

INSTALLATION RESTORATION PROGRAM
AD-A251 813



OHIO AIR NATIONAL GUARD
TOLEDO EXPRESS AIRPORT, SWANTON, OHIO

**QUALITY ASSURANCE PROJECT PLAN
PROJECT HEALTH AND SAFETY PLAN**

FINAL

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HAZWRAP SUPPORT CONTRACTOR OFFICE

Oak Ridge, Tennessee 37831

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For the U.S. DEPARTMENT OF ENERGY under contract DE-AC05-84OR21400



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AIR NATIONAL GUARD
INSTALLATION RESTORATION PROGRAM
SITE INVESTIGATION
FOR THE
OHIO AIR NATIONAL GUARD
TOLEDO EXPRESS AIRPORT, SWANTON OHIO

QUALITY ASSURANCE PROJECT PLAN
AND PROJECT HEALTH AND SAFETY PLAN

FINAL

Submitted to:

National Guard Bureau
Air National Guard Support Center
Andrews Air Force Base, Maryland 20331

Prepared by:

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Submitted by:

Hazardous Waste Remedial Actions Program
Martin Marietta Energy Systems, Inc.
Oak Ridge, Tennessee 37831

For the

U.S. Department of Energy
Under Contract No. DE-AC05-84OR21400

SAIC Project No. 1-827-03-350-02

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SITE INVESTIGATION
FOR THE OHIO AIR NATIONAL GUARD
TOLEDO EXPRESS AIRPORT, SWANTON, OHIO

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8400 Westpark Drive
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April 1990

Quality Assurance Project Plan

Submitted by:

Hazardous Waste Remedial Actions Program
Martin Marietta Energy Systems, Inc.
Oak Ridge, Tennessee 37831

U.S. Department of Energy
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LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ANG	Air National Guard
ANGB	Air National Guard Base
ANGSC	Air National Guard Support Center
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AVGAS	Aviation Gasoline
BLS	Below Land Surface
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (1980)
CLP	Contract Laboratory Program
CWA	Clean Water Act
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DQOs	Data Quality Objectives
ECD	Electron Capture Detector
ELSA	Emergency Life Support Apparatus
EMT	Emergency Medical Technician
ETG	Environmental Technology Group
FFS/RM	Focused Feasibility Study/Remedial Measures
FID	Flame Ionization Detector
FS	Feasibility Study
FTA	Fire Training Area
FWQC	Federal Water Quality Criteria
GC/MS	Gas Chromatography/Mass Spectrometry
gpm	Gallons Per Minute
HAZWRAP	Hazardous Waste Remedial Actions Program
HMTC	Hazardous Materials Technical Center
I.D.	Inside Diameter
IDLH	Immediately Dangerous to Life or Health
IRP	Installation Restoration Program
LOAEL	Lowest-Observable-Adverse Effect Level

LIST OF ACRONYMS (Continued)

MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MPRSA	Marine Protection, Research, and Sanctuaries Act
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSL	Mean Sea Level
MUL	Maximum Use Limit
NBS	National Bureau of Standards
NGB	National Guard Bureau
NIOSH	National Institute for Occupational Safety and Health
NOAEL	No-Observable-Adverse-Effect Level
O.D.	Outside Diameter
OEPA	Ohio Environmental Protection Agency
OH ANG	Ohio Air National Guard
OSHA	Occupational Safety and Health Administration
OWSs	Oil/Water Separators
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PEL	Permissible Exposure Limits
PF	Protection Factor
PM	Project Manager
PMP	Project Management Plan
POL	Petroleum, Oil, and Lubricants
POTWs	Publicly Owned Treatment Works
ppm	Parts Per Million
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act of 1986
SCBA	Self Contained Breathing Apparatus

LIST OF ACRONYMS (Continued)

SDWA	Safe Drinking Water Act
SHD	Safety and Health Director
SI	Site Investigation
SOP	Standard Operating Procedure
SOW	Statement of Work
SPT	Standard Penetration Test
SSHC	Site Safety and Health Coordinator
TCA	Trichloroethane
TCE	Trichloroethene
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
USTs	Underground Storage Tanks
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant

Toledo ANGB QAPP
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Revision No.: 0
Date: April 1990
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QUALITY ASSURANCE PROJECT PLAN APPROVAL

This Quality Assurance Project Plan (QAPP) was developed to ensure that all environmental data generated for the National Guard Bureau (NGB) Installation Restoration Program (IRP) are scientifically valid, defensible, comparable, and of known and acceptable precision and accuracy. The below signatures of key project personnel indicate concurrence with the procedures specified in the plan and a commitment to disseminate the plan and the philosophy of quality to all project personnel.

	<u>Signature</u>	<u>Date</u>
H.L. Arnold, Program Manager	_____	_____
C.D. Samson, Project Manager	_____	_____
M.S. Brouwer, Program Quality Assurance Officer	_____	_____
Laboratory	_____	_____

This plan is approved for use in the Ohio Air National Guard (OH ANG) Site Investigation (SI) at the Toledo Express Airport in Swanton, Ohio.

Adarsh Mehta, HAZWRAP Technical Project Manager

Date

QUALITY ASSURANCE/QUALITY CONTROL

1. INTRODUCTION

The objective of the National Guard Bureau (NGB) Installation Restoration Program (IRP) is to assess all past hazardous waste practices on NGB installations and to develop remedial actions for those sites that pose a threat to human health and welfare or the environment. During the course of the site investigation (SI) at the Ohio Air National Guard (OH ANG), Toledo Air National Guard Base (ANGB), laboratory and field analytical data will be used to determine the presence of environmental contamination. The primary goal of this Quality Assurance Project Plan (QAPP) is to define procedures that will ensure the quality and integrity of the samples, accuracy and precision of the analyses, representativeness of the results, and completeness of the information. The information gathered during this investigation will enable the SI team to evaluate fully the potential extent of contamination and the need for further investigation. Descriptions of all data quality objectives (DQOs) and procedures associated with sample collection, laboratory analysis, sample custody, initial and continuing instrument/equipment calibration, internal quality assurance (QA) checks, performance and system audits, preventive maintenance and scheduling, data quality assessment, corrective action, and QA reports to management applicable to this project are contained within this document.

As the contractor for the Toledo ANGB SI at the Toledo Express Airport in Swanton, Ohio, Science Applications International Corporation (SAIC) has the responsibility for setting DQOs and the corresponding QA standards by which the sampling and analysis effort will be conducted, and ensuring that those standards are met by all participants. In joining the team for this effort, each participating subcontractor has made a commitment to adhere to the procedures identified in the QA Program Plan and to follow the QAPP protocols for each assigned task.

2. PROJECT DESCRIPTION

An indepth discussion of the field effort proposed at Toledo ANGB is presented in the project Site Investigation Work Plan.

3. ORGANIZATION AND RESPONSIBILITIES

A discussion of the SI project team and individual roles and responsibilities is presented in the Site Investigation Work Plan.

4. QUALITY ASSURANCE OBJECTIVES

Comprehensive QA objectives for the SI at Toledo ANGB have been developed to provide guidelines for all field and laboratory operations. The primary goal of this study is the completion of investigations at eight sites at the airport, generating a data base that will support either a finding of no adverse impact where no contaminants hazardous to human health and the environment from past hazardous wastes management practices at the airport are identified, or a feasibility study (FS) to identify, evaluate, and select optimum remedial alternatives for control of contaminant migration. To achieve this goal, the scope of this SI has been developed to comprehensively identify and quantify the extent and magnitude of contaminants at each site investigated. During the course of this investigation, all activities and analyses will be conducted using standard procedures so that known and acceptable levels of precision, accuracy, representativeness, completeness, and comparability (PARCC) are documented. The results will be produced using established methodology and standard operating procedures (SOPs), and will be reproducible at all levels.

4.1 Accuracy

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value or actual concentration, the more accurate the measurement is. Analytical accuracy is expressed as the percent recovery of an analyte that has been added to the environmental sample at a known concentration before analysis. The equation used to calculate percent recovery is:

$$\text{Accuracy} = \text{Percent recovery} = \frac{A_r - A_o}{A_f} \times 100 \text{ percent}$$

where:

A_t = Total amount detected in spiked sample

A_o = Amount detected in unspiked sample

A_f = Amount added to sample.

Accuracy will be determined in the laboratory through the use of matrix spike and matrix spike duplicate (MS/MSD) analyses. The laboratory will select one environmental sample in 20 and split the sample into 3 aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest before analysis. The percent recoveries of the target analytes will be calculated and used as an indication of the accuracy of the analyses performed.

Sampling accuracy will be maximized, however, by the adoption of, and adherence to, a strict QA program. All procedures are documented as standard protocol and all equipment and instrumentation will be properly calibrated and well-maintained. Trip blanks, field blanks, and equipment blanks will be included in selected sample batches to ensure that all samples represent the particular site from which they were sampled and to assess any cross-contamination that may have occurred. In addition to equipment operation and SOPs, a high level of accuracy can be maintained by frequent and thorough review of field procedures. In this manner, deficiencies can be quickly documented and corrected. Specific QA objectives for accuracy as pertaining to the Martin Marietta Energy Systems, Inc. Hazardous Waste Remedial Actions Program (HAZWRAP) Level C SI at Toledo ANGB are presented in Sections 10 and 13.

4.2 Precision

Precision is defined as the reproducibility, or degree of agreement, among replicate measurements of the same quantity. The closer the numerical values of the measurements come to each other, the more precise the measurement is. Analytical precision is expressed as a percentage of the difference

between results of duplicate samples for a given analyte. Relative percent difference (RPD) is calculated as:

$$\text{Precision} = \text{RPD} = \frac{\frac{|C_1 - C_2|}{(C_1 + C_2)}}{2} \times 100 \text{ percent}$$

where:

C_1 = Concentration of the analyte in the sample

C_2 = Concentration of the analyte in the duplicate/replicate.

Precision will be determined through the use of MS/MSD analyses conducted on the environmental samples as described for accuracy determinations. The RPD between the two results will be calculated and used as an indication of the precision of the analyses performed.

Sample collection precision will be measured in the laboratory by the analysis of field replicates. Precision will be reported as the RPD for two measurements and as standard deviation for three or more measurements. Control limits for laboratory and field analyses conducted as part of this HAZWRAP Level C SI at Toledo ANGB are presented in Sections 10.1 and 13.1, respectively.

4.3 Completeness

Completeness is expressed as the percentage of valid data obtained from a measurement system. For data to be considered valid, they must meet all of the acceptance criteria, including accuracy and precision, as well as any other criteria specified by the analytical method used.

Field sampling conditions are unpredictable and nonuniform. The objective of the field sampling program at Toledo ANGB is to obtain samples for all analyses required at each individual site, provide sufficient quantity of sample material to complete those analyses, and produce quality control

(QC) samples that represent all possible contamination situations (e.g., contamination during sample collection, storage, and transport).

The overall DQO for completeness during the site investigation at Toledo ANGB is 90 percent. Project completeness will be calculated by the following equation:

$$\text{Completeness} = DP_v = \frac{DP_t - DP_i}{DP_t} \times 100 \text{ percent}$$

where:

DP_v = Valid data points

DP_t = Total quality control data points

DP_i = Invalid data points (e.g., sum of the percent recovery or RPD values outside laboratory or project control limits, the number of contaminants detected in blank samples, analyses conducted after method-recommended holding times).

Interference DQOs are discussed in Section 7.2. Contamination DQOs are discussed in Section 14.2. Sufficient sample volume will be collected to ensure that reanalysis can occur as needed.

4.4 Representativeness

Representativeness is defined as the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter relating to the proper design of a sampling program, and is ensured by collecting sufficient samples of a population medium, properly distributed with respect to location and time, and is evaluated by calculating the RPD between field replicate samples, as discussed in Sections 5.4 and 5.5. The precision of a representative set of samples reflects the degree of heterogeneity of the sampled medium, as well as the effectiveness of the sampling technique. The methods and protocols used to select samples that are representative of a particular sampling site are described in Sections 5.2 and 5.3.

4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another, and is limited to the other PARCC parameters because only when precision and accuracy are known can data sets be compared with confidence. Field and laboratory procedures greatly affect comparability. To optimize comparability, only the specific methods and protocols that have been selected or specified as appropriate for the IRP will be used to collect and analyze samples during the SI at Toledo ANGB. By using consistent sampling and analysis procedures, all data sets will be comparable within a specific site at Toledo ANGB, between sites at Toledo ANGB, or among NGB installations nationwide, to ensure that remedial action decisions and priorities are based on a consistent data base. Comparability will be further ensured by the analysis of U.S. Environmental Protection Agency (USEPA) standard reference materials, establishing that analytical procedures are generating valid data.

5. SAMPLING PROCEDURES

5.1 References

Samples will be collected and analyzed in strict accordance with the procedures contained in the documents referenced in Attachment 3.

5.2 Soil, Sediment, and Cuttings

The following is a listing of the procedures that will be followed for transferring soil samples at Toledo ANGB:

- All sampling equipment, including internal components, will be decontaminated before use and between samples, using laboratory-grade detergent and potable water, American Society for Testing and Materials (ASTM) Type II reagent water, and pesticide-grade methanol and hexane rinses, in that order. Specific information concerning decontamination procedures is located in Section 5.6.
- Decontaminated equipment will be allowed to air-dry, wrapped in a nonplastic material (aluminum foil or Teflon), and stored in a manner that reduces the potential for accidental contamination.
- Each sample cooler will contain sufficient ice or blue ice to maintain sample temperature at or below 4°C, but above 0°C. Each cooler will contain two coolant blanks (i.e., sample bottles filled with water and capped). Before shipment, or at occasions when the ice has

inadvertently been allowed to melt, the coolant blank will be opened and the temperature of its contents will be recorded. Laboratory personnel will repeat this procedure when the samples arrive at the laboratory. The corrective action to be conducted should the coolant blank temperature exceed 4°C is discussed in Section 14.

- Drilling rig(s) and tools will be thoroughly cleaned and decontaminated before initial use and after each borehole completion. Specific instructions for drill rig decontamination are presented in Section 5.6.
- Containers necessary for soil samples are described in Attachment 2.

5.2.1 Volatile Organics

Sediments collected for analysis by USEPA Method 8240 at Sites 2, 5, 6, 7, and 8, will be placed in two 40-mL vials and will be filled as full as possible. The Teflon liner and lid will be replaced and the vials put in the cooler. All samples will be kept at 4°C. All volatile analysis portions will be collected independently of the extractable and inorganic portions.

Soil samples obtained from the eight sites investigated at the Toledo ANGB will be collected at specific intervals using a lined sampler. The sample portion to be analyzed for volatile organics will be collected in a sample liner. Teflon inserts and plastic caps will be attached to each end of the liner and secured with waterproof tape. The sample label will be placed directly onto the outside of this container.

5.2.2 Extractable Organics

Samples collected at FTAs 1 and 2, the POL Storage Area, and the Eastern and Western Drainage Areas, to be analyzed by SW 3550/8270 (semivolatile organic compounds); and at all FTA sites, the POL Storage Area, and the Eastern and Western Drainage Areas to be analyzed by SW 3550/E 418.1 (petroleum hydrocarbon) analysis will be placed in a 16-ounce, wide-mouth jar and filled as full as possible. The Teflon-lined lid will be replaced and the jar put in the cooler. Each sample will be thoroughly mixed on a Teflon board before being containerized. All samples will be kept at 4°C. Sample portions for all extractable analyses from one discrete sampling location may be combined in one jar, if collected at the same time.

5.2.3 Priority Pollutant Metals

Soil samples collected at FTAs 1 and 2, the POL Storage Area, and the Eastern and Western Drainage Areas to be analyzed for priority pollutant metals, will be placed in a 16-ounce, wide-mouth jar and filled as full as possible. The Teflon -lined lid will be replaced and the jar put in the cooler. Each sample will be thoroughly mixed on a Teflon board before being containerized. All samples will be kept at 4°C. Sample portions for all metals and general chemical analyses from one discrete sampling point may be combined in one container, if collected at the same time.

5.3 Water

The following is a listing of the procedures that will be followed when collecting water samples or preparing field QC blanks.

- The procedures listed above for the transference of soil also will be observed here, except that sample preservation may be required before filling sample containers destined for certain types of analyses
- Containers and preservation techniques necessary for water samples are described in Attachment 1
- Nylon line or stainless steel wire used for lowering sampling equipment into the well will be dedicated for each well
- Water-level probes will be decontaminated before use in each well with laboratory-grade detergent wash and potable water rinse, as described in Section 5.6
- Precautionary steps for decontaminated tool storage also are adopted from the section on procedures for soils sampling.

5.3.1 Volatile Organic Compounds

The following is a description of the procedure that will be followed when preparing field QC blank samples for analyses of volatile organic compounds (VOCs) at the Toledo ANGB.

Sample containers will not be pre-rinsed with sample nor overfilled. For each environmental sample collected for VOC analysis by USEPA Method 8240, two 40-mL volatile organic analysis (VOA) vials will be filled with sample until the meniscus bulges over the rim of the vial. For each QC blank sample

prepared for this analysis, two 40-mL VOA vials will be filled as full as possible with ASTM Type II reagent water. The cap liner will be slid across the rim of the vial Teflon -side down and the plastic cap will be replaced. Two additional 40-mL VOA vials will be preserved with sufficient hydrochloric acid to lower the pH of the sample to 2 or below (about 4 drops). This preservation technique will be noted on the sample label and chain-of-custody form. For each environmental sample collected and each QC blank prepared for VOC analysis by USEPA Method 502.2 (ethylene dibromide), three 40-mL VOA vials will be filled with sample or ASTM Type II water until the meniscus rises above the rim of the vial. The cap liner will be carefully placed on the top of the vial Teflon -side down before the plastic cap is tightened securely. To ensure the vials contain no headspace, the vials will be inverted to check for bubbles. The vials will be placed in the cooler and kept at 4°C.

5.3.2 Extractable Organics

Semivolatile Organic Compounds (SW 3510/8270)-- The following is a description of the procedure that will be followed when preparing environmental and field QC blank samples for semivolatile organic analyses.

Sample containers will not be pre-rinsed nor overfilled. For each discrete environmental sample collected or field QC blank prepared, one 1.0-gallon glass container will be filled to the top with sample or reagent-grade water, and the Teflon -lined cap will be replaced. The container will be placed in the cooler and kept at 4°C.

Petroleum Hydrocarbons (E 418.1)--The following is a description of the procedure that will be followed when preparing environmental and field QC blank samples for petroleum hydrocarbon analyses.

Sample containers will not be pre-rinsed nor overfilled. For each discrete environmental sample collected or field QC blank prepared, one 1.0-liter (L) glass container will be filled with sample or ASTM Type II reagent water, and approximately 15 mL of sulfuric acid will be added as a preservative before replacing the Teflon -lined plastic cap. This presentation will be noted on the sample label and chain-of-custody form. The container will be placed in the cooler and kept at 4°C.

5.3.3 Metals Analyses

Priority Pollutant Metals--The following is a description of the procedure that will be followed when preparing environmental and field QC blank samples for priority pollutant metals analyses at the Toledo ANGB.

Sample containers will not be pre-rinsed with sample nor overfilled. Before preparation, approximately 2 mL of 1:1 nitric acid will be added to each sample container. This preservation technique will be so noted on the sample label and chain-of-custody form. For each discrete sampling location or field QC blank prepared, one 250-mL plastic bottle will be filled with sample or reagent-grade water before replacing the plastic cap. The turbidity of each environmental sample will be noted at this time. The bottle will be placed in the cooler and kept at 4°C.

Common Cations--The following is a description of the procedure that will be followed when preparing environmental samples and field QC blanks for common cations (calcium, magnesium, sodium, potassium, iron, and manganese) by USEPA Method 3010/6010.

Sample containers will not be pre-rinsed with sample nor overfilled. Before preparation, approximately 2 mL of 1:1 nitric acid will be added to each sample container. This preservation technique will be so noted on the sample label and chain-of-custody form. For each discrete sampling location or field QC blank prepared, one 250-mL plastic bottle will be filled with sample or reagent-grade water before replacing the plastic cap. The turbidity of each environmental sample will be noted at this time. The bottle will be placed in the cooler and kept at 4°C.

5.3.4 Total Hydrocarbons as JP-4

For water and soil samples collected at the POL Storage Area for analysis by USEPA Methods 8240 and 8270, one 40-mL VOA vial of pure JP-4 (jet fuel) will be obtained for volatile and extractable hydrocarbon characterization. SAIC will require assistance from Toledo ANGB in collecting the JP-4 sample.

5.3.5 General Chemical Analyses

Total Dissolved Solids--the following is a brief description of the procedure that will be followed when collecting water samples or preparing field QC blanks for total dissolved solids analyses (USEPA Method 160.1) at Toledo ANGB.

Sample containers will not be pre-rinsed with sample nor overfilled. For each discrete sampling location, one 250-mL plastic bottle will be filled with sample or reagent-grade water before replacing the plastic top. The bottle will be placed in the cooler and kept at 4°C.

Common Anions--The following is a description of the procedure that will be followed when collecting water samples or preparing field QC blanks for common anions (i.e., chloride and sulfate) analyses (Standard Methods 429) at Toledo ANGB.

Sample containers will not be pre-rinsed with sample nor overfilled. For each discrete sampling location, one 250-mL plastic bottle will be filled with sample or reagent-grade water before replacing the plastic top. The bottle will be placed in the cooler and kept at 4°C.

Nitrate-Nitrite--The following is a description of the procedure that will be followed when collecting water samples or preparing field QC blanks for nitrate-nitrite analysis by USEPA Method 353.1.

Sample containers will not be pre-rinsed with sample nor overfilled. For each discrete sampling location, one 250-mL plastic bottle will be filled with sample or reagent-grade water before replacing the plastic top. The bottle will be placed in the cooler and kept at 4°C.

Hardness--The following is a description of the procedure that will be followed when collecting water samples or preparing field QC blanks for hardness analyses (USEPA Method 130.1) at Toledo ANGB.

Sample containers will not be pre-rinsed with sample nor overfilled. Before sampling, approximately 1.0 mL of 1:1 nitric acid (50 percent concentrated HNO_3) will be added to each container. This treatment will be noted on the sample label and chain-of-custody. For each discrete sampling location, one 250-mL plastic bottle will be filled with sample or reagent-grade water before replacing the plastic top. The bottle will be placed in the cooler and kept at 4°C.

Total Suspended Solids and pH--The following is a description of the procedure that will be followed when collecting water samples or preparing field QC blanks for total suspended solids (USEPA Method 160.1) and pH at Toledo ANGB.

Sample containers will not be pre-rinsed with sample nor overfilled. For each discrete sampling location, one 250 mL plastic bottle will be filled with sample or ASTM Type II reagent water before replacing the plastic top. The bottle will be placed in the cooler and kept at 4°C.

5.4 REPLICATE SOIL SAMPLING PROCEDURES

Replicate soil samples will be collected as a means of assessing the precision of the sampling effort at Toledo ANGB. One replicate sample will be taken per 10 sampling locations, or 1 replicate sample per site or zone, if that site or zone contains less than 10 sampling locations. Field replicates do not release the laboratory from its own QC requirements for duplicate analyses. Samples to be analyzed for VOCs will be collected using a 3-inch, split-spoon sampler equipped with sample inserts. The sample portion for analysis of VOCs will be collected in a 2 and 1/2 -inch brass liner and inserted in series in the split-spoon to minimize loss of analyte through volatilization. Three sleeves will be used to collect soil samples at each depth. Each sleeve will be labeled "A," "B," or "C." Two of the sleeves will be designated as the replicates by the Site Manager, as required. Once the sampler is retrieved from the borehole, a Teflon liner and plastic cap will be placed on each end of the liner and secured in place with waterproof tape.

For sediment samples to be collected at the Eastern and Western Drainage Areas, the volatile portion will be collected first to minimize compound volatilization. Spatulas will be used to transfer the exposed sampling area directly into the 40-mL vials. Replicate samples will be collected at the same time using the same techniques.

After the samples for volatiles analysis have been collected, an empty split-spoon sampler will be driven again and the Supervisory Geologist will use these contents to describe the sample. Once the description has been recorded, the remaining sample will be mixed on a Teflon board and evenly subdivided between the remaining sample containers. The mixing will minimize the heterogeneity of the soil samples and provide a more representative replicate sample. The mixing will be used only for samples to be analyzed for inorganic and nonvolatile constituents.

After collection, all brass sleeves and sample bottles will be properly labeled and stored onsite in an ice chest at 4°C until they are packed and shipped via overnight delivery to the laboratory for analysis.

5.5 REPLICATE WATER SAMPLING PROCEDURES

Replicate water samples will be collected as a means of assessing the precision of the sampling effort at Toledo ANGB. One replicate will be taken for every 10 wells sampled, or one replicate sample per site or zone, if that site or zone contains less than 10 ten wells. Replicate samples will be coded in a manner to prevent laboratory personnel from recognizing them as QC samples. For the purposes of this project, water samples will be designated as replicates, even though several bailer volumes may be needed to fill the sample containers. Field replicates do not release the laboratory from its own QC requirements for duplicate analyses. The procedures for collecting and containerizing field replicate water samples are described below.

The volatile fraction will be collected first to minimize loss of analyte through volatilization. The first bailer volume will be used to fill the sample vials. The next bailer volume will be used to fill the replicate

sample vials. Sample collection, preservation, and containerization procedures will follow those described in Section 5.3.1 and Attachment 1. After the volatile fractions have been collected, the sample volumes necessary for the remaining analyses will be collected in the manner described above. Sample collection, preservation, and containerization procedures will follow those described in Section 5.3 and Attachment 1 for the applicable analysis. After collection, all sample bottles will be labeled properly and stored onsite at 4°C until they are packed and shipped via overnight delivery to the laboratory for analyses. Proper labeling procedures are presented in Section 6.1.1.

5.6 PREPARATION OF SAMPLE BATCH FOR SHIPMENT

The following is a description of the procedure that will be followed when transporting environmental samples from Toledo ANGB to the laboratory.

- The outer surface of all sample containers will be cleaned with potable water and paper towels.
- Sample collection points, depth increments, and sampling devices will be identified and documented.
- Logbook entries, sample tags, chain-of-custody forms, and field record sheets with sample identification points, date, time, and names or initials of all persons handling the sample in the field will be completed.
- Custody tape will be wrapped around the cap and neck of each sample container.
- Environmental samples and field QC blanks will be placed into a sample cooler along with ice packs and coolant blanks and the final cooler temperature will be recorded. After a cooler is filled, the appropriate chain-of-custody form will be placed inside the cooler and the outer surface of the cooler will be cleaned.
- Custody tape will be attached in two separate locations on the outside of each cooler.

5.7 DECONTAMINATION PROCEDURES

Before the commencement of sampling activities, between wells, and after sampling activities have been completed, all well sampling equipment will be decontaminated. The bailer, and any other small pieces of sampling equipment,

will be scrubbed with laboratory-grade detergent (e.g., Liqui-Nox®, Alconox®) and rinsed with potable water, ASTM Type II reagent water, and pesticide-grade methanol and hexane, in that order. The bailer will be allowed to air dry before lowering it into the well. The HNu probe will be inserted in and around the decontaminated equipment to determine whether the solvent has evaporated completely. The line used to lower the bailer into the well will be replaced between wells. Water level monitoring devices and measuring tapes will be scrubbed with laboratory-grade detergent and rinsed with potable water. A field blank will be prepared at the beginning of the soil sampling event and groundwater sampling event from the ASTM Type II reagent water used in the decontamination process to assess any cross-contamination that may potentially be introduced from this solvent.

Split-spoon samplers will be completely disassembled and decontaminated between sample intervals with a laboratory-grade detergent (e.g., Liqui-Nox®, Alconox®), potable water, rinsed with ASTM Type II reagent water, rinsed with pesticide-grade methanol and hexane, and allowed to air dry. This procedure will minimize any potential cross-contamination between samples. Field personnel are strongly cautioned to allow ample time for the hexane to evaporate completely. The hydrocarbon mixture that makes up pesticide-grade hexane will interfere with the gas chromatography/mass spectrometry (GC/MS) analysis of volatiles if the solvent is not completely evaporated before the equipment is used. The HNu will be used to determine the degree of solvent evaporation and whether the sampling equipment is ready to be re-assembled.

Drilling equipment (e.g., rods, bits, and tools) will be decontaminated at the designated decontamination area with a steam cleaner and laboratory-grade detergent (e.g., Liqui-Nox®, Alconox®) between drilling locations. The decontamination area will be cleaned after each use. A field blank will be prepared at the beginning of the field program from the potable water used in the steam cleaning process to assess any cross-contamination that may potentially be introduced from this solvent.

Equipment used to dispense ASTM Type II reagent water, methanol, and hexane will be constructed of glass and Teflon®. Plastic dispensing devices are prohibited.

All sample containers will be provided by the laboratory. The containers provided will be those described in 40 CFR 136 and cleaned in accordance with EPA protocols. Preparation certification and lot numbers will accompany all sample containers shipped to Toledo ANGB from the laboratory. The types of containers provided for the analytes of interest are listed in Attachments 1 and 2 along with the holding times and preservatives required for each analysis.

6. SAMPLE CUSTODY

A critical aspect of sound sample collection and analysis protocols is the maintenance of strict chain-of-custody procedures. Chain-of-custody procedures include inventorying and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if the sample is: 1) in the physical possession or view of the responsible party, 2) secured to prevent tampering, or 3) placed in the restricted area by the responsible party. The Supervisory Geologist is responsible for the custody of the collected samples in the field until they have been properly transferred to the Site Manager, who is responsible for sample custody until the samples are properly packaged and documented and released to a courier or directly to the laboratory.

6.1 CHAIN-OF-CUSTODY

6.1.1 Sample Labels

A label will be attached to all sample containers at the time of collection. An example of the sample label is presented in Figure 1. The label will be completed in indelible ink and contain the following information:

- Date and time collected
- Purpose of the sample (analyte and sample group)
- Sample number
- Source and location of the sample
- Project number and title of project

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 8400 Westpark Drive, McLean, Virginia 22102	
<u>Location</u>	<u>Project No. :</u>
<u>Sample Date/Time:</u>	
<u>Sample No. :</u>	<u>Sample Location:</u>
<u>Analysis:</u>	
<u>Collection Method:</u>	
<u>Purge Volume:</u>	
<u>Preservative:</u>	
<u>Comments:</u>	
<u>Collector's Initials:</u>	

FIGURE 1. SAMPLE LABEL

- Method of collection (bailer, suction pump, split-spoon, air-lift pump, etc.)
- Purge volume removed before sample collected (well samples only)
- Preservative used (if any)
- Name or initials of collector.

6.1.2 Chain-of-Custody Record

Chain-of-custody forms will be used to document the integrity of all samples. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, a chain-of-custody form will be filled out for each sample set at each sampling location. The chain-of-custody form will contain the following information:

- Sample number (for each sample in shipment)
- Collection date (for each sample in shipment)
- Time shipment was packed
- Number of containers of each sample (for each sample in shipment)
- Sample description (environmental medium)
- Analyses required for each sample
- Preservative added, if any (for each sample in shipment)
- Shipment number
- Shipping address of the laboratory
- Date, time, and method of shipment
- Container lot numbers, if applicable
- Spaces to be signed as custody is transferred between individuals
- Airbill number
- Temperature of coolant blank upon arrival at laboratory.

The Site Manager who is shipping samples from the field to the laboratory is also responsible for completing the chain-of-custody form, including referencing all blank samples to the applicable site or zone, signing the form, and noting the date and time of shipment. This individual also will inspect the form for completeness and accuracy. Any corrections to the chain-of-custody form entries will be initialed by the person making the change. After the form has been inspected and has been determined to be

satisfactorily complete, the Site Manager or his designee will sign, date, and note the time of transferral on the form. The chain-of-custody form will be placed in a reclosable plastic bag and taped to the inside of the cooler lid after the Site Manager has detached his copy of the form. This copy will be appropriately filed and kept onsite for the duration of the SI. An example of the four-part SAIC chain-of-custody form is presented in Figure 2.

6.1.3 Transfer of Custody and Shipment

Samples will be accompanied by an approved chain-of-custody form. When the possession of samples is transferred, the individual relinquishing the samples and the individual receiving the samples will sign, date, and note the time of transferral on the chain-of-custody document. This record will represent the official documentation for all transferral of sample custody, until the samples have arrived at the laboratory.

Samples will be wrapped with plastic packing material and packed with crushed ice or blue ice into sturdy, thermally insulated coolers. Packaging and shipping procedures are discussed in detail in Section 6.3. Sealed coolers will be transported to an air shipping company for overnight delivery to the laboratory. The air bill number, written on the top of the chain-of-custody form, will serve as custody documentation while the cooler is in the possession of the courier. The chain-of-custody record will be available for the courier when required by the courier organization to maintain chain-of-custody protocols within their own organizations during their time of possession. In this situation, the chain-of-custody form will be attached to the outside of the shipping containers during transportation. In all other situations, the chain-of-custody form will be placed in a recloseable plastic bag and taped to the inside lid of the cooler.

If samples are to be split with another laboratory facility or governmental agency, a separate chain-of-custody record will be prepared for those samples. This chain-of-custody record will indicate with whom the samples have been split, and will be appropriately signed and dated with the time of transfer of split samples.

Chain of Custody Record

Date _____ Page _____ of _____

Shipment No. _____

Name _____ Address _____ Phone Number _____ Project Manager _____ Project Name _____ Job/P.O. No. _____ Sampler (Signature) _____ (Printed Name) _____				Laboratory Name _____ Address _____ Phone _____ Contact Name _____ OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS _____											
Requested Parameters				NO OF CONTAINERS											
Laboratory No. _____				Sample No. _____				Date _____				Time _____			
Relinquished by				Received by				Date _____				Time _____			
Signature _____				Signature _____				Signature _____				Signature _____			
Printed Name _____				Printed Name _____				Printed Name _____				Printed Name _____			
Company _____				Company _____				Company _____				Company _____			
Relinquished by				Received by				Date _____				Time _____			
Signature _____				Signature _____				Signature _____				Signature _____			
Printed Name _____				Printed Name _____				Printed Name _____				Printed Name _____			
Company _____				Company _____				Company _____				Company _____			

Shipment Method:

SAIC Location (circle)
 Washington, D.C.
 8400 Westpark Dr., McLean, VA 22102
 (703) 734-2500
 Oakridge
 800 Oakridge Trpk., Oakridge, TN 37830
 (615) 482-9031
 Paramus Drive
 One Paramus Drive, Paramus, NJ 07652
 (201) 666-0000
 Denver
 1826 Cole Boulevard, Suite 270, Golden, CO 80601
 (303) 231-9004
 Seattle
 134008 Northrup Way, S.W., Bellevue, WA 98005
 (206) 747-7859
 San Diego
 1224 Campus Point, Building 3, San Diego, CA 92161
 (619) 535-7436

Total Number of Containers:

Instructions
 1. Fill out form completely except for shaded areas (lab use only).
 2. Complete in ballpoint pen. Draw one line through errors and initial.
 3. Request analyses using EPA method method numbers only. Consult the project OAPP for instructions. Complete as shown.
 4. Reference all field QC samples to the applicable site or zone.
 5. Note all applicable preservatives.
 6. Group all sample containers and requested analyses from one sampling location together. Do not list individually.

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White: Laboratory Print: Project Manager Yellow: Project OAD Goldenrod: Field Sample Manager

FIGURE 2. CHAIN-OF-CUSTODY FORM

6.1.4 Laboratory Custody Procedures

The following subsections describe laboratory custody procedures associated with sample receipt, storage, preparation, analysis, and general security.

Sample Receipt--All samples will be received by the sample custodian, or, in the absence of the sample custodian, by the document control coordinator. All samples received will be considered hazardous; therefore, all shipping containers will be opened in an approved exhaust hood or in an approved, well-ventilated area. All personnel associated with sample receipt will be familiar with safety procedures for the handling of hazardous samples. The objective of the sample receipt procedure is to ensure that all pertinent information concerning the condition of the sample is recorded for eventual use in reporting, and is communicated to laboratory personnel where appropriate for proper sample handling, preparation, and analysis.

The sample custodian will compare the information on the chain-of-custody form with the information on the sample tags. The sample custodian will document both agreement and discrepancies between the forms and tags, and record the temperature of the coolant blank. If all samples recorded on the chain-of-custody record are received by the laboratory and no problems are observed with the shipment, the custodian will sign the record in the "received for laboratory by" box. If problems are noted, the custodian will sign the form and note problems in the remarks box or reference other forms that describe the problems in detail. If discrepancies are found (e.g., if the temperature of the coolant blank is above 4°C), they will be reported to the Project Manager immediately. After the form has been completely filled out, the yellow portion is returned to the Project Quality Assurance Officer (QAO).

After all pertinent comments have been added to the form, the sample custodian will detach the bottom two parts of the form and send them to the appropriate project officer. A photocopy of the original laboratory copy of the chain-of-custody form will be mailed with the final analytical results.

Sample Storage--When samples are in the custody of the laboratory, sample integrity will be maintained through the use of locked storage areas. Samples will remain in locked storage areas, except when actively involved in the analytical process. A sample request form will be used to inform the sample custodian of the need for samples for sample preparation and/or analysis. Removal of samples will be documented on the internal chain-of-custody form.

Samples to be analyzed for VOCs will be stored with a storage blank, separately from other sample types. Standards will not be stored with any samples.

Sample Tracking--Samples will remain in locked storage areas, except when actively involved in the analytical process. A sample request form, an example of which is shown in Figure 3, will be used to inform the sample custodian of the need for samples for preparation and/or analysis. The sample custodian will distribute the requested chain-of-custody samples to the appropriate analysts. An internal chain-of-custody form, an example of which is shown in Figure 4, will be signed by the individual to whom the samples are relinquished. The internal chain-of-custody form will be secured in the project file and maintained under lock by the sample custodian. All laboratory personnel receiving samples for analytical purposes will be responsible for the care and custody of the samples from the time each sample, or fraction thereof, is received until the sample is returned to the sample custodian or until disposal is documented. All subsets (e.g., extracts, digestates) of the sample shall be kept in locked storage, controlled by the appropriate laboratory section manager.

Record Keeping--Documentation in the laboratory will be initiated by the sample custodian, who receives samples, assigns laboratory numbers, and generates internal chain-of-custody forms. Each shipment of samples received will be given a unique batch number. A batch will consist of a number of samples carried through the entire analytical procedure, along with samples and standards. All work performed on a sample batch will be documented in the Sample Receiving Logbook, which is a compilation of computer-generated sample summary forms entered into the Laboratory Information Management System (LIMS) on a sample receipt basis. The summary forms are compiled on a monthly basis to document sample receipt information.

Sample Request Form

Project Name: _____ Date of Request: _____

Charge No. : _____ Requestor's Name: _____

Requestor Lab.: GC GC/MS TM INORG Process EM (Circle One)

Samples are Required for Analysis on (Date): _____

Parameters to be Analyzed: _____

Listing of Required Samples

SAIC ID	SAIC ID

FIGURE 3. SAMPLE REQUEST FORM

Storage/Requirements: _____ **/Location:** _____

Relinquished _____ Date/Time: _____ Received By: _____ Date/Time: _____
By: _____
Relinquished _____ Date/Time: _____ Received By: _____ Date/Time: _____
By: _____

FIGURE 4. LABORATORY CHAIN-OF-CUSTODY

Laboratory and Sample Security--Samples received at the laboratory will be considered to be physical evidence and will be handled according to procedural safeguards established by EPA. Because of the legal nature of the work, the laboratory will provide complete security for samples, analysis, and data.

To ensure complete security for samples during analyses procedures, analytical samples will always be in the custody of the individual technician assigned to do the task.

The following security measures will be employed:

- Doors to the laboratory will be kept closed at all times
- Only authorized personnel and visitors under escort will have access to the laboratory
- Outside exit doors (with the emergency bar) will be kept closed and locked at all times
- All laboratory personnel will be aware of the need to question and determine legitimacy of a stranger's presence in the laboratory
- Persons with deliveries will be escorted to the laboratory from the main reception area or from the loading dock
- All personnel will display identification badges at all times.

6.2 DOCUMENTATION

The following sections address the requirements for developing, recording, and documenting the conditions, progress, and data collected during the performance of the SI at Toledo ANGB. The purpose of these documents is to account for and specify, in detail, all activities related to the SI at Toledo ANGB.

The following guidelines will be followed in documenting all fieldwork. Documentation logbooks, sample tags/labels, custody records, and other data sheets will be recorded in permanent black ink. Errors will not be obliterated, but crossed out with a single line, dated, and initialed by the originator. All handwritten documents will be recorded in such a manner as to

be completely legible. None of the accountable serialized documents listed will be destroyed or discarded, even if the contents of these documents are illegible or contain inaccuracies that will require replacement. All voided entries will be maintained in a file that will be kept onsite and referenced in the site logbook.

The following forms are required and will be maintained onsite during the SI at the Toledo ANGB:

- Field equipment log
- Soil boring log with descriptive text
- Groundwater sampling form
- Monitoring well construction log with descriptive text
- Well development log
- Water/sediment sampling form
- Field change request form.

These forms are presented in an attachment to the Field Sampling Plan developed for this SI. Each space provided for sampling information will be completed. If some information is not available or not applicable to this SI, the space will be marked as "N/A." Blank spaces are not acceptable. All entries will be made in permanent black ink. All forms used will be recorded in the Site Logbook and kept at Toledo ANGB in a three-ring binder or equivalent in the same location as the Site Logbook.

6.2.1 Sample Identification

Most methods of analysis of environmental samples must be accomplished within a specific amount of time after the collection of the sample. Where required, these time frames ("holding times") are given in the method. Careful tracking of the analytical status of samples is required to ensure that these holding times are met.

Sample tracking will be accomplished in the field by assigning each sample a unique identification number as it is collected. This number will be traceable back to the day, time, site, and depth (where appropriate) of

collection. This number will be recorded on the sample label and chain-of-custody form, as well as in the field logbook. A master log of the identification numbers used will be maintained by the onsite Site Manager. All containers will be labeled before actual sampling. A general identification number will be used to identify such items as monitoring well location and sample interval. Each number or letter provides vital information pertaining to site identification, sample location, and sampling interval.

Sample tracking will be accomplished in the laboratory by assigning each sample a unique laboratory sample number when it is logged into the laboratory. The number will be traceable back to the field sample identification number. This unique sample number will be used to identify the sample during storage, analysis and data reduction, data validation, and reporting.

The following sample information is recorded into the computerized LIMS:

- Customer and project information
- Date of receipt
- Client identification
- Date sampled
- Matrix type
- Number of containers
- Analytical requirements
- Other pertinent information.

After the sample is logged-in, an internal chain-of-custody/tracking form will be generated. This internal chain-of-custody document requires that the sample be formally relinquished by one party and accepted by the other at each step of the analytical process. This document accompanies the sample through each step of the analytical process. When the analytical activities are complete, internal and external chain-of-custody documents will be completed and filed in the appropriate project file. Based on specific contract requirements, any remaining samples either will be archived in locked storage areas or properly disposed of.

In addition to the external and internal chain-of-custody documents, a computer-generated listing of the various parameters for sample analysis will be used to control sample flow and facilitate tracking within the laboratory. Each laboratory unit participating in the analyses will be given the list of parameters and will be responsible for maintaining sample integrity, fulfilling chain-of-custody requirements, scheduling sample flow, and tracking sample status.

All sample data will be entered into the LIMS in accordance with the established protocols for sample control chain-of-custody requirements.

6.2.2 Site Logbook

The site logbook is the master field investigation document and is required for the SI at Toledo ANGB. It is a bound book with hard cover and sequentially numbered pages. The primary purpose of this document is to contain, in one location, the actual field data or references to other field documents that contain a specific description of every activity that has occurred during the SI on any given day. The site logbook will contain any administrative occurrences, conditions, or activities that may have affected the fieldwork or data quality of any environmental samples for any given day or field task during the SI. The front of the logbook will list the project number and project name; the names of the subcontracting company performing the field investigation (e.g., drilling, soil gas surveys), the service client, and the contract under which the investigation is being conducted; and the dates of duration of the SI. The site logbook will be updated daily.

The site logbook will contain the following information as a minimum:

- Day, date, time entered onsite, temperature, weather conditions, and names and titles of personnel present onsite
- Names, titles, and organization of any visitors who entered the site during the day
- Chain-of-custody details, including traffic report, air bill, sample, chain-of-custody form, and sample label/tag numbers; types of samples; and laboratories to which samples were sent, etc.

- Arrival time of any subcontractors onsite, number of feet drilled, total feet of casing installed, screen lengths, number of samples per borehole, number of duplicate samples, number of split samples, laboratory to which split samples were sent, depth of pit or length of trench excavated, references to field logbook(s), or field forms that contain more specific field information for any of the above tasks
- Numbers of samples by matrix and any field tests that may have occurred during the day's events, including a reference to the field logbook or the field forms that contain more specific information on all sampling that has occurred
- Decontamination iterations, equipment decontaminated, and procedures utilized
- Specific comments relative to any problem areas that occurred during the day's activities, the final resolution, and the anticipated impact on the outcome of the field investigation or on data quality
- Instruments calibrated during the day, the individual who performed the calibration, and reference to the page number in the calibration log that provides more specific information on calibration procedures and results
- A record of telephone calls (incoming or outgoing) pertaining directly to the decision-making process of the field investigation, along with the outcome of each conversation, and a reference to the telephone log to obtain more specific information on the call.

The Site Manager will sign the bottom of each page.

6.2.3 Daily Logs

Daily logs will be kept during field activities by the Site Manager and each Supervisory Geologist at the site. These daily logs will be kept in a bound field notebook of water-resistant paper. All entries will be made legibly in indelible ink, signed, and dated. Information that will be recorded in the field notebook includes:

- Date, time, and place of sampling
- Applicable field QC samples
- Weather conditions at time of sampling, including ambient temperature and approximate wind direction and speed
- Data from field analyses (temperature, specific conductance, pH, and alkalinity of water samples, if applicable)

- Turbidity of water samples
- Data from physical tests (e.g., slug tests)
- Observations about site and samples (e.g., odors, appearance)
- Information about any activities, extraneous to sampling activities, that may affect the integrity of the samples (e.g., low-flying aircraft nearby, fossil-fueled motors being used nearby, painting operations being carried out upwind of sampling sites)
- Analyses, required sample treatment techniques, and solution preparation
- Coolant blank temperature readings.

6.2.4 Field Equipment Logbook

The Field Equipment Logbook (FEL) will document the proper use, maintenance, and calibration of all field testing equipment used during the SI at Toledo ANGB. Before using field equipment, the Site Manager will inspect and approve the use of the field testing equipment by initialing the appropriate form in this document. A calibration log sheet will be maintained for each instrument used during the SI and will be kept in the log. The following items shall be tracked in the FEL, as a minimum, during the SI:

- Equipment calibration status
- Equipment decontamination status
- Equipment nonconformance
- Equipment inspection and repair records.

The person using, maintaining, or calibrating field equipment shall document his/her actions in the FEL. Entries will contain the following information:

- Names and signature of person making entry
- Date of entry
- Name of equipment and its identifying number
- Decontamination status
- Nature of work conducted

- List of procedures used for calibration or maintenance
- Manufacturer, lot number, and expiration date of calibration standards
- Names of all persons conducting work
- Measurement results (acceptable or unacceptable).

Entries in the logbook will be signed and dated by the person(s) making the entry. Every page in the log will be signed and dated by the Site Manager.

6.2.5 Materials Certification Log

Documentation (or copies) concerning the quality of all materials used onsite will be retained onsite for the duration of the SI at Toledo ANGB. The following is a list of the materials certification documentation that will be kept as a minimum.

- Analysis of all decontamination rinse water (e.g., tap water, and ASTM Type II water)
- Sieve analysis of filter pack material
- Manufacturer and lot number for calibration standards
- Material certificates for all construction materials
- Certificates of analysis for materials used in decontamination
- Certificates of acceptable calibration for thermometers
- Certificates of cleaning or decontamination furnished by the equipment manufacturer (the certificate shall detail the cleaning procedure).

Material blanks are samples of the construction materials used in sampling equipment, such as monitoring wells and lysimeters, that are archived for future analysis. Material blanks are required for all the applicable construction materials used during the SI at the Toledo ANGB. The types of material that will be sampled are pipe, well screen, filter pack material, drilling additives, bentonite, and cement.

Dry measure materials (e.g., cement, bentonite, silica sand) will be sampled and labeled in the same manner described for the environmental and

field QC samples. Approximately 2 pounds of dry material is required per sample for analysis. Liquid materials such as drilling additives, paint, and lubricants, will require at least 1 L of sample for analysis. Rigid materials such as riser pipe and well screen require at least 2 feet of material per sample.

The archived samples will be stored in clean containers and protected from exposure for the duration of the SI. The HAZWRAP Project Manager will determine the length of time material blanks are to be stored after completion of the SI.

6.2.6 Corrections to Documentation and Variances

A variance is a deviation from project requirements. All variances from procedural and planning/design documents and other project requirements will be documented on the Field Change Request form. The HAZWRAP Project Manager for Toledo ANGB will approve field changes that have major impact on cost, schedule, and/or technical performance before incorporation. The requirements for documentation and the approval authority for field changes are presented in Table 2.14 of the HAZWRAP document Quality Control Requirements for Field Methods, February, 1989 (DOE/HWP-69).

Field changes and deviations from project planning documents will be reviewed and approved by the Project Manager, Field Operations Manager, or the Project QAO. All deviations from procedural and planning documents will be recorded in the site logbook. Project reports will detail all field changes and deviations.

When it becomes necessary to make corrections to any form of documentation (e.g., sample tags, chain-of-custody forms, daily logbooks), the obsolete information will be crossed out and the changes made and initialed by the person making the change.

6.2.7 Photographs

A photographic record may be made during the field program, documenting field activities (i.e., drilling, soil boring, well installation, and sample

collection). This photographic record may be used to highlight and enhance appropriate sections in the report resulting from these activities.

6.2.8 Disposition of Documentation

Upon conclusion of the field effort at Toledo ANGB, all field documentation (i.e., maps, well logs, logbooks, photographs) will be clearly labeled and placed in the project files.

6.3 SAMPLE PACKAGING AND SHIPPING

6.3.1 Sample Packaging

Samples will be packed according to the following procedures:

- Custody tape will be wrapped over the neck and cap of each container
- Glass sample containers will be wrapped with plastic insulating material to prevent contact with other sample containers or the inner walls of the cooler
- Samples will be classified according to the U.S. Department of Transportation (DOT) regulations pursuant to Title 49 CFR.

6.3.2 Shipping Containers

Samples will be packaged in thermally insulated, rigid coolers, according to DOT specifications 173.510 and 172 Subparts B, C, and D, and Subparts A and B of Part 173. Sample containers will be placed in the cooler, which will contain blue ice and absorbent packing for liquids or styrofoam packing for solids. The completed chain-of-custody form will be placed inside of the shipping container, unless otherwise noted. The cooler then will be sealed.

6.3.3 Marking and Labeling

The cooler will be marked as follows:

- Proper shipping name: Hazardous substance, liquid, or solid.
- Hazardous class: To be determined (label placed in upper left corner of outer container).
- Labels: "This Side Up" or arrows placed on the opposite side of the outer container if a liquid is to be shipped.

- Two strips of custody tape will be placed on each cooler, with at least one strip at the front and one at the back. Custody seals will be located in a manner that will indicate tampering, if any occurs.

A hazardous material shippers certification will be filled out and will accompany the shipment. The container will be secured with strapping tape to prevent leakage and accidental opening.

7. CALIBRATION PROCEDURES AND FREQUENCIES

This subsection describes the calibration procedures and frequencies for field equipment, including water level indicators, field water quality, and field air quality screening equipment, and laboratory instrumentation, including inorganic and organic analytical instrumentation.

7.1 FIELD EQUIPMENT

In general, all equipment will be calibrated at least daily, before use, and immediately recalibrated if field personnel suspect that the calibration may have been altered. Reasons for such alteration include change of batteries, equipment being dropped or knocked around, or significant changes in ambient temperature since the last calibration.

The MSA combustible gas indicator and HNu Photoionization Analyzer will be utilized for field personnel safety purposes and for screening potentially hazardous soil samples. The remaining field equipment (i.e., pH meters, conductivity meters, field alkalinity analyzers, and thermometers) will be used to evaluate water well stability during purging. Because the instrumentation and procedures are continually being updated, field personnel are required to consult the appropriate instruction manual for calibration instructions.

7.1.1 HNu Photoionization Analyzer

Calibration of this instrument will be conducted according to SAIC SOP No. 750. See Appendix A of the SI Work Plan.

7.1.2 MSA Combustible Gas Indicator

Calibration of this instrument will be conducted according to SAIC SOP No. 770. See Appendix A of the SI Work Plan.

7.1.3 Specific Conductance Meter

The following is a brief description of the calibration procedure for the Specific Conductance Meter.

- With the instrument turned off, check the meter's mechanical zero setting. Adjust the screwdriver adjustment control on the meter face if necessary to obtain a zero reading.
- Press the power switch to "on" and press the battery check switch. Verify that the meter needle deflects to the battery check area.
- Connect a clean, dry probe to the instrument. Remove the instrument from its carrying case and place it on a padded surface.
- Press the 0-2 range switch and verify that the meter reads zero. If it does not, adjust the null adjust potentiometer RB9 on the amplifier circuit board to obtain a reading as near to zero as possible.
- Press the 0-2000 range switch.
- Immerse the probe in the 1,000 mg/L sodium chloride solution. The meter should read 1990 $\mu\text{hos/cm}$. If it does not, adjust the standardization potentiometer R32.

7.1.4 pH Meter

The following is a brief description of the calibration procedure for a pH meter.

- Connect the two probes to the appropriate jacks on the instrument panel. Be sure the fill hole in the pH electrode is uncovered. The fill hole is to remain covered at all times, except for calibration and pH measurement. When the electrode is not in use, slide the rubber sleeve over the fill hole.
- Prepare pH 4 and pH 9 buffer solutions by dissolving the contents of one powder pillow of each in separate beakers containing 50 mL ASTM Type II reagent water.
- Select the T(c) mode and measure the temperature of each buffer solution. Referring to the temperature coefficients table (present in the manufacturer's instruction booklet), determine the actual pH values of the buffer solutions for those temperatures. Calculate the difference between the two pH values.

- Immerse the probes in the pH 4 buffer solution and select the pH mode. Allow approximately 30 seconds to reach equilibrium and adjust the CAL control to obtain 0.00 reading.
- Remove the probes from the pH 4 solution and rinse thoroughly with ASTM Type II reagent water.
- Immerse the probes in the pH 9 buffer solution. Allow approximately 30 seconds for the probes to reach equilibrium. Adjust the SPAN control for a reading equal to the pH difference calculated in Step 3.
- Adjust the CAL control for a reading equal to the actual pH value of the pH 9 buffer, as adjusted for temperature.
- Rinse the probes thoroughly with ASTM Type II reagent water.

7.1.5 Water Level Indicator

This instrument arrives calibrated by the manufacture for water level measurement.

7.1.6 Digital Thermometer

Before shipment to Toledo ANGB, each thermometer used during the SI will be calibrated against a standard thermometer traceable to the National Bureau of Standards (NBS). Certification of acceptable calibration will accompany each shipment of thermometers.

7.1.7 Field Alkalinity Analyzer

The following calibration check will be performed when interferences are suspected or to verify analytical technique:

- Snap the neck off an Alkalinity Voluette Ampule Standard (0.500 N).
- Use a Ten Sette Pipet to add 0.1 mL of standard to the sample already titrated. Resume titration back to the same end point. Record the number of digits needed.
- Repeat, using two or more additions of standard 0.1 mL each. Titrate to the end point after each position.
- Each 0.1 mL addition of standard should require 25 additional digits of 1.600 N titrant or 250 digits of 0.1600 N titrant.

7.2 LABORATORY INSTRUMENTATION

Calibration is the process of determining and adjusting instrumental response, relative to physical or chemical standards. It is a reproducible reference point to which all sample measurements can be correlated. Section 7.2.2 provides a description of the initial and continuing calibration procedures to be used for those instruments employed in the analysis of samples from the SI at Toledo ANGB.

7.2.1 Instrument Calibration

A step-by-step calibration procedure will be kept with each instrument. The methods and frequency of calibration for each instrument will be in accordance with the manufacturer's recommendation, or in accordance with the specifications of the analysis method, whichever is more frequent.

To ensure calibration of instruments with daily variances, a series of calibration samples will be analyzed before any samples are run. Calibration check standards will be analyzed according to analysis method specifications. The laboratory will satisfy all calibration requirements of USEPA Methods 8240 and 8270 before initiating any on-going data collection for the applicable analysis.

7.2.2 Initial and Continuing Calibration Procedures

Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Argon-Plasma Systems (ICAP)--Calibration standards will be prepared by diluting stock metal solutions at the time of analysis. Low calibration standards will be prepared fresh each time analysis is to be conducted, and discarded after use. A calibration blank and at least three calibration standards within the linear working range of the instrument will be prepared. The requirement for an acceptable initial calibration is a correlation coefficient equal to or greater than 0.995. The calibration blank will be prepared from the same type of acid used to prepare the samples. The calibration blank will be aspirated first followed by the standards, in order from the lowest to the highest concentration, and the absorbance response will be recorded. All continuing calibration results must agree with the initial calibration to within 10 percent. Initial calibration will be verified every 10 samples and at the end

of each analytical run, using a calibration blank and a single point check standard. When continuing calibration fails to meet these criteria, fresh solutions will be prepared and analyzed. If the continuing calibration fails to meet acceptance criteria, the initial calibration will be re-established with a new set of standards. All samples analyzed since the last acceptable continuing calibration run will be re-analyzed. This corrective action will be documented, following the procedures outlined in Section 14.2 of this document.

After the AA has been calibrated, the accuracy of the initial calibration will be verified and documented for each analyte by the analysis of QC solutions. The continuing calibration verification (CCV) standard will be analyzed for each analyte after the tenth sample, or every 2 hours, whichever is more frequent. The CCV standard also will be analyzed before the first sample and after the last sample in the analytical sequence. QC solutions will not be used to establish calibration for the instrument and, as far as possible, they will have a dissimilar origin to the calibration standards. In many cases, check standards provided by the USEPA will be used as QC solutions, with acceptance criteria as stated in the documentation received with the solution. Normally, acceptance criteria are set for these solutions by the USEPA, at the 95 percent confidence limits. All continuing calibration results must agree with the initial calibration to within the required specification for each type of instrumentation and each analysis type. If the verification fails to meet the required specification, then the analyses will be terminated, the problem corrected, the instrument recalibrated, and the previous 10 samples re-analyzed. Where the USEPA (or other agencies) do not provide check standards, these standards will be prepared by the laboratory at concentrations at or near the mid-range level of the calibration curve. The AA will be calibrated daily, and each time the instrument is set up.

In addition to calibration standards, an ICAP interference check sample will be analyzed at the beginning and end of each sample analysis run, or a minimum of twice per 8-hour working shift, whichever is more frequent. If an interference cannot be resolved successfully, the technique or method of standard additions technique will be used for both AAS and ICAP. Standards of the analytes to be determined will be added to the duplicate sample and the

concentration of the analyte(s) will be determined by difference. The parameters to be checked and the acceptance criteria to be followed for each parameter are discussed in Section 10.2.

Gas Chromatography/Mass Spectrometry (GC/MS)--The first step in the calibration of the GC/MS system is the demonstration of the ionization and fragmentation of standard mass spectral tuning compounds. This will be accomplished, as well as a sensitivity check, with the use of 4-bromofluorobenzene (BFB) and decafluorotriphenylphosphine (DFTPP) injected at a concentration near the instrument detection limit for Method 8240 and for Method 8270, respectively. These standards will be run at least daily or every 12 hours to validate that the GC/MS system is tuned correctly. The results of all tuning analyses will be attached to the applicable samples and placed in the pertinent project file.

Calibration of the GC/MS will be established and validated by the injection of USEPA-traceable standards at five concentrations spanning the range of anticipated sample concentrations. Following the initial calibration, system performance check compounds and calibration check compounds will be evaluated to verify the validity of the calibration. Tables 1 and 2 present calibration criteria for volatile and semivolatile analyses, respectively. The initial calibration curve will be used as long as it can be demonstrated to be valid. A method blank will be analyzed immediately after the calibration verification. Surrogate standards will be added to each sample before the sample is prepared for extraction (Method 8270) or instrumental analysis (Method 8240). Surrogate standard recovery will be used as a method for determining the presence of matrix interferences and as an indication of extraction or purging efficiency. In addition, internal standards will be added to extracts or samples just before instrumental analysis, as an indicator of variations in instrumental conditions. An internal calibration procedure will be used (i.e., in addition to surrogate recovery compounds), sample extracts will be spiked with internal standards that span the retention time range of the analytes of interest. The concentration of the analytes will be calculated with reference to the response factor (RF) of the internal standard for each sample.

TABLE 1. CALIBRATION VERIFICATION CRITERIA -
 VOLATILE ANALYSES (SW 8240)

Compound	Criteria	
	Minimum Acceptable Response Factor	Maximum Acceptable Percent Relative Standard Deviation
<u>System Performance Check Compound (SPCC)</u>		
Chloromethane	0.300	--
1,1-Dichloroethane	0.300	--
Bromoform	0.250	--
1,1,2,2-Tetrachlorethane	0.300	--
<u>Calibration Check Compounds (CCC)</u>		
1,1-Dichloroethene	--	30
Chloroform	--	30
1,2-Dichloropropane	--	30
Toluene	--	30
Ethylbenzene	--	30
Vinyl Chloride	--	30

TABLE 2. CALIBRATION VERIFICATION CRITERIA -
 SEMIVOLATILE ANALYSES (SW 8270)

Compound	Criteria	
	Minimum Acceptable Response Factor	Maximum Acceptable Percent Relative Standard Deviation
<u>System Performance Check Compound (SPCC)</u>		
N-nitroso-di-n-propylamine	0.050	--
Hexachlorocyclopentadiene	0.050	--
2,4-Dinitriphenol	0.050	--
4-Nitrophenol	0.050	--
<u>Calibration Check Compounds (CCC)</u>		
Acenaphthene	--	30
Benzo(a)pyrene	--	30
4,-Chloro-3-methylphenol	--	30
1,4-Dichlorobenzene	--	30
2,4-Dichlorophenol	--	30
Fluoranthene	--	30
Hexachlorobutadiene	--	30
2-Nitrophenol	--	30
N-nitroso-di-n-propylamine	--	30
Di-n-octylphthalate	--	30
Pentachlorophenol	--	30
Phenol	--	30
2,4,6-Trichlorophenol	--	30

Spectrophotometers (Infrared)--A polystyrene sample will be used to check instrument wavelength. Acceptance criteria will be as per manufacturer's specifications. Spectrophotometers will be calibrated daily before any samples are analyzed. The calibration standards will be prepared from reference materials, at five concentrations to cover the anticipated range of measurements, and will include a calibration blank. The requirement for an acceptable initial calibration is a correlation coefficient equal to or greater than 0.996. Before sample analysis, an initial calibration verification standard will be analyzed. The response of this standard must be within 15 percent of the initial calibration, or the instrument will be recalibrated.

General Laboratory Equipment--Balances will be calibrated before every use with standard Class-S calibration weights, and at least semi-annually by a licensed specialist. The pH/specific-ion meters will be calibrated before each use with a minimum of three standard buffer solutions (pH 4, 7, and 10). The automatic micro-pipettes will be checked and initially calibrated by using a combination of precalibrated (marked) pipette tips and by weighing the volume of deionized water dispensed from the pipettes. A minimum of 100 mL (+5 percent) of water will be collected for this determination and the mass of water will be determined from the density of water adjusted for temperature. Results will be documented and maintained with the sample results generated. Continuing calibration will be verified by monitoring standard curve variation during analyses.

Ion Chromatography (Standard Methods 429)--The ion chromatograph will be calibrated daily using five concentrations of a standard mixture containing chloride and sulfate to cover the anticipated range of measurements. The correlation coefficient equal to or greater than 0.996 will be acceptable. Calibration will be verified after entry and each 8-hour period using a standard prepared from a source different from that used to prepare the calibration solution. The response of this standard must be within 15 percent of the initial calibration, or the instrument will be recalibrated.

8. ANALYTICAL PROCEDURES

8.1 FIELD TESTING AND SCREENING

During multimedia sampling activities performed during the field effort at Toledo ANGB, selected physical and chemical parameters in the air, water, and soil at the site will be measured. Equipment and general procedures for analysis of field samples are listed below. Because field instrumentation and analytical methodology continually is being updated, field personnel are required to consult each manufacturer's instruction manual for operating procedures.

8.1.1 Air Monitoring Measurements

A portable photoionization analyzer will be used to continuously monitor ambient air conditions during drilling. Measurements will be made both upwind and downwind of the site; in the breathing zone above the borehole; and over fresh, returned cuttings from the borehole. In addition, soil and formation samples will be selected for air testing as an early warning device should contaminants be present. A soil sample will be placed in a clean glass jar, and the air sampling probe will be inserted to withdraw an air sample to be analyzed according to the procedures described below.

HNu Photoionization Analyzer--Turn the function switch to the battery check position. The needle on the meter should read within or above the green battery arc on the scale plate. If the needle is in the lower position of the battery arc, the instrument should be recharged before any measurements are made. If the red LED comes on, the battery should be recharged.

Turn the function switch to the ON position. In this position, the UV light source should be on. Quickly look into the end of the probe to see the purple glow of the lamp.

To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection, while counterclockwise rotation yields a downscale deflection. No zero gas is

needed, since this is an electronic adjustment. If the span adjustment setting is changed after the zero is set, the zero should be rechecked and adjusted, if necessary. Wait 15 or 20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.

The instrument is now ready for measurement by switching the function switch to the proper measurement range. The instrument is supplied calibrated to read directly in parts per million (ppm, v/v), at ranges of 0-20, 0-200, and 0-2,000 ppm of benzene, with the span position set at 9.8. For additional sensitivity, the span potentiometer is turned counterclockwise (smaller numbers) to increase the gain. By changing the span setting from 10.0 to 1.0, the sensitivity is increased approximately ten-fold. Then, the 0-20, 0-200, and 0-2,000 ppm scales become 0.2, 0-20, and 0-200 ppm full-scale, respectively. This span control also is used to make the instrument scale read directly in ppm of the compound being measured. That is, it is adjusted to match the value of the calibration gas to that same reading on the instrument scale. The span control can be used to calibrate the meter to measure nearly any compound that can be measured by photoionization. For example, gain settings of 4.5 and 8.9 will provide direct reading capability (0-20, 0-200 ppm) for vinyl chloride and trichloroethylene, respectively.

A small DC operated fan is used to pull air through the photoionization sensor at a flow rate of 3 to 700 centimeters per minute (about 0.5 liters per minute). The fan provides nearly instantaneous response times, while consuming little power. The fan cannot tolerate a significant pressure drop without affecting the flow rate, and therefore affecting either the instrument reading or response time. Since photoionization is an essentially nondestructive process, changes in flow rate do not affect the signal, but if a large pressure drop is imposed at the inlet of the probe, the sample may not reach the sensor.

MSA Combustible Gas Indicator--Open the instrument lid and turn the center ON-OFF control to the HORN OFF position. Both meter pointers will move and one or both alarms may light.

The percent LEL meter pointer should be set to zero by adjusting the zero LEL control. To prevent accidental activation of the meter latch circuit, adjustment should be made within 10 seconds after the instrument is turned on.

If the percent oxygen meter pointer stabilizes at a value other than 20.8 percent, the pointer should be set to 20.8 percent by using the CALIBRATE O₂ control.

Press the ALARM RESET button; the alarm(s) should reset, and the green pilot light should flash.

Place a finger over the sample inlet fitting or the end of the sample line probe. Observe that the flow indicator float drops out of sight, indicating no flow.

Press the CHECK button and observe the percent LEL meter. The pointer must read 80 percent LEL or higher, as marked by the BATTERY zone on the meter. If the pointer reading is less, the battery pack must be recharged; no tests should be attempted, as the instrument will malfunction.

Turn the ON-OFF control to the ON position. The pilot lamp should light continuously.

Accessory equipment such as sampling lines, probes, carrying harness, filters, or line traps should be attached as required. Tighten all connections and test for flow indication by blocking flow at the far end of the sampling system. If the flow indicator float does not drop, check all connections and retest. The instrument is now ready for atmospheric sampling.

8.1.2 Measurements for pH

Measurements for pH will be made on water purged from wells before sample collection. The pH meter will be properly calibrated before measurements are made. Calibration procedures are given in Section 7.1.4. Groundwater samples will be collected after a stable pH is achieved to ensure that conditions are representative of the formation. Measurements also will be

taken on surface water samples. A Hach Model 19000 Digital pH meter, or equivalent, will be used for field analyses, using the procedure described below.

Rinse the probes thoroughly with ASTM Type II reagent water to prevent cross-contamination. Be sure the pH electrode fill hole is uncovered, and the mode switch is set to pH. Immerse the probes in the test sample and take the reading. Allow 30 seconds for the reading to stabilize. After pH measurements are conducted, slide the rubber sleeve over the fill hole.

8.1.3 Specific Conductance

Conductivity measurements will be taken on purge water and all groundwater and surface water samples using a Hach Model 16300 portable conductivity meter, according to the procedure described below.

Connect the probe to PROBE INPUT connector on the front panel. Press the POWER switch and perform a battery check. Press the switch for the highest range and immerse the probe in a beaker containing the sample solution. Shake or tap the probe on the bottom of the beaker to ensure that no air bubbles are trapped near the electrode. Allow about 10 seconds for the probe to stabilize before taking the reading. If the meter indicator falls in the lowest 10 percent of the range, switch to the next lower range. Repeat until the proper range is selected. Dilute the sample if necessary. Rinse the probe with ASTM Type II water between each use.

8.1.4 Temperature

Temperature data will be used in conjunction with the chemical data for groundwater and surface water characterization. Temperature measurements will be taken on purge water and all groundwater and surface water samples using a mercury thermometer or the conductivity meter, which is equipped to measure temperature, according to the procedure described below.

Connect the temperature probe and select the T(c) mode. Immerse the probe in the test sample and allow 30 seconds for equilibration. Take the reading. Rinse the probe with ASTM Type II reagent water after each use.

8.1.5 Alkalinity Measurements

A water sample is titrated with sulfuric acid to a colorimetric endpoint, corresponding to a specific pH. Phenolphthalein alkalinity is determined by titration to pH 8.3, as evidenced by the color change of the phenolphthalein indicator, and indicates the total hydroxide and one half the carbonate present. Total alkalinity is determined by titration to a pH between 3.7 and 5.1, and includes all carbonate, bicarbonate, and hydroxide. The procedure for determining alkalinity is described below:

TABLE 3. SAMPLE VOLUME SELECTION GUIDE

Range (mg/L as CaCO ₃)	Sample Volume (mL)	Titration Cartridge (H ₂ SO ₄)	Digit Multiplier
10-40	100	0.1600 N	0.1
40-160	250	0.1600 N	0.4
100-400	100	1.600 N	1.0
200-800	50	1.600 N	2.0
500-2000	20	1.600 N	5.0
1000-4000	10	1.600 N	10.0

- Collect samples in clean polyethylene or glass bottles. Fill completely and cap tightly. Avoid excess agitation or prolonged exposure to air. Samples should be analyzed as soon as possible after collection, but can be stored 24 hours by cooling to 4°C. Warm to room temperature before analyzing.
- Select the sample volume and sulfuric acid titration cartridge that correspond to the expected alkalinity concentrations as mg/L calcium carbonate, from Table 3.
- Insert a clean delivery tube into the titrator cartridge. Attach the cartridge to the titrator body.
- Turn the delivery knob to eject a few drops of titrant. Reset the counter to zero and wipe the tip.
- Use a graduated cylinder, or pipet, to measure the sample volume selected from Table 3. Transfer the sample into a 25 mL erlenmeyer flask. Dilute to 100 mL with ASTM Type II reagent water, if necessary.

- Add the contents of one phenolphthalein indicator powder pillow and swirl to mix. A solution of one pH 8.3 buffer powder pillow and one phenolphthalein powder pillow in 50 mL of ASTM Type II reagent water is recommended as a comparison for determining the proper endpoint color.
- Titrate to a colorless endpoint if the color turns pink. Place the delivery tube tip into the solution and swirl the flask while titrating with sulfuric acid. Record the number of digits required. Phenolphthalein alkalinity calculation: Digits required x Digit Multiplier (from Table 3) = mg/L Phenolphthalein alkalinity (as CaCO_3).

TABLE 3a. SAMPLE COMPOSITION

Sample Composition	Endpoint
Alkalinity about 30 mg/L	pH 5.1
Alkalinity about 150 mg/L	pH 4.8
Alkalinity about 500 mg/L	pH 4.5
Silicates or phosphates present	pH 4.5
Industrial waste or complex system	pH 3.7

- Add the contents of one Bromocresol Green-Methyl Red indicator powder pillow to the flask and swirl to mix. A solution of one Bromocresol Green-Methyl Red powder pillow and one pillow of the appropriate pH buffer in 50 mL deionized water is recommended as a comparison for judging the proper endpoint color.
- Continue the titration with sulfuric acid to a light greenish blue-gray (pH 5.1), a light violet-gray (pH 4.8) or a light pink (pH 4.5) color, as required by the sample composition (Table 3a). Record the number of digits required. Total alkalinity calculation: Digits required x Digit Multiplier = Total Alkalinity (as mg/L CaCO_3).
- Carbonate, bicarbonate, and hydroxide concentrations may be expressed individually using the relationships in Table 3b.

8.2 LABORATORY METHODS

The laboratory employs analytical procedures based on the EPA-approved samples. methods to be used for the inorganic and organic analysis of routine

TABLE 3b. ALKALINITY RELATIONSHIP TABLE

Result of Titration	Hydroxide Alkalinity	Carbonate Alkalinity	Biocarbonate Alkalinity
Phenolphthalein Alkalinity = 0	0	0	Equal to total
Phenolphthalein alkalinity less than one half of total alkalinity	0	2 times the phenolphthalein alkalinity	Total alkalinity minus 2 times phenolphthalein alkalinity
Phenolphthalein alkalinity equal to one half of total alkalinity	0	2 times the phenolphthalein alkalinity	0
Phenolphthalein alkalinity greater than one half of total alkalinity	2 times the phenolphthalein alkalinity minus the total alkalinity	2 times the difference between the total and phenolphthalein alkalinity	0
Phenolphthalein alkalinity equal to the total alkalinity	Equal to the total alkalinity	0	0

samples are based on the following references: 40 CFR Part 136 as published in the Federal Register dated Friday, October 26, 1984; EPA's publications Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846, 3rd Edition); Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water (June 1985, revised November 1985); and Methods for Chemical Analyses of Water and Wastes (600/4-79-020, USEPA 1983, with additions); and the American Public Health Association's publication Standard Methods for the Examination of Water and Wastewater (16th Edition). Methods to be used for analysis for soil and water samples collected during the SI at Toledo ANGB are listed in Tables 4 and 5, respectively.

All work completed on a sample set will be recorded in the following laboratory notebooks:

- Standards Logbook: The preparation and use of all standards in the laboratory will be recorded. Standard traceability of EPA or NBS standards will be indicated. Date of preparation, concentration, and name of the preparer will be noted.
- Chemist's Notebook: The raw data and final data of every batch will be recorded. All activities associated with the analytical process will be documented. Laboratory notebooks of each staff member are a functional record and will be pre-numbered.
- Instrument Benchsheet Logbook: Sample run sequence or injections done in a day's or shift's run will be recorded, noting all instrument working parameters.

9. DATA REDUCTION, VALIDATION, AND REPORTING

9.1 FIELD AND TECHNICAL DATA

The collected data will be divided into field data and technical documentation. Technical documentation will enable definitive characterization of the extent and magnitude of specific contaminants at each site. Field data will contain data from all measurements performed onsite, including well stability measurements, well logging, water level measurements, soil gas readings, and PID measurements. Technical data will include all field and analytical data, plus the results of the field and laboratory QC samples, and will be incorporated into the final report.

TABLE 4. ANALYTICAL METHODS, DETECTION LIMITS, AND TOTAL NUMBER OF SOIL/SEDIMENT ANALYSES

Parameter	Analytical Method ^a	Detection Limit ^b	Reporting Units ^c	Number of Analyses	Trip Blanks ^g	Field Blanks ^h	Equipment Blanks ⁱ	Replicates	Total Analyses
Petroleum Hydrocarbons	SW 3550/ E 418.1	50	mg/Kg	82/11	--	2	28/3	8/1	120/15
Priority Pollutant Metal Screen	SW 3050/ 6010	^d	mg/Kg	82/11	--	2	28/3	8/1	120/15
Arsenic	SW 3050/ 7060	0.5	mg/Kg	82/11	--	2	28/3	8/1	120/15
Antimony	SW 3005/ 7041	2.5	mg/Kg	82/11	--	2	28/3	8/1	120/15
Lead	SW 3050/ 7421	5.0	mg/Kg	82/11	--	2	28/3	8/1	120/15
Mercury	SW 7471	0.1	mg/Kg	82/11	--	2	28/3	8/1	120/15
Selenium	SW 3050/ 7740	0.5	mg/Kg	82/11	--	2	28/3	8/1	120/15
Thallium	SW 3050/ 7841	0.5	mg/Kg	82/11	--	2	28/3	8/1	120/15
Volatile Organic Compounds	SW 8240	^e	mg/Kg	82/11	28/3	2	28/3	8/1	146/18

(Continued)

TABLE 4. ANALYTICAL METHODS, DETECTION LIMITS, AND TOTAL NUMBER OF SOIL/SEDIMENT ANALYSES (Continued)

Parameter	Analytical Method ^a	Detection Limit ^b	Reporting Units ^c	Number of Analyses	Trip Blanks ^g	Field Blanks ^h	Equip-ment Blanks ⁱ	Total Replicates	Analyses
Semivolatile Organic Compounds	SW 3550/8270	•	mg/Kg	38/10	--	2	28/3	4/1	82/14
Ethylene Dibromide	SW 5030/E 502.2	0.5	mg/Kg	38/3	--	2	28/3	4/1	72/7
Soil Moisture Content	SW 846	--	Percent	82/11	--	--	--	--	82/11

TABLE 5. ANALYTICAL METHODS, DETECTION LIMITS, AND TOTAL NUMBER OF GROUNDWATER/SURFACE WATER ANALYSES

Parameter	Analytical Method ^a	Detection Limit ^b	Reporting Units ^c	Number of Analyses	Trip Blanks ^g	Field Blanks ^h	Equipment Blanks ⁱ	Replicates	Total Analyses
Petroleum Hydrocarbons	E 418.1	1.0	mg/L	10/11	--	2	3/3	1/1	16/15
Priority Pollutant Metal Screen	SW 3005/6010	^d	mg/L	10/11	--	2	3/3	1/1	16/15
Arsenic	SW 3050/7060	0.001	mg/L	11/11	--	2	3/3	1/1	16/15
Antimony	SW 3005/7041	0.003	mg/L	10/11	--	2	3/3	1/1	16/15
Lead	SW 3020/7421	0.001	mg/L	10/11	--	2	3/3	1/1	16/15
Mercury	SW 7470	0.0002	mg/L	10/11	--	2	3/3	1/1	16/15
Selenium	SW 3050/7740	0.002	mg/L	10/11	--	2	3/3	1/1	16/15
Thallium	SW 3020/7841	0.001	mg/L	10/11	--	2	3/3	1/1	16/15
Volatile Organic Compounds	SW 8240	^e	µg/L	10/11	3/3	2	3/3	1/1	19/18

(Continued)

TABLE 5. ANALYTICAL METHODS, DETECTION LIMITS, AND TOTAL NUMBER OF GROUNDWATER/SURFACE WATER ANALYSES (Continued)

Parameter	Analytical Method ^a	Detection Limit ^b	Reporting Units ^c	Number of Analyses	Trip Blanks ^d	Field Blanks ^e	Equipment Blanks ^f	Replicates	Total Analyses
Semivolatile Organic Compounds	SW 3550/8270	*	µg/L	6/10	--	2	3/3	1/1	12/14
Ethylene Dibromide	SW 5030/E 502.2	1.0	µg/L	6/3	3/3	2	3/3	1/1	15/10
Common Anions Chloride Sulfate	A429	0.1 0.1	mg/L	6/6	--	1	3/3	1/1	11/10
Nitrate-Nitrite	E353.1	0.01	mg/L	6/6	--	1	3/3	1/1	11/10
Total Dissolved Solids	E160.1	10	mg/L	6/6	--	1	3/3	1/1	11/10
Hardness	E130.2	25	mg/L as CaCO ₃	6/6	--	1	3/3	1/1	11/10
Total Suspended Solids	E160.1	10	mg/L	6/6	--	1	3/3	1/1	11/10
pH	E150.1	--	Units	6/6	--	1	3/3	1/1	11/10
Common Cations Calcium Magnesium Potassium Sodium Iron Manganese	SW 3005/6010	0.010 0.030 Undefined 0.029 0.007 0.002	mg/L	6/6	--	1	3/3	1/1	11/10

^aThe methods cited are from the following sources:

- "E" Methods Methods for Chemical Analysis of Water and Wastes, EPA
 Manuals, 600/4-79-020 (USEPA 1983 - with additions)
- Methods for Organic Chemical Analysis of Municipal and
 Industrial Wastewater, 40 CFR 136, Appendix A
- Inductively Coupled Plasma - Atomic Emission Spectrometer
 Method for Trace Elements Analysis of Water and Wastes, 40
 CFR 136, Appendix C
- Methods for Determination of Organic Compounds in Finished
 Drinking Water and Raw Source Water, 40 CFR 141.30
- "SW" Methods Test methods for Evaluating Solid Waste, Physical/Chemical
 Methods, SW-846, 3rd Edition (USEPA 1986).

^bThe detection limits presented represent those established by the laboratory
 for the analytical method indicated.

^cFor soil/sediment samples, report results as mg/Kg of dry soil or sediment.
 Moisture content for each sample will be reported for each soil or sediment.

^dMetals in water and soil/sediment samples using Method SW 6010. Limits of
 detection are based on laboratory detection limits or Practical Quantitation
 Limits (PQLs) as defined in SW-846, Third Edition. The detection limits are
 given as a guide for an instrument limit. The actual method detection limits
 are sample-dependent and may not always be achievable.

<u>Analyte</u>	<u>Detection or Practical Quantitation Limits</u>	
	<u>Water (ug/L)</u>	<u>Soil and Sediment (mg/Kg)</u>
Beryllium (Be)	0.003	0.1
Cadmium (Cd)	0.004	0.5
Chromium (Cr)	0.06	1
Nickel (Ni)	0.015	2
Silver (Ag)	0.07	1
Zinc	0.02	1

^eSemivolatile organic compounds in water and soil/sediment samples using
 Method SW 8270. PQLs listed for soil/sediment are based on wet-weight. Data
 are normally reported on a dry-weight basis; therefore, PQLs will be higher
 based on the percent moisture in each sample. Soil/sediment PQLs listed here
 are based on a 30 g sample of a low-level soil/sediment and gel chroma-
 tography cleanup. Since PQLs are highly matrix-dependent, the PQLs are
 provided for guidance and may not always be achievable.

<u>Analyte</u>	<u>Practical Quantitation Limits</u>	
	<u>Water (ug/L)</u>	<u>Soil and Sediment (mg/Kg)</u>
Acenaphthene	10	0.660
Acenaphthylene	10	0.660
Anthracene	10	0.660
Benzoic acid	50	3.3
Benzo(a)anthracene	10	0.660
Benzo(b)fluoranthene	10	0.660
Benzo(k)fluoranthene	10	0.660
Benzo(g,h,i)perylene	10	0.660
Benzo(a)pyrene	10	0.660
Benzyl Alcohol	20	1.3
bis(2-Chloroethoxy)methane	10	0.660
bis(2-Chloroethyl)ether	10	0.660
bis(2-Chloroisopropyl)ether	10	0.660
bis(2-Ethylhexyl)phthalate	10	0.660
Butyl benzyl phthalate	10	0.660
2-Chloroaniline	20	1.3
4-Chloro-3-methylphenol	20	1.3
2-Chloronaphthalene	10	0.660
4-Chlorophenyl phenyl ether	10	0.660
2-Chlorophenol	10	0.660
Chrysene	10	0.660
Dibenzo(a,h)anthracene	10	0.660
Dibenzofuran	10	0.660
2,4-Dimethylphenol	10	0.660
Di-n-butyl phthalate	10	0.660
1,2-Dichlorobenzene	10	0.660
1,3-Dichlorobenzene	10	0.660
1,4-Dichlorobenzene	10	0.660
3,3'-Dichlorobenzidine	20	1.3
2,4-Dichlorophenol	10	0.660
Diethyl Phthalate	30	0.660
Dimethyl Phthalate	10	0.660
4,6-Dinitro-2-methylphenol	50	3.3

Analyte	Practical Quantitation Limits	
	Water (ug/L)	Soil and Sediment (mg/Kg)
2,4-Dinitrophenol	50	3.3
2,4-Dinitrotoluene	10	0.660
2,6-Dinitrotoluene	10	0.660
Di-n-octyl phthalate	10	0.660
Fluoranthene	10	0.660
Fluorene	10	0.660
Hexachlorobutadiene	10	0.660
Hexachlorobenzene	10	0.660
Hexachloroethane	10	0.660
Indeno(1,2,3-cd)pyrene	10	0.660
Isophorone	10	0.660
Hexachlorocyclopentadiene	10	0.660
2-Methylnaphthalene	10	0.660
2-Methylphenol	10	0.660
4-Methylphenol	10	0.660
Naphthalene	10	0.660
2-Nitroaniline	50	3.3
3-Nitroaniline	50	3.3
4-Nitroaniline	50	3.3
Nitrobenzene	10	0.660
2-Nitrophenol	10	0.660
4-Nitrophenol	50	3.3
n-Nitrosodiphenylamine	10	0.660
n-Nitroso-di-N-propylamine	10	0.660
Pentachlorophenol	50	3.3
Phenanthrene	10	0.660
Phenol	10	0.660
Pyrene	10	0.660
1,2,4-Trichlorobenzene	10	0.660
2,4,5-Trichlorophenol	10	0.660
2,4,6-Trichlorophenol	10	0.660

^fVOCs in soil and water samples using Method SW 8240. Sample PQLs are highly matrix-dependent. The PQLs are provided for guidance and may not always be achievable. PQLs are established for a wet-weight basis. Detection will usually be at or below the values specified.

Analyte	Practical Quantitation Limits	
	Water (ug/L)	Soil and Sediment (mg/Kg)
Acetone	100	0.100
Benzene	5	0.005
Bromodichloromethane	5	0.005
Bromoform	5	0.005
Bromomethane	10	0.010
2-Butanone (MEK)	100	0.100
Carbon disulfide	5	0.005
Carbon tetrachloride	5	0.005
Chlorobenzene	5	0.005
Chloroethane	10	0.010

Analyte	Practical Quantitation Limits	
	Water (ug/L)	Soil and Sediment (mg/Kg)
Chloroform	5	0.005
Chloromethane	10	0.010
Dibromochloromethane	5	0.005
1,2-Dichlorobenzene	5	0.005
1,3-Dichlorobenzene	5	0.005
1,4-Dichlorobenzene	5	0.005
Dichlorodifluoromethane	5	0.005
1,1-Dichloroethane	5	0.005
1,2-Dichloroethane	5	0.005
1,1-Dichloroethene	5	0.005
1,2-Dichloroethene (total)	5	0.005
1,2-Dichloropropane	5	0.005
cis-1,3-Dichloropropene	5	0.005
trans-1,3-Dichloropropene	5	0.005
Ethylbenzene	5	0.005
2-Hexanone	50	0.50
Methylene Chloride	5	0.005
2-Methyl-2-pentanone (MIBK)	50	0.050
Styrene	5	0.005
1,1,2,2-Tetrachloroethane	5	0.005
Tetrachloroethene	5	0.005
Toluene	5	0.005
1,1,1-Trichloroethane	5	0.005
1,1,2-Trichloroethane	5	0.005
Trichloroethene	5	0.005
Vinyl acetate	50	0.050
Vinyl chloride	10	0.010
Xylenes, total	5	0.005

^gTrip blanks are defined as samples that originate from analyte-free water taken from the laboratory to the Toledo ANGB and returned to the laboratory with all samples to be analyzed for VOCs. One trip blank per cooler will accompany soil and water samples, stored at the laboratory with the samples, and analyzed. Trip blanks are analyzed only for VOCs (USEPA Method 8240) and ethylene dibromide (USEPA Method 502.2).

^hEquipment blanks are defined as the final analyte-free water rinse from equipment and are collected daily during a sampling event. These blanks will be analyzed for the same analytes as that analyzed for the environmental samples collected on the same day. Blanks collected with soil and sediment samples will be analyzed using the methods presented on Table 5.

ⁱField blanks are defined as the water used in decontamination (ASTM Type II reagent water) and steam cleaning (potable water). One field blank will be prepared from each source of water during the soil sampling event. One field blank will be prepared from the ASTM Type II reagent water during the groundwater and surface water sampling event. Field blanks collected with soil and sediment samples will be analyzed using the methods presented in Table 5.

9.1.1 Field and Technical Data Reduction

All field measurements and observations will be recorded in project log books, field data records, or similar types of recordkeeping books. Field measurements include pH, temperature, specific conductance, alkalinity, water flow, and certain air quality parameters. All data will be recorded directly and legibly in field logbooks, with all entries signed and dated. If entries must be changed, the change should not obscure the original entry. The reason for the change will be stated, and the correction and explanation will be signed and dated at the time the correction is made. Field data records will be organized into standard formats whenever possible, and retained in permanent files.

All laboratory data will be cross-referenced to the appropriate field QC samples (i.e., trip blanks, field blanks, equipment blanks, and replicates) and laboratory QC samples (e.g., method blanks, MS/MSD analyses, IC, CCV, etc.). Data and sample identification will be cross-referenced in spreadsheet fashion, both manually and electronically. In addition, all pertinent dates (i.e., dates collected, received by the laboratory, extracted, and analyzed) for each sample applicable to the Toledo ANGB SI will be referenced against their respective holding times.

9.1.2 Field and Technical Data Validation

Validation of field data will be performed on two different levels. First, all data will be validated by the Supervisory Geologists at the time of collection by following standard procedures and QC checks specified in Section 13. Second, data will be validated by the Site Manager, who will review the data to ensure that the correct codes and units have been included. After data reduction into tables or arrays, the Site Manager will review data sets for anomalous values. Any inconsistencies discovered will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for data collection, or by reperforming the measurement. The Site Manager also is responsible for ensuring that defensible and justifiable data were obtained by following the field objectives described below:

- The Toledo ANGB Work Plan will be adhered to
- Equipment and instruments will be properly calibrated and in working order

- Samples will be collected according to standard operating procedures
- Sufficient sample volume will be collected to maintain sample integrity and conduct all required analyses
- Samples will be properly preserved
- All applicable blanks and field QC samples will be provided with each sample set
- Complete chain-of-custody documentation will be kept throughout the duration of the field effort at the Toledo Express Airport, and copies will be included with each sample shipment
- Field samples will arrive at the laboratory in good condition.

Random checks of sampling and field conditions will be made by the Site Manager, who will check recorded data at that time to confirm observations. Whenever possible, peer review also will be incorporated into the data validation process to maximize data consistency between field personnel.

Once field and analytical data have been combined, the resulting technical documentation will be validated against the following criteria:

- Stated objectives of the Work Plan
- Stated QA objectives of this QAPP
- Analysis date versus the applicable holding times
- Percentage of QA analyses conducted
- Field and laboratory blank contamination
- Percent recoveries of laboratory QC spike samples
- RPDs of laboratory QC samples and field replicates.

Descriptive statistics for completeness will be calculated and reported.

9.1.3 Field and Technical Data Reporting

A detailed description of the type and format of technical reports to be produced during this project is presented in the Toledo ANGB Work Plan.

9.2 LABORATORY DATA

All bench chemists will document sample preparation activities in a bound laboratory notebook, which serves as the primary record for subsequent data

reduction. The data for GC/MS analyses will be generated by stand-alone computers and integrators, respectively. The data for AA analyses will be collected using the instrument digital read-out or meter to measure absorbance readings and strip chart recorder to record absorbance expressed in peak height units. Results of each analysis will be transcribed manually onto analytical results forms specific to the particular analysis. All data will be checked for accuracy and precision at the bench and instrument operator/analyst level, and at the laboratory manager and the project QA0 level. The concentration of the analytes found in the analysis will be expressed in the required units, depending on the sample matrix. Organic analysis results will be reported in $\mu\text{g/L}$ for water samples and mg/Kg for soil samples. Inorganic analyses results for water and soil samples will be reported in mg/L and mg/Kg , respectively. Results for soil samples will be reported on a dry-weight basis. Percent moisture results will be presented on all forms listing analytical results.

9.2.1 Laboratory Data Reduction

Gas Chromatography/Mass Spectrometry Results--Qualitative identification will be determined by obtaining extracted ion current profiles (EICPs) for the primary ion mass to charge ratio (m/z) and the secondary masses for each analyte. Positive identification will be based on the following criteria:

- The intensity of the three characteristic masses of each analyte must maximize in the same ratio (± 20 percent), within one scan of each other
- The relative retention time must fall within 30 seconds of the retention time of the authentic compound
- The relative peak heights of the three characteristic masses in the EICPs must fall within 20 percent of the relative intensities of these masses in a reference mass spectrum (standard analysis or reference library).

Structural isomers to be listed as separate analytes must have acceptable resolution. Acceptable resolution is achieved if, in a standard mix, the baseline to valley height between the isomers is less than 25 percent of the sum of the two peak heights. Otherwise, structural isomers will be identified as isomeric pairs.

The calculation for the concentration for the suspect peak will be made using the average RF for each analyte.

$$\text{Concentration} = \frac{(A_s)(C_{is})}{(\mu\text{g/L}) \quad (A_{is})(\text{RF})}$$

where:

- A_s = Area of characteristic m/z for the analyte to be measured
- A_{is} = Area of characteristic m/z for the internal standard
- C_{is} = Concentration of the internal standard, in $\mu\text{g/L}$
- RF = Average response factor as calculated from the area of the peak formed on an intensity plot of the ion of interest.

Atomic Absorption Spectrophotometry Results--Photometric absorbance is governed by the relationship:

$$\text{Absorbance} = \log (100/\%T) = 2 - \log \%T$$

where:

$$\%T = 100 - \% \text{ absorption}$$

Percent absorption is based on the amount of light of a particular wavelength absorbed by a specific metal. Its calculation is based on the loss of light after a beam of light of a particular wavelength is passed through a flame into which a solution containing metals of interest has been aspirated.

Calibration curves establishing the absorbance relationship with concentration will be generated at various concentrations. From these curves, a comparison will be made with absorbance from sample measurement. Since absorbance is directly related to concentration, a plot of the two parameters will be linear within operable ranges and will allow for determination of unknown concentrations in solutions (direct samples or extracts) after measurement of absorbances.

Ion Chromatography--Calibration curves establishing the peak height relationship with concentration will be generated at various concentrations.

From these curves, a comparison will be made with the peak heights resulting from sample injection. Each anion will be calculated by comparing the sample peak height to that of the same anion in the appropriate calibration curve. The following equation will be used to calculate common anions in water samples:

$$C = H \times F (x D)$$

where:

C = Concentration of analyte in mg/L

H = Peak height or area

F = Response factor (i.e., ratio of the concentration of the standard against the peak height or area generated from that standard concentration)

D = Dilution factor, if applicable.

9.2.2 Laboratory Data Validation

Data validation will be performed by the specific analytical task leader, the Laboratory QC Officer, and the Laboratory QA Manager. Validation will be accomplished through routine audits of the data collection and flow procedures and monitoring of QC sample results. Data collection and flow audits include:

- Review of sample documents for completeness by the analyst(s) at each step of the analysis scheme
- Daily review of instrument logs, performance test results, and analyst performance by the analytical task manager
- Unannounced audits of report forms, notebooks, and other data sheets by the Laboratory QA Manager
- Daily review of performance indicators such as blanks, surrogate recoveries, duplicate analyses, and matrix spike analyses by the analytical task manager
- Checks on a random selection of calculations by the Laboratory QA Manager
- Review by the Laboratory QA Manager of all reports before and after computerized data entry
- Review and approval of final report by the Laboratory QA Manager.

Results from the analysis of project and blind audit QC samples will be calculated and evaluated as reported. If these results indicate data quality problems, immediate corrective action will be taken and all data collected, since previous QC audits will be carefully reviewed for validity.

Minimum Criteria for an Out-of-Control Condition--A laboratory process for a particular analyte will be considered out of statistical control whenever, as a minimum, any one of the following conditions is demonstrated by a control chart monitoring that analyte:

- Any one point outside of the control limits
- Any three consecutive points outside the warning limits
- Any eight consecutive points on the same side of the center line
- Any six consecutive points such that each point is larger (smaller) than its immediate predecessor
- Any obvious cyclic pattern seen in the points.

9.2.3 Level C Validation Guidelines

All laboratory data are validated and approved for presentation in the SI report by the project QA0. The following are the basic activities that will be conducted as part of the HAZWRAP Level C laboratory data evaluation:

- Reconciliation of all data received with that proposed in the Toledo ANGB Work Plan and the analyses requested on the chain-of-custody documentation. Compilation of all missing data points and notification of the Project Manager and Laboratory Client Services Representative.
- Review of Laboratory QC check data applicable to all samples in one analytical batch for all sample shipments received. Compilation of all check points outside method control ranges. Assessment of the impact of laboratory QC data on data quality.
- Review of field QC check data applicable to all samples in one sample shipment for all shipments from the Toledo ANGB. Calculation of RPD values from concentrations of analytes in the field replicate pairs, as well as compilation of all blank contamination. Assessment of the impact of field data on data quality.
- Closure of all corrective action directives.
- Assessment of project DQOs.
- Calculations of project completeness.

9.2.4 Laboratory Data Reporting

Results of laboratory analyses of environmental samples will be reported in an appendix to the project report, and grouped with the appropriate QC samples. If one of these check samples corresponds to more than one group of samples, it will be reported with each group, for ease of data evaluation. The following are the minimum Level C data reporting requirements for GC/MS analyses (i.e., SW 8240 and 8270):

- Method blank spikes with results control charts. Analysis of one method blank spike per analytical batch.
- Sample results reported on CLP Form 1.
- Sample chromatograms and mass spectra.
- Surrogate recoveries reported on CLP Form 2.
- MS/MSD results reported on CLP Form 3.
- Method blank results report on CLP Form 4.
- GC/MS tuning results reported on CLP Form 5.
- Initial calibration data reported on CLP Form 6.
- Continuing calibration data reported on CLP Form 7.
- Internal standard areas reported on CLP Form 8.

The following are minimum HAZWRAP Level C data reporting requirements for priority pollutant metals and common cation analyses:

- Sample results reported on CLP Form 1 using the CLP flagging system
- Initial and continuing calibration data reported on CLP Form 2
- Method blank results reported on CLP Form 3
- ICP interference check sample results reported on CLP Form 4
- Matrix spike recovery results reported on part 1 of CLP Form 5
- Post digestion spike results reported on part 2 of CLP Form 5 if ICP predigest spike recoveries do not meet CLP limits
- Post digestion spike results for GFAA reported on raw data

- Duplicate analysis results reported on CLP Form 6
- Method spike results reported on a control chart for each applicable element
- Standard addition results reported on CLP Form 8
- Holding times reported on CLP Form 10.

The following are minimum HAZWRAP Level C reporting requirements for petroleum hydrocarbon and general chemistry (e.g., hardness, TDS, common anions, etc.) analyses:

- Blank spike results reported on the control chart for the applicable spiked parameter
- Method blank results
- Sample results
- MS/MSD results on initial calibration data
- 12-hour calibration verification results reported as percent relative standard deviation (RSD) or percent difference from initial calibration.

Laboratory QC data will be reported separately from the environmental data, but grouped by analysis method. Data necessary for calculation of percent recoveries will be presented along with the analytical results. The section containing QC data also will include upper and lower control limits for percent recovery and RPD.

Complete evaluation of the analytical data requires that the data be reported completely and correctly. The following information is required for complete evaluation of the analytical data:

- Laboratory sample identification number
- SAIC sample identification number
- Sample collection and laboratory receipt dates
- Sample extraction and analysis dates
- Volume or mass of sample purged or extracted

- Percent moisture for each solid sample
- Upper and lower control limits of percent recovery and RPD calculations for all applicable QC check analyses
- Parameter analyzed, analytical result, unit, and detection level of all compounds or parameters analyzed.

The following are additional analytical reporting requirements:

- All analytical results will be reported to one significant figure for values less than 10 and two significant figures for values greater than 10.
- Analytical reports will present the results in such a manner that all parameters for one sample (Sample XYZ) are included together (i.e., all metal compounds, all VOCs, and all extractable compounds are provided together in the final report).
- Analytical results for environmental samples will be reported in groups corresponding to samples grouped on one chain-of-custody form along with the applicable laboratory QC check results. If, for any reason, one of these check samples corresponds to more than one group of samples, it should be reported with each group.
- In addition to hard-copy reporting, the laboratory will provide data on magnetic computer diskette (5 1/4" double sided, double density). These data will be provided on diskette or electronically transmitted in the format required for the USEPA CLP diskette deliverable.
- The laboratory will provide the final report to SAIC by overnight delivery within 6 weeks of receipt of samples. The 6-week reporting time for a specific project will begin with the receipt of the last sample shipment from the applicable field effort.

10. INTERNAL QUALITY CONTROL CHECKS

10.1 INTERNAL FIELD QUALITY CONTROL CHECKS

Collection and analysis of field blanks, equipment washes, trip blanks, and field replicates are provided as QC checks on the integrity of sample collection and handling procedures and equipment decontamination procedures.

Field blanks, equipment blanks, and trip blanks will be prepared using ASTM Type II reagent water and sample bottles randomly selected from the bottles prepared for environmental samples. ASTM Type II reagent water is

used to prepare these field check samples, regardless of the environmental medium being sampled, because:

- It mimics the physical characteristics of groundwater and surface water
- It mimics a reproducible fraction (moisture) of soils and sediments
- No reproducible, affordable material is available that mimics the clay and organic portion of soils and sediments.

Field blanks (ambient conditions blanks) will be prepared at the beginning of each sampling event by pouring ASTM Type II reagent water or potable water used for equipment decontamination into prepared sample bottles. These sample bottles will be randomly selected from the supply of prepared sample bottles; a sample container will be selected that is appropriate for each type of analysis for which environmental samples are being collected. The field blanks will be handled and analyzed in the same manner as environmental samples. Because field blanks and environmental samples are collected under the same conditions, field blank analyses are used to indicate the baseline contamination that may be introduced by the use of reagent-grade or potable-quality water used in the Toledo ANGB field effort. Field blanks also may become contaminated during transport, but this may be assessed by the simultaneous use of trip blanks, which are discussed below.

Equipment blanks (bailer washes) will be prepared for manual and small automated sampling equipment used to collect environmental samples. Equipment blanks will be collected during the sampling day by pouring ASTM Type II reagent water into/through/over a clean piece of sampling equipment, such as hand-augers and split-spoon samplers, and then dispensing the water into prepared sample bottles. These sample bottles will be randomly selected from the supply of prepared sample bottles, selecting a sample container appropriate for each type of analysis for which environmental samples are being collected. Analyses of bailer washes are used to assess the efficiency of equipment decontamination procedures in preventing cross-contamination between samples.

Trip blanks will be prepared at the beginning of the sampling trip by pouring ASTM Type II reagent water into prepared sample bottles. These sample bottles will be randomly selected from the supply of prepared sample bottles. Sample containers will be filled to yield an appropriate sample volume for SW 8240 VOC analysis. These trip blanks will be prepared at the laboratory, shipped to the Toledo Express Airport, stored with the unused sample bottles, transported to the sampling site, and then shipped for analysis with the samples collected during the sampling event. The trip blanks will remain unopened throughout the sampling event. Analysis of trip blanks is used to assess contamination of sample containers during storage at the site and contamination of samples during transport back to the laboratory. One trip blank will be included in each shipping container containing soil samples for VOC analysis.

All sample containers provided by SAIC will be shipped with chain-of-custody records. These records will be completed by the field personnel and returned with the samples. The following QC samples will be collected:

- One trip blank per container per sampling team for each batch of soil to be analyzed for VOCs.
- One field blank per sampling event (i.e., soil and groundwater sampling) to be analyzed for all applicable analyses (i.e., SW 8240, SW 8270, petroleum hydrocarbons, priority pollutant metals, and miscellaneous inorganics) to be prepared from reagent-grade water and the potable water used in the equipment decontamination process.
- One set of equipment blanks for each day of sampling. All parameters will be analyzed.
- One field replicate for every 10 soil/sediment samples will be collected at a preselected monitoring point. Field replicates will be collected at the same time and in the same manner as the other samples. Field replicates are a separate sample, obtained from the same monitoring point. Results of the field replicate analyses are used to assess the precision of the field sampling techniques, not that of the analytical techniques.

10.2 INTERNAL LABORATORY QUALITY CONTROL CHECKS

The laboratory will analyze a number of QC check samples equivalent to 10 to 20 percent of the sample load in each project and/or laboratory function. Matrix spikes and matrix spike duplicate analyses will be performed

once every 20 samples received from Toledo ANGB. At least one MS/MSD analysis will be conducted for each required parameter on soil samples collected from the Toledo Express Airport. Method blanks will be analyzed with each batch of prepared samples.

Control limits will be established for each parameter in accordance with standard protocols, as defined in the QC section of each SW-846 method. Typical control limits are maintained at $\pm 2\sigma$ for warning limits and $\pm 3\sigma$ for control limits. A spike recovery result is out of control if it falls beyond the control limits or if it is the seventh consecutive value measured above the actual value or the seventh consecutive value below the actual value. Laboratory QC limits presented in Tables 6 through 10 are interim guidelines. The source of these QC limits is given on each table.

In general, internal laboratory QC checks will consist of the following:

- Organic Analyses

Before processing any samples, the analyst will demonstrate, through the analysis of a reagent water blank, that interferences from the analytical system, glassware, and reagents are under control. Each time a set of samples is extracted or there is a change in reagents, a reagent water blank will be processed as an indicator of laboratory contamination. The blank samples will be carried through all stages of the sample preparation and measurement steps. Section 1.14.2 describes method blank control criteria.

For each analytical batch (up to 20 samples), a method blank, matrix spike, and matrix spike duplicate will be analyzed. The blank and spiked samples will be carried through all stages of the sample preparation and measurement steps.

Each day that an analysis is performed, a daily calibration sample will be evaluated to determine if the chromatographic system is operating properly. If any changes are required to be made to the system (e.g., column replacement) the chromatographic system will be recalibrated.

Surrogate standards will be added to each sample before preparation and analysis (i.e., purging). Surrogate standard recovery will be used to determine the presence of matrix interferences, and as a measure of purging or extraction efficiency. Surrogate recovery re-analysis will occur for those samples in which surrogate recoveries fall outside acceptance limits (Tables 6 and 8). If, after re-analysis, surrogate recoveries remain outside control limits, the data will be flagged as "estimated concentration."

**TABLE 6. LABORATORY QUALITY CONTROL LIMITS
 GC/MS MATRIX SPIKE COMPOUNDS - VOLATILE ORGANIC ANALYSIS (SW 8240)**

Parameter	<u>Relative Percent Difference</u>		<u>Percent Recovery</u>	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
1,1-Dichloroethene	14	22	61-145	59-172
Trichloroethene	14	24	71-120	62-137
Chlorobenzene	13	21	75-130	60-133
Toluene	13	21	76-125	59-139
Benzene	11	21	76-127	66-142

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TABLE 7. LABORATORY QUALITY CONTROL LIMITS
 GC/MS SURROGATE SPIKE COMPOUNDS - VOLATILE ORGANIC ANALYSIS (SW 8240)

Parameter	Amount in Sample/Extract		Percent Recovery Control Limits	
	Water	Low/Medium Soil	Water	Low/Medium Soil
Toluene-d ₈	50 µg	50 µg	88-110	81-117
4-Bromofluorobenzene	50 µg	50 µg	86-115	74-121
1,2-Dichloroethane-d ₄	50 µg	50 µg	76-114	70-121

TABLE 8. GC/MS MATRIX SPIKE COMPOUNDS - SEMIVOLATILE ORGANIC ANALYSIS
 (SW 3510/3550/8270)

Matrix Spike Command	<u>Relative Percent Difference</u>		<u>Percent Recovery Limits</u>	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
1,2,4-Trichlorobenzene	28	23	39-98	38-107
Acenaphthene	31	19	46-118	31-137
2,4-Dinitrotoluene	38	47	24-96	28-89
Di-n-butyl Phthalate	40	47	11-117	29-135
Pyrene	31	36	26-127	35-142
N-Nitroso-di-n-Propylamine	38	38	41-116	41-126
1,4-Dichlorobenzene	28	27	36-97	28-104
Pentachlorophenol	50	47	9-103	17-109
Phenol	42	35	12-89	26-90
2-Chlorophenol	40	50	27-123	25-102
2-Chloro-3-methylphenol	42	33	23-97	26-103
4-Nitrophenol	50	50	10-80	11-114

**TABLE 9. LABORATORY QUALITY CONTROL LIMITS
GC/MS SURROGATE SPIKE COMPOUNDS - BASE/NEUTRAL AND ACID
EXTRACTABLE PRIORITY POLLUTANT ANALYSIS (SW 3510/3550/8270)**

Parameter	Amount in Sample/Extract		Percent Recovery Control Limits	
	Water	Low/Medium Soil	Water	Low/Medium Soil
Nitrobenzene-d ₅	50 µg	50 µg	35-114	23-120
4-Fluorobiphenyl	50 µg	50 µg	43-116	30-115
p-Terphenyl-d ₁₄	50 µg	50 µg	33-141	18-137
Phenol-d ₅	100 µg	100 µg	10-94	24-113
2-Fluorophenol	100 µg	100 µg	10-94	24-113
2,4,6-Tribromophenol	100 µg	100 µg	10-123	19-122

**TABLE 10. LABORATORY QUALITY CONTROL LIMITS
 PRIORITY POLLUTANT METALS AND EP TOX ANALYSES**

Parameter	Relative Percent Difference		Percent Recovery	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
<u>Trace Metals</u>				
Antimony (Sb)	0-20	0-30	90-110	75-125
Arsenic (As)	0-20	0-30	90-110	75-125
Barium (Ba)*	0-20	0-30	90-110	75-125
Beryllium (Be)	0-20	0-30	90-110	75-125
Cadmium (Cd)	0-20	0-30	90-110	75-125
Chromium (Cr)	0-20	0-30	90-110	75-125
Copper (Cu)	0-20	0-30	90-110	75-125
Lead (Pb)	0-20	0-30	90-110	75-125
Manganese (Mn)*	0-20	0-30	90-110	75-125
Nickel (Ni)	0-20	0-30	90-110	75-125
Selenium (Se)	0-20	0-30	90-110	75-125
Silver (Ag)	0-20	0-30	90-110	75-125
Thallium (Tl)	0-20	0-30	90-110	75-125
Zinc (Zn)	0-20	0-30	90-110	75-125
<u>EP TOX Metals (40 CFR 261.24)</u>				
Antimony (Sb)		0-30		75-125
Arsenic (As)		0-30		75-125
Beryllium (Be)		0-30		75-125
Cadmium (Cd)		0-30		75-125
Chromium (Cr)		0-30		75-125
Copper (Cu)		0-30		75-125
Lead (Pb)		0-30		75-125
Mercury (Hg)		0-30		75-125
Nickel (Ni)		0-30		75-125
Selenium (Se)		0-30		75-125
Silver (Ag)		0-30		75-125
Thallium (Tl)		0-30		75-125
Zinc (Zn)		0-30		75-125

* Analyte added to priority pollutant list for risk assessment purposes.

- Inorganic Analyses - ICAP Metals Scan

Two types of blanks are required for ICAP analysis. The calibration blank is used in establishing the analytical curve, and the reagent blank is used to correct for possible contamination resulting from varying amounts of the acids used in the sampling processing. A minimum of one reagent blank will be analyzed per sample batch to determine if samples have been contaminated or if any memory effects are occurring.

The instrument check standard will be prepared by the analyst by combining solutions of compatible elements at concentrations equivalent to the midpoint of their respective calibration curves. An interference check solution will be prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. Analytes of interest, and interfering elements, are presented in Table 11.

The QC sample will be prepared in the same acid matrix as the calibration standards at 10 times the instrumental detection limits and in accordance with the instructions provided by the supplier.

For each analytical batch (up to 20 samples), a matrix spike and matrix spike duplicate will be analyzed. The spiked samples will be carried through all stages of the sample preparation and measurement steps.

- Inorganic Analysis - ICAP Interference Check Sample (ICS) Analysis

To verify interelement and background correction factors, ICAP ICSs will be analyzed at the beginning and end of each analysis run or a minimum of twice per 8-hour working shift, whichever is more frequent. The ICS will be analyzed after the Initial Calibration Verification. The ICP ICSs will be obtained from EPA (EMSLV), if available, and will be analyzed according to the instructions supplied with the ICS.

The ICSs consist of two solutions: Solution A and Solution AB. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents. Both ICS solutions will be analyzed consecutively (starting with Solution A) for all wavelengths used for each analyte reported by ICAP.

Results for the ICAP analyses of Solution AB during the analytical runs must fall within the control limit of 20 percent of the true value for the analytes included in the ICSs. If not, the analysis will be terminated, the problem will be corrected, the instrument will be recalibrated, and the analytical samples analyzed, since the latest acceptable ICS will be re-analyzed.

[illegible]

TABLE 11. INTERFERENTS, INTERFERENT CONCENTRATIONS, AND RESULTING ANALYTE CONCENTRATIONS (SW 6010) (Continued)

Analyte	Wavelength (nm)	Interferent ^{a, b}									
		Aluminum (Al)	Calcium (Ca)	Chromium (Cr)	Copper (Cu)	Iron (Fe)	Magnesium (Mg)	Manganese (Mn)	Nickel (Ni)	Thallium (Tl)	Vanadium (V)
Vanadium (V)	292.402	—	—	0.05	—	0.005	—	—	—	0.02	—
Zinc (Zn)	213.856	—	—	—	0.14	—	—	0.29	—	—	—

^aDashes indicate that no interference was observed even when interferents were introduced at the following levels:

Aluminum (Al) - 1,000 mg/L,	Magnesium (Mg) - 1,000 mg/L,
Calcium (Ca) - 1,000 mg/L,	Manganese (Mn) - 200 mg/L,
Chromium (Cr) - 200 mg/L,	Thallium (Tl) - 200 mg/L,
Copper (Cu) - 200 mg/L,	Vanadium (V) - 200 mg/L
Iron (Fe) - 1,000 mg/L	

^bThe figures recorded as analyte concentrations are not the actual observed concentrations; to obtain those figures, add the listed concentration to the interferent figure.

- Inorganic Analyses - Atomic Absorption (AA) Analysis for Metals

A calibration curve will be prepared each day with a minimum of a reagent blank and three standards, verified by use of at least a reagent blank and one standard at or near the mid-range. Checks throughout the day must be within 20 percent of the original curve.

If 20 or more samples per day are analyzed, the working standard curve must be verified by running an additional standard at or near the mid-range every 10 samples.

For each analytical batch (up to 20 samples), a method blank, matrix spike, and matrix spike duplicate will be analyzed. The blank and spiked samples will be carried through all stages of the sample preparation and measurement steps.

Where the sample matrix is so complex that viscosity, surface tension, and composition cannot be accurately matched with standards, the method of standard addition will be used.

- Inorganic Analyses - General Chemistry

A calibration curve will be prepared each day with a minimum of a reagent blank and five standards, verified by use of at least a reagent blank and one standard at or near the mid-range. Checks throughout the day must be within 15 percent of the original curve.

If 20 or more samples per day are analyzed, the working standard curve must be verified by running an additional standard at or near the mid-range every 10 samples or every 8 hours, whichever is the more frequent.

For each analytical batch (up to 20 samples), a method blank, matrix spike, and matrix spike duplicate will be analyzed. The blank and spiked samples will be carried through all stages of the sample preparation and measurement steps. Table 12 presents MS/MSD control limits.

A calibration curve will be prepared each day with a minimum of a reagent blank and three standards, verified by use of at least a reagent blank and one standard at or near the mid-range. Checks throughout the day must be within 20 percent of the original curve.

If 20 or more samples per day are analyzed, the working standard curve must be verified by running an additional standard at or near the mid-range every 10 samples.

For each analytical batch (up to 20 samples), a method blank, matrix spike, and matrix spike duplicate will be analyzed. The blank and spiked samples will be carried through all stages of the sample preparation and measurement steps.

Where the sample matrix is so complex that viscosity, surface tension, and composition cannot be accurately matched with standards, the method of standard addition will be used.

TABLE 12. LABORATORY QUALITY CONTROL LIMITS*
MISCELLANEOUS ANALYSES (A 429/E 130.1)

Parameter	Relative Percent Difference	Percent Recovery
	Aqueous	Aqueous
<u>Common Anions (A 429)</u>		
Chloride	0-20	80-120
Nitrate	0-20	80-120
Sulfate	0-20	80-120
Hardness (E 130.1)	0-20	80-120

*The control limits presented above are the interim minimum guidelines to be used during the development of statistical control limits.

11. PERFORMANCE AND SYSTEM AUDITS

Audits of field activities will consist of two types: performance audits and system audits.

11.1 FIELD PERFORMANCE AUDITS

Field performance audits will be performed on an ongoing basis during the project as field data are generated, reduced, and analyzed. All numerical manipulations, including manual calculations, will be documented. All records of numerical analyses will be legible, of reproduction-quality, and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator.

Other indicators of the level of field performance are the analytical results of the blank and replicate samples. Each blank analysis is an indirect audit of the effectiveness of measures taken in the field to ensure sample integrity (e.g., field decontamination procedures). The results of the field replicate analyses are an indirect audit of the ability of each field team to collect representative sample portions of each matrix type.

11.2 FIELD SYSTEMS AUDITS

System audits of site activities will be accomplished by an inspection of all field site activities by an SAIC technical audit team. During this audit, the audit team will compare current field practices with standard procedures. The following elements will be evaluated during field systems audits at Toledo ANGB:

- Overall level of organization and professionalism
- All activities conducted in accordance with the Toledo ANGB Work Plan
- All procedures and analyses conducted according to procedures outlined in this QAPP
- Level of activity and sample documentation
- Working order of instruments and equipment
- Level of QA conducted per each field team

- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding
- Decontamination procedures
- Level of efficiency with which each team conducts planned activities at one site and proceeds to the next
- Sample packaging and shipment.

After completion of the audit, any deficiencies will be discussed with the field staff, and corrections will be identified. If any of these deficiencies could affect the integrity of the samples being collected, the audit team will inform the field staff immediately, so that corrections will be implemented immediately. The audit team will consist of the project QAO and the Field Operations Manager.

11.3 LABORATORY PERFORMANCE AUDITS

Laboratory performance audits will be conducted on a routine basis by the Laboratory QA Manager, and will include:

- Verification of written procedures and analyst(s) understanding
- Verification and documentation of procedures and documents
- Weekly unannounced inspection of the sample handling group
- Weekly unannounced inspection of the analytical process recordkeeping
- Review of 25 percent of all analytical data and calculations.

Corrective action will be taken for any deficiencies noted during the audit. Corrective action is discussed in Section 14.2.

11.4 LABORATORY SYSTEMS AUDITS

Laboratory system audits are qualitative audits of the measurement systems, ensuring that they are properly maintained and used. These audits will be performed on a regularly scheduled basis, and include review of:

- Analytical and support instrumentation maintenance logs
- Analytical and support instrumentation calibration logs
- Refrigerator and freezer temperature records

- Distilled/de-ionized water supply records
- Sample tracking system
- Standard tracking system
- Reagent chemical log-in, tracking, and disposal.

Another type of laboratory system audit is the on-site audit by the project QA0. During this audit, laboratory records and procedures will be inspected for completeness, accuracy, precision, and adherence to prescribed methods. This inspection will include:

- Following the sample chain-of-custody from time of sample receipt, through all analysis steps, to data reduction, validation, and report generation
- Examination of maintenance and calibration logbooks, to ensure that maintenance and calibration are performed on a scheduled basis
- Examination of procedures and records for data calculation, transfer, and validation
- Spot-check of calibration, QC, and sample data from selected instruments for selected days, to ensure acceptable precision, accuracy, and completeness
- Inspection of storage areas, glassware preparation areas, and distilled/de-ionized water system records and procedures
- Examination of QA procedures and records (standard and spike solution logbooks and storage areas, control charts, QA manuals).

An additional laboratory system audit will be performed by spot-checking analytical data from the laboratory. During the time that analytical activities are underway, the laboratory will be requested to send the project QA0 raw data for the analyses of a fraction of the samples. These spot-check data will include all methods specified in Section 8, but are expected to be concentrated in GC/MS analyses. These raw data will be reviewed by the QA0 for completeness, accuracy, precision, technical competence, and adherence to method specifications. Any deficiencies identified during this data review will be addressed immediately with the Laboratory Manager and the Project Manager, and corrective action will be taken.

In the event that a major defect is discovered as a result of one of these audits, a followup inspection will be conducted after sufficient time has passed for correction of the deficiency, or evidence of correction of the deficiency may be presented by the laboratory.

External laboratory systems audits are conducted by Martin Marietta Energy Systems, Inc. as part of the laboratory approval process for HAZWRAP.

12. PREVENTIVE MAINTENANCE OF EQUIPMENT AND INSTRUMENTATION

12.1 FIELD EQUIPMENT

Preventive maintenance will be carried out on all field equipment before it is shipped to Toledo ANGB. This preventive maintenance will include regular battery checks and maintenance of a sufficient stock of spare parts and supplies. Field personnel are strongly cautioned that these instructions are for general purpose only. Should equipment malfunction in the field and field crews are unable to repair the piece within a reasonable amount of time, the Equipment Manager in the McLean, Virginia office will be notified. A replacement will be shipped immediately by overnight courier. Whenever possible, duplicates of all equipment will initially be shipped to the field. For specific preventive maintenance procedures, the appropriate instrument manual should be consulted.

12.1.1 HNu Photoionization Analyzer

In general, the preventive maintenance procedures to be conducted on this instrumentation include battery checks, checking the UV light source, and checking all cables. All other maintenance will be conducted by the manufacturer.

12.1.2 MSA Combustible Gas Indicator

Each time the MSA combustible gas indicator is used, the battery should be recharged and the sample inlet filter should be examined for cleanliness. If the filter element appears to be coated with dirt or dust, it should be washed, dried, and reinserted, or a new element should be substituted. A new

filter O-ring should be installed with the new element. The inlet seal O-ring in the inlet filter cap should be checked to ensure that it is properly seated. If the O-ring is damaged or missing, it should be replaced before the instrument is used again.

12.1.3 pH Meter

The following is a description of the preventive maintenance procedures for the field pH meters:

- Charging Batteries

After the initial charge when first placing the instrument in operation, the batteries should be recharged after each 30 hours of operation. Allow the batteries to charge 16 hours to restore them fully. Exceeding the 16-hour period will not damage the batteries. Overnight charging is recommended, and periods of operation between charges should not exceed 30 hours. With proper charging practices, a set of batteries should last for more than 300 charge cycles.

- Battery Replacement

When batteries no longer hold a charge for a reasonable length of time, they should be replaced. This unit requires six AA size nickel-cadmium batteries. Replace them as follows:

- Remove the accessories from the foam insert above the instrument panel
- Remove the four screws securing the panel in the case
- Lift the panel from the case and place it face down on a padded surface
- Pry the batteries from their clips with a screwdriver and replace all six batteries
- Replace the panel in the case, and replace the accessories in the foam insert
- Connect the charger unit to the instrument and allow the batteries to charge for 15 hours.

- pH Electrode Care Storage

When the electrode is not in use, the wetting cap with filling solution-soaked cotton should be reinstalled over the tip, and the fill hole cover should be placed over the hole. This will prevent loss of filling solution through evaporation. Always maintain the filling solution level just below the fill hole.

- pH Electrode Cleaning

Normal cleaning of the electrode can be performed in the following manner:

- Immerse the electrode tip in 0.1 N hydrochloric acid followed by immersion in 0.1N sodium hydroxide and again in 0.1 N hydrochloric acid, each for a 2-minute period. Rinse with ASTM Type II reagent water and soak in pH 7 buffer solution for 30 minutes.
 - If the electrode is slow to respond or readings are unstable and the condition cannot be remedied with normal cleaning, the reference junction may be clogged. Clean the junction for 10 minutes in dilute potassium chloride solution. First dilute a saturated potassium chloride solution diluted about 1:10 with water. Place the electrode tip in the boiling solution for about 10 minutes.
 - Remove the heat and allow the electrode to cool while immersed in the solution. Then rinse with ASTM Type II reagent water and soak in pH 7 solution before testing again.
- If these steps fail to improve electrode response, replace the electrode. If the pH bulb becomes contaminated or left dry, it may be reconditioned by following the cleaning procedures above.

12.1.4 Specific Conductance Meter

The following is a description of the preventive maintenance procedures for the field specific conductivity meters:

- Battery Replacement

Low battery condition is indicated by an arrow on the LCD display. When the arrow appears, the battery should be replaced.

12.1.5 Thermometer

After each use, the thermometer probe will be rinsed with ASTM Type II reagent water. Should the sample contain oils or other heavy hydrocarbon mixture, the probe will be washed with laboratory-grade detergent and rinsed with ASTM Type II reagent water. The thermometer will be visually inspected for cracks and abrasions before being placed in the protective case.

12.1.6 Field Alkalinity Analyzer

The procedures for preventive maintenance of the field alkalinity analyzer are described below.

Carefully check the instructions or directions for use of the field alkalinity procedure, making sure that the proper reagents, titrant, sample volume, and digit multiplier are used. Verify that there is no air or liquid, other than the titrant being used, in the delivery tube by ejecting several drops of solution. Check the performance of the reagents by using a known standard solution to run the analysis or by obtaining a fresh lot of the reagent. If it is determined that the reagents are defective, repeat the accuracy check with new reagents.

Check the operation of the apparatus used in the performance of the analysis. Verify that the correct volumes of sample and standard were used. Check the glassware used in the procedure, making sure it is scrupulously clean. Dirty pipets and graduated cylinders are a source of contamination and will not deliver the correct volume. If a defect is found in the apparatus, repeat the accuracy check after the repair or replacement of the apparatus.

After demonstrating that the analysis, reagents, and apparatus are correct and operating properly, failure of calibration verification may be the result of standards outside of manufacturer's specifications. Prepare or obtain a new set of standards and repeat the accuracy check.

12.2 LABORATORY INSTRUMENTATION

12.2.1 Gas Chromatography/Mass Spectrometry

Thorough preventive maintenance is scheduled to be performed at quarterly intervals. The preventive maintenance includes the following services:

- Water filter change
- Mechanical pump oil change
- Analyzer cleaned as required
- Ionizer cleaned as required

- Filter cleaned
- System calibration
- Module function checks
- Sensitivity analysis
- Disc drive filters changed.

In addition, the GC/MS system resolution and performance will be evaluated and calibrated using DFTPP (BFB) to satisfy the EPA-specified criteria described by Eichelberger, Harris, and Budde (1975). GC/MS system sensitivity will be tested by 50-ng injections of DFTPP or 4-BFB for the electron impact ionization mode.

12.2.2 Atomic Absorption Spectrophotometry

A number of instrumental variables will be checked for performance consistency as a part of preventive maintenance: instrument warmup, burner alignment, gas flow, lamp intensity, slit width, wavelength, matrix effects, aspiration time, and aspiration rate. Preventive maintenance procedures include a minimum warmup period of 30 minutes. The hollow cathode lamp will be aligned to produce the maximum emitted light to the detector. In graphite furnace AA, the inert gas flow inside the furnace is optimized to ensure maximum sensitivity.

The digital readout values obtained for the standard curve of each element will be checked to ensure that they fall within a specified range. If readings are excessively low, the operator will check gas flows, burner or cell alignment, wavelength, slit width, photomultiplier voltage, and lamp intensity before analysis. Burner heads, nebulizers, optical lenses, quartz cells, and reduction flasks will be cleaned according to manufacturer's instruction whenever excessive electronic noise is apparent or whenever indicated by visual inspection. Tygon tubing will be replaced when deterioration is apparent.

12.2.3 General Laboratory Equipment

The most prevalent equipment type in this category is analytical balances of various capacities and operational modes. The balances will be cleaned and adjusted annually by a licensed specialist and officially recorded as a

verification of performance. All combination pH electrodes will be stored in a pH 4 buffer solution. A high-purity water system will be used to produce water that is free from particulates and total dissolved solids and has a purity of 18 megohm/cm. The purity will be checked before every use with a resistivity meter. When the water resistivity rises above 12 megohm/cm, new deionizing and filtration cartridges will be installed.

13. DATA ASSESSMENT PROCEDURES

13.1 FIELD DATA

13.1.1 Precision

Replicate soil samples analyzed by the laboratory will assess the precision of the sampling effort. Control limits for replicate RPDs will be set at 0 to 20 percent to provide an initial guide. Once a sufficient amount of replicate data becomes available, field precision control charts will be constructed similarly to the laboratory precision charts. For any given concentration, the mean and standard deviation of the replicates will be calculated. The mean is the centerline. Data from each sample set will be pooled with previous sample sets to generate control and warning limits for the next set. Warning and control limits for all samples are set at $\pm 2\sigma$ and $\pm 3\sigma$, respectively. Data outside of any control limit are subject to QA review.

13.1.2 Accuracy

Field instruments will be calibrated daily or more frequently, if needed, to ensure accuracy of the measurement of field parameters. All blanks associated with each sample set will be analyzed and evaluated for cross-contamination. Blank contamination and the resulting corrective action will be assessed on an individual basis.

13.1.3 Completeness

The Supervisory Geologist is responsible for ensuring that all field instrumentation and equipment are functioning properly and calibrated according to set procedures, and that all data are recorded accurately and legibly. In addition, the Supervisory Geologist must ensure that all sites

are sampled for all of the specified analyses, that sufficient sample volume has been provided to complete those analyses, and that all of the QC samples have been included with each sample set. For the purposes of this project, the goal for completeness for each sample set shipped to the laboratory will be 100 percent. The minimum acceptable completeness limit is 95 percent.

13.2 LABORATORY DATA

13.2.1 Accuracy

Unless otherwise directed by the requirements of a project, accuracy control charts typically will be generated as follows:

- Accuracy will be determined from the results of matrix spike and matrix spike duplicates performed at the rate of 1 set every 20 samples. Control limits for recovery will be defined by historical laboratory data.
- Using historical laboratory data, a control chart will be developed. From this control chart the control limits will be defined as the mean (center line) ± 3 standard deviations.

13.2.2 Precision

Precision will be based upon the results of the RPDs as calculated from the percent recoveries of the matrix spike and matrix spike duplicates associated with this project, for each parameter of interest. The control limits for precision will be based on historical laboratory data.

13.2.3 Completeness

Completeness will be expressed as the percentage of the amount of valid data obtained compared to the amount of data expected. For the percent recovery required to ensure data accuracy, unless specified in the method, a minimum of 90 percent completeness will be the goal for the project.

14. CORRECTIVE ACTION

14.1 FIELD CORRECTIVE ACTION

The initial responsibility for monitoring the quality of field measurements lies with the field personnel. The Supervisory Geologist is responsible for allowing all QA procedures and the Site Manager is responsible for verifying that these procedures are being followed. This requires that the Site Manager assess the correctness of the field methods and the ability to meet QA objectives, and make a subjective assessment of the impact a procedure has upon the field objectives and subsequent data quality. If a problem occurs that might jeopardize the integrity of the project, cause a QA objective to not be met, or impact data quality, the Site Manager will immediately notify the Project Manager and the Laboratory Manager, if appropriate. Corrective action measures then will be decided upon and implemented. The Technical Project Manager will be notified if the situation warrants. The Supervisory Geologist will document the situation, the field objective affected, the corrective action taken, and the results of that action. Copies of the documentation will be provided to the Project Manager and the Project QA0. Examples of situations requiring corrective action encountered in the field are listed in Table 13. An example of the proposed field corrective action form is presented in Figure 5.

14.2 LABORATORY CORRECTIVE ACTION

The need for corrective action comes from several sources: equipment malfunction, failure of internal QC checks, method blank contamination, failure of performance or system audits, and noncompliance with QA requirements.

When measurement equipment or analytical methods fail to meet QC requirements, the problem will immediately be brought to the attention of the Analytical Task Leader and the Laboratory QC Manager. If failure is due to equipment malfunction, the equipment will be repaired, recalibrated, and the analysis will be rerun. All attempts will be made to re-analyze all affected parts of the analysis so that the end product will not be affected by failure to meet QC requirements. Where this is not possible, data reported will be qualified with a note as to the reason for the qualification. All incidents

TABLE 13. CORRECTIVE ACTION PROCEDURES ACCORDING TO SITUATION*

Situation	Field Objective Affected	Corrective Action Procedure
Equipment malfunction	Equipment is calibrated and operating properly	• Notification of site supervisory personnel • Repair or replace malfunctioning parts • Resample or repeat task if necessary • Document to Project Manager and QAO
Incorrect sample collection procedures	Samples are taken according to standard operating procedures	• Notification of site supervisory personnel • Review of situation and correct procedures • Notify Laboratory Manager • Re-sample • Document to Project Manager and QAO
Insufficient sample volume collected	Sufficient sample volume is provided to maintain sample integrity and so that all required analyses can be conducted	• Notification of site supervisory personnel by the Laboratory Manager • Review site affected and impact of samples on site characterization and project DQOs • Document to Project Manager and QAO
Incorrect measurement data collection	Measurements are conducted according to standard operating procedures	• Notification of site supervisory personnel • Review situation and correct procedures • Conduct tests again • Document to Project Manager and QAO

* Situations requiring corrective action are too numerous to list comprehensively here. This table is provided to illustrate several examples.

TABLE 13. CORRECTIVE ACTION PROCEDURES ACCORDING TO SITUATION (Continued)*

Situation	Field Objective Affected	Corrective Action Procedure
Loss of sample shipment	Project completeness	• Review site affected and impact of samples on site characterization and project DQOs • Contact shipper • If samples arrive within analysis holding times and coolant blank is <10°C, then analyze • If samples do not arrive, arrive after method-recommended holding time, or coolant blank is 10°C or greater, then resample • Resample to provide more sample volume if necessary • Document to Project Manager and QAO • Notification of site supervisory personnel by the Laboratory Manager
Field contamination (equipment blanks only)	Acquisition of defensible data	• Notification of Project Manager and QAO, by the Laboratory Manager • Notify site supervisory personnel • Review decontamination procedures and correct deficiencies • Document to file for final report note: no resampling necessary

* Situations requiring corrective action are too numerous to list comprehensively here. This table is provided to illustrate several examples.

TABLE 13. CORRECTIVE ACTION PROCEDURES ACCORDING TO SITUATION (Continued)*

Situation	Field Objective Affected	Corrective Action Procedure
Field contamination (field and equipment blanks only - VOC analysis)	Acquisition of defensible data	• Notification of Project Manager and QAO by Laboratory Manager • Notify site supervisory personnel • Review ASTM Type II reagent water sources, test water on-site, and replace if necessary • Document to file for final report. Note: no resampling is necessary if the level of contamination found does not exceed any known action levels, or interferes with the identification and quantification of any nearby peak of interest.
Field contamination (interfering compounds detected in all blanks, except the laboratory method blank, and corresponding environmental samples) - VOC analysis	Acquisition of defensible, justifiable data	• Notification of Project Manager and QAO by the Laboratory Manager • Notify site supervisory personnel • Review situation, determine source of contamination and eliminate • Review level of contamination found and extent of affected samples • Executive decision by Project Manager as to course of action • Resample if necessary • Document to file for final report

* Situations requiring corrective action are too numerous to list comprehensively here. This table is provided to illustrate several examples.

TABLE 13. CORRECTIVE ACTION PROCEDURES ACCORDING TO SITUATION (Continued)*

Situation	Field Objective Affected	Corrective Action Procedure
No QC sample to support data from sample batch	Acquisition of defensible, justifiable data	• Notification of site supervisory personnel by the Laboratory Manager • Mail appropriate samples if available • If samples are not available, the Project Manager and QAO will be notified • Review site affected and impact of samples on site characterization • Resample if necessary • Document to file for final report
Duplicate or replicate RPDs outside of control limits	Acquisition of defensible, justifiable data	• Notification of Project Manager and QAO by Laboratory Manager • Re-analysis of in-house samples by the laboratory • Notification of site supervisory personnel if RPDs remain outside of control limits • Review site affected and impact of samples on site characterization • Executive decision by Project Manager concerning the importance of affected data • Resample if necessary • Document to Project Manager and QAO

* Situations requiring corrective action are too numerous to list comprehensively here. This table is provided to illustrate several examples.

TABLE 13. CORRECTIVE ACTION PROCEDURES ACCORDING TO SITUATION (Continued)*

Situation	Field Objective Affected	Corrective Action Procedure
Expired samples (holding times exceeded)	Acquisition of defensible, justifiable data	• Notification of Project Manager and QAO by Laboratory Manager • Notification of site supervisory personnel by Project Manager • Review of site affected and impact of samples on site characterization • Executive decision by Project Manager concerning the importance of the affected data • Resample if necessary • Document to Project Manager and QAO
Coolant blank above 4°C	Acquisition of defensible, justifiable data	• Notification of Project Manager and QAO by Laboratory Manager • Notification of site supervisory personnel by Project Manager • Review of site affected and impact of samples on site characterization • Executive decision by Project Manager concerning the importance of the affected data • Resample if necessary • Document to Project Manager and QAO

* Situations requiring corrective action are too numerous to list comprehensively here. This table is provided to illustrate several examples.



An Employee-Owned Company

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Field Corrective Action

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Audit Report No. ____

Date/Originator: _____

Person Responsible for Response: _____

Description of Problem and when identified: _____

Cause of problem if known or suspected: _____

Sequence of Corrective Action (state date, person, and action planned): _____

Corrective action approval: _____ Date: _____

Follow-up dates: _____

Description of follow-up: _____

Final corrective action approved by: _____ Date: _____

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White: File Pink: Field Manager Yellow: Project QAO Goldenrod: Supervisory Geologist

of failure to meet QC requirements, and the corrective action taken, will be documented. Corrective action reports will be placed in the appropriate project file. An example of laboratory corrective action documentation is presented in Figure 6. In addition, the bench chemist will be responsible for ongoing monitoring of the system(s) affected to ensure that any recurring problems are identified immediately. Also, corrective action will be prompt for deficiencies noted during check of raw data. This action will vary depending upon the problems noted, and can range from correcting miscalculated data to requiring the re-analysis of samples. As soon as sufficient time has elapsed for corrective action to be implemented, evidence of correction of the deficiency will be presented. Documentation of the corrective action measure will be forwarded to the Project QAO and the Project Manager.

When matrix interferences are encountered, the analytical report will indicate that the results for the parameter(s) of interest could not be calculated. If typical methods are rendered ineffective by matrix interferences, or if achieving required detection limit, precision, and specificity requires a nonroutine approach, alternate methods would be available. Once information is generated based on the source and history of the sample(s) involved, an analytical protocol will be established that would have the best chances of generating reliable analytical data. Most of the time, modification of an existing protocol for routine procedures is designed to overcome the inherent sample matrix problems, and often employ the use of more extensive sample cleanup or fractionation procedures.

Corrective action documentation will include the following information:

- Nature of the problem
- Date and time of discovery
- Analytical parameter affected
- Sample lot affected
- Date, time, and description of the resulting corrective action
- Signature of Laboratory QC Manager.

LABORATORY CORRECTIVE ACTION

DESCRIPTION OF EVENT:

Date and time recognized: _____ By: _____
Date of actual occurrence: _____ By: _____
Date corrected: _____ By: _____

ANALYTICAL METHOD:

Analyte: _____ Method: _____
Analyst: _____ Section Manager: _____
Description of QC problem encountered:

Corrective/Preventative Action Taken:

Contract/Project Number: _____
Samples affected (Lab ID):

SIGNATURE:

Analyst: _____ Date: _____
Section Manager: _____ Date: _____
QA Officer: _____ Date: _____
Laboratory Manager: _____ Date: _____

FIGURE 6. LABORATORY CORRECTIVE ACTION FORM

Control limits also have been established for method blank analysis. For the purpose of this project, the VOC method blank will not contain any target compound greater than five times the limit of detection. The extractables method blank will not contain any target compound above the limit of detection. All blank analytes will be reviewed by the bench chemist before sample analysis. When acceptance criteria for blank analyses are exceeded, no samples will be analyzed until a determination of the cause of contamination has been made and corrected.

15. QUALITY ASSURANCE REPORTS TO MANAGEMENT

15.1 FIELD QUALITY ASSURANCE REPORTS

The Project Manager will submit monthly status reports to describe the progress of the project. To support this requirement, the Site Manager will provide the Project Manager with daily field progress reports, compiled field data sets, and corrective action documentation at appropriate intervals. Based on information gathered during unannounced site audits, the QAO will provide the Project Manager with periodic QA updates. Situations requiring immediate corrective action measures will be brought to the attention of the Project Manager.

15.2 LABORATORY QUALITY ASSURANCE REPORTS

A project QA report that summarizes all QA activities and QC data for the project will be issued to the project QAO whenever analysis data are reported to the Project Manager. In addition, the Laboratory Director will provide QA update memoranda for each sampling episode to the Project Manager upon evaluation of the analytical work for that episode. The Project Manager will be notified immediately of laboratory QA situations requiring immediate corrective action. The sample custodian will note all QA situations that may affect laboratory and project QA objectives on the four-part chain-of-custody form and return the pink copy to the Project Manager and the yellow copy to the project QAO.

15.3 SPECIAL NOTIFICATIONS

All situations that indicate an imminent health risk will be brought to the immediate attention of the HAZWRAP Technical Program Manager. Written notification with supporting data will be forwarded within 3 days.

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ATTACHMENT 1
RECOMMENDATION FOR SAMPLING AND PRESERVATION
OF WATER SAMPLES ACCORDING TO MEASUREMENT

ATTACHMENT 1

RECOMMENDATION FOR SAMPLING AND PRESERVATION
 OF WATER SAMPLES ACCORDING TO MEASUREMENT^a

Measurement	Vol. Req. (mL)	Container ^b	Preservative ^{c,d}	Holding Time ^e
<u>Physical Properties</u>				
Specific Conductance	100	P,G	Cool, 4°C	Analyze onsite
pH	25	P,G	None Req.	Analyze onsite
<u>Residue</u>				
Filterable	100	P,G	Cool, 4°C	7 days
Non-Filterable	100	P,G	Cool, 4°C	7 days
Temperature	1,000	P,G	None Req.	Analyze onsite
<u>Inorganics, Non-Metallics</u>				
Alkalinity	100	P,G	Cool, 4°C	Analyze onsite
Chloride	50	P,G	None Req.	28 days
Hardness	100	P,G	Cool, 4°C HNO ₃ to pH <2	6 mos
Nitrate ^j	100	P,G	Cool, 4°C	48 hrs
Sulfate	50	P,G	Cool, 4°C	28 days
<u>Metals</u>				
Priority Pollutants	100	P,G	HNO ₃ to pH <2	6 mos
Mercury (Total)	100	P,G	HNO ₃ to pH <2	28 days
Common Cations	100	P,G	HNO ₃ to pH <2	6 mos
<u>Organics</u>				
Total Petroleum Hydrocarbons,	1,000	G only	Cool, 4°C H ₂ SO ₄ to pH <2	28 days
Ethylene Dibromide	40	G, Teflon - lined septum	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^f	14 days

ATTACHMENT 1

RECOMMENDATION FOR SAMPLING AND PRESERVATION
 OF WATER SAMPLES ACCORDING TO MEASUREMENT^a
 (Continued)

Measurement	Vol. Req. (mL)	Container ^b	Preservative ^{c,d}	Holding Time ^e
Volatile Organics Compounds	40	G, Teflon - lined septum	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^f , HCl to pH2 ^g	14 days
Semivolatile Organic Compounds	1.0 gallon	G, Teflon - lined lid	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^f	7 days until extraction, 40 days-analysis

^aMore specific instructions for preservation and sampling are found with procedures as detailed in EPA-600/4-79-020, revised March 1983, and in the Federal Register, Vol. 49, No. 209, Oct. 26, 1984, EPA 40 CFR Part 136, Table II.

^bPlastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

^cSample preservation should be performed immediately upon sample collection.

^dWhen any sample is to be shipped by common carrier or sent through the United States mail, it must comply with the Department of Transportation Hazardous Materials Regulations (40 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation, has determined that the Hazardous Materials Regulations do not apply to the following materials: hydrochloric acid (HCl) in water solutions at concentrations of 0.04 percent by weight or less (pH about 1.96 or greater); nitric acid (HNO₃) in water solutions at concentrations of 0.15 percent by weight or less (pH about 1.62 or greater); sulfuric acid (H₂SO₄) in water solutions at concentrations of 0.35 percent by weight or less (pH about 1.15 or greater); sodium hydroxide (NaOH) in water solutions at concentrations of 0.080 percent by weight or less (pH about 12.30 or less).

^eHolding times are defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time of sample analysis (SW 8246) or the date and time of sample extraction and analysis (SW 8270). Extraction hold times are further defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time the sample is concentrated to the final injection volume (excluding any extract cleanup techniques). Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

^fShould only be used in the presence of residual chlorine.

^gSample receiving no pH adjustment must be analyzed within 7 days of sampling.

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ATTACHMENT 2
RECOMMENDATION FOR SAMPLING AND PRESERVATION
OF SOIL SAMPLES ACCORDING TO MEASUREMENT^a

ATTACHMENT 2

RECOMMENDATION FOR SAMPLING AND PRESERVATION
 OF SOIL SAMPLES ACCORDING TO MEASUREMENT^a

Measurement	Vol. Req. (ounce)	Container ^b	Preservative ^{c,d}	Holding Time ^e
<u>Inorganics, Non-Metallics</u>				
Petroleum Hydrocarbons	16	G, Teflon - lined lid	Cool, 4°C	28 days
<u>Metals</u>				
Priority Pollutant	16	G	Cool, 4°C	6 mos
Mercury	16	G	Cool, 4°C	28 days
<u>Organics</u>				
Volatile Organic Compounds, Sediments	40 mL	G, Teflon - lined lid	Cool, 4°C	14 days
Volatile Organic Compounds, Soil	—	Stainless Steel, Teflon - lined plastic cap	Cool, 4°C	14 days
Semivolatile Organic Compounds	16	G, Teflon - lined lid	Cool, 4°C	14 days-extraction, 40 days-analysis

^aMore specific instructions for preservation and sampling are found with procedures as detailed in EPA-600/4-79-020, revised March 1983, and in the Federal Register, Vol. 49, No. 209, Oct. 26, 1984, EPA 40 CFR Part 136, Table II.

^bPlastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

^cSample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C temperature until compositing and sample splitting is completed.

^dWhen any sample is to be shipped by common carrier or sent through the United States mail, it must comply with the Department of Transportation Hazardous Materials Regulations (40 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation, has determined that the Hazardous Materials Regulations do not apply to the following materials: hydrochloric acid (HCl) in water solutions at concentrations of 0.04 percent by weight or less (pH about 1.96 or greater); nitric acid (HNO₃) in water solutions at concentrations of 0.15 percent by weight or less (pH about 1.62 or greater); sulfuric acid (H₂SO₄) in

ATTACHMENT 2

RECOMMENDATION FOR SAMPLING AND PRESERVATION
OF SOIL SAMPLES ACCORDING TO MEASUREMENT^a
(Continued)

water solutions at concentrations of 0.35 percent by weight or less (pH about 1.15 or greater); sodium hydroxide (NaOH) in water solutions at concentrations of 0.080 percent by weight or less (pH about 12.30 or less).

^aHolding times are defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time of sample analysis (SW 8246) or the date and time of sample extraction and analysis (SW 8270). Extraction hold times are further defined as the maximum amount of time allowed to elapse between the date and time of sample collection and the date and time the sample is concentrated to the final injection volume (excluding any extract cleanup techniques). Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

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ATTACHMENT 3
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ATTACHMENT 3

REFERENCES

American Public Health Association (APHA, AWWA, WPCF)

16th Edition

Standard Methods for the Examination of Water and Wastes

American Society for Testing and Materials

D-1452

Soil Investigation and Sampling by Auger Boring

D-1586

Penetration Test and Split Barrel Sampling of Soils

D-2487

Unified Soil Classification System

D-2488

Recommended Practices for Visual-Manual Description of Soils

Annual Book of ASTM Standards Section II, Water and Environmental Technology

Environmental Protection Agency

EPA-600/4-82-029

Handbook for Sampling and Sample Preservation of Water and Wastewater (1982)

EPA-600/4-79-019

Handbook for Analytical Quality Control in Water and Wastewater Laboratories

EPA-600/4-79-020

Methods for Chemical Analysis of Water and Wastes, March 1979 (USEPA 1983-with additions).

SW-846

Test Methods for Evaluating Solid Waste, 3rd Edition (1986)

EPA-600/4-84-076

Characterization of Hazardous Waste Sites - A Methods Manual: Volume II Available Sampling Methods, 2nd Edition (1984)

Technical Manual on Formation Testing, March 1985.

Driscoll, Fletcher G.

Groundwater and Wells, 2nd Edition, 1987.

Code of Federal Regulations

40 CFR 136.3e, Table II

"Required Containers, Preservation Techniques and Holding Times"

40 CFR 136, Appendix A

Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater

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REFERENCES (Continued)

- | | |
|---|--|
| 40 CFR 136, Appendix B | "Definition and Procedure for the Determination of the Method Detection Limit" |
| 40 CFR 136, Appendix C | "Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes, Method 200.7" |
| 40 CFR 141.30 | <u>Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water</u> |
| Martin Marietta Energy Systems, Inc. Hazardous Waste Remedial Action Programs | |
| DOE/HWP-38 | <u>Implementation Plan, Quality Assurance Requirements, November, 1987</u> |
| DOE/HWP-65 | <u>Requirements for Quality Control of Analytical Data, July, 1988</u> |
| DOE/HWP-69 | <u>Quality Control Requirements for Field Methods, February, 1989</u> |

AIR NATIONAL GUARD
SITE INVESTIGATION
FOR THE OHIO AIR NATIONAL GUARD
TOLEDO EXPRESS AIRPORT, SWANTON, OHIO

Science Applications International Corporation
8400 Westpark Drive
McLean, Virginia 22102

Project Health and Safety Plan

Submitted by:
Hazardous Waste Remedial Actions Program
Martin Marietta Energy Systems, Inc.
Oak Ridge, Tennessee 37831

U.S. Department of Energy
Contract No. DE-AC05-84OR21400

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LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ANG	Air National Guard
ANGB	Air National Guard Base
ANGSC	Air National Guard Support Center
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AVGAS	Aviation Gasoline
BLS	Below Land Surface
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (1980)
CLP	Contract Laboratory Program
CWA	Clean Water Act
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DQOs	Data Quality Objectives
ECD	Electron Capture Detector
ELSA	Emergency Life Support Apparatus
EMT	Emergency Medical Technician
EPA	Environmental Protection Agency
ETG	Environmental Technology Group
FFS/RM	Focused Feasibility Study/Remedial Measures
FID	Flame Ionization Detector
FS	Feasibility Study
FTA	Fire Training Area
FWQC	Federal Water Quality Criteria
GC/MS	Gas Chromatography/Mass Spectrometry
gpm	Gallons Per Minute
HAZVRAP	Hazardous Waste Remedial Actions Program
HMTC	Hazardous Materials Technical Center
I.D.	Inside Diameter
IDLH	Immediately Dangerous to Life or Health
IRP	Installation Restoration Program
LOAEL	Lowest-Observable-Adverse-Effect Level

LIST OF ACRONYMS (Continued)

MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MUL	Maximum Use Limit
NBS	National Bureau of Standards
NGB	National Guard Bureau
NIOSH	National Institute for Occupational Safety and Health
NOAEL	No-Observable-Adverse-Effect Level
O.D.	Outside Diameter
OEPA	Ohio Environmental Protection Agency
OH ANG	Ohio Air National Guard
OSHA	Occupational Safety and Health Administration
OWS	Oil/Water Separator
PA	Preliminary Assessment
PAHs	Polynuclear Aromatic Hydrocarbons
PEL	Permissible Exposure Limit
PF	Protection Factor
PM	Project Manager
PMP	Project Management Plan
POL	Petroleum, Oil, and Lubricants
POTW	Publicly Owned Treatment Works
ppm	Parts Per Million
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act (1986)
SCBA	Self Contained Breathing Apparatus

LIST OF ACRONYMS (Continued)

SDWA	Safe Drinking Water Act
SHD	Safety and Health Director
SI	Site Investigation
SOW	Statement of Work
SPT	Standard Penetration Test
SSHC	Site Safety and Health Coordinator
TCA	Trichloroethane
TCE	Trichloroethene
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UST	Underground Storage Tank
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

1. INTRODUCTION

Science Applications International Corporation (SAIC) has been contracted under the Air National Guard (ANG) Installation Restoration Program (IRP) to conduct a Site Investigation (SI) at the Ohio Air National Guard (OH ANG), Toledo Air National Guard Base, (ANBG), located at the Toledo Express Airport, Swanton, Ohio.

The SI is being conducted to augment the findings of a Preliminary Assessment (PA) that the Hazardous Materials Testing Center conducted at the Base (HMTTC 1989). Installation of groundwater monitoring wells and sampling and testing of groundwater, surface water, sediments, and solids will help to characterize the unknown, overall hazards posed at Toledo ANGB. This health and safety plan establishes requirements and provides general guidelines for workers and public safety during the sampling and drilling operations that will be conducted at Toledo ANGB. All SAIC field team members will be provided a copy of this plan and will be required to follow its protocols.

1.1 POLICY STATEMENT

It is the policy of SAIC to take every practical precaution to protect the health of its employees, the surrounding community, and official visitors from any adverse effects that might result from activities at a hazardous waste site. The safety and health precautions in this plan should allow the investigative activities at Toledo ANGB sites to be accomplished safely without placing an excessive burden of equipment and procedures on the personnel performing the work, and allowing the project to be performed efficiently and expeditiously.

SAIC and SAIC's Environmental Technology Group (ETG) have implemented health and safety policies that require compliance with the most stringent health and safety rules and regulations applicable to hazardous waste site operations (i.e., in effect at the Federal, state, local, and client levels). All ETG hazardous waste operations will be conducted in accordance with the provisions of both SAIC and ETG policy. The ETG Hazardous Waste Operations Safety and Health Policy and Procedures establishes a program structured to meet, and in cases exceed, Occupational Safety and Health Administration

(OSHA) standards on hazardous waste site worker protection (29 CFR 1910.120) regulations and guidance designed to protect the health and safety of hazardous waste operations personnel. Activities conducted in accordance with this policy will be in compliance with OSHA regulations governing hazardous waste operations. All ETG employees who conduct, supervise, and/or manage hazardous waste operations are responsible for conducting activities in compliance with the provisions of this policy. The ETG policy establishes a framework for implementing this policy as well as requirements for personnel training, medical surveillance, personal protective equipment, site/project-specific health and safety plans, and subcontractor requirements. Both the SAIC and ETG Health and Safety Policies are available upon request. Both are made a part of this document by reference.

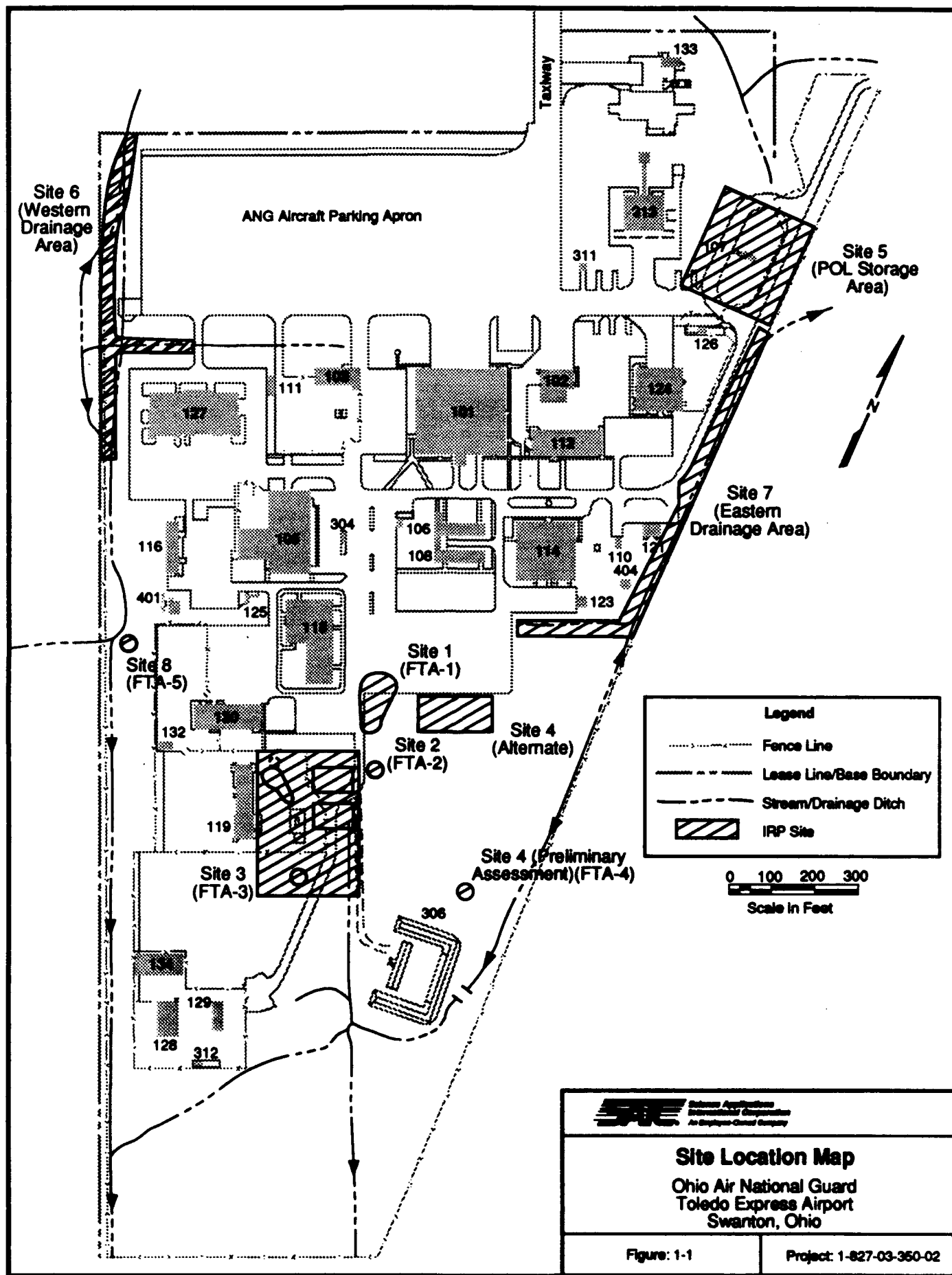
1.2 SITE DESCRIPTIONS

The Toledo ANGB is located at the Toledo Express Airport in Swanton, Ohio, approximately 15 miles southwest of Toledo. The Toledo ANGB is bordered on the north and west by the Toledo Express Airport and on the east and south by agricultural and commercial properties. Construction of the Base began in 1957 on undeveloped lowlands. The Base has since grown to approximately 64 acres in size and includes 32 facilities. This project is being conducted to assess the extent of contamination at the following eight sites at Toledo ANGB, as shown in Figure 1-1:

- Site 1: Fire Training Area No. 1
- Site 2: Fire Training Area No. 2
- Site 3: Fire Training Area No. 3
- Site 4: Fire Training Area No. 4
- Site 5: POL Storage Area
- Site 6: Western Drainage Area
- Site 7: Eastern Drainage Area
- Site 8: Fire Training Area No. 5.

1.2.1 Site 1: Fire Training Area No. 1

From the late 1950's to 1966, Toledo ANGB used Fire Training Area No. 1 (FTA-1), which was located approximately 70 feet east of Building 118 in an



area then covered by open field, for fire training exercises. Training exercises were conducted approximately 18 times per year, using 250 to 500 gallons of flammable liquid per exercise. Substances burned at FTA-1 included aviation gasoline (AVGAS), JP-4, solvents, and waste oils from the Toledo ANGB shops.

1.2.2 Site 2: Fire Training Area No. 2

Fire Training Area No. 2 (FTA-2) served as the major site for the Toledo ANGB fire training exercises between 1966 and 1978. It was located approximately 70 feet southwest of FTA-1. The frequency of use and quantity of fuel used at this site was similar to that of FTA-1. The majority of the liquid burned at this site was JP-4; however, small quantities of wastes such as oils, solvents, and strippers from the Toledo ANGB shops also were disposed of at this FTA. Fire training at FTA-2 was discontinued briefly in the early 1970's.

1.2.3 Site 3: Fire Training Area No. 3

Fire Training Area No. 3 (FTA-3) was located inside of the fenced area where the Motor Pool (Building 119) now stands. This FTA reportedly was used once or twice in the early 1970's and then abandoned due to the proximity of the FTA to planned construction sites and complaints from airport personnel about smoke blowing across the runway.

1.2.4 Site 4: Fire Training Area No. 4

Fire Training Area No. 4 (FTA-4) was located just north of the small arms range. This area was used for about 6 months in the early 1970's, immediately after fire training was discontinued at FTA-3. This FTA was abandoned because the sandy soil at the site would not retain water; therefore, fuel could not be floated before ignition.

1.2.5 Site 5: POL Storage Area

The POL facility has four 25,000-gallon underground storage tanks (USTs). A major 5,000-gallon spill occurred in the early 1960's. Since the mid-1970's, numerous small spills have occurred, ranging from 200 to 300 gallons.

1.2.6 Site 6: Western Drainage Area

The western drainage ditch runs parallel to the western Toledo ANGB boundary and receives storm drainage from the northwestern portion of Toledo ANGB, including effluent from oil/water separators (OWSs). This drainage ditch shows signs of organic contamination, possibly resulting from petroleum products in the effluent discharged from the OWSs.

1.2.7 Site 7: Eastern Drainage Area

The eastern drainage ditch runs parallel to the eastern Toledo ANGB boundary and receives storm drainage from the eastern portion of Toledo ANGB, including the POL facility and OWSs. Potential organic contamination was observed in the northern portion of this ditch, possibly resulting from petroleum products in the effluent discharged from the OWSs.

1.2.8 Site 8: Fire Training Area No. 5

During the mid-1980's, fire training took place on a concrete burn pad (FTA-5) located west of the Civil Engineering Building (Building 120). This was used two or three times, burning approximately 300 gallons of a mixture of waste oils and solvents pumped from shop OWSs. After the burns, any remaining liquids were drained to the storm drainage ditch adjacent to the burn pad.

2. HEALTH AND SAFETY RESPONSIBILITY

The review and approval of this health and safety plan will be the responsibility of the ETG Safety and Health Director (SHD). The SHD is responsible for the overall health and safety of all workers on the project and reports to the Group Manager. The SI Manager, in addition to his other field responsibilities, also will serve as the Site Safety and Health Coordinator (SSHC) by ensuring that all requirements of the health and safety plan are followed rigorously. The other site team members will have individual responsibility for complying with the plan and with the directions of the SHD and SSHC.

2.1 SAFETY AND HEALTH DIRECTOR

The SHD will provide technical information and assistance to the site team leader on the hazards of waste components and the methods for measuring and controlling exposure to toxic components. The SHD will conduct the safety and health training of the site team members in the following subject areas:

- Toxic effects and physical properties affecting exposure potential for chemical substances likely to be encountered at the site
- Instruments, methods, and sampling media for measuring airborne concentrations of toxic gases, vapors, mists, and dusts
- Safety equipment selection and maintenance
- Implications of results from analysis of environmental samples collected at the site in predicting possible exposure of workers.

The SHD will be routinely informed of analytical results that might assist in protecting the members of the field team. The SHD also will serve as the adviser to the Project Manager (PM) and the SSHC in matters of safety and health.

Additional duties and responsibilities of the SHD will include:

- Setting the dates for medical exams
- Reviewing the health and safety monitoring and incident reports submitted by the SSHC

- Coordinating with the PM and SSHC in solving health and safety problems
- Presenting initial safety and health training for new employees and regular updates to all team members
- Determining the level of protection (protective clothing and respirator) that will be used at the site under the conditions as reported by the SSHC
- Supervising the ordering of safety and emergency supplies and equipment
- Performing audits to ensure compliance with the health and safety plan.

2.2 SITE SAFETY AND HEALTH COORDINATOR

The SSHC will ensure that all requirements of this health and safety plan are rigorously followed throughout the field activities. If the SSHC determines that site conditions have become unsafe, he has the authority to suspend SAIC operations and those of SAIC subcontractors temporarily until the unsafe circumstances have been resolved and the PM reinitiates work activities. The duties of the SSHC also include:

- Ensuring the proper cleaning and maintenance of protective clothing and equipment
- Overseeing and keeping records of occupational illnesses and injury (OSHA Form 101) and records of individual site assignments and exposure monitoring results
- Enforcing all health and safety procedures at the site
- Determining the need for additional safety equipment (e.g., respirators), depending on site-specific conditions
- Obtaining emergency assistance
- Preparing and submitting incident reports (see Section 8).

2.3 VISITORS

To protect site visitors from any adverse health effects that may result from site activities, all visitors will be required to follow the rules as set

forth in this health and safety plan. Only official visitors will be permitted to be in the proximity of field activities. Visitors will be advised to prearrange their visit with the PM, who will notify the SSHC of the impending visit. Upon arrival, the SSHC will instruct the visitors concerning the safety precautions in effect and the personal protective equipment required during the visit. Each visitor will provide the necessary protective equipment for use during the visit. At the end of the visit, the visitors will be required to go through cleaning or decontamination procedures under the supervision of the SSHC.

2.4 SAIC PROJECT TEAM ORGANIZATION

<u>SAIC Project Position</u>	<u>SAIC Project Team Member</u>
Program Manager	Lou Arnold
Project Manager	Connie Samson
Site Investigation Manager	Chris Manikas
Quality Assurance/Quality Control Officer	Mamie Brouwer
Project Health and Safety Officer	Fernando Padilla
Site Safety and Health Director	Chris Manikas
Risk Assessment Scientist	Fred Zafran
Field Geologist/Geophysicist	John Carter

3. PERSONNEL HEALTH AND SAFETY TRAINING

All SAIC personnel participating in site work at Toledo ANGB will have undergone 40 hours of OSHA-equivalent health and safety training before beginning field activities. This training includes the following topics:

- Government regulations (OSHA/EPA)
- Characteristics of site hazards - chemical and physical
- Toxicology
- Monitoring equipment and hazard identification
- Engineering and administrative hazard control
- Personal protective equipment
- Decontamination procedures
- Principles of respiratory protection
- Respiratory protection workshop and respirator fit testing
- Handling, storage, and transportation of samples and other hazardous materials
- Rules and regulations of work on or around mobile equipment and vehicles
- Risk assessment
- Site safety plan and organization
- Site operations and responsibilities
- Sampling methods
- Confined space entry
- Work plan development for necessary protection level
- Handling emergencies and self rescue
- Community relations.

In addition, all SAIC personnel involved in site work at Toledo ANGB receive annually an 8-hour refresher course, as required by OSHA.

The OSHA training will be augmented by fit-testing of respirators and annual physical examinations. Documentation of these activities will be available to the Contracting Officer upon request. In addition, SAIC personnel involved with onsite activities will be briefed about the site-specific health and safety requirements for Toledo ANGB before site activities begin. A roster and support documentation for all employees who have received training will be maintained by the SSHC, who will forward it to the SHD. Each trained employee will be required to be familiar with the contents of this plan.

The health and safety training program that will be instituted for the SI at Toledo ANGB consists of a comprehensive review of the health and safety procedures and equipment specifically required for the project. The hazards at the site will be thoroughly reviewed with the site personnel during this phase of training. The hazardous substances and hazardous site conditions known to exist at the site will be indicated and established during this training. Each hazardous substance known to be present at the site will be discussed in terms of concentrations, the potential exposure modes, the levels of protection required, and the degree to which air monitoring will be implemented. Site-specific characteristics also will dictate safety procedures that will be used in the design of contingency procedures.

Upon arrival at Toledo ANGB, all SAIC staff, subcontractor personnel, and key Base personnel (e.g., Fire, Safety, Engineering) will tour Toledo ANGB and sites to identify any hazards present and the location of emergency equipment and facilities. This tour will be conducted by the SSHC.

4. MEDICAL SURVEILLANCE

All SI team members participate in a medical program, which includes a medical monitoring program, provisions for emergency treatment, recordkeeping, and program review. The health monitoring is accomplished through a system of medical examinations. Three types of medical examinations are required for the SI team: an initial screening examination, annual follow-up examinations, and episodic or follow-up examinations as required. These examinations monitor the health of all site investigators to assess their fitness to perform the required tasks, detect symptoms of exposure to toxic substances, and assess potential problems. The types of medical examinations and the elements of the examinations are discussed in the following sections.

4.1 TYPES OF MEDICAL EXAMINATIONS

All team members undergo an initial physical examination to determine general fitness and ability to perform the job. This screening examination includes tests of the sensory system (e.g., hearing, sight), lungs, liver, kidney, and cardiovascular system. The examination will establish baseline data for each team member to verify the efficiency of protective measures and to determine if exposures have adversely affected the worker. Subsequent examinations will be compared to the baseline to determine whether any changes in the physiological condition of the investigator have occurred. By identifying biologic trends, early signs of adverse health effects may be detected, thereby facilitating appropriate protective measures.

Annual examinations will be given to the site investigators. These follow-up examinations will screen the investigators for symptoms of exposure or physiological changes from the baseline, indicating exposure to toxic substances or a developing physiological condition that may be further aggravated through exposures to hazardous substances during hazardous waste SIs.

Episodic examinations will be given when the circumstances of an illness, accident, or overexposure to toxic substances during site operations are suspect. These examinations may reveal symptoms of possible overexposure to toxic substances. Following a known instance of overexposure to toxic

substances, the local physician will consult with the SHD to determine the appropriate time lapse between the unscheduled examination and the follow-up examination.

4.2 EMERGENCY MEDICAL TREATMENT

In the event that personnel exhibit signs or symptoms of chemical exposure or physical stress while onsite, the emergency medical treatment provisions of the overall site emergency response program should be implemented. This includes emergency first aid, transportation to a nearby medical facility, and subsequent medical examinations to ensure that any potential job-related symptoms or illnesses are evaluated. All such events shall be reported immediately to the ETG-SHD and applicable personnel office.

5. PROTECTIVE, MONITORING, AND EMERGENCY EQUIPMENT

Working exposure to toxic materials at Toledo ANGB will be prevented and controlled through safe work procedures and the use of personal protective, monitoring, and emergency equipment. The success of work procedures and protective equipment in protecting worker health is greatly dependent on worker cooperation. Carefully prepared work plans, effective employee training, and enforcement by supervisors of this health and safety plan and standard operating procedures are necessary to ensure the cooperation of each worker in protecting himself from toxic exposure. OSHA has issued a final standard that provides health and safety requirements for workers at hazardous waste sites. The following discussion and the system for selecting protective equipment are based on four levels of protection adapted from these requirements and on the experience of SAIC's health and safety personnel.

5.1 PERSONAL PROTECTIVE EQUIPMENT

Numerous items of personal protective equipment will be required in performing the field activities at Toledo ANGB. Two levels of protection will be required for the environmental sampling efforts and the drilling operations, and a third level of protection may be necessary if levels of hazardous constituents are higher than expected.

Level C protection was selected for the environmental sampling efforts, drilling operations, and well installation operations to be conducted at the sites based on the types and concentrations of existing respirable materials. This protection scheme consists of the following personal protective equipment:

- Half-face, air purifying cartridge respirator (Wilson; Series 100 half-face respirator), MSA Comfo II full-face respirators, or Survivair full-face respirators with organic vapor cartridges)
- Chemical-resistant coveralls
(E.I. Dupont de Nemours & Company; Tyvek suits during normal site operations)
- Chemical-resistant gloves
(Granet; Nitrile 492)

- Safety goggles
(Monogoggles; ANSI #Z87.1-1979; SEI-certified model)
- Hardhat
(Mine Safety Appliances Company; V-GARD)
- Chemical-resistant boots
(Rainfair; ANSI #Z41.1-1972-75; Neoprene, steel toe and shank).

A respirator's air-purifying cartridge will be replaced as necessary based on an evaluation of the service life of the cartridge, gases and vapors present at the site, temperature and relative humidity, and level of physical effort required to perform a task. Proper references will be available to site personnel to ensure that proper permissible exposure limits (PELs), "immediately dangerous to life or health" (IDLH) concentrations, protection factors (PFs), and maximum use limits (MULs) can be determined (e.g., American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), NIOSH/OSHA Pocket Guide to Chemical Hazards). Respirators and cartridges will be stored in sealed plastic bags when not in use.

Level D protection is the minimum basic work uniform worn for any site operation and will be used at all times by onsite personnel who are not engaged in sampling, drilling, or well installation operations, and are not within 20 feet of drilling operations. The Level D protection scheme consists of the following protective equipment:

- Chemical-resistant coveralls
(E.I. Dupont de Nemours & Company; Tyvek suits)
- Chemical-resistant gloves, if environmental samples or contaminated equipment is handled
(Granet; Nitrile 492)
- Safety or chemical-resistant boots
(Personal work boots or Rainfair, ANSI #Z41.1-1972-75; Neoprene, steel toe).

Hearing protection will be provided to site personnel in the event that excessive noise levels are encountered associated with drilling or Toledo ANGB operations. A full complement of spare protective equipment will be kept at the site so that damaged or malfunctioning equipment can be replaced immediately.

For personnel performing subsurface drilling at the site, well installation, and sampling, and for all those working within 20 feet of such drilling, Level C protection is required because of the possibility of encountering contaminated soil or groundwater. If the analysis of representative subsurface soil and groundwater samples shows that the soil and water contaminant levels are sufficiently low to preclude release of hazardous levels of airborne contamination, or air monitoring shows no air contamination, Level D protection will be sufficient for drilling, well installation, and sample collection at the site. It is expected that Level C and D protection will be adequate to protect the health and safety of field personnel; Level B protection is not authorized by this health and safety plan.

If the SHD and SSHC determine that Level B protection is required, all SAIC and subcontractor personnel will demobilize from the site being investigated and all activities at that site will cease. The SHD and PM will be notified of existing conditions immediately. No further investigative activities will be performed at the site of concern until approved by the SHD and instructed by the PM.

5.2 SAFETY MONITORING EQUIPMENT AND PROCEDURES

The greatest risk to workers during the field operation will be inhalation of gases or vapors containing the following suspected organic contaminants: fuel oil, gasoline, xylenes, benzene, toluene, PCE, TCE, or 1,1,1-TCA. The volatile nature of these hazardous contaminants necessitates continuous monitoring of site conditions to determine airborne respiratory hazards. The portable monitoring equipment to be used onsite will include organic vapor measuring instruments and combustible gas meters. The following specific monitoring equipment and procedures will be used:

- **Wind Direction**

- All sampling and drilling activities will take place so that personnel are stationed upwind of the suspected contaminated area
- If dusts are originating from suspected contaminated surface soils or drilling operations, try to maintain an upwind position relative to the dust; wet the dust source to suppress dust generation

- If visible dust or obvious vapors are in the breathing zone after precautionary measures have been taken, upgrade to Level C protection.
- HNu Photoionization Analyzer
 - HNu Systems, Inc; Model PI101; Lamp 10.2 eV.
 - The HNu should be calibrated before each day's activities according to manufacturer's instructions. Calibration data should be recorded in the health and safety field logbook.
 - High humidity levels may require periodic lamp cleanings.
 - Sampling activities should be monitored continuously when an initial positive reading is attained.
 - All measured levels should be recorded in logbooks before any activity and every 30 minutes thereafter or more frequently if contamination is suspected or evident.
- HNu Action Levels
 - Background reading Level D protection
 - Background to 1 parts per million (ppm) above background reading → Level D protection; if the vapor source persists for more than 15 minutes, upgrade to Level C protection
 - > 1 ppm above background reading for 5 minutes → Level C protection
 - > 5 ppm above background reading for 10 minutes → stop operations and leave work area by moving upwind; after 10 minutes of venting, monitor area from upwind direction using Level C protection; if concentration persists, contact Project Manager; Level B protection may be required.
- Combustible Gas and Oxygen Meter (LEL)
 - MSA Instrument Division; Model 261.
 - The LEL will be calibrated before each day's activities according to manufacturer's instructions. Calibration data should be recorded in the health and safety field logbook.
 - The LEL will be positioned so as to monitor drilling and sampling activities continuously.
- LEL Action Levels
 - 0 to 10 percent LEL reading → continue work
 - 10 to 25 percent LEL reading → continue work with caution; be prepared to stop work

- >25 percent LEL reading —→ stop work, leave site in upwind direction, and notify the Toledo ANGB safety officer (see Table 8-1).

5.3 EMERGENCY EQUIPMENT

In spite of safety and health training, use of appropriate protective equipment, and exercise of due caution by members of the site teams, the possibility exists for injury and illness in the field. To provide emergency assistance to sick or injured workers, the following supplies and equipment will be available onsite:

- Portable emergency eyewash
- Potable water or Gatorade with ice (1 to 2 gallons per person)
- First aid kit containing supplies for initial treatment of minor cuts and abrasions, severe lacerations, shock, heat stress, eye injuries, skin irritation, thermal and chemical burns, snake and insect bites, and for immobilization of fractures
- Fire extinguisher
- Emergency life support apparatus (ELSA) escape respirators.

6. FIELD OPERATING PROCEDURES

Rules and procedures for personnel conduct at the Toledo ANGB sites are set forth to minimize the possibility of worker exposure to toxic materials. The procedures are to protect the health and safety of all site investigators and will be strictly enforced.

Field operating procedures for the investigators include the establishment of a clean area where the investigation team may eat, drink, and rest, and a series of rules designed to protect team members by minimizing exposure to toxic substances.

6.1 CLEAN AREA

At each contaminated site, the SSHC will designate a "clean" area and a decontamination point. Both the clean area and decontamination point will be located upwind from the waste contaminated area, with the clean area located the farthest away.

The clean area is a place where site investigators may rest, eat, or drink. Clean safety equipment may be put on, or brought into, the clean area. Contaminated equipment (including personal protective gear) must be removed or decontaminated before entering the clean area. Water and first aid supplies will be located at the clean area.

6.2 EXCLUSION ZONE

The exclusion zone includes the area in the immediate vicinity of well drilling operations. This area will be temporary (i.e., once well installation has been completed and residuals removed, the area will be considered to be clean). Entry into or departure from the exclusion zone must be by way of the decontamination point. The boundaries of the exclusion zone will be clearly understood by all onsite personnel and marked if appropriate for site conditions.

6.3 DECONTAMINATION

All protective clothing, safety equipment, monitoring equipment, and sampling equipment will be decontaminated at the decontamination point before

leaving the contaminated area. Safety equipment will be decontaminated, removed, and left at the decontamination point while the wearer takes a rest, break, or a meal at the clean area. Decontamination facilities and equipment will be set up at each site as well as at a designated area nearby on the Base.

6.3.1 Respirators

Respirators will be cleaned with soap and water after each day of use, and normally when personnel change sites. Clean water will be available for such purposes. After washing, each respirator will be disinfected by wiping both the inside and outside with alcohol. The cleaned respirators are stored in clean plastic bags for next usage.

6.3.2 Reusable Equipment

Items such as boots, goggles, and hard hats are reusable. These items will be decontaminated by washing them with a laboratory-grade detergent (e.g., Alconox), rinsing thoroughly, and air drying or wiping dry with paper towels.

6.3.3 Disposable Equipment

Disposable coveralls, nitrile rubber gloves, disposable sampling materials, unusable safety equipment (used respirator cartridges, punctured boots, etc.), and other contaminated materials such as bags and paper towels, will be disposed of properly. These items must be discarded in such a way that they cannot be reused. All items will be put into heavy plastic garbage bags; the bags will be sealed and disposed of in an area designated by Base personnel. The Tyvek coveralls and nitrile rubber gloves will be disposed of at least daily and more frequently if torn or grossly contaminated.

6.3.4 Decontamination Procedures

Personnel: Each activity location should have a segregated equipment drop. Decontamination procedures should progress as follows:

- Scrub boots, soles, and outer gloves with a laboratory-grade detergent (e.g., Alconox) and a water rinse
- Remove outer gloves

- Remove and discard outer coveralls
- Remove hard hat and respirator; discard respirator cartridges
- Remove boots if leaving the site
- Remove and discard inner gloves
- Wash hands and face with soap and water.

At the end of each work day, site personnel should shower and wash their hair as soon as possible. Clothes worn onsite should be segregated and washed separately.

Beverage Breaks: During breaks, site personnel should adhere to the following procedures:

- Remove hard hat
- Wash and remove outer gloves
- Remove respirator
- Partially unzip coveralls
- Remove inner gloves
- Wash hands and face.

Personnel should make sure not to touch any used protective clothing during the break. The above procedure should be reversed for personnel to return to work.

6.4 MANDATORY SAFE WORK PROCEDURES

All personnel working in the field at the Toledo ANGB sites will follow these rules and procedures:

- Designated personal protective equipment will be worn at all times.
- Soil, surface water, sediment, and groundwater samples will not be handled without protective gloves.
- Additional protective equipment, including respirator and goggles, will be worn as needed based on monitoring sampling results, as well as when releases are detected.

- Only authorized personnel will be permitted within a 20-foot radius of the drill rig site.
- A wind-flag will be attached to the drill rig and, to the extent possible (i.e., depending on site conditions), the drill rig and the drilling crew will be positioned upwind with respect to the prevailing wind direction so that the workers will be minimally exposed to the emissions from the borehole or from the drill rig's exhaust.
- Smoking, eating, drinking, chewing gum or tobacco, taking medication, and applying cosmetics will not be permitted within the contaminated area and not until the workers have washed face, hands, and forearms in the clean area.
- Proper decontamination procedures will be followed before leaving the site area (see Section 6.3.4).
- Required safety equipment (see Section 5) will be worn at all times in the contaminated area. Safety equipment will be readily accessible.
- When respirators and goggles are not in use, they will be physically carried by the site investigator for easy access.
- No open flames will be permitted in the contaminated area.
- Additional safety equipment, such as respirator or Self Contained Breathing Apparatus (SCBA), will be used at the direction of the SSHC.

7. HEALTH AND SAFETY MONITORING PROCEDURES

Based on the volatile nature of some of the contaminants at the Toledo ANGB sites, the potential risks to workers during the field operations are:

- Inhalation of gas or vapors containing the following suspected organic contaminants: fuel oil, gasoline, xylenes, benzene, toluene, PCE, TCE, or 1,1,1-TCA
- Skin adsorption of hazardous substances.

Tables 7-1 and 7-2 provide information on the toxicological, chemical, and physical properties of the potential contaminants at Toledo ANGB. While documented evidence of the disposal of explosive materials at the sites of concern is not available, combustible gas monitors will be used as a component of the health and safety monitoring procedures at the sites. Potential inhalation of gas or vapors will be minimized through air monitoring procedures conducted during both sampling and drilling operations. Because levels of airborne chemical constituents are subject to change, ongoing air monitoring will be conducted at the sites using HNu photoionization meters and detector tubes. The SSHC will be responsible for calibrating the instruments, setting the alarm level, and the operation of the equipment during the course of each day.

The potential skin adsorption hazard is minimized by worker adherence to this health and safety plan. If the rules and procedures for site work are enforced properly and all onsite personnel follow the health and safety protocols outlined in this plan, incidents of skin contact with toxic material should not occur. Enforcing the rules and procedures with respect to protective and safety equipment and site operations, which is the responsibility of the SSHC, will provide protection against this potential hazard.

7.1 HAZARD EVALUATION

7.1.1 Overall Hazard Level

Moderate to Low Potential hazards are principally chemical in nature. Based on a preliminary review of existing data, contaminants that are expected

TABLE 7-1. TOXICOLOGICAL PROPERTIES OF POTENTIAL
CONTAMINANTS AT OHIO AIR NATIONAL GUARD, TOLEDO EXPRESS AIRPORT, SWANTON, OHIO

ORGANIC CONTAMINANT	PEL (in ppm)	IDLH (in ppm)	SYMPTOMS OF ACUTE EXPOSURE
Xylene	100	10,000	Exposure to high concentrations adversely affects the central nervous system and irritates the mucous membranes.
Benzene	1	—	Known human carcinogen (Leukemia). Exposure to high concentrations in the air causes central nervous system depression and cardiovascular effects. Dermal exposure may cause dermatitis.
Toluene	100	2,000	Acute exposure depresses the central nervous system and causes narcosis.
Methylene chloride	100	10,000	Exposure in high concentrations adversely affects the central nervous system, kidney, and liver.
PCE	50	500	Inhalation exposure causes liver, kidney, and central nervous system damage in animals.
TCE	50	1,000	Inhalation exposure to high concentrations causes liver, kidney, neural damage, and dermatological reactions in animals.
Methyl ethyl ketone	200	3,000	At high doses, affects the nervous system and irritates the eyes, mucous membranes, and skin of exposed laboratory rats.
Phenol	5	100	Exposure has been shown to irritate the eyes, nose, and throat.
Carbon Tetrachloride	5	300	Exposure causes liver and kidney damage.
1,1,1-TCA	350	1,000	Inhalation exposure to high concentrations depresses the central nervous system, affects cardiovascular function, damages lungs, liver, and kidneys. Exposure causes irritation of skin and mucous membranes.
1,1,2-TCA	10	500	Exposure causes liver and kidney damage in dogs.

TABLE 7-2. CHEMICAL AND PHYSICAL PROPERTIES OF POTENTIAL CONTAMINANTS AT OHIO AIR NATIONAL GUARD, TOLEDO EXPRESS AIRPORT, SUMMIT OHIO

Organic Contaminant	Molecular Weight	Boiling Point (C)	Melting Point (C)	Specific Gravity (AT 20 C)	Solubility in Water (MG/L)	Solubility in Organics	Log Octanol/Water Partition Coefficient	Vapor Pressure (in mm Hg)	Vapor Density	Flash Point (C) (Closed Cup)
Xylene	106.17	m-Xylene 139 o-Xylene 144 p-Xylene 138	m-Xylene -48 o-Xylene -25 p-Xylene 13	0.8657 0.8617 0.8626	130 175 198	Soluble in alcohol, ether, and other organic solvents	m-xylene:3.26 o-xylene:2.95 p-xylene:3.15	10 at 25(C)	3.7	25 17 25
Benzene	78.12	80.1	5.56	0.0879	1,780 at 25(C)	Miscible with ethanol, ether, acetic acid, chloroform, carbon disulfide, carbon tetrachloride	1.95-2.13	75 at 20(C)	2.77	11.1
Toluene	92.13	110.6	-95	0.8669	534.8 at 25(C)	Soluble in acetone, ligroin, carbon disulfide, Miscible with alcohol, ether, benzene, chloroform, glacial acetic acid, and other organic solvents	2.69	28.7 at 25(C)	3.14	4.4
Methylene Chloride	85	40	-95.1	1.3289	17,000 at 25(C)	Soluble in alcohol.	1.26	36.2	----	----
PCE	165.83	121	-22.7	1.63	150-200	Miscible with chloroform, ether, and glacial acetic acid	2.88	14 at 20(C)	----	----
TCE	131.5	87	-73	1.4642	1,000	Soluble in alcohol, ether, acetone, and chloroform	2.29	60 at 20(C)	4.53	----
Methyl Ethyl Ketone	72.1	79.6	-86.35	0.805	Very soluble in water	Miscible with alcohol, ether, acetone, and benzene	0.29	71.2 at 20(C)	2.41	2.0 (open cup)
Phenol	94.11	181.75	43	1.0576	93,000 at 25(C)	Soluble in alcohol, chloroform, and carbon disulfide; very soluble in ether. Miscible with carbon tetrachloride and hot benzene	1.46	0.3513 at 25(C)	3.24	85
Carbon Tetrachloride	153.8	76.7	22.9	1.59 (liq) 5.3 (gas)	800	Miscible with alcohol, benzene, chloroform, ether, and carbon disulfide	2.64	90 at 20(C)	5.32	----
1,1,1-TCA	133.4	74.1	-30.4	1.34 (liq)	480-400 at 20(C)	Soluble in acetone, benzene, carbon tetrachloride, methanol, ether, carbon disulfide, and chlorinated solvents	2.17	123 at 20(C)	5.32	----
1,1,2-TCA	133.41	133.8	-36.5	1.4397	4.5 at 20(C)	Soluble in alcohol, ether, and chloroform	2.17	19 at 20(C)	4.63	----

to be encountered at the site are given in Table 7-1. The PELs for worker exposure to individual contaminants (see Table 7-1) have been reviewed in developing the action levels found in this plan.

7.2 GENERAL HEALTH EFFECTS

The following list of constituents and their associated adverse health effects has been compiled from standard toxicological literature. The concentrations of contaminants found at the site are expected to be generally far below concentrations that would cause these effects. Strict adherence to the health and safety protocols, including the use of appropriate personal protective equipment, will be required throughout the project duration. Information on the chemical and physical properties of all contaminants detected at the site will be available to all workers at the site and will be in the possession of the SSHC.

Chlorinated Hydrocarbons -- The chlorinated alkenes (trichloroethylene) and alkanes (1,1,1-TCA) act primarily on the central nervous system and may cause liver and kidney damage from prolonged exposure. Initial symptoms are irritation or burning of the eyes, nose, and throat, with headache and dizziness. Exposure to high concentrations can cause cardiac arrhythmia and loss of consciousness. Routes of entry include inhalation and moderate skin absorption.

Base Neutral Organics -- Base neutral organics generally have a low volatility and water solubility. They have a large potential for dermal absorption and bioaccumulation. Skin protection is required.

Benzene -- Benzene is a known human carcinogen. Exposure to high concentrations in the air causes central nervous system depression and cardiovascular effects. Dermal exposure may cause dermatitis.

Ketones -- These solvents can cause irritation to the eyes and dryness to the skin with repeated exposure. Inhalation of high concentrations will irritate mucous membranes and cause headache, dizziness, and deaden sense of smell. They are extremely flammable.

Physical Hazards -- Physical hazards that may be encountered at the site include:

- There will be the usual hazards associated with drilling. Noise levels may require hearing protection. Noise levels will be measured onsite by the SSHC. Hard hats are to be worn around the drilling rigs. If Level C protection is required, extra precautions should be taken when near the rig because of limited visibility.
- All electrical equipment must be well-grounded. Observe all overhead lines and maintain a safe distance (approximately 20 feet).
- When personnel are wearing protective clothing and working at ambient temperatures above 75°F, measures will be taken to prevent heat stress. Prevention techniques include: a work-rest regimen to limit the protective clothing wearing time in between rest periods, frequent fluid replenishment, training in the symptoms and prevention of heat stress, and provision for seated and shaded rest areas. A beverage break is required every 2 hours when temperatures exceed 75°F, every 1 and 1/2 hours above 80°F, every 1 hour above 85°F, and every 1/2 hour above 90°F. Work at temperatures above 95°F should be avoided by planning the daily work schedule to avoid mid-afternoon periods of the day.

8. CONTINGENCY PLAN FOR EMERGENCY PROCEDURES

The site investigation team will have a list of emergency numbers (telephone numbers and radio call numbers, as appropriate). These emergency numbers include local police, fire department, and hospital, as shown in Table 8-1. The numbers will be kept in an easily accessible place that is known to all team members (e.g., first aid kit). All team members will be instructed in how to obtain assistance.

In the event of an emergency (i.e., accident, illness, hazardous situation at a site, or intentional acts of harm), emergency assistance will be obtained by the SI Manager or other member of the team if the SI Manager is unable to do so. If a hazardous or potentially dangerous situation is known or believed to be present at a site based on background information or previous visits, the site investigators will notify local authorities and emergency assistance teams as to the impending activities at that site.

If air monitoring indicates elevated contaminant levels at or above IDLH levels during field operations, the following actions will be taken:

- Work will stop, drilling rigs will be turned off
- Workers will leave the vicinity of the alarm by moving upwind
- The SSHC and his line-of-sight backup team will don appropriate protective gear and investigate the release and the monitoring device.
- If preliminary measurements near the release point indicate a level that is IDHL, the SSHC will advise the workers to leave the site and will do so himself
- In the event of an IDHL release, the SSHC will notify the Toledo ANGB point-of-contact, SAIC SHD, SAIC PM, and local fire department.

Based on the relatively low hazard potential at the Toledo ANGB site, it is not necessary to require special medical personnel or facilities to be located at the site as part of special medical procedures. Any emergency that may occur during site activities will be handled as described herein.

**TABLE 8-1. EMERGENCY HELP AND ASSISTANCE OHIO AIR NATIONAL GUARD,
TOLEDO AIR NATIONAL GUARD BASE, TOLEDO EXPRESS AIRPORT**

Central Security (Toledo ANGB 24 hours)	866-2077
Medical Emergency Ambulance (Toledo ANGB)	866-2077
Medical Consultant - Dr. Kenneth Chase, Washington Occupa- tional Health Associates (0800-1730 EST).	(202) 463-6698
After hours answering service	(202) 463-6440
SAIC ETG Health and Safety Officer - Stanleigh Phillips . . .	(702) 794-7868
SAIC Project Health and Safety Officer - Fernando Padilla . .	(703) 827-8122
Fire Department (Toledo ANGB)	866-2117
Military Police (Toledo ANG).	866-2077
Rescue, Emergency Medical Technician.	866-2077
Base Civil Engineer's Office.	866-2009 866-2133
Base Contact - Lt. Bill Antoszewski	866-2009
Local Area Code	419
When dialing a Base number from on Base, dial last 4 digits	
When dialing an off Base number from on Base, dial 9 + number	

An incident is defined as an accident, illness, or case of exposure (suspected or actual). Should an incident occur during the SI, the following actions should be taken:

- Stop all work and take action to prevent further injury; notify the SSHD.
- Get medical attention immediately by calling the Toledo ANGB rescue EMT at extension 2077.
- Depending on the type and severity of the incident or injury, notify the occupational physician. Chemical exposures should be reported to the consulting physician.
- Notify the SAIC PM.
- Notify the injured person's personnel office.

It is necessary for an incident report to be submitted in the event of an incident or injury. The incident report will include:

- Date, time, and place of occurrence
- Person(s) involved
- Type of incident
- Description of incident and action taken
- Recommendations for prevention of a similar occurrence.

The PM and SHD will discuss the incident and identify possible measures for preventing a recurrence of the incident. The report must be signed and dated by the person completing it. The PM will sign and date the report upon receipt. All incident reports and follow-up action on the incidents will be kept on file by the PM.

9. REFERENCES

Hazardous Materials Technical Center (HMTc), 1989. Installation Restoration Program Preliminary Assessment for 180th Tactical Fighter Group Ohio Air National Guard, Toledo Express Airport, Swanton, Ohio and 200th Civil Engineering Squadron Ohio Air National Guard, Camp Perry ANG, Port Clinton, Ohio. February, 1989.

Occupational Safety and Health Administration Safety and Health Standards, Code of Federal Regulations, "Hazardous Waste Operations and Emergency Response," Title 29, Subpart H, 1910.120.