Sampling and Analysis Plan
(Template)

[Facility Name]
[Facility Address]
[City, State, Zip Code]

Submitted to:

Arkansas Department of Environmental Quality (ADEQ)
5301 Northshore Drive
North Little Rock, Arkansas
72118-5317

Prepared by:

[Company Name]
[Company Address]
[City, State, Zip Code]
[Phone Number]
[Fax Number]
[E-Mail Address]
[Website Address]

[Date]

_____ _____

[Name of Company Representative]
[Title]

[Name of Consultant]
[Title]

NOTE: This is a template provided for the purposes of guidance.

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1.0 INTRODUCTION

[Facility Name] is implementing a Sampling and Analysis Plan (SAP) to assist with site characterization and for determining the level and extent of specific contaminants generated during site operations. The SAP outlines specific sampling and analysis protocols to be followed during sampling activities. These protocols are pursuant to the technical requirements of the Arkansas Pollution Control and Ecology Commission (APC&EC) Regulation No. 23, Federal and State Guidance, and/or Arkansas Department of Environmental Quality (ADEQ) policies and/or procedures. The SAP describes the sample collection program, including the design and implementation of the proposed sampling; sample collection and management; analytical methods; health and safety procedures; and quality assurance goals. Qualitative data acquired during the investigation will be utilized in the subsequent development and implementation of a Remedial activities, if determined to be necessary by the Arkansas Department of Environmental Quality (ADEQ).

1.1 Responsible Agency

[Facility Name] will conduct the SAP investigation of this Site under the guidance of the ADEQ.

1.2 Project Organization

Persons involved in the SAP activities and their roles and responsibilities are included in Table 1 below:

Table 1
Project Personnel

Title/Responsibility	Name	Phone Number
Contractor Staff		

A copy of the [Insert Name of ADEQ Certified Laboratory] analytical certification with the Arkansas Department of Environmental Quality is included as Appendix A.

2.0 BACKGROUND INFORMATION

2.1 Site Location and Description

The [Facility Name] is located at [Facility Address, City, State (County)]. The coordinates for the site are [Insert latitude and longitude collected at front entrance to the site]. A Site Vicinity Map is presented as Figure 1.

[Insert information such as the approximate number of acres the Site is situated on, as well as the surrounding land uses to the North, South, West, and East.]

[Include number of drinking water wells located within a one mile radius of the site and the aquifer in which each of them is screened.]

[Insert a listing of any facility Permits and associated Permit Numbers.]

[Insert summary of surface drainage on and from the Site.]

2.2 Geologic Setting

[Insert a brief description of the physiography and regional and site geology underlying the Site and surrounding locale.]

2.2.1 Physiography

[Insert a summary of the physiographic province in which the Site is located.]

Figure 1 [Insert Site Vicinity Map]

Figure 2 [Insert Facility Site Plan]

2.2.2 Local Geology

[Insert a summary of the local geology in which the Site is located.]

2.2.3 Site Geology

[Insert a summary of the Site Geology that is known. Include any information as to the depth to groundwater and any findings of previous hydrogeologic investigations at the Site.]

2.3 Historical Operations/Arkansas Department of Environmental Quality Regulatory Involvement

The site is located in an [Insert one: industrially or residentially] zoned area. [Note: If the area your site is located in does not have a zoning criterion, please list the city and county in which the site is located.]

The following outlines a chronology of events relating to historical operations and associated regulatory involvement at the Site: [Insert summary of historical operations and regulatory citations. Include the years of operation, ownership history, and a description of any reported, known, and/or suspected spills and waste disposal practices, as well as any previous investigations. Include all sampling dates; the type of media sampled; all constituents handled at the site; and laboratory methods used. Attach reports or summary tables of sample results or include as an appendix, if applicable.]

3.0 DATA QUALITY OBJECTIVES

In identifying preliminary data gaps to the Conceptual Site Model (CSM), the Data Quality Objectives (DQO) process will be utilized. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision making. DQOs are qualitative and quantitative statements, developed using the DQO process, that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions as outlined in USEPA's *Guidance for the Data Quality Objectives* (EPA/600/R-96/055, August 2000). The sampling planning approach for the Site is detailed in Table 2 below:

TABLE 2 **DATA QUALITY OBJECTIVE PLANNING PROCESS** **[Facility Name]** **[Facility Address]** **[City, State]**	
1. State the Problem	[Insert a statement describing why the sampling event is being conducted and the overall objective(s)]
2. Identify the Decision	Decision Statement [Insert a statement describing how the problem will be investigated/remedied] Alternative Actions [Insert a statement describing any alternative actions that will be taken should the decision stated above fail]
3. Define the Boundaries of the Study	Sample Population [Insert a statement stating the number of samples to be collected and in what media]
	Spatial Boundaries [Insert a statement defining where the samples will be collected]
	Sampling Time Frame [Insert a statement stating the dates in which sample collecting will commence and end]
	Practical Constraints For Collecting Data [Insert a statement detailing any foreseeable concerns with any selected sampling locations/techniques]
4. Develop a Decision Rule	Decision Rule [Insert a statement describing the end point of the investigation/remedy]

After data collection activities associated with SAP activities have been completed, the resulting data will be validated and the CSM revised to reflect the new data.

4.0 FIELD ASSESSMENT/SAMPLING METHODOLOGY

[Insert detailed discussions about the number of samples, a description of whether the samples will be collected grab or composite, and type of media or waste that will be sampled during the sampling event.]

All field operations will be supervised by personnel experienced in site assessment and sampling activities. All drilling activities will be conducted by an Arkansas licensed driller. Field operations will be performed in accordance with a site-specific Health and Safety Plan (HASP) included as Appendix B.

4.1 Identified Areas of Concern

[Insert a description of each AOC and proposed sampling locations associated with each AOC.]

Figure 3 [Insert Layout with Proposed Sampling Locations and Areas of Concern]

[Note: Insert additional figures, if needed, to adequately depict any off-site sampling locations]

4.2 Drilling Method (*complete only if applicable)*

[Insert description of drilling techniques]

Collected samples will be described in a dedicated logbook in the field using the Unified Soil Classification System in accordance with *American Society of Testing and Materials (ASTM), Standard D-2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure*),(March 2000). A qualified environmental scientist or geologist will oversee the drilling and will be responsible for generating boring logs and as-built diagrams, as necessary. Boring logs generated for geologic and hydrogeologic interpretation of the site have been certified by an Arkansas Registered Professional Geologist.

Upon completion of the field investigation, a survey will be conducted to locate each soil boring, both horizontally and vertically. The vertical elevations will be surveyed to an accuracy of $\pm$0.01 foot in relation to mean sea level. The horizontal locations will be supplied in state plane coordinates, using the 1983 North American Datum (NAD83).

4.3 Field Instrumentation and Volatile Vapor Screening Procedure

[Insert a description of the photo-ionization detector (PID) and the calibration frequency. Note: If the use of field instrumentation is not planned, include a statement to that effect.]

4.4 Sampling

[Insert a description of each media or waste to be sampled with reference to Figure 3 for soil and groundwater sampling. Also include the proposed depth(s) of sampling.]

4.4.1 Sampling Procedures

[Insert a description of the field equipment and techniques that will be used in collection of all media samples.]

4.4.2 Analytical Procedures

Based on generator process knowledge, ADEQ documentation, and/or site visit all media samples will be analyzed for [insert list of constituents that will be analyzed]. Containers, preservatives, and holding times for each media sample are outlined in Table 3 below:

Table 3
Containers, Preservatives, and Holding Times for Media Samples

Analysis	Matrix	EPA Analytical Method	Sample Container Size/Type	Preservation	Holding Time

United States Environmental Protection Agency Risk-Based Concentration (RBC) Levels (http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm) will provide the regulatory thresholds (RTs). The analytical data will be screened against the residential levels listed within the most recent version of the RBC table unless prior approval is obtained from ADEQ. For constituents of concern (COCs) that do not have an established screening level, site-specific levels will be

established in consultation with ADEQ. In addition to investigative samples, Quality Assurance/Quality Control (QA/QC) samples will also be collected for laboratory analysis. These include: duplicates, equipment rinsate blank, trip blanks, and matrix spike/matrix spike duplicates.

- Duplicates ─ One per 10 investigative samples;
- Equipment Rinsate Blank ─ One per day and following auger decontamination;
- Trip Blank ─ One per cooler (for investigative samples);

Information relating to project-specific personnel, data quality objectives, sample control procedures, analytical protocols, and field and laboratory QA/QC is presented in the Quality Assurance Project Plan (QAPP) included as Appendix C.

4.5 Equipment Decontamination Procedures

All non-dedicated sampling equipment will be thoroughly decontaminated using a solution of anionic soap (e.g., Liquonox®) and deionized water supplied by the analytical laboratory followed by a "clean" rinse using deionized water. To ensure that all sampling equipment is free of contamination, equipment blanks must be collected at a rate of one per day of field work. An equipment blank sample will be collected from a randomly selected piece of equipment following decontamination. All liquids generated during decontamination procedures will be containerized in new or reconditioned Department of Transportation approved 55-gallon drums. The characterization and disposition of Investigative Derived Wastes (IDW) is discussed in Section 6.1.

Any dedicated sampling equipment will be appropriately disposed of or wrapped securely and transported safely back to its destination and appropriately decontaminated at that location.

4.5.1 Sampling Equipment

Sampling equipment includes any downhole equipment or sampling utensils (hand augers, Teflon-coated stainless steel leaders, bailers, pumps, etc.) not dedicated to the sample location. Hollow downhole equipment or equipment with holes potentially transmitting water will be cleaned on the inside and outside. When available, hot water will be used for field decontamination.

5.0 SAMPLE DOCUMENTATION AND SHIPMENT

5.1 Field Notes

[This section should discuss record keeping in the field. This may be through a combination of logbooks, preprinted forms, photographs, or other documentation. Information to be maintained, at a minimum, is provided below.]

5.1.1 Field Logbooks

[Insert a description on how field logbooks will be used and maintained.]

[Note: Field logbooks should be used to document where, when, how, and from whom any vital project information was obtained. Logbook entries should be complete and accurate enough to allow reconstruction of field activities. All entries should be legible, written in blue or black ink, and signed by the individual making the entries. Only factual and objective language should be used.]

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description
- Site or Sampling area sketch showing sample location and measured distances
- Sampler's name(s)
- Date and Time of each sample collection
- Designation of sample as composite or grab
- Type of sample (e.g., soil, sediment, or water)
- Type of sampling equipment used to collect each sample
- Field instrument readings and calibrations
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for water: clear water with strong ammonia-like odor)
- Sample preservations
- Lot numbers of sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers
- Shipping arrangements (overnight air bill number)

- Name(s) of recipient laboratory(ies)

In addition to the sampling information listed above, the following specific information will also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities
- Time of arrival/entry on site and time of site departure
- Other personnel on site
- Summary of any site meetings or discussions with contractors, agency personnel, site personnel, etc.
- Deviations from sampling plans, site safety plans, and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection

5.1.2 Photographs

Photographs will be taken at the sampling locations and at other areas of interest on site or sampling area. Photographs will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the field logbook or recorded in a separate field photography log:

- Time, date, location, direction, and weather conditions
- Description of the subject photographed
- Name of person taking the photograph and name of person witnessing the photograph

5.2 Labeling

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have preassigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information:

- Station location
- Date of collection
- Analytical parameter(s)
- Method of preservation, if applicable

Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

5.3 Sample Chain-of-Custody Forms and Custody Seals

Chain-of-custody forms are used to document sample collection and shipment to laboratories for analysis. All sample shipments for analyses will be accompanied by a chain-of-custody form.

Figure 4 [Insert Chain of Custody Form]

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped or delivered to an Arkansas certified Laboratory, the custody of the samples will be the responsibility of [Insert name of organization conducting the sampling]. The sampling team leader or designee will sign the chain-of-custody form in the "relinquished by" box and note date, time, and air bill number.

The sample numbers for all rinsate samples, reference samples, laboratory QC samples, and duplicates will be documented on the chain-of-custody form as found in Figure 4. The original form is left with the laboratory analyzing the samples.

A self-adhesive custody seal will be placed across the lid of each sample jar. For VOC samples, the seal will be wrapped around the cap. The shipping containers in which the samples are stored (e.g., usually an ice chest), will be sealed with self-adhesive custody seals any time the samples are not in someone's possession or view before shipping. All custody seals will be signed and dated.

5.4 Packaging

The following outlines the packaging procedures that will be followed:

- When ice is used, it will be packed in zip-locked, double plastic bags.
- The bottom of the cooler will be lined with bubble wrap or vermiculite to prevent breakage.
- All sample bottles will be affixed with custody labels and placed in heavy duty plastic zip-lock bags.

6.0 INVESTIGATION-DERIVED WASTE

Investigative-Derived Waste (IDW) generated during this investigation could include, but is not limited to, soil cuttings produced while installing borings; soils generated for logging field screening and sampling purposes; disposable personal protective equipment (PPE) and sampling utensils; and decontamination fluid from cleaning PPE, sampling equipment, and drilling equipment. Groundwater may be encountered and therefore, is considered as potential IDW material. [Facility Name] will be responsible for waste management at the site, which includes drumming and securing the IDW, and labeling, staging, and profiling it for ultimate disposal within a timely manner.

6.1 IDW Management

As IDW is generated, it will be stored onsite in a designated area and remain in that location until characterized. IDW will be placed in new or reconditioned, Department of Transportation (DOT)-approved 55-gallon drums. Drums will be in good condition and suitable for transportation. IDW drums will be placed in a configuration that allows room for inspections, operations and maintenance, and handling. Each drum will be labeled with the following information: contents, name of generator, and date.

6.2 Characterization

IDW will be disposed of promptly after characterization is performed. The IDW characterization process is outlined in USEPA's *Management of Investigation-Derived Wastes During Site Inspections* (9345.3-02, May 1991) and *Guidance to Management of Investigation-Derived Wastes* (9345.3-03FS, April 1992). Classification of IDW will also follow the regulations as published in APC&EC Regulation No. 23, Part 261. Once the IDW is characterized, a determination will be made as to the proper management.

Each container will be referenced to a particular set of analytical (sample) data based on sample identification. Before receipt of data, all IDW will be characterized based on site knowledge, field observations, and field analytical data. All classification/characterization activities will be conducted when analytical data are received.

IDW containers will be routinely inspected to ensure that all containers remain in serviceable condition and to ensure good housekeeping practices. Container inspections will be used to identify any problems associated with drum usage, such as bulging, leaking, or improper/missing labels. Any problems will be addressed immediately upon discovery.

7.0 REPORTING

A report including all analytical data and sampling locations, iso-concentration maps (if appropriate), conclusions and recommendations, will be submitted to the ADEQ within timeframes defined within the Consent Administrative Order (CAO) or Elective Site Cleanup Agreement (ESCA). Data obtained from sampling and analysis procedures will be summarized in tables and supported by raw laboratory reports. Several formats may be used to present sampling results graphically. Cross-sectional plots may be used to enhance the CSM. Forms completed during the investigation will be included in appendices of the report. Accumulated data and analytical results will be interpreted to develop proper conclusions and recommendations.

8.0 SCHEDULE OF IMPLEMENTATION

This section outlines the anticipated time schedule for operations related to the SAP activities at the Site as requested by the ADEQ. Table 4 presents estimates for the duration of each work plan task and the anticipated days to complete those tasks.

TABLE 4
ESTIMATED TASK-BASED TIME SCHEDULE

Tasks	**Start Date**	**End Date**	**Duration (Days)**
Task 1: SAP Preparation			
Anticipated ADEQ SAP Approval			
Task 2: SAP Field Activities			
Task 3: SAP Report Submission to ADEQ			

9.0 REFERENCES

[Note: Insert any additional references that apply to your site-specific SAP and Remedial activities]

American Society of Testing and Materials. *ASTM Standard D-2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

United States Environmental Protection Agency. (1991). *Risk Assessment Guidance for Superfund,*
P*art A.* Office of Solid Waste.

— (1993, September). Data Quality Objectives for Superfund, Interim Final Guidance (540/G-93/017).

— (1991, May). *Management of Investigation-Derived Wastes During Site Inspections* (9345.3-02).

— (1991, revised 2008). Risk *Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals).* Publication 9285.7-01B. Office of Emergency and Remedial Response, Washington, DC. NTISPB92-963333.

— (1992, April). *Guidance to Management of Investigation-Derived Wastes* (9345.3-03FS).

— (1998, January). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. Chapter 9. Publication 846, Office of Solid Waste and Emergency Response.

— (August 2000). *Guidance for the Data Quality Objectives* (EPA/600/R-96/055,).

Appendix A

ADEQ Laboratory Certification for [Insert Laboratory Name]

Appendix B

Health and Safety Plan (HASP)

HEALTH AND SAFETY PLAN

for

SAP and/or Remedial Activities

[Facility Name]
[Facility Address]
[City, State, Zip Code]

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared for employees of [Insert Name and location of Party conducting the sampling activities] for the [Insert Facility Name and location]. All subcontractors and site visitors who are reasonably anticipated to be subjected to the health and safety risks associated with this work are required to read, understand, and fully comply with all aspects of this HASP. This program is designed to comply with OSHA 1910.120(b) and to identify and evaluate the health and safety hazards which may be encountered, provide for appropriate training of personnel, inform personnel of potential hazards, establish an appropriate medical surveillance program, and establish certain work and safety procedures for personnel engaged in the above mentioned tasks. Attachment 1 is a Health and Safety Plan Log that must be signed before work at this site is allowed. A copy of this HASP is to be maintained on site at all times while work is being performed.

2.0 SCOPE OF WORK

Work activities covered under this HASP are as follows:

[Insert bullet point listing of sampling and other field activities to be performed at the Site as part of this SAP]

3.0 HAZARD IDENTIFICATION

The following sections describe the prominent hazards that could be encountered at this Site. The hazards described below have been identified based on available information regarding the site history and other relevant data discovered on the Site.

3.1 Chemical Hazards

[Insert a listing of the chemicals located onsite and the types of containers. Note in this section if there is any evidence of potential releases and to what media the release(s) may have occurred. If there are any potential chemical hazards to workers, please note such hazards in this section, as well]

3.2 Fire and Explosion Hazards

Fire and explosion hazards are expected to be [Insert either minimal or maximum]. However, there will be no smoking or open flames during any assessment or sampling activities.

3.3 Physical Hazards

[Insert a summary of any physical hazards which could be encountered such as traffic hazards or heavy machinery]

Hearing protection is required when continued exposure to extreme noise exists. All equipment must maintain at least 10 feet of clearance from overhead power cables. If this clearance cannot be maintained, the electric utility company must be contacted and requested to disconnect the cables from the power supply.

Some subsurface utilities could be present at the Site. Utilities will be located prior to intrusive activities and the location of those utilities will be painted on the ground surface.

Slip, trip, and fall hazards are commonly associated with this type of work. These hazards need to be recognized and corrected as soon as possible to avoid accidental injury.

3.4 Biological Hazards

Workers should be aware that snakes and insects could present hazards in association with the performance of this type work.

4.0 PERSONAL TRAINING AND PERRSONAL PROTECTIVE EQUIPMENT

All workers at this site are required to have completed the 40-hour Occupational Safety and Health Administration (OSHA) training course for hazardous waste operations as required under 20 CFR 1910.120. Furthermore, each worker is required to be current with the annual 8-hour refresher course requirement.

All workers at this site are required to use [Insert appropriate Level of Personal Protective Equipment necessary for the work being conducted at the Site]. At a minimum, PPE shall include:

- Chemically-resistant gloves
- Steel-toed boots
- Hard hat
- Safety glasses
- Hearing protection (if prolonged exposure to high noise levels exists)
- Long pants

5.0 AIR MONITORING

Air monitoring will be conducted for two purposes: identification of explosive atmospheres and determination of inhalation hazards. Monitoring will be conducted with a PID meter. The following air monitoring procedures will be used for determination of inhalation hazards:

- Workers will monitor the general work area using the PID meter. The meter will be placed near the work area in the downwind direction. If the meter indicates

that the lower explosive limit ("LEL") value is 10% or greater, all work will be halted until the level has subsided to <10% LEL.

- Workers will monitor the breathing zone for volatile organic compounds at regular time intervals throughout the workday. If a sustained reading (longer than one minute) of 30 ppm or greater is present in the breathing zone, all work will be halted and workers will leave the exclusion zone until those levels subside.

6.0 GENERAL SAFETY PROCEDURES:

- A Health and Safety meeting will be conducted prior to initiating sampling activities. A Copy of the Health and Safety Plan will be distributed to all workers. All workers will be required to read the plan, discuss the plan, and sign the Health and Safety Plan before work commences. All visitors to the site will be required to read, sign, and comply with the plan.

- "Tailgate" Health and Safety meetings will be conducted prior to each days' work, and as deemed necessary by the Project Manager or the Site Supervisor.

- There will be no smoking, eating, or drinking within the exclusion zone. For the purposes of this HASP, the exclusion zone will be considered to be a 25-foot radius around each Area of Concern.

- At least two (2) workers will be present on site at all times during the performance of the work.

- The work areas will be maintained in a clean fashion. Unnecessary debris, tools, hoses, equipment, and other items will be properly stored such that the possibility of slip, trip, and fall injuries is minimized.

- Protective barricades and caution flagging will be used to delineate any open excavation in excess of 4 feet in depth. Workers will maintain 10 feet clearance from the edge of open excavation.

- Any accident or injury resulting from the work conducted at this site should be reported as soon as possible to the Project Manager (PM) or Site Supervisor (SS).

7.0 PERSONNEL AND AUTHORITY

The Health and Safety Officer is responsible for implementation of the Health and Safety Plan. The Project Manager (PM) has authority to halt work activities if unsafe practices or unsafe conditions are observed or reported. [Insert the name of the Project Manager] is the PM for this SAP.

The Site Supervisor (SS) directs the day-to-day progress of the work and implements the HASP in the field. Like the PM, the SS has the authority to halt work activities if conditions become unsafe or if worker practices do not comply with the terms of the HASP. [Insert the name of the Site Supervisor] is the SS for this SAP.

[Insert list of all authorized onsite workers] are authorized onsite workers. Each worker is required to participate in health and safety meetings, to conduct field activities in accordance with the HASP, and to report all accident/injuries (regardless of the severity of same) to the PM or the SS as soon as possible.

8.0 EMERGENCY CONTACTS

In the event of an emergency situation (such as accident, injury, or fire) personnel are directed to call the local 911 operator. The location of the site and the nature of the incident will be provided to the 911 operator. Personnel are further directed to stay on the line until released by the operator.

After release by the 911 operator, the PM should be contacted and made aware of the situation. The Project Manager's contact numbers are as follows:

Project Manager
[Name]
[Cell Phone Number]
[Office Phone Number]

Other emergency numbers are as follows:

[Insert County] County Emergency Management	[Phone Number]
[Insert County] County Sheriff	[Phone Number]
[Insert City] Police Dept.	[Phone Number]
[Insert City] Fire Dept.	[Phone Number]
[Insert Name of Hospital]	[Phone Number]

Attachment 1

HEALTH AND SAFETY PLAN LOG

NAME	COMPANY	DATE	TIME IN	TIME OUT	INITIALS

9.0 ROUTE TO HOSPITAL

The nearest Emergency Room to the Site is located at [Insert Name and Address of nearest Medical Facility]. A map showing the route to the Hospital from the work site is below [Insert Map].

Appendix C

Quality Assurance Project Plan (QAPP)

QUALITY ASSURANCE PROJECT PLAN

for

Sampling and Analysis and/or Remedial Activities

[Facility Name]
[Facility Address]
[City, State, Zip Code]

This Quality Assurance Project Plan (QAPP) was prepared to supplement the SAP and/or Remedial activities for the [Insert Facility Name] located at [Insert Facility Address]. The QAPP presents project-specific personnel, data quality objectives, sample control procedures, analytical protocols, and field and laboratory quality assurance/quality control (QA/QC).

1.0 PROJECT ORGANIZATION

The Project Manager, [Insert Name of PM], will coordinate all personnel and project activities. He or She will provide technical assistance as needed and will have the ultimate responsibility for project performance and data quality. Responsibilities for project QA/QC lie with the Quality Assurance Officer (QAO)**,** [Insert Name of QAO], who will recommend and evaluate all project data, and perform audits to determine proper performance and compliance with the QAPP. The QAO will be responsible for adherence to all QA/QC, as defined in this QAPP.

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.

The laboratory chosen will be certified by Arkansas Department of Environmental Quality (ADEQ) and will adhere to the requirements outlined in this QAPP and the laboratory's Quality Assurance Plan (QAP). The laboratory's QAP will be on file with [Insert Facility Name] and with ADEQ as part of ADEQ's certification program. [Insert Facility Name] will retain an analytical laboratory through a service agreement, which will specify the expected scope of services, the analytical QA requirements, and the information to be developed and reported.

2.0 DATA QUALITY OBJECTIVES

The general quality assurance objectives of this project are to assess and document the precision, accuracy, representativeness, completeness, and comparability of all sampling and analyses performed. Quality criteria are set herein to assure suitability for intended use of data obtained during the project and to meet goals established by the USEPA. The following sections discuss in detail data quality assurance criteria specific to this project and its goals. To facilitate in understanding of how these objectives will be achieved, each of these criteria are defined below.

2.1 Precision

Precision is a measure or estimate of the reproducibility of measurements and methods. It is defined for quantitative data as the variability of a group of values compared with their average value. Duplication of activities is generally the method by which precision is assessed. For purposes of assessing precision of the measurement systems (sampling events and analysis) to be used in this project, duplicate samples (both from the field and within the laboratory) will be obtained and analyzed along with the investigative samples.

The precision of the method for organic compounds will be expressed in terms of the relative percent difference (RPD) for matrix spike recoveries calculated as follows:

$$RPD = \frac{(R_{MS} - R_{MSD})}{\frac{(R_{MS} + R_{MSD})}{2}} \times 100$$

Where RPD, R_{MS} and R_{MSD} are relative percent difference, matrix spike recovery, and matrix spike duplicate recovery, respectively.

The precision for inorganic compounds for the laboratory analysis will be expressed in terms of RPD. For the laboratory duplicate (LD) result and sample result (SR), the RPD is calculated as follows:

$$RPD = \frac{(LD - SR)}{\frac{(LD + SR)}{2}} \times 100$$

[Insert Acceptance criteria for field samples]

2.2 Accuracy

The determination of measurement accuracy requires knowledge of the true or accepted value for the signal being measured. The laboratory analysis accuracy will be evaluated employing laboratory control sample (LCS) analyses. Accuracy may be calculated in terms of bias as follows:

$$Bias = \overline{X} - T$$

$$\% \ Bias = \frac{100(\overline{X} - T)}{T}$$

Where:

$\overline{X}$ = average observed value of measurement
T = "true" value

Accuracy may also be calculated in terms of the recovery of spiked samples as in the case of LCS for this program.

$$\% \ Recovery = 100\left[\frac{\overline{X}}{T}\right]$$

Additionally, blanks will be used to evaluate whether laboratory or field procedures represent a possible source of contamination in the field samples. Unmonitored contamination can allow false positive results to be reported and treated as true sample components when in fact they are not. This type of error will adversely affect the reported results accuracy. Several blank types

(field blanks, method blanks, and laboratory analytical blanks) will be used throughout this project.

[Insert Acceptance criteria for field samples]

2.3 Representativeness

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. Representativeness is a qualitative parameter, which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling approach was designed to provide data representative of the site conditions. During development of this approach, consideration was given to current and past site activities, existing analytical data, and physical setting. Representativeness will be satisfied by ensuring that the Plan1, the QAPP, and USEPA protocols are followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded by the laboratory.

2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct normal conditions. The completeness goal for field measurements will be greater that 90 percent. Completeness goals of field measurements reflect the ability to resample immediately (i.e., prior to declaring well stability) and obtaining samples for subsequent analysis. Laboratory analysis for this project will have a completeness goal of greater than 95 percent. Completeness will be calculated by dividing the number of valid results by the number of possible individual analyte results, expressed as a percentage.

2.5 Comparability

Comparability is the degree to which one data set can be compared to another. The objective of this QAPP is to produce a high level of comparability between data sets. The use of standard methods for sampling and analysis (USEPA protocols), reporting data in standard units, and

using standard and comprehensive reporting formats will optimize the potential for high levels of data comparability.

2.6 Field QC Sample Objectives and Collection Frequency

Primary measurements for field (and laboratory) QA/QC are derived from matrix spike/matrix spike duplicate samples, duplicate samples, field blanks, and rinsate blanks collected in the field. The types of QA samples that will be utilized during SAP and/or Remedial activities activities are discussed below. Table 1 summarizes the frequency at which each of these samples is to be collected.

Table 1

QC Sample Collection Frequency

Quality Control Sample	Frequency of Collection
Duplicates	10% (one field duplicate for every 10 investigative samples of each matrix)
Rinsate Blanks	One (1) field blank will be collected every day of field activities and following auger decontamination.
Trip Blanks	One per cooler (for investigative samples)

2.6.1 Duplicates

A duplicate is an identical sample collected from the same location, at the same time, under identical conditions as the original. Duplicate samples are analyzed along with the original to ascertain procedural precision and inherent source variability.

2.6.2 Rinsate Blanks

For non-disposable sampling equipment, rinsate (or equipment) blanks are collected by retaining rinsate from sampling equipment. The equipment is rinsed with deionized water after sampling and full decontamination procedures have been completed. One (1) rinsate sample will be collected during the first day of sampling for each collection method.

2.6.3 Trip Blanks

A trip blank, which is prepared by the analytical laboratory, is a sample container filled with organic-free water that is transported unopened with the sample bottles. It is opened in the laboratory and analyzed for VOCs along with the investigative field samples. One (1) trip blank will be submitted with each shipment container.

3.0 SAMPLE CONTROL AND FIELD RECORDS

- Site name and location
- Date and time of sample collection
- Type of analysis to be performed
- Preservation
- Sample identification number
- Project number (if applicable)

Sample chain-of-custody procedures begin at the time the sample is containerized and labeled, and continue through transport, sample receipt, preparation, analysis, and storage, data generation and reporting, and sample disposal. Record of sample custody will be maintained in the field records, project file(s), and laboratory records. A chain-of-custody form will be used for transferring sample shipment to the laboratory. Upon transfer of custody, the form will be signed by a member of the sampling team, who will note the date and time the samples were relinquished to the laboratory.

All chain-of-custody forms received by the laboratory will be signed and dated by the laboratory sample custodian and returned as part of the data reporting package. The analytical laboratory will carry the chain-of-custody through the laboratory during the analytical process.

Packaging Samples

All samples must be packed so as to avoid breakage and prevent cross-contamination, according to the following procedures.

1. Select a cooler in good condition. Seal the drain plug on the inside and outside of the cooler with tape to prevent leakage.
2. In order to prevent breakage while packaging samples, *either*:

    - Wrap samples in bubble wrap or other suitable packaging materials, and seal around the containers with tape. Protective wrap is not required for plastic containers, but take care when packing the coolers so that the containers do not directly touch each other

    or

    - Place two to four inches of inert packaging material on the bottom of the cooler. Place the bagged containers inside the cooler so the bottles do not touch each other. Place cooling material (e.g., bagged ice, blue ice) around and between the samples. Completely fill any remaining space with additional inert packaging material such as vermiculite or cellulose insulation.

3. Include a temperature blank or strip in each sample cooler.
4. Place a trip blank in each cooler containing volatile organic compounds (VOCs).
5. Place ice (or Blue Ice) inside the cooler to chill the samples to 4ºC (+/-2ºC).
6. Seal the cooler with tape and custody seals so that the cooler cannot be opened without breaking the seal.

4.0 ANALYTICAL PROCEDURES

The parameters being measured, analytical methods to be employed and anticipated sample containers and preservatives are presented in the following Table. Samples will be analyzed in accordance with *Test Methods for Evaluation of Solid Waste* (Physical/Chemical Methods), (SW-846), USEPA Office of Solid Waste and Emergency Response, Third Edition, December 1996 or other ADEQ-approved methods.

Table 2
Analytical Methods

Parameter	Analytical Method	Method Description	Sample Containers	Preservatives

5.0 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Internal quality control procedures for the laboratory analytical methods are specified in the SW-846 and EPA methods. These specifications include the type of QC checks required which include: method blanks, reagent/preparation blanks, matrix spike and matrix spike duplicates, calibration standards, internal standards, surrogate standards, the specific calibration check standards, laboratory duplicate/replicate analysis. Field duplicates and field QC blanks will be collected and analyzed to assess precision and bias. The laboratory that is selected to perform the analyses will have a QC program to ensure the reliability and validity of the analyses performed.

All data obtained will be properly recorded. Any samples analyzed in nonconformance with the 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.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

The laboratory procedures for data reduction, validation, and reporting are to be included in the laboratory QAP. Data reduction, validation, and reporting by the laboratory will meet the criteria needed to facilitate internal data validation.

Internal QC checks and data validation procedures are described below:

Field Data Package

The field data, including all field records and measurements obtained at the Site by the sampling personnel will be reviewed for completeness and accuracy by conducting the following:

- A review of field data on water and soil sampling logs for completeness.
- Verification that sample rinsate blanks and trip blanks were properly prepared, identified, and analyzed.
- Check on field analyses for equipment calibration and condition.
- Review of chain-of-custody forms for proper completion, signatures of field personnel and the laboratory sample custodian, and dates.

Analytical Data Package

The analytical data package will be validated by the project QA officer or designee. The validation steps will be performed by applying, where applicable, the USEPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review, and EPA Precision and Accuracy statements for the analytical methods employed. The analytical data package validation procedure includes, but is not limited to, review of the items outlined below:

Data Validation Procedures

- Comparison of sampling, sample extraction, and analysis dates to check that samples were extracted and/or analyzed within the proper holding times.

- Review analytical methods and required detection limits to verify that they agree with the QAPP and the laboratory contract.

- Review field and laboratory blanks to evaluate possible contamination sources. The preparation techniques and frequencies, and the analytical results (if appropriate) will be considered.

- Evaluation of all blanks (equipment rinsate blanks, field blanks, reagent blanks, method blanks, and extraction blanks) to confirm that contaminants were not detected at the specified detection limits.

6.1 Data Qualification

The data will be qualified by the project QA officer (or designee) based upon the level of reportables and the results of evaluating the field and analytical data packages. The possible data qualifiers are outlined below:

R/UR flag: One or more QC parameters grossly exceed control limits; unusable data, may not be used for any purpose.

J flag: Estimated value; one or more QC parameters were outside control limits or the value was detected below the laboratory's quantitation limit.

U flag: Undetected; the analyte was analyzed for but not detected or the analyte was found in an associated blank but at a concentration less than five times (10 for common laboratory contaminants) the quantitation limit.

UJ flag: Undetected and estimated; the analyte was analyzed but not detected and the quantitation limit is estimated because one or more QC parameters were outside control limits.

D flag: Diluted result; the compound was reanalyzed at a secondary dilution factor. The "D" flag will remain on the value to alert the data user that the value from a secondary dilution was used.

As with laboratory data validation, the qualification of data is based on specifically defined criteria. Samples are evaluated by matrix against the specific class criteria and qualified accordingly. Samples for which analytical data are unacceptable must be replaced by supplemental sampling, until data completeness goals for the sample/matrix are met.