U.S. ARMY CORPS
OF ENGINEERS
LOUISVILLE DISTRICT

Quality Assurance Project Plan

Limited Site Inspection of the former

Plum Brook Ordnance Works

Garage Maintenance Area

Sandusky, Ohio

DERP-FUDS HTRW Project No. G05OH001825

July 2000

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APPENDICES

ATTACHED DOCUMENTS

ASSOCIATED DOCUMENTS NOT ATTACHED

List of Acronyms

ASTM	American Standards for Testing Materials
BTEX	benzene, toluene, ethylbenzene, xylene
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CLP	Contract Laboratory Program
COC	Chain of Custody
CRL	Central Regional Laboratory
D&D	Decontamination & Decommissioning
DERP	Defense Environmental Restoration Program
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
ERIIS	Environmental Risk Information & Imaging Services
ERNS	Emergency Response Notification System
FSP	Field Sampling Plan
FUDS	Formerly Used Defense Sites
gpm	gallons per minute
GSA	General Services Administration
HNO_3	acetic acid
IDW	Investigation-Derived Waste
INPR	Inventory Project Request
IT	IT Corporation
LeRC	Lewis Research Center
MDL	Method Detection Limit
MRL	Method Reporting Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
msl	mean sea level
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautical and Space Administration
NIST	National Institute of Standard Technology
NPL	National Priorities Lists
OEPA	Ohio Environmental Protection Agency
PA	Preliminary Assessment
PAWL	Pentolite Area Waste Lagoons
PBOW	Plum Brook Ordnance Works
PBRF	Plum Brook Reactor Facility
PBS	Plum Brook Station

PE	Pentaerythritol
PETN	Pentaerythritol tetranitrate
PID	Photoionization Detector
ppb	parts per billion
PRGs	Preliminary Remediation Goals
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SAS	Spectial Analytical Services
SI	Sight Investigation
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compound
SW846	Test Methods for Evaluating Solid Waste 1986
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
TNT	trinitrotoluene
USACE	U.S. Army Corp of Engineers
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

SECTION I

PROJECT DESCRIPTION

1.1 Introduction

The purpose of this Site Investigation is to gather sufficient information to determine if there is environmental contamination at the site that requires further attention. This Quality Assurance Project Plan has been prepared by the U.S. Army Corps of Engineers (USACE), Louisville District. A QAPP, Field Sampling Plan, and Data Quality Objectives dated May 1999, revised July 2000, have been prepared. The Site-Specific Health and Safety Plan (SSHSP) associated with this document is not attached.

1.2 Installation Description

The former Plum Brook Ordnance Works (PBOW) facility is located near Sandusky, Ohio in Erie County. Based on the Archives Search Report (USACE, 1993), the original Plum Brook Station site was established in 1941 and referred to as Plum Brook Ordnance Works (PBOW). In the early 1940s the U.S. Army Ordnance Department contracted with Trojan Powder Company to manufacture 2,4,6-TNT, dinitrotoluene and pentolite at PBOW. Trojan Powder Company of Allentown, Pennsylvania, a business incorporated in the State of New York, provided full production and maintenance services for the PBOW facilities. The facility architect was the E.B. Badger & Sons Company. Production began on 16 December 1941 and continued through late 1945, ceasing two weeks after V-J Day (2 September 1945). After operations ceased, the area was turned over to the Army Ordnance Department, renamed Plum Brook Depot, and used for ammunition storage.

Decontamination of TNT, acid, pentolite and DNT manufacturing lines was completed during the last quarter of 1945. On 17 December 1945, the physical custody of the plant was transferred from the Trojan Powder Company to the Ordnance Department. The USACE assumed responsibility for maintenance and custodial duties until September 1946 when the property was transferred to the War Assets Administration (predecessor to the Government Services Administration). At this point in time the property was certified by the U.S. Army to be decontaminated. An agreement was made in 1956 to lease 500 acres of the northern portion of PBOW to construct and operate the Plum Brook Reactor Facility (PBRF). The reactor was planned to be a scientific investigation reactor where the effects of radiation on various materials could be measured. The National Aeronautics and Space Administration (NASA) acquired the PBOW in 1963 and is presently using the site, now referred to as Plum Brook Station.

The PBS site currently lies in an area that is primarily rural and agricultural with a low population density. The site is currently owned by NASA and is operated as the Plum Brook Station of the Glenn Research Center. Prior to 1999, the center was known as the Lewis Research Center. The NASA Glenn Research Center main office is located in Cleveland, Ohio. The NASA Glenn Research Center occupies a majority of the former ordnance works. The Department of the Army maintains a reserve center on the westernmost portion of the facility.

The remainder of the former installation is in private ownership with the vast majority being cultivated. A tract on the northern boundary is owned by the Perkins Board of Education and is utilized as a bus maintenance facility.

1.2.1 Site Specific

The Garage Maintenance Area (GMA) is located in the central portion of the PBOW facility. The site areas that are the subject of this investigation are the Locomotive Shop and the Railroad Car Washing Pit. The Locomotive Shop is located north of Maintenance Road in the eastern part of the Maintenance Area. The former Railroad Car Washing Pit is east of the Locomotive Shop. Figure 1 depicts the site.

The Locomotive Shop is the easternmost building located in the GMA. The shop was used for the maintenance of equipment, vehicles, and rail cars. Within this building is a maintenance pit which is the primary area of concern in the building. The pit measures 60 feet long, 3 feet 8 inches wide, and 5 feet deep (E.B. Badger & Sons Co., 1941a). The pit is located below the northern set of railroad tracks that run through the Locomotive Shop. NASA backfilled this pit with loose stone and is currently using the building as a storage garage. The pit was used to work on the rail cars and locomotives during the operation of PBOW. The waste effluent from the pit was sent into the sewer system via a sump pump. The sump pump is located in a pit measuring 9 feet 2 inches deep and 2 feet 6 inches across, and is located on the south side of the building (E.B. Badger & Sons Co., 1941a).

1.2.2 Facility Size and Borders

The site is bordered to the north by Bogard Road, to the south by Mason Road, to the west by Patten Tract and Campbell Roads and to the east by Highway 250 and Columbus Road. The entire PBOW is encompassed by Patrol Road. The former PBOW area was 9,009 acres of land.

The GMA is bordered to the South by Acid Area # 1, to the North by an open grassy field which borders Pentolite Road, to the East by an open drainage ditch, and to the West by Railcar Unloading/Sellite Area and an open grassy field.

1.2.3 Topography

Section 1.5 of the SI Field Sampling Work Plan provides information concerning the site's general topography.

1.2.4 Local Geology & Hydrogeology

Section 1.6 and Section 1.7 of the SI Field Sampling Work Plan provide information concerning the site's geology and hydrogeology.

1.3 Past Data Collection Activities

There have not been previous studies to either the Locomotive Shop or the Rail Car Washing Pit, but Plum Brook Ordnance Works has been subject to a number of investigations since 1989. In 1989 IT Corporation installed four groundwater monitoring wells. Concentrations of several Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds (SVOCs) were detected at elevated levels in the groundwater, surface water, and subsurface soil samples. In addition, chromium, magnesium, and sulfate were also detected at elevated levels in some groundwater samples.

In 1991, SAIC conducted a preliminary assessment to evaluate past waste management and hazardous material handling processes at PBS, including the PBOW history. SAIC concluded that ten sources had released hazardous substances to the environment, including nitroaromatics, heavy metals, acetone, methylene chloride, solvents, petroleum hydrocarbons, and asbestos. The releases were from the former Red Water Disposal Ponds, the burning grounds, underground storage tank removal areas, and the steam piping systems. The surface water pathways were determined to be the most significant factor leading to releases into the environment.

In 1992, H^+GCL conducted a site investigation of the Snake Road Burning Ground and the adjacent burning grounds used by NASA. In some documents this area is described as Disposal Area Three. The purpose of the investigation was to characterize possible groundwater and surface water contamination due to the use of this area as an uncontrolled burning ground. H^+GCL installed soil borings and monitoring wells in the area, including one background monitoring well. Based on the results of the investigation, no further action at the site was recommended.

In 1993, MK Corporation conducted a site inspection from June to July of 1993 for NASA. The purpose of this inspection was to identify any form of threat present in the environment that would call for further action on NASA's behalf. The results of the inspection identified limited contamination by nitroaromatics and metals.

In May 1995, Dames & Moore conducted a Site Wide Ground Water Investigation under contract to USACE. The objectives were: to evaluate groundwater occurrence and flow conditions in the overburden water bearing zone and bedrock aquifer; to assess the groundwater quality in both the overburden water bearing zone and at the Red Water Ponds and TNT Manufacturing Areas; to investigate the baseline site wide groundwater quality of the bedrock aquifer; and to evaluate the necessity of additional work at PBOW. A total of 11 monitoring wells were installed in the overburden water-bearing zone and eight wells were installed into the bedrock aquifer. Groundwater samples were collected from 25 wells. Sampling included existing and newly installed wells. Samples were analyzed for nitroaromatics, nitrates, and metals. Samples from the bedrock wells were also analyzed for VOCs and SVOCs. The analytical results indicated that explosive residuals are present in the overburden water bearing zone vicinity of the Red Water Disposal Ponds and within each manufacturing area. Several bedrock wells within the Red Water Disposal Pond Area and TNT Manufacturing Area were found to be contaminated by nitroaromatics.

In 1996, IT Corporation conducted a site investigation for USACE at the suspected G-8 Burning Ground. Soil and sediment samples were collected following a geophysical survey of the site. Samples were analyzed for VOCs, SVOCs, metals, nitroaromatics, and pesticides/PCBs. Based on the results of the investigation, no further site specific actions at the site were recommended.

In 1996, IT Corporation under contract to USACE, conducted site investigations of Acid Areas No. 1, 2 and 3, the Maintenance Shop Area, and the Power Substation that are associated with Acid Area No. 3. A total of 53 surface and 51 subsurface soil samples were collected for chemical analysis. All soil samples were analyzed for VOCs, SVOCs, and metals. In addition, soil samples collected from selected areas were analyzed for nitroaromatics, PCBs (surface samples only), nitrate, sulfate, and pH. The results of the analyses showed that SVOCs, PCBs, and metals were all found at levels of concern. The rest of the analytes were all below the concentrations of concern.

1.4 Current Status

The Fiscal Year 1999 FUDS program has authorization for six site investigations at the PBOW property. The Locomotive Maintenance Area is designated as project G05OH001825 on the FUDS data listing. Based on reports and documents reviewed for the site, the Locomotive Maintenance Area was utilized by the Army during the time the explosives were being manufactured at PBOW.

1.5 Project Objectives

The purpose of this investigation is to gather sufficient information to determine if environmental contamination at the site merits further study or other actions. Objectives of the investigation will be as follows:

- Verify the existence of contamination in the area. Data quality must be sufficient to be able to compare with U.S. Environmental Protection Agency (USEPA) Region 9 PRG criteria.

- Collect sufficient data on contaminated media to support a recommendation for further study, action, or closure of the site.

The investigation will integrate existing data with information gathered through direct field investigations.

The field investigation will include sampling of media as described below.

> Surface soil sampling will be performed using a stainless steel hand auger. The area around the boring location will be cleared of any debris. Some borings may be advanced using a direct-push hydraulic sampler that will be on site during the GMA fieldwork. The amount of availability of the direct-push sampler time will be proportional to delays

experienced in prosecuting the fieldwork sitewide at the former PBOW.

Sampling will be continuous throughout the boring. Samples will be collected at 1 foot and at another deeper interval selected during fieldwork. If there are visual signs of contamination at greater depths additional samples will be collected or composited.

Any variances in sampling due to field conditions or findings will be properly documented. All borings will be documented with boring log notes and soils will be classified using the Unified Soil Classification System. Once the proper depth is obtained the auger will be removed from the borehole and the sample collected from the sampling section (void) of the auger. A headspace portion will be placed in a clean glass container (no more than half full) and sealed with aluminum foil. Photoionization detector (PID) readings will be collected from the headspace container. Immediately after the headspace measurement is collected, a VOC portion will be placed in a pre-cleaned glass sample jar with Teflon lined lid supplied by the laboratory, labeled, and sealed. If the PID reading indicates the presence of VOCs, the jar of soil will be a candidate for submission for analysis. The remains of the sample will be placed in a stainless steel bowl and thoroughly mixed and homogenized before placing samples in the appropriate container.

A deep ditch that flows northward away from Maintenance Road runs through a channel located east of the locomotive building. It is planned to share labor resources with others on the CELRL field team to sample the surface water in the open ditch that is located in the area east of Building 718. This open ditch is a receiving waterway for both the Locomotive Maintenance Area and Ash Pit 1 Area.

Samples will be analyzed for SVOCs, and/or PCBs and/or metals. A limited number of samples will also be analyzed for Atterburg limits, percent moisture, grain size distribution, and total organic carbon (TOC) to determine soil physical parameters. Soil pH tests will be conducted on a selected number of samples.

If SI data suggests that sufficient site characterization information has been collected to determine that no further action is required at the site, a Decision Document to that effect will be prepared in coordination with Ohio EPA. If, on the other hand, the SI data shows a need for further investigation or other action, work plans for the next action will be developed and submitted to OEPA.

1.5.1 Specific Objectives and Associated Tasks

The site investigation will include:

- Sludge sampling at the indoor pits if sludge is still extant at the building;
- Sediment and surface water sampling;
- Direct-push sampling of the soil in the work pit in Building 718;
- Direct-push sampling or hand auger sampling of the soil near Building 718; and

- Direct-push sampling or hand auger sampling of the soil in the car pit area along the former railroad tracks.

The field data requirements are summarized in the Field Sampling Plan. Analyte concentrations will be used to compare results to appropriate screening levels.

1.5.2 Project Target Parameters and Intended Data Usages

The list of target parameters for this project is provided in the Field Sampling Plan. Intended data usages are to screen for SI analytes. The data shall be compared to screening soil levels, or to measured detection limits and other low level criteria.

1.5.3 Quality Objectives and Criteria for Measurement Data

Data Quality Objectives (DQOs) are qualitative and quantitative statements derived from outputs of each step of the DQO process that:

* Clarify the study objective;
* Define the most appropriate type of data to collect; and
* Determine the most appropriate conditions from which to collect the data.

The DQOs are then used to develop a scientific and resource-effective sampling design.

The DQO process allows decision-makers to define their data requirements and acceptable levels of decision during planning before any data are collected. DQOs are based on the seven step process described in EPA QA/G-4 (September 1994) document. The DQOs for this site are attached to this QAPP.

1.6 Sample Rationale

The rationale for sample locations (in respective media) is described in detail in Section 4.0 of the Field Sampling Plan.

1.6.1 Sample Network by Task and Matrix

Sample matrices, analytical parameters, and intended frequencies of sample collection can be found in Section 4.0 Field Sampling Plan.

1.6.2 Site Maps of Sampling Locations

The sample location plan is presented in the Field Sampling Plan, which is incorporated into this QAPP through reference. It is possible, however, that depending on the nature of encountered field conditions some of these locations will be changed. The Technical Team Leader, whose responsibilities are described in Section 2.0 of this QAPP, will be responsible for making such decisions.

1.6.3 Rationale of Selected Sampling Locations

The Field Sampling Plan provides the rationale used to select sampling locations and depths.

1.7 Project Schedule

1.7.1 Anticipated Date of Project Mobilization

The earliest date for which samples are planned to be collected is 7 June 1999.

1.7.2 Task Chart and Associated Timeframes

The dates of projected milestones are indicated in the SI Schedule.

Task	**Jan -99**	**Feb-99**	**Mar-99**	**Apr-99**	**May -99**	**Jun-99**	**Jul-99**	**Aug-99**	**Sept-99**
Research/Planning	19-	28							
Site Visit			16-17						
Document Prep.			22		28				
DQO				13					
QAPP					24				
SSHP					20				
SAP				21					
Field Investigation						10			
Data Validation							30		
SI Report Prep.								6	
Review SI Report								30	
Submit SI Report									29

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

The USACE has overall responsibility for all phases of the SI. The Louisville District will perform the field investigation and prepare the SI report. The various quality assurance and management responsibilities of key project personnel are defined below.

2.1 Project Organization

Shelton M. Poole, CHMM, RPIH — Health and Safety Manager (HSM)

Mr. Poole has the responsibility for ensuring that the provisions of the Health and Safety Plan (HASP) are adequate and implemented in the field. Changing field conditions may require decisions to be made concerning the adequacy of the protection programs. Mr. Poole meets the additional training requirements specified by OSHA in 29 CFR 1910.120. The HSM is also responsible for briefing personnel on a regular basis in order to ensure the effectiveness of the HASP.

David Brancato, Ph.D., RPIH — Risk Assessor

Dr. Brancato is experienced in risk assessment methodologies. He also has the responsibility for ensuring that the provisions of the HASP are adequate and implemented in the field in the stead of Mr. Poole. He has had the additional training requirements specified by OSHA in 29CFR1910.120. He will serve as an alternative to Mr. Poole.

Samir A. Mansy, Ph.D. — Quality Assurance Manager

Dr. Mansy served as the Chief of the Quality Assurance Section at Great Lakes and Ohio River Division Laboratory, Cincinnati, Ohio. He is currently the Data Quality Assurance Manager in Louisville District, Environmental Engineering Branch. He is experienced in data review, validation, and troubleshooting. Dr. Mansy provides an independent review of the analytical data based on SW846 and National Functional Guidelines.

Christopher Inlow — Project Scientist

Mr. Inlow has the responsibility for acting as the Project Scientist. He has overall responsibility for ensuring that the projects meets the Corps of Engineers' objectives and quality standards. The Project Scientist will provide assistance in writing and distributing the QAPP to all those parties connected with the project including the laboratory, Quanterra Environmental Services. The Project Engineer/Scientist is responsible for the technical quality control and project oversight. Mr. Inlow has experience in environmental remediation scope preparation at both the Baltimore and Louisville Districts.

2.2 Management Responsibilities

Rick Meadows — Project Manager

The Project Manager, Rick Meadows, Huntington District, has the overall responsibility for all phases of the PBOW projects.

Doug Meadors — Technical Team Leader

Mr. Meadors serves as the Technical Team Leader. He is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The Technical Team Leader's primary function is to ensure the successful achievement of technical, financial, and scheduling objectives. The Technical Team Leader will:

- Define project objectives and develop a detailed work plan schedule;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical resources as needed to ensure performance within budget and schedule constraints;
- Orient appropriate personnel concerning the project's special considerations;
- Monitor and direct field work;
- Develop and meet ongoing project requirements, including mechanisms to review and evaluate each task project;
- Review the work performed on each task to ensure its quality, responsiveness and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Approve all reports (deliverables) before their submission to Ohio EPA;
- Ultimately be responsible for the preparation of reports; and
- Represent the project team at meetings.

2.3 Quality Assurance (QA) responsibilities

QA Manager

The QA Manager will remain independent of direct job involvement and day-to-day operations, and have direct access to corporate executive staff as necessary, to resolve any QA dispute. Dr. Mansy is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, U.S. Army Corps of Engineers, and Ohio EPA requirements. Specific functions and duties include:

- Providing QA audit on various phases of the field operations;
- Reviewing and approving of QA plans and procedures;
- Providing QA technical assistance to project staff;
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Scientist and to the Technical Team Leader;
- Data validation including tentatively identified compounds;
- Review and approval of field and laboratory procedure; and
- Performance and system Audits of the Laboratory.

All samples will be analyzed by Quanterra Environmental Services, North Canton, Ohio, with the exception of Atterburg Limits and grain size analysis, which will be subcontracted to an approved laboratory. Data validation will be done by Roy F. Weston, Inc., Miamisburg, Ohio. Validation will be conducted randomly on 10% of the sample results.

2.4 Field Responsibilities

Technical Team Leader

The technical team leader for this project will monitor and direct fieldwork. The technical team leader will be responsible for determining whether locations to be sampled will be changed.

USACE Field Technical Staff

The technical staff (team members) for this project will be drawn from USACE pool of Louisville District, Environmental Engineering Branch resources. The technical team staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

2.5 Laboratory Responsibilities

Quanterra Laboratory Project Manager

The Quanaterra Project Manager, Debora Hula, will report directly to the USACE Quality Assurance Manager and will be responsible for the following:

- Ensuring all resources of the laboratory are available on an as-required basis;
- Review of final analytical reports; and
- Approving final analytical reports prior to submission to Louisville District.

Quanterra Operations Manager

The Quanterra Operation Manager will report to the Quanterra Project Manager and will be responsible for:

- Coordinating laboratory analyses;
- Supervising in-house chain-of-custody;
- Scheduling sample analysis;
- Overseeing data review; and
- Overseeing preparation of analytical reports.

Quanterra Quality Assurance Officer

Ms. Opal Davis-Johnson is the Quanterra QA Officer, and has the overall responsibility for data after it leaves the laboratory. The Quanterra QA Officer will be independent of the laboratory but will communicate data issues through the Quanterra Project Manager. In addition, the Quanterra QA Officer will:

- Provide overview of laboratory quality assurance;
- Review QA/QC documentation;
- Conduct random audits of detailed data;
- Determine whether to implement laboratory corrective actions, if required;
- Define appropriate laboratory QA procedures;

- Prepare laboratory Standard Operating Procedures; and

- Sign the title page of the QAPP.

Quanterra Sample Custodian

The Quanterra sample custodian, Lois Ezzo, will report to the Quanterra Operations Manager and the Laboratory Supervisor. Responsibilities of the sample custodian will include:

- Receiving and inspecting the incoming sample containers;

- Recording the condition of the incoming sample containers;

- Signing appropriate documents;

- Verifying chain-of-custody and its correctness;

- Notifying Laboratory Manager and Laboratory Supervisor of sample receipt and inspection;

- Assigning a unique identification number and customer number, and entering each into the sample receiving log;

- With the help of the Laboratory Manager, initiating transfer of the samples to appropriate lab sections; and

- Controlling and monitoring access/storage of samples and extracts.

Final responsibility for project quality rests with the USACE Project Manager. Independent quality assurance will be provided by the Quanterra Project Manager and QA Officer prior to release of all data to the USACE Project Scientist.

Quanterra Technical Staff

The Quanterra technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the Quanterra Operations Manager. Members of the technical staff have signed Ethics Agreements which state: they will abide by the high standards of integrity; they shall report actual data; and they will report to the officials of any accidental or intentional non-authentic data. Copies of the agreements are included in Appendix A.

SECTION 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results that are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventative maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1 Precision

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent difference (RPD) and relative standard deviations (RSD) for three or more samples. The equations to be used for precision in this project can be found in section 12 of this QAPP. Precision control limits are included in the provided SOPs.

3.2 Accuracy

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation and holding times.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or standard reference materials (SRM) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in section 12 of this QAPP. Accuracy control limits are included in the provided SOPs.

3.3 Completeness

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements obtained from all the measurements taken in the project. The equation for completeness is presented in section 12 of the QAPP. Field completeness for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in section 12 of this QAPP. Laboratory completeness for this project will be greater than 95 percent.

3.4 Representativeness

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan (FSP) is followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicated samples. The sampling network is designed to provide data representative of facility conditions. During development of this network, consideration is given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the FUDS program. The rationale of the sampling network is discussed in detail in the Field Sampling Plan (FSP).

3.5 Comparability

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is also dependent on similar QA objectives.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

3.6 Level of Quality Control Effort

Field blank, trip blank, method blank, duplicate, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the facility which may cause samples contamination. Trip blanks are used to assess the potential for contamination of samples due to contamination migration during sample shipping and storage. Trip blanks pertain to volatile organic samples only. Trip blanks prepared prior to the sampling event in the actual sample containers and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other samples and sent for analysis. There should be one trip blank included in each sample shipping container. At no time after their preparation are the sample containers opened before they reach the laboratory.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and are subsequently referred to as MS/MSD samples. One matrix spike/matrix spike duplicate will be collected for every 20 or fewer investigative samples. MS/MSD samples are designated/ collected for organic analyses only.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. However, aqueous MS/MSD samples must be collected at triple the volume for VOCs and double the volume for extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., water, soil).

SECTION 4

SAMPLING PROCEDURES

The sampling procedures to be used in this site investigation will be consistent, and are presented in Section 5.0 of the Field Sampling Plan.

SECTION 5

CUSTODY PROCEDURES

Proper sample collection and analysis requires the maintenance of strict chain-of-custody (CoC) procedures. These procedures include tracking and documentation during sample collection, shipment, and laboratory processing.

A sample is considered to be in an individual's custody if it is:

- In the physical possession or view of the individual party.
- Secured to prevent tampering.
- Placed in a restricted area by the responsible party.

5.1 Field Custody Procedures

The sampling team leader is responsible for the custody of the collected samples in the field until they are properly packaged, documented, and released to the courier for shipment to the laboratory. The laboratory is responsible for sample custody thereafter. Custody will be documented by using the CoC record initiated for each day that samples are collected. This record will accompany the samples from the site to the laboratory and will be returned to key project personnel with the final analytical report. All personnel with sample custody responsibilities are required to sign, date, and note the time on the CoC record when relinquishing and receiving samples from their immediate custody. Any discrepancies will be noted at this time. All samples will be shipped via overnight courier to the analytical laboratory. Bills of lading will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. Sample documentation and custody for field and laboratory activities are detailed in the following sections.

The laboratory will supply sample containers. The respective containers will be selected to ensure compatibility with the sample matrix, chemical constituents to be analyzed, and to minimize breakage during transportation. Sample bottle size, preservatives, and holding times are listed in the tables below. Sample containers, blank labels, preservatives, and packing materials will be supplied by the laboratory. Sample labels will be attached to containers and completed at the time of sampling. The following information will be recorded on each label:

sample identification number
project number
collector's initials
preservatives added (if applicable)
date and time of collection
sample type
depth

Each sample will be assigned a unique identification number that identifies the sample for analysis.

The following procedures will be performed during sample packaging:

- Number of samples will be verified with field logbook documentation.
- Sample labels will be checked for accuracy and legibility.
- All samples will be wrapped in bubble pack, and placed in a sealed Zip-lock bag.
- All coolers will have a temp blank so that the temperature can be monitored.
- Samples will be packaged in a thermally insulated, rigid cooler.
- Packing material will be placed in the coolers to prevent breakage.
- Ice will be placed in the cooler for samples requiring 4°C ± 2° preservation.
- Each cooler will have a Chain of Custody (CoC) form reflecting the samples inside.
- The CoC form will be placed in a sealed zip-lock bag, and taped to the inside lid of the cooler.
- The cooler will be closed and sealed with duct tape around both ends, and around the lid.
- Custody seals will be placed in two separate locations on the cooler across the lid and main body of the cooler and signed by the field team leader.
- An addressed courier bill will be placed on the cooler so that shipment of the cooler to the proper laboratory location can take place.

All samples will be accompanied by a CoC form. When possession of samples is transferred, the individual relinquishing the samples and the individual receiving the samples will sign, date, and note the time of transfer on the CoC document. This record will represent the official documentation for all transfers of sample custody until samples arrive at Quanterra Laboratories, North Canton, Ohio. Contact information for Quanterra Laboratories is listed below.

Quanterra Laboratory	Phone: (330) 497-9396
4101 Shuffel Drive NW	Fax: (330) 497-0772
North Canton, OH 44720	

Samples will be shipped for overnight delivery by the courier. This will minimize the time interval from sampling to analysis, and will help ensure that all constituent holding times are met. Notification of sample shipment to the laboratory will be performed by the sampling team leader.

5.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and log-in, sample storing and numbering, tracking during sample preparation and analysis, and storage of data are described in the Quanterra Standard Operating Procedures in Appendix B. Examples of laboratory chain of custody traffic reports along with instructions for completion are also included.

5.3 Final Evidence Files

The final evidence file will be the central repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. The USACE is the custodian of the evidence file and maintains the content of evidence files for the site, including all relevant records, reports, logs, field notebooks, subcontractor reports, and data reviews. The final evidence file shall be maintained in a secured, limited access area and under custody of the USACE Technical Team Leader.

The final evidence file will typically include:

- field logbooks;

- field data and data deliverables;

- drawings;

- soil boring logs;

- laboratory data deliverables;

- data validation reports;

- data assessment reports;

- progress reports, QA reports, interim project reports, etc.; and

- shipping documents and air bills.

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.1 Field Instrument Calibration

Organic Vapor Photoionization detector (PID)

Organic vapor photoionization detector (PID) instruments will be rented from Hazco Services Inc., a reputable instrument rental, sales, and repair company. The rental agreement will include provision for a cylinder of span gas and any other materials needed for proper calibration of the instrument. The instrument manufacturer's operation manual will be used as a check list during field operations.

The instruments will be obtained from the following location:

Hazco Services Inc.
6501 Centerville Business Parkway
Dayton, OH 45459
(937) 824-4400

6.2 Laboratory Instrument Calibration

Calibration procedures for a scientific laboratory instrument will consist of an initial calibration (2, 3, 5, or 6 points, depending on the method), initial calibration verification and continuing calibration verification. For a description of the calibration procedures for a specific laboratory instrument, refer to the applicable SOPs in Appendix B of this QAPP. The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance criteria and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution (CRI-brand as second source).

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, date of calibration, analyst, calibration solutions run, and the samples associated with these calibrations.

Organic Analyses

Prior to calibration, the instrument(s) used for Gas Chromatographic/Mass Spectrometer (GC/MS) analyses are tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semivolatile analyses. Once the tuning criteria for these reference compounds are met, the instrument should be initially calibrated by using a five-point calibration curve. The instrument tune will be verified for every 12 hours of operation.

The calibration standards will be USEPA- or NBS-traceable and are spiked with internal standards and surrogate compounds. Calibration and continuing calibration verification at midpoint and at MRL (Method Reporting Limit) levels will be performed at approved intervals as specified by the manufacturer or the analytical method (whichever is more frequent). Calibration standards used as reference standards will be traceable to the source.

Metals Analysis

The Atomic Absorption Spectrophotometer (AAS) and Inductively Coupled Plasma Emission Spectrophotometer (ICP) instruments are calibrated by use of a blank and a one-point standard prepared by dilution of certified stock solutions. An analysis blank is prepared with one calibration standard at the MRL for the metal. The other standards bracket the concentration range of the samples. Calibration standards will contain acids at the same concentration as the digestates.

A continuing calibration standard, prepared from a different stock solution than that used for preparation of the calibration standards, is prepared and analyzed after ten samples or every two hours of continuous operation. The value of the continuing calibration standard concentration must agree with ± 10 percent of the initial value or the appropriate corrective action is taken which may include recalibrating the instrument and reanalyzing the previous ten samples.

For the ICP, linearity near the reporting limit will be verified with a standard prepared at a concentration at the reporting limit (MRL >3MDL). This standard must be run at the beginning and end of each sample analysis run or a minimum of twice per 8-hour period.

SECTION 7

ANALYTICAL PROCEDURES

Samples will be analyzed by Quanterra Laboratories, North Canton, Ohio.

7.1 Field Analytical Procedures

During soil sampling, a headspace portion will be placed in a clean glass container (no more than half full), and sealed with aluminum foil. PID readings will be taken from the headspace container. The operation manual for the PID instrument will be consulted prior to taking the PID readings for each sampling event.

7.2 Laboratory Analytical Procedures

The laboratory named above will implement the project required Standard Operating Procedures (SOPs). These laboratory SOPs for sample preparation, cleanup, and analysis are based on the latest SW-846 Revision. These SOPs provide sufficient detail and are applicable to this investigation.

The site samples for VOC analysis (VOA) shall be screened in the laboratory, as described in the VOA SOP, and shall be analyzed either as low- or medium-level concentration samples, or as a series of dilutions in order to cover the expected concentration range of the site-specific compounds of interest.

The site soil sample extracts requiring pesticide/PCB and/or SVOC analysis (acid/base/neutral analysis or ABNs) shall be subject to gel permeation chromatography cleanup and/or other column chromatography cleanup as necessary.

The laboratory of record has prepared tables that summarize the analyte groups of interest, appropriate laboratory SOP numbers, and EPA reference method for the organic and inorganic analytes to be evaluated in this investigation. The Quanterra SOPs to be used in this investigation are contained in a separate document.

7.3 List of project target compounds and laboratory detection limits

A complete listing of project target compounds can be found in the Field Sampling Plan. Current laboratory determined detection limits for each analyte group are presented in an attachment provided by the laboratory of record. The method detection limits shown have been experimentally determined using the procedure found in 40CFR, Part 136, Appendix B, or equivalent statistical approach. The latest MDLs at the time of sample analysis will be used.

SECTION 8

INTERNAL QUALITY CONTROL CHECKS

8.1 Field Quality Control Checks

The only field measurement planned for this site investigation is monitoring VOCs as measured with the PID. There is no reference standard for PID monitoring since the instrument cannot distinguish between individual compounds. Calibration of the field instrument can be accomplished with the span gas cylinder provided by the equipment supplier.

8.2 Laboratory Quality Control Checks

The laboratory identified in Section 7 of this QAPP has a QC program which ensures the reliability and validity of the analyses performed at the laboratory. All analytical procedures are documented in writing as SOPs. Each SOP includes a QC section which addresses the minimum QC requirements for the procedure. The internal quality control checks might differ slightly for each individual procedure, but in general the QC requirements include the following:

- Field /Trip blanks
- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks
- Matrix spikes/matrix spike duplicates
- Surrogate spikes
- Analytical spikes (Graphite furnace)
- Field duplicates
- Laboratory duplicates
- Laboratory control standards
- Internal standard areas for GC/MS analysis; control limits
- Mass tuning for GC/MS analysis
- Endrin/DDT degradation checks for GC/EC analysis
- Second dissimilar column confirmation for GC/EC analysis

For a description of the specific QC requirements of this site investigation and the frequency of audit, refer to the laboratory SOPs contained in Appendix B. Quality Control (QC) criteria are also included in the SOPs.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed which do not conform with QC criteria will be reanalyzed by the laboratory if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

SECTION 9

DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities or by the laboratory operation shall be reduced and validated prior to reporting. No data shall be disseminated by the laboratory until it has been subjected to the procedures summarized below.

9.1 Data Reduction

9.1.1 Field data reduction procedures

Only direct reading instrumentation will be employed in the field. The use of PID instruments will generate measurements directly read from the meters following calibration per manufacturer's recommendations as outlined in Section 6 of this QAPP. These measurements will be used for screening. No data from photoionizable species sensing is anticipated to be reported as interval/ratio data for this SI. The presence of photoionizable species will be noted in the field log. It is planned to report the data from field sensing for photoionizable species in air as nominal /ordinal data.

9.1.2 Laboratory data reduction procedures

Laboratory data reduction procedures will be followed according to the following protocol: All raw analytical data will be recorded in numerically identified laboratory notebooks (paper or electronic form). These notebooks will be issued only by the Laboratory QA Manager. Data are recorded in this notebook along with other pertinent information, such as the sample identification number and the sample tag number. Other details will also be recorded in the lab notebook, such as the analytical method used (SOP#), name of analyst, the date of analysis, matrix sampled, reagent concentrations, instrument settings, and the raw data. Each page of the notebook shall be signed and dated by the analyst. Copies of the strip chart printouts (such as gas chromatograms) will be maintained on file. Periodic review of these notebooks by the lab QA Manager takes place at the opening and closing of laboratory logs, at a minimum. Records of notebook entry inspections are maintained by the QA Manager.

All calculations are checked by the Organic, and Inorganic including Metal Section Supervisor at the conclusion of each operating day. Errors are noted, corrections are made, but the original notations are crossed out legibly. Analytical results for soil samples shall be calculated and reported on a dry weight basis.

Quality control data (e.g. laboratory duplicates, surrogates, matrix spikes, and matrix spike duplicates) will be compared to the method acceptance criteria. In Level 1 review, the analyst reviews all of the data and QC. This is followed by Level 2 review, in which a senior analyst reviews 100% of QC and 10% of the raw data. Data considered to be acceptable will be entered into the laboratory computer system. The computer system compares QC data to internally generated limits (LCS< MS/MSD, and surrogate) and method criteria. The data are logged into the project database format. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Lab Project Manager approves these data, they are considered ready for third party data validation.

9.2 Data Validation

Data validation procedures shall be performed for both field and laboratory operations as described below:

9.2.1 Procedures Used to Evaluate Field Data

It is planned to report the data from field sensing for photoionizable species in air as nominal /ordinal data. Hence, the presence or absence of photoionizable species will be noted. There is no applicable validation procedure.

9.2.2 Procedures to Validate Laboratory Data

USEPA Contract Laboratory Program National Functional Guidelines (NFG) for Organic and Inorganic Data Review, February 1994, procedures will be modified to include SW-846 criteria summarized in Appendix C, Laboratory Analysis Criteria. The modified NFG will be followed to validate laboratory data in conjunction with the Data Validation Checklist found at Appendix D.

Roy F. Weston assessment will be accomplished by the joint efforts of the Data Reviewer and Project Manager. The data assessment by the Project Manager will be based on the criteria that the sample was properly collected and handled according to the field Sampling Plan and Section 5 of this QAPP.

The Roy F. Weston Data Reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. All technical holding times shall be reviewed, the GC/MS instrument performance check sample results shall be evaluated, results of initial and continuing calibration will be reviewed and evaluated by trained reviewers independent of the laboratory. Also, results of all blanks, surrogate spikes, matrix spikes/matrix spike duplicates, laboratory control samples, internal standards, target compound identification and quantitation, tentatively identified compounds, system performance checks shall be performed for volatile organic compounds by the validator. Additionally, documents of method detection limits study will be provided to the validator. The study results shall also be validated. Ten percent (10%) of the data shall be validated.

The Data Review will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analysis may be made by the Project Engineer/Project Scientist based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for the site will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by Quanterra in accordance with the Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (February 1994) and Inorganic Analyses (February 1994), as well as additional comments of the Data Reviewer. The laboratory-provided data flags will include such items as:

- concentration below required detection limit;
- estimated concentration due to poor spike recovery; and
- concentration of chemical also found in laboratory blank.

The Data Reviewer comments will indicate that the data are:

- useable as a quantitative concentration;
- useable with caution as an estimated concentration; or
- unusable due to out-of-control QC results.

All CLP forms summarizing this information will be checked as well. The overall completeness of the data package will also be evaluated by the Data Validator. Completeness checks will be administered on all data to determine whether deliverables specified in the SI Work Plan and QAPP are present. At a minimum, deliverables will include sample chain-of-custody forms, analytical results, QC summaries, and supporting raw data from instrument printouts. The reviewer will determine whether all required items are present and will request copies of missing deliverables.

9.3 Data Reporting

Data reporting procedures shall be carried out for field and laboratory operations as indicated below:

9.3.1 Field Data Reporting

It is planned to report the data from field sensing for photoionizable species in air as nominal ordinal data. Hence, the presence or absence of photoionizable species will be noted.

9.3.2 Laboratory Data Reporting

Laboratory data is not considered official, reportable data until after the validation activity has been concluded via the laboratory QA Officer/Manager. The Laboratory Project Manager must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. In addition to the record of chain-of-custody, the report format shall consist of the following:

1. Case Narrative:

- Date of Issuance
- Laboratory analysis performed
- Any deviations from intended analytical strategy
- Laboratory batch number
- Numbers of samples and respective matrices
- Quality control procedures utilized and also references to the acceptance criteria
- Laboratory report contents
- Project name and number
- Condition of samples 'as received'
- Discussion of whether or not sample holding times were met
- Discussion of technical problems or other observations which may have created analytical difficulties
- Discussion of any laboratory quality control checks which failed to meet project criteria
- Tables summarizing QC checks for MRLs (true values, found values, and % recoveries) in CLP form
- Signature of the laboratory QA Manager

2. Chemistry Data Package

- Case narrative for each package/analytical group
- Summary page indicating dates of analyses for samples and laboratory quality control checks
- Cross-referencing of laboratory samples to project sample identification numbers
- Data qualifiers to be used should be adequately described
- Sample preparation and analyses for samples
- Sample results
- Raw data for sample results and laboratory quality control samples
- Results of calibration checks and GC/MS tuning results
- Matrix spike and matrix spike duplicate recoveries, laboratory control samples, method blank results, calibration check compounds, and system performance check compound results
- Labeled and dated chromatograms/spectra of sample results and laboratory quality control checks
- Results of tentatively identified compounds

The Data package will be a "CLP-like" format consisting of all the information presented in a CLP data package.

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of laboratory activities will be conducted to verify that analyses are performed in accordance with the procedures established in the FSP and QAPP. The audits of laboratory activities include two independent processes: internal and external audits.

10.1 Laboratory Performance and Systems Audits

The Quanterra Analytical Services laboratories are audited on a regular basis by the USACE. The USACE Center of Expertise in Omaha, Nebraska, is responsible for the system audits of the laboratories on an annual basis, and conducts performance audits.

The system audits include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc. The performance audits will consist of sending performance evaluation (PE) samples to laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of PE samples are evaluated by the USACE Center of Expertise to ensure the laboratories maintain acceptable performance levels.

10.1.1 Internal laboratory Audits

10.1.1.1 Internal Lab Audit Responsibilities

The internal laboratory audit will be conducted by the Quanterra QA Officer.

10.1.1.2 Internal Lab Audit Frequency

The internal lab system audits will be done on an annual basis while the internal lab performance audits will be conducted on a quarterly basis.

10.1.1.3 Internal Lab Audit Procedures

The internal lab system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc. The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The Quanterra QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance. The laboratory audit checklist has been submitted.

10.1.2 External Laboratory Audits

10.1.2.1 External Lab Audit Responsibilities

An external audit may be conducted by the Corps of Engineers.

10.1.2.2 External Lab Audit Frequency

An external lab audit may be conducted at least once prior to the initiation of the sampling and/or during analysis activities. These audits may or may not be announced and are at the discretion of the USACE, Louisville District.

10.1.2.3 Overview of the External Lab Audit Process

External lab audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

SECTION 11

PREVENTATIVE MAINTENANCE

11.1 Field Instrument Preventative Maintenance

Photoionization detectors will be used in the field for this project. The specific preventative maintenance procedures to be followed for the field equipment for this limited SI are those recommended by the manufacturer. The instruments will be checked and calibrated daily for use. Batteries will be kept on-site to reduce downtime. Backup instruments and equipment will be available on-site or within 1-day shipment to avoid delays in the field schedule.

11.2 Laboratory Instrument Preventative Maintenance

As part of their QA/QC Program, a routine preventative maintenance program is conducted by a service contractor on a limited basis to minimize the occurrence of instrument failure and other system malfunctions. Quanterra Laboratories personnel perform routine scheduled maintenance, and repair or coordinate with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives.

SECTION 12

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

12.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample will be randomly selected from each sample shipment received at the laboratory, and spiked with a known amount of the analyte or analytes to be evaluated. In general, a sample spike will be included in every set of 20 samples tested on each instrument. The spike sample will be then analyzed. The increase in concentration of the analyte observed in the spike sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. Control charts will be plotted periodically for each commonly analyzed compound and kept on method-specific, matrix-specific, and analyte-specific bases. The percent recovery for a spiked sample is calculated according to the following formula:

$$\%R = \frac{Amount\ in\ Spiked\ Sample - Amount\ in\ Sample}{Known\ Amount\ Sampled} \times 100$$

12.2 Precision Assessment

Spiked samples are prepared by choosing a sample at random from each sample shipment received at the laboratory, dividing the sample into equal aliquots, and then spiking each of the aliquots with a known amount of analyte. The duplicate samples will be then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the spike and duplicate spike will be calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{|Amount\ in\ Spike\ \#1 - Amount\ in\ Spike\ \#2|}{\frac{Amount\ in\ Spike\ \#1 + Amount\ in\ Spike\ \#2}{2}} \times 100$$

Control Charts for recoveries (%), and RPDs will be submitted with the data packages to the U.S. Army Corps of Engineers, Louisville District.

12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$Completeness = \frac{(number\ of\ valid\ measurements)}{(number\ of\ measurements\ planned)} \times 100$$

SECTION 13

CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to encounter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the Project Scientist, or his designee. If immediate corrective action is required, approvals secured by telephone from the Project Scientist should be documented in an additional memorandum.

For noncompliance problems during laboratory analysis, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the Project Manager, who in turn will notify the USACE Quality Assurance Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established quality control procedures in the QAPP or Field Sampling Plan will be identified and corrected in accordance with the QAPP. The USACE Quality Assurance Manager, or his designee, will issue a nonconformance report for each nonconformance condition.

No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by stop-work order by the Quality Assurance Manager.

13.1 Field Corrective Action

Corrective action in the field may be necessary when the sample network is changed (i.e. more/less samples, sampling locations other than those specified in the QAPP), sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Project Scientist or designee. The Project Scientist will be responsible for assessing the suspected problems and making decisions based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, a nonconformance report will be initiated by the Project Scientist.

The Project Scientist will be responsible for ensuring that corrective action for nonconformances are initiated by:

- O evaluating all reported nonconformances;
- O controlling additional work on nonconforming items;
- O determining disposition or action to be taken; and
- O ensuring nonconformance reports are included in the final site documentation in project files.

If appropriate, the SI Project Scientist will ensure that additional work that is dependent on the nonconforming activity is not performed until the corrective actions are completed. Corrective action for field measurements may include:

- O Repeat the measurement to check the error;
- O Check the batteries;
- O Re-Calibration:
- O Check the calibration;
- O Replace the instrument or measurement devices; and
- O Stop work (if necessary).

The Field Team Leader or his designee is responsible for all site activities. In this role, the Field Team Leader is required to adjust the site programs to accommodate site specific needs. When it becomes necessary to modify a program, the responsible person notifies the Field Team Leader of the anticipated change and implements the necessary changes after obtaining the approval of the Field Team Leader. The Field Team Leader must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The Quality Assurance Officer will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field Operations Manager and field team. Corrective action will be documented in quality assurance reports to the entire project management.

Corrective actions will be implemented and documented in the field record book. Staff members will not initiate corrective action without prior communication of findings through the proper channels. If corrective actions are not sufficient, work may be stopped by the USACE QA Manager.

13.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during, and after initial analysis. A number of conditions such as broken sample containers, multiple phases, low/high pH readings, potentially high concentration samples, may be identified during sample log-in or just prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for the laboratory Quality Control Coordinator to approve the implementation of corrective action. The submitted SOPs specify conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc. A summary of method-specific corrective actions is found in this QAPP.

Corrective action is implemented at several different levels. The laboratories are required to have a written SOP specifying corrective action to be taken when an analytical error is discovered or the analytical system is determined to be out of compliance. The SOP requires documentation of the corrective action and notification by the analyst about the errors and corrective procedures. The USACE may request corrective action for any contractual nonconformance identified by audits or data validation. The USACE may also request corrective action by the laboratories for any nonconformances identified in the data validation process or, for minor problems, the lab may be contacted directly. Corrective actions may include:

- Re-analyzing the samples, if holding time criteria permits;
- Resampling and analyzing, and/or;
- Evaluation and amending sampling procedures and/or
- Evaluation and amending analytical procedures; and/or
- Accepting data and acknowledging the level of uncertainty.

If resampling is deemed necessary due to laboratory problems, the Project Manager must identify the necessary approach for the additional sampling effort.

Corrective actions are required whenever an out-of-compliance event or potential is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;

- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the QA department during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

These corrective actions are performed prior to release of the data from the laboratory. The corrective actions will be documented in both the laboratory's corrective action log (signed by analyst, section leader and quality control coordinator), and the narrative data report sent from the laboratory to the data validator. If corrective action does not rectify the situation, the laboratory will contact the Corps of Engineers QA Manager.

13.3 Corrective Action During Data Validation and Data Assessment

The USACE may identify the need for corrective action during either data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the required quality assurance objectives (e.g. the holding time for samples is not exceeded, etc.). When the USACE data assessor identifies a corrective action situation, the Project Manager will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the QA Manager.

SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Project Manager will be responsible for deliverables associated with the tasks identified in the Work Plan. The Quality Assurance Officer will be responsible for reporting on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

14.1 Contents of Project QA Reports

The QA reports will contain on a routine basis all results of field and laboratory audits, all information generated during the past month reflecting on the achievement of specific data quality objectives, and a summary of corrective action that was implemented, and its immediate results on the project. The status of the project with respect to the Project Schedule included in the QAPP will be determined. Whenever necessary, updates on training provided, changes in key personnel, anticipated problems in the field or lab for the upcoming month that could bear on data quality, along with proposed solutions, will be reported. Detailed references to QAPP modifications will also be highlighted. All QA reports will be prepared in written, final format by the Project Manager or his designee. In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project Organization or Corrective Action sections of this QAPP. However, these events, and their resolution will be addressed in the final QA report.

14.2 Frequency of QA Reports

Based on the duration of this investigation, only one QA Report will be prepared. The QA Report will be prepared at the end of the project. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

14.3 Individuals Receiving/Reviewing QA Reports

All individuals identified in the Project Organization chart will receive copies of the QA report.

REFERENCES

Dames & Moore, (D & M) April 1997, ***Sitewide Groundwater Investigation – Final Report Plum Brook Ordnance Works Plum Brook Station / NASA Sandusky, Ohio***.

E.B Badger & Son Co., April 2, 1941, "Location Plan & Cross Sections for Soil Test Pits", Drawing No. 1661-S-1.

E.B Badger & Son Co., July 3, 1941a, "Locomotive Shop Building #279", Drawing No. 1669-405.

E.B Badger & Son Co., July 7, 1941b, "Proposed Grades in Acid and Maintenance Area", Drawing No. 1691-S-2.

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IT Corporation (IT), January 1991, ***Engineering Report for the Contamination Evaluation at the Former Plum Brook Ordnance Works, Sandusky, Ohio,*** (prepare for Corps of Engineers, Nashville District).

IT Corporation (IT), December 1997, ***Site Investigations of the Reservoir No. 2 Burning Ground, Wastewater Disposal Plant No. 2 and Power House No. 2 Ash Pit Former Plum Brook Ordnance Works Sandusky, Ohio.***

IT Corporation (IT), February 1999, ***Site-Wide Groundwater Monitoring (1997-1998) Former Plum Brook Ordnance Works, Sandusky, Ohio, Volume I & II.***

Morrison Knudsen Ferguson Group (MK), May 20, 1994b, ***Closure Work Plan, Garage/Maintenance Area, NASA Plum Brook Station***.

National Institute for Occupational Safety and Health (NIOSH), 1998, ***Pocket Guide to Chemical Hazards***

Ohio Department of Natural Resources (ODNR), 1994, ***Erie County Soil Survey Process Report, Erie Soil and Water Conservation District, Sandusky, Ohio.***

Ohio Department of Natural Resources (ODNR), Division of Water, 1979, ***Ground-water Resources of Erie County.***

Peecook, Keith, NASA Glenn Research Center, Personal Communication, March 1999.

Science Applications International Corporation (SAIC), June 1991, ***Plum Brook Station Preliminary Assessment***.

Soil Conservation Services (SCS), 1971, ***Soil Survey for Erie County, Ohio, Ohio Department of Natural Resources, Division of Lands and Soils.***

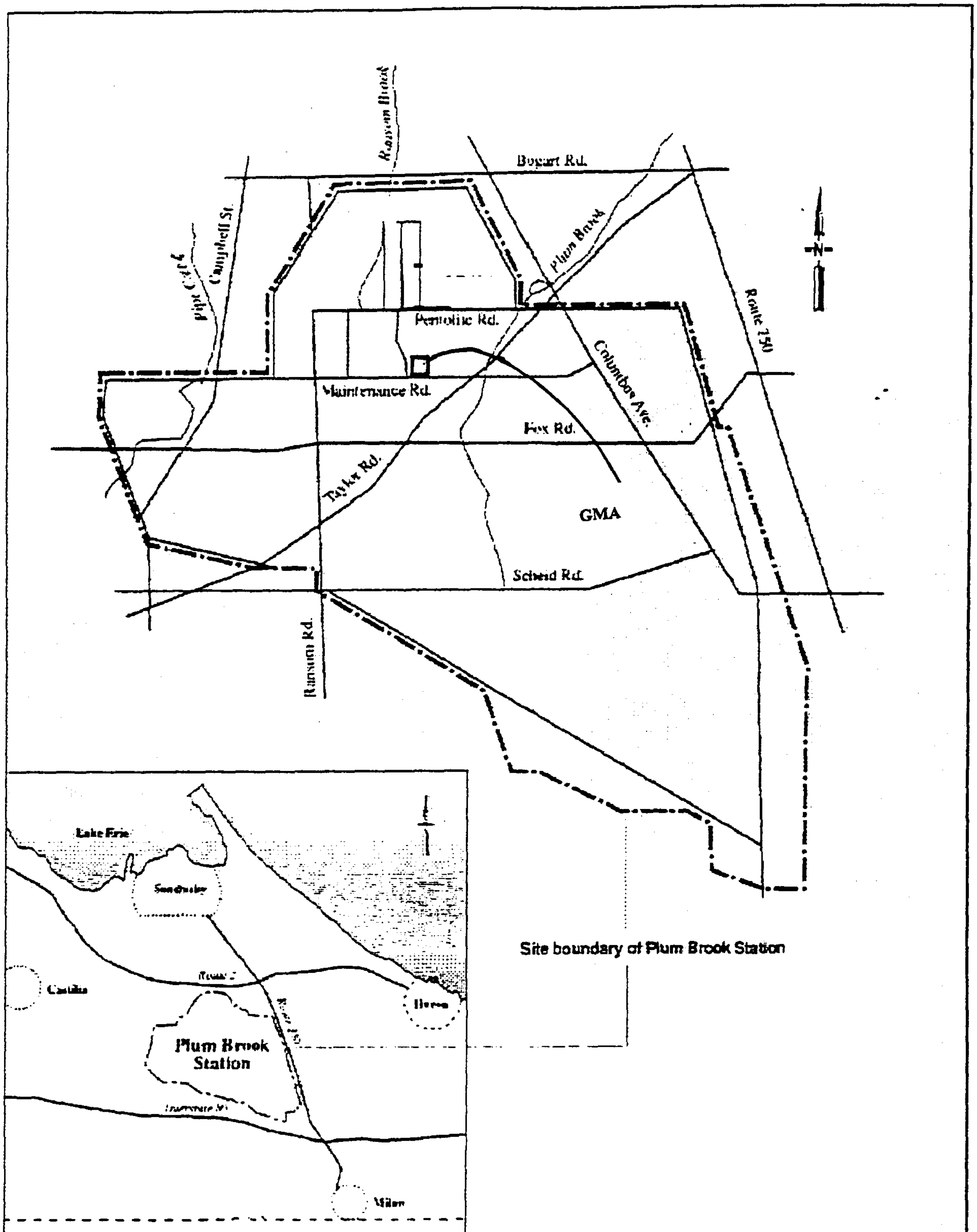
Trojan Powder Company, June 7, 1943, "Proposed Underground Water Line for Car Washing Pit", Drawing No. (8170) 1663-T-503-5-1/4.

United States Geological Survey (USGS), 1979, "Sandusky, Ohio", N4122.5-W8237.5 / 7.5 minute series.

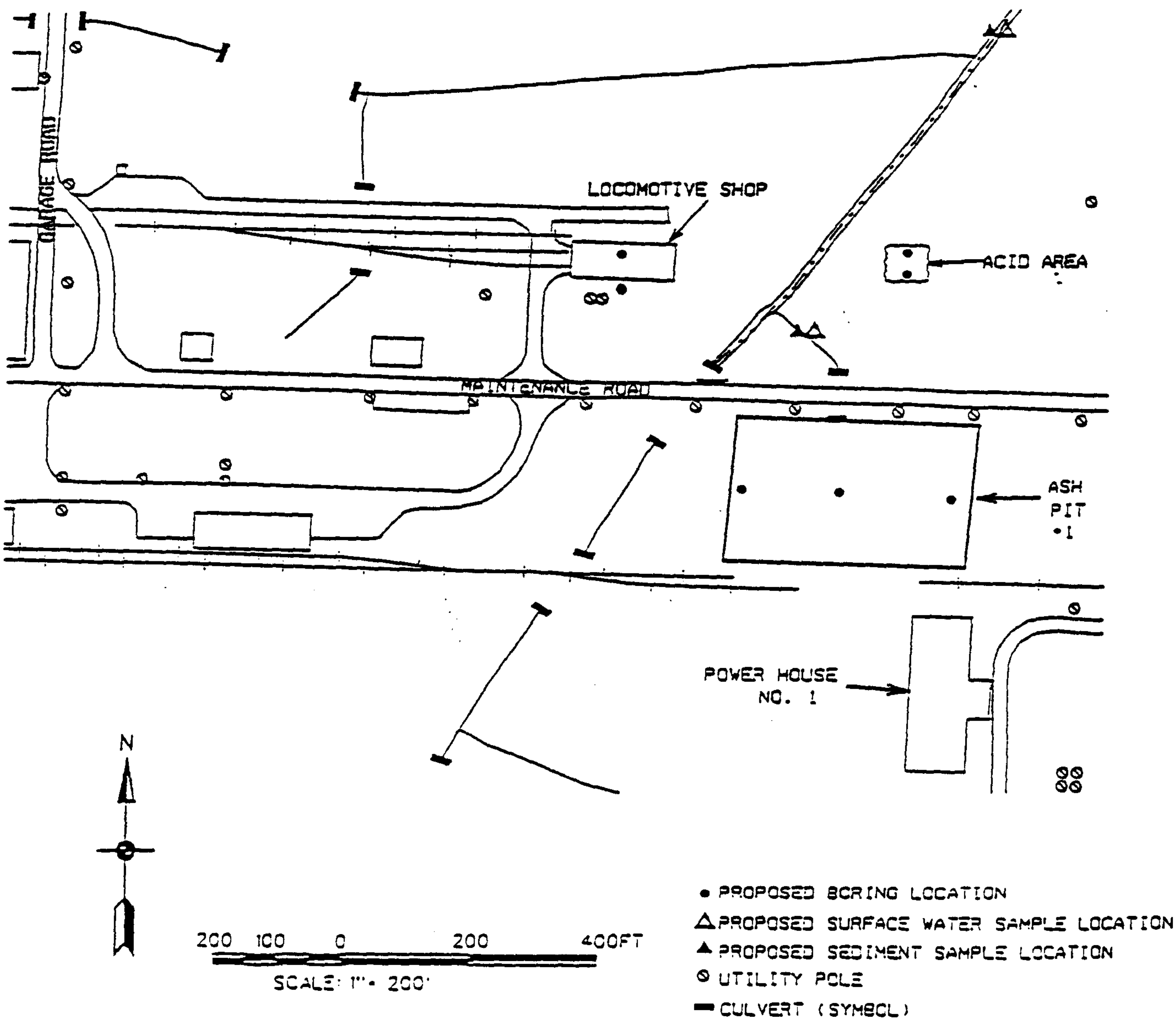
Figures

Figure 1: Site Location Plan

Figure 2: Proposed Sample Location Plan



Design By:	Drawn By:	Checked By:	US Army Corps of Engineers — PLUM BROOK STATION SANDUSKY, OHIO LIMITED SITE INVESTIGATION FY 99	LOCATION OF THE GARAGE MAINTENANCE AREA
Reviewed By:	Approved By:			
Date: 10 MAY 99	Scale: 1" = 200'	Drawing Code:	Sheet Ref. No.	Figure 1



Design By:	Drawn By:	Checked By:	US Army Corps of Engineers	PLUM BROOK STATION SANDUSKY, OHIO LIMITED SITE INVESTIGATION FY 99	PROPOSED SAMPLE LOCATIONS ASH PIT #1 GARAGE MAINTENANCE AREA
Reviewed By:		Approved By:			
·te:	Scale: 1" = 200'	Drawing Code:	Sheet Ref. No.	Figure 2	

APPENDIX A

ETHICS AGREEMENTS

This section not reproduced in this Garage Maintenance Area submission. This section was provided in the submission of the Former Plum Brook Ordnance Works, Pentolite Area.

APPENDIX B

QUANTERRA STANDARD OPERATING PROCEDURES (SOPs)

This section not reproduced in this Garage Maintenance Area submission. This section was provided in the submission of the Former Plum Brook Ordnance Works, Pentolite Area.

APPENDIX C

LABORATORY ANALYSIS CRITERIA

This section not reproduced in this Garage Maintenance Area submission. This section was provided in the submission of the Former Plum Brook Ordnance Works, Pentolite Area.

APPENDIX D

DATA VALIDATION CHECKLIST

This section not reproduced in this Garage Maintenance Area submission. This section was provided in the submission of the Former Plum Brook Ordnance Works, Pentolite Area.

APPENDIX E

QUANTERRA REFERENCE DATA SUMMARY (METHOD DETECTION LIMITS AND METHOD RECOVERY LIMITS)

This section not reproduced in this Garage Maintenance Area submission. This section was provided in the submission of the Former Plum Brook Ordnance Works, Pentolite Area.

Comment Responses

Document: **Quality Assurance Project Plan (QAPP) and Final Report, Limited Site Inspection for the Garage Maintenance Area (GMA).**
Name: **Ronald E. Nabors, Ohio EPA**

QAPP

1. General Comment: The Ohio EPA, DERR, would prefer to receive the Quality Assurance Project Plan under separate cover and have it referenced in all site investigation Work Plan submittals.

Response: We apologize for not obtaining an OEPA, DERR preferred format to develop the Quality Assurance Project Plan (QAPP). We have prepared QAPP documents for projects in Illinois, Michigan and Ohio. The QAPP and associated FSP and DQO attachments were assembled for the Former Plum Brook Ordnance Works using the EPA Region 5 model QAPP, the format we typically use. We apologize for this inconvenience. If our office executes future phases of work for this Formerly Used Defense Site, we will incorporate the OEPA, DERR preferred format in preparing documents.

2. Section 1.1 Introduction, page 1: Please indicate if the Health and Safety Plan reference in the third sentence should read Data Quality Objectives dated May 1999.

Response: Correction implemented, sentence now reads Data Quality Objectives.

3. Section 1.2 Site Description, page 2: This document is referred to as the Garage Maintenance Area. However, the first paragraph on the page states that only the Locomotive Shop and Car Washing Pit will be investigated. This document and subsequent text should reference the Locomotive Shop and Railroad Car Washing Pit. This is recommended because there are other buildings in the GMA that are not being investigated and the title of the document should reflect the are that is being studied.

Response: QAPP was titled from the title present on the documents received requesting this study.

4. Section 1.2 Site Description, page 2: Please rename the "Car Washing Pit" as the "Rail Car Washing Pit."

Response: Correction implemented.

5. General Comment: The flow of the document is very confusing as it jumps back and forth between the entire Plum Brook Ordnance Works (PBOW) history and the history of the Garage Maintenance Area (GMA). Please create a Plum Brook

Ordnance Works general history section and focus the remainder of the document on the GMA site investigation.

Response: Future documents will comply to an approved format selected by the reviewing office.

6. Section 1.2.1 Facility Size and Borders, page 2: Please indicate the size and the Borders of the GMA.

Response: Correction implemented.

7. Section 1.3 Past Data Collection Activities, page 2: This section should focus on the Locomotive Shop and the Rail Car Washing Pit. Historical information should only be included if it can be applied to the site.

Response: There have not been previous studies to either the Locomotive Shop or the Rail Car Washing Pit.

8. Field Sampling Plan, Section 1.2.2 Site Specific, page 3: Figure 1, as referenced in the text is mislabeled.

Response: Correction implemented.

Final Report

1. General Comment: This document is referred to as the Garage Maintenance Area. However, only the Locomotive Shop and Car Washing Pit were investigated. This document and subsequent text should reference the Locomotive Shop and Railroad Car Washing Pit. This is recommended because there are other buildings in the GMA that were not investigated and the title of the document should reflect the are that was studied.

Response: Report was titled from the title present on the documents received requesting this study.

2. General Comment: Since the Locomotive Shop and the Rail Car Washing Pit areas have been recommended for further studies/action, Ohio EPA, DERR will not request data gap analysis at this time.

Response: Thank you!

U.S. ARMY CORPS
OF ENGINEERS
LOUISVILLE DISTRICT

Field Sampling Plan

Limited Site Inspection of the former

Plum Brook Ordnance Works

Garage Maintenance Area

Sandusky, Ohio

DERP-FUDS HTRW Project No. G05OH001825

July 2000

TABLE OF CONTENTS

FIELD SAMPLING PLAN

1.0 PROJECT DESCRIPTION

1.1 Introduction

Located near Sandusky Ohio, the former Plum Brook Ordnance Works (PBOW) was operated from 1941 to 1945 by the Army as a manufacturing plant for trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Contamination detected at the site by previous studies has been related to those activities and is being addressed under the framework of the Defense Environmental Restoration Program (DERP), Formerly Used Defense Sites (FUDS) program.

A limited Site Investigation (SI) of two areas of the former PBOW site, in the Garage Maintenance Area, will be conducted under this project. The purpose of the SI is to evaluate the potential for contamination of the sites that may be traced to Army activities.

This project is one of six limited SI projects simultaneously undertaken by the US Army Corps of Engineers to be executed by the Louisville District (CELRL) under the direction of the Huntington District (CELRH).

1.2 History and Usage

1.2.1 Installation

Based on the Archives Search Report (USACE, 1993), the original Plum Brook Station (PBS) site was established in 1941 and referred to as Plum Brook Ordnance Works (PBOW). In the early 1940s the U.S. Army Ordnance Department contracted with Trojan Powder Company to manufacture 2,4,6-TNT, dinitrotoluene and pentolite at PBOW. Trojan Powder Company, of Allentown, PA, a business incorporated in the State of New York, provided full production and maintenance services for the PBOW facilities. The facility architect was the E.B. Badger & Sons Company. Production began on 16 December 1941 and continued through late 1945, ceasing two weeks after V-J Day (2 September 1945). After operations ceased, the area was turned over to the Army Ordnance Department, renamed Plum Brook Depot and used for ammunition storage.

Decontamination of TNT, acid, pentolite and DNT manufacturing lines was completed during the last quarter of 1945. On 17 December 1945, the physical custody of the plant was transferred from Trojan to the Ordnance Department. The U.S. Army Corps of Engineers assumed responsibility for maintenance and custodial duties until September 1946 when the property was transferred to the

War Assets Administration (predecessor to the Government Services Administration). At this point in time the property was certified by the U.S. Army to be decontaminated. An agreement was made in 1956 to lease 500 acres of the northern portion of PBOW to construct and operate the Plum Brook Reactor Facility (PBRF). The reactor was planned to be a scientific investigation reactor where the effects of radiation on various materials could be measured. NASA acquired the PBOW in 1963 and is presently using the site, now referred to as Plum Brook Station (PBS).

The PBS site currently lies in an area that is primarily rural and agricultural with a low population density. The NASA Glenn Research Center occupies a majority of the former ordnance works. The Department of the Army maintains a reserve center on the westernmost portion of the facility. The remainder of the former installation is in private ownership with the vast majority being cultivated. A tract on the northern boundary is owned by the Perkins Board of Education and is utilized as a bus maintenance facility.

1.2.2 Site Specific

The Garage Maintenance Area (GMA) is located in the central portion of the PBOW facility. The site areas that are the subject of this investigation are the Locomotive Shop and the Car Washing Pit. The Locomotive Shop is located North of Maintenance Road in the eastern part of the Garage and Maintenance Area. The former Car Washing Pit is east of the Locomotive Shop. Figure 1 depicts the site.

The Locomotive Shop is the eastern most building located in the Garage and Maintenance Area. The shop was used for the maintenance of equipment, vehicles, and rail cars. Within this building is a maintenance pit which is the primary area of concern in the building. The pit measures 60 feet long, 3 feet 8 inches wide, and 5 feet deep (E.B. Badger & Sons Co., 1941a). The pit is located below the northern set of railroad tracks that run through the Locomotive Shop. NASA backfilled this pit with loose stone and is currently using this building as a storage garage. The pit was used to work on the rail cars and the locomotives during the operation of PBOW. The waste effluent from the pit was sent into the sewer system via a sump pump. The sump pump is located in a pit which measures nine feet two inches deep and two feet six inches across, and is located on the South side of the building (E.B. Badger & Sons Co., 1941a).

The Locomotive Shop was originally numbered 718 on the facility numbering listing. It was located south of a track known as "Z" track. "Z" track was labeled as being the track "to (the) caustic dock" (E.B. Badger and Sons Co., 1941a). Three rubble piles were observed to the east of the Locomotive Shop; the contents of these piles are unknown but visual examination indicated the presence of masonry materials.

The Car Washing Pit is located east of the Locomotive Shop (Trojan Powder Co., 1943). This area is outside and is generally across Maintenance Road from Ash Pit #1 (Figure 1). During the operation of PBOW this area was used to perform an operation on the locomotives that involved an acid. The Car Washing Pit is also referred to the acid area. Today the area is open land with some moderate vegetation cover. The area is not near any easily recognizable man made structure other than the locomotive building.

The Car Washing Pit is located in the area surrounding the southern track in the pair of railroad tracks that exited the locomotive shop from the eastern end of the locomotive building. There was a car washing pit located two hundred and sixty one feet from the east wall of the Locomotive Shop. According to the general notes portion of the drawing, the installer was cautioned, "Do not run 3 inch line through acid saturated earth. Should this be necessary paint water line with black acid resisting paint" (Trojan Powder Co., 1943).

The GMA was the subject of an Inventory Project Report INPR (November 1998) prepared by Huntington District. For this project, it will be necessary to gather sufficient information to evaluate the Locomotive Shop and the nearby Car Washing Pit. Available reports and drawings will be carefully studied to assess the nature of the Plum Brook natural and anthropogenic features. In order to assess the presence or absence of hazardous constituents at the locomotive shop and the acid area soil samples will be collected during this project term for likely contaminants of concern.

1.3 Location

CELRL personnel photographed the locomotive shop on March 17, 1999. It was noted that the locomotive shop was in the vicinity of the former PBOW garage maintenance area. It is located in the eastern part of the garage maintenance area, on the North side of Maintenance Road. A deep ditch that flows northward away from Maintenance Road runs through a channel located east of the locomotive building. There are no easily discernable visual cues as to the location of the acid area. The Car Washing Pit was located two hundred and sixty one feet from the east wall of the Locomotive Shop (Trojan Powder Co., 1943).

1.4 Climate

The climate for Erie County is continental with cold and cloudy winters and warm humid summers. The county's first freezing temperature is typically in October, and its last freezing temperature is typically in April. Average annual precipitation for Sandusky from 1961 to 1990 was 34.05 inches. Within that time period February had the lowest mean monthly rainfall average with 1.65 inches, whereas July had a high of 3.70 inches. The weather changes every few days as cold fronts move through the region. Wind is from the southwest 55 percent of the time. (Morrison Knudsen, 1994, Dames and Moore, 1997)

1.5 Topography

The elevation around the Locomotive Building ranges from 636 to 637 above mean sea level (msl). The top of rail elevation immediately north of the Locomotive Building is 637.70 above msl (E.B. Badger and Sons Co., 1941b).

Three rubble piles were observed to the east of the Locomotive Shop. With the exception of the three ruble piles and the drainage ditch the area is relatively flat.

Surface water drainage for the Garage Maintenance Area runs to a series of deep ditches which feed into Plum Brook. The location of this juncture between the series of ditches and Plum Brook is southwest of the intersection of Patrol Road and Pentolite Road. This point is just east of Taylor Road (USGS, 1979).

1.6 Geology

1.6.1 PBOW (Installation wide)

According to the Site Wide Groundwater Study, three formations, all of the Devonian Age, underlie the PBOW site. The Delaware Limestone is the lowermost formation. It is characterized as a hard, dense, finely crystalline limestone and dolomite. Dissolution of this unit has been described which has produced solution channels along bedding planes and joints, and even producing caverns in some areas. The unit is typically buff colored and usually described as fossiliferous. Overlying the Delaware Limestone is the Olentangy Formation. Two members of the Olentangy Formation have been characterized at the PBOW site, the Plumbrook Shale and the overlying Prout Limestone. The Plum Brook Shale is interpreted to consist of approximately 35 feet of bluish-gray, soft, fossiliferous shale containing thin layers of dark, hard, fossiliferous limestone. The Prout Limestone has been interpreted to be a unit approximately 15 feet thick which outcrops occasionally in a 1,000 to 2,000 foot-wide, northeast striking band across the middle portion of the PBOW. It has been described as a dark-gray to blue, very hard, silicious, fossiliferous limestone or dolomitic mudstone. The uppermost formation at the PBOW site is the Ohio Shale. Only one member of the Ohio Shale is present in the PBOW area- the Huron Shale. This unit has been described as black, thinly bedded, with pyrite and abundant carbonaceous matter with some large pyrite/carbonate concretions up to 6 feet in diameter.

The bedrock overburden in Erie County is predominantly glacial till, glacial outwash or glacial lacustrine (lake) deposits. In the vicinity of PBOW, the soil has been interpreted to be lacustrine. In many areas, the overburden also consists of highly weathered bedrock. The thickness of the overburden ranges from approximately 5 feet or less for most of PBOW to greater than 25 feet. The overburden is thickest on the northern portion of the site (SCS, 1971) (IT Corporation, 1998). In the vicinity of PBOW, benzene, toluene, ethyl benzene, and xylene (BTEX) and hydrogen sulfide are common in area quarries (SAIC, 1991).

1.6.2 GMA (Site Specific)

Underlying the Garage Maintenance Area is about one foot of fill, followed by 7 feet of sandy clay. Ground water was noted at 8 feet in the central portion of the former PBOW. (Ebasco, 1991) (E. B. Badger & Sons, 1941). The Groundwater Resources map for Erie County shows the GMA lies over an area where the overburden soils have thin discontinuous sand and gravel deposits interbedded in fine sandy clay found above a layer of shale. (ODNR, 1986)

1.7 Hydrogeology

1.7.1 PBOW (Installation Wide)

Based on the Site Wide Groundwater Study, potable groundwater is encountered in the bedrock units underlying the PBOW site. Generally this groundwater flows northward toward Lake Erie (IT Corporation 1997-1998). Based on the published hydrogeologic information concerning the groundwater resources of Erie County, the PBOW site includes 3 distinct hydrogeologic regimes. Groundwater yields from these regimes range from limited, to the northeast and south, to more than 500 gallons per minute (gpm), to the northwest (ODNR, 1986).

1.7.2 GMA (Site Specific)

Underlying the Garage Maintenance Area is about one foot of fill, followed by 7 feet of sandy clay. Ground water was noted at 8 feet in the central portion of the former PBOW. (Ebasco, 1991) (E. B. Badger & Sons, 1941). The Groundwater Resources map for Erie County shows the GMA lies over an area where the overburden soils have thin discontinuous sand and gravel deposits interbedded in fine sandy clay found above a layer of shale. (ODNR, 1986)

Since the shale is continuous in this area, the shale forms a confining layer to surface water migration to deeper strata. The groundwater observed in the test pits reported by E. B. Badger & Sons would appear to be water resulting from surface water trapped in the soil above the impervious shale layer.

The area along Maintenance Road is described as an area in which yields of [seldom exceed] 3 ~~to 10 GPM~~ may be developed in accordance with the Groundwater Resources Map of Erie County.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 General

This work is being pursued by the United States Army Corps of Engineers (USACE) as part of the Defense Environmental Restoration Program (DERP)/ Formally Used Defense Sites (FUDS). The primary responsibility for the project lies with the Huntington District (CELRH) that acts as the administrator of the funds and performs the overall management functions. CELRH has tasked the Louisville District (CELRL) with the fieldwork for the project. Several individuals will coordinate efforts to carry on the project. Their names and functions are listed below.

2.2 Team Members

The limited site investigation team members are:

<u>Louisville District:</u>	
Chris Inlow	Project Scientist
Shelton M. Poole, CHMM, RPIH	Health and Safety Manager (HSM)
Robert Wheeler	Engineering Intern
Shirley Dunn	Health and Safety Specialist
David Brancato, Ph.D., RPIH	Health and Safety Manager Alternate
Martin Wahking	Hydrogeologist
Samir A. Mansy, Ph.D.	Quality Assurance Manager
Douglas Meadors	Technical Team Leader
<u>Huntington District:</u>	
Rick Meadows	Project Manager

3.0 SCOPE AND OBJECTIVES

The purpose of this limited SI is to evaluate the potential for contamination of the site due to past Army activities. Historical information was utilized to identify environmental media and locations most likely to be affected. Field sampling and chemical laboratory analysis will be performed to evaluate the suspect media. Results of the laboratory analysis will be compared to risk based, media specific screening criteria. USEPA Region 9 Preliminary Remediation Goals will be used for the screening criteria. Comparison to background values is out of the scope of this project.

The Field investigation for this Limited SI will include:

- A visual survey to assess and document site conditions

- Surface soil sampling

Target parameters include semivolatile organics, PCBs, TAL metals, soil pH, and TOC. These analytes will be identified based on analytical results using United States Environmental Protection Agency (USEPA) SW-846 methodology. This data will be used to evaluate the potential for contamination at the site by comparing results to the Region 9 PRGs.

Additional data will be gathered to help assess the physical characteristics of the site and potential migration characteristics of identified mission related contaminants. This includes pH, total organic carbon (TOC) and soil grain size distribution and soil plasticity.

4.0 SAMPLING DESIGN AND RATIONALE

The sample design and rationale for sample locations (in respective media) is based on the existing documentation and field conditions anticipated at the site. Inside the Locomotive Shop, Building 718, there is a work pit built to allow maintenance personnel to work below the locomotives. There was a sump built into the work pit. During the time of NASA operation of the facility the work pit was filled with loose stone (Peecook, 1999). Samples will be collected from the lowest reach of the work pit to determine if contaminants are in the work pit.

A sump was located inside the South wall of Building 718. Any existing liquid in the sump will be sampled to determine if contaminants are present in Building 718.

Soil on the South side of the building will be collected to determine if the maintenance activities conducted in Building 718 have resulted in residual soil contamination. The location of the soil samples are slated to be near the pipe that exited from the South side of Building 718.

It is planned to sample the Car Washing Pit that surrounds the southern track in the pair of railroad tracks that exited the locomotive shop from the eastern end of the locomotive building. The primary analytes of interest at the acid area are metals.

Surface water in the open ditch that is located in the area east of Building 718 will be sampled. This open ditch is a receiving waterway for both the locomotive maintenance area and the Ash Pit 1 area. So these samples will be considered in the analysis of the site investigation of both sites.

SAMPLE SELECTION

Site Location	Sample Type (Method)	Sample Location	Sample Selection Criteria
Inside Locomotive Shop	Soil (Geoprobe)	Maintenance Pit	Beneath Shop Area where locomotives were serviced
Outside Locomotive Shop	Soil (auger)	Near Junction Pit	Drainage Activity
Inside Locomotive Shop	Water/sludge	South Wall Sump Pit	Receiving Pit where Sump Pump was located
Outside Locomotive Shop	Water/sludge	Junction Pit	Received effluent from Sump Pit
Car Washing Pit	Soil (Auger/ Geoprobe)	Former Railcar Washing Pit	Beneath Washing Area
Drainage Ditch	Surface Water	Drainage Ditch	Surface Water Drainage
Drainage Ditch	Sediment (grab)	Drainage Ditch	Surface Water Drainage

5.0 FIELD ACTIVITIES AND SAMPLING PROCEDURES

5.1 Visual Inspection

A visual inspection of the site will be performed before actual sampling takes place. The inspection will consist of a thorough walkover of the site to familiarize the working team with the site and locate visual signs of contamination and potential migration pathways. Modifications to the sampling design may result from this action.

5.2 Sample Documentation

Logbooks with sequentially numbered pages will be kept at the site during all field activities and will be assigned to each sample team. These logs will be updated continuously. Information to be recorded in the logs includes, but is not limited to the following:

- Project Identification.
- General work activity, work dates, and general time of occurrence.
- Unusual events.
- Communication with the facility representative.

- Visitors on site.
- Sample number and time of day for each sample collected for analysis.
- Record of telephone calls to laboratory informing it of sample shipment.
- Variances from project plans and procedures.
- Accomplishment of tailgate safety meetings.
- Photographs taken and identification numbers (including location, spatial orientation, and a brief description of the photograph subject).

5.3 Photographs

Color photographs will be taken of sampling areas to record significant field observations or to record site conditions in the case of visual inspections. Pictures will be logged in the field logbook to identify each picture taken. Prints will be identified with the project number, date and time taken, and a brief description of the subject, location, and orientation of the photograph.

5.4 Surface and Subsurface Soil Sampling

Surface soil sampling will be performed using a stainless steel hand auger. The area around the boring location will be cleared of any debris (twigs, rocks, litter). Some borings may be advanced using a direct push hydraulic sampler that will be on site during the GMA fieldwork. The availability of the direct push sampler will be proportional to delays experienced in prosecuting the fieldwork sitewide at the former PBOW.
For hand auger sampling events, a piece of plastic sheeting will be placed on the ground around the sample boring location to prevent cross contamination. Samples will not come into direct contact with this plastic sheeting. Hand augers will be decontaminated prior to being used. The boring will be advanced by turning the hand auger's crossbar at the same time the operator presses the auger into the ground. Sampling will be continuous throughout the boring. Samples will be collected at 1 foot and at 3-4 feet. If there are visual signs of contamination at other depths, additional boring samples will be taken or composited.

Any variances in sampling due to field conditions or findings will be properly documented. All borings will be documented with boring log notes and soils will be classified using the Unified Soil Classification System, USCS. Once the proper depth is obtained the auger will be removed from the borehole and the sample taken from the sampling section (void) of the auger. A headspace portion will be placed in a clean glass container (no more than half full), and sealed with aluminum foil. PID readings will be taken from the headspace container. Immediately after the headspace portion is collected, a VOC portion will be placed in a laboratory pre-cleaned glass sample jar with Teflon lined lids, labeled, and sealed. If the PID reading indicates the presence of VOC, the VOC jar of soil will be a candidate for analysis. The remains of the sample will be placed in a stainless steel bowl and will be thoroughly mixed and homogenized before placing samples in the appropriate container. Sample containers will be clearly identified on the labels and put on ice for preservation. The proper volume of sample will be taken to insure that all internal laboratory quality control samples (i.e., Matrix Spike/Matrix Spike Duplicates (MS/MSDs), spikes, lab duplicates) can be performed by the laboratory. Sample collection information will be recorded in a field logbook. All sampling equipment will be appropriately decontaminated prior to each individual sampling episode to prevent down-hole and cross-hole contamination and prior to leaving the investigative area.

5.5 Surface Water and Sediment Sampling

Each pair of surface water and sediment samples will be collected from the same location. The water samples will be collected first and sediments second to minimize collection of sediment within the water samples. Water samples will be collected by dip sampling. The sample container will be filled by holding the container just beneath the surface of the water. If access is limited, a clamp and pole will be used to extend the reach of the sampling team member. Sediment samples will be collected by using a stainless steel scoop or equivalent stainless steel tool. If access is limited or the depth of sediment is too great, an extension pole will be used to extend the reach of the sampler. Effort will be made to obtain sediment samples beneath the water- sediment interface. Any excess water collected with sediment samples will be decanted from the sediment. Both water and sediment samples will be collected facing upstream. All samples requiring preservation will be preserved in the field with the appropriate preservatives. Sediment samples will be placed in a stainless steel bowl and homogenized, before placing samples in containers. All samples will be clearly identified on the sample labels and put on ice for preservation. The proper volume of sample will be taken to insure that all internal laboratory quality control samples (i.e., MS/MSDs, spikes, lab duplicates) can be performed by the laboratory. Sample collection information will be recorded in a field logbook. All sampling equipment will be decontaminated prior to each individual sampling episode to prevent cross contamination and prior to leaving the investigative area.

5.6 Field Quality Control Sampling

The following field quality control samples will be collected to monitor sampling precision, cross contamination, and decontamination procedures:

- Duplicates - Duplicate samples will be collected at the same time as the original sample and in the same analytical sequence. One field duplicate will be collected for every 10 primary samples. Duplicate samples will be used to monitor sampling precision in the field.

- Rinsate - Rinsate samples will be collected by rinsing sampling equipment (i.e., hand augers, stainless steel scoops) with deionized water after decontamination has been performed. The water being used to rinse the equipment will be collected in the appropriate sample container. One rinsate will be collected for every 20 investigative samples. These samples will monitor field-sampling procedures for decontamination completeness.

- Temperature Blanks - These samples will be prepared by submitting a bottle prefilled by the analytical laboratory. Coordination has been accomplished with the receiving laboratory to ensure that adequate temperature blanks will be provided to the field samplers. These samples will be clearly identified as a temperature blank. This sample will be added in every cooler prepared for shipment to the analytical laboratory to monitor temperature of the samples while in transit from the field to the laboratory.

5.7 Decontamination

Decontamination procedures are implemented to prevent cross contamination, to control potential migration of chemical constituents, and to prevent worker exposure to chemicals or pathogens that may contaminate clothing or protective gear. A decontamination system will be established to wash and rinse all sampling equipment. Several gallons of clean, distilled water will be maintained on site along with plastic buckets, brushes, and soap to decontaminate during the sample collection process.

Personal safety and health considerations are presented in the Site-specific Health and Safety Plan. In addition, all hand tools and equipment will require decontamination prior to removal from the work area. The disposition of investigative derived wastes is presented in Section 7.0, IDW.

Only minor decontamination of site personnel is recommended, incorporating gross decontamination of the soles of work boots and any personal protective equipment used while on site. All discarded materials shall be handled in such a manner as to preclude spreading of contamination, creating a sanitary hazard, or littering the site. In addition, site workers must wash their hands (and face optional, if exposure warrants) with soap and water before eating, drinking, and before leaving the investigative area.

Decontamination procedures involved in this site investigation will generally involve the subsequent cleaning of any sampling equipment associated with soil, sediment and water collection. Generally accepted measures for ensured data quality and reliability will be employed, specifically involving rinsing of sampling tools and equipment with distilled water and soap (Alconox or other non-phosphate detergent), with a final rinse of deionized water.

This will be accomplished by moving the equipment to a contained area and washing all suspect contaminated equipment down with brush scrubbing and the soap solution. Hand tools, trowels, scoops, and bowls used for sample collection of soils, sediments, surface water shall similarly be decontaminated between samples and before leaving the site for the day.

Rinsates and decontamination fluids will require containerization in containers approved for liquids, labeled and properly stored, while awaiting approval for disposal. Based on the anticipated levels of contamination on most sites, it is believed that disposal approvals will permit disposal of decontamination fluids through the local sanitary sewer.

Materials used for decontamination will be compatible and safe for the purpose intended and for site workers. Consistent with the Hazardous Communication Standard, 29 CFR 1910.1200, any chemical materials brought on site will be accompanied by a Materials Safety Data Sheet (MSDS) and kept with the field team.

6.0 FIELD SAMPLE IDENTIFICATION AND CUSTODY PROCEDURES

Proper sample collection and analysis requires the maintenance of strict chain-of-custody (CoC) procedures. CoC procedures include tracking and documentation during sample collection, shipment, and laboratory processing (FSP Attachment A). A sample is considered to be in an individual 's custody if it is:

- In the physical possession or view of the individual party.
- Secured to prevent tampering.
- Placed in a restricted area by the responsible party.

The sampling team leader is responsible for the custody of the collected samples in the field until they are properly packaged, documented, and released to the courier for shipment to the laboratory. The laboratory is responsible for sample custody thereafter. Custody will be documented by using the CoC record initiated for each day that samples are collected. This record will accompany the samples from the site to the laboratory and will be returned to key project personnel with the final analytical report. All personnel with sample custody responsibilities are required to sign, date, and note the time on the CoC record when relinquishing and receiving samples from their immediate custody. Any discrepancies will be noted at this time. All samples will be shipped via overnight courier to the analytical laboratory. Bills of lading will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. Sample documentation and custody for field and laboratory activities are detailed in the following sections.

6.1 Sample Containers, Preservation and Holding Times

The laboratory will supply sample containers. Containers will be selected to ensure compatibility with the sample matrix, chemical constituents to be analyzed, and to minimize breakage during transportation. Sample bottle size required, preservatives, and holding times are listed in the tables below. Sample containers, blank labels, preservatives, and packing materials will be supplied by the laboratory. Sample labels will be attached to containers and filled out at the time of sampling. The following information will be recorded on each label:

- sample identification number
- project number
- collectors initials
- date and time of collection
- preservatives added (if applicable)
- sample type
- depth

Summary Table of Sample Containers, Preservation Methods, and Holding Times for Water Samples

Parameter	Analytical Method	Quantity	Type	Preservation Methods	Holding Times
SVOCs	8270	2	1-liter, narrow-mouth amber glass, Teflon®-lined cap	Cool, 4°C	Extraction: 7days Analysis: 40 days
Metals	6010	1	1-liter, polyethylene bottle	HNO_3 to pH<2	6 months mercury - 28 days

Summary Table of Sample Containers, Preservation Methods, and Holding Times for Soils Samples

Parameter	Analytical Method	Quantity	Type	Preservation Methods	Holding Times
SVOCs	8270	1	4-ounce, wide-mouth, amber glass, Teflon®-lined cap,	Cool, 4°C	Extraction: 14days Analysis: 40 days
Metals	6010	1	4-ounce, wide-mouth, amber glass, Teflon®-lined cap,	Cool, 4°C	6 months mercury - 28 days
Sieve Analysis	ASTM D-2217	1	16-ounce, wide-mouth, glass	None	30 days
Atterberg Limis	ASTM D-4318	1	16-ounce, wide-mouth, glass	None	30 days
TOC	900	1	4-ounce, wide-mouth, amber glass, Teflon®-lined cap,	Cool, 4°C	28 Days

6.2 Sample Identification

Each sample will be assigned a unique identification number that identifies the particular sample for analysis.

6.3 Sample Packaging

The following procedures will be performed during sample packaging:

Number of samples will be verified with field logbook documentation.

Sample labels will be checked for accuracy and legibility.

All samples will be wrapped in bubble pack, and placed in a sealed zip-locked bag.

All coolers will have a temp blank so that the temperature can be monitored.

Samples will be packaged in a thermally insulated, rigid cooler.

Packing material will be placed in the coolers to prevent breakage.

Ice will be placed in the cooler for samples requiring 4°C ± 2° preservation.

Each cooler will have it's own Chain of Custody (CoC) form reflecting the samples inside.

The CoC form will be placed in a sealed zip-lock bag, and taped to the inside lid of the cooler.

The cooler will be closed and sealed with duct tape around both ends, and around the lid.

Custody seals will be placed in two separate locations on the cooler across the lid and main body of the cooler and signed by the field team leader.

An addressed courier bill will be placed on the cooler so that shipment of the cooler to the proper laboratory location can take place.

6.4 Custody Transfer and Shipment Procedures

All samples will be accompanied by a CoC 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 transfer on the CoC document. This record will represent the official documentation for all transfers of sample custody until samples arrive at Quanterra Laboratories, North Canton, Ohio. Samples will be shipped for overnight service by the courier. This will allow for the least amount of time from sampling and analysis, and will ensure that all holding times are met. Notification of sample shipment to the laboratory will be performed by the Field sampler.

Quanterra Laboratory
4101 Shuffel Drive NW
North Canton, OH 44720

Phone: (330) 497-9396
Fax: (330) 497-0772

7.0 Disposition Of Field Investigative Derived Waste (IDW)

Investigation derived waste will be minimal for this field activity. All personal protective equipment (PPE) (e.g., Tyvek®, nitrile or latex gloves) will be placed in a plastic garbage bag and taken to a dumpster for disposal. All decontamination water will be collected and stored in an appropriate storage container then emptied into a nearby sewer at the end of the field day. Care will be exercised to insure that the sewer is a collection sewer for the local wastewater treatment plant. Written permission has been granted by the City of Sandusky, Department of Utility Services and is provided as Attachment B. The volume of rinsate water is expected to be limited to amounts that can be moved by hand. IDW will be identified and properly handled while it is being accumulated or stored on site.

IDW shall be contained and handled in compliance with the following requirements:

- Turnings from hand auger work will be neatly abandoned at the boring locations where sampling occurs.
- Soil from direct push sampling will be neatly abandoned at the boring where sampling occurs.
- Waste generation will be minimized whenever possible and feasible.
- Voids created in the upper portion of holes from direct push activity will be filled with granular bentonite.
- Should IDW be generated that does not meet the above mentioned criteria such IDW will be stored at the site of generation or consolidated at a central storage location supplied by NASA-GRC-PBS, pending analytical results.
- Stored IDW, pending analytical results, will be characterized for appropriate disposal at a licensed disposal facility within 45 days of initiating field activities.

8.0 Schedule

8.1 Start Date

The earliest date for which field activities will begin is 7 June 1999.

8.2 Pre-mobilization

The following activities will be completed before field activities begin:

- Site Access - Access has been obtained from NASA by the U.S Army Corps of Engineers to enter Plum Brook Station.
- Security - Access to Plum Brook Station is controlled by the main gate and security office located on Taylor Road. The security procedures for gaining access are vehicle and personnel registration. The Security office will issue vehicle and personnel badges. Only U.S. citizens with picture I.D. can obtain access to the station. All personnel allowed access to Plum

Brook Station are required to view a short 10-minute safety and informational video. The security office will also dispense hand radios to personnel performing fieldwork for safety reasons.

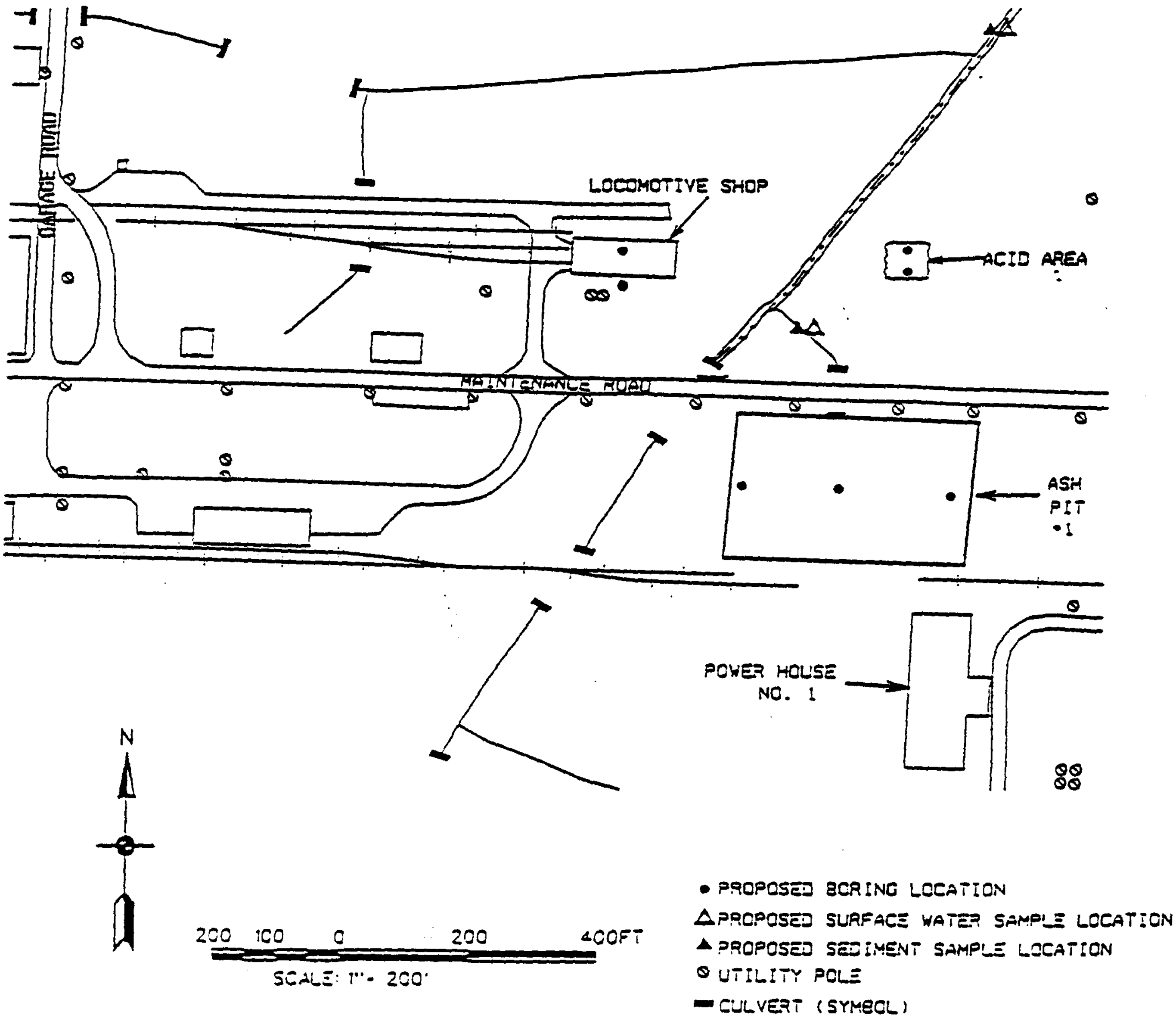
- Staging and Support Area - NASA has provided the USACE with a staging area within NASA's shipping and receiving building #9209 located south of Maintenance Road in the Garage Maintenance Area. This area will be used as a staging area for small sampling and decontamination supplies and sample shipment.
- Site Visit - A site visit was accomplished on March 16 and 17. This site visit allowed USACE personnel to visually assess sites, and to determine sampling design and rationale.

8.3 Mobilization

Mobilization includes efforts required by USACE personnel to prepare for the sampling portion of the site investigation. All sampling equipment and materials will be inspected for proper decontamination and good working condition. All provisions will be made by USACE to ensure that field supplies are available and appropriate for sampling team members. These supplies include logbooks, sample containers, labels, chain of custody forms, shipping supplies, coolers, and packing materials.

8.4 Demobilization

At the completion of sampling activities USACE personnel will demobilize. Arrangements have been made for the disposal of investigation-derived waste (IDW). Preparations of the waste manifests, if necessary will be prepared by USACE personnel. All sampling equipment will be removed by USACE personnel from the site as well as the staging area provided by NASA. USACE personnel will maintain a clean and safe work environment at the investigative site as well as the staging area provided by NASA. Efforts will be made to leave investigative areas in the same condition as they were found.



Design By:	Drawn By:	Checked By:	US Army Corps of Engineers PLUM BROOK STATION SANDUSKY, OHIO LIMITED SITE INVESTIGATION FY 99	PROPOSED SAMPLE LOCATIONS ASH PIT #1 GARAGE MAINTENANCE AREA
Reviewed By:	Approved By:			
te:	Scale: 1" = 200'	Drawing Code:	Sheet Ref. No.	Figure 1

Chain of Custody Record

Quanterra Environmental Services

Client: Your Company Name	Project Manager: Report Recipient	Date	Chain Of Custody Number: 07728
Address: and Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ___ of ___
City / State / Zip Code	Site Contact		
Project Name: Your Project Location	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	VOC - 8240	Metals*	TRPH - 418.1
Monitoring Well #1	7/ DATE SAMPLES TAKEN	TIME SAMPLES TAKEN	SAMPLE MATRIX	2x40ml	40ml	2	HCL		X		
Soil Boring #1				60ml	2oz	1	—		X		
Soil Composite #1				125ml	4oz	1	—			X	X

Special Instructions: Any comments you feel the laboratory needs to know.

Possible Hazard Identification: Please complete if known
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Turn Around Time Required: ☐ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By: Your Signature	Date: Today's Date	Time: Today's Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: *Metals = TAL list (or specific elements)

Attachment A

CITY OF SANDUSKY OHIO FOUNDED 1818

Attachment B

Department of Utility Services

Division of Water (419) 627-5806
Division of Sewer (419) 627-5908

222 MEIGS STREET
SANDUSKY, OHIO 44870
FAX (419) 627-5825

FACSIMILE

DATE: 6-7-99

TO: ROB WHEELER FROM: Norm Rotruck

PHONE#: 502-582-6049 PHONE #: (419)627-5907

FAX #: 502-582-5168 FAX #: (419)627-5800

SUBJECT: DISCHARGE TO SANDUSKY SEWER SYSTEM

MESSAGE: You are hereby authorized to discharge sample water from your current project. Please advise start of discharge.

Thank you.

NUMBER OF PAGES, INCLUDING FAX COVER SHEET: 1

(If you do not receive all pages indicated, please call 419/627-5907)

U.S. ARMY CORPS
OF ENGINEERS
LOUISVILLE DISTRICT

Data Quality Objectives

Limited Site Inspection of the former

Plum Brook Ordnance Works

Garage Maintenance Area

Sandusky, Ohio

DERP-FUDS HTRW Project No. G05OH001825

July 2000

1.0 DATA QUALITY OBECTIVES PROCESS

The purpose of this document is to provide the rationale for developing Data Quality Objectives (DQOs) for the Site Investigation (SI) of the Garage Maintenance Area (GMA) located at the former Plum Brook Ordnance Works (PBOW), Ohio FUDS Site. The former Plum Brook Ordnance Works (PBOW) was operated from 1941 to 1945 by the Trojan Powder Company under contract to the Army Ordnance Department. The facility manufactured trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Investigation of the PBOW is being addressed by the DOD under the Defense Environmental Restoration Program (DERP), Formerly Used Defense Sites (FUDS) program. This project is being undertaken by the US Army Corps of Engineers Louisville District (CELRL) under the direction of the US Army Corps of Engineers Huntington District (CELRH).

The DQO process is a strategic planning approach based on the Scientific Method that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, sample collection locations, the tolerable level of decision errors for the study, and how many samples should be collected.

The DQO process consists of the following seven distinct steps (USEPA, 1994):

- Step 1: State the Problem – Concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem.

- Step 2: Identify the Decision – Identify what questions the study will attempt to resolve, and what actions may result.

- Step 3: Identify the Inputs to the Decision – Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.

- Step 4: Define the Study Boundaries – Specify the time periods and spatial area to which decisions will apply. Determine when and where the data should be collected.

- Step 5: Develop a Decision Rule – Define the statistical parameters of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions.

- Step 6: Specify Tolerable Limits on Decision Error – Define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision.

- Step 7: Optimize the Design – Evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.

The DQO process is iterative by design; the outputs of one step may influence other steps in the process and improve the investigation as knowledge of the site increases.

2.0 BACKGROUND

2.1 Installation and Site History

Based on the Archives Search Report (USACE, 1993), the original Plum Brook Station (PBS) site was established in 1941 and referred to as Plum Brook Ordnance Works (PBOW). In the early 1940s the U.S. Army Ordnance Department contracted with Trojan Powder Company to manufacture 2,4,6-TNT, dinitrotoluene and pentolite at PBOW. Trojan Powder Company, of Allentown, PA, a business incorporated in the State of New York, provided full production and maintenance services for the PBOW facilities. The facility architect was the E.B. Badger & Sons Company. Production began on 16 December 1941 and continued through late 1945, ceasing two weeks after V-J Day (2 September 1945). After operations ceased, the area was turned over to the Army Ordnance Department, renamed Plum Brook Depot and used for ammunition storage.

Decontamination of TNT, acid, pentolite and DNT manufacturing lines was completed during the last quarter of 1945. On 17 December 1945, the physical custody of the plant was transferred from Trojan to the Ordnance Department. The U.S. Army Corps of Engineers assumed responsibility for maintenance and custodial duties until September 1946 when the property was transferred to the War Assets Administration (predecessor to the Government Services Administration). At this point in time the property was certified by the U.S. Army to be decontaminated. An agreement was made in 1956, to lease 500 acres of the northern portion of PBOW to construct and operate the Plum Brook Reactor Facility (PBRF). The reactor was planned to be a scientific investigation reactor where the effects of radiation on various materials could be measured. NASA acquired the PBOW in 1963 and is presently using the site, now referred to as Plum Brook Station (PBS).

The PBS site currently lies in an area that is primarily rural and agricultural with a low population density. The NASA Glenn Research Center occupies a majority of the former ordnance works. The Department of the Army maintains a reserve center on the westernmost portion of the facility. The remainder of the former installation is in private ownership with the vast majority being cultivated. A tract on the northern boundary is owned by the Perkins Board of Education and is utilized as a bus maintenance facility.

The Garage Maintenance Area is located in the central portion of the PBOW facility. The site areas that are the subject of this investigation are the Locomotive Shop and the Car Washing Pit. The Locomotive Shop is located North of Maintenance Road in the eastern part of the Garage Maintenance Area. The former Car Washing Pit is east of the Locomotive Shop and is also identified as the acid area. Figure 2 depicts the site.

The Locomotive Shop is the eastern most building located in the Garage Maintenance Area. The shop was used for the maintenance of equipment, vehicles, and rail cars. Within this building is a maintenance pit which is the primary area of concern in the building. The pit measures 60 feet long, 3 feet 8 inches wide, and 5 feet deep (E.B. Badger & Sons Co., 1941a). The pit is located below the northern set of railroad tracks that run through the Locomotive Shop. NASA backfilled this pit with loose stone and is currently using this building as a storage garage. The pit was used to work on the rail cars and the locomotives during the operation of PBOW. The waste effluent from the pit was sent into the sewer system via a sump pump. The sump pump is located in a pit which measures nine feet two inches deep and two feet six inches across, and is located on the South side of the building (E.B. Badger & Sons Co., 1941a).

The Locomotive Shop was originally numbered 718 on the facility numbering listing. It was located south of a track known as "Z" track. "Z" track was labeled as being the track "to (the) caustic dock" (E.B. Badger and Sons Co., 1941a). Three rubble piles were observed to the east of the Locomotive Shop; the contents of these piles are unknown but visual examination indicated the presence of masonry materials.

The Car Washing Pit is located east of the Locomotive Shop (Trojan Powder Co., 1943). This area is outside and is generally across Maintenance Road from Ash Pit #1 (Figure 2). During the operation of PBOW this area was used to perform an operation on the locomotives that involved an acid. Today the area is open land with some moderate vegetation cover. The area is not near any easily recognizable man made structure other than the locomotive building.

The Car Washing Pit is located in the area surrounding the southern track in the pair of railroad tracks that exited the locomotive shop from its eastern end. The Car Washing Pit was located two hundred and sixty one feet from the east wall of the Locomotive Shop. According to the general notes portion of the drawing, the installer was cautioned, "Do not run 3 inch line through acid saturated earth. Should this be necessary paint water line with black acid resisting paint" (Trojan Powder Co., 1943).

2.2 GMA Topography

The GMA is on relatively flat terrain characterized by topography that slopes gently north towards Lake Erie. The ground surface has an average slope of less than six percent. The surficial deposits and landforms were produced by glacial processes (IRS, 1995).

The elevation around the Locomotive Building ranges from 636 to 637 above mean sea level (msl). The top of rail elevation immediately north of the Locomotive Building is 637.70 above msl (E.B. Badger and Sons Co., 1941b).

Three rubble piles were observed to the east of the Locomotive Shop. With the exception of the three rubble piles and the drainage ditch the area is relatively flat.

Surface water drainage for the Garage Maintenance Area runs to a series of deep ditches which feed into Plum Brook. The location of this juncture between the series of ditches and Plum Brook is southwest of the intersection of Patrol Road and Pentolite Road. This point is just east of Taylor Road (USGS 1979).

2.3 Geology

According to the Site Wide Groundwater Study, three formations, all of the Devonian Age, underlie the PBOW site. The Delaware Limestone is the lowermost formation. It is characterized as a hard, dense, finely crystalline limestone and dolomite. Dissolution of this unit has been described which has produced solution channels along bedding planes and joints, and even producing caverns in some areas. The unit is typically buff colored and usually described as fossiliferous. Overlying the Delaware Limestone is the Olentangy Formation. Two members of the Olentangy Formation have been characterized at the PBOW site, the Plumbrook Shale and the overlying Prout Limestone. The Plum Brook Shale is interpreted to consist of approximately 35 feet of bluish-gray, soft, fossiliferous shale containing thin layers of dark, hard, fossiliferous limestone. The Prout Limestone has been interpreted to be a unit approximately 15 feet thick which outcrops occasionally in a 1,000 to 2,000 foot-wide, northeast striking band across the middle portion of the PBOW. It has been described as a dark-gray to blue, very hard, silicious, fossiliferous limestone or dolomitic mudstone. The uppermost formation at the PBOW site is the Ohio Shale. Only one member of the Ohio Shale is present in the PBOW area- the Huron Shale. This unit has been described as black, thinly bedded, with pyrite and abundant carbonaceous matter with some large pyrite/carbonate concretions up to 6 feet in diameter.

The bedrock overburden in Erie County is predominantly glacial till, glacial outwash or glacial lacustrine (lake) deposits. In the vicinity of PBOW, the soil has been interpreted to be lacustrine. In many areas, the overburden also consists of highly weathered bedrock. The thickness of the overburden ranges from approximately 5 feet or less for most of PBOW to greater than 25 feet. The overburden is thickest on the northern portion of the site (SCS, 1971) (IT Corporation, 1998).

Underlying the Garage Maintenance Area is about one foot of fill, followed by 7 feet of sandy clay. Ground water was noted at 8 feet in the central portion of the former PBOW.

(Ebasco, 1991) (E. B. Badger & Sons, 1941). The Groundwater Resources map for Erie County shows the GMA lies over an area where the overburden soils have thin discontinuous sand and gravel deposits interbedded in fine sandy clay found above a layer of shale. (ODNR, 1986).

2.4 Hydrogeology

Based on the Site Wide Groundwater Study, potable groundwater is encountered in the bedrock units underlying the PBOW site. Generally this groundwater flows northward toward Lake Erie (IT Corporation 1997-1998). Based on the published hydrogeologic information concerning the groundwater resources of Erie County, the PBOW site includes 3 distinct hydrogeologic regimes. Groundwater yields from these regimes range from limited, to the northeast and south, to more than 500 gallons per minute (gpm), to the northwest (ODNR, 1986).

Underlying the Garage Maintenance Area is about one foot of fill, followed by 7 feet of sandy clay. Ground water was noted at 8 feet in the central portion of the former PBOW. (Ebasco, 1991) (E. B. Badger & Sons, 1941). The Groundwater Resources map for Erie County shows the GMA lies over an area where the overburden soils have thin discontinuous sand and gravel deposits interbedded in fine sandy clay found above a layer of shale. (ODNR, 1986)

Since the shale is continuous in this area, the shale forms a confining layer to surface water migration to deeper strata. The groundwater observed in the test pits reported by E. B. Badger & Sons would appear to be water resulting form surface water trapped in pockets in the soil above the impervious shale layer.

The area along Maintenance Road is described as an area in which yields of 3 to 10 GPM may be developed in accordance with the presentation made on the Groundwater Resources Map of Erie County.

3.0 Data Quality Objectives Process

3.1 Step 1 – State the Problem: The purpose of this step is to define the problem so that the focus of the study will be unambiguous. Concisely describe the problem to be studied and review prior studies and existing information to gain a sufficient understanding to define the problem.

3.1.1 Identification of Planning Team Members:

Louisville District:

Chris Inlow	Project Scientist
Shelton M. Poole, CHMM, RPIH	Health and Safety Manager (HSM)
Robert Wheeler	Engineering Intern
Shirley Dunn	Health and Safety Specialist
David Brancato, Ph.D., RPIH	Health and Safety Manager Alternate
Martin Wahking	Hydrogeologist
Samir A. Mansy, Ph.D.	Quality Assurance Manager
Douglas Meadors	Technical Team Leader

Huntington District:

Rick Meadows	Project Manager

3.1.2 Description of Problem: Potential contamination at the GMA was identified in a project summary sheet, as an exhibit to an Inventory Project Report (INPR) prepared by Huntington District, which requested a Limited Site Investigation. The purpose of the Limited SI was to identify any contamination related to the previous Army activities. Soil samples have not been collected in this area.

3.1.3 Potential Transport Mechanisms: Potential transport mechanisms in the GMA include:

- Surface runoff to a tributary of Plum Brook.
- Leaching through the soil column to the subsurface soil and groundwater.

***3.1.4 Resources and Relevant Deadlines for the Site Investigation*:** The funding resources for Site Investigations are provided under the DERP-FUDS DOD program. This limited SI will be completed by the end of FY 99 in order to closeout the records for this project in the financial system. The Louisville District Environmental Engineering Branch is slated to provide the necessary labor to complete the investigation. This is slated to be a limited SI since it is the initial investigative work for the GMA.

3.2 Step 2: Identify the Decision – The purpose of this step is to define the decision statement that the study will attempt to resolve.

3.2.1 Principal Study Question – Do constituents of concern exist in the environmental media at the GMA at levels that would exceed those found in USEPA Region 9 PRGs.

3.2.2 __Alternative Actions that could result from Resolution of the Principle Study Question__:

- SI report recommendation: Coordinate with federal and state regulatory authorities to proceed toward a no further action (NFA) decision document.
- SI report recommendation: Additional site investigation or removal action.

3.2.3 __Decision Statement__ – The primary decision for the site investigation is to determine whether the COCs present at the GMA are at levels that exceed media specific screening criteria (Region 9 PRGs) and thus would require further action.

3.3 Step 3: Identify Inputs to the Decision – The purpose of this step is to identify the informational inputs that will be required to resolve the decision statement and determine which inputs require environmental measurements.

3.3.1 __Information Required to Resolve Decision Statement__:

- Historical records, interviews, aerial photographs, visual inspections, previous environmental investigations, site topography, geology, site hydrology and hydrogeology will be utilized to make an informed decision about the expected type of COCs. This information will also help position the most likely location of samples within the GMA where contaminated media will be discovered.
- Transport mechanisms and chemical properties of COCs to evaluate migration pathways.
- Analytical samples and results from the corresponding environmental media within the GMA to compare to PRGs.

3.3.2 __Sources for Information__ – DERP-FUDS and EPA guidance are the principle tools leading this investigation. CELRH has an extensive administrative record (AR) for the former PBOW. A review of excepts from this AR and other sources including historic aerial photographs, historical topographic quadrangles, published geologic information and data base searches revealed useful information about the site. Information regarding the chemical properties and characteristics of COCs can be obtained from the NIOSH *Chemical Guide (NIOSH 1998).* The "References" section of the Quality Assurance Project Plan (QAPP) dated June 1999 for this project contains a complete listing of the reviewed information.

3.3.3 __Information Needed to Establish the Action Level and Confirm that Appropriate Measurement Methods Exist to Provide the Necessary Data__ – The action levels for the contaminants of concern (COCs) will be the USEPA Region 9 screening criteria for the protection of human health. USEPA SW 846 analytical methods were selected for sample analysis to provide Method Detection Limits that are sufficiently low to allow comparison with applicable screening criteria. The performance-based methods have inherent quantitative and qualitative QA objectives, internal method requirements, and specific QC limits. These methods along with strict USEPA QA/QC guidance and protocols will provide data that will meet data quality objectives.

3.4 Step 4 – Define Site Investigation Boundaries – This step describes the spatial and temporal boundaries of the site investigation to which decisions will apply. Characteristics of the population to be sampled are defined, and practical considerations for the site investigation are evaluated in this section. Based on the initial results of the site investigation, additional data may be required to further define the investigation boundaries.

3.4.1 Characteristics that Define the Population of Interest – The COCs associated with the substances stored in the USTs were identified in the reports from the previous UST removals. Closure reports on these tanks are being prepared by NASA. NASA is coordinating all action for the former USTs in the GMA. For the two remaining areas, the Locomotive Shop and Maintenance Acid areas, no previous soil samples have been taken, therefore the soil should be analyzed for all COCs. Because different populations of COCs may exist in different strata, more than one stratum should be characterized by sampling. A hand auger and geoprobe are planned to be used to take these samples.

3.4.2 Spatial Boundary of the Decision Statement – The site investigation will focus on the GMA, identified in historical drawings, aerial photos, and site visits. The approximate size of the GMA is 0.37 acres. The horizontal extent of the investigation is shown on the Proposed Sample Location Plan (Field Sampling Plan (FSP)). The potential vertical extent of contamination is to bedrock, which is anticipated to be about 8 feet bgs.

3.4.3 Temporal Boundary of Decision Statement – The analytical data obtained from this site investigation will be used as valid indicators of COCs throughout an exposure timeframe of 50 years. The sampling for this investigation should take place in the time frame of early spring through summer. If performed in this time frame, optimum weather conditions for fieldwork should occur.

3.4.4 Scale of Decision Making – The scale of decision making will be based on the concentrations of the possible contaminants identified in the surface water, surface soil, and subsurface soil samples compared to the values for the Region 9 PRGs.

3.4.5 Practical Constraints on Data Collection – Practical constraints on data collection for this site investigation could be scheduling problems, access problems, personal injury during fieldwork, illness, dangerous weather, and/or budget constraints.

3.5 Step 5: Develop a Decision Rule – Define the statistical parameters of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions.

3.5.1 *Specify the Parameter that Characterizes the Population of Interest* – The concentration levels of the COCs found will be compared to the levels of the specific screening criteria. Any findings surpassing the criteria levels will become the area of focus for further investigation.

3.5.2 *Specify the Action Level for the Site Investigation* – The analytical sample results will be compared to the proper screening standard set forth by Region 9 PRGs. The levels of screening are conservative so that the proper protection is met for both human health and the environment.

3.5.3 *Decision Rule* – If concentration levels of the COCs are higher than that of the criteria levels then a recommendation for further investigation and/or remediation will be implemented. If the concentration levels are below the criteria, then an approach for a No Further Action (NOFA) will be developed. During the review process data gaps may be uncovered. Such data gaps may require additional media sampling and analytical chemistry effort to proceed to NOFA.

This is a limited SI, which only uses a small number of samples. Such samples are taken from the most likely locations of contamination. Therefore, each sample result will be compared to screening criteria.

3.6 Step 6: Specify Tolerable Limits on Decision Error – Define the decision maker's tolerable decision error rates based on a consideration of the consequences of making and incorrect decision.

3.6.1 *Determine the Possible Range of the Parameter of Interest* – Previous samples have not been taken at the former GMA Locomotive Building site. Therefore, the minimum value used for the parameter of interest is the concentration at the detection limit for each COC. The maximum values are those that exceed the appropriate screening criteria.

3.6.2 *Identify the Decision Errors and Choose the Null Hypothesis* – A non-statistical sampling plan will be used to position the location of each sample along with the number of samples. This process is being implemented because this is a limited SI. The sampling will be both purposeful and biased to locations that are most likely contaminated. Four steps are used to define where each decision error occurs relative to an action level and establish the decision errors associated with the sampling design.

Definition of Decision Error – As in any statistical test, there are two kinds of error that can occur in implementing the decision rule: the null hypothesis may be rejected when true (Type I error, with probability α), or the fail to reject decision may be made when false (Type II error, with probability β). The number of samples needed to make the decision is driven by the error rate that can be tolerated, as well as by other considerations such as spatial variability of COCs distributions. Because this is a limited SI, probability errors will not be considered herein.

The Null Hypothesis (baseline condition) and the Alternative Hypothesis– The baseline conditions or null hypothesis for the GMA is "COCs detected in the soil or surface water are at concentrations that warrant additional investigation activities". The alternate hypothesis is "COCs detected in the soil or surface water are at concentrations that do not demand additional investigation activities". In terms of this investigation, the default assumption (null hypothesis) is that the concentrations of COCs at the site are significant enough to require further investigation.

Potential Consequence of Each Decision Error – In the event that the COCs expected do not exceed the criteria levels when actually they do (Type I error), then possible endangerment of human health and the environment could occur. If this takes place then the Army Corps of Engineers and its sister agencies responsible for protection of human health and the environment would not be meeting their stated mission. If the COCs are detected at a concentration level that exceeds the criteria levels when actually they do not, then the Army will have unnecessary expenses associated with additional investigation activities.

Which Decision Error Has More Severe Consequences Near the Action Level – For the purpose of protecting human health and the environment, the Type I error has more severe consequences in terms of the stated null hypothesis. The Type I decision error has a more severe consequences near the action level since the risk of jeopardizing human health is likely to outweigh the consequences associated with additional investigation expenditures and schedule delays. In using the data collected careful review will be made to insure that the Type I error is not likely to occur. If the review warrants, additional investigation will be recommended.

*3.7 Step 7: **Optimization of the Sampling Design*** – The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy DQOs. This SI will be based on surface and subsurface soil samples collected within and below the potential source area. As more information is obtained, the sampling design may be optimized to accomplish the goals of this investigation.

No existing chemical data is available for the GMA Locomotive Building. Therefore, the sampling design is based on postulated expectations of what may be detected at the site. Alternative sampling plans could require additional samples and funds; however, the scope of this SI is limited in nature. For the two areas, a limited site investigation for these relatively small areas would require a minimum of two soil samples from the locomotive shop, and two soil samples from the Car Washing Pit. Surface soil sampling will be performed using a stainless steel hand auger. Some borings may be advanced using a direct push hydraulic sampler that will be on site during the GMA fieldwork. The amount of availability of the direct push sampler time will be proportional to delays experienced in prosecuting the fieldwork sitewide at the former PBOW.

Locomotive Shop – A geoprobe boring will be advanced within the preexisting working pit. The pit is located inside the locomotive shop, and it is 60 feet long, 3 feet 8 inches wide and 5 feet deep. The construction of the pit is all concrete with a drain in the center, which leads into a sump pit and then out into the sewer system. Gutters on each side of the pit (along the walls) run the length of the pit and join at the center where the drain is found. Due to the backfill soil that was placed in the pit, the one sample needs to be at the sump trench elevation, which is the trench for the drain of the maintenance pit. The sample will be analyzed for PCBs, semivolatiles, and TAL metals. The rationale for this location is as follows.

This location will be chosen to be near the drainage pipe in the bottom of the pit, since this would be the most likely location if contaminants were present during PBOW operation. The reasoning behind this location is this location lies right on the drainage trough which connects to the two 3 inch gutters running along the walls leading to the drainage pipe.

The location of the second of two soil samples is optional. The candidate sample location for this soil sample location is outside the south wall of Locomotive Building, Building 718. Since the working pit effluent flowed outside the building at this location this would be the most likely place where contaminants were present during PBOW operation.

A fluid sample is planned to be taken from the fluid inside the sump pit located approximately 28 feet south of the Locomotive Shop working pit. If contaminants are present, they would have been pumped into this pit from the maintenance pit and may be able to be detected through sampling the fluid in the sump.

Car Washing Pit- A minimum of two hand auger or direct push borings will be advanced within the area of the preexisting acid area. Two samples will be taken in each boring. The first sample will be a surface sample (0-1 ft), and the second will be collected at a range of 3-4 ft. The soil samples will be analyzed for pH and TAL metals. The location of the soil samples can be seen in Figure 2 and the rationale for these locations are as follows.

The two soil samples will be taken from within the boundaries of the acid area, which appear to be the most contaminated. Exact sample locations will be determined in the field. Since the acid area was associated with the railroad tracks, the samples will be collected as close as is practicable to the former track locations. During the March 17, 1999 visit, it was noted that evidence of the locomotive track location is still visible.

Field headspace screening will be performed on a portion of each soil sample interval based on visual indications. Headspace screening will be performed using a Photoionization Detector (PID). Each sample collected will be classified in accordance with the Unified Soil Classification System (USCS) using field index tests. Selected soil samples will be sent, under chain of custody protocol, to an off site laboratory for chemical analysis. Testing for pH, TOC and Sieve/plasticity analysis will be performed for upper soil strata. Samples selected for chemical analysis will be based on the interval most likely to be contaminated from the organoleptic indications and/or field screening results. Selection of samples for sieve/plasticity testing will be determined in the field in order to validate field USCS classifications.