for all samples associated with the digestion batch

UCL = upper control limit    LCL = lower control limit    CL = control limit

### 8.3 QUALITY ASSURANCE REPORTS

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors and task leaders. These reports shall describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

### 8.4 ERPIMS ELECTRONIC DATA REPORTS

The prime contractor shall provide an electronic deliverable report in the Environmental Restoration Program Information Management System (ERPIMS) format as specified by the SOW for the project.

ERPIMS is a data management system designed to accommodate all types of data collected for IRP projects. Specific codes and data forms have been developed to allow consistent and efficient input of information to the system. The database information shall be provided by the prime contractor via ASCII files in specified ERPIMS format on 3.5" floppy diskettes. The information transferred shall include all required technical data such as site information; well characteristics; and hydrogeologic, geologic, physical, and chemical analysis results. Electronic data reporting formats and requirements are given in the most current version of the *ERPIMS Data Loading Handbook*.

### 8.5 ARCHIVING

Hardcopy and electronic data shall be archived in project files and on electronic archive tapes for the duration of the project or a minimum of five years, whichever is longer.

### 8.6 PROJECT DATA FLOW AND TRANSFER

The data flow from the laboratory and field to the project staff and data users shall be sufficiently documented to ensure the data are properly tracked, reviewed, and validated for use.

### 8.7 RECORDKEEPING

The laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted pursuant to the SOW. The minimum records the laboratory shall keep contain the following: (1) COC forms, (2) initial and continuing calibration records including standards preparation traceable to the original material and lot number, (3) instrument tuning records (as applicable), (3) method blank results, (4) IS results, (5) surrogate spiking records and results (as applicable), (6) spike and spike duplicate records and results, (7) laboratory records, (8) raw data, including instrument printouts, bench work sheets, and/or

chromatograms with compound identification and quantitation reports, (9) corrective action reports, (10) other method and project required QC samples and results, and (11) laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.

## 8.8 HARDCOPY DATA REPORTS FOR SCREENING AND DEFINITIVE DATA

The hardcopy data reports shall conform to the formats identified in this section.

A screening data report package shall consist of the following AFCEE forms: COC, S-1, S-2, and S-3.

A definitive data inorganic report package shall consist of the following AFCEE forms: COC, I-1, I-2, I-3, I-4, I-5, I-6, I-7, I-8 and I-9 for each AAB with inorganic analyses performed.

A definitive data organic report package shall consist of the following AFCEE forms: COC, O-1, O-2, O-3 or O-3A, O-4, O-5 or O-5A, O-6, O-7, O-8, O-9 and O-10 for each AAB with organic analyses performed.

A definitive data wet chemistry report package shall consist of the following AFCEE forms: COC, W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, and W-9 for each AAB with wet chemistry analyses performed.

Exceptions to these report forms are as follows: for mercury analysis, form I-3A shall be substituted for form I-3 in the inorganic report package; for cyanide analysis, form I-3B shall be substituted for form I-3 in the inorganic report package; for GC/MS analyses, forms O-3A and O-5A shall be used and form O-11 shall be added to the organic report package.

In addition to the above, all pertinent raw data, including run logs, sample preparation logs, standard preparation logs, Laboratory notebooks in which data are recorded manually, and any and all related instrument output, will be incorporated into the final hard copy deliverable.

## INSTRUCTIONS FOR COMPLETING AFCEE REPORT FORMS

The following instructions shall be used in completing the AFCEE report forms for screening and definitive data. The bold lettering identifies the fields on the AFCEE report form.

Use as many sheets as necessary. Sheets may be duplicated with only those sections necessary to be completed filled out (i.e., you do not have to duplicate previously reported information from one sheet to the next). Sequentially number the sheets at the bottom of the page if more than one sheet is necessary.

**\*Reporting Dilutions\*** Justification for diluting samples shall be provided in the comments section on the appropriate form (I-2, O-2 or W-2). If the result for any analyte is outside the calibration range (i.e., greater than the highest calibration standard), the sample shall be diluted appropriately and reanalyzed. Results from the undiluted and diluted sample shall be reported on the appropriate form (I-2, O-2 or W-2). The results of the analysis of the diluted sample shall be reported with the dilution noted on the report form and the MDL and RL adjusted for the dilution.

ALL INORGANIC, ORGANIC AND WET CHEM FORMS

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Lab Name:** Enter the laboratory name (e.g., Garland Labs, Inc.)

**Contract #:** Enter the Air Force contract number and delivery order number under which the analytical work is being performed (e.g., F21625-94-D-8005/0001)

**Comments:** Enter any comments

FORM I-1

**Base/Command:** Enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

**Prime Contractor:** Enter the name of the prime contractor (e.g., RDS, Inc)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

FORM I-1 (continued)

**Lab Sample ID:** Enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM I-2

This form is completed for all environmental samples including the MD and MSD.

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Lab Sample ID:** Enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

**Matrix:** Enter the sample matrix (e.g., water, soil)

**% Solids:** Enter the % solids

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the sample results

**Date Received/Prepared/Analyzed:** Enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

**Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg dry weight)

**Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.

**MDL** Enter the laboratory derived method detection limit

**RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte

**Concentration:** Enter the numeric result

**Dilution:** Enter the dilution (if applicable) (e.g., 1:5)

**Qualifier:** Enter the qualifier flag (see QAPP Sections 7 and 8)

FORM I-3

**AAB#:** (optional) Enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Date of Initial Calibration:** Enter the appropriate date in the format DD-MMM-YY  
(e.g., 3 Jun 96)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event

**Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)

**Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)

**RF1, RF2, RF3:** Enter the response factor corresponding to the standard with the same number

**Std 1, Std2, Std3:** Enter the concentration of the standard

**r:** Enter the correlation coefficient

**Q:** Enter a "\*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

FORM I-3A (Mercury analyses only)

**AAB#:** (optional) Enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Date of Initial Calibration:** Enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 96)

**Initial Calibration ID:** Enter the unique identifying number given to this initial calibration event

**Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)

**RF1, RF2, RF3, RF4, RF5:** Enter the response factor corresponding to the standard with the same number

**Std 1, Std 2, Std 3, Std 4, Std 5:** Enter the concentration of the standard

**r:** Enter the correlation coefficient

**Q:** Enter a "\*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

FORM I-3B (Cyanide analyses only)

**AAB#:** (optional) Enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Date of Initial Calibration:** Enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 96)

**Initial Calibration ID:** enter the unique identifying number given to this initial calibration event

**Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)

**RF1, RF2, RF3, RF4, RF5, RF6:** Enter the response factor corresponding to the standard with the same number

**Std 1, Std 2, Std 3, Std 4, Std 5, Std 6:** Enter the concentration of the standard

**r:** Enter the correlation coefficient

**Q:** Enter a "\*" for all corresponding correlation coefficients that were not acceptable as per QAPP Section 7

**Expected** Enter the expected result (i.e., the concentration of the calibration material).

**Found:** Enter the measured result.

**%D:** Enter the per cent difference between the expected and found

FORM I-4

**AAB#:** (optional) Enter the unique AFCEE analytical batch number if these calibration events pertain to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the calibration verification results

**2nd Source ID:** Enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)

**CCV #1 ID:** Enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

- CCV #2 ID:** Enter the unique identification number for the second CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)
- Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)
- Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.
- Expected:** Enter the expected result (i.e., the concentration of the calibration material).
- Found, Found 1, Found 2:** Enter the measured result. Found 1 corresponds to the first CCV run, Found 2 corresponds to the second CCV run, etc.
- %D:** Enter the per cent difference between the expected and found
- Q:** Enter a "\*" for any %D that was not acceptable as per QAPP Section 7

FORM I-5

- AAB#:** Enter the unique AFCEE analytical batch number for the method blank (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)
- Initial Calibration Blank ID:** Enter the identification number for the calibration blank (the same ID number will be found in the run sequence log, e.g., CB960603)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the initial calibration blank results
- Method Blank ID:** Enter the unique identifying number given to the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the method blank results

- CCB #1 ID:** (used for 6010B analysis) enter the identification number for the first CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-1)
- CCB #2 ID:** (used for 6010B analysis) enter the identification number for the second CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-2)
- CCB #3 ID:** (used for 6010B analysis) enter the identification number for the third CCB (the same ID number will be found in the run sequence log, e.g., CCB960603-3)
- Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.
- Initial Calibration Blank:** Enter a numeric result for the calibration blank
- Continuing Calibration Blank 1:** Enter a numeric result for the first continuing calibration blank run
- Continuing Calibration Blank 2:** Enter a numeric result for the second continuing calibration blank run
- Continuing Calibration Blank 3:** Enter a numeric result for the third continuing calibration blank run
- Method Blank:** Enter a numeric result for the method blank
- RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte
- Q:** Enter a "\*" for any calibration or method blank analytes that were not acceptable as per QAPP Section 7

FORM I-6

- AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- LCS ID:** Enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log e.g., LCS960603)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the LCS results
- Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)
- Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.
- Expected:** Enter the expected result (i.e., the concentration at which the analyte was spiked in LCS material)
- Found:** Enter the measured result of the LSC analytes
- %R:** Enter the per cent recovery
- Control Limits:** Enter the control limits required to be met see QAPP Section 7)
- Q:** Enter an "\*" for any %R that was not acceptable as per QAPP Section 7

FORM I-7

- Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)
- % Solids:** Enter the % solids of the parent field sample
- Parent Field Sample ID:** Enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)
- MS ID:** Enter the unique identification number for the matrix spike such that the MS could be traced back to the source

material used for spiking (the same ID number will be found in the run sequence log e.g., MS960603)

**MSD ID:** Enter the unique identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log e.g., MSD960603)

**Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.

**Parent Sample Result:** Enter the numeric result of the parent sample. If an analyte was not detected above the MDL, leave this column blank

**Spike Added:** Enter the amount of spike added to the parent sample

**Spiked Sample Result:** Enter the numeric result of the MS

**%R:** Enter the per cent recovery

**Duplicate Spiked Sample Result:** Enter the numeric result of the MSD

**%RPD:** Enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

**Control Limits %R:** Enter the control limits required to be met (see QAPP Section 7)

**Control Limits %RPD:** Enter the control limits required to be met (see QAPP Section 7)

**Q:** Enter the qualifier flag as needed (see QAPP Sections 7 and 8)

FORM I-8

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Field Sample ID:** enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

- Date Collected:** Enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 6 Jun 96)
- Date Received:** Enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)
- Date Analyzed:** Enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)
- Max. Holding Time:** Enter the maximum allowable holding time in days (see QAPP Section 5)
- Time Held:** Enter the time in days elapsed between the date collected and the date analyzed
- Q:** Enter a "\*" for any holding times that were greater than the maximum allowable holding time as per QAPP Section 5

FORM I-9

- Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)
- Field Sample ID/Std ID/Blank ID/QC Sample ID** Enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed
- Date Analysis Started:** Enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 6 Jun 96)
- Time Analysis Started:** Enter the time the sample analysis was started in 24-hour format (e.g., 0900, 2130)
- Date Analysis Completed:** Enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 6 Jun 96)
- Time Analysis Completed:** Enter the time the sample analysis was completed in 24-hour format (e.g., 0900, 2130)

FORM O-1

- Base/Command:** Enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

**Prime Contractor:** Enter the name of the prime contractor (e.g., RDS, Inc)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Lab Sample ID:** Enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM O-2

This form is completed for all environmental samples including the MD and MSD.

**AAB#:** Enter the unique AFCEE analytical batch number (see section 4.4 of the AFCEE QAPP for a definition of a batch)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Lab Sample ID:** Enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

**Matrix:** Enter the sample matrix (e.g., water, soil)

**% Solids:** Enter the % solids

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the sample results

**Date Received/Prepared/Analyzed:** Enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

**Concentration Units:** .. Enter the appropriate units (i.e.,  $\mu\text{g/L}$  or  $\text{mg/kg}$  dry weight)

**Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.

**MDL:** Enter the laboratory derived method detection limit

**RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte

**Concentration:** Enter the numeric result

**Dilution:** Enter the dilution (if applicable) (e.g., 1:5)

**Confirm:** Enter the numeric result from the confirmation column/detector

**Qualifier:** Enter the qualifier flag as needed (see QAPP Section 7)

**Surrogate:** Enter the name of the surrogate(s) used

**Recovery:** Enter the per cent recovery of the surrogate

**Control Limits:** Enter the control limits for the recovery of the surrogate (see QAPP section 7)

**Internal Std:** (used for 8260B and 8270C analysis) enter the name of the internal standard(s) used

FORM O-3 and 3A

**AAB#:** (optional) Enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Date of Initial Calibration:** Enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 96)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event

**Concentration Units:** Enter the appropriate units (i.e.,  $\mu\text{g/L}$  or  $\text{mg/kg}$ )

**Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7. (On form 3A, some analyte names already appear on the form as provided, leave those analytes in that order.)

**RF1, RF2, RF3, RF4, RF5, RF6, RF7:** Enter the response factor corresponding to the standard with the same number (RF6 and RF7 are used for non-linear calibrations)

**Std 1, Std 2, Std 3, Std 4, Std 5, Std 6, Std 7:** Enter the concentration of the standard (Std 6 and Std 7 are used for non-linear calibrations)

**%RSD:** Enter the per cent relative standard deviation of the response factors

**Mean %RSD:** Enter the mean of the RSDs of all analytes for those analytes not using a least squares regression or non-linear calibration

**r:** (optional) if least squares regression is used for the calibration of an analyte, enter the correlation coefficient

**COD:** (optional) if a non-linear calibration is used for the calibration of an analyte, enter the coefficient of determination

**Q:** Enter a "\*" for any calibration that was not acceptable as per QAPP Section 7 and for any RFs not meeting minimum requirements for SPCCs and/or CCCs.

FORM O-4

- AAB#:** (optional) Enter the unique AFCEE analytical batch number if this calibration event pertains to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the second source calibration verification results
- 2nd Source ID:** Enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)
- Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7.
- Expected:** Enter the expected result (i.e., the concentration of the calibration material).
- Found:** Enter the measured result.
- %D:** Enter the per cent difference between the expected (i.e., the concentration of the second source calibration material) and measured result
- Q:** Enter a "\*" for any % D that was not acceptable as per QAPP Section 7

FORM O-5 and O-5A

- AAB#:** (optional) Enter the unique AFCEE analytical batch number if these calibration events pertain to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the calibration verification results

**ICV ID:** Enter the unique identification number for the ICV such that the ICV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., ICV960603-1)

**CCV #1 ID:** Enter the unique identification number for the CCV run after the first 12 hours of operation such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

**CCV #2 ID:** Enter the unique identification number for the CCV run after the second 12 hours of operation such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)

**Analyte:** Enter all analyte names in the same order as listed in the tables in QAPP Section 7. (On form O-5A, some analyte names already appear on the form as provided, leave those analytes in that order.)

**RF:** (form O-5A) enter the response factor for the SPCCs only

**% D:** Enter the per cent difference

**% D or % drift:** (form O-5) enter the per cent difference if using RFs or % drift if using CFs

**Q:** Enter a "\*" for any % drift that was not acceptable as per requirements in QAPP Section 7

FORM O-6

- AAB#:** Enter the unique AFCEE analytical batch number for the method blank (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- Concentration Units:** Enter the appropriate units (i.e., µg/L or mg/kg)
- Method Blank ID:** Enter the unique identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the method blank results
- Analyte:** Enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)
- Method Blank:** Enter a numeric result for the method blank
- RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte
- Q:** Enter a "\*" for any method blank analyte result that was not acceptable as per QAPP Section 7
- Surrogate:** Enter the name of the surrogate(s) used
- Recovery:** Enter the per cent recovery of the surrogate

FORM O-7

- Control Limits:** Enter the control limits for the recovery of the surrogate (see QAPP section 7)
- Internal Std:** (used for 8260B and 8270C analysis) enter the name of the standard(s) used
- AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**LCS ID:** Enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., LCS960603)

**Concentration Units:** Enter the appropriate units (i.e.,  $\mu\text{g/L}$  or  $\text{mg/kg}$ )

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the LCS results

**Analyte:** Enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

**Expected:** Enter the expected result of the LCS)

**Found:** Enter the measured result of the LSC analytes

**%R:** Enter the per cent recovery

**Control Limits:** Enter the control limits required to be met (see QAPP Section 7)

**Q:** Enter a "\*" for any % R that was not acceptable as per QAPP Section 7

**Surrogate:** Enter the name of the surrogate(s) used

**Recovery:** Enter the per cent recovery of the surrogate

**Internal Std:** (used for 8260B and 8270C analysis) enter the name of the internal standard(s) used  
I

FORM O-8

**Concentration Units:** Enter the appropriate units (i.e.,  $\mu\text{g/L}$  or  $\text{mg/kg}$ )

**Parent Field Sample ID:** Enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)

**% Solids:** Enter the % solids

**MS ID:** Enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MS960603)

**MSD ID:** Enter the identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log, e.g., MSD960603)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the MS/MSD results

**Analyte:** Enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

**Parent Sample Result:** Enter the result of the parent sample. If an analyte was not detected above the MDL, leave this column blank.

**Spike Added:** Enter the amount of spike added to the parent sample

**Spiked Sample Result:** Enter the numeric result of the MS

**%R:** Enter the per cent recovery

**Duplicate Spiked Sample Result:** Enter the numeric result of the MSD

**%RPD:** Enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

**Control Limits %R:** Enter the control limits required to be met (see QAPP Section 7)

**Control Limits %RPD:** Enter the control limits required to be met (see QAPP Section 7)

**Q:** Enter the qualifier flag as needed (see QAPP Sections 7)

FORM O-9

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Date Collected:** Enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 3 Jun 96)

**Date Received:** Enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

**Date Extracted:** Enter the date the sample was extracted by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

**Max. Holding Time E:** Enter the maximum allowable holding time in days until the sample is extracted (if applicable - see QAPP Section 5)

**Time Held Ext.:** Enter the time in days elapsed between the date collected and the date extracted (if applicable)

**Date Analyzed:** Enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 3 Jun 96)

**Max. Holding Time A:** Enter the maximum allowable holding time in days until the sample is analyzed (see QAPP Section 5)

**Time Held Anal.:** Enter the time in days elapsed between the date collected and the date analyzed

**Q:** Enter a "\*" for any holding time (Max. Holding Time E, or Max. Holding Time A, or Time Held Anal.) that was greater than the maximum holding time that was not acceptable as per QAPP Section 5

FORM O-10

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Field Sample ID/Std ID/Blank ID/QC Sample ID:** Enter the unique identifying number of each sample (environmental sample, standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

**Date Analysis Started:** Enter the date the sample analysis was started in the format D-MMM-YY (e.g., 3 Jun 96)

**Time Analysis Started:** Enter the time the sample analysis was started in 24-hour format (e.g., 0900, 2130)

**Date Analysis Completed:** Enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 3 Jun 96)

**Time Analysis Completed:** Enter the time the sample analysis was completed in 24-hour format (e.g., 0900, 2130)

FORM O-11

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Compound:** Enter BFB or DFTPP as appropriate

**Injection Date/Time:** Enter the date (in the format DD-MMM-YY) and time (in 24-hour format) of the performance check

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the MS/MSD results

**Mass:** Enter the mass of the ion used for tuning (see QAPP Section 7)

**Ion Abundance Criteria:** Enter the criteria for the specific mass (see QAPP Section 7)

**% Relative Abundance:** Enter the per cent relative abundance as the result of the tune

**Q:** Enter a "\*" for any % relative abundance results that was not acceptable as per QAPP Section 7

FORM W-1

**Base/Command:** Enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

**Prime Contractor:** Enter the name of the prime contractor (e.g., RDS, Inc)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Lab Sample ID:** Enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

FORM W-2

This form is completed for all environmental samples including the MD and MSD.

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Lab Sample ID:** Enter the unique identifying number given to the sample by the laboratory that corresponds to the Field Sample ID

**Matrix:** Enter the sample matrix (e.g., water, soil)

**% Solids:** Enter the % solids

- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the sample results
- Date Received/Prepared/Analyzed:** Enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)
- Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg dry weight)
- Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)
- MDL:** Enter the laboratory derived method detection limit
- RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte
- Concentration:** Enter the numeric result
- Dilution:** Enter the dilution (if applicable) (e.g., 1:5)
- Qualifier:** Enter the qualifier flag (see QAPP Sections 7 and 8)
- FORM W-3
- AAB#:** (optional) Enter the unique AFCEE analytical batch number if this calibration pertains to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)
- Date of Initial Calibration:** Enter the appropriate date in the format DD-MMM-YY (e.g., 3 Jun 96)
- Initial Calibration ID:** Enter the unique identifying number given to this initial calibration event

**Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)

**RF1, RF2, RF3:** Enter the response factor corresponding to the standard with the same number

**Std 1, Std2, Std3:** Enter the concentration of the standard

**r:** Enter the correlation coefficient

**Q:** Enter a "\*" for any correlation coefficients that were not acceptable as per QAPP Section 7

FORM W-4

**AAB#:** (optional) Enter the unique AFCEE analytical batch number if these calibration events pertain to all the samples from one batch (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the calibration verification results

**2nd Source ID:** Enter the unique identifier for the 2nd source standard such that the standard could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., 2S960603)

**ICV ID:** Enter the unique identification number for the ICV such that the ICV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., ICV960603)

**CCV #1 ID:** Enter the unique identification number for the first CCV such that the CCV could be traced back to its source material (the same ID number will be found in the run sequence log, e.g., CCV960603-1)

**CCV #2 ID:** Enter the unique identification number for the second CCV such that the CCV could be traced back to its source

material (the same ID number will be found in the run sequence log, e.g., CCV960603-2)

- Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)
- Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)
- Expected:** Enter the expected result (i.e., the concentration of the calibration material)
- Found, Found 1, Found 2:** Enter the measured result. Found 1 corresponds to the first CCV run, Found 2 corresponds to the second CCV run, etc.
- %D:** Enter the per cent difference between the expected and found
- Q:** Enter a "\*" for any %D that was not acceptable as per QAPP Section 7

FORM W-5

- AAB#:** Enter the unique AFCEE analytical batch number for the method blank (see Section 4.4 of the AFCEE QAPP for a definition of a batch)
- Concentration Units** Enter the appropriate units (i.e., mg/L or mg/kg)
- Calibration Blank ID:** Enter the identification number for the calibration blank (the same ID number will be found in the run sequence log, e.g., CB960603)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the calibration blank results
- Method Blank ID:** Enter the identification number for the method blank (the same ID number will be found in the run sequence log, e.g., MB960603)
- Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the method blank results
- Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)

**Calibration Blank:** Enter a numeric result for the calibration blank

**Method Blank:** Enter a numeric result for the method blank

**RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte

**Q:** Enter a "\*" for any calibration or method blank analyte that was not acceptable as per QAPP Section 7

FORM W-6

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**LCS ID:** Enter the unique identification number for the laboratory control sample such that the LCS could be traced back to its source material (the same ID number will be found in The run sequence log e.g., LCS960603)

**Initial Calibration ID:** Enter the unique identifying number given to the initial calibration event used in the determination of the LCS results

**Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)

**Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)

**Expected:** Enter the expected result (i.e., the concentration at which the analyte was spiked in LCS material)

**Found:** Enter the measured result of the LCS analyte

**%R:** Enter the per cent recovery

**Control Limits:** Enter the control limits required to be met (see QAPP Section 7)

**Q:** Enter a "\*" for any %R that was not acceptable as per QAPP Section 7

FORM W-7

**% Solids:** Enter the % solids

**Parent Field Sample ID:** Enter the field sample ID of the parent sample (the sample spiked for the MS and MSD)

**MS ID:** Enter the unique identification number for the matrix spike such that the MS could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log e.g., MS960603)

**MSD ID:** Enter the unique identification number for the matrix spike duplicate such that the MSD could be traced back to the source material used for spiking (the same ID number will be found in the run sequence log e.g., MSD960603)

**Concentration Units:** Enter the appropriate units (i.e., mg/L or mg/kg)

**Analyte:** Enter the name of the analytes (use the same name as used in the tables in Section 7 of the QAPP)

**Parent Sample Result:** Enter the numeric result of the parent sample. If an analyte was not detected above the MDL, leave this column blank

**Spike Added:** Enter the amount of spike added to the parent sample

**Spiked Sample Result:** Enter the numeric result of the MS

**%R:** Enter the per cent recovery

**Duplicate Spiked Sample Result:** Enter the numeric result of the MSD

**%RPD:** Enter the relative per cent difference between the spike (MS) and spike duplicate (MSD)

**Control Limits %R:** Enter the control limits required to be met (see QAPP Section 7)

**Control Limits %RPD:** Enter the control limits required to be met (see QAPP Section 7)

**Q:** Enter the qualifier flag as needed (see QAPP Sections 7 and 8)

FORM W-8

**AAB#:** Enter the unique AFCEE analytical batch number (see Section 4.4 of the AFCEE QAPP for a definition of a batch)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Date Collected:** Enter the date the sample was taken in the field in the format DD-MMM-YY (e.g., 6 Jun 96)

**Date Received:** Enter the date the sample was received at the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)

**Date Analyzed:** Enter the date the sample was analyzed by the laboratory in the format DD-MMM-YY (e.g., 6 Jun 96)

**Max. Holding Time:** Enter the maximum allowable holding time in days (see QAPP Section 5)

**Time Held:** Enter the time in days elapsed between the date collected and the date analyzed

FORM W-8 (continued)

**Q:** Enter a "\*" for any holding time that was greater than the maximum allowable holding time as per QAPP Section 5

FORM W-9

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Field Sample ID/Std ID/Blank ID/QC Sample ID:** Enter the unique identifying number of each sample (environmental sample,

standard, blank, LCS, MS, MSD, etc.) in the sequence they were analyzed

**Date Analysis Started:** Enter the date the sample analysis was started in the format DD-MMM-YY (e.g., 6 Jun 96)

**Time Analysis Started:** Enter the time the sample analysis was started in 24-hour format (e.g., 0900, 2130)

**Date Analysis Completed:** Enter the date the sample analysis was completed in the format DD-MMM-YY (e.g., 6 Jun 96)

**Time Analysis Completed:** Enter the time the sample analysis was completed in 24-hour format (e.g., 0900, 2130)

FORM S-1

**Base/Command:** Enter the base name and the Air Force command (e.g., Banks AFB/SPACECOM)

**Prime Contractor:** Enter the name of the prime contractor (e.g., RDS, Inc)

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Signature:** Signature of person completing data package

**Name:** Name of person completing data package

**Date:** Enter the date the in the format DD-MMM-YY (e.g., 6 Jun 96)

FORM S-1 (continued)

**Title:** Title of person completing data package

FORM S-2

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Matrix:** Enter the sample matrix (e.g., water, soil)

**Date Analyzed:** Enter the appropriate dates in the format DD-MMM-YY (e.g., 3 Jun 96)

**Units:** Enter the appropriate units (e.g.,  $\mu\text{g/L}$ , mg/kg, degrees C)

**Analyte/Test:** Enter the name of the analyte or test performed (e.g., pH)

**MDL:** Enter the method detection limit if applicable

**RL:** Enter the project AFCEE reporting limit as stated in the QAPP or approved variance for each analyte

**Result:** Enter the result

**Qualifier:** Enter the qualifier needed (see QAPP Sections 7 and 8)

FORM S-3

**Units:** Enter the appropriate units (e.g.,  $\mu\text{g/L}$ , mg/kg, degrees C)

**Analyte/Test:** Enter the name of the analyte or test performed (e.g., pH)

**Sample Result:** Enter the result of the sample

**Duplicate Sample Result:** Enter the result of the duplicate sample

**%D or %RPD:** Enter the per cent or difference relative per cent difference between the sample and duplicate as appropriate

**Acceptance Criteria:** Enter the acceptance criteria required to be met (see QAPP Section 6)

**Q:** Enter a "\*" for any % D or % RPD that was not acceptable as per QAPP Section 6

DL FORM

**Matrix:** Enter the sample matrix (e.g., water, soil)

**Analysis Date:** Enter the date (or inclusive dates if performed over a period of days) the MDL was performed in the format DD-MMM-YY (e.g., 6 Jun 96)

**Instrument ID:** Enter the instrument identifier (e.g., the serial number or other identifying number/name)

**Analyte:** Enter the name of the analyte (use the same name as used in the tables in Section 7 of the QAPP)

**Amt. Spiked:** Enter the amount of spike added to the matrix

**Replicate 1,2,3,4,5,6,7:** Enter the result of the replicate

**Std. Dev.:** Enter the standard deviation of the seven replicates

**MDL:** Enter the calculated MDL

CHAIN OF CUSTODY FORM

**COC#:** Enter a unique number for each chain of custody form

**Ship to:** Enter the laboratory name and address

**Carrier:** Enter the name of the transporter (e.g., FedEx) or handcarried

**Airbill#:** Enter the airbill number or transporter tracking number (if applicable)

**Project Name:** Enter the project name (e.g., Banks AFB RI/FS)

**Sampler Name:** Enter the name of the person collecting the samples

**Sampler Signature:** Signature of the person collecting the samples

**Send Results to:** Enter the name and address of the prime contractor

**Field Sample ID:** Enter the unique identifying number given to the field sample (includes MS, MSD, field duplicate and field blanks)

**Date:** Enter the year and date the sample was collected in the format M/D (e.g., 6/3)

**Time:** Enter the time the sample was collected in 24-hour format (e.g., 0900)

**Matrix:** Enter the sample matrix (e.g., water, soil)

**Pres:** Enter the preservative used (e.g., HNO<sub>3</sub>) or "none"

**Filtered/Unfilt.:** Enter "F" if the sample was filtered or "U" if the sample was not filtered

**# of Containers:** Enter the number of containers (i.e., jars, bottles) associated with the sample

**MS/MSD:** Enter "X" if the sample is designated the MD/MSD

**Analyses Requested:** Enter the method name of the analysis requested (e.g., SW6010B)

**Comments:** Enter comments

**Sample Condition Upon Receipt at Laboratory:** Enter any problems with the condition of any sample(s)

**Cooler Temperature:** Enter the internal temperature of the cooler, upon opening, in degrees C

**Special Instructions/Comments:** Enter any special instructions or comments

**Released by: (SIG):** Enter the signature of the person releasing custody of the samples

**Company Name:** Enter the company name employing the person releasing/receiving custody

**Received by: (SIG):** Enter the signature of the person receiving custody of the samples

**Date:** Enter the date in the format M/D/YY (e.g., 6/3/96) when the samples were released/received

**Time:** Enter the time in 24-hour format (e.g., 0900) when the samples were released/received







AFCEE  
INORGANIC ANALYSES DATA SHEET 3  
MERCURY INITIAL MULTIPOINT CALIBRATION

Analytical Method: \_\_\_\_\_ AAB # \_\_\_\_\_  
 Lab Name: \_\_\_\_\_ Contract #: \_\_\_\_\_  
 Instrument ID: \_\_\_\_\_ Date of Initial Calibration: \_\_\_\_\_  
 Initial Calibration ID: \_\_\_\_\_ Concentration Units (mg/L or mg/kg): \_\_\_\_\_

Analyte	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	r	Q
Mercury												

r = correlation coefficient

Comments:

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AFCEE FORM I-3A

AFCEE  
 INORGANIC ANALYSES DATA SHEET 3  
 CYANIDE INITIAL MULTIPOINT CALIBRATION

Analytical Method. \_\_\_\_\_ AAB #. \_\_\_\_\_  
 Lab Name: \_\_\_\_\_ Contract #. \_\_\_\_\_  
 Instrument ID \_\_\_\_\_ Date of Initial Calibration. \_\_\_\_\_  
 Initial Calibration ID: \_\_\_\_\_ Concentration Units (mg/L or mg/kg): \_\_\_\_\_

Analyte	Std 1	RF 1	Std 2	RF 2	Std 3	RF 3	Std 4	RF 4	Std 5	RF 5	Std 6	RF 6	r	Q
Cyanide														

r = correlation coefficient

	Expected	Found	%D	Q
High Distilled Standard				
Low Distilled Standard				

Comments:

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AFCEE FORM I-3B









































AFCEE  
ORGANIC ANALYSES DATA SHEET 11  
INSTRUMENT PERFORMANCE CHECK  
(BFB or DFTPP)

Analytical Method: \_\_\_\_\_

Lab Name: \_\_\_\_\_ Contract #: \_\_\_\_\_

Instrument ID: \_\_\_\_\_ Compound: \_\_\_\_\_ Injection Date/Time: \_\_\_\_\_

Initial Calibration ID: \_\_\_\_\_

Mass	Ion Abundance Criteria	% Relative Abundance	Q



















AFCEE  
SCREENING DATA PACKAGE

Analytical Method: \_\_\_\_\_

Contract #: \_\_\_\_\_

Base/Command: \_\_\_\_\_

Prime Contractor: \_\_\_\_\_

Field Sample ID

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Title: \_\_\_\_\_

AFCEE FORM S-1









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## 9.0 SYSTEMS AND PERFORMANCE AUDITS, PERFORMANCE EVALUATION PROGRAMS, MAGNETIC TAPE AUDITS, AND TRAINING

Technical systems and performance audits shall be performed as independent assessments of sample collection and analysis procedures. Audit results will be used to evaluate the ability of an analytical contractor to (1) produce data that fulfill the objectives established for the program, (2) comply with the QC criteria, and (3) identify any areas requiring corrective action. The systems audit is a qualitative review of the overall sampling or measurement system, while the performance audit is a quantitative assessment of a measurement system. Audit guidance can be found in the *HQ AFCEE Technical Services Quality Assurance Program*, current version. Full data validation is also a quantitative check of the analytical process, where all documentation and calculations are evaluated and verified. Data validation is discussed in Section 8.

### 9.1 PROJECT AUDITS

#### 9.1.1 State/Federal Project Audits

Audits by various state and federal agencies are commonly conducted for the laboratories that will analyze project samples. Audit reports from these agencies shall be reviewed by the prime contractor to determine whether data produced by the analytical contractor shall fulfill the objectives of the program.

Audit findings shall be transmitted from the laboratory to the prime contractor and to AFCEE. The prime contractor shall review the audit findings and provide a written report to AFCEE. This report shall include the recommended corrective actions or procedures to correct the deficiencies identified during the state/federal audits(s). The audit results and discussion shall be incorporated into the QA report for each sampling effort.

#### 9.1.2 Technical Systems Audits

A technical systems audit is an on-site, qualitative review of the sampling or analytical system to ensure that the activity is being performed in compliance with the Sampling and Analysis Plan (SAP) specifications. Sampling and field procedures, and the analytical laboratories shall be audited by the prime contractor at the beginning of the project. In addition, a laboratory systems audit may be performed by AFCEE if previous audit reports indicate corrective actions are outstanding, a recent audit has not been conducted, or quality concerns have arisen based upon the use of that laboratory for other projects. The laboratory systems audit results will be used to assess the prime contractor's oversight and to review laboratory operation and ensure the technical procedures and documentation are in place and operating to provide data that fulfill the project objectives and to ensure outstanding corrective actions have been addressed.

Critical items for a laboratory or field systems audit include: (1) sample custody procedures, (2) calibration procedures and documentation, (3) completeness of data forms, notebooks, and other reporting requirements, (4) data review and validation procedures, (5) data storage, filing, and

record keeping procedures, (6) QC procedures, tolerances, and documentation, (7) operating conditions of facilities and equipment, (8) documentation of training and maintenance activities, (9) systems and operations overview, and (10) security of laboratory automated systems.

Critical items for a sampling systems audit include: (1) calibration procedures and documentation for field equipment, (2) documentation in field logbooks and sampling data sheets, (3) organization and minimization of potential contamination sources while in the field, (4) proper sample collection, storage, and transportation procedures, and (5) compliance with established COC and transfer procedures.

After each on-site audit, a debriefing session will be held for all participants to discuss the preliminary audit results. The auditor will then complete the audit evaluation and submit an audit report including observations of the deficiencies and the necessary recommendations for corrective actions to the prime contractor. Compliance with the specifications presented in the SAP will be noted and noncompliance or deviations shall be addressed in writing by the prime contractor to AFCEE with corrective actions and a time frame for implementation of the corrective actions. Follow-up audits will be performed prior to completion of the project to ensure corrective actions have been taken.

### **9.1.3 Project-Specific Performance Evaluation Audits**

Performance audits quantitatively assess the data produced by a measurement system. A performance audit involves submitting project-specific performance evaluation (PE) samples for analysis for each analytical method used in the project. The prime contractor shall submit project specific PE samples once per quarter per project. The project-specific PE samples are selected to reflect the expected range of concentrations for the sampling program. The performance audit answers questions about whether the measurement system is operating within control limits and whether the data produced meet the analytical QA specifications.

The project-specific PE samples are made to look as similar to field samples as possible and are submitted as part of a field sample shipment so that the laboratory is unable to distinguish between them and project samples. This approach ensures unbiased sample analysis and reporting by the laboratory.

The critical elements for review of PE results include: (1) correct identification and quantitation of the PE sample analytes, (2) accurate and complete reporting of the results, and (3) measurement system operation within established control limits for precision and accuracy.

The concentrations reported for the PE samples shall be compared to the known or expected concentrations spiked in the samples. The percent recovery shall be calculated and the results assessed according to the accuracy criteria for the LCS presented in Section 7. If the accuracy criteria are not met, the cause of the discrepancy shall be investigated and a second PE sample shall be submitted. The prime contractor shall notify the project staff, AFCEE, and agencies of the situation at the earliest possible time and the prime contractor shall keep AFCEE up to date regarding corrective actions and subsequent PE sample results.

#### **9.1.4 Magnetic Tape Audits**

Magnetic tape audits involve the examination of the electronic media used by the analytical laboratory and by the prime contractor to collect, analyze, report, and store data. These audits are used to assess the authenticity of the data generated, and assess the implementation of good automated laboratory practices. AFCEE may perform magnetic tape audits of the laboratories or of the prime contractors when warranted by project PE results, on-site audit results, or by other state/federal investigations.

#### **9.1.5 Performance Evaluation Sample Programs**

All laboratories shall participate in the U.S. EPA PE Water Supply and Water Pollution Studies programs or equivalent programs for state certifications. Satisfactory performance in these non project-specific PE programs also demonstrate proficiency in methods used to analyze AFCEE samples. The laboratory shall document the corrective actions to unacceptable PE results to demonstrate resolution of the problems.

### **9.2 TRAINING**

Training shall be provided to all project personnel to ensure compliance with the health and safety plan and technical competence in performing the work effort. Documentation of this training shall be maintained in the records of the contracted organizations.

211 346

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## 10.0 PREVENTIVE MAINTENANCE

A preventive maintenance program shall be in place to promote the timely and effective completion of a measurement effort. The preventive maintenance program is designed to minimize the downtime of crucial sampling and/or analytical equipment due to unexpected component failure. In implementing this program, efforts are focused in three primary areas: (1) establishment of maintenance responsibilities, (2) establishment of maintenance schedules for major and/or critical instrumentation and apparatus, and (3) establishment of an adequate inventory of critical spare parts and equipment.

### 10.1 MAINTENANCE RESPONSIBILITIES

Maintenance responsibilities for equipment and instruments are assumed by the respective facility managers. The managers then establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although the managers retain responsibility for ensuring adherence to the prescribed protocols.

### 10.2 MAINTENANCE SCHEDULES

The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted as needed. Manufacturers' recommendations provide the primary basis for the established maintenance schedules, and manufacturers' service contracts provide primary maintenance for many major instruments (e.g., GC/mass spectrometry instruments, AA spectrometers, and analytical balances).

### 10.3 SPARE PARTS

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment downtime. The inventory includes those parts (and supplies) that are subject to frequent failure, have limited useful lifetimes, or cannot be obtained in a timely manner should failure occur.

Field sampling task leaders and the respective laboratory managers are responsible for maintaining an adequate inventory of spare parts. In addition to spare parts and supply inventories, the contractor shall maintain an in-house source of backup equipment and instrumentation.

#### 10.4 MAINTENANCE RECORDS

Maintenance and repair of major field and laboratory equipment shall be recorded in field or laboratory logbooks. These records shall document the serial numbers of the equipment, the person performing the maintenance or repairs, the date of the repair, the procedures used during the repair, and proof of successful repair prior to the use of the equipment.

## 11.0 CORRECTIVE ACTION

Corrective actions, if necessary, shall be completed once. If acceptance criteria were not met and a corrective action was not successful or corrective action was not performed, apply the appropriate flagging criteria. Requirements and procedures for documenting the need for corrective actions are described in this section.

### 11.1 CORRECTIVE ACTION REPORT

Problems requiring corrective action in the laboratory shall be documented by the use of a corrective action report. The QA coordinator or any other laboratory member can initiate the corrective action request in the event QC results exceed acceptability limits, or upon identification of some other laboratory problem. Corrective actions can include reanalysis of the sample or samples affected, resampling and analysis, or a change in procedures, depending upon the severity of the problem.

### 11.2 CORRECTIVE ACTION SYSTEM

A system for issuing, tracking, and documenting completion of formal Recommendations for Corrective Action (RCA) exists for addressing significant and systematic problems. Recommendations for corrective actions are issued only by a member of the QA group, or a designee in a specific QA role. Each RCA addresses a specific problem or deficiency, usually identified during QA audits of laboratory or project operations. An RCA requires a written response from the party to whom the RCA was issued. A summary of unresolved RCAs is included in the monthly QA report to management. The report lists all RCAs that have been issued, the manager responsible for the work area, and the current status of each RCA. An RCA requires verification by the QA group that the corrective action has been implemented before the RCA is considered to be resolved. In the event there is no response to an RCA within 30 days, or if the proposed corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

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## 12.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

At a minimum, the QA coordinator of the laboratory shall prepare a summary report quarterly of the status of the project, of QA/QC problems, corrective actions taken, and unresolved RCAs with recommended solutions for management. The report shall also include results from all PE samples, audit findings, and periodic data quality assessments. This report shall be available for review by AFCEE auditors upon request.

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# TAB

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# **FINAL SITE SAFETY AND HEALTH PLAN**

## **Remedial Actions/Investigations at Multiple Sites**

Project Number UEBL 930014

Prepared for:

**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE**

Prepared by:

Dames & Moore  
6310 Lamar Avenue  
Overland Park, Kansas 66202



November, 1999

**FINAL**  
**SITE SAFETY AND HEALTH PLAN**

**REMEDIAL ACTION AT BUILDING 1100 AREA;  
REMEDIAL INVESTIGATION AT BUILDING 1200 AREA;  
REMOVAL ACTION AT ST-007;  
CLOSURE OF THE FUEL HYDRANT LINE;  
CLOSURE OF THE INDUSTRIAL WASTE LINE;  
REMEDIAL ACTION AT ST005;  
REMEDIAL ACTION ALONG STORM SEWER LINE;  
REMEDIAL INVESTIGATIONS AT 4 FORMER UST SITES;  
REMEDIAL ACTION AT 8 FORMER UST SITES, AND  
BACKFILLING/MONITORING WELL CLOSURE AT POL YARD**

Prepared for

**AFCEE/ERD**  
**Contract No. F41824-94-D-8102/0004 Modification 12**

Dames & Moore Job No. 01016-740-149  
November 1999

## SITE SAFETY AND HEALTH PLAN APPROVALS

This Site Safety and Health Plan (SSHP) was developed to provide safety and health guidance for Dames & Moore personnel during the remedial activities, removal activities, and closure activities at Richards-Gebaur AFB, Grandview, Missouri. The signatures below indicate approval of the plan and agreement to following the procedures described therein.

---

Martha J. Boss, CIH (CN 4952), CSP (SN 11308)  
Project Safety and Health Manager

November, 1999

---

John Plevniak, P.G.  
Senior Project Manager

November, 1999

---

L. Kristopher Moore, R.G.  
Technical Project Manager

November, 1999

TABLE OF CONTENTS

Section	Page
SITE SAFETY AND HEALTH PLAN ACRONYM LIST.....	vi
EMERGENCY PHONE NUMBERS .....	viii
1.0 INTRODUCTION AND APPLICABILITY.....	1
1.1 STATEMENT OF SAFETY AND HEALTH POLICY .....	1
2.0 FACILITY BACKGROUND/WORK PLAN .....	3
2.1 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION..	3
2.2 SCOPE OF WORK .....	3
2.2.1 Remedial Action at Building 1100 Area .....	3
2.2.2 Remedial Investigation at Building 1200 Area ..	3
2.2.3 Removal Action at ST-007 .....	4
2.2.4 Closure of Fuel Hydrant Line.....	4
2.2.5 Closure of the Industrial Waste Line.....	4
2.2.6 Removal Action at C5-003 (Oil/Water Separators).....	4
2.2.7 Remedial Investigations at 4 Former UST Sites.....	5
2.2.8 Removal Action at 8 Former UST Sites.....	5
2.2.9 Remedial Investigation of the Storm Sewer Line. ....	6
2.2.10 Backfilling at the POL Yard.....	6
3.0 SAFETY PROGRAM ADMINISTRATION .....	7
3.1 PROJECT MANAGER.....	7
3.2 PROJECT SAFETY AND HEALTH MANAGER .....	8
3.3 SITE SAFETY AND HEALTH OFFICER.....	8
3.4 REGIONAL HEALTH AND SAFETY MANAGER. ....	10
3.5 PROJECT PERSONNEL .....	10
3.6 SUBCONTRACTOR'S SAFETY REPRESENTATIVE.....	10
4.0 HAZARD ASSESSMENT.....	12
4.1 CHEMICAL HAZARDS .....	12
4.1.1 Exposure Limits.....	12
4.1.2 Physical Properties .....	12
4.1.3 Site Constituents.....	13
4.1.3.1 Kerosene (similar to Jet Fuel).....	13
4.1.3.2 Benzene .....	13
4.1.3.3 Toluene.....	14
4.1.3.4 Ethyl Benzene.....	14
4.1.3.5 Xylene (o-, m-, p-isomers) .....	14
4.1.3.6 Trichloroethylene .....	15
4.1.3.7 Cis-Dichloroethene. ....	15
4.1.3.8 Dichloroethane .....	15
4.1.3.9 Vinyl Chloride .....	16
4.1.3.10 Tetrachloroethylene.....	16
4.1.4 Exposure Routes .....	17
4.1.5 Hazard Communication.....	17
4.2 PHYSICAL HAZARDS .....	18
4.3 STANDARD SAFE OPERATING PROCEDURES. ....	18
4.3.1 General Site Rules/Prohibitions.....	18
4.3.2 Heat Stress Recognition and Control .....	20
4.3.3 Slip/Trip/Fall Hazards ...	20
4.3.4 Lifting Hazards.....	20

TABLE OF CONTENTS (Continued)

211 358

Section	Page
4.3.5 Noise .....	21
4.3.6 Electrical Safety .....	21
4.3.7 Underground and Overhead Utilities .....	22
4.3.8 Work Area Protection.....	22
4.3.9 Heavy Equipment.....	23
4.3.10 Drill Rig Work Practices .....	23
4.3.10.1 Movement of Drill Rigs.....	23
4.3.10.2 Housekeeping On and Around the Drill Rig .....	24
4.3.10.3 Use of Hand Tools.....	25
4.3.10.4 Use of Augers .....	25
4.3.10.5 Air Rotary Drilling.....	26
4.3.10.6 Start-Up Procedures.....	28
4.3.10.7 Drill Rig Operation .....	28
4.3.11 Gas Cylinders .....	29
4.3.12 Machine Guarding.....	29
4.4 AIRFIELD SAFETY.....	30
4.4.1 Definitions .....	30
4.4.2 General Requirements .....	30
4.4.3 Landing Areas .....	31
4.4.4 Safety Precaution Areas .....	32
5.0 RESPIRATORY PROTECTION.....	33
5.1 UPGRADE AND DOWNGRADE CRITERIA .....	33
5.2 SELECTION CRITERIA .....	34
5.3 MEDICAL SCREENING .....	34
5.4 FIT TESTING .....	34
5.5 RESPIRATOR USE INSTRUCTIONS .....	35
5.6 CLEANING OF RESPIRATORS.....	36
5.6.1 Cleaning Procedure for Individually Assigned Respirators .....	37
5.6.2 Cleaning Procedure for Visitor or Multi-Assigned Respirators .....	37
5.7 RESPIRATOR MAINTENANCE .....	37
5.8 STORAGE OF RESPIRATORS .....	37
6.0 PERSONAL PROTECTIVE EQUIPMENT PROGRAM .....	39
6.1 LEVELS OF PROTECTION .....	39
6.1.1 Level C Protection.....	39
6.1.2 Level D Protection .....	39
7.0 AIR MONITORING PROCEDURES AND ACTION LEVELS .....	40
7.1 AIR MONITORING INSTRUMENTS.....	40
7.2 AIR MONITORING FOR GENERAL SITE ACTIVITIES .....	40
7.3 BACKGROUND READINGS.....	40
7.4 DATA LOGGING.....	40
8.0 SITE CONTROL MEASURES.....	42
8.1 PERSONNEL LISTS .....	42
8.2 WORK ZONES .....	42
8.3 VISITOR CONTROL .....	43
8.4 SITE CONTROL AND SECURITY.....	43
9.0 DECONTAMINATION PROTOCOL.....	44
9.1 PERSONNEL DECONTAMINATION.....	44

TABLE OF CONTENTS (Continued)

211 359

Section	Page
9.1.1 Contamination Prevention .....	44
9.1.2 Decontamination Area .....	44
9.1.3 Decontamination Procedures for Level C and D Protection .....	45
9.1.4 Procedures for Direct Contact with Hazardous Waste .....	46
9.1.5 Personnel Decontamination in Medical Emergencies .....	46
9.2 EQUIPMENT DECONTAMINATION .....	46
9.2.1 Decontamination of Tools .....	47
9.2.2 Decontamination of Monitoring Instrumentation .....	47
9.3 SITE HOUSEKEEPING .....	47
10.0 PERSONNEL TRAINING REQUIREMENTS .....	48
10.1 SITE SAFETY BRIEFINGS .....	48
10.2 SAFETY BRIEFINGS .....	49
10.3 FIRST AID/CPR TRAINING .....	49
10.4 VISITOR TRAINING .....	49
11.0 MEDICAL SURVEILLANCE .....	50
12.0 EMERGENCY RESPONSE PLAN .....	51
12.1 PLAN PROCEDURES .....	51
12.2 RESPONSIBILITIES OF THE EMERGENCY COORDINATOR (EC) .....	51
12.3 COORDINATED EMERGENCY SERVICES .....	51
12.3.1 Obtaining Emergency Services .....	51
12.3.2 Communications .....	52
12.3.3 Emergency Services Information .....	52
12.3.4 Directions to Hospital .....	52
12.4 EMERGENCY PROCEDURES .....	53
12.5 ESCAPE ROUTE AND PLACES OF REFUGE .....	54
12.6 FIRE PROTECTION .....	54
12.7 FIRST AID EQUIPMENT .....	55
12.7.1 First Aid Supply List .....	55
12.8 OPERATIONS SHUTDOWN .....	55
12.9 DISTRIBUTION OF THIS EMERGENCY RESPONSE PLAN .....	56
12.10 PROCEDURES FOR PLAN REVIEW AND AMENDMENT .....	56
13.0 ACCIDENT PREVENTION PLAN .....	57
13.1 RESPONSIBILITIES .....	57
13.2 RECORD KEEPING AND INCIDENT REPORTING .....	57
13.2.1 Program Responsibilities .....	58
13.2.2 Accident and Illness Investigation .....	58
13.2.3 Responsibilities For An Accident or Illness Investigation .....	59
13.2.4 Incident/Accident Reporting .....	59
13.2.5 Record Keeping .....	60
13.3 DAILY WORK AREA INSPECTIONS .....	60
13.4 HEALTH AND SAFETY EQUIPMENT LIST .....	61
14.0 SPILL CONTROL .....	62
14.1 NOTIFICATION OF SPILLS AND DISCHARGES .....	62
14.2 REQUIRED EQUIPMENT .....	62
14.3 SPILL CONTROL .....	62
14.4 DECONTAMINATION .....	62

**LIST OF APPENDICES**

<b>APPENDIX A</b>	SSHP Compliance Agreement Form
<b>APPENDIX B</b>	Incident/Accident Report Form
<b>APPENDIX C</b>	Site Inspection Log
<b>APPENDIX D</b>	Hazard Communication Program Material Safety Data Sheets
<b>APPENDIX E</b>	Summary of Chemical Hazards - Table 1 and Table 2
<b>APPENDIX F</b>	Activity Hazard Analysis Heat Stress Monitoring
<b>APPENDIX G</b>	Visitors Log
<b>APPENDIX H</b>	Documentation of On Site Hazardous, Toxic, and Radioactive Waste Field Experience
<b>APPENDIX I</b>	Instrumentation Documentation and Field Activity Documentation
<b>APPENDIX J</b>	Emergency Information
<b>APPENDIX K</b>	Excavation/Trenching Safety

SITE SAFETY AND HEALTH PLAN ACRONYM LIST	
ACGIH	American Conference of Governmental Industrial Hygienists
AFB	Air Force Base
AFCEE	Air Force Center For Environmental Excellence
ANSI	American National Standards Institute
APR	Air Purifying Respirator
BEC	Base Environmental Coordinator
BTEX	Benzene, Toluene, Ethyl Benzene, Xylene
CFR	Code Of Federal Regulations
CGI	Combustible Gas Indicator
CIH	Certified Industrial Hygienist
cis-DCA	cis-Dichloroethane
COR	Contracting Officer Representative
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
DCA	Dichloroethylene
EC	Emergency Coordinator
EPA	Environmental Protection Agency
eV	Electron Volts
EZ	Exclusion Zone
°F	Degrees Fahrenheit
GFCI	Ground Fault Circuit Interrupter
H <sub>2</sub> S	Hydrogen Sulfide
iaw	In Accordance With
IDLH	Immediately Dangerous To Life And Health
IP	Ionization Potential
IWL	Industrial Waste Line
LEL	Lower Explosive Limit
MDNR	Missouri Department of Natural Resources
mm	Millimeter
mm Hg	Millimeters Of Mercury
MSDS	Material Safety Data Sheet
NIOSH	National Institute For Occupational Safety And Health
O <sub>2</sub>	Oxygen
OBZ	Operator's Breathing Zone
OSHA	Occupational Safety And Health Administration
OWS	Oil/Water Separator
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager

SITE SAFETY AND HEALTH PLAN ACRONYM LIST (Continued)	
POL	Petroleum, Oil, and Lubricants
PPE	Personal Protective Equipment
ppm	Parts Per Million
PVC	Polyvinyl Chloride
RA	Remedial Action
REL	Recommended Exposure Limit
RHSM	Regional Health and Safety Manager
RI	Remedial Investigation
SCBA	Self Contained Breathing Apparatus
SHM	Safety And Health Manager
SOP	Standard Operating Procedures
SOW	Statement Of Work
SSHO	Site Safety And Health Officer
SSHP	Site Safety and Health Plan
SSR	Subcontractor's Safety Representative
STEL	Short Term Exposure Limit
SZ	Support Zone
TCE	Trichloroethylene
TLV	Threshold Limit Value
TWA	Time Weighted Average
USACE	U.S. Army Corps Of Engineers
USAF	U.S. Air Force
UST	Underground Storage Tank
VP	Vapor Pressure

## EMERGENCY PHONE NUMBERS

Key responsibilities have been assigned to the following Dames & Moore personnel

Mr. John Plevniak	Overland Park, KS	Senior Project Manager	(913) 677-1490
Mr. L. Kristopher Moore	Overland Park, KS	Technical Project Manager	(913) 677-1490
Mr. Dennis Day	Omaha, NE	Regional Health and Safety	(402) 334-8182

AFCEE Restoration Team Chief:	Ms. Kay M. Grosinske		
	San Antonio, Texas		
	Contracting Officer Representative (COR)		(210) 536-6451

Mr. Mike Nikelow	Richards-Gebaur Base Environmental Coordinator (BEC) and Point of Contact (POC)		(614) 492-8065 Ext 27
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Kansas City Police/Emergency			911
Research Belton Hospital, Belton, Missouri			(816) 348-1200

Belton Fire Department			911 (816) 331-2121
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Belton Police			(816) 331-5522
Poison Control Center			(816) 234-3434 (800) 366-8888

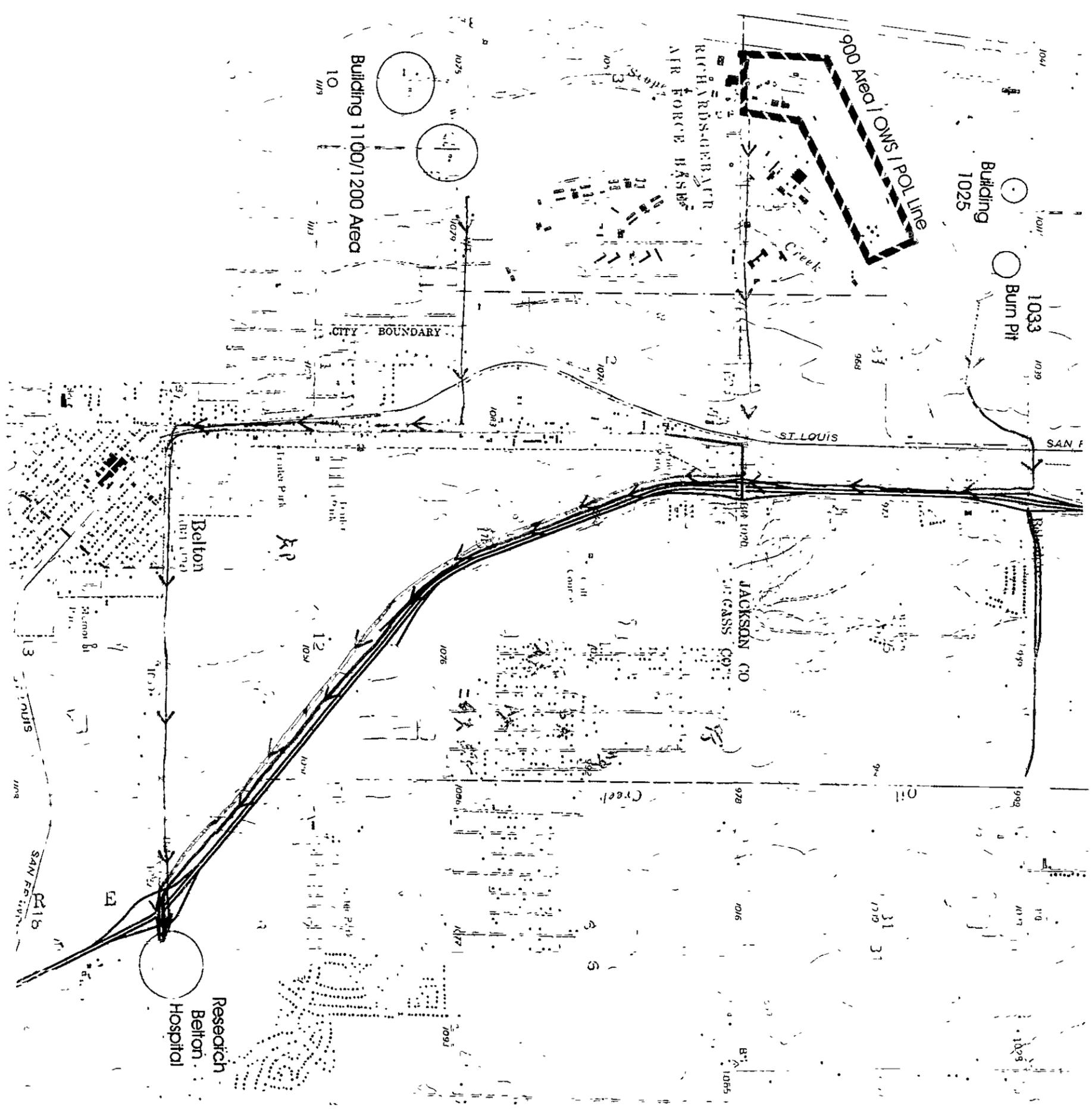
**NOTE:** No military emergency facilities exist at the Base. Research Belton Hospital is located approximately four miles south of Richards-Gebaur Air Force Base (AFB) on U.S. Highway 71. The following routes are based on the location of the specific site(s) in relation to Research Belton Hospital:

- From the **1100 Area and 1200 Area**: take Markey Road east to Scott Avenue and turn right (south) onto Missouri Highway 58. Proceed east on Missouri Highway 58 approximately two miles to Research Belton Hospital located immediately east of U.S. Highway 71 interchange.
- From the **ST-007 Area, Building 903, Building 965, Building 940, Building 948, Building 944, Storm Sewer Line, the northern portions of the fuel hydrant line and the industrial waste line**: take Hangar Road south to 155<sup>th</sup> Street and turn east. Proceed east on 155<sup>th</sup> Street to U.S. Highway 71 and turn right (south). Proceed south on U.S. Highway 71 approximately four miles to the Missouri Highway 58 exit (third exit). Research Belton Hospital is located immediately east of the Missouri Highway 58 exit;
- From **ST-005 (Oil/Water Separators), Building 942, POL Yard, and the eastern portions of the fuel hydrant and industrial waste lines**: take Andrews Road north

to Missouri Highway 150 and turn east (right) to U.S. Highway 71. Proceed south on U.S. Highway 71 approximately four miles to the Missouri Highway 58 exit (third exit). Research Belton Hospital is located immediately east of the Missouri Highway 58 exit

- From **Building 1025 and Building 1033 areas**: follow the old runway and gravel road northeast to Andrews Road. Turn left onto Andrews Road and proceed north to Missouri Highway 150 and turn right (east) to U.S. Highway 71. Proceed south on U.S. Highway 71 approximately four (4) miles to the Missouri Highway 58 exit (third exit). Research Belton Hospital is located immediately east of the Missouri Highway 58 exit.

A map to Research Belton Hospital is provided following this section.



Scale 1:24,000

**RICHARDS-GEBAUR AIR FORCE BASE  
HOSPITAL ROUTES**

- Route from Building 1025 and 1033 Burn Pit
- Route from 900 Area/OWS POL Line
- Route from Building 1100 and 1200 Area

## 1.0 INTRODUCTION AND APPLICABILITY

The purpose of this site health and safety plan (SSHP) is to assign responsibilities, establish the overall site health and safety program standards and mandatory safety procedures, and provide for contingencies that may arise during activities at Richards-Gebaur AFB, Grandview, Missouri. These activities are associated with the Remedial Action (RA) at Building 1100 Area, Remedial Investigation (RI) at Building 1200 Area, Removal Action at ST-007, Closure of the Fuel Hydrant Line, Closure of the Industrial Waste Line (IWL), Removal Activities at ST005, RI along the Storm Sewer Line, RIs at 4 Former underground storage tank (UST) Sites, RA at 8 Former UST Sites, and backfilling/monitoring well closure at the petroleum, oil, and lubricants (POL) Yard. This SSHP complies with, but does not replace, Federal Health and Safety Regulations as set forth in 29 CFR 1910 and 1926, the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual, EM 385-1-1 most recent version, and U.S. Air Force (USAF) Safety and Health Requirements. If site conditions vary from those expected, then this SSHP will be modified to reflect those changes. All proposed changes to this SSHP will be reviewed with the Safety and Health Manager (SHM). Changes will be annotated on the original SSHP and included as copies on all SSHPs generated for this site. The COR and the SSHP will initial and date the SSHP changes prior to their implementation.

### 1.1 STATEMENT OF SAFETY AND HEALTH POLICY

It is the policy of Dames & Moore to provide a safe and healthful work environment for all of its employees and to ensure the prevention of occupational injuries and illnesses.

The basis for loss prevention and safety programs is that accidents that cause injuries or illness to personnel or property damage can be prevented. All Dames & Moore personnel are expected to conduct business in a manner that actively integrates the elements of the Firmwide Health and Safety Program into applicable aspects of Dames & Moore operations.

The goal of the Firmwide Health and Safety Program is zero accidents; therefore, accident prevention continues to be of paramount importance to the firm. To this end, safety takes precedence over expediency or short cuts.

Dames & Moore has established procedures that provide direction on health and safety matters to all employees. These procedures, which are contained in the *Dames & Moore Firmwide Health and Safety Manual*, are periodically evaluated in light of current case law, new regulations, and emerging industry practices.

Dames & Moore's disciplinary program is described in the "*Employee Handbook of Human Resources Policy*", section III-10, "Problem Performance". Disciplinary actions for misconduct or unsatisfactory performance include verbal and written warnings, and suspension without pay. A serious violation of safety or health rules, or engaging in conduct that creates a safety or health hazard may be considered a "serious offense that may result in immediate termination".

The responsibilities of managers and supervisors are described in the *Dames & Moore Firmwide Health and Safety Policy and Procedures Manual*; responsibilities that pertain to this specific project are provided in Section 3.0. The health and safety performance of supervisory personnel is specifically evaluated during annual and mid-year performance reviews.

## **2.0 FACILITY BACKGROUND/WORK PLAN**

### **2.1 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION**

Site activities will take place at Richards-Gebaur AFB (RGAFB) located in extreme western Missouri, approximately 18 miles south of downtown Kansas City and approximately 3 miles east of the Kansas state line. Contaminants of potential concern include petroleum fuels, solvents, waste oil, polychlorinated biphenyls (PCBs), and ethylene glycol

### **2.2 SCOPE OF WORK**

The following fieldwork is to be performed for this project:

#### **2.2.1 Remedial Action at Building 1100 Area**

This portion of the work will consist of removing and disposing of petroleum contaminated soils and performing confirmatory sampling to verify cleanup. The work will include the removal of approximately 25 cubic yards of petroleum contaminated soil using a backhoe and or excavator. The contaminated soil will be loaded into roll-off boxes for storage prior to disposal. The confirmatory sampling will be conducted using the backhoe or excavator bucket to remove soil from the excavation. The soil will then be sampled by Dames & Moore field personnel. The excavation will be backfilled with clean soil from an off-site location after collection of the confirmatory samples. The excavation will be fenced off to prevent people and/or animals from entering the excavation when Dames & Moore personnel are not at the site.

#### **2.2.2 Remedial Investigation at Building 1200 Area**

A subsurface investigation will be conducted at this location. If the presence of petroleum contaminated soils is confirmed in excess of Missouri Department of Natural Resources (MDNR) cleanup levels, the soil will be excavated and disposed of at an off-base site in accordance with MDNR regulations. The subsurface investigation will include excavating test pits in the former UST areas adjacent to Buildings 1201 and 1202. Impacted soils will be sampled and field screened by Dames & Moore field personnel. The impacted soil will be placed into roll-off boxes for storage prior to disposal. It is anticipated that approximately 134 cubic yards of impacted soil will be removed from the 1200 Area. Confirmatory sampling will be conducted using the backhoe or excavator bucket after field screening measurements indicate that impacted soil has been removed from the excavations. The excavations will be backfilled with clean soil from an off-site location after collection of the confirmatory samples. The excavations will be fenced off to prevent people and/or animals from entering the excavations when Dames & Moore personnel are not at the site.

### 2.2.3 Removal Action at ST-007

The field activities at Site ST-007 will include the removal of 18 bio-vents and the abandonment of the corresponding boreholes. A drilling subcontractor will pull the polyvinyl chloride (PVC) casing and then backfill the borehole according to MDNR regulations. The top 2 to 4 feet of each borehole will be backfilled with topsoil and the area re-seeded with grass. The PVC casings and associated soil removed from the boreholes will be placed in a roll-off box for disposal at an off-site facility.

### 2.2.4 Closure of Fuel Hydrant Line

The initial task for closure of the fuel hydrant line is to excavate the area adjacent to Building 942 where the line was previously remediated and excavate the location where the fuel hydrant line enters the fenced POL Yard. A subcontractor will then abate the asbestos wrap from the fuel hydrant line at the POL Yard in these locations so the pipe can be cut. A subcontractor will then clean the fuel hydrant line of excess product using an approved method (pigging or jetting device). The line will then be flushed to remove remaining product, fluids, and sludge and dispose of such at an off-site disposal facility. When cleaning of the hydrant line is complete, it will be filled with grout.

Dames & Moore personnel will excavate the soil from around the fuel hydrant line at 100 foot intervals and at elbow joints. The soil will be removed to a depth of one foot beneath the fuel hydrant line using an excavator. Dames & Moore field personnel will sample the soil beneath the line using the excavator bucket. The excavations will then be backfilled with the excavated soil. Each excavation will be fenced off to prevent people and/or animals from entering the excavations when Dames & Moore personnel are not at the site.

### 2.2.5 Closure of the Industrial Waste Line

Closure of the IWL will include sampling the soil adjacent to 24 manholes using a direct-push drilling rig, cleaning the IWL by pigging or jetting, backfilling the manhole locations, with clean soil, and restoration of the site to grade. Field personnel work space will be monitored for hydrogen sulfide (H<sub>2</sub>S) using an oxygen/combustible gas indicator (CGI) equipped with a H<sub>2</sub>S toxin meter.

Cleaning of the IWL will be conducted by subcontract personnel.

### 2.2.6 Removal Action at C5-003 (Oil/Water Separators)

The activities included in the closure of the Oil/Water Separators (OWS) (Site C5-003) include collecting soil samples adjacent to the OWSs using direct-push methods, removal of liquid contents from the OWSs, sampling of the liquids, cleaning of the OWSs, removal of the OWSs, removal of impacted soil, confirmatory sampling of the soil, and backfilling the excavation.

The direct-push drilling will be conducted by a subcontractor to collect soil samples from the area surrounding the OWSs. Soil from the borings will be analyzed to determine if the soil in the area of the OWSs has been impacted by a release.

After review and confirmation of the results from the soil sampling, a subcontractor will remove the fluids from the OWSs. The subcontractor will then clean the inside of the separators. All fluids will be containerized and sampled by Dames & Moore field personnel for characterization for disposal. The fluids will be disposed of at an off-site location.

A subcontractor will then use an excavator and possibly a crane to remove the OWSs. The associated vent stacks and piping will also be removed during this operation. Any steel tanks will be transported to a recycling/scrap facility. Concrete will be demolished and placed in roll-off boxes for transport to a landfill. Soil determined to be contaminated during the removal operation will be excavated. The soil will be placed in roll-off boxes for transport and disposal at an off-site landfill. The excavations will be backfilled with soil brought from an off-site location after the results of the confirmatory samples have been reviewed and it is determined that soil has not been further impacted from releases from the OWSs. Anytime that Dames & Moore personnel are not at the site, each excavation will be fenced off from the remainder of the area to minimize the chance for people and/or animals from entering the excavations.

#### **2.2.7 Remedial Investigations at 4 Former UST Sites**

RI activities will be conducted at former UST sites at Buildings 940, 944, 965, and 1033. The RI activities will involve the use of a subcontractor to conduct direct-push drilling methods. A maximum of eight borings will be advanced at each UST location. Soil, and if encountered, ground water samples will be collected from each of these boreholes. The soil borings will then be plugged by the subcontractor. If the sample results indicate that a specific area has been impacted at concentrations exceeding the site cleanup standards, then the areas will be included in the removal action portion of this contract.

#### **2.2.8 Removal Action at 8 Former UST Sites**

Removal activities will be conducted at former UST sites at Buildings 903, 942, 948, and 1025. If any of the buildings (940, 944, 965, and 1033) have impacts noted during the above mentioned RI that exceed the site cleanup guidelines, these sites will be added to the removal action list.

The Removal Actions will involve Dames & Moore personnel using excavating equipment to remove the impacted soil from each former UST location. The contaminated soil will be loaded into roll-off boxes for storage prior to disposal. The confirmatory sampling will be conducted using the backhoe or excavator bucket to remove soil from the excavation. The soil will then be sampled by Dames & Moore field personnel. The extra soil will then be returned to the excavation. The excavation will be backfilled with soil brought from an off-site location after the results of the confirmatory samples have been reviewed and it is determined that the soil exceeding the site cleanup standards presented in the Work Plan has been remediated. Anytime that Dames & Moore personnel are not at the site, the excavations

will be fenced off from the remainder of the area to minimize the chance for people and/or animals from entering the excavations.

### **2.2.9 Remedial Investigation of the Storm Sewer Line**

Activities related to the RI at the storm sewer line will include using a subcontractor to conduct direct-push drilling techniques to collect soil and ground water samples along an estimated 300 linear feet of the line. The soil samples will be collected at approximately 25-foot intervals and at all storm sewer manholes within this 300 foot section of line. The subcontractor will plug the borings after the samples have been collected by Dames & Moore field personnel. The samples will be analyzed and if contamination is present above the site cleanup guidelines, a removal action will be conducted along the storm sewer line

The Removal Actions will involve Dames & Moore personnel using excavating equipment to remove the soil from each impacted area along the storm sewer line. The contaminated soil will be loaded into roll-off boxes for storage prior to disposal. The confirmatory sampling will be conducted using the backhoe or excavator bucket to remove soil from the excavation. The soil will then be sampled by Dames & Moore field personnel. The extra soil will then be returned to the excavation. The excavation will be backfilled with soil brought from an off-site location after the results of the confirmatory samples have been reviewed and it is determined that the soil with concentrations exceeding the site cleanup guidelines has been remediated. Anytime that Dames & Moore personnel are not at the site, the excavations will be fenced off from the remainder of the area to minimize the chance for people and/or animals from entering the excavations.

### **2.2.10 Backfilling at the POL Yard**

Dames & Moore personnel will conduct backfilling activities in the depression that was at one time occupied by Buildings 951 and 953 in the POL Yard. The backfilling activities will involve the removal of the fluids that are currently present in the depression. These fluids will be pumped through the CS003 separators prior to the removal of the separators. Backfilling activities will be started after the monitoring well that is located in the depression has been plugged in accordance with State of Missouri well abandonment regulations. The backfill will be placed in 6 to 8-inch lifts and tracked into place using a bulldozer. The elevation of the fill will be brought up to a level consistent with the surrounding area.

### 3.0 SAFETY PROGRAM ADMINISTRATION

Site personnel and visitors will strictly adhere to the provisions of this SSHP along with the applicable regulations issued by governmental entities. **Each contractor will be held accountable for the safe and healthful performance of work by each of their employees, subcontractors, or support personnel who may enter the site.**

#### 3.1 PROJECT MANAGER

The Project Manager (PM) will direct on-site operations. The PM may delegate any or all of the following responsibilities to a duly qualified Site Manager. At the site the PM, assisted by the Site Safety and Health Officer (SSHO), has primary responsibility for:

- Seeing that appropriate Personal Protective Equipment (PPE), monitoring equipment, and facilities are available and properly utilized by all on-site personnel,
- Establishing that personnel are aware of the provisions of this plan, are instructed in the work practices necessary to enhance safety, and are familiar with planned procedures for dealing with emergencies;

Establishing that:

- All on-site personnel working with hazardous waste have completed a minimum of 40 hours of health and safety training,
- Site supervisors have the additional 8 hours of training required in accordance with (iaw) 29 CFR 1910.120, and
- All personnel have appropriate medical clearance as required by 29 CFR 1910.120, and have been fit tested for the appropriate respirators;
- Personnel are aware of the potential hazards associated with site operations;
- Visually monitoring the safety performance of all personnel to see that the required work practices are employed;
- Correcting any work practices or conditions that may result in injury or exposure to hazardous substances;
- Seeing to the completion of the *SSHP Compliance Agreement* by site personnel (Appendix A)
- Halting site operations, if necessary, in the event of an emergency or to correct unsafe work practices;

- Completing the *Incident/Accident Report Forms* located in Appendix B as soon as possible after an accident has occurred;
- Serving as a liaison with public officials and medical personnel; and
- Reviewing and approving this SSHP.

### **3.2 PROJECT SAFETY AND HEALTH MANAGER**

An American Board of Industrial Hygiene-Certified Industrial Hygienist (CIH) and Board of Certified Safety Professional-Certified Safety Professional (CSP) will serve as the project Safety and Health Manager (SHM) and administer this SSHP. The SHM is responsible for the following safety and health related activities at the site:

- Developing, approving, and enforcing this SSHP,
- Making changes or modifications to this SSHP, with concurrence of the PM and the Regional Health and Safety Manager (RHSM), as necessary throughout the project;
- Overseeing the on-site SSHO;
- Reviewing all accident reports and conduct accident/illness investigations as warranted;
- Reviewing the results of daily site inspections as warranted;
- Providing health and safety support as requested by the SSHO and PM iaw this SSHP

### **3.3 SITE SAFETY AND HEALTH OFFICER**

The SSHO is responsible for site safety and health during this project. The SSHO will be on site during all activities to implement this SSHP. The SSHO will be an individual experienced in implementing SSHPs, and skilled in conducting the air monitoring tasks described in Section 7.0. The individual selected for this function must be approved by the SHM. The SSHO will work under the direction of the SHM, and is responsible for the following activities:

- Implementing and enforcing this SSHP, and reporting any deviations from the anticipated conditions described in this plan to the SHM and PM;
- Seeing that the PM enforces disciplinary action when unsafe acts or practices occur;
- Maintaining the safety and health records for site personnel including Medical Notifications and training certificates;

- Granting permission for site access, controlling entry and exit points, maintaining site security, and maintaining exit and entry signs;
- Selecting the appropriate PPE for site personnel and periodically inspecting PPE for defects and proper maintenance;
- Dispensing PPE and seeing that PPE is available for site personnel;
- Providing ongoing review of the protection level needs as project work is performed, and informing the PM and SHM of the need to upgrade/downgrade protection levels as appropriate;
- Monitoring site employees for cold and heat stress during work activities;
- Training employees on emergency procedures and evacuation routes, and providing follow-up training on the use of PPE;
- Monitoring on-site hazards and conditions and making requests to the PM and SHM for revisions to this SSHP if conditions change or new hazards are found that were not previously covered,
- Evaluating the use of monitoring equipment by site personnel, seeing that it is calibrated in accordance with the manufacturer's instructions or other standards, and that results are properly recorded and filed,
- Implementing monitoring of site personnel as described in Section 7.0 and recording results of exposure evaluations;
- Enforcing the "buddy system" when working in remote locations, or working in areas where personal protective equipment is required;
- In accordance with Section 9.0, setting up decontamination lines, controlling decontamination, preparing decontamination solutions, disposing of contaminated materials, and evaluating the effectiveness of the system;
- Coordinating with the Occupational Physician to identify personnel for whom special PPE or exposure monitoring may be required or desirable;
- Conducting safety meetings and completing the *Site Inspection Log* (Appendix C), attach extra note pages as needed to record meeting discussions;
- Maintaining a list of the hazardous chemicals brought on site by contractors, and providing Hazard Communication training to site personnel to inform them of the hazards and health effects associated with the chemicals brought on site by all contractors and subcontractors;

- Halting site operations, if necessary, in the event of an emergency or to correct unsafe work practices;
- Notifying emergency response personnel in the event of an emergency.
- Reviewing and approving this SSHP, and
- Assuming any other duties as directed by the PM or SHM/RHSM.

#### 3.4 REGIONAL HEALTH AND SAFETY MANAGER

The Dames & Moore RHSM is responsible for overseeing health and safety activities for all projects. Unless otherwise noted, the RHSM has the final authority for the Contractor over decisions that impact health and safety on these projects. The RHSM is responsible for:

- Seeing that health and safety functions are conducted by appropriately qualified personnel;
- Determining the need for periodic audits of the operation to evaluate compliance with this SSHP; and
- Reviewing and approving this SSHP, as well as all proposed changes and modifications to this Plan.

#### 3.5 PROJECT PERSONNEL

Project personnel, including subcontractor personnel, involved in on-site operations are responsible for:

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees;
- Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the SSHO or PM;
- Implementing the procedures set forth in the SSHP, and reporting any deviations from the procedures described in this SSHP to the SSHO or PM for action;
- Notifying the PM and SSHO of any special medical problems they may have and seeing that other appropriate on-site personnel are aware of any such problems; and
- Reviewing this SSHP and signing the *Compliance Agreement* form.

#### 3.6 SUBCONTRACTOR'S SAFETY REPRESENTATIVE

Each subcontractor is required to designate a Subcontractor's Safety Representative (SSR), who typically is the subcontractor supervisor. The SSR is responsible for the safe and healthful performance of work by his work force and subcontractors. These individuals will be trained as Site Supervisors (29 CFR 1910.120). During the subcontractor's activities on site, the SSR will perform continuing work area

inspections, and conduct safety meetings and safety orientations for all new employees. The SSR will attend periodic safety meetings with the SSHO. The SSR will also investigate accidents and overexposures involving subcontractor personnel.

Each SSR is responsible for:

- Establishing that their on-site personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies;
- Establishing that their on-site personnel have completed training appropriate to the tasks being performed and have been fit tested for the appropriate respirators (all certificates are to be available on site);
- Seeing that their on-site personnel are aware of the potential hazards associated with site operations;
- Monitoring the safety performance of their on-site personnel to see that the required work practices are employed;
- Correcting any work practices or conditions that may result in injury or exposure to hazardous substances;
- Preparing any accident/incident reports for their activities (see Section 13.2.4 and/or Appendix B);
- Seeing to the completion of the *SSHP Compliance Agreement* by their on-site personnel (Appendix A);
- Halting their site operations, if necessary, in the event of an emergency or to correct unsafe work practices; and
- Reviewing this SSHP and signing the *SSHP Compliance Agreement* (Appendix A).

## 4.0 HAZARD ASSESSMENT

### 4.1 CHEMICAL HAZARDS

There are two categories of chemical hazards associated with site activities:

- Site Constituents
- Chemicals used to conduct the site work

Site constituents are those which exist at the site and are the cause for conducting site activities. The chemicals that are brought on site in order to conduct the work may be hazardous and subject to regulation under Occupational Safety and Health Association's (OSHA's) Hazard Communication Standard (29 CFR 1910.1200).

#### 4.1.1 Exposure Limits

OSHA permissible exposure limits (PELs), the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), and the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs), which are expressed as time weighted averages (TWAs), are defined as concentrations for an 8-hour work day, 40-hour work week to which almost all workers can be repeatedly exposed without suffering adverse health effects.

Short Term Exposure Limit (STEL) is defined as the concentration to which workers can be exposed for short time periods without irritation, tissue damage, or narcosis sufficient to likely cause impairment of self-rescue or precipitate accidental injury. The STEL is a 15-minute time-weighted average that should not be exceeded at any time during the workday.

#### 4.1.2 Physical Properties

**Ionization Potentials (IP)** refer to the electron voltage (eV) required to break apart a molecule. In the selection of air monitoring instrumentation, specifically photoionization Detectors (PIDs), ionization is an important criterion for PID lamp selection. In order for the PID to be able to detect a chemical, the lamp selected must have an energy level expressed as eV that exceeds the chemical's IP. The lamps available are 9.8, 10.2, and 11.7 eV. The 11.7 eV lamp is seldom used for fieldwork because this lamp is unreliable and often does not work well in on-site situations. For this project a 10.2 eV lamp will be used.

**Vapor Pressure (VP)** refers to the chemical pressure relative to one atmosphere of air. Chemicals with VPs higher than 1 atmosphere will displace air. Sometimes 1 atmosphere is expressed as 760 millimeters of mercury (mm of Hg), in that case chemicals denoted as having VPs in excess of 760 mm of Hg will displace air.

#### 4.1.3 Site Constituents

The chemicals listed below are those associated with the activities that have been historically conducted at the sites. Air monitoring will be performed during field activities that may involve potential contact with hazardous waste as described in Section 7.0 to document the presence or absence of airborne contamination.

The following are the chemical constituents of concern at the sites

- Total Petroleum Hydrocarbons (TPH) associated with jet fuels
- BTEX
  - Benzene
  - Toluene
  - Ethylbenzene
  - Xylene
- Trichloroethylene (TCE)
- TCE Breakdown products of concern
  - Cis-Dichloroethene (cis-DCE)
  - Dichloroethane (DCA)
  - Vinyl Chloride (VC)
- Tetrachloroethylene (PCE)

##### 4.1.3.1 Kerosene (similar to Jet Fuel)

<b>REL</b>	<b>14 ppm</b>
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Inhalation produces effects typical of other lower molecular weight hydrocarbons, namely dizziness and nausea. Narcosis may occur at high exposure levels due to central nervous system depression

Kerosene vapors are moderately explosive when exposed to heat or flame. Because kerosene is a mixture of varying proportions, a mean odor threshold or IP has not been determined.

##### 4.1.3.2 Benzene

<b>PEL</b>	<b>1 ppm</b>
<b>TLV</b>	<b>0.5 ppm</b>
<b>STEL</b>	<b>2.5 ppm</b>
<b>REL</b>	<b>0.1 ppm</b>

Benzene is a central nervous system depressant. Symptoms include headache, nausea, tremors, and fatigue, but these typically do not occur until exposure concentrations are in excess of 150 parts per million (ppm). There is significant evidence that chronic exposures are carcinogenic causing a progressively malignant disease of the blood-forming organs (leukemia)

Benzene is poorly absorbed through intact skin, but contact with liquid benzene may cause blistering and dermatitis. Benzene vapors can cause transient eye irritation. The mean air odor threshold for benzene is 34 ppm, which yields unsatisfactory warning properties. Benzene's IP is 9.25 eV and its VP is 75 mm Hg.

#### 4.1.3.3 Toluene

<b>PEL</b>	<b>200 ppm</b>
<b>STEL</b>	<b>150 ppm</b>
<b>TLV</b>	<b>50 ppm</b>
<b>REL</b>	<b>100 ppm</b>

Toluene is a central nervous system depressant. Symptoms include headache, nausea, dizziness and fatigue, but such symptoms typically do not occur at exposures below 200 ppm. Repeated and prolonged contact with liquid toluene may cause drying of the skin and dermatitis. Mild, transitory eye irritation may be experienced with exposure to vapors above 200 ppm. Toluene is not considered carcinogenic. Toluene's mean odor threshold is 3 ppm, which gives it good warning properties. Toluene's IP is 8.82 eV, and its VP is 21 mm Hg.

#### 4.1.3.4 Ethyl Benzene

<b>PEL/TLV</b>	<b>100 ppm</b>
<b>STEL</b>	<b>125 ppm</b>
<b>REL</b>	<b>100 ppm</b>

Ethyl benzene is an eye and mucous membrane irritant at levels well above the TLV. Liquid ethyl benzene is a significant skin irritant, and can cause defatting and blistering with repeated exposures. Vapor can cause transitory eye irritation at concentrations above 200 ppm. Ethyl benzene is not considered carcinogenic. The mean odor threshold is 0.5 ppm, which gives Ethyl benzene good warning properties. Ethyl benzene's IP is 8.76 eV, and its VP is 10 mm Hg.

#### 4.1.3.5 Xylene (o-, m-, p-isomers)

<b>PEL/TLV</b>	<b>100 ppm</b>
<b>STEL</b>	<b>150 ppm</b>
<b>REL</b>	<b>100 ppm</b>

Xylene is an eye, nose and throat irritant at concentrations nearing 200 ppm. At higher concentrations, it is a central nervous system depressant, with symptoms including nausea, fatigue, and headaches. Liquid xylene acts on the skin as an irritant and can cause dermatitis. Exposure to vapor can cause eye irritation. Xylene is not considered carcinogenic. Xylene's mean odor threshold is 1 ppm, which gives it good warning properties. The IP for the Xylene isomers are 8.56, 8.56, and 8.44 eV, respectively, and the VP range from 7 to 9 mm Hg.

#### 4.1.3.6 Trichloroethylene

PEL/TLV	100 ppm
Ceiling	200 ppm

TCE is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. TCE was and is used mainly as a solvent to remove grease from metal parts, and as an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

TCE is not thought to occur naturally in the environment. However, TCE is present in most underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

TCE is one of the most abundant environmental pollutants of groundwater in the United States. In some groundwater, TCE undergoes reductive dechlorination catalyzed by anaerobic bacteria that yields vinyl chloride, a potent human carcinogen. The intermediary chemicals of concern as TCE degrades to vinyl chloride are cis-DCE and DCA. TCE's IP is 9.45 eV and its VP is 58 mm Hg.

#### 4.1.3.7 Cis-Dichloroethene

PEL/TLV	1 ppm
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Dichloroethene (DCE), primarily cis-1,2-DCE, is the isomer produced by biodegradation of TCE. Chemically manufactured DCE can be distinguished from biogenic DCE because chemically manufactured DCE contains a mixture of isomers, of which cis-DCE is a minor component. DCE's IP is 9.65 eV and its VP is 180 to 265 mm Hg.

#### 4.1.3.8 Dichloroethane

TLV	200 ppm
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DCA can also be found in the environment as a breakdown product of 1,1,1-trichloroethane in landfills where no air comes in contact with the 1,1,1-trichloroethane (an intermediary breakdown product of TCE).

DCA is a colorless, oily, man-made liquid. DCA evaporates quickly at room temperature, has an odor like ether, and burns easily. When 1,1-dichloroethane is released to the environment, it usually exists as a vapor rather than a liquid.

DCA does not dissolve easily in water. The small amounts released to water can evaporate easily into the air. Small amounts of DCA released to soil can also evaporate into the air or move through the soil to enter groundwater. It is not known how long 1,1-dichloroethane remains in the soil. Although DCA does not dissolve easily in water, low levels can be found in water.

There is no reliable information on what levels of exposure to DCA have resulted in harmful health effects in humans. DCA is deadly to animals if large enough quantities are breathed or swallowed.

DCA can be smelled when it is present in the air at levels of 120 to 200 ppm.

There are no regulatory standards or advisories for DCA in drinking water and food. The Environmental Protection Agency (EPA) has determined that any release to the environment in excess of 1,000 pounds should be reported

#### 4.1.3.9 Vinyl Chloride

PEL/TLV	1 ppm
Ceiling	5 ppm
REL	100 ppm

VC is a FLAMMABLE GAS

VC has a Ceiling Limit of 5.0 ppm, not to be exceeded during any 15-minute work period. Vinyl Chloride is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level. VC's IP is 9.99 eV and its VP is 3.0 atmospheres.

#### 4.1.3.10 Tetrachloroethylene

PEL	25 ppm
STEL	200 ppm
REL	0.1 ppm

PCE is a ~~SUSPECTED~~ CARCINOGEN in humans. PCE is a colorless, nonflammable liquid with a sweet chloroform-like odor, used mainly as a solvent in the dry cleaning industry and to a lesser extent as a solvent to degrease metals. It is heavier than water and is moderately soluble in water.

Exposure can cause dizziness in humans along with eye irritation, sinus congestion, nasal discharge, and sleepiness.

TABLE 1; Exposure Limits and Selected Physical Characteristics and TABLE 2, Routes Of Entry, Symptoms Of Exposure, First Aid Treatment, and Target Organs are contained in Appendix E.

#### 4.1.4 Exposure Routes

The following potential exposure routes may exist at the site:

- Skin contact with contaminated materials
- Inhalation of vapors or particulates.
- Ingestion of contaminated materials.
- Injection hazards from puncture wounds and or traumatic injuries.

During this project, skin contact with contaminated or potentially contaminated materials will be minimized by the use of PPE (as described in Section 6.0). Air monitoring and the use of respiratory protection will minimize inhalation of vapors during site activities when appropriate. Ingestion of contaminated materials will be minimized by the use of appropriate personal hygiene procedures during decontamination. Decontamination procedures will include thoroughly washing face and hands with soap and water after leaving the work area and prior to eating, drinking, smoking or using the restroom.

#### 4.1.5 Hazard Communication

Materials that are considered hazardous materials under the OSHA Hazard Communication Standard may be used during this project. Copies of the Material Safety Data Sheets (MSDSs) for such materials are included in Appendix D. The SSHO will make copies of these MSDSs available to all contractors on this project

Any material brought on site that may be considered hazardous under OSHA regulations must first be cleared through the SSHO, so appropriate provisions can be made, if necessary, for compliance with the Hazard Communication Standard. The Hazard Communication Program is contained in the Dames & Moore Health and Safety Program Manual that will be maintained on the site

Site personnel will use the following chemicals:

- Trisodium Phosphate (decontamination)
- Isobutylene (calibration)
- Portland Cement
- Bentonite
- Gasoline and Diesel Fuel (equipment fuel)

All subcontractors are required to provide copies to the SSHO of the MSDSs for all chemicals they bring on site. A complete list of the hazardous chemicals brought on site will be maintained and updated by the SSHO whenever chemicals are added or deleted from the inventory.

The SSHO is also responsible for providing Hazard Communication training to contractor personnel to inform them of the hazards and health effects associated with the chemicals brought on site by all

contractors. Training will be updated when new chemicals are added to the chemical inventory list. The program will be available to all site employees at all times.

#### 4.2 PHYSICAL HAZARDS

The following tasks will be performed during this project:

- Contamination Characterization
- Soil sampling
- Hydrant and Industrial Waste Line Closures
- Hydrant Fuel Line Closures
- Removal of Oil-Water Separators

Physical hazards at the site include those associated with:

- Heat stress
- Cold stress
- Slip-trip-fall types of accidents
- Back injuries due to improper lifting and driving sampling tubes
- Noise from the operation of equipment
- Electrical wiring and controls
- Overhead electrical
- Underground utilities
- Vehicle traffic
- Heavy equipment
- Pressurized gas cylinders
- Pinch points associated with moving parts on pumps and blowers
- Airfield operations

*Activity Hazard Analysis* included in Appendix F summarizes these hazards and response measures

#### 4.3 STANDARD SAFE OPERATING PROCEDURES

##### 4.3.1 General Site Rules/Prohibitions

The following safe work practices will be observed during all field activities:

1. Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the Exclusion Zone (EZ) and Contamination Reduction Zone (CRZ) or where the possibility for the transfer of contamination exists.
2. Smoking and other ignition sources are not allowed in the work area.
3. No alcoholic beverages are allowed on site. Alcohol use is prohibited during both work and off-hours.
4. All personnel enter designated work areas only through the CRZ. All personnel leaving an EZ exit through the CRZ and pass through the decontamination station as described in Section 9.0.

5. Personnel wash their hands and face thoroughly with soap and water prior to eating, drinking or smoking
6. Contact with potentially contaminated substances is minimized. Do not walk through puddles, pools, or mud. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, decontamination pad).
7. All field crew members will make use of their senses to alert them to potentially dangerous situations in which they should not become involved (i.e., presence of strong, irritating or nauseating odors).
8. Only those vehicles and equipment required for the completion of work tasks are permitted within the EZ. All non-essential vehicles will remain within the Support Zone (SZ)
9. Containers, such as drums, will be moved only with the proper equipment and are secured to prevent dropping or loss of control during transport.
10. Field survey instruments [i.e., PIDs and oxygen meters/combustible gas indicators (O<sub>2</sub>/CGIs)] will be covered with plastic or similar covering to minimize the potential for contamination. Such covering will not cover any of the inlet portals for these instruments.
11. No matches or lighters are permitted in the EZ or CRZ.
12. Contaminated PPE (i.e., as respirators, hoses, boots and disposable protective coveralls), will be cleaned, or properly packaged and labeled prior to removal from the EZ or CRZ.
13. Spillage and splashing of contaminated materials will be prevented to the extent possible given site activities. In the event that a spillage occurs, contain liquid if possible.
14. Field crew members will be familiar with the physical characteristics of the site, including:
  - Accessibility to equipment and vehicles;
  - Communications;
  - Areas of known or suspected contamination;
  - Site access; and
  - Nearest water sources
15. The number of personnel and equipment in the contaminated area will be minimized but only to the extent consistent with workforce requirements for safe site operations
16. All wastes generated during Contractor activities at the site will be disposed of as directed by the PM.
17. All PPE will be used as specified and required by this SSHP

Personnel are to immediately notify the SSHO if any indications of potential explosions, or unusual conditions are observed.

#### **4.3.2 Heat Stress Recognition and Control**

The wearing of PPE can place a worker at considerable risk of developing heat stress. This can result in health effects ranging from transient heat fatigue to serious illness or death. A number of interacting factors, including environmental conditions, clothing, workload, and the individual characteristics of the worker cause heat stress. Because heat stress is probably one of the most common (and potentially serious) illnesses, when wearing impermeable PPE in hot environments regular monitoring and other preventive precautions are vital.

Heat stress monitoring should commence when personnel are wearing PPE, including Tyvek-type coveralls, and the ambient temperature exceeds 70°F. If standard work garments (cotton coveralls) are worn, monitoring should commence at 85°F. An ear probe thermometer is recommended over an oral thermometer to monitor the worker's temperature. The oral type can be used to calibrate the ear probe thermometer. Heat stress monitoring and control guidance can be found in Appendix F.

#### **4.3.3 Slip/Trip/Fall Hazards**

Workers should exercise caution when walking around the site to avoid fall and trip hazards. If holes or uneven terrain are located in the work area that could cause site personnel to fall or trip, these areas must be covered, flagged or marked to warn workers. If conditions become slippery, workers should take small steps with their feet pointed slightly outward to decrease the probability of slipping. Gravel or sand should be spread in muddy areas to reduce slipperiness. Workers should watch where they are walking and plan the route to walk in areas of good stability.

#### **4.3.4 Lifting Hazards**

The following guidelines will be followed whenever lifting equipment such as coolers filled with samples, any other objects that are of odd size or shape, or objects that weigh over 40 pounds:

- Get help when lifting heavy loads.
- When moving heavy objects such as drums or containers, use a dolly or other means of assistance.
- Plan the lift. If lifting a heavy object, plan the route and where to place the object. In addition, plan communication signals to be used (i.e., "1, 2, 3 lift," etc.)
- Wear sturdy shoes in good condition that supply traction when performing lifts.

- Keep your back straight and heads aligned during the lift, and use your legs to lift the load - do not twist or bend from the waist. Keep the load in front of you - do not lift or carry objects from the side.
- Keeping the heavy part of the load close to your body will help maintain your balance.

#### 4.3.5 Noise

Noise hazards at this site include the operation of the drill rig. All site personnel and visitors within 25 feet of operations expected to be in excess of 85 decibels will wear hearing protective devices (either muffs or plugs). All personnel working in or around the drill rig where equipment creates noise levels high enough to impair conversation, will wear hearing protective devices (either muffs or plugs).

Personnel are to wash their hands with soap and water prior to inserting ear plugs to avoid initiating ear infections.

A copy of the OSHA Occupational Noise Exposure Standard (29 CFR 1910.95) will be posted in the SZ. All Dames & Moore personnel are in the Dames & Moore Hearing Conservation Program and have had baseline and, where appropriate, annual audiograms.

#### 4.3.6 Electrical Safety

Ground fault circuit interrupters (GFCI) will be used on all extension cords. All extension cords will have a non-current carrying grounding conductor, and will be equipped with strain relief. Cords with damaged insulation, plugs, or sockets will not be used. Damaged extension cords are not to be repaired and will be taken out of service. The SSHO is responsible for performing periodic inspections on portable extension cords and GFCIs. Extension cords that are used in the work area are to be inspected weekly. The SSHO is responsible for establishing a system of unique identifiers for extension cords and GFCIs, and a means of denoting that the system passed the periodic inspection. All portable tools will be grounded or fabricated of approved, double insulated construction.

Warning signs will be posted on all equipment-requiring lockouts. "Lockout" involves physically locking out the energy source(s) to a piece of equipment that is going to be worked on. The idea is to prevent an accidental movement or startup of the equipment while it is being worked upon. The lockout rule applies to almost every piece of equipment that is to be worked on. The exception to this lockout rule is cord-and-plug equipment if:

- This equipment is unplugged
- The plug is in the control of the worker at all times, and
- There are no other sources of energy to the equipment.

The types of energy that may need to be addressed include electrical and mechanical. Where a piece of equipment has more than a single source or type of energy, each will have to be addressed. The lockout hardware used is to be durable for the type of use it will receive, identifiable as to its purpose and owner,

and individually assigned so that only the worker using the lock has the key. Workers who will be conducting work that will involve Lockout/Tagout procedures are to notify any other workers who may be affected by the Lockout. No worker is to attempt to remove the lock of another and restart locked and tagged out machinery.

#### 4.3.7 Underground and Overhead Utilities

The Site Manager or SSHO is responsible to see that underground utility locations are identified prior to the commencement of any subsurface (> 0.3 meters (1 foot.) activities. Resources include site plans, utility companies, and regional utility locating services. The proper utility company personnel will certify in writing to the Site Manager or SSO the deactivation of underground utilities, and the certification retained in the project files.

Excavation, drilling, crane, or similar operations adjacent to overhead lines will not be initiated until operations are coordinated with the utility officials. Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:

Power has been shut off and positive means (e.g. Lockout/Tagout) have been taken to prevent lines from being energized. Wherever possible, the Dames & Moore SSHO will observe power shut off and place a lock and tag on the switch. In all cases utility company personnel will certify in writing to the Site Manager or SSHO the deactivation of overhead utilities, and the certification retained in the project files. The Site Manager or SSHO must also attempt to verify power shut off by checking that power is no longer available to the affected building or equipment.

Equipment, or any part of the equipment, cannot come within the following minimum clearance from energized overhead lines:

Power Lines Nominal System (kilovolts)	Minimum Required Clearance
0-50	10 feet
51- 200	15 feet
201-300	20 feet
301-500	25 feet
501-750	350 feet
751-1000	450

#### 4.3.8 Work Area Protection

As the project operations may be undertaken near a roadway or parking lot, motor vehicles may be a hazard. Consideration should be given to parking a work vehicle within the coned area between the work area and on-coming traffic.

#### 4.3.9 Heavy Equipment

Operation of heavy equipment during site activities presents potential physical hazards to personnel. The following precautions must be observed whenever heavy equipment is in use:

- PPE such as steel-toed shoes, safety glasses or goggles, and hard hats must be worn whenever such equipment is present.
- Personnel must at all times be aware of the location and operation of heavy equipment, and take precautions to avoid getting in the way of its operation. Never assume that the equipment operator sees you; make eye contact and use hand signals to inform the operator of your intent, particularly if you intend to work near or approach the equipment.
- Traffic safety vests **are required** for Dames & Moore personnel working near mobile heavy equipment, such as backhoes and other excavators.
- Never walk directly *in back of* or *to the side of*, heavy equipment without the operator's acknowledgment.
- When an equipment operator must operate in tight quarters, the equipment subcontractor should provide a person to assist in guiding the operator's movements.
- Keep all non-essential personnel out of the work area. Entry into trenches and excavations by field personnel is prohibited without proper shoring or sloping of excavation sides.
- All heavy equipment that is used in the EZ should remain in that zone until its task is completed. The equipment subcontractor should completely decontaminate such equipment in the designated equipment CRZ prior to moving the equipment outside of the EZ/CRZ.

#### 4.3.10 Drill Rig Work Practices

The drill rig operator has superior knowledge regarding, and is responsible for drill rig maintenance and safety. The following information, taken from the National Water Well Association's Manual of Safe Operating Procedures, provides general guidelines for safe practices on site.

##### 4.3.10.1 Movement of Drill Rigs

The following safety guidelines relate to off-road movements of drill rigs:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, slumps, gullies, ruts, and similar obstacles.

- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle of 4x4 or 6x6 vehicles or carriers when traveling off the highway on a hilly terrain.
- Use caution when traveling on a hillside. Conservatively evaluate the hillside capability of drill rigs, because the addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill.
- Attempt to cross obstacles such as small logs, small erosion channels or ditches squarely, not at an angle.
- When lateral or overhead clearance is close, use the assistance of someone on the ground as a guide.
- Underground utilities are as dangerous as overhead lines. Be aware and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer, and water. Ask for assistance:
- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign; telephone the utility company and *check it out*. The underground utilities may be a considerable distance away from the warning sign.
- Always contact the owners of the utility lines or the nearest underground utility location service before drilling. The utility personnel should determine the location of underground lines and should mark and flag these locations. Determine, with the utility personnel, what specific precautions must be taken to assure safety.

#### 4.3.10.2 Housekeeping On and Around the Drill Rig

To complete the first requirement for safe field operations, the safety supervisor of the drilling crew must understand and fulfill his responsibility for maintenance and "housekeeping" on and around the drill rig. The following are a few specific and general suggestions that apply to housekeeping around drill rigs:

- Suitable storage locations will be provided for all tools, materials, and supplies. The locations will allow for the convenient handling of tools, materials or supplies without the danger that these could fall on or hit a member of the drill crew or a visitor.
- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig.

- Pipe, drill rods, bits, casing, augers, and similar drilling tools should be stacked in an orderly manner on racks or sills to prevent spreading, rolling, or sliding.
- Penetration hammers or other types of driving hammers should be placed at a safe location on the ground or secured to prevent movement when not in use
- Work areas, platforms, walkways, scaffolding, and other access ways should be kept free of materials, obstructions, and substances such as ice, excess grease, or oil that could cause a surface to become slick or otherwise hazardous.
- Keep all controls, control linkages, and warning and operation lights and lenses free of oil, grease, and/or ice.
- Do not store gasoline in any portable container other than a non-sparking, red container with a flame arrestor in the fill spout. The word "GASOLINE" must be clearly visible on the container.

#### 4.3.10.3 Use of Hand Tools

There are many kinds of hand tools that can be used on or around a drill rig. The most important rule is "use the tool for its intended purpose." The following are a few specific and general suggestions that apply to the safe use of several hand tools often used on and around drill rigs:

- When a tool becomes damaged, either repair or discard the tool.
- When using a hammer, any kind of hammer, for any purpose, wear safety glasses and require all others around you to do the same.
- When using a chisel, any kind of chisel, for any purpose, wear safety glasses and require all others around you to do the same.
- Keep all tools cleaned and stored in an orderly manner when not in use.
- Replace hook and heel jaws when they become visibly worn.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be caught between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

#### 4.3.10.4 Use of Augers

The following general procedures should be used when advancing a boring with continuous flight or hollow-stem augers.

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at a low speed
- The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must be sure that the tool handler is well away from the auger column and that the auger fork has been removed before starting rotation.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tool during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place your hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow your feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Never use your hands or feet to remove cuttings away from auger.

Augers should be cleaned only when the drill rig is in neutral, and the augers have stopped rotating.

#### 4.3.10.5 Air Rotary Drilling

Air drilling is basically the same as mud drilling except that the mud pump is replaced by an air-compressor including cooling system, air receiver and unloading system. The air line is connected to the swivel hose at the top of the head drive. The air is forced down through the drilling pipe and out through the holes at the bottom of the rotary drill bit. A small stream of water is often introduced into the air system to help cool the drill bit and control dust. The air serves to cool the drill bit and force cutting up out of the hole and are collected at the top. Air is used principally in hard clay or rock formations, in as much as once the air pressure is turned off, loose formations would cave-in against the drill pipe. This is not the case when mud is used.

The use of the air rotary downhole hammerdrill in the drilling phase has many advantages. The downhole hammer is often used in formations that are extremely hard and abrasive. In addition to providing maximum penetration rates, the downhole hammer works extremely well in deviated formations, thus permitting the operator to drill a much faster and straighter hole. It is not uncommon for the percussion hammer to out drill a conventional air rotary system.

The hammer requires very little weight on the bit in order to make it operate. However, it requires slightly more air volume to enable the hammer to operate properly, as well as provide the required uphole velocities to remove the cuttings.

A wide range of hammers are available to hole sizes to 156 mm to 768 mm. All are designed to work with an air circulating medium. However, some are designed also to work with foam.

Additional safety precautions must be used anytime a compressor is used on-site. These include:

- Compressors and related equipment will be located to provide safe access to all parts of the equipment for operation, maintenance, and repairs.
- Safety appliances, such as valves indicating devices, and controlling devices, will be located and installed so that they cannot be readily rendered inoperative by any means.
- Every air compressor will:
  - Automatically stop its air-compressing operation before the discharge pressure exceeds the maximum working pressure allowable on the weakest portion of the system, or
  - An air by-pass and alarm will be installed. If this automatic mechanism is electrically operated, the actuating device will be so designed and constructed that the electrical contacts cannot lock or fuse in position that will cause the compressor to continue its operation.
  - Provision will be made to: Exclude flammables, toxic gases, vapors, or dust from the compressor; prevent steam, water, or waste being blown or drawn into the compressor intake. A stop valve will be installed between the air receiver and each piece of stationary utilization equipment at a point convenient to the operator.

All pressure lines will be inspected to ensure there are no mismatched unions.

Since high pressure lines will be used, the restraining safety clamps must be installed according to manufacturers directions (from the compressor system).

The safety clamps must be sized to grip the smaller diameter of the hose and remain in place when pressure fluctuations occur.

1. Check the safety clamps on all high pressure mud rotary hoses.
2. Ensure the safety clamps are in their correct positions.
3. Ensure that the safety clamps are of the correct size for the diameter of hose.

All threaded unions (if used) for compressed air delivery lines will be checked for mismatched threads. Threads will be correctly "made up" prior to the introduction of pressure on these lines. Both halves of the union will have the same pressure rating.

#### 4.3.10.6 Start-Up Procedures

All drill rig personnel and visitors should be instructed to "*stand clear*" of the drill rig immediately prior to and during and starting of an engine.

Before starting a drill rig engine, make sure that all of the gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct non-actuating positions, and the cathead rope is not on the cathead.

#### 4.3.10.7 Drill Rig Operation

Safety requires the attention and cooperation of every worker and site visitor. The following procedures are related to safety during drilling operations:

- Do not drive the drill rig from hole to hole with the mast in the raised position. Before raising the mast, look up to check for overhead obstructions.
- Before raising the mast, clear all drill rig personnel (with the exception of the operator) and visitors from the areas immediately to the rear and the sides of the mast. In addition, inform them that the mast is being raised.
- Before the mast of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be re-leveled if it settles after the initial set up. Lower the mast only when leveling jacks are down, and do not raise the leveling jack pads until the mast is completely lowered.
- Before starting drilling operations, secure and/or lock the mast, if required by the drill manufacturer's recommendations.
- The drill rig operator should operate a drill rig only from the position of the controls. The operator should shut down the drill engine before leaving the vicinity of the drill.
- "*Horsing around*" within the vicinity of the drill rig and tool and supply storage areas is strictly prohibited, even when the drill rig is shut down. Watch for slippery ground when mounting/dismounting the platform.

- Drilling operations should be terminated during an electrical storm.
- Consuming alcoholic beverages, depressants, stimulants, or any other chemical substance while on the job is strictly prohibited.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors or animals from stepping or falling into the hole. When the drilling project has been completed, all open boreholes should be covered, protected or backfilled adequately and according to local or state regulations.

#### 4.3.11 Gas Cylinders

Cylinders must not be placed where they might form part of an electrical circuit. Keep cylinders away from grating, layout tables and piping systems that may be used for the grounding or electrical welding circuits.

- Secure cylinders with chains or store in cylinder rack.
- Pressure-adjusting screws on regulators will be fully released before the regulator is attached to a cylinder and the cylinder valve opened. Open the cylinder valve slowly; stand to one side, not in front of pressure regulator gauge faces when opening cylinder valves.
- Before regulator is removed from a cylinder, the cylinder valve will be closed and the gas released from the regulator.
- Hoses are to be periodically inspected and replaced when worn or damaged.
- Valve protection caps must always be kept on cylinders when they are being moved, stored, or until ready for use.

#### 4.3.12 Machine Guarding

Remediation equipment such as pumps and blowers present a hazard from nip points and rotating parts. Also, some of the treatment system equipment may start automatically. This equipment will be labeled with warning signs indicating that the equipment starts automatically. Equipment must be provided with machine guarding (e.g. cages, shields) to protect employees. This guarding must be designed to prevent the operator from having any part of his body in the danger zone where it could be caught or struck by moving parts during the operating cycle.

Machine guarding must not be removed for any reason except during necessary maintenance and repair. Proper lockout and tagout procedures must be followed to prevent the accidental energizing of equipment during maintenance and repair. Machine guards must be put back in place following maintenance and

repair work. Warning signs will be posted at all machine guards indicating that personnel are not to operate the equipment unless guards are in place.

#### 4.4 AIRFIELD SAFETY

Some of the characterization activities will take place next to active runways. The following procedures will be strictly adhered to during work near runways.

##### 4.4.1 Definitions

"Landing Areas" - The primary surfaces, comprising the surface of the runway, runway shoulders, and lateral safety zones. The length of each primary surface is the same as the runway length. The width of each primary surface is 2,000 feet (1,000 feet on each side of the runway centerline);

"Clear Zone" - The area beyond the ends of each runway

- The extension of the primary surface for a distance of 1,000 feet beyond each end of each runway;
- All taxiways, plus the lateral clearance zones along each side for the length of the taxiways (the outer edge of each lateral clearance zone is laterally 250 feet from the far or opposite edge of the taxiway, e.g., A 75 foot wide taxiway would have a combined width of taxiway and lateral clearance zones of 425 feet); and
- All aircraft parking aprons, plus the area 125 feet in width extending beyond each edge all around the aprons.

"Safety Precaution Areas" - The area of approach-departure clearance zones and transitional zones where placement of objects incident to contract performance might result in vertical projections at or above the approach-departure clearance, or the transitional surface.

"Approach-Departure Clearance Surface" - An extension of the primary surface and the clear zone at each end of each runway, for a distance of 50,000 feet, first along an inclined (glide angle) and then along a horizontal plane, both flaring symmetrically about the runway centerline extended.

##### 4.4.2 General Requirements

The following requirements will be complied with while:

- Operating all ground equipment (mobile or stationary);
- Placing all materials; and
- Performing all work, upon and around all airfields.

The SSHO will report to the COR before initiating any work and will notify the COR of any proposed changes to locations and operations.

No equipment or personnel will use any runway for purposes other than aircraft operation without permission of the COR, unless the runway is:

- Closed by order of the COR, and
- Marked by red flags by day, and electric, battery-operated low-intensity red flasher lights by night

All paved surfaces, such as runways, taxiways, and hardstands, will be kept clean at all times and, specifically, free from small stones which might damage aircraft propellers or jet aircraft.

Mobile equipment will be operated according to the safety provisions of this SSHP, while actually performing work on the airfield. At all other times, mobile equipment will be removed to locations

- Approved by the COR;
- At a distance of at least 750 feet from the runway centerline, plus any additional distance; and
- Necessary to ensure compliance with other provisions of this section.

#### 4.4.3 Landing Areas

Nothing will be placed upon the landing areas without the authorization of the COR.

Landing areas hazardous to aircraft will be outlined, using (unless otherwise authorized by the COR) red flags by day, and electric, battery-operated low-intensity red flasher lights by night.

All vehicles operating in landing areas will be identified by means of a flag on a staff attached to, and flying above, the vehicle. The flag will be three feet square, and consist of a checkered pattern of international orange and white squares of one foot on each side (except that the flag may vary up to ten percent from each of these dimensions).

All other equipment and materials in the landing areas will be marked using red flags by day, and electric, battery-operated low-intensity red flasher lights by night.

Work will be performed so as to leave that portion of the landing area which is available to aircraft free from hazards, holes, piles of material, and projecting shoulders that might damage an airplane tire.

#### 4.4.4 Safety Precaution Areas

Nothing will be placed upon the safety precaution areas without authorization of the COR.

All equipment and materials in safety precautions areas will be marked using (unless otherwise authorized by the COR) red flags by day and electric, battery-operated, low intensity red flasher lights by night.

All objects placed in safety precaution area will be provided with a red light or red lantern at night, if the objects project above the approach-departure clearance surface or above the transitional surface.

## 5.0 RESPIRATORY PROTECTION

The PID will be used every 15 minutes to monitor for site vapors. At the conclusion of five monitoring cycles, and assuming that no further soil staining, water sheen, or sensory detection of hydrocarbons has occurred, PID monitoring can be scaled back to reflect regular site monitoring protocols.

PID reading will be obtained in the vicinity of augured/drilled holes and any excavation areas (including trenches). These readings will be compared with background levels obtained during initial site approach and activity initiation that disturbed site media (waters and/or soils)

### 5.1 UPGRADE AND DOWNGRADE CRITERIA

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been trained in the selection, use, care and limitations of the respirators, and the proper respirator has been selected for the task and fit tested. All Air-Purifying Respirators (APRs) will be pressure checked during each donning and prior to site entry.

Engineering controls should always be the primary control of contaminated air (i.e. elimination of source of contamination, ventilation equipment, barriers).

If elevated levels of hydrocarbon vapors are discovered during any activity, site personnel will don a half-face APR with organic vapor cartridges.

- Elevated levels will be defined as sustained readings (for one minute) on the PID that exceed five ppm and confirmation that either benzene or vinyl chloride is present. The assumption being that approximately 20% of any total volatilized chemical indication via PID could be a benzene or vinyl chloride fraction equaling 1 ppm.).
- Confirmation is a positive colorimetric tube result for benzene or vinyl chloride at one ppm.

In lieu of donning respirators, as project scheduling permits, workers may temporarily "back-off" from the work area and wait for natural ventilation to remove some of the vapors. If this approach is taken, workers will re-approach the work site with the PID monitoring to establish that safe re-entry and resumption of site work without respirators may continue.

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- In the event that benzene is detected in excess of one ppm, 1/2 face APRs equipped with organic vapor cartridges will be donned. These respirators will be worn until benzene levels are below one ppm. In the event that benzene levels exceed 10 ppm, workers will don full-face piece APRs. If benzene levels exceed 50 ppm, workers will "back-off" and allow the area to ventilate. Approach and continuation of work activities will only commence when benzene levels are less than 50 ppm

- In the event that vinyl chloride is detected in excess of one ppm, full face APRs equipped with organic vapor cartridges will be donned. These respirators will be worn until vinyl chloride levels are below one ppm. If vinyl chloride levels exceed five ppm, workers will "back-off" and allow the area to ventilate. Approach and continuation of work activities will only commence when vinyl chloride levels are less than five ppm

## 5.2 SELECTION CRITERIA

Once the need for respirators has been established, the respirators will be selected on the basis of the hazards to which the worker is exposed.

Selection criteria should include:

- Contaminant concentration
- Whether the contaminant may be sufficiently toxic to be Immediately Dangerous to Life or Health (IDLH)
- Oxygen deficiency potential
- Useful life of the respirator or cartridge.
- Escape routes available.
- Whether the equipment is intended for emergency use, for periodic use, or for stand-by purposes.

## 5.3 MEDICAL SCREENING

Prior to assigning personnel tasks requiring the use of respirators, the employee will be medically evaluated in compliance of requirements of 29 CFR 1910.134. The physician conducting the medical examination will provide a written opinion statement that *the employee is fit to wear the chosen respirator(s)*. This physician's opinion will constitute medical clearance as described in the Medical Notification statements. Copies of these clearance statements will be attached to this SSHP and are also available in the SZ contractor files area.

Employees not physically and psychologically capable of wearing respirators will be assigned to such work that does not include the use of respirators.

The medical status of each employee is to be reviewed annually and as may be deemed necessary if the physical status of the employee changes.

## 5.4 FIT TESTING

Fit testing will be performed in accordance with accepted fit test procedures defined in *HS 150 of the Dames & Moore Firmwide Health and Safety Policy and Procedures Manual* a copy of which is maintained at the site. The *Dames & Moore Respiratory Protection Program* is included in this Manual.

Records of fit testing will be maintained on site in the SZ contractor files area and by the employee's office and/or corporate medical surveillance program.

Records of fit testing will be maintained on site in the SZ contractor files area and by the employee's office and/or corporate medical surveillance program.

## 5.5 RESPIRATOR USE INSTRUCTIONS

Only those employees who have been properly trained and qualified on the specific type of respirator to be worn will use respirators.

All employees whose job assignment requires the use of respirators will be given respirator training at the time of fit testing and before being assigned to the job. Retraining will be performed annually on each type of respirator worn by the individual. Training records are kept on file by the employee's office.

Only NIOSH approved respirators and cartridges approved for the hazardous atmosphere to be encountered will be used.

**CAUTION:** Full face piece or 1/2 face piece APRs are not to be used where an oxygen deficiency may occur. Only air-supplied full-face respirators with a 15-minute emergency escape cylinder or Self-Contained Breathing Apparatus (SCBA) will be worn when an oxygen deficiency exists. Since SCBA will not be available on-site, **no oxygen deficient atmospheres will be entered.**

**CAUTION:** A respirator does not protect against excessive heat or against hazardous substance that can attack the body through the skin.

A person wearing a respirator must be clean-shaven in the area of the face piece seal. Long hair, sideburns, and skullcaps that extend under the seal are not allowed. Glasses with temple pieces extending under the seal are not allowed. Persons with facial conditions that prevent a proper seal are not allowed to wear a full-face piece respirator until the condition is corrected.

### Respirator Inspection:

Respirators will be inspected by the user before and after each day's use and those not used routinely used will be inspected once a month. All routine inspections will be conducted in the SZ or in the *clean* side of the CRZ.

Inspection procedure for APRs (full-face piece and 1/2-face piece cartridge respirators): Examine the face piece for:

- Excessive dirt
- Cracks, tears, holes, or distortion from improper storage.

- Inflexibility
- Cracked or badly scratched lenses.
- Incorrectly mounted lens or broken or missing mounting clips
- Cracked or broken air purifying element holder, badly worn threads, or missing gaskets.
- Examine the head straps or head harness for:
  - Breaks or cracks
  - Broken or malfunctioning buckles. Excessively worn serration on the head harness that may permit slippage
- Examine exhalation valve for the following after removing cover:
  - Foreign material
  - Cracks, tears, or distortion in the valve material.
  - Improper insertion of the valve body in the face piece.
  - Cracks, breaks, or chips in the valve body, particularly in the sealing surface.
  - Missing or defective valve cover.
  - Improper installation of the valve in the valve body.
- Examine the air purifying elements for:
  - Missing cartridge adapter gasket
  - Incorrect cartridge/canister, or filter for the hazard.
  - Incorrect installation, loose connections, missing or worn gaskets, or cross threading in the holder.
- Cracks or dents in outside case or threads of filter or cartridge/canister.

## 5.6 CLEANING OF RESPIRATORS

Respirators assigned and worn by one individual must be cleaned after each day's use. Visitors' or multi-assigned respirators must be cleaned and disinfected after each use.

Extreme caution must be exercised to prevent damage from rough handling during the cleaning procedure.

After cleaning, respirators must be reassembled.

A respirator disinfectant wipe is approved as disinfectant between continuous use but not for cleaning and sanitizing after each day's use

### 5.6.1 Cleaning Procedure for Individually Assigned Respirators

**Washing:** The respirator must be disassembled and washed with a mild liquid detergent in warm water. A brush should be used. To avoid damaging the rubber and plastic in respirator face pieces, use a soft bristle brush and a cleaner/water solution between 90 and 100°F.

**Rinsing:** The respirator should be rinsed thoroughly in clean water (140°F maximum) to remove all traces of detergent. This is very important to prevent dermatitis.

**Drying:** The following drying methods may be used:

- Draining and drying on a clean surface;
- Draining and drying when hung from racks (take care to prevent damage); or
- Towel drying with soft clothes or paper towels.

### 5.6.2 Cleaning Procedure for Visitor or Multi-Assigned Respirators

**Washing:** The respirator must be disassembled and washed with a brush in a cleaning solution in warm water. To avoid damaging the rubber and plastic in respirator face pieces, use a soft bristle brush and a cleaner/water solution between 90 and 100°F.

**Rinsing:** The respirator must be immersed in a disinfectant solution noted below for at least two minutes and then rinsed in clean water at 140°F maximum.

**Disinfection:** Quaternary ammonia solution prepared according to the respirator manufacturer's instructions will be used for disinfection.

**Drying:** The following drying methods will be used: draining and drying on a clean surface; draining and drying when hung from racks.

## 5.7 RESPIRATOR MAINTENANCE

Respirator maintenance of a routine nature will only be performed by the SSHO

Approved replacement parts must be used. Substitution of parts from a different brand or type of respirator invalidates the technical approval of the respirator.

Only an individual who has been certified by the manufacturer will do maintenance on a SCBA.

## 5.8 STORAGE OF RESPIRATORS

When not in use, respirators will be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage

Respirators will be stored in reusable plastic bags between shifts.

- With the exception of APRs designated as "*Emergency Use*", all cartridges will be stored separate from the respirator harness.
- The cartridges must be bagged separately or in a pair, and marked as to prior *date of use* and remainder of *active service life*.
- If respirators are stored between shifts with the cartridges loaded, the outside of the cartridge will be taped and the harness deconned prior to placement of the respirator in a large Ziplock bag. These Ziplock bags will be replaced after each storage event.

The respirator storage environment must be clean, dry and away from direct sunlight.

## 6.0 PERSONAL PROTECTIVE EQUIPMENT PROGRAM

### 6.1 LEVELS OF PROTECTION

The following is a brief description of the levels of protection that may be utilized at the Richards-Gebaur AFB Project and the general types of PPE incorporated in each. All personnel, including visitors, must provide proof of medical fitness or clearance prior to being provided PPE.

Level C and Level D protection, primarily Level D, will be worn during site activities

#### 6.1.1 Level C Protection

Level C protection may be worn based on air monitoring. Generally, Level C is employed where skin contact with site constituents is not likely, and where the airborne exposure is primarily from low levels of vapor constituents or airborne dusts. Level C PPE is listed below

APRs (1/2-face or full-face) with organic vapor cartridges  
 Disposable, one-piece Tyvek® coverall  
 Nitrile gloves  
 Deconnable chemically-resistant boots with steel toe and shank.  
 Hard hat  
 Hearing protection, either muffs or plugs  
 American National Standards Institute (ANSI) approved safety glasses or goggles  
 Additional equipment (as warranted by conditions):

- 2-way, intrinsically safe radios
- Face shield

#### 6.1.2 Level D Protection

This fieldwork uniform will be used for most activities at the site, as long as chemical contaminants are not encountered above the established action levels. The Level D personal protective equipment for this project includes:

Work gloves (as required)  
 Nitrile gloves (for handling decontamination chemicals or potentially contaminated soils)  
 Work boots with steel toe and shank  
 Hard hat  
 Hearing protection (as required): either muffs or plugs  
 ANSI approved safety glasses or goggles.

## 7.0 AIR MONITORING PROCEDURES AND ACTION LEVELS

### 7.1 AIR MONITORING INSTRUMENTS

The field instrumentation described in this subsection has been specifically selected for the contaminants that may be reasonably anticipated to be encountered during the course of this project. Selection factors include anticipated airborne concentrations, potential interference, IPs, instrument sensitivity, and occupational exposure limits. The action levels described below are established with the expectation that these specific instruments will be used. **DO NOT SUBSTITUTE INSTRUMENTS WITHOUT THE CONSENT OF THE SHM.**

### 7.2 AIR MONITORING FOR GENERAL SITE ACTIVITIES

A PID will be used to monitor for organic vapors during general site activities. The analyzer will be used on a regular basis, typically every fifteen minutes, to monitor in the immediate vicinity of the work area. If readings exceed an average of 5 ppm above background levels for more than one minute, monitoring in the Operator's Breathing Zone (OBZ) of the person working nearest the emission source will start immediately, and personnel will don protective clothing as described in Section 6.1.1. The analyzer operator will be familiar with the proper use and operation of the equipment and understand the limitations of air monitoring in general.

Upgrade and Downgrade Criteria for respiratory protection are discussed in Section 5.1.

### 7.3 BACKGROUND READINGS

All direct-reading instrument (PID) readings will be evaluated relative to background readings, not "*meter zero*". Instrument readings will be obtained upwind of the site work area in order to determine the level of "*background*" readings. These readings will be obtained:

- Prior to the start of work at each shift, and
- When work is occurring outdoors and a significant shift in wind direction occurs.

Background levels may be affected by local vehicle traffic, emissions from nearby operations unrelated to the site, and airfield activities. Site readings will be evaluated against these background readings (i.e., if an action level is listed as 20 ppm, it is evaluated as 20 ppm above background).

### 7.4 DATA LOGGING

All direct-reading instrument monitoring data, including background readings, will be logged in the Field Log Book.

The results of daily instrument calibrations will be logged in the Field Log Book

- All monitoring instruments will be calibrated prior to the start of each shift.
- Calibration should also be performed whenever inconsistent or erratic readings are obtained

If an instrument cannot be calibrated to specification, or becomes otherwise inoperable, all invasive site work will cease until the instrument is appropriately repaired or replaced; the SHM should be contacted for further guidance.

The form *INSTRUMENTATION CALIBRATION & FIELD ACTIVITY DOCUMENTATION* is provided in Appendix I

## 8.0 SITE CONTROL MEASURES

Barricades and barricade tape will be used to delineate an EZ and CRZ

- An opening in the barricades at the CRZ will serve as the personnel and equipment entry and exit point.
- The personnel CRZ will be established between the EZ and SZ. All entry to and exit from the work area will be made at this opening in order to control potential sources of contamination.

The PM or SSHO will designate an evacuation area prior to each shift; this area should be out of the path of vehicular traffic. All personnel should be notified of the evacuation area location. A compressed gas horn will be used to signal an evacuation in the event of an emergency. **Three blasts** of the horn will be the agreed-upon signal to immediately stop work and proceed to the evacuation area

The SSHO will provide site hazard and emergency action information to all site visitors before they enter the site (see Appendix G). This information will be included in an initial five to ten minute safety briefing.

### 8.1 PERSONNEL LISTS

The SSHO will maintain a list of all authorized personnel on the site

All site visitors' sign will sign the *Visitors' Log*. The term "visitors" is not applicable to personnel who in any way direct on-site activities. Individuals who direct site activities must be trained iaw 29 CFR 1910.120 and are participants in the site work force

All contractor personnel will sign in at their initial entry on-site. During this initial entry at the SZ, the contractor personnel will provide the following documentation to the SSHO:

- Medical clearance in the form of a physician's opinion statement with agreement by the physician that this worker is fit to participate in required work activities given the level of respiratory protection required
- Completion of 40 hours of training iaw 29 CFR 1910.120

### 8.2 WORK ZONES

The following work zones will be set up in the following manner to help control the spread of hazardous materials out of the immediate work area.

**Exclusion Zone** - a perimeter around the work area will be defined and delineated before work starts. The location of the perimeter will be recorded in the *Field Log Book* each day. The encircled area will

constitute the EZ. This zone is where potentially hazardous contaminants and physical hazards to the workers will be contained. Full PPE will be required in this area. The size of the EZ may be altered to accommodate site conditions and to enhance contaminant containment.

**Contamination Reduction Zone** - a corridor leading from the EZ will be defined, and will lead to the SZ. All decontamination activities will occur in the CRZ. A waste container will be placed at the end of the corridor so contaminated disposable equipment can be placed inside and covered. Surface/soil contamination in this area should be controlled using plastic sheeting. Disposal containers will be labeled as potentially contaminated materials.

**Support Zone** - a SZ, the outermost part of the site, must be defined for each field activity. Support equipment is located in this uncontaminated or clean area. Normal work clothes are appropriate within this zone. The location of this zone depends on factors such as accessibility, wind direction (upwind of work area), and resources (that is, roads, shelter, utilities). Toilets, break areas, lunch areas and general support areas will be located in this zone.

### 8.3 VISITOR CONTROL

All site visitors (including Federal and state agency employees) will be required to obtain a visitor badge from the SSHO and sign a visitor log prior to entering any construction areas. The SSHO will inform the visitors of the site hazards, site rules, emergency procedures, and personal protective equipment requirements before they enter the site. At no time will visitors be allowed to enter the EZ or CRZ unless they show proof of:

- Medical clearance in the form of a physician's opinion statement with agreement by the physician that this worker is fit to participate in required work activities given the level of respiratory protection required
- Completion of 40 hours of training iaw 29 CFR 1910.120
- A *VISITORS LOG* is provided in Appendix G.

### 8.4 SITE CONTROL AND SECURITY

Site personnel will obtain required security badges. Contractor's vehicles and equipment may be searched at any time by security police for items that are prohibited at the facility. These items include firearms or other weapons, explosives, alcohol, and illegal drugs. Site personnel are prohibited from having any of these items. In addition, if site personnel witness any activities that appear to be unauthorized, including unauthorized entries onto base property, the security police will be notified.

## 9.0 DECONTAMINATION PROTOCOL

### 9.1 PERSONNEL DECONTAMINATION

#### 9.1.1 Contamination Prevention

Eating, drinking, smoking, application of cosmetics, and chewing tobacco are prohibited in the work areas. These activities are permitted in the SZ only after the employees have removed their protective clothing and respirators and washed their hands and face.

Disposable clothing, gloves, hard hats and respirators will be removed before leaving the work area. Hard hats used in the EZ cannot be taken out of the EZ until they have been completely decontaminated.

Employees will not kneel or sit on the ground or on drums, containers or other contaminated areas.

As practical, monitoring and sampling instruments will be covered with visqueen or placed in a plastic bag prior to entrance into the EZ to protect them from becoming contaminated.

Good housekeeping is of primary importance for an effective decontamination program and is enforced accordingly. Discarded equipment will be disposed of in appropriate containers (i.e., gloves, rags, coveralls).

Employees will not remove any contaminated clothing or equipment from the site

Torn or otherwise damaged protective clothing, gloves, rubber boots, safety glasses and hard hats will be replaced immediately.

#### 9.1.2 Decontamination Area

For activities that result in exposure to or generate hazardous materials, a decontamination station will be provided.

The decontamination area is to be covered with plastic sheeting that will be replaced when torn or heavily soiled, and at the end of each shift. The SSHO will evaluate actual site conditions and needs of the workforce when setting up the decontamination area.

All spent decontamination fluids (rinse waters, etc.) will be handled as hazardous waste until lab results indicate otherwise.

Disposable clothing, gloves and spent respirator cartridges will be disposed of after each work shift. These items are to be placed in receptacles located inside the CRZ. These receptacles are to be emptied daily into containers for shipment to an approved disposal facility.

- If site activity logs document that these materials were never used where contaminated media was disturbed, and exposure levels never exceeded background levels, the materials may be disposed of as sanitary waste
- If there is any doubt as to the waste characteristics of these materials, the spent PPE will be disposed of as hazardous waste in accordance with landfill disposal protocols.

Employees will be responsible for the cleaning and maintenance of their respirators. Used respirators are to be cleaned by the employee at the end of each shift. Clean respirators are stored in respirator bags.

### **9.1.3 Decontamination Procedures for Level C and D Protection**

Remove all monitoring equipment, sample containers, and notes to the CRZ. The decontamination helper will obtain decontamination solutions and decontaminate the equipment as necessary.

1. Scrub boots and gloves with a stiff bristle brush and decontamination solution.
2. Rinse with water.
3. Remove tape from around wrist and ankles.
4. Remove outer gloves.
5. Brush gross contamination from disposable coverall.
6. Remove deconnable chemical protective boots or boot covers
7. Remove disposable coverall taking care not to touch the outside of the garment, discard in provided container.
8. Remove hardhat and eye protection (place in bin to be decontaminated).
9. Remove respirator (Level C protection only).
10. Remove inner gloves; discard in provided container.
11. Wash hands and face in soapy water and rinse with potable water.

#### 9.1.4 Procedures for Direct Contact with Hazardous Waste

Any employee whose skin, eyes, or other body parts come into direct contact with hazardous materials will proceed as follows:

1. Douse the affected area using the emergency safety showers and/or eyewash provided at the site to rinse off the contamination
2. Remove his/her protective clothing and respirator and dispose of them in the appropriate laundry or waste receptacle for cleaning or disposal
3. Proceed to the CRZ, go through decontamination, and don clean PPE

If warranted, the employee will be taken for immediate medical attention.

ALL such incidents must be reported to the SSHO or the PM immediately after decontamination.

#### 9.1.5 Personnel Decontamination in Medical Emergencies

In the event of physical injury or other serious medical concerns, immediate First Aid should be administered in lieu of further decontamination efforts.

### 9.2 EQUIPMENT DECONTAMINATION

Prior to equipment leaving the exclusion zone, or any vehicles that have come in contact with contaminated materials, the following steps must be taken.

Where it is likely that vehicles or equipment have come in contact with contaminated material, such equipment will be decontaminated upon leaving the EZ.

All spent decontamination fluids or sludges (that is, rinse waters, mud slurries, and so on) will be handled as hazardous waste until lab results indicate otherwise.

Following the washing, the equipment will be inspected by the SSHO. Upon SSHO approval, the equipment may leave the active project area. Under no circumstances will heavy equipment be allowed to leave the site if the equipment is not inspected and decontaminated.

### 9.2.1 Decontamination of Tools

When all work activities have been completed, contaminated tools will be totally decontaminated. A job is NOT considered complete until the work area has been cleaned and all used material properly discarded and tools cleaned and properly stowed.

All tools will be constructed of non-porous, non-absorbent materials. This will aid the decontamination process. Tools will be placed on a decontamination pad or into a bucket and thoroughly washed using a soap solution and brushing or high-pressure spray, followed by a water rinse. All visible particles will be removed before the tool is considered clean. If contaminants are not easily cleaned with water due to organic nature, a commercially available cleaner or Alconox will be used at the direction of the SSHO or SHM.

### 9.2.2 Decontamination of Monitoring Instrumentation

Due to the sensitive electronic nature of industrial hygiene monitoring equipment, special care will be taken when decontaminating it. If the equipment is likely to contact contaminated materials during use in the EZ, the equipment will be wrapped in plastic. The equipment will not be tightly wrapped or wrapped in such a manner that inlet or exhaust portals are obstructed. A damp wipe down with a cloth moistened with decontamination solution will be conducted before leaving the EZ if the equipment contacted contaminated materials during use.

## 9.3 SITE HOUSEKEEPING

To complete the first requirement for safe field operations, the SSHO and the subcontractor safety representatives must understand and fulfill their responsibility for maintenance and "housekeeping" at the site.

Suitable storage locations will be provided either in the SZ or the CRZ for all tools, materials, and supplies. The locations will allow for the convenient handling of tools, materials or supplies without danger that these could fall on or hit anyone.

## 10.0 PERSONNEL TRAINING REQUIREMENTS

All personnel involved in work involving potential contact with hazardous waste will satisfy the requirements of 29 CFR 1910.120 (e), including:

- Forty hours of initial offsite training.
- Eight hours of annual refresher training for all personnel.
- Eight hours of supervisor training for personnel serving in a supervisory capacity and directing site work.
- Three days of work activity under the supervision of a trained and experienced supervisor. This supervisor will have received iaw 1910.120, 48 hours of initial training and documented supervised on-site experience (not necessarily all at one site) of three days. A form to document on-site experience is provided in Appendix H.

A briefing as to site contaminants and products to be used on the project will be conducted for all employees prior to commencement of on-site work.

The SSHO will maintain, at the site, current copies of training certificates for all site personnel.

In addition, all site personnel will review this SSHP and sign a copy of the SSHP *Compliance Agreement*, which are found in Appendix A. The SSHO will maintain these agreements at the site, and forward them to the SHM and PM at the conclusion of the operation. Copies of these agreements will be attached to the SSHP.

### 10.1 SITE SAFETY BRIEFINGS

Prior to the start of operations at the site, and for all new personnel who report to the project after the start of operations, the SSHO will conduct a site safety briefing that will include all personnel involved in site operations. At this meeting, the SSHO will discuss.

- Contents of this SSHP;
- Personnel rights and responsibilities under OSHA;
- Names of employees and alternates responsible for safety and health;
- Types of hazards at the site and means for minimizing exposure to them;
- Health effects associated with exposure to petroleum hydrocarbons and chlorinated hydrocarbons.
- The type of monitoring that will be performed;
- Action levels for upgrade and downgrade of PPE;
- PPE that will be used,
- Heat and cold stress monitoring and control,
- Confined Space Entry requirements,
- Engineering controls;

- Decontamination protocol,
- Site control measures, including safe operating practices and communication;
- Location and use of emergency equipment,
- Evacuation signals and procedures;
- Routes of entry, toxicology, and health hazard information; and
- Conduct hazard communication training for all chemicals brought on site.

## 10.2 SAFETY BRIEFINGS

Subsequent site safety briefings will be conducted at least weekly to:

- Address hazards associated with new tasks and locations,
- Discuss problems observed during the previous shift such as improper use of respirators or protective clothing, violation of decontamination procedures, and other variances from the SSHP, and
- Discuss the hazards associated with additional chemicals brought on site by contractor personnel

The SSHO will also provide special training when unanticipated problems or changes in operations occur and to new employees as needed.

For each site safety briefing, the SSHO will complete a *Site Safety Briefing Form* (Appendix G) and submit each on a regular basis to the PM and SHM.

## 10.3 FIRST AID/CPR TRAINING

The SSHO and the site manager will maintain current certification in American Red Cross First Aid and Cardiopulmonary Resuscitation (CPR) training or the equivalent. All other on-site personnel who are responsible for responding to site emergencies and incidents will also maintain current certification in American Red Cross First Aid and CPR training or the equivalent. Two individuals with First Aid/CPR training and Bloodborne Pathogen training will be on site at all times.

## 10.4 VISITOR TRAINING

The SSHO will brief visitors to aid in protecting their safety while visiting the site. The training will familiarize visitors with hazards associated with the site, describe work zone boundaries and access and exit procedures, explain emergency procedures, and describe the use of PPE required during the visit.

## 11.0 MEDICAL SURVEILLANCE

All personnel who will be working on site during this project must be participating in the Medical Surveillance Program. *Medical Notifications* for project personnel will be maintained at the project field office.

The exam protocol, and a description of the Medical Surveillance Program is contained in the *Dames & Moore's Firmwide Health and Safety Program Manual*, a copy of which is maintained at the site.

## **12.0 EMERGENCY RESPONSE PLAN**

### **12.1 PLAN PROCEDURES**

The purpose of this Emergency Response Plan is to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil or surface water.

The provisions of this Emergency Response Plan must be implemented immediately whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents that could threaten human health or the environment.

Emergency information, points of contact and a map showing the route to the hospital is contained in the figure section of this Health and Safety Plan. These pages should be photocopied and laminated for posting on site.

### **12.2 RESPONSIBILITIES OF THE EMERGENCY COORDINATOR (EC)**

The SSHO will act as the EC at the project site. The EC has the responsibility for coordinating all emergency response measures, and initiating materials and equipment purchases. Qualified backup ECs will be designated so an EC will either be located on the site or on call (available to reach the site to respond to an emergency within 15 minutes). The EC has the authority to commit the resources required to implement this emergency response procedure.

The EC is responsible for being thoroughly familiar with:

- The SSHP and base's Emergency Response Plan.
- All operations and activities associated with the project.
- The location and characteristics of the waste handled.
- The emergency signals and evacuation routes.
- The location of all operation-specific records.
- The physical layout of the facility and location of emergency equipment.

### **12.3 COORDINATED EMERGENCY SERVICES**

#### **12.3.1 Obtaining Emergency Services**

To obtain emergency services, the EC will first investigate the severity of the emergency/injury. If the emergency/injury requires outside emergency services, the EC will immediately contact the appropriate emergency services. The PM will be notified next of the emergency and the impending arrival of emergency services.

### 12.3.2 Communications

A communication network will be set up to alert site personnel of emergencies and to summon outside emergency assistance. Where voice communication is not feasible an alarm system (i.e., sirens, horns) will be set up to alert employees of emergencies. Radio communication may also be used to communicate with personnel in the exclusion zone. Where phone service is not readily available, radios or portable phones will be used to communicate with outside agencies. Site personnel will be trained on the use of the site emergency communication network. Emergency phone numbers will be posted at the phone or radio used for outside communication. The SSHO/EC is responsible for establishing the communication network prior to the start of work, and for explaining it to all site personnel during the site safety briefing.

Personnel in the event of an emergency will use the following hand signals:

Signal	Definition
Hands clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm all right/I understand
Thumbs down	NO/negative
Arms waving upright	Send back support
Grip partner's wrist	Exit area immediately

### 12.3.3 Emergency Services Information

In the event of an emergency, site personnel will evacuate from areas involved in hazardous material emergencies and summon outside assistance from agencies with personnel trained to deal with the specific emergency. This section outlines the procedures to be followed by site personnel in the event of a site emergency. These procedures are to be reviewed during the on-site safety briefings conducted by the SSHO/EC.

In the event of a medical emergency or fire notify.

**Fire:** (911)  
**Ambulance:** (911)  
**Hospital:** (911)

### 12.3.4 Directions to Hospital:

- From the 1100 Area and 1200 Area; take Markey Road east to Scott Avenue and turn right (south) onto Missouri Highway 58. Proceed east on Missouri Highway 58 approximately two miles to Research Belton Hospital located immediately east of U.S. Highway 71 interchange.
- From the ST-007 Area, Building 903, Building 965, Building 940, Building 948, Building 944, Storm Sewer Line, the northern portions of the fuel hydrant line, tarmac area and the industrial waste line; take Hangar Road south to 155<sup>th</sup> Street and turn east. Proceed east on 155<sup>th</sup>

Street to U.S. Highway 71 and turn right (south). Proceed south on U.S. Highway 71 approximately four miles to the Missouri Highway 58 exit (third exit). Research Belton Hospital is located immediately east of the Missouri Highway 58 exit;

- From **ST-005 (Oil/Water Separators), Building 942, POL Yard, and the eastern portions of the fuel hydrant and industrial waste lines**; take Andrews Road north to Missouri Highway 150 and turn east (right) to U.S. Highway 71. Proceed south on U.S. Highway 71 approximately four miles to the Missouri Highway 58 exit (third exit). Research Belton Hospital is located immediately east of the Missouri Highway 58 exit.
- From **Building 1025 and Building 1033 areas**; follow the old runway and gravel road northeast to Andrews Road. Turn left onto Andrews Road and proceed north to Missouri Highway 150 and turn right (east) to U.S. Highway 71. Proceed south on U.S. Highway 71 approximately four (4) miles to the Missouri Highway 58 exit (third exit). Research Belton Hospital is located immediately east of the Missouri Highway 58 exit.

Prior to the start of work, the SSHO will confirm that these numbers remain appropriate. Prior to the commencement of site operations, the SSHO/EC will notify emergency medical personnel, ambulance crews, and hospital emergency room staff of the possibility of having to handle contaminated clothing or employees, or both, and will advise them of appropriate decontamination measures. Copies of this SSHP will be provided to emergency units as appropriate prior to the start of work.

A map presenting the route to the hospital is provided in the figures section of this Health and Safety Plan.

#### 12.4 EMERGENCY PROCEDURES

This section of the Emergency Response Plan describes the actions that will be taken by site personnel in response to any injury, accident, fire, explosion, or unplanned sudden or non-sudden release of hazardous waste, hazardous waste constituent, or hazardous material to the air, soil, or surface water.

Upon discovery or notification that an emergency exists, the EC will:

1. Determine the extent of the emergency
2. Implement evacuation, if needed, to prevent injury.
3. Call for outside assistance as needed.
4. Notify the COR.
5. Start immediate control actions.

6. Implement cleanup or other responses.
7. Notify local, state, and federal agencies as required.
8. Assure completion of cleanup.
9. Provide for storage of cleanup material, including hazardous waste.
10. Evaluate possible hazards to human health or environment.
11. Make a final written *Incident Report*.
12. Whenever there is an imminent or actual emergency situation, the EC, or his designee, will:
  - Immediately call by radio or phone to notify all site personnel, and sound the audible alert system (i.e., siren, alarm); and
  - Immediately notify the appropriate federal, state, and/or local agencies with designated response roles if their help is needed.

### 12.5 ESCAPE ROUTE AND PLACES OF REFUGE

In the event of a site emergency requiring evacuation, all personnel will evacuate to a pre-designated primary assembly area located a safe distance from any health or safety hazard and safely away from the area of influence. The SSHO/EC in conjunction with the COR will designate escape routes and a primary assembly area prior to the start of work each day. The daily pre-designated primary assembly area may have to be re-designated by the SSHO/EC in the event of an emergency where the area of influence affects the primary assembly area.

Once the workers are assembled, the SSHO/EC will take a head count. The SSHO/EC will evaluate the primary assembly area to determine if the area is outside the influence of the situation; if not, the SSHO/EC will redirect the group to a new assembly area where a new head count will be taken.

During any site evacuation, all employees will be instructed to observe wind direction indicators. Windsocks will be used if other wind direction indicators are not readily visible. During evacuation, employees will be instructed to travel upwind or crosswind of the area of influence. The SSHO/EC will provide specific evacuation instructions, via the site emergency radio if necessary, to site personnel regarding the actual site conditions.

### 12.6 FIRE PROTECTION

Type ABC fire extinguishers will be available on-site to contain and extinguish small fires. The local fire department will be summoned in the event of any fire on site. The nearest fire station will be notified of operations prior to their commencement, and will be provided with a copy of this SSHP.

## 12.7 FIRST AID EQUIPMENT

The following items and emergency response equipment will be located within easy access at all times.

- First Aid Kit (at least one for every 25 people - see recommended contents - Section 12.7.1).
- American Red Cross Standard First Aid Manual;
- Eyewash - A 15-minute eyewash will be available on site for flushing foreign particles or contaminants out of eyes. The SSHO will demonstrate the proper operation of the unit(s) prior to the start of work. Small quart or pint eyewash bottles will be available to provide eyewash assistance during transport of personnel to the larger eyewash unit and/or to medical and First Aid assistance.
- Emergency Phone Numbers List;
- Portable radios for emergency communications in remote areas;
- Portable fire extinguishers.

### 12.7.1 First Aid Supply List

Adhesive dressings	Sterile Gloves
Adhesive tape rolls, 1 inch wide	Pen Light
Sterile eye dressing packets	Hydrogen Peroxide
1-inch gauze bandage rolls	Sterile eye irrigating solution
2-inch gauze bandage rolls	Glucose packets (for diabetics)
4-inch gauze bandage rolls	Splints (arm and leg)
Sterile gauze pads, 2 inch square	Antibiotic ointment
Sterile gauze pads, 4 inch square	Cotton-tipped applicators
Sterile surgical pads suitable for pressure dressings	Flashlight
Triangular bandages	Cold packs
Safety pins	Blankets (2)
Tweezers and scissors	CPR Microshields/Clear Mouth Barriers
Tape for bandaging	(2) These need to have one-way valves
Ace bandages	Hand soap
Latex gloves	Drugs, inhalants, or medications will not be included in the First Aid Kit.

Supplies should be re-ordered as they are used. A weekly inventory of the First Aid kits must be completed and supplies re-ordered that have been used and not reported.

## 12.8 OPERATIONS SHUTDOWN

Under certain extreme hazardous situations the SSHO may request that site operations be temporarily suspended while the underlying hazard is corrected or controlled. During operation shutdown, all

personnel will be required to evacuate the site and support areas as necessary. The SSHO will have ultimate authority for operations shutdown and restart as applies to safety and health related issues.

#### **12.9 DISTRIBUTION OF THIS EMERGENCY RESPONSE PLAN**

A copy of this Emergency Response Plan will be available to all of the local emergency services, all applicable Federal, state, and local regulatory agencies, and made available to all site personnel. A copy of this Emergency Response Plan will also be distributed to the EC, Backup ECs, the Site Supervisor, and PM.

#### **12.10 PROCEDURES FOR PLAN REVIEW AND AMENDMENT**

This Emergency Response Plan will be reviewed and amended as necessary if either one of the following happens:

- The plan fails in an emergency.
- The site changes in its design, construction, operation, maintenance, or other circumstances that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency.
- The ECs change.

Changes to this Emergency Response Plan will be made by the EC, and SHM if any of the above mentioned occurs. Revised copies of this ER will be distributed to the EC, Backup ECs, the Site Supervisor, and PM.

## **13.0 ACCIDENT PREVENTION PLAN**

### **13.1 RESPONSIBILITIES**

The SSHO will implement the SSHP that includes this Accident Prevention Plan at the project site. The SSHO is responsible for seeing that this plan is implemented and followed by all site personnel

The SSHO and SSR are responsible for being thoroughly familiar with:

- The SSHP and this Accident Prevention Plan.
- All operations and activities associated with the project
- The safe work practices to be implemented during this project.
- The chemical and physical hazards associated with site activities.
- Accident and incident reporting and investigations requirements.
- The location of all emergency equipment including fire extinguishers.
- First Aid and medical facilities to be used in case of an accident, and the names and locations of site personnel who are trained in First Aid and CPR.
- The location of all operation-specific records.
- The physical layout of the facility.

Additional responsibilities for accident prevention and site health and safety activities are outlined in Section 3.0 of this SSHP.

### **13.2 RECORD KEEPING AND INCIDENT REPORTING**

The investigation and reporting of occupational injuries, illnesses and dangerous occurrences is essential for project management to be able to take the steps necessary to avoid additional injuries or illnesses. A complete investigation will provide information regarding the elements of the incident and the process by which they came together to cause the injury, illness, or dangerous occurrence. By identifying the elements and processes, further incidents can be avoided. Timely reporting also permits project contractors to remain in compliance with OSHA record keeping regulations.

### 13.2.1 Program Responsibilities

The SHM shall:

- Determine if an incident warrants a formal investigation, and conduct incident investigations as required.
- Provide reports of formal investigations to the PM and COR.
- Review all accident reports.
- Maintain the project OSHA Form 200.

If the SHM is not available in the event of an emergency, the SSHO will contact the RHSM for guidance regarding the need for a formal investigation.

The PM, or his designee, will:

- Investigate all incidents on his projects, and
- Complete and submit reports in accordance with this Procedure.

Site personnel are responsible for reporting ALL incidents involving injuries or illnesses, including near-misses, to their supervisor in a timely fashion (i.e., within one working day).

### 13.2.2 Accident and Illness Investigation

Sometimes the investigation of an accident or illness is necessary to prevent similar occurrences. An investigation should not attempt to prove guilt or innocence; rather its purpose should be to ascertain the existence of hazards by identifying the elements and sources that caused the accident or illness. Additionally, a proper investigation should result in the identification of any corrective measures that may be required.

The objectives of an accident or illness investigation are to:

- Determine the existence of any hazards or contributing factors involved.
- Make recommendations for eliminating the hazards.
- Determine if any unsafe or unhealthful behavior or condition was involved.

- Make recommendations for eliminating the unsafe or unhealthful condition or behavior involved.

### 13.2.3 Responsibilities For An Accident or Illness Investigation

Accident or illness investigations require a search for all factors involved in the accident or illness. Every factor must be found, evaluated and considered in order to determine what actually occurred and why. Failure to gather and consider all factors could allow recurrent accidents or illnesses from the same cause.

When a Supervisor is advised that an accident or illness has occurred, he/she should:

- Immediately notify the COR.
- Complete the appropriate *Accident Report Forms* (See Appendix B)
- Investigate promptly
- Determine what happened and how it happened.
- Determine the results.
- Determine what immediate corrective action to take.
- Notify the SHM and SSHO and request assistance, if needed.

When the SHM or SSHO is advised that an accident or illness has occurred, the SHM will determine if a formal investigation is required. If required, the following steps should be observed:

- Immediately notify the COR.
- Conduct an investigation promptly.
- Collect and weigh all facts, and justify the conclusions reached by the evidence.
- Determine familiarity by the employee with equipment and procedures involved.
- Determine the conditions or situations relative to the cause of the accident or illness.
- Determine if the accident or illness was caused by a physical hazard or by an unsafe act.
- Assign one or more persons to investigate major lost time accidents or illnesses.
- Be objective and independent from the individuals or programs involved in the accident or illness.

### 13.2.4 Incident/Accident Reporting

In the event of an injury or illness, work is to be stopped until the cause of the incident has been determined and appropriate action has been taken. Any injury or illness, regardless of severity, is to be reported on an *Accident Report Form* located in Appendix B.

Immediate (eight hour) reporting to OSHA is required under 29 CFR 1904 if a fatality or catastrophe (three or more people sent to the hospital with injuries that require an overnight stay) occurs. This reporting is done **only** by the SHM or RHSM.

All personal injuries requiring First Aid or resulting in lost time will be recorded on an OSHA Form 200 by the SHM.

Any damage to government property will be reported immediately to the COR securing medical attention for injured personnel. Any damage caused to service lines (i.e., gas, sewer, water) will be immediately reported to the base fire department and bulk fuels.

### 13.2.5 Record Keeping

*OSHA Form 200, the Log and Summary of Occupational Injuries and Illnesses*, is maintained for the project by the SHM. This function is centralized so a uniform procedure is used for the completion and distribution of Form 200.

The SHM has five workdays from the date of the occurrence of the recordable injury or illness to make the appropriate entries in the log. Therefore, the supervisor must complete the Accident Report Form immediately upon report and initial investigation of the incident and forward a copy to the SHM.

The SHM will complete an *OSHA Report of Occupational Injury or Illness* and will update the site's Form 200 using the information from the *OSHA Form 101*. The OSHA Form 101 is the employer's first report of occupational injury. The SHM will also need to know how many days the affected individual was off duty and/or on restricted duty in order to complete the update.

At the end of each calendar year, an annual summary of occupational injuries and illnesses for that year will be prepared. The summary must be posted for the entire month of February in the year following the summary year. The posted summary will not show the names of the personnel whose illnesses or injuries are listed.

The log and summary, OSHA Form 200, accident report forms, and OSHA Form 101 must be retained for five years. All OSHA records will be made available upon request for inspection and copying by authorized Federal and State government officials. Site personnel, former site personnel, and representatives are provided access only to the log, Form 200. Access to these records will be provided in a reasonable manner and at a reasonable time.

### 13.3 DAILY WORK AREA INSPECTIONS

The SSHO will conduct a daily inspection of the work area to assess if operations are being performed in accordance with the requirements of this SSHP and OSHA regulations. A *Health and Safety Checklist Log* will be filled out on a daily basis to document inspection activities. Copies of work area inspections conducted will be submitted to the SHM

#### 13.4 HEALTH AND SAFETY EQUIPMENT LIST

OSHA Required Safety Sign

*Dames & Moore Firmwide Health and Safety Policy  
and Procedures Manual*

Hardhats

Ear plugs or muffs

Disposable, one-piece Tyvek® coverall

Nitrile outer gloves

Work gloves

Safety glasses

Goggles and/or faceshields

Leather boots with steel toe and shank

Deconnable chemical resistant boots with steel toe and shank

Plastic sheeting (visqueen)

55-gallon 17-H drums (for contaminated solids)

and 17-E drums (for liquids)

Drum liners

Barricade tape

Wash tubs and scrub brushes

Paper towels

Decontamination solution (i e ,Alconox)

Portable eyewash

Respirator sanitizing equipment

First aid kit

Hand soap

Drinking water and water cooler

Gatorade or similar drink

Drinking cups

Type ABC fire extinguishers

Half-face and full-face air-purifying  
respirators (NIOSH approved)

Organic vapor cartridges

PID and calibration kit

Mobile phone

Garden sprayer

Compressed gas horn

Duct tape

Trash bags

## **14.0 SPILL CONTROL**

### **14.1 NOTIFICATION OF SPILLS AND DISCHARGES**

If a spill occurs and humans or the environment are threatened, site personnel will immediately contact the SSHO or PM who in turn will immediately notify Air Force personnel

After spill response activities are completed, a Spill Report will be issued to the COR. This spill report will identify the cause and extent of the spill, any resulting contamination danger, and the corrective actions taken by Contractor and emergency personnel.

### **14.2 REQUIRED EQUIPMENT**

The following equipment will be kept at the site at all times to provide for the means to cleanup an unexpected spill or discharge:

- gallon bucket or 55-gallon drum as necessary
- Spill kit including absorbent pads and "pigs"
- Shovel

The equipment is limited since the chemicals brought to the site will be minimal.

### **14.3 SPILL CONTROL**

If a spill occurs at the site, the Contractor will immediately take the following actions:

1. Notify the COR;
2. Control sources of ignition;
3. Contain the spill;
4. Do not allow anyone to touch or approach the spilled material without wearing the appropriate PPE;
5. Keep combustibles away from the spilled material;
6. Place the spilled material and affected soil in a five gallon bucket or container for disposal; and
7. Conduct any other actions as needed.

### **14.4 DECONTAMINATION**

After the spill area has been controlled, personnel will undergo decontamination procedures as outlined in Section 9.0.

**APPENDIX A**

**SSHP Compliance Agreement Form**

## SSHP COMPLIANCE AGREEMENT FORM

**For:** Remedial Action at ST005, Remedial Action at 8 Former UST Sites, Remedial Investigations at 4 Former UST Sites, Remedial Action at the Building 1100 Area, Remedial Investigation at the Building 1200 Area.

Richards-Gebaur Air Force Base  
Grandview, Missouri

I, \_\_\_\_\_, have received a copy of the SSHP for the Project. I have reviewed the SSHP, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the health and safety requirements specified in the plan.

Signed \_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

**APPENDIX B**

**Incident/Accident Report Form**

ACCIDENT REPORT FORM

211 431

Employee Name \_\_\_\_\_ Date of birth \_\_\_\_\_  
 Home Address \_\_\_\_\_ Phone \_\_\_\_\_  
 Sex:  Male  Female Job Title \_\_\_\_\_ Social Security No \_\_\_\_\_  
 Office No. \_\_\_\_\_ Office Location \_\_\_\_\_ Date of Hire \_\_\_\_\_  
 Hours Usually worked: Hours per day \_\_\_\_\_ Hours per week \_\_\_\_\_ Total hours weekly \_\_\_\_\_

Where did accident or exposure occur? (Include address) \_\_\_\_\_

County \_\_\_\_\_ On employer's premises?  Yes  No

What was employee doing when injured (Be specific) \_\_\_\_\_

How did the accident or exposure occur? (Describe fully) \_\_\_\_\_

What steps could be taken to prevent such an occurrence? \_\_\_\_\_

Object or substance that directly injured employee \_\_\_\_\_

Describe the injury or illness \_\_\_\_\_ Part of body affected \_\_\_\_\_

Name and address of physician \_\_\_\_\_

If hospitalized, name and address of hospital \_\_\_\_\_

Date of injury/illness \_\_\_\_\_ Time of day \_\_\_\_\_ Loss of one or more day of work?  yes  no

If yes, date last worked \_\_\_\_\_

Has employee returned to work? \_\_\_\_\_ If yes, date returned \_\_\_\_\_ Did employee die?  yes  no

If yes, date of death \_\_\_\_\_

Completed by (Print name) \_\_\_\_\_ Signature \_\_\_\_\_

Title \_\_\_\_\_ Date \_\_\_\_\_

An Accident/exposure report must be completed by the supervisor or site safety officer immediately upon learning of the incident. The completed report must be immediately transmitted to the office administrative manager and the Division Health and Safety Manager.

**APPENDIX C**  
**Site Inspection Log**





HAZARDOUS WASTE OPERATIONS - DAILY SAFETY INSPECTION CHECKLIST

Project/Number: \_\_\_\_\_ Date: \_\_\_\_\_  
 Project Location: \_\_\_\_\_ Project Manager: \_\_\_\_\_  
 Checklist Completed By: \_\_\_\_\_  
 Activities/Type Project: \_\_\_\_\_  
 Subcontractors, Responsibilities: \_\_\_\_\_  
 Site Conditions, Weather: \_\_\_\_\_

	YES	NO	N/A
Current Health and Safety Plan (HSP) available on site?			
HSP Acceptance forms (Attachment A) signed by all D&M site personnel?			
Do activities conform to the scope described in the HSP? If not, has the Health and Safety Group been contacted?			
Daily site health and safety briefings held and documented?			
Does at least 1 person on site at all times have current CPR and First Aid training?			
Are OSHA posters (where required) posted?			
Is a copy of the firmwide health and safety manual available in the field?			
Emergency phone numbers conspicuously posted at site?			
Is site control established to keep unauthorized persons and vehicles out of the work area?			
Does the written inventory of chemicals in the HSP match those that are present on site?			
MSDSs available for every chemical listed/used?			
Health and safety instrumentation available and in use per the HSP?			
Air monitoring instrumentation maintenance and calibration logs available and current?			
Air monitoring log available and current?			
Has heat stress monitoring been implemented?			
Are engineering controls used on-site? If no, could they be used?			
Is all PPE called for in the HSP available and used in accordance with the HSP?			
Are ear muffs or ear plugs worn by personnel on-site in areas of loud equipment?			
Decontamination areas situated to minimize contamination potential of uncontaminated personnel or equipment?			
Are HSP decontamination procedures observed?			
Have proper underground utility clearances been obtained prior to drilling?			
Is good housekeeping practiced at the site (site orderly, debris removed daily, tripping hazards removed/repaired, all emergency equipment accessible)?			
Is electrical equipment for all 110V outside, wet locations, or portable (5 KW) power sources protected by a Ground-Fault Circuit Interrupter (GFCI)?			
Any gross unsafe activities observed?			
Any unsafe deviations from HSP? If yes, have they been properly documented and investigated?			

Additional Information - Explain any discrepancies noted and actions taken.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Highlight Items as they are discussed using a Yellow Highlighter

Site Safety & Health Officer (SSHO)			
Location of On-site SSHP			
Site Training		Perchlorates	HAZCOM, HTRW
		Mercury	HAZCOM, HTRW
		Asbestos	AHERA
Medical Surveillance	ALL		
Planned Work			
General Safety & Health Issues	/		
Physical Hazards & Controls	Lock-out/Tag-out		
	Heavy Equipment		
	Trench/Excavation		
	Explosive/Flammable Hazard		
Chemical Hazards & Controls			
Discuss Symptoms of Overexposure			
Biological Hazards & Controls			
Levels of PPE	C + Blast Shields		
	C		
	D		
PPE Required		Respirator	
			Full-face
			½ Mask
		Coveralls	
			Tyvek ®
			Saranex ®
			Cotton
		Safety Glasses/Goggles	
		Foot protection	
			Deconnable Boots
			Leather Boots w/Latex overboots
			Leather Boots
		Inner Gloves (Nitrile)	
		Outer Gloves	
		Hearing Protection	

Best Available Copy

211 436

		Other	
Review Inspection Procedures			
Review Decontamination Procedures			
Review Maintenance Procedures			
Review Limitations of PPE			
EZ established	Radius		
Discuss Site Emergency Plan			

Comments:

--	--

**APPENDIX D**

**Hazard Communication Program Material Safety Data Sheets**

MATERIAL SAFETY DATA SHEET

MSDS 1015  
MSDS# 38

AMEREX CORPORATION  
P. O. BOX 81, TRUSSVILLE, AL 35173-0081  
RESPONSIBLE PARTY: MSDS COORDINATOR

TELEPHONE: 205-655-3271  
EMERGENCY TELEPHONE NO. DAY/NIGHT: CHEMTREC 1-800-424-9300

DATE PREPARED 8-1-91  
SUPERSEDES 6-22-88

IDENTIFICATION

PRODUCT NAME: ABC DRY CHEMICAL  
SYNONYMS: MULTI-PURPOSE DRY CHEMICAL, MAP, (MONO) AMMONIUM PHOSPHATE, ALL-PURPOSE DRY CHEMICAL

HAZARDOUS INGREDIENTS

MATERIAL	CAS NO	OSHA PEL TWA - mg/m3	ACGIH TLV TWA - mg/m3
Mica	12001-26-2	3 Respirable Dust	3 Respirable Fraction
Kaolin	1332-58-7	10 Total Dust 5 Respirable Fraction	10 (c)

OTHER INGREDIENTS

MATERIAL	CAS NO.	OSHA PEL TWA - mg/m3	ACGIH TLV TWA - mg/m3
Monoammonium Phosphate	7722-76-1	15 Total Dust (a) 5 Respirable Fraction	10 (b)
Ammonium Sulfate	7783-20-2	15 Total Dust (a) 5 Respirable Fraction	10 (b)

(a) Particulate matter not otherwise classified.

(b) Particulate matter not otherwise classified. Total dust containing no asbestos & less than 1% crystalline silica.

(c) Total dust containing no asbestos & less than 1% crystalline silica.

PHYSICAL AND CHEMICAL CHARACTERISTICS

BOILING POINT (°F): NA	SPECIFIC GRAVITY (H <sub>2</sub> O = 1): 0.85	VAPOR PRESSURE (MM HG): NA
PERCENT VOLATILE (%): NA	VAPOR DENSITY (AIR = 1): NA	EVAPORATION RATE: NA
SOLUBILITY IN WATER: Water repellent coated	REACTIVITY IN WATER: None	MELTING POINT (°F): NA
pH: 4.4	APPEARANCE & ODOR: Yellow powder. No characteristic odor.	
FLASH POINT (°F): None	AUTO IGNITION TEMPERATURE (°F): NA	FLAMMABLE LIMITS IN AIR BY VOL: NA
EXTINGUISHER MEDIA: None. This material is an extinguishing agent.		
SPECIAL FIRE FIGHTING PROCEDURES: None		UNUSUAL FIRE AND EXPLOSION HAZARDS: None

PHYSICAL HAZARDS

STABILITY: Stable	CONDITIONS TO AVOID: NA
INCOMPATIBILITY (MATERIALS TO AVOID): Strong Alkalis, Mg, Sodium Nitrite, Swimming Pool Sanitizers (Inorganic Perchlorates, Sodium Dichloroisocyanurate Hydrate, Trichloroisocyanuric Acid, Calcium Hypochlorite, Etc.)	
HAZARDOUS DECOMPOSITION PRODUCTS: Ammonia, Carbon Monoxide and Oxides of Nitrogen	
HAZARDOUS POLYMERIZATION: Will not occur	CONDITIONS TO AVOID: NA



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 (518) 377-8854

Material Safety Data Sheets Collection:

 Sheet No. 467  
 Automotive Gasoline, Lead-free

Issued: 10/81

Revision: A, 9/91

**Section 1. Material Identification**

**Automotive Gasoline, Lead-free, Description:** A mixture of volatile hydrocarbons composed mainly of branched-chain paraffins, cycloparaffins, olefins, naphthenes, and aromatics. In general, gasoline is produced from petroleum, shale oil, Athabasca tar sands, and coal. Motor gasolines are made chiefly by cracking processes, which convert heavier petroleum fractions into more volatile fractions by thermal or catalytic decomposition. Widely used as fuel in internal combustion engines of the spark-ignited, reciprocating type. Automotive gasoline has an octane number of approximately 90. A high content of aromatic hydrocarbons and a consequent high toxicity are also associated with a high octane rating. Some gasolines sold in the US contain a minor proportion of tetraethyllead, which is added in concentrations not exceeding 3 ml per gallon to prevent engine "knock." However, methyl-tert-butyl ether (MTBE) has almost completely replaced tetraethyllead.

**Other Designations:** CAS No. 8006-61-9, benzine, gasoline, gasolene, motor spirits, natural gasoline, petrol.

**Manufacturer:** Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*<sup>TM</sup> for a suppliers list.

R	1	NFP
I	2	
S	2*	
K	4	
* Skin absorption		
		HMD
		H
		F
		R
		PPC
		† Se

**Cautions:** Inhalation of automotive gasoline vapors can cause intense burning in throat and lungs, central nervous system (CNS) depression, and possible fatal pulmonary edema. Gasoline is a dangerous fire and explosion hazard when exposed to heat and flames.

**Section 2. Ingredients and Occupational Exposure Limits**

Automotive gasoline, lead-free\*

**1990 OSHA PELs**8-hr TWA: 300 ppm, 900 mg/m<sup>3</sup>15-min STEL: 500 ppm, 1500 mg/m<sup>3</sup>**1990-91 ACGIH TLVs**TWA: 300 ppm, 890 mg/m<sup>3</sup>STEL: 500 ppm, 1480 mg/m<sup>3</sup>**1990 NIOSH REL**

None established

**1985-86 Toxicity Data\***

Man, inhalation, TC<sub>50</sub>: 900 ppm/1 hr; toxic effects include sensory organs and special senses (conjunctiva irritation), behavioral (hallucinations, distorted perceptions), lungs, thorax, or respiration (cough)

Human, eye: 140 ppm/8 hr; toxic effects include mild irritation  
 Rat, inhalation, LC<sub>50</sub>: 300 g/m<sup>3</sup>/5 min

\* A typical modern gasoline composition is 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content is approximately 1%. Other additives: sulfur, phosphorus, and MTBE.

† See NIOSH, RTECS (LX3300000), for additional toxicity data.

**Section 3. Physical Data**

**Boiling Point:** Initially, 102 °F (39 °C); after 10% distilled, 140 °F (60 °C); after 50% distilled, 230 °F (110 °C); after 90% distilled, 338 °F (170 °C); final boiling point, 399 °F (204 °C)

**Vapor Density (air = 1):** 3.0 to 4.0

**Density/Specific Gravity:** 0.72 to 0.76 at 60 °F (15.6 °C)

**Water Solubility:** Insoluble

**Appearance and Odor:** A clear (gasoline may be colored with dye), mobile liquid with a characteristic odor recognizable at about 10 ppm

**Section 4. Fire and Explosion Data**

**Flash Point:** -45 °F (-43 °C)

**Autoignition Temperature:** 536 to 853 °F (280 to 456 °C)

**LEL:** 1.3% v/v

**UEL:** 6.0

**Extinguishing Media:** Use dry chemical, carbon dioxide, or alcohol foam as extinguishing media. Use of water may be ineffective to extinguish fire, but use water spray to knock down vapors and to cool fire-exposed drums and tanks to prevent pressure rupture. Do not use a solid stream of water since it may spread the fuel.

**Unusual Fire or Explosion Hazards:** Automobile gasoline is an OSHA Class IB flammable liquid and a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow to an ignition source and flash back. Automobile gasoline can also react violently with oxidizing agents.

**Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, and full protective clothing. When the fire is extinguished, use nonsparking tools for cleanup. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

**Section 5. Reactivity Data**

**Stability/Polymerization:** Automotive gasoline is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

**Chemical Incompatibilities:** Automotive gasoline can react with oxidizing materials such as peroxides, nitric acid, and perchlorates.

**Conditions to Avoid:** Avoid heat and ignition sources.

**Hazardous Products of Decomposition:** Thermal oxidative decomposition of automotive gasoline can produce oxides of carbon and partially oxidized hydrocarbons.



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 Sheet No. 470  
 Diesel Fuel Oil No. 2-D

Issued: 10/81

Revision: A, 11/90

**Section 1. Material Identification:**

**Diesel Fuel Oil No. 2-D Description:** Diesel fuel is obtained from the middle distillate in petroleum separation; a distillate oil of low sulfur content. It is composed chiefly of unbranched paraffins. Diesel fuel is available in various grades, one of which is synonymous with fuel oil No. 2-D. This diesel fuel oil requires a minimum Cetane No. (efficiency rating for diesel fuel comparable to octane number ratings for gasoline) of 40 (ASTM D613) Used as a fuel for trucks, ships, and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.

**Other Designations:** CAS No. 68334-30-5, diesel fuel.

**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*<sup>TM</sup> for a suppliers list.

**Cautions:** Diesel fuel oil No. 2-D is a skin irritant and central nervous depressant with high mist concentrations. It is an environmental hazard and moderate fire risk.

 R 1  
 I -  
 S 2  
 K 2

NFPA

HMIS

H 0

F 2

R 0

PPG\*

\* Sec. 8

**Section 2. Ingredients and Occupational Exposure Limits:**

Diesel fuel oil No. 2-D\*

 1989 OSHA PEL  
 None established

 1990-91 ACGIH TLV  
 Mineral Oil Mist  
 TWA: 5 mg/m<sup>3</sup>†  
 STEL: 10 mg/m<sup>3</sup>

 1988 NIOSH REL  
 None established

1985-86 Toxicity Data‡

 Rat, oral, LD<sub>50</sub>: 9 g/kg produces gastrointestinal (hypermotility, diarrhea) effects

\* Diesel fuel No. 2-D tends to be low in aromatics and high in paraffinics. This fuel oil is complex mixture of: 1) >95% paraffinic, olefinic, naphthenic, and aromatic hydrocarbons, 2) sulfur (<0.5%), and 3) benzene (<100 ppm). [A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)]. Although low in the fuel itself, benzene concentrations are likely to be much higher in processing areas.

† As sampled by evaporator-collecting method.

‡ Monitor NIOSH, RTECS (HZ1800000), for future toxicity data.

**Section 3. Physical Data:**

Boiling Point Range: 340 to 675 °F (171 to 358 °C)

Specific Gravity: &lt;0.86

Viscosity: 1.9 to 4.1 centistoke at 104 °F (40 °C)

Water Solubility: Insoluble

Appearance and Odor: Brown, slightly viscous liquid.

**Section 4. Fire and Explosion Data:**

Flash Point: 125 °F (52 °C) min.

Autoignition Temperature: &gt;500 °F (932 °C)

LEL: 0.6% v/v

UEL: 7.5% v/v

**Extinguishing Media:** Use dry chemical, carbon dioxide, or foam to fight fire. Use a water spray to cool fire exposed containers. Do not use a forced water spray directly on burning oil since this will scatter the fire. Use a smothering technique for extinguishing fire.

**Unusual Fire or Explosion Hazards:** Diesel fuel oil No. 2-D is a OSHA Class II combustible liquid. Its volatility is similar to that of gas oil. Vapors may travel to a source of ignition and flash back.

**Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to pollution and fire or explosion hazard.

**Section 5. Reactivity Data:**

**Stability/Polymerization:** Diesel fuel oil No. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

**Chemical Incompatibilities:** It is incompatible with strong oxidizing agents; heating greatly increases the fire hazard.

**Conditions to Avoid:** Avoid heat and ignition sources.

**Hazardous Products of Decomposition:** Thermal oxidative decomposition of diesel fuel oil No. 2-D can produce various hydrocarbons and hydrocarbon derivatives, and other partial oxidation products such as carbon dioxide, carbon monoxide, and sulfur dioxide



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Material Safety Data Sheets Collection:

Sheet No. 470  
Diesel Fuel Oil No. 2-D

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**Section 1. Material Identification**

33

**Diesel Fuel Oil No. 2-D Description:** Diesel fuel is obtained from the middle distillate in petroleum separation; a distillate of low sulfur content. It is composed chiefly of unbranched paraffins. Diesel fuel is available in various grades, one of which is synonymous with fuel oil No. 2-D. This diesel fuel oil requires a minimum Cetane No. (efficiency rating for diesel fuel comparable to octane number ratings for gasoline) of 40 (ASTM D613). Used as a fuel for trucks, ships, and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.

**Other Designations:** CAS No. 68334-30-5, diesel fuel.

**Manufacturer:** Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*<sup>TM</sup> for a suppliers list.



HMS  
H 0  
F 2  
R 0  
PPG\*  
\* Sec. 8

**Cautions:** Diesel fuel oil No. 2-D is a skin irritant and central nervous depressant with high mist concentrations. It is an environmental hazard and moderate fire risk.

**Section 2. Ingredients and Occupational Exposure Limits**

Diesel fuel oil No. 2-D\*

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data†
None established	Mineral Oil Mist TWA: 5 mg/m <sup>3</sup> STEL: 10 mg/m <sup>3</sup>	None established	Rat, oral, LD <sub>50</sub> : 9 g/kg produces gastrointestinal (hypermotility, diarrhea) effects

\* Diesel fuel No. 2-D tends to be low in aromatics and high in paraffins. This fuel oil is complex mixture of: 1) >95% paraffinic, olefinic, naphthenic, and aromatic hydrocarbons, 2) sulfur (<0.5%), and 3) benzene (<100 ppm). [A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)]. Although low in the fuel itself, benzene concentrations are likely to be much higher in processing areas.

† As sampled by nonvapor-collecting method.

‡ Monitor NIOSH, RTECS (HZ1800000), for future toxicity data.

**Section 3. Physical Data**

Bolling Point Range: 340 to 675 °F (171 to 358 °C)	Specific Gravity: <0.86
Viscosity: 1.9 to 4.1 centistoke at 104 °F (40 °C)	Water Solubility: Insoluble

Appearance and Odor: Brown, slightly viscous liquid.

**Section 4. Fire and Explosion Data**

Flash Point: 125 °F (52 °C) min.	Autoignition Temperature: >500 °F (932 °C)	LEL: 0.6% v/v	UEL: 7.5% v/v
----------------------------------	--	---------------	---------------

**Extinguishing Media:** Use dry chemical, carbon dioxide, or foam to fight fire. Use a water spray to cool fire exposed containers. Do not use a forced water spray directly on burning oil since this will scatter the fire. Use a smothering technique for extinguishing fire.

**Unusual Fire or Explosion Hazards:** Diesel fuel oil No. 2-D is a OSHA Class II combustible liquid. Its volatility is similar to that of gas oil. Vapors may travel to a source of ignition and flash back.

**Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to pollution and fire or explosion hazard.

**Section 5. Reactivity Data**

**Stability/Polymerization:** Diesel fuel oil No. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

**Chemical Incompatibilities:** It is incompatible with strong oxidizing agents; heating greatly increases the fire hazard.

**Conditions to Avoid:** Avoid heat and ignition sources.

**Hazardous Products of Decomposition:** Thermal oxidative decomposition of diesel fuel oil No. 2-D can produce various hydrocarbons and hydrocarbon derivatives, and other partial oxidation products such as carbon dioxide, carbon monoxide, and sulfur dioxide.

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 Burdick & Jackson Division  
 1953 South Harvey Street  
 Muskegon, MI 49442 USA

MSDS# 31

211 441A

information/emergency telephone no. 616.726.3171  
 chemtrec telephone no. 800.424.9300  
 canadian emergency telephone no. 613.996.6666

**MATERIAL SAFETY  
 DATA SHEET**
**I. Identification**

chemical name Hexane molecular weight 86.18  
 chemical family Aliphatic Hydrocarbon formula C<sub>6</sub>H<sub>14</sub>  
 synonyms n-Hexane  
 DOT proper shipping name Hexane  
 DOT hazard class Flammable Liquid  
 DOT identification no. UN1208 CAS no. 110-54-3

HEXANE

**II. Physical and Chemical Data**

boiling point, 760mm Hg. 68.7°C freezing point -95.3°C evaporation rate (BuAc=1) ca 10  
 vapor pressure at 20°C 124 mm Hg vapor density (air=1) 3.0 solubility in water @ 20°C 0.014%  
 % volatiles by volume ca 100 specific gravity (H<sub>2</sub>O=1) @ 20°C 0.659 stability Stable  
 hazardous polymerization Not expected to occur.  
 appearance and odor Clear, colorless liquid with a mild hydrocarbon odor.  
 conditions to avoid Heat, sparks, open flame, open containers, and poor ventilation.

materials to avoid Strong oxidizing agents.

hazardous decomposition products Incomplete combustion can generate carbon monoxide and other toxic vapors.

**III. Fire and Explosion Hazard Data**

flash point, (test method) -26°C (Tag closed cup) auto ignition temperature 225°C  
 flammable limits in air % by volume: lower limit 1.1 upper limit 7.5  
 unusual fire and explosion hazards Very volatile and extremely flammable.

extinguishing media Carbon dioxide, dry chemical or foam.

special fire fighting procedures Water will not be effective in extinguishing a fire and may spread it, but a water spray can be used to cool exposed containers. Wear full protective clothing and self-contained breathing apparatus. Heat will build pressure and may rupture closed storage containers.

**IV. Hazardous Components**

Hexane and isomers % ca 100 TLV 50 ppm CAS no. 110-54-3

**Burdick & Jackson's Disclaimer:** The information and recommendations presented in this Material Safety Data Sheet are based on sources believed reliable on the date hereof. Burdick & Jackson makes no representation on its completeness or accuracy. It is the user's responsibility to determine the product's suitability for its intended use, the product's safe use, and the product's proper disposal. No representations or warranties, either express or implied, merchantability or fitness for a particular purpose or of any other nature are made with respect to the information provided in this Material Safety Data Sheet. The product to which such information refers. Burdick & Jackson neither assumes nor authorizes any other person to assume for it, any other or additional liability or responsibility resulting from the use of, or reliance upon, this information.

# MATERIAL SAFETY DATA SHEET



## LIQUID CARBONIC

125 SOUTH LA SALLE STREET - CHICAGO ILLINOIS 60603-4262  
PHONE: (312) 855-2500

UN 1055  
HAZ. CL.: Division 2.1  
LABEL: Flammable Gas

September 1991

24 hour Emergency Phone Numbers: (504) 673-8831, CHEMTREC (800) 424-9300

### SECTION I--PRODUCT IDENTIFICATION

CHEMICAL NAME: Isobutylene  
COMMON NAME AND SYNONYMS: Isobutene, 2-Methylpropene  
CHEMICAL FAMILY: Monolefin  
FORMULA: (iso) C<sub>4</sub>H<sub>8</sub>

### SECTION II--HAZARDOUS INGREDIENTS

MATERIAL	VOLUME %	CAS NO.	1991-1992 ACGIH TLV UNITS
Isobutylene	99+	115-11-7	No TWA listed by ACGIH or OSHA 1989.*

\* Should be considered a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure (pO<sub>2</sub>>135 torr).

### SECTION III--PHYSICAL DATA

BOILING POINT (°F.):	19.5	SPECIFIC GRAVITY (H <sub>2</sub> O=1):	0.627 (B.P./60°F)
VAPOR PRESSURE:	@ 70°F = 39 psia	% VOLATILE BY VOLUME:	99+
VAPOR DENSITY (AIR=1):	@ 70°F = 1.98	EVAPORATION RATE (BUTYL ACETATE=1):	Unknown
SOLUBILITY IN WATER:	Insoluble		
APPEARANCE AND ODOR:	A colorless flammable gas with an unpleasant odor similar to coal gas.		

### SECTION IV--FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED):	-105°F (CC)	FLAMMABLE LIMITS:	LEL	UEL
EXTINGUISHING MEDIA:	Carbon dioxide, dry chemical, halon and water.		1.8	9.6

### SPECIAL FIRE FIGHTING PROCEDURES:

Stop flow of gas if possible. Use water spray to cool fire exposed containers. If feasible, allow fire to burn itself out to avoid accumulation of an unburned flammable mixture.

(Continued on Supplemental Sheet)

### SECTION V--HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation?	Yes	Skin?	Yes	Ingestion?	No
Carcinogenicity:	NTP?	No	IARC Monographs?	No	OSHA?	No

### EFFECTS OF OVEREXPOSURE:

Inhalation: Moderate concentrations so as to exclude an adequate supply of oxygen to the lungs causes dizziness, drowsiness and eventual unconsciousness. It also has a very mild anesthetic effect which might cause lack of coordination or lesser mental alertness.

Skin or Eye: It is mildly irritating to mucous membranes. Due to its rapid rate of evaporation, it can cause tissue freezing or frostbite on dermal contact.

Persons in ill health where such illness would be aggravated by exposure to isobutylene should not be allowed to work with or handle this product.

### EMERGENCY AND FIRST AID PROCEDURES:

If Inhaled: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important.

(Continued on Supplemental Sheet)

## SUPPLEMENTAL SHEET - ISOBUTYLENE MATERIAL SAFETY DATA SHEET

SECTION IV--FIRE AND EXPLOSION HAZARD DATA (Continued)

## UNUSUAL FIRE AND EXPLOSION HAZARDS:

Keep personnel away from fire scene since containers can rupture violently when exposed to fire. Fire fighters should use self-contained breathing apparatus and protective clothing. Unless gas supply is shut-off, it can reignite or explode. Vapor can flow to distant ignition source then flash back.

SECTION V--HEALTH HAZARD DATA

## EMERGENCY AND FIRST AID PROCEDURES:

if Inhaled: (Continued)

Unconscious persons should be moved to an uncontaminated area, given assisted respiration and supplemental oxygen. Further treatment should be symptomatic and supportive.

Skin or Eye Contact: Remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

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DATE: 12/28/89  
INDEX: 02893550227

ACCT: 046782-01  
CAT NO: A144C212

211 444  
PO NBR: 020482

\*\*HYDROCHLORIC ACID, CONCENTRATED (36-37%)\*\*  
\*\*HYDROCHLORIC ACID, CONCENTRATED (36-37%)\*\*  
\*\*HYDROCHLORIC ACID, CONCENTRATED (36-37%)\*\*

-----  
MATERIAL SAFETY DATA SHEET  
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FISHER SCIENTIFIC  
CHEMICAL DIVISION  
1 REAGENT LANE  
FAIR LAWN NJ 07410  
(201) 796-7100

EMERGENCY NUMBER: (201) 796-7100  
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION  
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CAS-NUMBER 7647-01-0  
SUBSTANCE: \*\*HYDROCHLORIC ACID, CONCENTRATED (36-37%)\*\*

TRADE NAMES/SYNONYMS:  
HYDROCHLORIC ACID, HYDROCHLORIDE, MURIATIC ACID, SPIRITS OF SALT,  
HYDROCHLORIC ACID, CONCENTRATED, HYDROGEN CHLORIDE, 23 EG, UN 1789, A-142,  
A-144, A-508, A-486, ACC1155

CHEMICAL FAMILY:  
INORGANIC ACID

MOLECULAR FORMULA: H-CL

MOLECULAR WEIGHT: 36.46

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=1 PERSISTENCE=0  
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=0

-----  
COMPONENTS AND CONTAMINANTS  
-----

COMPONENT: HYDROGEN CHLORIDE PERCENT: 37

COMPONENT: WATER PERCENT: 63

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:  
HYDROGEN CHLORIDE (HYDROCHLORIC ACID):  
5 PPM OSHA CEILING  
5 PPM ACGIH CEILING

500 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY (GAS)  
1 POUND SARA SECTION 304 REPORTABLE QUANTITY (GAS)  
5000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY (LIQUID)  
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

-----  
PHYSICAL DATA  
-----

DESCRIPTION: COLORLESS OR SLIGHTLY YELLOW FUMING LIQUID WITH A PUNGENT

ODOR. BOILING POINT: 384 F (196 C) SPECIFIC GRAVITY: 1.2

VAPOR PRESSURE: NOT AVAILABLE PH: 1.1 (0.1 N)

SOLUBILITY IN WATER: SOLUBLE VAPOR DENSITY: 1.3

-----  
FIRE AND EXPLOSION DATA  
-----

FIRE AND EXPLOSION HAZARD:  
NEGLECTIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

FIREFIGHTING MEDIA:  
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR STANDARD FOAM  
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGE FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM  
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:  
MOVE CONTAINERS FROM FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES  
WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK  
ENDS (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 60).

**CORROSIVE.**

**ACUTE EXPOSURE-** CONTACT MAY CAUSE SEVERE IRRITATION, CONJUNCTIVITIS, CORNEAL NECROSIS AND BURNS WITH IMPAIRMENT OR PERMANENT LOSS OF VISION. A DROP OF HYDROCHLORIC ACID SPLASHED IN THE EYE AND IMMEDIATELY WASHED OUT HAS PRODUCED A WHITE COAGULATION OF THE CORNEAL AND CONJUNCTIVAL EPITHELIUM. ANIMALS EXPOSED TO VAPOR CONCENTRATIONS OF 1350 PPM FOR ONE AND A HALF HOURS SHOWED CLOUDING OF THE CORNEA AND 300 PPM FOR 6 HOURS SHOWED SLIGHT EROSION OF THE CORNEAL EPITHELIUM. CONTACT WITH A COMPRESSED GAS MAY CAUSE FROSTBITE.

**CHRONIC EXPOSURE-** ANIMALS EXPOSED TO VAPOR AT 100 PPM FOR 6 HOURS DAILY FOR 90 DAYS SHOWED ONLY SLIGHT UNREST AND IRRITATION OF THE EYES, BUT NO OCULAR INJURY. EFFECTS ARE DEPENDENT UPON CONCENTRATION AND DURATION OF EXPOSURE. CONJUNCTIVITIS OR EFFECTS SIMILAR TO THOSE FOR ACUTE EXPOSURE MAY OCCUR.

**FIRST AID-** WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

**INGESTION:**

**HYDROGEN CHLORIDE (HYDROCHLORIC ACID):**

**CORROSIVE.**

**ACUTE EXPOSURE-** INGESTION OF THE ACID MAY CAUSE BURNS OF THE MOUTH, THROAT ESOPHAGUS AND STOMACH WITH CONSEQUENT PAIN, UNEASINESS, NAUSEA, SALIVATION, VOMITING, DIARRHEA, CHILLS, SHOCK AND INTENSE THIRST. NEPHRITIS, FEVER AND PERFORATION OF THE INTESTINAL TRACT, AND CIRCULATORY COLLAPSE MAY OCCUR. DEATH MAY BE DUE TO ESOPHAGEAL OR GASTRIC NECROSIS. **CHRONIC EXPOSURE-** NO DATA AVAILABLE.

**FIRST AID-** DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY BY DRINKING LARGE QUANTITIES OF WATER OR MILK. IF VOMITING PERSISTS, ADMINISTER FLUIDS REPEATEDLY. INGESTED ACID MUST BE DILUTED APPROXIMATELY 100 FOLD TO RENDER IT HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT SHOCK. (OREISBACH, HANDBOOK OF POISONING, 12TH ED.). GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

**ANTIDOTE:**

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

-----  
**REACTIVITY**

**REACTIVITY:**

REACTS EXOTHERMICALLY WITH WATER OR STEAM TO PRODUCE TOXIC AND CORROSIVE FUMES.

CONTACT WITH COMMON METALS PRODUCES HYDROGEN WHICH MAY FORM EXPLOSIVE MIXTURES WITH AIR.

**INCOMPATIBILITIES:**

**HYDROGEN CHLORIDE (HYDROCHLORIC ACID):**

ACETIC ANHYDRIDE; VIOLENT REACTION.

ALCOHOLIC HYDROGEN OXANIDE; EXPLOSIVE REACTION.

ALUMINUM; EXPLOSION.

ALUMINUM-TITANIUM ALLOYS; IGNITES OR INCANDESCES WHEN HEATED.

2-AMINOETHANOL; VIOLENT REACTION.

AMMONIUM HYDROXIDE; VIOLENT REACTION.

BASES; VIOLENT REACTION.

BRASS; CORRODES.

BRONZE; CORRODES.

CALCIUM CARBIDE; REACTS WITH INCANDESCENCE.

CALCIUM HYPOCHLORITE; IGNITION.

CESIUM ACETYLIDE; IGNITES ON CONTACT.

CHLORINE + DINITROANILINES; VIGOROUS REACTION WITH RELEASE OF FLAMMABLE HYDROGEN GAS FUMES.

CHLOROSULFONIC ACID; VIOLENT REACTION.

1,1-DIFLUOROETHYLENE; EXTREMELY EXOTHERMIC DECOMPOSITION REACTION.

DOWICIL 100; DECOMPOSES.

ETHYLENE; DIAMINE; VIOLENT REACTION.

ETHYLENE; IMINE; VIOLENT REACTION.

FLUORINE; IGNITES ON CONTACT.

HEXALITHIUM DISILICIDE; INCANDESCES.

IRON; CORRODES WITH EVOLUTION OF FLAMMABLE HYDROGEN GAS.

MAGNESIUM BORIDE; PRODUCES A SPONTANEOUSLY FLAMMABLE GAS.

MERCURIUM SULFATE; VIOLENT REACTION AT 125 C.

METAL ACETYLIDES; VIOLENT REACTION.

METALS; SEVERE CORROSION WITH EVOLUTION OF FLAMMABLE HYDROGEN GAS.

OLEUM; VIOLENT REACTION.

OXIDIZERS (STRONG); VIOLENT REACTION.

OXYGEN + PLATINUM; IGNITES ON CONTACT.

PERCHLORIC ACID; VIOLENT REACTION.

PLASTICS; RUBBER, COATINGS; ATTACKS.

POTASSIUM PERMANGANATE; EXPLOSION HAZARD.

BETA-PROPIOLACTONE; VIOLENT REACTION.

PROPYLENE OXIDE; VIOLENT REACTION.

RUBIDIUM ACETYLIDE; IGNITES ON CONTACT.

SILICA (GEL); INCOMPATIBLE.

DATE: 12/28/89  
INDEX: 02893550227

ACCT: 046782-01  
CAT NO: A144C212

PO NBR: 020482

211 446

RESPIRATOR:  
THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION. THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

**HYDROGEN CHLORIDE (HYDROCHLORIC ACID):**

- 50 PPM- ANY SUPPLIED-AIR RESPIRATOR.  
ANY SELF-CONTAINED BREATHING APPARATUS.  
ANY CHEMICAL CARTRIDGE RESPIRATOR WITH CARTRIDGE(S) PROVIDING PROTECTION AGAINST HYDROCHLORIC ACID.  
ANY POWERED AIR-PURIFYING RESPIRATOR WITH CARTRIDGE(S) PROVIDING PROTECTION AGAINST HYDROCHLORIC ACID.
- 100 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.  
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.  
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
- ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER.  
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.
- FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:  
SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.  
SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

**CLOTHING:**  
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE IMPERVIOUS CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

**GLOVES:**  
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

**EYE PROTECTION:**  
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

**EMERGENCY WASH FACILITIES:**  
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.  
CREATION DATE: 04/30/85 REVISION DATE: 09/06/89

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## MATERIAL SAFETY DATA SHEET

#159

SULFURIC ACID SOLUTIONS, 5% -93%

SULFURIC ACID SOLUTIONS, 0.02N - 12N

Cat# LC25570, LC25580, LC25590, LC25800, LC25620, LC25640, LC25650, LC25680, LC25670, LC25680  
LC25700, LC25720, LC25730, LC25740, LC25770, LC25790, LC25800, LC25830, LC25840, LC25850, LC25870,  
LC25880 page 1 of 3

**SECTION I**

LabChem Inc  
 200 William Pitt Way  
 Pittsburgh, PA 15238

revised: 7/2/96  
 contact: Al Baranek  
 phone: (412) 826-5290

**SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION**

NAME: SULFURIC ACID SOLUTIONS 5-93%, SULFURIC ACID SOLUTIONS 0.02N - 12N

FAMILY: inorganic acid

COMPONENTS:	CAS:	FORMULA/WT.
(1) sulfuric acid, 0.05-80%	7664-93-9	H <sub>2</sub> SO <sub>4</sub> / 98.07
(2) water, balance	7732-18-5	H <sub>2</sub> O / 18.00

NFPA RATING (0-4): Health-3 Fire-0 Reactivity-2

**SECTION III - PHYSICAL AND CHEMICAL CHARACTERISTICS**

Boiling pt:	Melting pt:	Sp. gravity:	Evaporation rate:	Vapor press:	Vapor density:	pH:
n/a	n/a	1.0 - 1.7	< ether	n/a	n/a	acidic

Appearance/Odor: clear colorless liquid/odorless.

Solubility: water - soluble.

**SECTION IV - FIRE AND EXPLOSION HAZARD DATA**

Flash pt: non-flammable Explosion level-lower(LEL): n/a -upper(UEL): n/a Autoignition: n/a

Extinguishing Media: dry chemical or carbon dioxide. Large fires, use water from a distance.

Firefighting: negligible fire and explosion hazard when exposed to heat or flame. Move containers, cool if possible. Do not use water directly on material. Water spray may be used to knock down corrosive vapors, avoid breathing vapors, keep upwind. May ignite combustible materials on contact. Keep run-off out of sewers and drains. Contact with metals may evolve hydrogen gas.

**SECTION V - REACTIVITY DATA**

Stability: stable at normal room temperatures and pressures.

Condition to Avoid: violent exothermic reactions with water and organic materials. may ignite finely divided combustible materials. incompatibilities-explosive or violent reactions with acetone cyanohydrin, acetone and nitric acid or potassium dichromate, acrylonitrile, alcohols, hydrogen peroxide, allyl chloride, bromates and metals, bromine pentafluoride, carbides, all chlorates, chlorine trifluoride, cuprous nitride, ethylene cyanohydrin, fulminates, indane and nitric acid, iron, mercuric nitride, nitric acid and glycerides, p-nitrotoluene, pentasilver trihydroxydiaminophosphate, perchlorates, phosphorus isocyanate picrates, silver permanganate, sodium, sodium carbonate, toluene and nitric acid. Dangerous temperatures and pressures occur with other substances, especially organic combinations. Explosive hydrogen gas is evolved from contact with steel, other metals.

Hazardous Decomposition/Byproducts: thermal decomposition byproducts include highly toxic fumes of sulfur oxides. Explosive hydrogen gas may be generated in some reactions.

## MATERIAL SAFETY DATA SHEET #115

## NITRIC ACID SOLUTIONS

Cat # LC17750, LC17770, LC17800, LC17840, LC17850, LC17870

page 1 of 3

SECTION I

LabChem Inc  
200 William Pitt Way  
Pittsburgh, PA 15238

revised: 12/7/98  
contact: Al Beranek  
phone: (412) 826-5230

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

NAME: NITRIC ACID SOLUTIONS, 0.4% - 50% v/v, 0.1N-6.0N

COMPONENTS:	CAS:	FORMULA/F.WT.
(1) nitric acid, 0.04% - 50% v/v	7697-37-2	HNO <sub>3</sub> /63.02
(2) water, balance	7732-18-5	H <sub>2</sub> O/18.00

NFPA RATING (0-4): (for nitric acid &lt;40% w/w) Health-3 Fire-0 Reactivity-0

SECTION III - PHYSICAL AND CHEMICAL CHARACTERISTICS

Boiling pt:	Melting pt:	Sp. gravity:	Evaporation rate:	Vapor press:	Vapor density:
212F to 181F	32F to -44F	1.0 to 1.5	>1 (ether=1)	14mmHg(25C)-62mmHg(25C)	0.7-2.2
pH: acidic					

Appearance/Odor: clear, colorless liquid/acrid odor at higher concentrations/odor threshold: <5ppm (not an adequate warning property).

Solubility: soluble in water

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash pt: non-flammable Explosion level-lower(LEL): n/a -upper(UEL): n/a Autoignition: n/a

Extinguishing Media: dry chemical, carbon dioxide, water spray or foam.

Firefighting: negligible fire/explosion hazard for solutions below 5%. At higher concentration; increased flammability of combustibles, readily oxidizable materials. Severe explosion hazard by reaction with incompatibles (metallic powders, carbides, hydrogen sulfide, turpentine). In or near fire material emits toxic and reactive nitrogen oxides of gases. Avoid breathing toxic and corrosive vapors. Move container if possible, cool with water.

SECTION V - REACTIVITY DATA

Stability: stable under normal temperature and pressure up to boiling point. Avoid acid vapors. Nitric oxides quietly evolved - sunlight catalyses oxide formation (yellow color, aging)

Condition to Avoid: incompatibilities - easily oxidized substances. Violent or explosive reaction can occur with acetonitrile, acetone, acetic acid, acetic anhydride, other anhydrides, acrylonitriles, alcohols, arsine, various metals (easily powdered, alloys), perchlorates, carbides, phosphides, dioxides, thiocyanates, other organic/inorganic acids, fluorines, chlorines, ketones and many other organic or cyclic compounds, halides, aldehydes, etc.

Hazardous Decomposition/Byproducts: nitric acid vapors and nitric oxides are quietly evolved - this reaction is catalyzed by sunlight.

Hazardous Polymerization: not known to occur.

**APPENDIX E**

**Summary of Chemical Hazards – Table 1 and Table 2**

TABLE 1  
EXPOSURE LIMITS AND SELECTED PHYSICAL CHARACTERISTICS AST

COMPOUND	EXPOSURE VALUE <sup>a</sup> PEL/TLV	IDLH <sup>b</sup> LEVEL	LEL <sup>c</sup>	UEL <sup>d</sup>	Ipe	vpf	CARCINOGEN
Gasoline	300 ppm (TWA)-PEL/TLV 500 ppm (STEL)-PEL/TLV		1.4%	7.6%			IARC-2B NIOSH-X
Benzene	1 ppm (TWA) PEL 5 ppm (STEL)-PEL	3000 ppm	1.3%	7.9%	9.24 eV	75 mm	EPA-A IARC-1 NIOSH-X NTP-1 OSHA-X TLV-A2
Ethyl benzene	100 ppm (TWA)-PEL/TLV 125 ppm (STEL)-PEL/TLV	2000 ppm	1.0%	6.7%	8.76 eV	(79°F) 10 mm	EPA-D
Xylenes (o-, m-, p-isomers)	100 ppm (TWA)-PEL/TLV 150 ppm (STEL)-PEL/TLV	1000 ppm	1.1/1.0/1.0%	7.07/0.70%	8.56/8.56/8.44 eV	7/9/9 mm	EPA-D IARC-3
Naphtha	100 ppm-PEL	10,000 ppm	---	---		<5 mm	---
Toluene	50 ppm (TWA)-TLV 150 ppm (STEL)-PEL	2000 ppm	1.2%	7.1%	8.82 eV	(65°F) 20 mm	EPA-D IARC-3
Hexane (n-Hexane)	50 ppm (TWA)-PEL/TLV	5000 ppm	1.1%	7.5%	10.18 eV	(77°F) 150 mm	IARC-3
Tetraethyl lead	0.075 mg/m <sup>3</sup> (TWA)-PEL	40 mg/m <sup>3</sup>	1.8%		11.10 eV	0.2 mm	IARC-3
Tetramethyl lead	0.075 mg/m <sup>3</sup> (TWA)-PEL	40 mg/m <sup>3</sup>			8.50 eV	23 mm	IARC-3
Ethylene dibromide	20 ppm (TWA)-PEL 30 ppm (Ceiling)-PEL 50* ppm (STEL)-PEL *5 min peak per 8-hr shift	400 ppm			9.45 eV	12 mm	EPA-B2 IARC-2A NIOSH-X NTP-2 TLV-A2
Ethylene dichloride	1 ppm (TWA)-PEL 2 ppm (STEL)-PEL	1000 ppm	6.2%	16%	11.05 eV	64 mm	EPA-B2 IARC-2B NIOSH-X NTP-2
TCE	100 ppm (TWA)-PEL	1000 ppm (Ca)	8%	10.5%	9.45 eV	58 mm	EPA-B1
DCE	200 ppm (TWA)-PEL	1000 ppm	5.6%	12.8%	9.65 eV	265 mm	
DCA	100 ppm (TWA)-PEL	3000 ppm	5.4%	11.4%	11.06 eV	182 mm	
Vinyl Chloride	1 ppm (TWA)-PEL	Ca	3.6%	33%	9.99 eV	2508 mm	EPA-A

footnotes on following page:

Ceiling - The concentration that shall not be exceeded during any part of the working exposure  
 EPA - U.S. Environmental Protection Agency  
 IARC - International Agency for Research on Cancer  
 NTP - National Toxicology Program  
 STEL - Short-Term Exposure Limit. Usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA, or PEL-TWA  
 TWA - Time-weighted average exposure concentration for a normal 8-hour (TLV, PEL) workday and a 40-hour workweek

- (a) Permissible Exposure Limit (OSHA) or Threshold Limit Value (ACGIH).  
 More Conservative Value Utilized.
- (b) Immediately Dangerous to Life and Health
- (c) Lower Explosive Limit
- (d) Upper Explosive Limit
- (e) Ionization Potential
- (f) Vapor Pressure

Carcinogen Designations:

EPA-A: Human Carcinogen: sufficient evidence from epidemiological studies to support a causal association between exposure and cancer  
 -B: Probable Human Carcinogen weight of evidence of human carcinogenicity based on epidemiological studies is limited. agents for which weight of evidence of carcinogenicity based on animal studies is sufficient.  
 -B2: Sufficient evidence from animal studies; inadequate evidence or no data from epidemiological studies  
 -D: Not Classifiable as to Human Carcinogenicity: inadequate human and animal evidence of carcinogenicity or no data are available.  
 IARC-1: Carcinogenic to Humans. sufficient evidence of carcinogenicity  
 -2A: Probably Carcinogenic to Humans limited human evidence. sufficient evidence in experimental animals  
 -2B: Possibly Carcinogenic to Humans limited evidence in humans in the absence of sufficient evidence in experimental animals  
 -3: Not Classifiable as to Carcinogenicity to Humans  
 NIOSH-X Carcinogen defined with no further categorization  
 NTP-1: Known to be carcinogenic: sufficient evidence from human studies  
 -2: Reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals  
 OSHA-X: Carcinogen defined with no further categorization  
 TLV-A2: Suspected Human Carcinogen: Agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) considered relevant to worker exposure. Available epidemiological studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans

TABLE 2  
 ROUTES OF ENTRY, SYMPTOMS OF EXPOSURE, FIRST AID TREATMENT, AND TARGET ORGANS

COMPOUND	ROUTES OF ENTRY	SYMPTOMS OF EXPOSURE	GENERAL FIRST AID TREATMENT	TARGET ORGANS
Benzene	Inhalation, ingestion, skin absorption, skin and/or eye contact	Irritation of eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow depressant	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	blood, central nervous system, skin, eyes, bone marrow respiratory system
Ethylbenzene	Inhalation, ingestion skin and/or eye contact	Irritation of eyes, mucous membrane, headache, dermatitis, narcosis, coma	eye: irrigate immediately skin: water flush promptly breath: respiratory support swallow: medical attention immediately	eyes, upper respiratory system, skin, central nervous system
Hexane (n-Hexane)	Inhalation, ingestion skin and/or eye contact	Light-headedness, nausea, headache, numbness of extremities, muscle weakness, irritation of eyes, nose, dermatitis, chemical pneumonia, giddiness	eye: irrigate immediately skin: soap wash immediately breath: respiratory support swallow: medical attention immediately	eyes, skin, respiratory system
Tetraethyl lead	Inhalation, skin absorption, ingestion, skin and/or eye contact	Insomnia, lassitude, anxiety, tremor, hyper-reflexia, spastic, bradycardia, hypotension, hypothermia, pallor, nausea, anorexia, low-weight, disorientation, hallucinations, psychosis, mania, coma, convulsions, eye irritation	eye: irrigate immediately skin: soap wash immediately breath: respiratory support swallow: medical attention immediately	central nervous system cardiovascular system, kidneys, eyes
Tetramethyl lead	Inhalation, skin absorption, ingestion, skin and/or eye contact	Insomnia, bad dreams, restless, anxious, hypotension, nausea, anorexia, delirium, mania, convulsions, coma	eye: irrigate immediately skin: soap wash immediately breath: respiratory support swallow: medical attention immediately	central nervous system cardiovascular system, kidneys, eyes
Ethylene dibromide	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of respiratory system, eyes, dermatitis with vesiculation	eye: irrigate immediately skin: soap wash immediately breath: respiratory support swallow: medical attention immediately	respiratory system, liver, kidneys, skin, eyes

Ethylene dichloride	Inhalation, skin absorption, ingestion, skin and/or eye contact	Central nervous system, depression, nausea, vomiting, dermatitis, irritation of eyes, corneal opacity	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	kidneys, liver, eyes, skin, central nervous system
Xylenes (o-, m-, p- isomers)	Inhalation, ingestion, skin absorption, skin and/or eye contact	Dizziness, excitement, drowsiness, incoherence, staggering gait, irritation of eyes, nose throat, corneal vacuolization, nausea, vomiting, abdominal pain, dermatitis	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	central nervous system, eyes, gastrointestinal tract, blood, liver, kidneys, skin
TCE	Inhalation, ingestion, skin absorption, skin and/or eye contact	Dizziness, drowsiness, visual disturbance, tremors, eye and skin irritation, nausea, vomiting, liver injury, dermatitis	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	central nervous system, eyes, heart, liver, kidney
DCE	Inhalation, ingestion, skin absorption, skin and/or eye contact	Central nervous system depression, incoherence, staggering gait, irritation, irritation of eyes	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	central nervous system, eyes
DCA	Inhalation, ingestion, skin absorption, skin and/or eye contact	Dizziness, excitement, liver, kidney and lung damage, irritation of eyes and skin	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	central nervous system, eyes, liver, kidney, lung, skin
Vinyl Chloride	Inhalation,	Abdominal pain, gastrointestinal distress, enlarged liver, nausea, vomiting	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	central nervous system, gastrointestinal tract, liver lymphatic system

TABLE 2 - Continued

COMPOUND	ROUTES OF ENTRY	SYMPTOMS OF EXPOSURE	GENERAL FIRST AID TREATMENT	TARGET ORGANS
Toluene	Inhalation, ingestion skin absorption, skin and/or eye contact	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis	eye: irrigate immediately skin: soap wash promptly breath: respiratory support swallow: medical attention immediately	central nervous system, liver, kidneys, skin
<u>General First Aid Treatment</u>				
EYE	If this chemical contacts the eyes and upper lids. Get medical attention immediately.	Immediately wash the eyes with large amounts of water, occasionally lifting the lower eyelids. Contact lenses should not be worn when working with this chemical.		
SKIN	If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water and get medical attention promptly.			
SKIN	If this chemical contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates through the clothing, promptly remove the clothing and wash the skin with soap and water. Get medical attention promptly.			
SKIN	If this chemical contacts the skin, flush the contaminated skin with water promptly. If this chemical penetrates the clothing, immediately remove the clothing and flush the skin with water promptly. Get medical attention.			
BREATH	If a person breathes large amount of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform mouth to mouth resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.			
SWALLOW	If this chemical has been swallowed, get medical attention immediately.			

**APPENDIX F**

**Activity Hazard Analysis Heat Stress Monitoring**

## HEAT STRESS MONITORING AND CONTROL

### SIGNS, SYMPTOMS AND FIRST AID

Heat rash (prickly heat) may result from continuous exposure to heat or humid air. It appears as red papules (elevated skin lesion), usually in areas where the clothing is restrictive, and gives rise to a prickly sensation, particularly as sweating increases. It occurs in skin that is persistently wetted by unevaporated sweat. The papules may become infected unless treated.

*First Aid for Heat Rash* - to prevent heat rash: shower after work, dry off thoroughly, and put on clean, dry underwear and clothes. Try to stay in a cool place after work. If, in spite of this, you develop heat rash, see your physician.

Heat Cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

- muscle spasms
- pain in the hands, feet and abdomen

*First Aid for Heat Cramps* - leave the work area, and rest in a cool, shaded place. Drink one or two glasses of electrolyte replacement drink, and try to gently massage the cramped muscle. Once the spasms disappear, you may return to work; taking adequate breaks and drinking electrolyte replacement drink should prevent the cramps from returning.

Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- pale, cool, moist skin
- heavy sweating
- dizziness
- nausea
- fainting

The key here is that the victim is still sweating, so the cooling system is still working; it's just under severe stress. The body core temperature should still be near normal. It is important to recognize and treat these symptoms as soon as possible, as the transition from heat exhaustion to the very hazardous heat stroke can be quite rapid.

*First Aid for Heat Exhaustion* - leave the work area immediately, go through decon and remove all chemical protective clothing. Rest in a cool, shaded place and open your clothing to allow air circulation; lay flat except when taking fluids. Drink plenty of cooled electrolyte replacement drinks. Your work is over for the day; do not attempt to return. Medical assistance should be summoned.

### DETERMINATION OF THE INITIAL WORK/REST CYCLES

Measure the air temperature with a standard thermometer with the bulb shielded from radiant heat; this yields T (actual). Estimate the fraction of sunshine by judging what percent time the sun is not shielded by clouds that are thick enough to produce a shadow. 100 percent sunshine - no cloud cover = 1.0, 50 percent sunshine - 50 percent cloud cover = 0.5; 0 percent sunshine - full cloud cover = 0.0.

Plug these variables into the following equation to determine the adjusted temperature:

$$T \text{ (adjusted)} = T \text{ (actual)} + (13 \times \text{fraction sunshine})$$

Use the chart below to determine the length of the first work shift. At the first break, initiate the heart rate monitoring as described in the next section.

#### INITIAL WORK/MONITORING CYCLES

ADJUSTED TEMPERATURE	NORMAL WORK CLOTHES	PROTECTIVE CLOTHING
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

### TEMPERATURE

Monitor oral body temperature to determine if employees are adequately dissipating heat buildup. Ear probe thermometers which are adjusted to oral temperature are convenient and the preferred method of measurement. EPA/OSHA guidelines are as follows:

1. Use a clinical thermometer (3 minutes under the tongue) to measure oral temperature at the end of the work period before drinking.
2. If temperature exceeds 99.6° F., shorten the following work period by 1/3 without changing the rest period.
3. If temperature still exceeds 99.6° F., shorten the following work period by 1/3.
4. Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6°F.

**APPENDIX G**

**Visitors Log**



**APPENDIX H**

**Documentation of On-Site Hazardous, Toxic, and Radioactive Waste Field  
Experience**

# Certificate of Completion

In Recognition of Work Performed  
and the Satisfactory Demonstration  
of a Basic Knowledge of  
Field Investigation Techniques to Satisfy  
OSHA Rules, 29 CFR Part 1910.120  
This Certificate is Awarded to

(40 hour Training for Hazardous Waste Field Investigation)

**L. KRISTOPHER MOORE**

Presented by  
**Dames & Moore**

  
Course Instructor

September 24 28, 1990  
Date

# *Certificate of Completion*

*This certifies that*

*L. Kristopher Moore*

has completed an 8-hour HAZWOPER Refresher Training Course in  
accordance with 29 CFR 1910.120

Presented by:

Dames & Moore

  
William M. Berlett, Jr., IHIT  
Central Division Health & Safety Manager



**DAMES & MOORE**  
A DAMES & MOORE GROUP COMPANY

Overland Park, Kansas  
August 5, 1998

RECORD OF FIELD EXPERIENCE

Dames & Moore Health & Safety Procedure HS 110 requires Class 1 personnel to obtain three (3) days of supervised field experience prior to performing independent hazardous waste field operations (per 29 CFR 1910.120(e)). This form is for the documentation of such experience. Forward the completed form to the Health and Safety Manager for review and acceptance. See HS 110 for additional information.

Trainees's Name L Christopher Moore, Office 149  
Off-Site Training provider DCVH & JW Darling Date 11/15/90

\*\*\*\*\*

Day One

Project BALTIMORE ENNIS LAND CO., INC (UST INVESTIGATION) Date 10-2-90  
Trainee's Activities LEVEL D, SOIL BORINGS, SOIL SAMPLING  
CHAIN OF CUSTODY, BORING LOGS, FIELD SCREENING SAMPLES w/HNW,

Level of Protection Used (circle) A B C (D)

Supervisor's Name JEFF DARLING

\*\*\*\*\*

Day Two

Project BELC (UST INVESTIGATION) Date 10-3-90  
Trainee's Activities MONITOR WELL INSTALLATION, SOIL BORINGS,  
SOIL SAMPLING, DECON PROCEDURES

Level of Protection Used (circle) A B C (D)

Supervisor's Name JEFF DARLING

\*\*\*\*\*

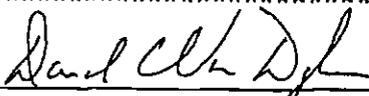
Day Three

Project BELC (UST INVEST.) Date 10-4-90  
Trainee's Activities MONITOR WELL INSTALLATION, SOIL BORINGS,  
BORING LOG WORK, CHAIN OF CUSTODY, DECON PROCEDURES, HNW FIELD  
SCREENING SAMPLES

Level of Protection Used (circle) A B C (D)

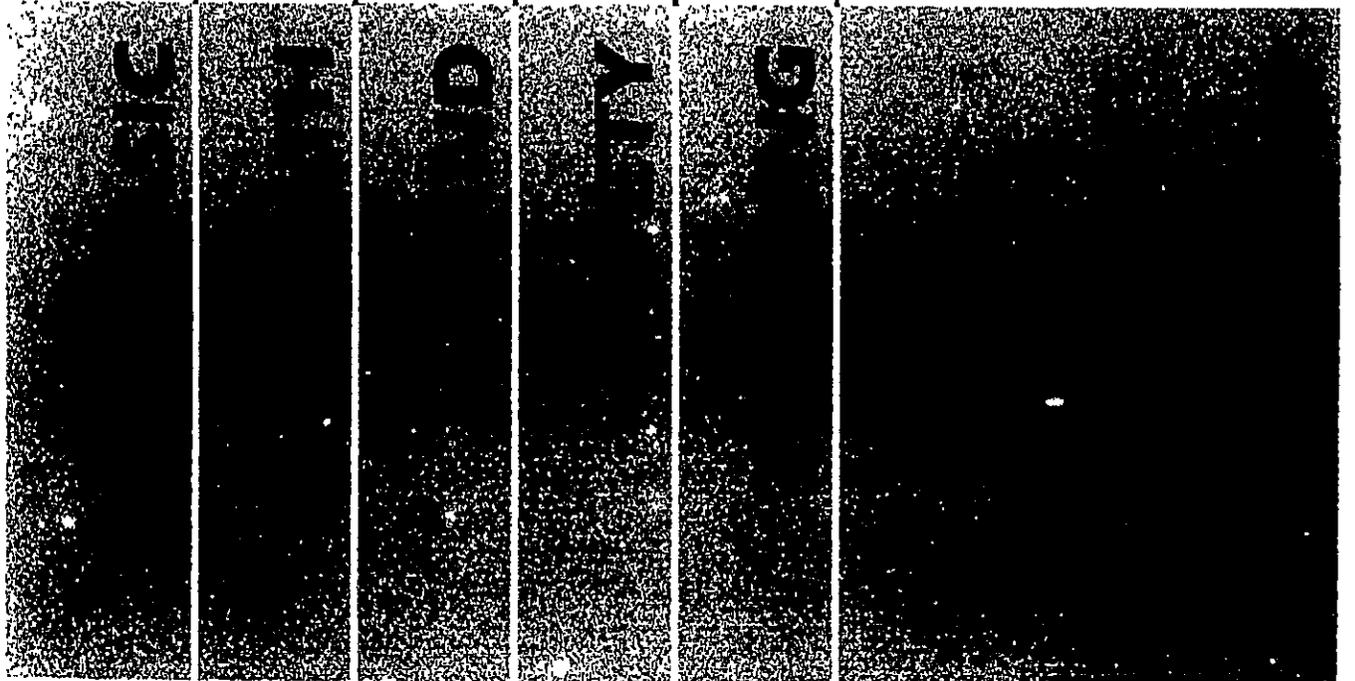
Supervisor's Name JEFF DARLING

\*\*\*\*\*

Field Experience Completed   
Health and Safety Manager

Approved for Level C Protection.

BEST AVAILABLE  
COPY



This certifies that

**Theresa P. Hecht**

has successfully completed

Forty hours training fulfilling initial  
training requirements for hazardous  
waste workers under OSHA 1910.120

Phillip L. Jones, C.I.A.  
Woodward-Clyde Consultants

Course Date: November 13-16, 1990  
Course Location: Denver, CO  
Serial Number: 226-86-0149

# Certificate of Completion



This Certifies That

Theresa P. Hechl

has completed the 8-hour OSHA HAZWOPER Course  
in accordance with 29 CFR 1910.120.

Presented by:



**DAMES & MOORE**

A DAMES & MOORE GROUP COMPANY

Martha J. Boss

Martha J. Boss, CIH, CSP, Training Director

Overland Park, Kansas  
February 1998

# The University of Kansas

## Division of Continuing Education

Robert J. Weber

has completed a course in

**Hazardous Waste  
Site Operations**

OSHA 40-Hour

Number KU35070--2

Soc. Sec.# 510-84-5164

December 7-11, 1992

*David L. Menden*

# Certificate of Completion



This Certifies That

*Robert J. Weber*

has completed the 8-hour OSHA HAZWOPER Course  
in accordance with 29 CFR 1910.120.

Presented by:



Overland Park, Kansas  
February 1998

*Martha J. Boss*

Martha J. Boss, CIH, CSP, Training Director

RECORD OF FIELD EXPERIENCE

Dames & Moore Health & Safety Procedure HS 110 requires Class 1 personnel to obtain three (3) days of supervised field experience prior to performing independent hazardous waste field operations (per 29 CFR 1910.120(e)). This form is for the documentation of such experience. Forward the completed form to the Health and Safety Manager for review and acceptance. See HS 110 for additional information.

Trainees's Name ROBERT J. WEBER Office 149  
Off-Site Training provider \_\_\_\_\_ Date \_\_\_\_\_

\*\*\*\*\*

Day One

Project OSACE POL USE INVESTIGATION FT RILEY KS Date 12-14-92  
Trainee's Activities CHAIN OF CUSTODY FOR SAMPLES SAMPLE PREP FOR SHIPPING. AIR METERING IN WORKSPACE W/ HNU. HNU CALIBRATION. DEMO PROCEDURES

Level of Protection Used (circle) A B C (D)

Supervisor's Name F. Kuntzke  
\*\*\*\*\*

Day Two

Project OSACE POL USE INVESTIGATION FT RILEY KS Date 12-17-92  
Trainee's Activities SOIL SAMPLING W/ DRILLING RIG FROM 5' CONTINUOUS SAMPLES. HEADSPACE READINGS W/ HNU. SAMPLE LABELING. FIELD NOTE-TAKING. RECORDING SOIL W/ HNU SHEET'S

Level of Protection Used (circle) A B C (D)

Supervisor's Name F. Kuntzke  
\*\*\*\*\*

Day Three

Project OSACE POL USE INVESTIGATION FT RILEY KS Date 12-18-92  
Trainee's Activities SOIL DRILLING RECORDING SAMPLE PACKING HEADSPACE W/ HNU. CHAIN OF CUSTODY. DEMO HEADSPACE JARS.

Level of Protection Used (circle) A B C (D)

Supervisor's Name F. Kuntzke  
\*\*\*\*\*

Field Experience Completed Robert J. Weber

Health and Safety Manager

Approved for Level B Protection.

THIS CERTIFIES THAT

**AARON STEIGERWALT**

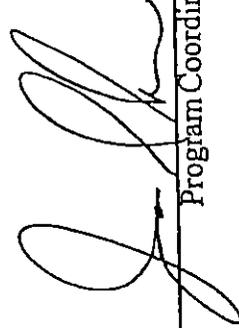
SSN486-94-1354

has successfully completed the course work & examination for

**40 - HOUR HAZARDOUS WASTE OPERATIONS  
& EMERGENCY RESPONSE TRAINING**

**TTC** Training Services  
6700 Corporate Drive, Suite 130  
Kansas City, Missouri 64120  
(816) 231-5580

August 8-12, 1994  
Course Date

  
Program Coordinator

# *Certificate of Completion*

*This certifies that*

*Aaron Steigerwalt*

has completed an 8-hour HAZWOPER Refresher Training Course in accordance with 29 CFR 1910.120

Presented by:

Dames & Moore

  
William M. Berlett, Jr., IHIT  
Central Division Health & Safety Manager



**DAMES & MOORE**  
A DAMES & MOORE GROUP COMPANY

Overland Park, Kansas  
August 5, 1998

Name: THOMAS L. STEIGERWALT Soc. Sec. No. 488-54-13574

Project title: Field Technician Location: Fort Riley, KS

Work activities: Soil Sampling, Groundwater Sampling, MW + SB Installation

Time spent in field: 5 hrs

SUSPECT HAZARDOUS MATERIALS ON SITE: POL CONSTITUENTS  
 Include the following:  
 Physical (noise, vibration, radiation) NOISE  
 Chemical (metals, acids, solvents) N/A  
 Biological materials (viruses, bacteria) N/A

Protective equipment used: NITRILE GLOVES, HAND AWE, SAFETY GLASSES, STEEL TOE BOOTS

\*\*\*\*\*

Project title: Field Technician Location: Fort Riley, KS

Work activities: Soil Sampling, Groundwater Sampling, MW + SB Installation

Time spent in field: 5 hrs

SUSPECT HAZARDOUS MATERIALS ON SITE: POL CONSTITUENTS  
 Include the following:  
 Physical (noise, vibration, radiation) NOISE  
 Chemical (metals, acids, solvents) N/A  
 Biological materials (viruses, bacteria) N/A

Protective equipment used: NITRILE GLOVES, HAND AWE, SAFETY GLASSES, STEEL TOE BOOTS

\*\*\*\*\*

Project title: Field Technician Location: Fort Riley, KS

Work activities: Soil Sampling, Groundwater Sampling, MW + SB Installation

Time spent in field: 8 hrs

SUSPECT HAZARDOUS MATERIALS ON SITE: POL CONSTITUENTS  
 Include the following:  
 Physical (noise, vibration, radiation) NOISE  
 Chemical (metals, acids, solvents) N/A  
 Biological materials (viruses, bacteria) N/A

Protective equipment used: NITRILE GLOVES, HAND AWE, SAFETY GLASSES, STEEL TOE BOOTS

Robert J. Weber  
Staff Geologist  
OSHA SUPERVISOR. SHR

Robert J. Weber 07-94

**APPENDIX I**

**Instrumentation Documentation and Field Activity Documentation**



**APPENDIX J**  
**Emergency Information**

## EMERGENCY RESPONSE/CONTINGENCY PLAN

### *Personnel Roles and Lines of Authority*

- The SSHO has primary responsibility for responding to and correcting emergency situations involving on site personnel. This includes taking appropriate measure to ensure the safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area, and evacuation of adjacent residents.
- The SSHO is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed when the emergency is directly related to activities on-site.

### *Pre-Emergency Planning*

The SSHO must coordinate an emergency response/contingency plan.

Prior to initiating on-site activities, the appropriate local emergency response teams listed in *EMERGENCY CONTACTS & APPROVAL PAGE*, page 2 of this SSHP will be contacted and informed as to the site location, the activities to be conducted, the anticipated hazards, the levels of personal protection equipment required on-site, and any other pertinent information.

In the event of a worker-related injury; the -Safety Manager will be notified. The associated SSHO responsibilities include the following:

- Establishing site evacuation routes and zones.
- Notifying offsite emergency response teams.
- Assessing emergencies.

Safety equipment will be maintained on site. This safety equipment will include:

- For rescue purposes, two- (2) positive pressure SCBA. These will be dedicated and marked "For Emergency Only". The SCBA will be maintained in the CRZ.
- Emergency eyewashes and showers in compliance with ANSI Z358.1
- Fire Extinguishers with a minimum rating of 20-A: 120-B: C will be maintained on the site and in all vehicles that enter the EZ.

Emergency phone numbers and area maps to nearest medical facilities will be laminated and posted on-site.

### *Lines of Authority in an Emergency*

In the event of an emergency:

- The Contractor SSHO will be in charge, or;
- When an offsite emergency response team is on-site, this team will be lead by an Incident Commander or officer in charge. The -Safety Manager will act as a liaison to Incident Commander or the officer in charge.

***Site Security and Control***

In cases where an emergency situation does not pose a threat to the public and offsite emergency response teams will not be dispatched to the site, the SSHO will be responsible for coordinating the appropriate emergency response and communicating with the public as necessary.

However, if an emergency arises that presents an immediate threat to the public or otherwise requires additional support, the SSHO may activate the emergency response system in the manner prescribed by the offsite emergency response organization.

In an emergency situation when the police, fire department, or other local emergency response team has been dispatched to the site, the local authorities will mandate site security and control.

***Emergency/Accident Recognition and Prevention***

All personnel will bring to the attention of the SSHO any unsafe condition, practice, or circumstance associated with or resulting from the on-site activities.

In cases of **immediate hazard** to employees or the public:-

- ~~Any employee on the scene will take all practicable steps to eliminate or neutralize the hazard; this may include leaving the site.~~
- Follow-up consultation with the Safety Manager must be made at the first opportunity.
- In such circumstances, the SSHO will take the necessary steps to ensure that the investigation can be completed safely. Such steps will include: notification changes in procedures, removal or neutralization of a hazard, consultation with appropriate experts, or the use of a specialist.

In cases where the hazard is **not an immediate danger** to the employees, the SSHO will be consulted regarding appropriate corrective measures.

**If a hazard poses an immediate threat to the public**, the SSHO will be responsible for activating the emergency response system in the manner prescribed by the local fire and police departments.

In the event that any member of the team experiences any **extreme adverse effects or symptoms of chemical exposure** while on-site; the entire team will immediately leave the site and seek appropriate medical aid.

In the event that any member of the work force is **overcome, incapacitated, or traumatically injured** while on-site:

- The remaining members will immediately call for assistance and make reasonable efforts to rescue the affected person.
- At least one person will remain outside the problem area until help arrives.
- ~~• Once removed from the problem area the affected person will not be left unattended.~~
- If possible, limited personnel decontamination will be conducted, but only if time is not critical to getting the injured person to medical aid.
- Note: In cases where personnel contamination has occurred, those persons involved will make every reasonable effort to **decontaminate themselves**, so minimal spreading of contaminants occur.
- Medical aid will be acquired either via ambulance or SSHO directed transfer of personnel to the medical facility using site vehicles.

- The SSHO will determine the fitness of the driver.
- If the driver's fitness is questioned, medical assistance must be contacted by phone.

### ***Incident/Accident Report***

An Incident/Accident Report will be completed by the SSHO following any accident involving on-site personnel as defined by EM 385-1-1. A copy of the report will be attached to this SSHP or filed and referenced from this SSHP. A copy of the report will be submitted to the Safety Manager within 24 hours.

### ***Safety Distances and Places of Refuge***

The SSHO will establish safe evacuation distances prior to initiation of field activities.

- An emergency evacuation assembly point will be designated daily by the SSHO based on the current wind direction.
- The emergency evacuation assembly point will be located upwind and will be updated as needed.
- The location of the evacuation points will be recorded in the **Safety & Health Log**.

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### ***Evacuation Routes and Procedures***

All evacuation routes will be designated to move personnel away from an affected area in a safe and efficient manner and to establish efficient traffic patterns for fire and emergency equipment during an emergency response.

- These evacuation routes will be located at a safe distance upwind of all areas of activities.
- The SSHO will be responsible for personnel accounting at each emergency evacuation assembly point.

### ***Emergency Decontamination***

In addition to routine decontamination procedures, emergency decontamination procedures must be established. In an emergency, the primary concern is to prevent the loss of life or severe injury to site personnel.

- If immediate medical treatment is required to save a life; limited decontamination will be performed or the person will be wrapped in a blanket.
- Any person, who is not fully decontaminated and requires transportation to a medical facility, will be wrapped in a blanket to protect the emergency vehicle. As an alternative, the seats of the emergency vehicle will be covered with polyethylene or a blanket.
- If a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life, decontamination will be performed immediately.
- The SSHO will designate personnel who are not directly involved in the emergency to properly dispose of contaminated clothing and equipment.

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### ***Emergency Medical Treatment and First Aid***

At least two team members will have successfully completed a Red Cross sponsored course in adult first aid and cardiopulmonary resuscitation.

Prior to the start of work, the SSHO will make arrangements for medical facilities, ambulance service, and medical personnel to be available for prompt attention to the injured.

On-site activities will require a first aid kit located within the support zone.

Emergency telephone numbers and reporting instructions for ambulance, hospital, poison control center, fire department, and police will be conspicuously posted or available.

If the SSHO determines that a situation exists that could threaten human health or the environment outside the site area, he/she will immediately notify the local fire department, Safety Manager, and the National Response Center. The telephone report will include:

- Name and telephone number or reporter
- Name and address of facility
- Time and type of incident (e.g., release, fire)
- Name and quantity of material(s) involved, to the extent known, and the location of the discharge within the facility
- The extent of injuries, if any
- The possible hazards to human health, or the environment, outside of the site area
- Actions the person reporting the discharge proposed to take to contain, clean up, and remove the substance

#### ***Exclusion Zone Personnel Decontamination.***

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible.

- If the injury or illness is minor, full decontamination must be completed prior to transport.
- ~~If the patient's condition is serious, at least partial decontamination must be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.)~~

All injuries and illnesses must immediately be reported to the project manager.

Any person being transported to a clinic or hospital for treatment must take with them information on the chemical(s) at the site.

Any vehicle used to transport contaminated personnel will be treated and cleaned as necessary.

#### ***Emergency Response Procedure***

~~All site personnel will be responsible for responding to incipient fires and other minor emergencies.~~

The SSHO will have ready access to all fire fighting equipment and first-aid supplies during site operations.

In the event of fire, spill, or other emergencies that cannot be controlled, all site personnel will evacuate to a predesignated location. Site personnel will wait in the designated zone for further instructions from the SSHO or emergency response personnel.

During an emergency, the SSHO will direct all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste at the site. These measures will include, where applicable, collecting and containing release material and ~~removing or isolating containers.~~

***Critique of Response and Follow-up***

A follow-up meeting will be held after any emergency situation to assess the actions taken. The Safety Manager, the SSHO, and other individuals as appropriate will attend the meeting.

- A record of the meeting will be kept by the SSHO.
- Recommendations from the meeting will be incorporated into the future responses to emergency situations.

The SSHO will ensure that all emergency equipment listed in this contingency plan is cleaned and fit for use before operations are resumed.

***Emergency Response Briefings and Review***

- During the site briefings, all employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes.
- The plan will be reviewed and revised if necessary, on a regular basis by the SSHO. This will ensure that the plan is adequate and consistent with prevailing site conditions.

***Evacuation Alarm Procedures***

In the event of an emergency which necessitates an evacuation of the site; the following alarm procedures may be implemented:

- Verbal notification of other employees.
- Personnel will be expected to proceed to the Support Zone with their buddy.
- Personnel will remain at the SZ until the SSHO provides further instructions.

***Fire or Explosion***

The SSHO will advise the fire commander of the location, nature, and identification of the hazardous materials onsite.

***Spill or Leaks***

In the event of a spill or a leak caused by activities on-site; site personnel will:

- Inform the SSHO immediately;
- Locate the source of the spillage and stop the flow if this can be done safely; and,
- Begin containment and recovery of the spilled materials.

**APPENDIX K**

**Excavation/Trenching Safety**

## EXCAVATIONS

Excavation safety requirements are quite similar to trenching requirements. For excavations in which employees may be exposed to unstable ground, qualified personnel using practices that are compatible with standards required by a registered architect, a registered professional engineer or other duly licensed or recognized authority will design support systems such as piling, cribbing, bracing and shoring that meet accepted engineering requirements to contain the walls. Excavations with conditions such as water, silty materials, loose boulders, erosion, deep frost action or earth fracture planes require that the slope of the earth adjacent to the excavation be lessened. Scaling, benching, barricading, rock bolting, wire meshing or other equally effective means of excavation support must meet accepted engineering requirements for all sides, slopes and faces of excavations. Materials used to support excavations should be maintained in good condition.

Never excavate below the level of the base of the footing or retaining wall, except in hard rock, unless the wall is underpinned and appropriate precautions are taken to ensure the stability of adjacent walls. If it is necessary to place or operate power shovels, derricks, trucks, materials or other heavy objects on a level above and adjacent to an excavation, the side of the excavation must be sheet-piled, shored, braced or sloped as necessary to resist the additional pressure resulting from such loads. Install substantial stop logs or barricades when using mobile equipment on or near an excavation, grade away from the excavation, and provide walkways or bridges with standard guardrails for employees or equipment to cross over excavations.

## TRENCHES

Exposed trench faces that are more than five feet high must be stabilized by either shoring, sloping the face of the wall back to a stable slope or some equivalent method to prevent cave-ins. If the trench is excavated in hard, compact soil materials more than five feet in depth, the wall must be supported. If the walls of a trench are less than five feet deep and in soft or unstable soil materials, then trench boxes, shoring, sheeting, bracing, sloping or other equivalent methods are required to prevent the trench wall from collapsing. Trench walls above five feet in height may be sloped instead of shored.

Materials used for trench boxes, sheeting, sheet piling, bracing, shoring and underpinning should be in good condition, and should be installed so that they provide support that is effective to the bottom of the trench. Timber must be sound and free from large or loose knots. Vertical planks in the bracing system should be extended to an elevation no less than one foot above the top of the trench face.

When employees are required to be in trenches that are four feet or more in depth, an adequate means of exit, such as a ladder or steps, must be provided and located so that no more than 25 feet of lateral travel is required for a person to reach the exit structure. The trench should be braced and shored during excavation and before personnel are allowed entry. Cross braces and trench jacks should be secured in true horizontal positions and spaced vertically in order to prevent trench wall material from sliding, falling or otherwise moving into the trench. Portable trench boxes (also called sliding trench shields) or safety cages may be used to protect employees instead of shoring or bracing. When in use, these devices must be designed, constructed and maintained in a manner that will provide at least as much protection as shoring or bracing, and extended to a height of no less than six inches above the vertical face of the trench.

During the backfill operation, backfill and remove trench supports together, beginning at the bottom of the trench. Release jacks or braces slowly and, in unstable soil materials, use ropes to pull them from above after employees have left the trench.

**FINAL PAGE**

**ADMINISTRATIVE RECORD**

**FINAL PAGE**