Scope of Work
for the Site Investigation of Reservoir #2 Burning Ground
at the former Plum Brook Ordnance Works

(1 June 1995)

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List of Acronyms

AE	Architect Engineer
AOC	Area of Concern
bgs	Below Ground Surface
CEORH	Huntington District Corps of Engineers
CEORN	Nashville District Corps of Engineers
COC	Contaminant of Concern
CCQC	Contractor Chemical Quality Control
CO	Contracting Officer
COE	Corps of Engineers
CSM	Chemical Surety Material
CWM	Chemical Warfare Material
DCQCR	Daily Chemical Quality Control Report
DoD	Department of Defense
DQO(s)	Data Quality Objectives
FSP	Field Sampling Plan
LeRC	Lewis Research Center
MK	Morrison-Knudsen
NASA	National Aeronautics and Space Administration
OEW	Ordnance and Explosive Waste
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PAH(s)	Polynuclear Aromatic Hydrocarbons
PBOW	Plum Brook Ordnance Works
PBS	Plum Brook Station
PCB(s)	Polychlorinated Biphenyls
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAP	Sampling and Analysis Plan
SI	Site Inspection
SSHP	Site Safety and Health Plan
SOW	Scope of Work
SSL(s)	Soil Screening Levels
SVOC(s)	Semivolatile Organic Compound
TNT	Trinitrotoluene
USEPA(V)	United States Environmental Protection Agency Region V
UXO	Unexploded Ordnance
VOC(s)	Volatile Organic Compound

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1.0 Introduction

Chemical contamination related to former Department of Defense (DoD) activities has been documented at the former Plum Brook Ordnance Works located near Sandusky, Ohio. The PBOW was operated from 1941 to 1945 as a manufacturing plant for 2,3,6-Trinitrotoluene (TNT), dinitrotoluene, and pentolite. Some of the areas used by the DoD were decontaminated in the 1950s and 1960s; other areas have been decommissioned, but not decontaminated. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station (PBS) of the Lewis Research Center (LeRC). The NASA LeRC is located in Cleveland, Ohio.

1.1 Site Description

1.1.1 Reservoir #2 Burning Ground Site Background

There has not been a previous site investigation of this site. The Reservoir #2 Burning Ground was located on a preliminary site reconnaissance conducted by Dames and Moore and CEORN personnel in March 1994. According to a former employee of the PBS, the burning ground was located south of Reservoir #2 in the location of a former NASA ball field. Aerial photographs taken in 1968 indicates a large cleared area south of Reservoir #2. Comparison of the 1950 photographs to the other burning areas on the same set of photographs, indicates the burning ground was approximately 125 feet wide by 175 feet long. The size of the cleared area shown on the 1968 photograph is considerably larger, indicating that a fire-break may have been cleared around the burning ground.

Presently this area consists of open fields with young hardwood trees and brush. No stressed vegetation or burned areas were observed on the recent site visit.

In DPI Bulletin 62, dated November 30 1962, guidance for "Disposal of Industrial Wastes at PBS" is addressed. Item 6 states: "Combustible and non-combustible waste, contaminated or potentially contaminated with acid or explosives: deposit at Fox Road Burning Area inside the revetment in the center of the area." The Bulletin further states: "Fox Road Burning Area is located adjacent to Booster Pump Station Number 2." This indicates that the "Fox Road Burning Area": referenced in this Bulletin may be the Reservoir #2 Burning Ground. Item 7 of this same Bulletin states that non-contaminated salvageable scrap is to be deposited at the "Fox Road Burning Area" outside the

revetment.

Two of the historical negatives recovered during the records review dated June 8, 1962 and labeled "Decontamination of Piping etc., Burning of TNT, Sodium, and Misc. Material." Photographs made from these negatives are contained in "Records Review report, prepared by Dames & Moore, dated 27 April 1995, A water tower shows up very faintly in the center of photograph # 5-7 of the Dames & Moore report. Photograph # 5-8, from the same report, indicates that the burning ground was bermed and was located adjacent to an unpaved road with electric power line paralleling the road. Based on this information and review of historical aerial photographs and the November 1962 Bulletin stated above, it appears that these photos were taken at Reservoir #2 Burning Ground. Therefore, this burning ground was used from 1950 until at least 1962 (per the Bulletin). On September 5, 1963 personnel at Ravenna Arsenal were instructed to "clear the TNT burning ground near Reservoir #2 of all debris and decontaminate ground, restore ground to proper grade."

1.2 Project Planning Overview and Objectives

The purpose of the site investigation is to provide information about the Reservoir #2 Burning Ground that can be used in making initial management decisions and for designing a more detailed and comprehensive sampling investigation should further work be necessary. Since the data collected during this site investigation will be used to make important decisions about the site, it is essential that the reliability of the data be demonstrated through incorporation and implementation of adequate Quality Assurance (QA) and Quality Control (QC).

This site investigation is the foundation upon which other studies in hazardous waste site assessment should be based. As part of this study, it is essential to determine whether or not soils are the sample media of importance to the total assessment. If the soils in this site investigation are found to be below the clean-up levels for this region, the groundwater will most likely not have been affected either. The total assessment must provide data which will enable decision makers to decide whether the soil contaminants pose an imminent and substantial endangerment to human health requiring emergency action, and whether there is an unacceptable long-term risk to man or the environment. If soils are determined to be below Region V soil screening levels in this site investigation, it is likely that no further attention will be directed to them.

1.2.1 Data Quality Objectives (DQOs)

1.2.1.2 Data Quality Objective Conceptual Site Model

As stated previously, Reservoir #2 Burning Ground is located

south of Reservoir #2 at the location of the former NASA ball field in an area between Ransom Road and Campbell Street. It is possible that a fire-break may have been cleared around the burn ground. This area prseently consists of open fields covered with young hardwood trees and brush. There has been no previous investigations of this area.

At this time we will focus our attention on the soils in this area. Our sampling strategy will focus on eight (8) soil boring samples taken at the former burn area at three different depths. One sample will be taken from 0-6", one from 2-3' and one sample from 6-7', for each boring.

Prior to the commencement of the soil borings, magnetic surveys will be conducted to locate any metallic fragments left from the decontamination and burning of the pipe material and to determine an approximate location of the burn area.

The scoping/planning team consists of Doug Mulledore, Doug Webb, Tom Lerner, and Becky Terry of the USACE.

The primary objective of the site investigation is to determine the location of the burning ground, determine if this site is contaminated by analytical testing, determine which contaminants are present, decide if the contamination poses a threat to human health and the environment, and determine if the contaminant(s) warrants clean-up actions. The data generated to support decisions regarding Reservoir #2 Burning Ground should definitively support all decisions made regarding this site. Additionally, data collected at this site should be useful for any additional environmental investigations. (i.e. Remedial Investigation)

Contaminants of concern (COCs) at this site include Polynuclear Aromatic Hydrocarbons (PAHs), nitroaromatics, solvents, pesticides, polychlorinated biphenyls (PCBs) and metals.

Potential pathways for human exposure are direct contact by NASA workers, hunters, and trespassers from contaminated surface soil via stormwater runoff, the entrainment and transport of contaminated soils by wind. Potential pathways for indirect human exposure may occur by the harvesting of contaminated aquatic and terrestrial organisms or infiltration/percolation of rain water through contaminated soils, which could be further transported to the groundwater.

CEORN shall concentrate on identifying any potential source of contamination. If contamination is identified, the average levels of contamination will be compared to the EPA Guidance for Soil Screening values for this area to determine if further investigation is required. For inorganic constituents, background values will be the point of reference. If no sources

are identified then it will be assumed that activities at the burn ground did not cause either soil or ground water contamination and the investigation at these areas will be terminated.

1.2.2. Soil Screening Levels

Soil screening levels (SSLs) for several PAH compounds, one volatile organic compound (VOC), and several nitroaromatics are presented in Table 1. Background concentrations of many inorganic constituents are currently being evaluated and shall be available by the end of May 1995.

Table 1: Soil Screening Criteria for the Reservior #2 Burning Ground[1].

Compound	Soil Ingestion	Transfer from Soil to Air (Inhalation)[2]	Transfer from Soil to Ground Water
Acenapthene	4700	120	200
Anthracene	23000	6.8	4300
Benzo(a)anthracene	0.9	27	0.7
Benzo(b)fluoranthene	0.9	23	4
Benzo(k)fluoranthene	8.8	NA	4
Benzo(a)pyrene	0.088	11	4
Dibenzo(a,h)anthracene	0.088	7.2	11
Fluoranthene	3100	68	980
Fluorene	3100	89	160
Indeno(1,2,3-cd) pyrene	0.88	280	35
Pyrene	2300	56	1400
2-Butanone	47000	NA	NA
2,4,6 Trinitrotoluene	21	NA	NA
2,4 Dinitrotoluene	160	120	0.2
2,6 Dinitrotoluene	78	370	0.1

[1]Units for all concentrations are mg/kg
[2]Please reference Draft Guidance for Soil Screening Level Framework (July 1994) and Risk Based Concentration Table, (January-June 1995) for information regarding the derivation of SSL.

1.2.2.3 Decision Criteria.

Soils at PBOW shall be considered contaminated if any contaminant

is detected at concentrations above any of the action levels listed in Table 1. If a compound is detected that is not listed in Table 1 then the Risk Based Screening Criteria developed by USEPA (III) shall be consulted so that a screening value can be derived.

1.2.2.4 Sampling Design.

In the future, it may be necessary to determine the average concentration of contaminants that may be present in the burning ground, it is necessary to collect samples that allow for the calculation of an unbiased estimate of the population mean. The first objective of this study is to identify the location of the burning ground so that future samples can be more accurately sited.

After the location and size of the burning ground is determined by using magnetic surveying, then the analytical sampling locations will be determined and samples will be collected. The number of samples, analytes, and matrices to be analyzed shall be discussed in other sections of this SOW.

1.3 Summary of Site Investigations Task

The Architect/Engineer (AE) Firm selected for this investigation shall be obligated to perform the following work, unless otherwise directed by the Contracting Officer (CO):

Task 1 - Records Review;
Task 2 - Site Visit and Coodination Meeting;
Task 3 - Contractor Work Plan Preparation/Sampling and Analysis Plan/Preparation of Specific Health and Safety Plan
Task 4 - Kickoff Meeting/Field Investigations
Task 5 - Sample Analyses, Data Assessment/Validation and Reporting;
Task 6 - Preparation and Submission of Draft Site Investigations Report;
Task 7 - Draft Site Investigations Report Meeting;
Task 8 - Preparation and Submission of Final Site Investigations Report.

2.0 Project Requirements

2.1 Task 1 - Records Review

The AE shall review aerial photographs and the "Records Review Report, Plum Brook Ordnance Works, Sandusky Ohio", dated 27 April 1995, prepared by Dames & Moore. The AE shall pay particular attention to Chapter 5 of this report. The AE shall be allowed six man days for review of pertinent site records.

2.2 Task 2 - Site Visit and Coordination Meeting

The AE shall visit the former Reserviour #2 Burning Ground to gather information for the preparation of the work plans. The AE shall take still photographs of the site during this visit and record pertinent information in a field logbook. If necessary the AE should utilize these photographs in the development of the Site Investigations Report. During this site visit the AE shall also meet with representatives from PBS to discuss any coordination requirements with the facility. Two (2) people shall be allowed to travel to PBS for this task. One (1) day shall be allowed for each person to travel from Knoxville to the coordination meeting and back. One clerical person shall be allowed an additional one half day (four hours) to prepare travel arrangements before the trip and to prepare travel reimbursement vouchers after the trip. A meeting attendee shall be allowed one half day (four hours) after the trip to summarize the meeting minutes and formally submit them to COE.

2.3 Task 3 - Contractor Workplan Preparation/Submission

The AE shall prepare the workplans as directed in the following paragraphs of this section.

2.3.1 Safety and Health

2.3.1.1. General. The AE shall review all available site information and develop the necessary safety and health documents sufficient to protect on-site personnel, the environment, and potential off-site receptors. The AE shall utilize the services of qualified personnel, as defined in Appendix B of ER 385-1-92, to oversee the development and implementation of required safety and health documents.

2.3.1.2. Regulatory Requirements. All site investigation activities and safety and health documents required by this scope of work shall comply with pertinent sections of the following regulations and reflect the following guidance publications:

(1) Federal Acquisition Regulation, F.A.R. Clause 52.236-13: Accident Prevention.

(2) U.S. Army Corps of Engineers (USACE), Safety and Health Requirements Manual, EM 385-1-1.

(3) U.S. Army Corps of Engineers (USACE), ER 385-1-92, Appendix B, Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities.

(4) Nuclear Regulatory Commission Standards, 10 CFR 19 -- 171.

(5) Occupational Safety and Health Administration (OSHA) General Industry Standards, 29 CFR 1910, and Construction Industry Standards, 29 CFR 1926; especially 29 CFR 1910.120/29 CFR 1926.65 - "Hazardous Waste Site Operations and Emergency Response".

(6) NIOSH/OSHA/USCG/EPA, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities", October 1985. [DHHS (NIOSH) Publication No.85-115]

(7) Other applicable federal, state, and local safety and health requirements.

2.3.1.3 Documents. The following safety and health documents are required.

2.3.1.3.1 Safety and Health Program. The Occupational Safety and Health Administration (OSHA) requires all employers performing on-site activities at hazardous waste sites to develop and maintain an ongoing written Safety and Health Program in compliance with OSHA standard 29 CFR 1910.120(b)/29 CFR 1926.65(b). The program, including updates, shall be made available upon request.

2.3.1.3.2 Site Safety and Health Plan (SSHP). The SSHP required by 29 CFR 1910.120(b)(4)/29 CFR 1926.65(b)(4), and as defined by this SOW, shall be prepared and submitted. On-site activities shall not commence until the plan has been reviewed and accepted. The SSHP shall describe the site-specific safety and health procedures, practices, and equipment to be implemented and utilized in order to protect affected personnel from the potential hazards associated with the site-specific tasks to be performed. The level of detail provided in the SSHP shall be tailored to the type of work, complexity of operations to be accomplished, and hazards anticipated. The AE shall address all elements contained in Appendix B of ER 385-1-92 in preparing the SSHP. Where the use of a specific topic is not applicable to the project, the AE shall provide a negative declaration to establish that adequate consideration was given the topic, and give a brief justification for its omission. Information readily available in standard texts shall be repeated only to the extent necessary to meet the requirements of this SOW. The SSHP shall not duplicate general information contained in the Safety and Health Program which is not specifically related to this project.

2.3.1.3.3. Ordnance and Explosive Waste (OEW). If explosives or chemical surety and warfare material (CSM/CWM), or unexploded ordnance (UXO) are discovered at any time during operations, the AE shall immediately stop operations in the affected area, mark the location and notify the CO and all onsite personnel of the OEW hazard and the area's restrictions. The Government shall make appropriate arrangements for evaluation and proper disposal of

the device(s). The SSHP shall specifically address procedures to be followed should known or potential CSM/CWM, UXO, or other such items be encountered during any phase of field work.

2.3.2 Sampling and Analysis Plan

The Sampling and Analysis Plan (SAP) shall be composed of the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). Guidance documents that the AE shall use to develop the SAP include Requirements for the Preparation of Sampling and Analysis Plans (EM-200-1-3) and Region V Model Quality Assurance Project Plan. A computer disk that contains the model QAPP is included with this SOW. A copy of the referenced engineering manual can be obtained upon request.

2.3.2.1 Format

The following format shall be used by the AE developing the SAP.

Title Page. The title page shall be the first page of the SAP. The following items shall appear on the title page: name of document, site name and location, USACE contract number, authority under which the activities are being performed and date of preparation.

Table of Contents. This shall be a general table of contents that outlines the layout of the SAP.

Field Sampling Plan. The following sections briefly describes the contents of the FSP:

(1) Title Page. The FSP shall have an abbreviated title page that includes the name of the document and the date it was prepared.

(2) Table of Contents. The table of contents shall include a of the FSP elements, any appendices that are required to augment the FSP, tables and figures.

(3) Project Description. This section of the FSP shall be as specific as possible. Sufficient infomation shall be included in this section to permit a technical person unfamiliar with the project to evaluate the sampling and analytical approach. A description of the location, size, and important physical features of the site shall be included. A figure showing the site location and layout shall also be included. A chronological site history including descriptions of the use of the site and use of chemicals should be provided. The historical data from previous sampling efforts at the site should be identified and summarized. The effects of this information on the current project shall also be discussed. The site

background section of the FSP shall also indicate startup and ending dates, including those for preliminary studies and field and laboratory activities.

(4) Project Organization and Responsibilities. This element of the FSP shall identify all key field personnel or organizations that are necessary for each field activity. The organizational chart shall include all subcontractors and their key points of contact. The organizational chart should also identify QA managers. This section of the FSP shall also describe the responsibilities of all project field personnel, including QA managers. This summary should designate responsibility for planning, coordination, sample collection, disposal of investigation derived waste, and sample custody.

(5) Scope and objectives. Specific objectives of a sampling effort that describes the intended uses of data shall be clearly and distintively stated. General QA/QC procedures shall be discussed.

(6) Field Activities.

(a) Rationale. This section of the FSP shall discuss the rationale for each of the field activities. Subsections of the FSP that address each of the matrices to be sampled shall include the rationale behind the required number of field samples; the strategy for selection of the particular sampling location and depth; a summary of the required number of field, and field QC samples; and the type of sample (discrete or composite). QC and QA samples shall be identified. QC samples shall be "disguised" as individual field samples by using a sample numbering system similar to that used for all field samples. This section of the FSP shall also include a list of all measurements that shall be made during the project. It is recommended that parameters planned for each sample be summarized in tabular form. This table shall indicate the total number of samples for each sample location, including Quality Assurance (Note: Please identify QA samples with the same number as the sample that they are derived from with the addition of QA designator) and quality control samples. The discussion of field QC samples shall include the rationale for the QC samples (how the data shall be used), as well as the frequency for collecting QA and QC duplicates, matrix/matrix spike/matrix spike duplicates and equipment rinsates blanks.

(b) Procedures. The subsections of the FSP that address each of the matrices to be sampled shall include the proposed procedures for installation of equipment, field measurements, sample collection, sample homogenization and/or splitting and decontamination. Field screening

procedures, the screening criteria, and the required actions based on the screening criteria shall be addressed. The specifications and requirements for field instrumentation, the initial and continuing calibration verification of the equipment, the schedule of calibration verification, as well as the requirements for field data evaluation and reporting shall be outlined in the FSP. Each subsection shall discuss the sampling procedures; a description of containers, reagents, and procedures used for each matrix' sample collection, preservation, transport, and storage; and a notation of any time constraints or other difficulties with sending samples to the laboratory, including contingencies in the event of delays and/or slippage in schedule.

(c) Geophysical (Magnetic Survey). This section of SP shall include discussion of the objectives of geophysical analysis and the techniques proposed to meet these objectives. The discussion shall include the rationale used to delineate the study area and determine the spacing of the geophysical measurements. The proposed equipment, equipment calibration, and quality control procedures; preliminary testing of the method employed and early termination procedures; reporting requirments; delineation of area to be investigated; data processing; and interpretation of the data shall also be discussed.

(d) Subsurface Soil (any soil at depths greater than six (6) inches below grade. This section of the FSP shall discuss the rationale for each boring location, discrete and/or composite sampling, and any field analytical parameters to be measured. In addition, this section of the FSP shall sampling methods for physical and chemical analyses.

(e) Surface Soil and Sediment. This section of the FSP shall discuss the rationale for the location and frequency of discrete and/or composite samples and all drilling methods, drill logging procedures and log/sampling forms.

(7) Sample Chain of Custody/Documentation. This section of the FSP shall describe appropriate sample custody/ documentation procedures. Chain of Custody procedures shall always be used. Chain of custody procedures shall correspond to items identified in Appendix F of EM 200-1-3.

(a) Field Logbook. The AE shall include in the SAP the requirements for the field sampling logbook. The AE shall maintain a permanent bound logbook. The AE shall discuss the following: how the logbook shall be filled out, how corrections shall be made, the types of information to be included in the logbook, etc. The following items shall be included in the logbook, as applicable:

- Project Name and Number.
- Name and Title of author, date, and time of entry.
- Purpose of sample activity.
- Name and Address of Field Contact.
- Names and Responsibility of field crew members.
- Names and titles of any site visitors.
- Types of waste, suspected waste concentration if known, and sample matrix.
- Sample collection method.
- Number and volume of sample(s) taken.
- Location, description, and log of photographs of the sampling points.
- References for all maps and photographs of the sample site(s).
- Information concerning sampling changes, scheduling modifications, and change orders.
- Information concerning drilling decisions.
- Details of the sampling location.
- Date and time of sample collection.
- Field Observations.
- Any field measurements made.
- Sample identification number(s).
- Documentation of procedures for preparation of reagents or supplies that become an integral part of the sample.
- Sampling methodology, including distinction between grab and composite samples.
- Sample preservation.
- Sample distribution and transportation.
- A match list of Quality Assurance Split Samples and Field Samples.
- All sample documentation, such as:
  Bottle lot numbers as received from repository,
  Chain of Custody record numbers.
- Decontamination procedures.
- All documentation for investigation derived wastes, such as
  Contents and approximate volume of waste,
  Disposal Method,
- Summary of daily tasks (including cost) and documentation on any cost or scope of work changes required by field conditions.
- Signature and date by the personnel responsible for observations.

(b) Photographs. This section of FSP shall describe how sampling points are to be marked and prepared for photographs. It shall also discuss how photographs shall numbered and documented.

(c) Sample Identification System. The Contractor shall identify the methodology that shall be utilized to label/identify samples. A proposed methodology is shown in

Table 2.

(d) Sample documentation. This section of the FSP shall discuss how each sample is to be documented in the permanent record. This section should include a discussion on sample labels or tags, sample field sheets, chain of custody records, custody seals, and cooler receipt forms. Examples of such items shall also be presented in this section.

Table 2: Sampling Identification Scheme.

Project Code	Year	Sample Type*	Site Number	Sample Number*	Depth
PBOW	95	XX	RS2	XXXX	XXXXX

*Sample Type: describes the matrix of the sample.
Soil Samples = SO;
Sediment Samples = SD;

(e) Documentation procedures. This section of the FSP shall include a checklist of step-by-step procedures of how each sample is to be documented, i.e., filling out sample container air bills, chain-of-custody records, sample tracking matrics, etc.

(f) Corrections to documentation. This section of the FSP shall discuss how changes are to be made on sample documentation forms.

(8) Sample Packaging and Shipping. In the SAP the AE shall include the SOPs for sample labeling, sample packing, sample preservation, icing, document inclusion and shipping procedures such that the sample integrity is established and maintained throughout custody process. Sample handling that is not in accordance with the protocol established in Appendix F of ER-1110-1-263 shall result in the need for the AE to resample the location from where the invalid sample was collected. No additional charge shall be incurred by the Government for this resampling.

(9) Investigation Derived Waste (IDW). This section of the FSP shall discuss the procedures for collecting, labeling, storing, and disposing of IDW. The AE shall collect all IDW from the installation of soil borings. This waste shall be drummed and properly labeled according to the Safety Plan. All drums shall be labeled with the project name, date, contractor's name, USACE Nashville District, and contents. Soil and water waste should not be mixed in the same

container. All PPE which can not be decontaminated shall be placed in a labeled sealable drum separated from the liquid and drill cuttings. All drums shall be kept within a secured area. (EPA/540/G-91/009) The results of the analytical analyses shall be used to evaluated the IDW material. If the analyses indicate that further evaluation of the IDW is necessary, modifications shall be made to this scope of work for the further evaluation and subsequent disposal of the IDW. The AE shall determine the optimum method for disposing of these wastes and furnish a plan with an estimated cost for this work to CEORN.

(10) Contractor Chemical Quality Control (CCQC). The AE is required to ensure that quality is maintained throughout all field work by means of a three phase control process (ER 1180-1-6, EP 715-1-2). CCQC phase (preparatory, initial, and follow-up) shall be performed onsite by the AE whether or not a government representative is present. The AE shall summarize the activities of each CCQC phase in the daily chemical quality control report (DCQCR). The CCQC phases shall be performed for each definable feature of work. A definable feature is a task that is separate and distinct from other tasks and has separate control requirements. This section of the FSP shall contain the contractor's detailed plans for implementing the CCQC phases, including: identification of the CQC representative; listing of field equipment; description of activities during the phases; identification of the definable features of the work; and generation of a sample table that shall be used to match up primary and QA samples.

(a) Preparatory phase. The CQC representative, in conjunction with sampling team shall conduct the preparatory phase prior to beginning any definable feature of work. This phase shall include a review of all work requirements; a physical examination of all required materials and equipment; an examination of work areas to ascertain completion of all preliminary work; and a demonstration of all field activities. If new sampling or technical personnel arrive onsite during the work effort, the CQC representative must repeat this phase before new personnel begin work.

(b) Initial phase. The CQC representative is responsible for overseeing every step of the definable feature of work when that work is first initiated.

(c) Follow-up phase. The CQC representative is responsible for continued daily contract compliance until completion of the particular feature of work.

(11) Daily Chemical Quality Control Reports (DCQCR). The

Contractor is responsible for providing a daily report which contains the required performance and documentation of chemical parameter measurement. The Contractors DCQCR shall contain the following elements:

(a) Job Identification and Site numbers.

(b) Weather including temperature, wind speed and direction, barometric reading, significant wind changes, etc.

(c) Chemical Data acquisition work performed including QA samples collected and calibrations.

(d) Sampling and Sample delivery problems which may affect project DQO requirements.

(e) Chemical parameter measurement problems which may affect project DQO requirements.

(f) Any sampling performed as contingency sampling and rationale.

(g) Corrective Actions and/or deviations from the identified problems including acceptance.

(h) Chemical quality control activities implemented. Confirmation that all deviations or actions jeopardizing project DQOs have been forwarded to the Contracting Officer.

(i) Signatures of responsible authority and initials of all persons conducting changes/actions.

(12) Corrective Action. The FSP shall include corrective action procedures to be taken in the event a discrepancy is discovered by field personnel, or during a desk or field audit, and/or the laboratory discovers discrepancies or problems.

(13) Project Schedule. The FSP shall include an outline of the schedule. Listed items shall include: project plan review periods, fieldwork, sample analysis, data management and validation, and investigation report writing.

(14) Sampling Apparatus and Field Instrumentation. The FSP shall include a list of all the equipment and instruments to be used in the field. This list should include a schedule for the instrument calibration and the people in the organization which have been trained to use the instuments.

Quality Assurance Project Plan. The Quality Assurance Project

Plan shall be prepared using the model developed by United States Environmental Protection Agency Region V (USEPA V), which is included on the enclosed computer disk. All relevant sections shall be developed and explained.

2.4 Field Investigations and Kickoff Meeting

2.4.1 Kickoff Meeting. The AE shall conduct a Kickoff Meeting the day the Field Investigations are to begin for all of the interested parties.

2.4.2 Geophysical (Magnetic Survey). The AE shall perform magnetic surveys with an electromagnetic magnometer in the suspected area of the Reservior #2 Burning Ground. The AE shall take a systemic approach using historic maps and aerial photographs in locating the suspected area of concern. The AE shall determine the exact location of the burning ground by using the railroad track that runs north to south as the most easterly portion of the burn ground. The distance between Reservior #2 and Fox Road shall be determined and this distance should be divided by one-half to determine the approximate center of the burn ground and the magnetic surveys shall proceed from the approximate center in all directions to determine the location in which shall be the focus of future analytical efforts.

2.4.3. Surface Soil Sampling. The AE shall collect eight (8) soil samples from a depth of 0-6" below ground surface (bgs). These samples shall be collected at eight (8) different locations and shall be collected from the same location as subsurface soil samples identified in Paragraph 2.4.3 of this section. These samples will be analyzed for the parameters listed in Table 3 of this scope.

2.4.4 Subsurface Soil Sampling. The AE shall collect eight (8) soil samples from a depth of 2'-3' below ground surface (bgs) and eight (8) soil samples at a depth of 6'-7' at the same sampling locations. These samples will also be analyzed for the parameters listed in Table 3 of this scope. If rock is encountered before 7', these eight (8) samples shall be collected directly above the rock. All samples shall be collected using a hand auger, however, a portable power auger may be used to drill the hole to the top of the required sampling depth. The samples shall be collected with a bucket auger and not from the cuttings of the flight auger.

2.4.5 Environmental Sampling Instructions.

2.4.6.1 Soil Samples.

2.4.6.1.1 Collection of Samples for Volatile Organic Analysis. The SAP shall contain a method for the collection of samples for Volatile Organic Analysis. The proposed method is as follows:

Samples collected for volatile organic analysis shall be transferred directly from the sample collection device to the sample container (4 oz sample jar with screw cap and like all other samples, a Teflon-silicone disk in the cap). To prevent contamination of the sample by the cap, the Teflon disks shall be placed in the caps, Teflon side contacting the sample, by the laboratory prior to the beginning of the sampling program. The sample container shall be completely filled to prevent volatilization. There shall be no headspace left in the jar after filling. In order to minimize contaminant loss through agitation/volatilization or adherence to another container, samples collected for volatile organic analysis shall never be homogenized/agitated before introduction into the sample container.

2.4.6.1.2 Collection of Samples for Analyses, Other than VOA. The AE shall include methods for the collection of samples to be analyzed for contaminants other than volatile organic compounds. The proposed techniques are presented in the following subparagraphs.

2.4.6.1.2.1 Homogenizing Techniques. The AE shall homogenize samples collected for semivolatile organic, metals, and PCBs/Pesticides analyses. The procedure used to homogenize the material shall be included in the SAP.

2.4.6.1.2.2 Sampling Equipment. The mixing and sampling equipment shall be constructed so as not to contaminate the sample being collected. The equipment shall also be decontaminated between samples to prevent cross contamination. The AE shall include the procedures for sampling equipment decontamination in the SAP. The standard materials for sampling equipment used for trace organic compounds or metals analyses are in order of decreasing desirability: Teflon, glass, stainless steel, and steel. The Contractor shall state in the SAP which material shall be used for collection of samples.

2.4.7 Quality Assurance and Quality Control Samples. From two (2) sample locations, the AE shall collect sufficient sample material for three samples. The first sample shall be the field sample, the second the QC duplicate sample and the third the QA split sample. The QC duplicate sample shall be blind to the contract laboratory. The AE shall identify the "QA" sample using the same identification as the field sample with the two letter designator QA at the end of the identification symbol.

2.4.8 Surveying. The AE shall survey in all sample points in accordance with Chapter 9 Topographic Surveying of Monitor Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites, EM 1110-1-4000, dated 31 August 1994

2.4.9 COE, Regulatory Review and Comment. The AE shall revise

the workplans to reflect any relevant comment from COE or regulatory personnel before any field work begins.

2.5 Sample Analyses, Data Assessment/Validation and Reporting

2.5.1 Analytical Procedures.

2.5.1.1 General Analytical Requirements.

2.5.1.1.1 Analytical Methods. The AE shall establish in the SAP, to the extent not already defined in the Design Analysis, the methods and procedures used to prepare and analyze the project samples and parameter measurement. Method selection shall be consistent with project DQOs for chemical measurements. In general, the preferred methods are the methods of analysis in SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Parameters. The preferred analytical methods for the analysis of soil/sediment matrices are presented in Table 3.

2.5.1.1.2 The AE shall define in the SAP, the source (reference) of the method, the method prep, the method number and the chemical parameter to be determined for all project samples acquired for chemical analysis. The AE shall also include the Standard Operating Procedures for each method.

2.5.1.1.3 The AE shall define the source (reference) of the measurement method and method identification for all chemical parameters measured by instrumental means in the SAP.

Table 3
Approved Analytical Methods for Soils/Sediments in Reservior #2 Burning Ground

Analytical Parameter	Analytical Method
Volatile Organic Compounds	SW-846, 8260A
SemiVolatile Organic Compounds	SW-846, 3540/8270A
Target Analyte List (TAL) Metals[1]	SW-846, 3050/6010A[2] SW-846, 3050/7471A (Hg)
Explosives	SW-846, 8330
PCBs/Pesticides	SW-846, 3540/8081

[1]TAL metals include Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, Zn.
[2]The method used for Sb preparation shall be 3005.

2.5.2 Data Reduction, Validation, Documentation and Reporting Form. The AE shall discuss methods for data validation,

documentation and report format in the SAP. At a minimum the following sections shall be included in the SAP. All analytical data generated by the Contract Laboratory shall be extensively reviewed prior to report generation to assure the validity of the reported data. This internal data review process shall consist of data generation, reduction, and a minimum of three levels of data review. In each stage, the review process shall be documented using an appropriate checklist form that is signed and dated by the reviewer. The analyst who generates the analytical data has the prime responsibility for the correctness and completeness of the data. Each step of this review process involves evaluation of data quality based on both results of the QC data and the professional judgement of those conducting the review. This application of technical knowledge and experience to the evaluation of data is essential in ensuring that the data generated is consistent and of quality. All data generated and reduced shall follow well documented AE Laboratory in-house protocols.

2.5.2.1 Level 1, Technical Data Review. Each Contract Laboratory analyst shall review the quality of their work based on an established set of guidelines. The review criteria as established in each method, in this instruction, and as stated within the Contract Laboratory Quality Management Manual shall be used. The review shall at a minimum ensure that : (1) Sample preparation information is correct and complete; (2) Analysis information is correct and complete; (3) The appropriate SOPs have been followed; (4) Analytical results are correct and complete; (5) QC samples are within established control appropriate QC limits; (6) Special sample preparation and analytical requirements have been met; (7) Documentation is complete (any anomalies have been documented and forms complete, holding times documented, etc.) Level 1 data review shall include a checklist form that has the above mentioned items and is signed and dated by the reviewer.

2.5.2.2 Level 2, Technical Review. The level 2 review shall be performed by a supervisor or data review specialist whose function is to provide an independent review of the data package. This review shall also be conducted according to an established set of guidelines and is structured to ensure that; (1) All appropriate laboratory SOPs have been followed; (2) Calibration data are scientifically sound, appropriate to the method, and completely documented; (3) QC samples are within established guidelines; (4) Qualitative identification of sample components is correct; (5) Quantitative results are correct; (6) Documentation is complete and accurate (any anomalies have been documented and forms complete, etc.); (7) The data is ready for incorporation into the final report; (8) The data package is complete and ready for data archive. Level 2 review shall be structured so that all calibration data and QC sample results are reviewed and all of the analytical results from at least ten

percent of the samples are checked back to the sample preparation and analytical bench sheets. If no problems are found with the data package, the review is complete. If any problems are found with the data package, an additional ten percent of the sample results shall be checked back to the sample preparatory and analytical bench sheets. This cycle then repeats until either no errors are found in the data set checked or all data has been checked. All errors and corrections noted shall be documented. Level 2 data review shall also be documented with a check list with the signature and date of the reviewer.

2.5.2.3 Level 3, Administrative Data Review. Level 3 review is performed by the QA Officer or the program administrator at the AE Laboratory. This review shall be similar to the review as provided in Level 2 except that it shall provide a total overview of the data package to ensure its consistency and compliance with this instruction. All errors noted shall be corrected and documented. Level 3 data review shall also be documented on a checklist with the signature and date of the reviewer.

2.5.2.4 Data Reduction. The AE shall report all data reduction procedures including the methods or equations of concentration calculations, reporting units of concentrations, moisture related data and the procedure for calculating precision and accuracy.

2.5.2.5 Data Validation. The AE shall be required to provide data validation procedures for fifty percent of all chemical data. Methodologies for validation shall be included in the QAPP. Data validation shall be provided by a qualified memeber of the AE's staff who does not report to any laboratory personnel and has no responsibility for sample collection or analysis. Analytical data shall be validated in accordance with the following USEPA guidance documents:

Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analses (July 1989);

USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Publication 9240.1-05-01, EPA-540/R-94-013, PB94-963502, February 1994.

USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Publication 9240.1-05, EPA-540/R-94-012, PB94-963501, February 1994.

2.5.2.5.1 Data Reporting. The AE shall submit two data packages during this project; (1) a data package shall be submitted to the USACE Quality Assurance Laboratory for CQAR generation, and (2) a fully validatable package(i.e. similar to CLP) shall be submitted to the Contracting Officer. These standard reporting formats require the reporting of all data along with the supporting QC information. The AE shall fulfillment the requirements of the

memorandum on the USACE Minimum Chemistry Data Reporting and shall follow the guidance set forth in EM 200-1-3 Appendix B.

2.5.2.5.1.1 Data Reporting Format. Contract Laboratory reports shall be structured to clearly present all of the contract required items. This report shall be organized as follows.

2.5.2.5.1.1.1 General Discussion. Description of the sample types received, test performed, and problems encountered, and general comments shall be given here. This section shall include any case narratives. The project shall be clearly identifiable. A table shall be presented that clearly shows all samples received that includes the Contract Laboratory sample identification number, the sample matrix, and the tests assigned. Another table shall be presented that summarizes all failed QC parameters along with corrective actions taken by the Contract Laboratory. All pages shall be numbered and an index provided so that the Quality Assurance Laboratory can quickly and accurately review the data.

2.5.2.5.1.1.2 Analytical Data. The AE shall report data by sample or test. Pertinent information shall include, at a minimum, field sample identification number, Contract Laboratory sample number, date sample collected, date sample received at the Contract Laboratory, date(s) sample extracted/digested/analysis performed, batch number(s), dilution factors, all analytes tested for and their associated reporting limits, any data qualifiers assigned, matrix, units, percent of solids for solid samples, and sample description, including preservation. Any other factors that could affect the sample results shall also be noted. Data for solid samples shall be reported on a dry weight basis. Both the original and diluted results shall be reported or samples that are reanalyzed due to certain analytes that have exceeded the calibration ranges. Results may be combined together on a single report. Data qualifiers used shall be referenced from the guidance document for data validation.

2.5.2.5.1.1.3 Calibration Information. All initial calibration curve data shall be presented by the AE. All continuing calibration verification data to include standards and blanks shall be presented with acceptance ranges clearly shown.

2.5.2.5.1.1.4 Laboratory Performance and Matrix Specific Information. The AE shall include all of the associated method QC information, even if this information was run on samples other than those associated with this project, shall be reported. This information shall include method blanks, laboratory control samples, matrix duplicates, matrix spikes, matrix spike duplicates, and other method specific QC samples that may have been run. Spiking levels shall be clearly shown. This QC information shall be specific to the batch that the field sample analysis was associated with. Batch numbers shall be clearly

shown. Method specific QC information shall be reported with all acceptance criteria clearly shown. All method QC must meet the acceptance requirements as stated within the method or in this instruction. Any deviations from this acceptance criteria shall be identified with appropriate corrective actions that have been conducted, and documented.

2.5.2.5.1.1.5 Other Information. Any other information that is pertinent to project samples shall be reported. This shall include copies of the original chain of custody forms, copies of cooler receipt forms, copies of any telephone conversation records, and copies of any other forms (i.e. corrective action forms, Level 1, 2, and 3 review checklists, and validation forms, etc.). The AE Laboratory shall maintain on file all of the supporting data and documentation for these samples. The contract laboratory shall provide, upon request, copies of raw data for specific methods and samples at no additional cost.

2.5.2.5.1.1.6 Fully Validatable Data Reporting Package Format. The AE shall utilize the reporting format specified by the Data Quality Objectives Process for Superfund, EPA 540-R-93-071, September 1993, in order to allow a full independent validation of the data. The equivalent electronic deliverable shall also be included with the hard copy report.

2.5.2.5.1.1.7 Report Turnaround Time. The AE shall have twenty-one (21) calendar days for standard delivery from the time of sample receipt, unless accelerated turnaround times are requested and agreed upon.

2.5.2.5.1.1.8 Compliance. The AE shall be required to provide procedures to confirm the compliance with documentation requirements including field documentation, daily quality control reports, daily instrument and monitor outputs, authenticity of all document entries by signed or initialed entries, data reporting packages, QC documentation and production of deliverables.

2.5.2.5.1.1.9 Quality Assurance (QA) Laboratory Functions. The QA laboratory shall be obligated to perform the following functions: (1) Inspection of QA samples to insure that sampling procedures correspond to the SAP, with regard to sample container, preservation, labeling, and chain of custody, (2) Analyses of QA samples, (3) Evaluation of data deliverables specified in the SAP, (4) Comparison of analytical results obtained by the contract laboratory from split or replicate samples. The AE shall be responsible for collecting, packaging, and shipping quality assurance samples to the quality assurance laboratory. The Quality Assurance Laboratory for this removal action and all sampling events associated with this removal action is the U.S. Army Corps of Engineers, Ohio River Division Laboratory (CEORD-PE-GL) located in Cincinnati, Ohio. Samples

collected for Quality Assurance Analysis shall be sent to

U.S. Army Corps of Engineers, Ohio River Division Laboratory
Mr. John Adams
11275 Sebring Drive
Cincinnati, OH 45240-2714

The results from the analytical data shall be sent to

U.S. Army Corps of Engineers, Ohio River Division Laboratory
Mr. Sam Mansy
11275 Sebring Drive
Cincinnati, OH 45240-2714

2.5.2.6 Data Reportables. The Contractor shall be required to deliver data reportables, submittals, etc. by specified reporting formats such as EPA SW-846 and USACE Minimum Data Reporting Requirements Memorandum dated 16. August 1989 and EM 200-1-3 Guidlines.

2.5.2.6.1 SAP Deliverables. This section of the SAP shall indicate to the SAP user the required deliverables derived from the data acquired by the SAP activities and when and how the deliverables shall be reported. Deliverables include: Daily Quality Control Reports, Quality Control Summary Reports, Chemical Data Reports, Summary Chemical Data Reports and if required, Interim Chemical Data Reports.

2.5.2.7 Sample Information. Table 4 contains the number of field, QC, QA and equipment rinsate samples and the different parameters that will be tested at this site. Table 5 lists Matrix Spike and Matrix Spike Duplicate Requirements for this field effort.

Table 4
Sample Information
Soil

Parameter	Field Samples	QC Samples	QA Samples
VOCs	24	2	2
SVOCs	24	2	2
Nitroaromatics	24	2	2
PCB/Pesticides	24	2	2
Metals	24	2	2

Table 5
Matrix Spike/Matrix Spike Duplicate Information

Parameter	Field Samples	Matrix Spike	Matrix Spike Duplicates
VOCs	24	2.	2
SVOCs	24	2	2
Nitroaromatics	24	2	2
PCB/Pesticides	24	2	2
Metals	24	2	2

2.5.2.8 Detection Limits. Detection Limits for the compounds identified in Table 1 of this SOW shall be lower than the lowest value listed for each individual constituent. For volatile organic compounds that estimated quantiation limit shall be as described in Table 6 of this SOW. For inorganic elements analyzed by ICP the required reporting limits are contained in Table 7 of this SOW.

2.6 Task 6 - Preparation and Submission of Draft Site Investigations Report.

The AE shall prepare and submit the Draft Site Investigation Report to Corps of Engineers for review and comment. The report shall be a stand alone document with a discussion of purpose and organization of report, background information (including site description and site history), data quality assessment, conclusions, and recommendations. The data quality assessment shall compare the results with the prescribe data quality objectives. The DQOs shall be provided by COE personnel.

2.7 Task 7 - Draft Site Investigations Report Meeting.

The AE shall be available for a meeting to be held at Nashville District - Corps of Engineers Facility two (2) weeks after the submittal of the Draft Site Investigations Report. The purpose of this meeting is to discuss the subject report. Two days shall be allowed for this meeting (One travel day and one meeting day). For cost estimating purposes two people shll attend this meeting.

2.8 Task 8 - Preparation and Submission of Final Site Investigations Report.

The AE shall revise the draft report to include any pertinent comments that arise from regulatory and COE review of the draft report. The AE shall formally respond in writing to all officially submitted COE and regulatory comments.

3.0 Schedule.

4.0 Submissions.

Table 6
Compound List and Reporting Limits for Volatile Organics by GC/MS (SW-846, 8260A)

Volatiles	MDL (µg/l)	EQL (µg/kg) (Soil)
Benzene	0.04	5
Bromobenzene	0.03	5
Bromochloromethane	0.04	5
Bromodichloromethane	0.08	5
Bromoform	0.12	5
Bromomethane	0.11	5
n-Butylbenzene	0.11	5
sec-Butylbenzene	0.13	5
tert-Butylbenzene	0.14	5
Carbon Tetrachloride	0.21	10
Chlorobenzene	0.04	5
Chloroethane	0.10	5
Chloroform	0.03	5
Chloromethane	0.13	5
2-Chlorotoluene	0.04	5
4-Clorotoluene	0.06	5
Dibromochloromethane	0.05	5
1,2-Dibromo-3-chlor-propane	0.26	10
1,2 Dibromomethane	0.06	5
Dibromomethane	0.24	10
1,2 Dichlorobenzene	0.03	5
1,3 Dichlorobenzene	0.12	5
1,4 Dichlorobenzene	0.03	5
Dichlorodifluoromethane	0.10	5
1,1-Dichloroethane	0.04	5
1,2-Dichloroethane	0.06	5
1,1-Dichloroethene	0.12	5
cis-1,2-Dichloroethene	0.12	5
trans-1,2-Dichloroethene	0.06	5
1,2-Dichloropropane	0.04	5
1,3-Dichloropropane	0.04	5
2,2-Dichloropropane	0.35	15
1,1-Dichloropropene	0.10	5
Ethylbenzene	0.06	5
Hexachlorobutadiene	0.11	5
Isopropylbenzene	0.15	5
p-Isopropyltoluene	0.12	5
Methylene Chloride	0.03	5
Naphthalene	0.04	5
n-Propylbenzene	0.04	5
Styrene	0.04	5
1,1,1,2-Tetrachloroethane	0.05	5
1,1,2,2-Tetrachloroethane	0.04	5
Tetrachloroethane	0.14	5
1,2,3-Trichlorobenzene	0.03	5
1,2,4-Trichlorobenzene	0.04	5
1,1,1-Trichloroethane	0.08	5
1,1,2-Trichloroethane	0.10	5
Trichloroethene	0.19	10
Trichlorofluoromethane	0.08	5
1,2,3-Trichlorpropane	0.32	15
1,2,4-Trimethylbenzene	0.13	5
1,3,5-Trimethylbenzene	0.05	5
Vinyl Chloride	0.17	10
o-Xylene	0.11	5
m-Xylene	0.05	5
p-Xylene	0.13	5

Table 7:
Element List and Reporting Limits (Soil) for Metals by ICP (6010A, SW-846, 3rd Edition, Update 1, Rev.1, November 1990)

Metal	Instrument Detection Limit (µg/l)	Practical Quantitation Limits (mg/kg)
Aluminum	45	9
Antimony	32	6
Barium	2	0.4
Beryllium	0.3	0.06
Cadmium	4	0.8
Calcium	10	10
Chromium	7	1
Cobalt	7	1
Copper	6	1
Iron	7	1
Lead	42	8
Magnesium	30	6
Manganese	2	0.4
Nickel	15	3
Potassium		1
Selenium	75	15
Sodium	29	58
Thallium	40	8
Vanadium	8	2
Zinc	2	0.4