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SAMPLING AND ANALYSIS PLAN FOR SOIL DEBRIS REMOVAL AT WASTE DUMP NAS
FORT WORTH TX
6/1/1993
METCALF AND EDDY



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**NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
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SAMPLING AND ANALYSIS PLAN
FOR
SOIL/DEBRIS REMOVAL AT THE WASTE DUMP

Carswell Air Force Base, Texas 76127-5000

Metcalf & Eddy, Inc.
5600 Northwest Central Drive, Suite 102
Houston, Texas 77092

June 1993

PREPARED FOR

AIR FORCE BASE DISPOSAL AGENCY
DISPOSAL MANAGEMENT TEAM
ENVIRONMENTAL PROGRAMS OFFICE
CARSWELL AIR FORCE BASE, TEXAS 76127-5000

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BASE CLOSURE RESTORATION DIVISION (AFCEE/ESB)
8001 INNER CIRCLE DRIVE, SUITE 2
BROOKS AIR FORCE BASE, TEXAS 78235-5328

197002

SAMPLING AND ANALYSIS PLAN

FOR

SOIL/DEBRIS REMOVAL AT OFFSITE WEAPONS STORAGE AREA WASTE DUMP

Air Force Base Disposal Agency
Carswell Air Force Base, Texas 76127-5000

June 1993

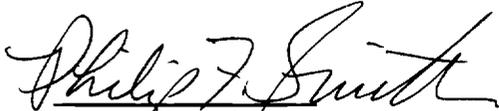
PREPARED BY

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Houston, Texas 77092

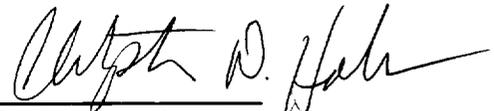
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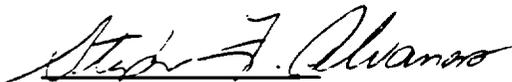
CONTRACTOR CONTRACT NO: 012037-0004



Philip E. Smith
Contractor's
Project Manager



Christopher D. Hobbins
Technical Project
Manager



Stephen F. Alvanas
Contractor's Regional
QA Officer



Frank Grey
Chief Environmental Engineer
(AFBDA/SWH)
Air Force Base Disposal Agency
Carswell AFB, TX 96127-5000

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BASE CLOSURE RESTORATION DIVISION (AFCEE/ESB)
8001 INNER CIRCLE DRIVE, SUITE 2
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**SAMPLING & ANALYSIS PLAN
CARSWELL AIR FORCE BASE**

197003

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ACRONYMS

AFCEE	Air Force Center for Environmental Excellence
AFB	Air Force Base
CQP	Construction Quality Plan
CRM	Count Rate Meter
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
HASP	Health & Safety Plan
M&E	Metcalf & Eddy
MS/MSD	Matrix Spike/Matrix Spike Duplicate
msl	Mean Sea Level
OSW	Office of Solid Waste
PID	Photo Ionization Detector
PQL	Practical Quantitation Limits
QA	Quality Assurance
QC	Quality Control
QPP	Quality Program Plan
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
USAF	United States Air Force
WSA	Weapons Storage Area

SECTION ONE INTRODUCTION

Metcalf & Eddy (M&E) has been tasked by the Air Force Center for Environmental Excellence (AFCEE) under Contract No. F41625-92-0-8002 Delivery Order 0002, to remove debris located at the Waste Dump at the off-base Weapons Storage Area (WSA) located at Carswell Air Force Base (AFB), Texas.

As part of this task a Quality Program Plan (QPP) has been prepared by M&E which provides the detailed guidance and procedures by which work will be conducted at Carswell AFB, Texas. The QPP includes three distinct plans, the Health and Safety Plan (HASP), the Construction Quality Plan (CQP), and the Sampling and Analysis Plan (SAP). The HASP covers topics such as personal protective equipment, decontamination, emergency procedures, and other related health and safety issues. The CQP deals with quality control during the soil/debris removal. The SAP deals with sampling and analysis issues for both the laboratory and the field.

As prime contractor for Carswell AFB Waste Dump debris removal, M&E has the responsibility for setting data quality objectives (DQOs), and the corresponding quality assurance (QA) and quality control (QC) standards by which the sampling and analysis effort shall be conducted, and ensuring that those standards are met by all participants.

The SAP defines the rationale for the selected sampling and analysis methods used for determining the presence of potentially hazardous contaminants, waste characterization, and waste disposal. Section 2 of the SAP outlines the data quality objectives and the corresponding quality assurance standards for laboratory analyses. This document also presents the detailed site-specific laboratory protocols to be followed to ensure quality and integrity of data collection, accuracy and precision of the analyses, representativeness of results, and completeness of information.

The SAP provides a guide to the field activities to be conducted at Carswell AFB, and incorporates field investigation methods with appropriate quality assurance/quality control requirements. The SAP is prepared to ensure that field activities are conducted in accordance with all applicable U.S. Environmental Protection Agency (EPA) and State of Texas regulatory requirements and guidance.

The SAP will be used by field team members to perform sampling and analysis associated with the planned debris removal. One copy of the SAP will be made available to each field team and to the subcontractor laboratory. The collection of environmental samples and other data from the Waste Dump area, and subsequent sample analyses, are necessary for the removal and transportation of the debris and disposal facility acceptance.

1.1 Project Description

The purpose of this project, as described in the Statement of Work (SOW), is to provide for the removal of debris at the Waste Dump in the vicinity of the off-base Weapons Storage Area, Carswell AFB. Contamination includes non-hazardous debris such as wooden pallets, used bomb crates, scrap metal, newspapers, and sawdust type materials.

The scope of work includes sampling of surface soils upgradient and downgradient of the debris pile for potential contaminants and migration of potential contaminants from the debris pile. Soils will be analyzed by a subcontractor laboratory to determine the presence or absence of hazardous constituents. After removal of the debris, underlying soils will be analyzed to confirm the presence or absence of hazardous contaminants in the Waste Dump area.

1.2 Site Description

The Weapons Storage Area (WSA) is an off-base facility that exists under the ownership and control of Carswell AFB. The WSA is located about 4 miles west of Carswell AFB, just north of White Settlement Road. The facility, built in 1956, consists of 247 acres of fee-owned land surrounded by an additional 264 acres of easements.

Facilities at the WSA include two munitions inspection shops, 16 ordnance storage buildings (including 11 igloos), one entry control building, an emergency power plant, an EOD range, a radioactive waste disposal facility, a water storage tank, and two water wells.

Physical Geography and Hydrology

The WSA is located within the Grand Prairie section of the central lowlands physiographic province. Soils in the area generally consist of the Aledo-Bolar-Sanger Association which is defined as gently sloping to moderately steep, very shallow to deep, loamy and clayey soils; on uplands. Soil permeabilities range from less than 4.2×10^{-5} to 9×10^{-4} cm/sec. The WSA is located in an area where the Fredericksburg and Washita Groups outcrop. In some areas, this formation has been eroded away, exposing the underlying Paluxy sand.

The WSA is located between two forks of Live Oak Creek, which flows east, discharging into Lake Worth. All surface runoff discharges to this creek. Elevations in the area range from 720 to 800 feet mean sea level (msl).

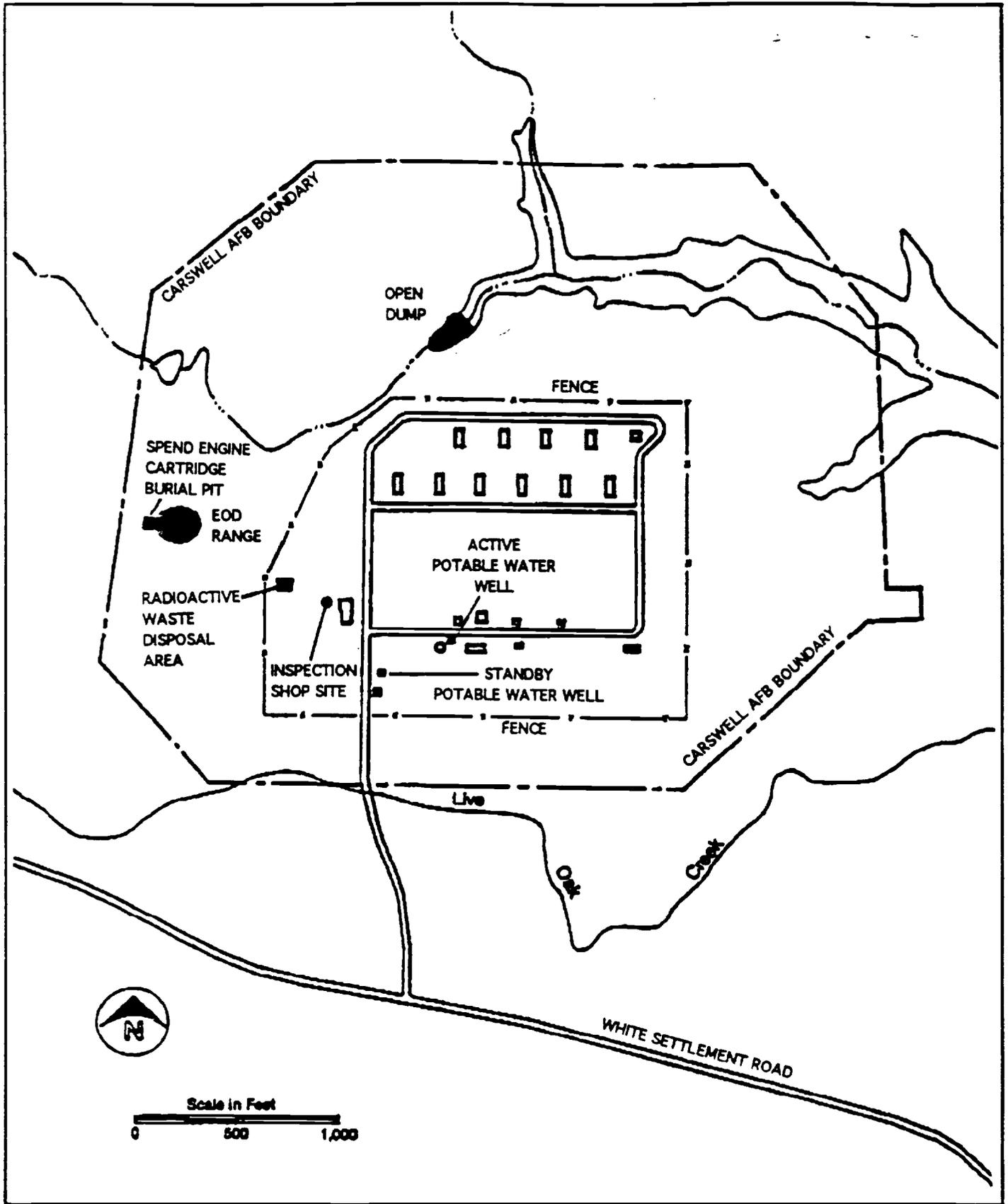
Potable water is supplied by two wells (one is standby), each reported to be 218 feet deep. It is probable that these wells develop water from the Paluxy and Twin Mountains Aquifers.

Ecology

The WSA is located on gently rolling land in the Cross Timbers and Prairies Region of Texas. Most of this land is in unimproved pasture and is heavily grazed by beef cattle. Also, part of the WSA area is in natural, xeric, oak woodlands, especially on hillsides and in ravines. Wildlife populations are similar to those on Carswell AFB, with the addition of some larger mammals such as white-tailed deer and coyotes.

Open Waste Dump

This site is located outside of the fenced area but within the WSA property boundary (Figure 1.1). According to Carswell AFB personnel, the site is occasionally used by WSA personnel for disposal of debris (wood, metal, paper, etc.) and is not used for disposal of hazardous or other liquid wastes. An inspection of the site by the record search team during the base visit seemed to substantiate the above. The site, however, is still of some concern due to two factors: (1) the public has access to the site and has used it on occasion and (2) the site is in a gorge that drains into a tributary to Live Oak Creek which flows into Lake Worth. The site should be closed to prevent its possible use for disposal of hazardous materials. The site was not rated since hazardous materials were not suspected of being present at the site.



**FIGURE 1.1
SITE MAP OF WEAPONS STORAGE AREA
CARSWELL AFB**

**SECTION 2
DATA QUALITY OBJECTIVES**

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Project DQOs must be established to ensure that the measurement and analytical data, obtained both in the field and at the laboratory, can provide the level of information necessary to satisfy the project objectives. DQOs are based on the concept that different data uses may require varying minimum levels of data quality. Data quality is defined as the degree of certainty of a data set with respect to precision, accuracy, reproducibility, comparability, and completeness. DQOs are qualitative and quantitative statements specifying the required quality of data needed to ensure the absence of contamination or document the presence of contamination in the area around the Waste Dump.

2.1 Analytical Support Levels

Analytical levels are distinguished by their grade of technology and documentation. The analytical levels appropriate to this project are described below.

Screening (DQO Level I): This level provides the lowest data quality, but the most rapid results. It is often used for health and safety monitoring at the site, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives. These types of data include those generated on site through the use of an organic vapor analyzer, low level radiation detector, and other real-time monitoring equipment at the site.

Laboratory Analysis (DQO Level III) Level III laboratory analyses are designed to provide identification of compounds, both organic and inorganic, and corresponding qualification in samples of various matrixes. This level of analysis typically provides data to support site characterizations, environmental monitoring, confirmation of field data, engineering studies, and in specific cases, risk assessments. For this project, Level III analysis will be used to confirm the presence or absence of potential contamination and to help assess the extent of environmental contamination.

2.2 Data Quality Characteristics

This project requires that five characteristics of data quality be considered in assessing the data produced during the sampling and analysis activities. These five characteristics (precision, accuracy, completeness, representativeness, and comparability) are defined and discussed in this section.

All analytical data will be evaluated for precision, accuracy, and completeness. The laboratory will compare precision and accuracy results to their internal acceptance criteria

which are recorded and tracked using regularly updated control charts. Numerical control limits for precision and accuracy are presented in Table 2.1.

Precision is a measure of agreement among individual measurements of the same property under similar conditions. It is expressed in terms of Relative Percent Difference (RPD) between replicates or in terms of the standard deviation when three or more replicate analyses are performed.

Precision shall be determined through the use of Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses and control charts. For MS/MSD analysis, the RPD between the two results shall be calculated as a measure of analytical precision. Out of control situations will be evaluated to determine accuracy. Project-specific objectives for precision are listed in Table 2.1.

Accuracy is defined as the degree of agreement of a measurement (or measurement average) with an accepted reference or true value. It is a measure of system bias and is usually expressed as a percentage of the true value.

Accuracy shall be determined in the laboratory through the use of MS/MSD analyses. Sampling accuracy shall be maintained by the implementation and adherence to strict procedural protocols. Trip blanks and equipment blanks shall be collected and analyzed to ensure that samples are representative of site conditions and not contaminated by transportation or sampling methods. Project-specific objectives for accuracy are listed in Table 2.1.

Completeness is a measure of the amount of valid data obtained compared to the amount expected to be collected under normal correct conditions. It is usually expressed as a percentage. The completeness criteria for the project is 90 percent.

Completeness is calculated as the percentage of valid data points obtained compared to the quantities of valid data that were to be collected to achieve particular project requirements. Data points may not be valid if samples exceeded holding times, if quality control sample criteria were not met and reanalysis of samples was not possible, or if sample containers were broken or otherwise destroyed.

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a data population, process condition, sampling point, or an environment. Representativeness is a qualitative parameter of the sampling program. Sample collection procedures are described in detail in Section 4.0, Field Sampling Program. Representativeness is also dependent on proper sample collection techniques that can be evaluated through the analysis of field duplicate samples.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. To achieve comparability in this project, the data generated shall be reported using units of $\mu\text{g/L}$, mg/L and mg/kg . All sampling and analysis procedures used shall be consistent with EPA, State of Texas, and United States Air Force (USAF) protocols. All analytical results collected from different sites within the base will, therefore, be comparable.

TABLE 2-1
SUMMARY OF PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
FOR SOIL ANALYSES

Parameter	Method No. ⁽¹⁾ Reference	Precision ^(a) (as RPD)	Accuracy ^(b) (Recovery)	Completeness
AROMATIC VOLATILE ORGANICS				
Benzene	8020	21%/50%	66-142%	90%
Toluene	8020	21%/50%	59-139%	90%
Chlorobenzene	8020	21%/50%	60-133%	90%
Ethylbenzene	8020	NPM/50%	NPM	90%
m- & p-Xylene	8020	NPM/50%	NPM	90%
o-Xylene	8020	NPM/50%	NPM	90%
HALOGENATED VOLATILE ORGANICS				
Dichlorodifluoromethane	8010	NPM/50%	NPM	90%
Chloromethane	8010	NPM/50%	NPM	90%
Vinyl Chloride	8010	NPM/50%	NPM	90%
Chloroethane	8010	NPM/50%	NPM	90%
Bromomethane	8010	NPM/50%	NPM	90%
Trichlorofluoromethane	8010	NPM/50%	NPM	90%
1,1-Dichloroethene	8010	NPM/50%	NPM	90%
Methylene Chloride	8010	NPM/50%	NPM	90%
t-1,2-Dichloroethane	8010	NPM/50%	NPM	90%
1,1-Dichloroethane	8010	22%/50%	59-172%	90%
Chloroform	8010	NPM/50%	NPM	90%
1,1,1-Trichloroethane	8010	NPM/50%	NPM	90%
Carbon Tetrachloride	8010	NPM/50%	NPM	90%
1,2-Dichloroethane	8010	NPM/50%	NPM	90%
Trichloroethene	8010	24%/50%	62-137%	90%
1,2-Dichloropropane	8010	NPM/50%	NPM	90%
Bromodichloromethane	8010	NPM/50%	NPM	90%
c-1,3-Dichloropropene	8010	NPM/50%	NPM	90%
t-1,3-Dichloropropene	8010	NPM/50%	NPM	90%
t-1,3-Dichloropropene	8010	NPM/50%	NPM	90%
1,1,2-Trichloroethane	8010	NPM/50%	NPM	90%
Tetrachloroethene	8010	NPM/50%	NPM	90%

TABLE 2-1
SUMMARY OF PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
FOR SOIL ANALYSES

Parameter	Method No. ⁽¹⁾ Reference	Precision ^(a) (as RPD)	Accuracy ^(b) (Recovery)	Completeness
Dibromochloromethane	8010	NPM/50 %	NPM	90 %
Chlorobenzene	8010	NPM/50 %	NPM	90 %
Bromoform	8010	NPM/50 %	NPM	90 %
1,1,2,2-Tetrachloroethane	8010	NPM/50 %	NPM	90 %
1,3-Dichlorobenzene	8010	NPM/50 %	NPM	90 %
1,4-Dichlorobenzene	8010	NPM/50 %	NPM	90 %
1,2-Dichlorobenzene	8010	NPM/50 %	NPM	90 %
SEMI-VOLATILES				
Phenol	SW8270	35 %-50 %	26-90 %	90 %
bis(-2-Chloroethyl)Ether	SW8270	NPM/50 %	NPM	90 %
2-Chlorophenol	SW8270	50 %/50 %	25-102 %	90 %
1,3-Dichlorobenzene	SW8270	NPM/50 %	NPM	90 %
1,4-Dichlorobenzene	SW8270	27 %/50 %	28-104 %	90 %
1,2-Dichlorobenzene	SW8270	NPM/50 %	NPM	90 %
2-Methylphenol	SW8270	NPM/50 %	NPM	90 %
bis(2-chloroisopropyl) Ether	SW8270	NPM/50 %	NPM	90 %
4-Methylphenol	SW8270	NPM/50 %	NPM	90 %
N-Nitroso-Di-Propylamine	SW8270	38 %/50 %	41-126 %	90 %
Hexachloroethane	SW8270	NPM/50 %	NPM	90 %
Nitrobenzene	SW8270	NPM/50 %	NPM	90 %
Isophorone	SW8270	NPM/50 %	NPM	90 %
2-Nitrophenol	SW8270	NPM/50 %	NPM	90 %
2,4-Dimethylphenol	SW8270	NPM/50 %	NPM	90 %
bis(2-Chloroethoxy) Methane	SW8270	NPM/50 %	NPM	90 %
2,4-Dichlorophenol	SW8270	NPM/50 %	NPM	90 %
1,2,4-Trichlorobenzene	SW8270	23 %/50 %	38-107 %	90 %
Naphthalene	SW8270	NPM	NPM	90 %
4-Chloroaniline	SW8270	NPM	NPM	90 %
Hexachlorobutadiene	SW8270	NPM	NPM	90 %

**TABLE 2-1
SUMMARY OF PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
FOR SOIL ANALYSES**

Parameter	Method No. ⁽¹⁾ Reference	Precision ^(a) (as RPD)	Accuracy ^(b) (Recovery)	Completeness
4-Chloro-3-Methylphenol	SW8270	33%/50%	26-103%	90%
Hexachlorocyclopentadiene	SW8270	NPM/50%	NPM	90%
2,4,6-Trichlorophenol	SW8270	NPM/50%	NPM	90%
2,4,5-Trichlorophenol	SW8270	NPM/50%	NPM	90%
2-Chloronaphthalene	SW8270	NPM/50%	NPM	90%
2-Nitroaniline	SW8270	NPM/50%	NPM	90%
Dimethyl Phthalate	SW8270	NPM/50%	NPM	90%
Acenaphthylene	SW8270	NPM/50%	NPM	90%
3-Nitroaniline	SW8270	NPM/50%	NPM	90%
Acenaphthene	SW8270	19%/50%	31-137%	90%
2,4-Dinitrophenol	SW8270	NPM/50%	NPM	90%
4-Nitrophenol	SW8270	50%/50%	11-114%	90%
Dibenzofuran	SW8270	NPM/50%	NPM	90%
2,4-Dinitrotoluene	SW8270	47%/50%	28-89%	90%
2,6-Dinitrotoluene	SW8270	NPM/50%	NPM	90%
Diethylphthalate	SW8270	NPM/50%	NPM	90%
4-Chlorophenyl-phenylether	SW8270	NPM/50%	NPM	90%
Fluorene	SW8270	NPM/50%	NPM	90%
4,6-Dinitro-2-Methylphenol	SW8270	NPM/50%	NPM	90%
N-Nitrosodiphenylamine	SW8270	NPM/50%	NPM	90%
4-Bromophenylphenyl ether	SW8270	NPM/50%	NPM	90%
Hexachlorobenzene	SW8270	NPM/50%	NPM	90%
Pentachlorophenol	SW8270	47%/50%	17-109%	90%
Phenanthrene	SW8270	NPM/50%	NPM	90%
Anthracene	SW8270	NPM/50%	NPM	90%
Di-N-Butylphthalate	SW8270	NPM/50%	NPM	90%
Fluoranthene	SW8270	NPM/50%	NPM	90%
Pyrene	SW8270	36%/50%	35-142%	90%
Butylbenzylphthalate	SW8270	NPM/50%	NPM	90%
3,3'-Dichlorobenzidine	SW8270	NPM/50%	NPM	90%

**TABLE 2-1
SUMMARY OF PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
FOR SOIL ANALYSES**

Parameter	Method No. ⁽¹⁾ Reference	Precision ^(a) (as RPD)	Accuracy ^(b) (Recovery)	Completeness
Benzo(a)Anthracene	SW8270	NPM/50%	NPM	90%
bis(2-Ethylhexyl) Phthalate	SW8270	NPM/50%	NPM	90%
Chrysene	SW8270	NPM/50%	NPM	90%
Di-N-Octyl Phthalate	SW8270	NPM/50%	NPM	90%
Benzo(b)Fluoranthene	SW8270	NPM/50%	NPM	90%
Benzo(k)Fluoranthene	SW8270	NPM/50%	NPM	90%
Benzo(a)Pyrene	SW8270	NPM/50%	NPM	90%
Indeno(1,2,3-cd)Pyrene	SW8270	NPM/50%	NPM	90%
Dibenz(a,h)Anthracene	SW8270	NPM/50%	NPM	90%
Benzo(g,h,i)Perylene	SW8270	NPM/50%	NPM	90%
METALS				
Aluminum	3050/6010	35%/50%	75%-125%	90%
Antimony	3050/7041	35%/50%	75%-125%	90%
Arsenic	3050/7060	35%/50%	75%-125%	90%
Barium	3050/6010	35%/50%	75%-125%	90%
Beryllium	3050/6010	35%/50%	75%-125%	90%
Cadmium	3050/7131	35%/50%	75%-125%	90%
Calcium	3050/6010	35%/50%	75%-125%	90%
Chromium	3050/6010	35%/50%	75%-125%	90%
Cobalt	3050/6010	35%/50%	75%-125%	90%
Copper	3050/6010	35%/50%	75%-125%	90%
Iron	3050/6010	35%/50%	75%-125%	90%
Lead	3050/6010	35%/50%	75%-125%	90%
Magnesium	3050/6010	35%/50%	75%-125%	90%
Manganese	3050/6010	35%/50%	75%-125%	90%
Mercury	7471	35%/50%	75%-125%	90%
Nickel	3050/6010	35%/50%	75%-125%	90%
Potassium	3050/6010	35%/50%	75%-125%	90%
Selenium	3050/7740	35%/50%	75%-125%	90%

TABLE 2-1
SUMMARY OF PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
FOR SOIL ANALYSES

Parameter	Method No. ⁽¹⁾ Reference	Precision ^(a) (as RPD)	Accuracy ^(b) (Recovery)	Completeness
Silver	3050/6010	35%/50%	75%-125%	90%
Sodium	3050/6010	35%/50%	75%-125%	90%
Thallium	3050/7841	35%/50%	75%-125%	90%
Vanadium	3050/6010	35%/50%	75%-125%	90%
Zinc	3050/6010	35%/50%	75%-125%	90%

NPM - Not part of method.

(1) SW 1000-9000 Methods - Test Methods for Evaluating Solid Waste:

Physical/Chemical Methods, SW846, Third Edition, U.S. EPA, November 1986.

(a) Precision - Relative Percent Difference (RPD) between laboratory replicates/field duplicate for analysis

(b) Accuracy - Expected recovery as specified by the method.

SECTION 3 ANALYTICAL METHODS AND PROCEDURES

3.1 Standard Analytical Methods

The standard analytical methods to be used for investigating samples collected at the site are summarized in Table 3-1. Further information on the procedural techniques is included in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, U.S. EPA OSW, Third Edition, November 1986. Upon selection of the subcontractor laboratory by M&E, copies of the subcontractor laboratory standard operating procedures (SOPs) will be submitted to AFCEE for final approval.

3.2 Project-Specific Detection Limits

Detection limits are determined using procedures outlined in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA, Third Edition, November 1986. Table 3-2 lists the Practical Quantitation Limits (PQLs) expected to be achieved by the laboratory during analysis of environmental soil samples in the Waste Dump area.

3.3 Laboratory Generated QC Samples

The laboratory shall comply with the QC sample requirements for each analytical method specified. The QC sample types required by the analytical methods are described below. A summary of the QC sample types and internal quality control procedures is listed in Table 3-3.

Continuing Calibration Verification. One continuing calibration verification (CCV) standard shall be analyzed for every 10 samples run for all project-specific inorganic parameters. A CCV is chosen as one of the mid-range working calibration standards that is reanalyzed periodically throughout the sample analysis to verify that the original calibration is still valid.

Method/Reagent Blank. At least one method/reagent blank shall be analyzed with each sample batch tested. A method blank is comprised of laboratory-pure, analyte-free water carried through the entire sample preparation and analysis procedure. Analysis of the method blank provides a check of the background contamination due to sample preparation procedures.

With the exception of toluene, detection of any target analyte within the method blank will require initiation of corrective action procedures by the laboratory, including possible reanalysis of the sample batch. If toluene is detected within the method blank at 5 times the

method detection limit, corrective action procedures will be initiated by the contractor laboratory.

Matrix Spike/Matrix Spike Duplicates. Matrix spikes and matrix spike duplicates shall be performed every 20 samples, or once for every group of less than 20 samples. Matrix spikes and matrix spike duplicates shall be performed for each group of samples submitted to the lab by M&E having a similar concentration range and matrix composition. The analyte spike shall be added prior to digestion/distillation of the sample. If the spike recovery is not within the acceptable criteria limits specific to this project, the data of those samples associated with that spiked sample must be handled appropriately.

Surrogate Spikes. All collected samples requiring organic analysis by gas chromatography (GC) shall be spiked with surrogate standards prior to sample preparation. The surrogate standards encompass the range of organics types to be analyzed in the sample, and shall also serve as checks on any matrix interference exhibited by the samples. If the percent recoveries of the surrogates are outside acceptable limits, the associated samples may be reanalyzed if the problem appears to be due to laboratory error. The laboratory supervisor or QA/QC director shall determine whether to reanalyze the sample or quality the data. Surrogate information is presented in Table 3-4.

3.4 Sampling Handling

Table 3-5 summarizes the sampling parameters, containers, holding times, and preservation requirements for the soil samples and aqueous field QC samples collected during this project. Sample containers, including those necessary for field QC samples, will be obtained pre-preserved from the laboratory. A description of the procedures for sample packaging and transport is summarized in Section 4.4.

**TABLE 3-1
STANDARD ANALYTICAL METHODS**

Parameters	Method
Purgeable Aromatic Hydrocarbons	SW8020
Purgeable Halogenated Volatiles	SW8010
Semivolatile Organic Compounds	SW8270
Total Petroleum Hydrocarbons	SW3550/E418.1
Gross Alpha Radiation	SW9310
Gross Beta Radiation	SW9310
Target Analyte List Metals	SW6010
SW - <u>Test Methods for Evaluative Solid Waste, Physical/ Chemical Methods, SW846, USEPA 3rd Ed., as amended, 1987.</u>	
E - <u>Methods for Chemical Analysis of Water and Wastes , USEPA 600/4-79-020.</u>	

**TABLE 3-2
PRACTICAL QUANTITATION LIMITS
FOR VOLATILE ORGANIC COMPOUNDS IN SOIL**

	PQL $\mu\text{g}/\text{kg}^{(1)}$
HALOGENATED VOLATILE ORGANICS:	
Dichlorodifluoromethane	10
Chloromethane	10
Vinyl Chloride	10
Chloroethane	10
Bromomethane	10
Trichlorofluoromethane	10
1,1-Dichloroethene	10
Methylene Chloride	10
t-1,2-Dichloroethane	10
1,1-Dichloroethane	10
Chloroform	10
1,1,1-Trichloroethane	10
Carbon Tetrachloride	10
1,2-Dichloroethane	10
Trichloroethene	10
1,2-Dichloropropane	10
Bromodichloromethane	10
c-1,3-Dichloropropene	10
t-1,3-Dichloropropene	10
1,1,2-Trichloroethane	10
Tetrachloroethene	10
Dibromochloromethane	10
Chlorobenzene	10
Bromoform	10
1,1,2,2-Tetrachloroethane	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
1,2-Dichlorobenzene	10
AROMATIC VOLATILE ORGANICS:	
Benzene	10
Toluene	10
Chlorobenzene	10
Ethylbenzene	10
m- & p-Xylene	10
o-Xylene	10

**TABLE 3-2
PRACTICAL QUANTITATION LIMITS
FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SOIL**

	PQL ⁽¹⁾ µg/kg
SEMIVOLATILE ORGANICS:	
Phenol	330
bis(2-Chloroethyl)Ether	330
2-Chlorophenol	330
1,3-Dichlorobenzene	330
1,4-Dichlorobenzene	330
1,2-Dichlorobenzene	330
2-Methylphenol	330
2,2'-oxybis(1-Chloropropane)	330
4-Methylphenol	330
N-Nitroso-Di-n-Propylamine	330
Hexachloroethane	330
Nitrobenzene	330
Isophorone	330
2-Nitrophenol	330
2,4-Dimethylphenol	330
bis(2-Chloroethoxy)Methane	330
2,4-Dichlorophenol	330
1,2,4-Trichlorobenzene	330
Naphthalene	330
4-Chloroaniline	330
Hexachlorobutadiene	330
4-Chloro-3-Methylphenol	330
2-Methylnaphthalene	330
Hexachlorocyclopentadiene	330
2,4,6-Trichlorophenol	330
2,4,5-Trichlorophenol	800
2-Chloronaphthalene	330
2-Nitroaniline	800
Dimethyl Phthalate	330
Acenaphthylene	330
2,6-Dinitrotoluene	330
3-Nitroaniline	800
Acenaphthene	330
2,4-Dinitrophenol	800
4-Nitrophenol	800
Dibenzofuran	330
2,4-Dinitrotoluene	330
Diethylphthalate	330
4-Chlorophenol-phenylether	330
Fluorene	330
4-Nitroaniline	800
4,6-Dinitro-2-Methylphenol	800
N-Nitrosodiphenylamine(1)	330
4-Bromophenyl-phenylether	330
Hexachlorobenzene	330
Pentachlorophenol	800
Phenanthrene	330
Anthracene	330
Carbazole	330
Di-n-Butylphthalate	330
Fluoranthene	330
Pyrene	330
Butylbenzylphthalate	330
3,3'-Dichlorobenzidine	330

**TABLE 3-2
PRACTICAL QUANTITATION LIMITS
FOR SEMIVOLATILE ORGANIC COMPOUNDS IN SOIL**

	PQL ⁽¹⁾ µg/kg
SEMIVOLATILE ORGANICS (continued)	
Benzo(a)Anthracene	330
Chrysene	330
bis(2-Ethylhexyl)Phthalate	330
Di-n-OctylPhthalate	330
Benzo(b)Fluoranthene	330
Benzo(k)Fluoranthene	330
Benzo(a)Pyrene	330
Indeno(1,2,3cd)Pyrene	330
Dibenzo(a,h)Anthracene	330
Benzo(g,h,i)Perylene	330

**TABLE 3-2
PRACTICAL QUANTITATION LIMITS FOR INORGANIC ANALYTES
IN SOIL**

Analyte	PQL ⁽¹⁾ mg/kg
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Berillium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	3
Magnesium	500
Manganese	15
Mercury	0.2
Nickel	40
Potassium	500
Selenium	0.5
Silver	10
Sodium	20
Thallium	0.2
Vanadium	2
Zinc	15
TPH	100

⁽¹⁾ Detection limits for soil samples are highly matrix dependent and are provided here as guidance.

**TABLE 3-3
SUMMARY OF INTERNAL QUALITY CONTROL PROCEDURES FOR
LABORATORY GENERATED QC SAMPLES**

Type	Purpose	Frequency	Criteria	Corrective Action
Method Blank	Verifies clean reagents, instrument systems and lab environment	1 per 12-hour analysis day per sample matrix	No compound of interest > 5 times MDL	Reanalyze; if second blank exceeds system's criteria, clean and recalibrate system; document corrective action
System Performance Check (for GC/MS compounds)	Checks performance of analytical system	When sample matrix interference is suspected	≥ 0.05 response factor % recovery specific to method	Check system; recalibrate; reanalyze
Laboratory Replicates (including matrix spike duplicates)	Precision check on analytical method	1 per batch of 20 samples as supplied from the field	RPD ¹ as outlined in Tables 4.1a and 4.1b	Compare with field duplicates; check for matrix interferences
Calibration Check Sample	Verifies calibration curve	≥ 1 per analysis day	$\geq 20\%$ initial calibration	Recalibrate; check system
Matrix Spikes and Duplicates (MS/MSD)	Checks recovery from real matrix	Performed at 5% frequency of samples	Specified in analytical methods	Qualify data or recalibrate, reanalyze, and document corrective action
Surrogate Standards	Determine recoveries, control limits, matrix effects	All GC/MS samples and all GC samples	As specified in analytical methods	Reanalyze samples; qualify or reject data

¹ RPD - Relative Percent Difference of Duplicate Measurements

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**TABLE 3-4
LABORATORY CONTROL LIMITS FOR MATRIX SPIKES,
MATRIX SPIKE DUPLICATES, AND SURROGATE SPIKES**

	% Recovery		RPD	
	Water	Soil	Water	Soil
VOLATILE ORGANIC COMPOUNDS:				
1,1-Dichloroethane	61-145	59-172	14	22
Trichloroethene	71-120	62-137	14	24
Benzene	76-127	66-142	11	21
Toluene	76-125	59-139	13	21
Chlorobenzene	75-130	60-133	13	21
SURROGATE COMPOUNDS:				
Toluene-d8	88-110	84-138	--	--
Bromofluorobenzene	86-115	59-113	--	--
1,2-Dichloroethane-d4	76-114	70-121	--	--
SEMIVOLATILE ORGANIC COMPOUNDS:				
Phenol	12-110	26-90	42	35
2-Chlorophenol	27-123	25-102	40	50
1,4-Dichlorobenzene	36-97	28-104	28	27
N-Nitroso-di-n-propylamine	41-116	41-126	38	38
1,2,4-Trichlorobenzene	39-98	38-107	28	23
4-Chloro-3-methylphenol	23-97	26-103	42	33
Acenaphthalene	46-118	31-137	31	1.9
4-Nitrophenol	10-80	11-114	50	50
2,4-Dinitrotoluene	24-96	28-89	38	47
Pentachlorophenol	9-103	17-109	50	47
Pyrene	26-127	35-142	31	36
SURROGATE COMPOUNDS:				
Nitrobenzene-ds	35-114	23-120	--	--
2-Fluorobiphenyl	43-116	30-115	--	--
Terphenyl-d ₁₄	33-141	18-137	--	--
Phenol-5 ₃	10-110	24-113	--	--

**TABLE 3-4
LABORATORY CONTROL LIMITS FOR MATRIX SPIKES,
MATRIX SPIKE DUPLICATES, AND SURROGATE SPIKES**

	% Recovery		RPD	
	Water	Soil	Water	Soil
2-Fluorophenol	21-110	25-121	--	--
2,4,6-tribromophenol	10-123	19-122	--	--
2-Chlorophenol-d ₄	33-110	20-130*	--	--
1,2-Dichlorobenzene-d ₄	16-110	20-130*	--	--

*Advisory limits

**Table 3-5
SAMPLE PARAMETERS, CONTAINERS, AND PRESERVATION REQUIREMENTS**

Parameter	Matrix	Container	Minimum container size	Minimum number of containers	Preservation	Maximum holding time limit
Volatile organics	Soil	Wide mouth glass with Teflon liner	4 oz.	2	Cool to 4°C	14 days
Volatile organics	Water	Vial with Teflon lined septum cap	40 mL	4	4 drops conc. HCl, cool to 4°C	14 days
Semivolatile organics	Soil	Wide mouth glass with Teflon liner	8 oz.	1	Cool to 4°C	Extracted with 14 days analyzed within 40 days after extraction
Semivolatile organics	Liquid	Amber glass with Teflon liner	1L	2	Cool to 4°C	Extracted within 7 days analyzed within 40 days after extraction
Metals	Soil	Glass or polyethylene	10 oz.	1	Cool to 4°C	6 months
Metals	Liquid	Glass or polyethylene	1L	1	Nitric acid to pH < 2	6 months

SECTION 4.0
FIELD SAMPLING PROGRAM

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The field sampling program provides requirements and procedures for all field sampling work associated with the removal of debris at the Waste Dump area at Carswell AFB. A very brief outline of the field work is presented below.

Prior to the start of field activity, equipment will be mobilized to the work site at the Waste Dump Area and decontamination and support zones will be established. Preliminary screening of the sampling locations and breathing zones will be performed using organic vapor analyzers; flame ionizing detector (FID) or photoionizing detector (PID) and a low level radiation detector; count rate meter (CRM).

Soil samples will be collected at points upgradient and downgradient from the debris pile. Samples will be analyzed for the project-specific parameters listed in Section 3.0 by the subcontractor laboratory. Analytical data will be evaluated to determine potential contamination released from the debris in the Waste Dump area.

This section provides detailed information regarding sampling and analysis procedures only. The Construction Quality Plan provides detailed information on the procedures, equipment cleaning, and disposal of the debris in the Waste Dump Area.

4.1 Sample Types and Locations

Three surface soil samples will be collected to confirm the presence or absence of potential contaminants. Assuming no flow of surface waters, one surface soil sample will be collected in the dry drainage swale upgradient of the debris pile, and one sediment sample will be collected in the downgradient stream bed. One soil sample will be collected within the sawdust/gravel pile adjacent to the debris pile. A total of three surface soil samples will be collected and analyzed for the parameters listed in Section 3, Table 3-2.

An additional composite surface soil will be collected after removal of the debris from the underlying ground surface for confirmation of the absence of contaminants.

4.2 Quality Control Samples

During each sampling episode, a number of QC samples will be collected and submitted for laboratory analysis. The number and frequency of the QC sample collection are stated in this section. The types of QC samples that will be collected along with a brief description of each sample type are outlined below. A summary of the quality control procedures for field generated QC samples is listed in Table 4-1.

**TABLE 4-1
SUMMARY OF QUALITY CONTROL PROCEDURES FOR
FIELD GENERATED QC SAMPLES**

Type	Purpose	Frequency	Criteria	Corrective Action
Trip Blank	Verifies no contamination during sample transport/storage	1 per cooler of VOCs shipped to laboratory	No common laboratory contaminant > 5 times MDL ⁽¹⁾ and no other compound > MDL	Qualify data or resample
Source Blank	Verifies integrity of water used for decontamination	1 per water type per sampling episode	No compound of interest shipped from field > 5 times MDL ⁽¹⁾	Qualify data or resample
Field Blanks	Determine the effect of ambient air conditions on a sample	1 per sampling event	No compound of interest > 5 times MDL	Qualify data or resample
Equipment Rinsate	Verifies effective decontamination procedures used in field	10% of samples from each sampling method	No common laboratory contaminant > 5 times MDL ⁽¹⁾ and no other compound > MDL	Qualify data or resample
Field Duplicate	Submit "blind" to lab to determine sample variability	10% of samples per matrix	± 30% RPD ⁽²⁾ (aqueous) ± 50% RPD ⁽²⁾ (soil)	Compare to lab replicates; check systems for possible matrix interferences or improper sample collection procedure

⁽¹⁾ MDL - Method Detection Limit

⁽²⁾ RPD - Relative Percent Difference of Duplicate Measurements

Trip Blanks are used in the chemical analysis of volatile organics. The analytical results serve as a baseline measurement of volatile organic contamination that sample containers may be exposed to during transport and laboratory storage prior to analysis.

Trip blanks originate in the laboratory. They are comprised of organic-free reagent water, which is placed in sample containers by the laboratory, transported to the site location, handled along with the samples, and returned to the laboratory along with samples of water and/or soil collected for volatile organic analysis. The trip blank containers are not to be opened in the field.

One trip blank will be included in the shipping container for volatile organics analysis. Trip blanks are stored in the laboratory with the samples, and analyzed by the laboratory (for volatile organics only).

Equipment Rinsates are collected for equipment used in the collection of samples when devices other than the sample bottle itself are required. The analysis of these rinsates serves to verify the cleanliness of the sampling equipment and the effectiveness of the decontamination procedure.

Equipment rinsates are comprised of organic-free reagent water supplied by the laboratory, which is transported to the sample collection site, opened, poured onto the sampling device following equipment decontamination procedures, and transferred to a sample bottle. One equipment rinsate will be collected prior to the soil sampling event. The equipment rinsate is analyzed for the same parameters as the associated samples.

Field Duplicates are defined as two samples collected independently of each other at the same sampling location during a single sampling episode. Duplicate analysis provides statistical information relating to sample variability and serves as a check on the precision of any sample collection method.

One surface soil duplicate sample will be submitted for laboratory analysis. The field duplicate will be labeled in such a manner that persons performing laboratory analyses are not able to distinguish duplicates from other collected samples.

4.3 SAMPLING PROCEDURES

Surface soils will be collected at a depth of 0.5 to 1 foot using stainless steel trowel or spade. All sampling equipment will be decontaminated prior to collection using the procedures outlined in Section 5.2.

Equipment

- . Stainless steel trowel, and spoon or spatula
- . Stainless steel tile spade
- . Field logbook
- . FID or PID and CRM
- . Nitrile gloves
- . Pyrex bowl
- . Sample containers
- . Black waterproof marker
- . Camera

Procedure

1. Remove surface vegetation and debris using stainless steel tile spade. Wear protective gloves and change gloves between samples.
2. Photograph the sample location.
3. Excavate sample location to approximately 3 to 4 inches, removing roots, grass, and surface debris.
4. Collect sample for volatile organics first. Minimize any disturbance or mixing of the soil. Invert sample jar and insert directly into the sample soil, quickly fill containers completely to eliminate air space.
5. After volatile organics have been collected sufficient soil is collected in pyrex bowl and mixed to be homogeneous. Fill the sample containers using a stainless steel spoon or spatula.
6. Immediately label, preserve, and log the sample into the field log book and complete the chain-of-custody forms.

Samples will be placed in a cooler with ice and shipped to the subcontractor laboratory for analysis within 24 hours of collection.

Documentation

The following information should be documented in the field log book when sampling surface soils.

- . Description of sample
- . Depth of sample collection

- . Discrete or composited sample
- . Method of collection
- . Time and date of sample collection
- . Weather conditions

4.4 SAMPLING HANDLING PROCEDURES

All samples will be preserved immediately following collection. Table 3-3 summarizes the containers and preservation requirements for aqueous and soil samples to be collected.

Liquid Samples. Samples to be analyzed for volatile organics shall be contained within a 40 ml pre-prepared volatile organic analysis (VOA) vials. After filling the vial, it should be turned upside-down and tapped lightly to ensure that there are no air bubbles. Other liquid samples shall be placed into pre-preserved sampling bottles obtained from the laboratory, such as a 1 liter amber glass bottle. The container shall be filled 3/4 full (at a minimum), labeled with the sample ID number, and placed in a sealable plastic bag. All samples will be packed with ice in an ice chest in a manner such that the containers will not be damaged during shipping.

Soil Samples. Samples shall be contained within the appropriate size bottles provided by the subcontractor laboratory. Containers should be filled at least 3/4 full. The caps will be secured to the liner with Teflon tape. Each sample will be labeled with the sample ID number. Each sample will be placed in a sealable plastic bag. All samples are to be preserved with ice, and packed in an ice chest in a manner such that the contents will not be damaged during shipping.

4.4.1 Sample Labeling

Each sample container will have a clean label for identification preaffixed to it. Typically, the label will have an adhesive backing. The sample identification label will be completely filled out in waterproof or indelible ink with the following information.

- . Sample identification number
- . Sample location
- . Depth interval
- . Date of collection
- . Time of collection
- . Name or initials of personnel collecting the sample
- . Analysis requested
- . Types of preservatives (if any)
- . Any other information pertinent to the sample

4.4.2 Sample Custody

Custody of samples must be maintained and documented from the time of sample collection to completion of the analysis. The Field Team Leader is responsible for overseeing and supervising the implementation of proper sample custody procedures in the field. The Field Team Leader is also responsible for ensuring sample custody until the samples have been transferred to a courier or directly to the laboratory. A sample is considered to be under a person's custody if:

- . The sample is in the person's physical possession.
- . The sample is in view of the person after that person has taken possession.
- . The sample is secured by that person so that no one can tamper with the sample.
- . The sample is secured by that person in an area which is restricted to authorized personnel.

All samples will be accompanied to the laboratory by a chain-of-custody record. The chain-of-custody record will be completed with waterproof ink. When the samples are transferred from one party to another, the individuals will sign, date, and note the time on the record. A separate chain-of-custody record will accompany each sample delivery to the laboratory. The sampling personnel will retain a copy of the form.

Once received at the laboratory, laboratory custody procedures will apply. It is the laboratory's responsibility to maintain custody records throughout sample preparation and analysis.

Chain-of-Custody Record. A chain-of-custody form must be completed for each sample set collected at a sampling location. The form is maintained as a record of sample collection, transfer, shipment, and receipt by the laboratory. The forms must also contain pertinent information concerning sampling location, date, and times; signatures of the sampling team members; types of samples collected along with a unique sample identification number; the number of samples collected and shipped for analysis in each lot; the project name and number; and the name of the laboratory to which the samples are being sent.

Transfer of Custody. Samples shall be accompanied by an approved and completed chain-of-custody form during each step of custody, transfer, and shipment. When physical possession of samples is transferred, both the individual relinquishing the samples and the individual receiving them shall sign, date, and record the time on the chain-of-custody form. In the case of sample shipment by an overnight courier, a properly prepared airbill of non-

hazardous materials) shall serve as an extension of the chain-of-custody form while the samples are in transit.

4.4.3 Sample Packaging and Shipping

Following sample collection, all samples shall be brought to an on-site location for batching and paperwork checks. At this central location, like sample types are matched (i.e., solids, liquids, etc.) with similar sample types from all sample locations. Labels, tags (as required), and log information are checked to be sure there is no error in sample identification. The samples are packaged to prevent breakage and/or leakage, and the shipping containers are labeled in accordance with the DOT regulations for transport.

As soon as field personnel are ready to transport samples from the field to the laboratory, the laboratory shall be notified by telephone of the shipment along with the estimated time of arrival. All samples shall be shipped directly to the laboratory within 24 hours of collection. The field team shall determine whether it is best to directly transport the packages to the shipping office or to arrange for on-site pick-up. For each sample shipment to the subcontractor laboratory, an overnight airbill must be properly completed. Unless field-collected information indicates otherwise, all environmental samples collected shall be treated as non-hazardous aqueous liquids and non-hazardous soil.

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**SECTION 5.0
FIELD QUALITY CONTROL PROCEDURES**

5.1 EQUIPMENT CALIBRATION AND MAINTENANCE

Photoionization Detector (PID) and Flame Ionization Detector (FID) will be calibrated at the beginning of each day using a single point calibration. High purity air will be used to zero the meters. FIDs will be calibrated using a 100 ppmv methane standard.

Calibration records for the meters will be recorded on calibration data sheets. The calibration records will include the date, time, standard gas compound and concentration, instrument reading, and initials of the person calibrating the meter.

Count Rate Meter (CRM) is calibrated prior to field use by the manufacturer under the recommended maintenance program. Verification of the proper operation of the CRM is required prior to each use. Items necessary for verification of CRM function include: checking needle movement, audible response, position of probe, and appropriate scale setting.

Maintenance for the FID and CRM shall comply with the recommended maintenance procedures given in the manufacturer's operation and maintenance manuals.

5.2 EQUIPMENT DECONTAMINATION PROCEDURES

Decontamination is the process of removing contaminants that have accumulated on soil or water handling equipment and sampling apparatus. Proper decontamination is essential to minimize the transfer of harmful materials into clean areas, to prevent cross-contamination between samples due to the use of improperly decontaminated field/sampling equipment, and to protect workers from hazardous substances. Personal decontamination procedures are covered in the HASP.

Cleaning Materials. The materials used throughout the cleaning procedures outlined in this manual may be dangerous if improperly handled. Caution must be exercised by all personnel, and all applicable safety procedures outlined in the HASP must be followed.

The organic solvents, laboratory detergent solutions, and rinse waters used to clean equipment will not be reused. The cleaning materials referred to throughout the decontamination procedures are defined in the following paragraphs.

Laboratory Detergent. A standard brand of phosphate-free detergent such as Sparkleen, Liquinox, or Alconox is used as the laboratory detergent for decontaminating field equipment.

Tap Water. Tap water from any municipal potable water supply system may be used for initial rinsing of field equipment. For this project tap water will be obtained from the active potable water well located in the WSA. An untreated or nonpotable water supply is not an acceptable substitute for tap water.

Deionized Water. Deionized water will be used for rinsing of all field equipment. This water will be supplied by the laboratory and shipped to the site in gallon jugs.

Organic Solvents. Solvents (methanol, isopropanol) must be pesticide-grade or better.

Brushes. The use of brushes with wire-wrapped bristles should be avoided due to contamination from the wire. Totally plastic brushes should be used, if possible. However, plastic brushes with wooden handles are acceptable.

A list of typical materials required for onsite decontamination of sampling equipment is given below.

- . Laboratory detergent
- . Aluminum foil
- . Bottle brush
- . Deionized water
- . Isopropanol or methanol
- . Plastic basin and scrub brush
- . Paper towels
- . Plastic sheeting
- . Personal protective clothing (see HASP)
- . Sealable plastic bags
- . Tap water
- . Water supply (available onsite through Carswell AFB water supply system)

Sampling Equipment. Reusable sampling equipment must be decontaminated prior to use at each sampling point, and before the equipment is transported offsite. Guidelines for decontamination of sampling equipment are outlined below:

1. Wash the equipment thoroughly with phosphate-free laboratory detergent and tap water. Use a brush to remove any particulate matter or surface film.
2. Rinse with tap water.
3. Rinse with deionized water.

4. Rinse with pesticide-grade isopropanol.
5. Allow to air dry.

If the sampling equipment was used to collect samples that contained oil, grease, or other hard-to-remove materials, it may be necessary to steam clean the equipment several times prior to washing with the laboratory detergent solution. If the field equipment cannot be cleaned using these procedures, it should be properly discarded.

Ice Chests and Shipping Containers. All ice chests used for sample storage or shipment and reusable shipping containers will be washed onsite with laboratory detergent, rinsed with tap water, and air-dried before storage. In the event that an ice chest or shipping container becomes severely contaminated with waste or other toxic material, it will be disposed of properly.

Vehicles. All heavy equipment which comes into direct contact with potentially contaminated soil shall be decontaminated (by physical removal of packed dirt and debris) prior to leaving the contaminated reduction zone established at the site.

5.3 DOCUMENTATION

All decontamination procedures performed during the course of a field investigation must be documented in the site-specific field logbook. Any deviations from the standard decontamination protocols must be noted.

All sampling procedures, instrument calibration, and information pertinent to sampling conditions, progress, and field data collection must be documented following a prescribed set of guidelines. The documentation serves as a permanent and traceable record of all activities related to a specific field investigation project. The record must be legible and accessible to allow ease in verifying sampling activities and addressing future questions which may arise concerning such issues as sample integrity, sample traceability, etc.

All documentation must be recorded in permanent ink. Any errors must be crossed out with a single line, dated, and initialed; the use of white-out is not permissible.

Field Logbooks

The field logbook shall contain a diary of all pertinent project activities. Standard information recorded in the field logbook includes: general observations made in the field, identification and calibration of instruments used, and field data.

The front of each field logbook shall contain the following information:

- . Project name and number
- . Name of the contract under which the investigation is being conducted
- . Date(s) of use

The last item to be entered at the bottom of each page of the field logbook shall be the signature of the person responsible for completing the data entry.

SECTION 6.0 DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the data reduction, review, and reporting procedures that will be used at the laboratory. Primary responsibility for implementation of these procedures within the laboratory resides with the QA/QC Director. The QA/QC Director approves all data reports before transferring the information to the M&E Project Manager and the QA/QC Manager. The M&E Project Manager and QA/QC Manager ensure that laboratory data are in compliance with Q/QPP specifications. Final responsibility for validation and reporting of data resides with the M&E QA/QC Manager.

Data processing begins with the collection of data and continues through the reduction and review processes to the final data reporting procedure. This process is outlined in the following sections.

Data Collection. At the laboratory analytical data are usually recorded in bound laboratory notebooks. Data recorded includes: a unique sample identification number, a project sample identification number, the analytical method used, the analyst's signature and date of analysis, reagent concentrations, instrument settings (where applicable), raw data, and any comments or descriptions pertinent to the analysis.

The laboratory analysts must sign and date all notebook entries daily. The notebooks shall be available for periodic review by the appropriate laboratory section manager or during an audit of the laboratory section by AFCEE, M&E, or their designated representatives.

Data Reduction. Data reduction is performed by experienced chemists and consists of calculating concentrations of analytes in samples from the raw data obtained from the analytical instruments. The complexity of the data reduction depends on the specific analytical method and the number of discrete operations (extractions, digestions, dilutions, concentrations) involved in obtaining a sample that can be measured.

Laboratory Data Review. System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews are further verified by a laboratory supervisor prior to data submission. The final routine review and approval is performed by the QA/QC Director prior to reporting the results to the client. The QA/QC Director checks all information and completeness of the documentation in addition to 10 percent of the calculations. The Laboratory QA/QC Officer will check all data against the QC requirements of the client. Any out-of-control data is flagged using the seven EPA-defined qualifiers for labeling and flagging analytical data.

Evaluation of Data Using Control Charts. The laboratory shall apply precision and accuracy criteria to each parameter that is analyzed. When analysis of a sample set is completed, the quality control data will be reviewed and evaluated through the use of control charts.

Control charts shall be established for all major analytical parameters. A minimum of ten measurements of precision and accuracy are required before control limits can be established. Once established, control limits are updated annually and as additional precision and accuracy data become available.

Laboratory Data Reporting. The final laboratory data report will be checked and approved by the QA/QC Director. Data will be presented in a tabular format whenever possible and will be in the standard laboratory report format required by Level III quality control. Reports shall contain final results uncorrected for blank contamination or spike recoveries. The number of significant figures reported must be consistent with the limits of uncertainty inherent in the analytical method; most analytical results are reported to no more than two significant figures. Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., $\mu\text{g/L}$). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., mg/kg).

Data reports will include:

- . Client's name and project name/identification
- . Sample identification number
- . Contractor laboratory report identification
- . Date sample was taken
- . Date sample received
- . Date sample extracted
- . Date sample analyzed
- . Methods or procedure used for analysis
- . Results of associated quality control sample analysis
- . Copy of the chain-of-custody form

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