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Appendix D

Quality Assurance Project Plan

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Quality Assurance Project Plan

USEPA RCRA 3013(a)
Administrative Order
EPA ID No. MSD 008 182 081
Docket No. RCRA-04-2011-4251
MDEQ AI No. 2022

Hattiesburg, Mississippi

16 September 2011

ARCADIS

Quality Assurance Project Plan

USEPA RCRA 3013(a)
Administrative Order
Hattiesburg, Mississippi

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4 Sample Containers, Preservation, Methods and Holding Times

Appendices

A EQuIS Lab SOP

B COC Form

C Laboratory Standard Operating Procedures

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Distribution List

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Acronyms and Abbreviations

AO	Administrative Order
BATCO	Bonner Analytical Testing Company
COC	Chain-of-Custody
CLP	Contract Laboratory Program
CWA	Clean Water Act
DAF	Dissolved Air Floatation
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EPA	Environmental Protection Agency
ft	feet
GC/MS	Gas Chromatography/Mass Spectrometry
GIS	Geographic Information System
IB	Impoundment Basin
IDW	Investigation-derived Waste
LCS	Laboratory Control Samples
MCL	Maximum Containment Level
MBPC	Mississippi Bureau of Pollution Control
MCLG	Maximum Containment Level Goals
MDEQ	Mississippi Department of Environmental Quality
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	mean sea level
NCP	National Contingency Plan
NEIC	National Enforcement Investigations Center
OSHA	Occupational Safety and Health Administration
PAR	Preliminary Assessment Reassessment
PCB	Polychlorinated biphenyls
QA	Quality Assurance
QAC	QA Coordinator
QAPP	QA Project Plan

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QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SQL	Sample Quantitation Limit
SVOC	Semivolatile organic compound
TRG	Target Remediation Goals
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound

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Introduction

This Quality Assurance Project Plan (QAPP) was prepared for the Hercules Incorporated (Hercules) site located at 613 West 7th Street, Hattiesburg, Mississippi (the Site). It supplements the Phase I Sampling and Analysis Work Plan (Work Plan) developed to evaluate the Site and surrounding area within a 4-mile radius of the Site pursuant to Paragraph 74 of the May 9, 2011, Administrative Order (the AO) issued by Region 4 of the U.S. Environmental Protection Agency (USEPA). The AO was issued pursuant to Section 3013(a) of the Resource Conservation and Recovery Act (RCRA), 42 United States Code (USC) §6934(a), and is specific to Hercules', Hattiesburg, Mississippi, facility. Together, this QAPP and the Work Plan constitute the Sampling and Analysis Plan for the Site.

This QAPP was prepared in a manner consistent with the following reference and guidance documents:

U.S. Environmental Protection Agency (USEPA) guidance document entitled *EPA Requirements for QA Project Plans*, EPA-QA/R-5 (USEPA 2001a), which replaces QAMS-005/80, *Interim Guidance and Specifications for Preparing QA Project Plans* (USEPA 1980);

USEPA *Guidance for QA Project Plans,* EPA-QA/G-5 (USEPA 2002b);

USEPA Field Branches Quality System and Technical Procedures; Field Branches Quality Management Plan; May 8, 2009. http://www.epa.gov/region4/sesd/fbqstp/; and

The National Enforcement Investigations Center (NEIC) *Policies and Procedures Manual* (USEPA 1991).

Information contained in this QAPP has been organized into the following sections:

Section	Content
Project Management	
1	Project Organization
2	Project Background
3	Project Description
4	Quality Objectives and Criteria for Measurement Data
5	Special Training Requirements/Certification

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Section	Content
6	Documentation and Records
Measurement/Data Acquisition	
7	Sampling Process Design
8	Sampling Method Requirements
9	Sample Handling and Custody Requirements
10	Analytical Method Requirements
11	Quality Control Requirements
12	Instrument/Equipment Testing, Inspection, and Maintenance Requirements
13	Instrument Calibration and Frequency
14	Inspection/Acceptance Requirements for Supplies and Consumables
15	Data Acquisition Requirements for Non-Direct Measurements
16	Data Management
Assessment/Oversight	
17	Assessment and Response Actions
18	Reports to Management
Data Validation and Usability	
19	Data Reduction and Review
20	Data Validation and Verification
21	Reconciliation with User Requirements
22	References

Details on each of the subjects listed above are provided in the subsequent sections.

1. Project Organization

1.1 Project Organization

The activities to be completed under the Work Plan will require integration of personnel from the organizations identified below, collectively referred to as the "project team." A detailed description of the responsibilities of each member of the project team is presented below.

1.1.1 Overall Project Management

ARCADIS personnel will perform related sampling activities and will evaluate data and prepare the deliverables as specified in the Work Plans. Project direction will be provided with lead regulatory oversight by the USEPA. A list of key project management personnel is provided below.

Company/Organization	Title	Name	Phone Number
USEPA	Project Coordinator	Meredith C. Anderson	404.562.8608
MDEQ	Project Manager	Willie McKercher	601.961.5731
Hercules	Project Manager	Timothy D. Hassett	302.995.3456
ARCADIS	Project Manager	John Ellis	225.292.1004
	Task Manager	Craig Derouen	225.292.1004
	Technical Manager	TBD	
	QA Coordinator (QAC)	Dennis Capria	315.671.9299

Company/Organization	Title	Name	Phone Number
Analytical Laboratory – TestAmerica Savannah	Project Manager	Lidya Gulizia	912.354.7858
	QA Manager	Andrea Teal	912.354.7858
Bonner Analytical Testing Company (BATCO)	Lab Director	Dr. Micheal Bonner	601.264.2854

1.1.2 Task Managers

The staff performing the site activities will be directed by representatives of the project team. The personnel responsible for each of the site activities are listed below.

Company/Organization	Title	Name	Phone Number
Environmental Consultant	Field Coordinator/Field Operations Manager	TBD	TBD
	Task Manager	TBD	TBD
	Health and Safety Officer	TBD	TBD

1.2 Team Member Responsibilities

The responsibilities of the various team members are summarized below by organization.

1.2.1 Hercules

Project Manager

Responsibilities and duties include:

- Provide overall direction of site actions.
- Direct Consultant(s) and Contractors/Subcontractors.

- Review work products, including data, memoranda, letters, reports, and all other documents transmitted to the USEPA.

1.2.2 Environmental Consultant (ARCADIS US, Inc.)

Project Manager/Assistant Project Manager

Responsibilities and duties include:

- Manage and coordinate the project as defined in the Work Plans with an emphasis on adhering to the objectives of the site activities.
- Review documents prepared by environmental consultant and their subcontractors.
- Verify that corrective actions are taken for deficiencies cited during any audits of site activities.

Task Managers

The sampling components will be managed by various Task Managers, as set forth in Section 1.1.2. Duties of each Task Manager include, as appropriate:

- Manage relevant day-to-day activities.
- Develop, establish, and maintain files on relevant site activities.
- Review data reductions from the relevant site activities.
- Perform final data review of field data reductions and reports on relevant site activities.
- Verify that corrective actions are taken for deficiencies cited during audits of relevant site activities.
- Perform overall QA/QC of the relevant portions of the site activities.
- Review relevant field records and logs.
- Instruct personnel working on relevant site activities.

- Coordinate field and laboratory schedules pertaining to relevant site activities.
- Request sample canisters from laboratory.
- Review field instrumentation, maintenance, and calibration to meet quality objectives.
- Prepare reports pertaining to relevant site activities.
- Maintain field and laboratory files of notebooks/logs, data reductions, and calculations. Transmit originals to the Project Manager.

Field Personnel

Responsibilities and duties include:

- Perform field procedures associated with the investigations as set forth in the Work Plans.
- Perform field analyses and collect QA samples.
- Calibrate, operate, and maintain field equipment.
- Reduce field data.
- Maintain sample custody.
- Prepare field records and logs.

Quality Assurance Coordinator

Responsibilities and duties include:

- Review laboratory data packages.
- Oversee and interface with the analytical laboratory.
- Coordinate field QA/QC procedures with Task Managers, concentrating on field analytical measurements and practices to meet data quality objectives (DQOs).

- Perform and review audit reports.
- Prepare interim QA/QC compliance reports.
- Prepare a QA/QC report in accordance with USEPA guidelines, including an evaluation of laboratory data and data usability reports.

1.2.3 Analytical Laboratories

General responsibilities and duties of the analytical laboratories include:

- Perform sample analyses and associated laboratory QA/QC procedures.
- Supply sample bottles, summa air canisters and shipping cartons.
- Maintain laboratory custody of sample.
- Strictly adhere to all protocols in the QAPP.

Laboratory Project Manager

Responsibilities and duties include:

- Serve as primary communication link between environmental consultant and laboratory technical staff.
- Monitor workloads and maintain availability of resources.
- Oversee preparation of analytical reports.
- Supervise in-house chain-of-custody (COC).

Quality Assurance Manager

Responsibilities and duties include:

- Supervise personnel reviewing and inspecting all project-related laboratory activities.

- Conduct audits of all laboratory activities.

1.2.4 Regulatory Agencies

Project Manager (PM)

Responsibilities and duties include:

- Provide USEPA/MDEQ review and approval of the QAPP, Work Plans, supporting documents, and future deliverables.
- Monitor progress of site activities.

1.2.5 Project Organization Chart

The project organization chart is presented below. The end data users for the project who will be provided copies of this QAPP, as indicated in the organization chart, include USEPA, MDEQ, Hercules and its Consultants, Contractors and Subcontractors, and the analytical laboratories.

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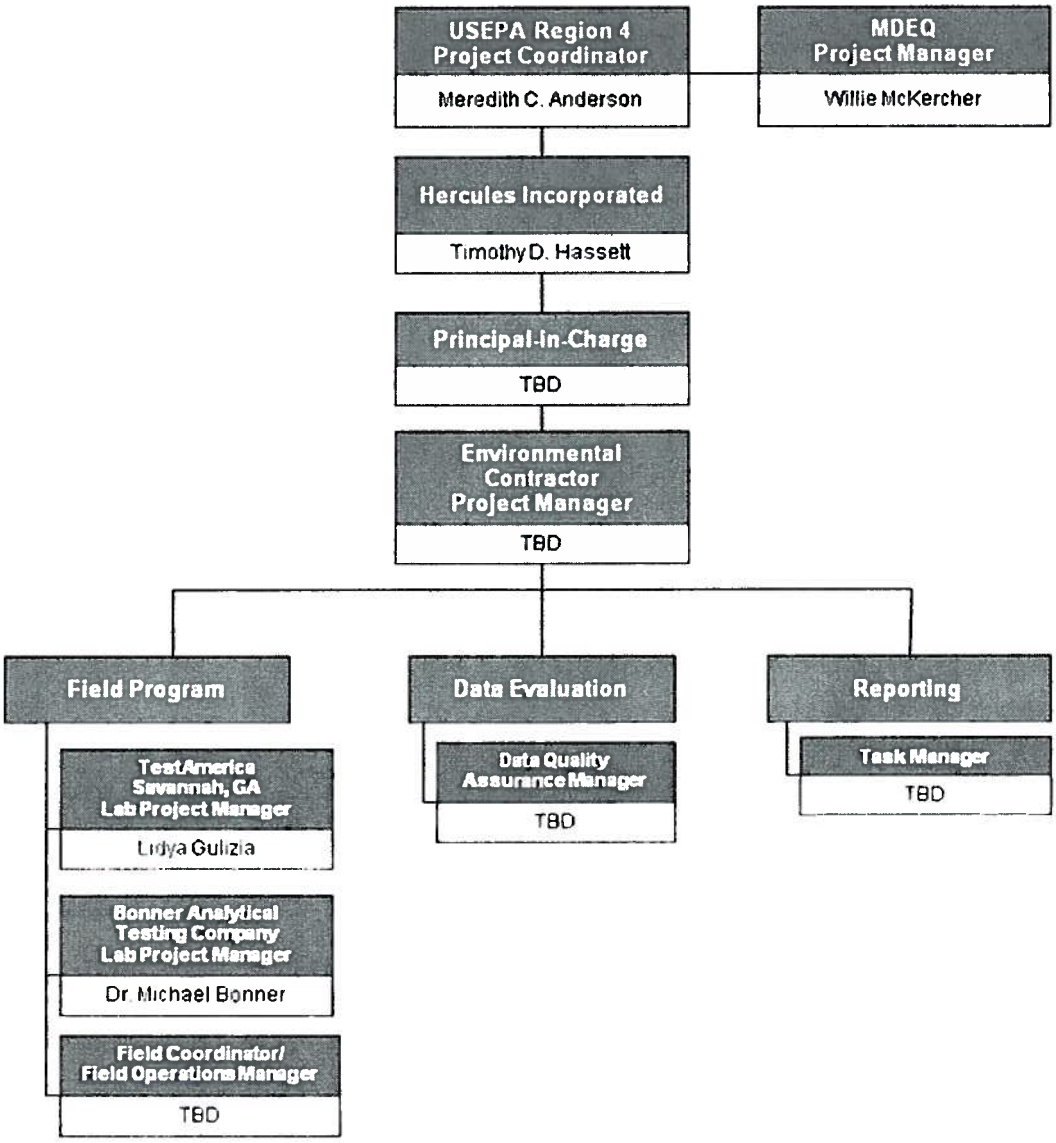
Organizational Chart

Phase I Sampling and Analysis Work Plan



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2. Project Background

The following summarizes background information for the Site which is located in Hattiesburg, Mississippi.

2.1 Site Location and Description

The Hercules site is located on approximately 200 acres of land north of West Seventh Street in Hattiesburg, Forrest County, Mississippi (Figure 1). The Site is located in Township 4 North, Range 13 West, within Sections 4 and 5 just north of Hattiesburg, Mississippi. The geographic coordinates of the Site are 31° 20' 20" North latitude and 89° 18' 25" West longitude. The physical address of the Site is 613 West Seventh Street, Hattiesburg, Mississippi. Figure 2 presents a plan view of the Site depicting the physical layout of the Site prior to recent demolition activities.

The Site is bordered to the north by Highway 42 and beyond which is Illinois-Central & Gulf Railroad, along with various residential and commercial properties. The southern property boundary is bordered by 7th Avenue and by Roseland Park cemetery and Zeon Chemical Corporation to the south-southwest. Across from these locations are residential areas. The eastern and western boundaries are bordered by residential and commercial areas.

The Site is zoned for industrial use and this zoning category is unlikely to change in the future due to the size of the property and available infrastructure. Figure 3 shows the zoning categories for the parcels located in the vicinity of the Hercules site.

2.2 Site History/Summary of Activities and Current Status

The facility began operations in 1923 and has produced over 250 products during its decades of operation. By 2009, the facility had ceased all manufacturing operations. Some of the products produced at the facility were modified resins, polyamides, ketene dimmer, crude tall oil wax emulsions, synthetic rubber, and Delnav, an agricultural pesticide. Processes included wood grinding, shredding extraction, fractionation, refining, distillation, and processing of rosin from pine tree stumps.

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3. Project Description

This section presents the objectives of the monitoring and describes the associated activities to be conducted at the site.

3.1 Objectives

The objectives of the Phase I Work Plan are to:

- Determine the presence of Site-related Constituents; and
- Evaluate the nature and extent of Site-related Constituents.

Execution of the activities set forth in this Work Plan will obtain data that can be used to determine if impacts exist offsite. Media that will be evaluated may include surface water, groundwater, sediment, soil gas, and/or indoor air.

3.2 Approach

Samples collected during the assessment will be measured for concentrations of specific analytes, as described in the Work Plan. The specific analytes for measurement are dependent upon the collection location of the sample(s).

3.3 Project Schedule

The schedule for the sampling events will vary by area sampled. The sampling schedule is specified in the Work Plan.

4. Quality Objectives and Criteria for Measurement Data

The DQO process, as described in Guidance for QA Project Plans (USEPA 2002b), is intended to provide a "logical framework" for planning field investigations. The following section addresses, in turn, each of the seven sequential steps in the USEPA's QAPP DQO process.

Step 1: Problem Statement

The Site-specific constituent list can be found in the Work Plan. The Work Plan approach includes incorporating and utilizing existing sampling data previously collected as part of Site-related assessments conducted in the area by Hercules, USEPA, or the state that relate to the purposes of the AO, including assessments to characterize the source(s) of any Site-related constituents, characterize the potential pathways of migration of these constituents, define the degree and extent of the presence of these Constituents, and identify actual or potential human and/or ecological receptors. Detected Site-related constituents will be investigated to determine the extent of any impacts.

Step 2: Decision Identification

If maximum detected concentrations of the constituents are below the USEPA and MDEQ standards for any medium, then the constituent is dropped from further consideration. There will be no excess risk to human health and adverse effects would not be expected to occur.

If maximum detected concentrations of the constituents exceed the limiting USEPA or MDEQ standards for any medium, then acceptable constituent concentrations may be recalculated using alternative acceptable risk standards ($1x10^{-6}$) as defined by precedent in USEPA Region 4.

Step 3: Identifying Decision Inputs

Decision inputs incorporate both the concentration and distribution of constituents in Site media. A fundamental basis for decision making is that a sufficient number of data points of acceptable quality must be available from the investigation to support the decision. Thus, the necessary inputs for the decision are: 1) the proportion of non-rejected (usable) data points; and 2) the quantity of data needed

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to evaluate whether there is unacceptable risk to human health and the environment at and surrounding the Site.

The data will be evaluated for completeness, general conformance with requirements of this QAPP, and consistency among data sets and with historical data, as appropriate.

Step 4: Defining the Study Boundaries

The facility is located within the City of Hattiesburg, Forrest County, Mississippi. The facility encompasses approximately 170 acres and is irregular in shape. Per the requirements of the AO, the surrounding area must be evaluated on a 4-mile radius and some media sampled within a one half mile radius from the Site. The Work Plan contains decision matrices per each media to be sampled that will be used to define the study boundaries.

Step 5: Developing a Decision Rule

The decision on whether data can be used will be based on the validation results. Following validation, the data will be flagged, as appropriate, and any use restrictions will be noted. The media-specific sampling plans have been devised so that the loss of any single data point will not hinder description of the distribution of constituents or the development of a risk assessment. Given this, a reasonable decision rule would be that 90 percent of the data points not be rejected or deemed unusable.

The usable data will be evaluated versus the appropriate Mississippi and USEPA standards as set force in the AO. The required reporting limits are documented in Table 3a, 3b, 3c-1 and -2, 3d and 3e with the intent that the lowest achievable detection limit will be reported by the laboratory and where possible at or below the screening criteria. Applicable actions would be evaluated, if needed, based on the results of the exposure evaluation.

Step 6: Limits on Decision Errors

Specifications for this step call for: 1) giving forethought to corrective actions to improve data usability; and 2) understanding the representative nature of the sampling design. This QAPP has been designed to meet both specifications for this step. The sampling and analysis program has been developed based on a review of previous site data and knowledge of present Site conditions. The representative nature of the sampling

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design has been facilitated by discussions among professionals familiar with the Site and the appropriate government agencies.

Step 7: Design Optimization

The overall QA objective is to develop and implement procedures for field sampling; COC, laboratory analysis, and reporting that will provide results to support the evaluation of the Site data consistent with AO requirements. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, data reporting, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

A DQO summary for the sampling efforts is presented in the following subsection. The summary consists of stated DQOs relative to data uses, data types, data quantity, sampling and analytical methods, and data measurement performance criteria.

4.1 Data Categories

Three data categories have been defined to address various analytical data uses and the associated QA/QC effort and methods required to achieve the desired levels of quality. These categories are:

Screening Data: Screening data afford a quick assessment of site characteristics or conditions. This DQO is applicable to data collection activities that involve rapid, non-rigorous methods of analysis and QA. This objective is generally applied to physical and/or chemical properties of samples, the degree of contamination relative to concentration differences, and preliminary health and safety assessment.

Screening Data with Definitive Confirmation: Screening data allow rapid identification and quantitation. This DQO is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings (10 percent or more). This objective can also be used to verify less rigorous laboratory-based methods.

Definitive Data: Definitive data are generated using analytical methods such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce raw data (*e.g.,* chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files.

It is anticipated that only screening data and definitive data will be used during the field investigation. For this project the level of data reporting for definitive data has been defined as follows:

- Level 2 - Modified Reporting: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols. Based on the intended data use, modified reporting may require some supporting documentation, but not full Contract Laboratory Program-(CLP-) type reporting. Examples of supporting documentation include, but may not be limited to, method blank results, laboratory control sample (LCS) recoveries, matrix spike recoveries and relative percent difference (RPD), surrogate recoveries, and serial dilution results. Raw data is not required for Level 2 modified reporting.

The analytical analysis will be performed by TestAmerica located at Savannah, Georgia, and Knoxville, Tennessee, and BATCO of Hattiesburg, Mississippi. The analytical results will be reported by the laboratory in the electronic data deliverable format outlined in EQuIS Lab Standard Operating Procedure (SOP) FSMP Rev. 5 (Appendix A) and of the Form Is (results sheets) in a PDF or electronic spreadsheet format within 15 working days from date of receipt. The Level 2 data packages from the laboratory will be due within 15 working days from date of receipt.

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4.2 Field Investigations

As part of the USEPA AO, field sampling will be conducted to support the DQOs. Further details of field sampling are described in the Work Plan.

4.2.1 Drinking Water Wells

Drinking water well samples will be analyzed for the following below. Please note that drinking water samples will be analyzed for the Appendix IX compound list using Drinking water methods were applicable and SW-846 methods for compounds which are not covered by the drinking water methods

- Appendix IX Volatile Organic Compounds (VOCs) by EPA 524.2, 504.1, and SW-846 8260

- Appendix IX Semivolatile Organic Compounds (SVOCs) by EPA 525,2 and SW-846 8270

- Appendix IX Pesticides by EPA 525.2, 508, and SW-846 8081
- Appendix IX Polychlorinated Biphenyls (PCBs) by EPA 508
- Appendix IX Herbicides by EPA 515
- Dioxins and Furans by USEPA method 1613
- Appendix IX Metals by EPA 200.8, 2007, 245.2 and SW-846 6020
- Cyanide by Standard Methods 4500-CN
- Sulfide by SW-846 9034
- Delnav – (Dioxenethion, *cis* and *trans* Dioxathion)(SW-846 3510/9321 Modified)

Modification to the constituent list may occur after initial data collection and screening.

4.2.2 Surface Water and Sediment

Surface water and sediment samples will be analyzed for the following:

- Appendix IX VOCs by SW-846 8260
- Appendix IX SVOCs by SW-846 8270
- Appendix IX Pesticides by SW-846 8081
- Appendix IX PCBs by SW-846 8082
- Appendix IX Herbicides by SW-846 8151
- Dioxins and Furans by SW-846 8290
- Appendix IX Metals by SW-846 6020/7470
- Cyanide by SW-846 9012
- Sulfide by SW-846 9034

- Delnav – (Dioxenethion, *cis* and *trans* Dioxathion)(SW-846 3510/9321 Modified)

Modification to the constituent list may occur after initial data collection and screening.

4.2.3 Groundwater Sampling

Groundwater samples will be analyzed for the following:

- Appendix IX VOCs by SW-846 8260
- Appendix IX SVOCs by SW-846 8270
- Appendix IX Pesticides by SW-846 8081
- Appendix IX PCBs by SW-846 8082
- Appendix IX Herbicides by SW-846 8151
- Dioxins and Furans by SW-846 8290
- Appendix IX Metals by SW-846 6020/7470
- Cyanide by SW-846 9012
- Sulfide by SW-846 9034
- Delnav – (Dioxenethion, *cis* and *trans* Dioxathion)(SW-846 3510/9321 Modified)

Modification to the constituent list may occur after initial data collection and screening.

4.2.4 Soil Gas

Soil gas samples will be analyzed for the following:

- VOCs by TO-15

Modification to the constituent list may occur after initial data collection and screening.

4.2.5 Sub-Slab Soil Gas and Indoor Air

Sub-slab soil gas and indoor air samples will be analyzed for the following:

- VOCs by TO-15

Data Use

The data generated as part of the field sampling will be used for the monitoring program as specified in the Work Plan.

Data Quantity

The sample quantities and quality control requirements are summarized in Table 1. Additional information regarding the choice of specific sample collection locations can be found in the Work Plan.

Sampling and Analytical Methods

Sampling methods will be described in the Work Plan. The analytical methods are as specified in Table 1. Level 2 will be used for definitive data reporting (as defined previously).

Measurement Performance Criteria

Precision and accuracy QC limits for chemical constituents used during data review to assess analytical performance are included in Table 2. Reporting limits are presented in Table 3a through 3e. Data representativeness is addressed by the sample quantities and locations identified in the Work Plan. Data comparability is intended to be achieved through the use of standard USEPA-approved methods. Data completeness will be assessed at the conclusion of the analytical activities.

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5. Special Training Requirements/Certification

In compliance with the Occupational Safety and Health Administration's (OSHA) final rule, "Hazardous Waste: Operations and Emergency Response," 29 Code of Federal Regulations 1910.120(e)", all personnel performing sampling activities at the site, except as noted below, will have completed the requirements for OSHA 40-Hour Hazardous Waste Operations and Emergency Response initial training and current 8-hour refresher training. Persons in field supervisory positions will have also completed the additional OSHA 8-Hour Supervisory Training.

Prior to the commencement of field activities, copies of applicable training certificates for consultant, contractor and subcontractor personnel will be provided to Hercules, or their consultant, for verification of training requirements. Copies of training certificates and records will be kept in the project file.

6. Documentation and Records

6.1 General

Samples will be collected as described in the Work Plan. Detailed descriptions of the documentation and reporting requirements are presented below.

6.2 Sample Designation System

6.2.1 Sample Codes

Samples will be identified with a unique designation system that will facilitate sample tracking. The sample designation system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events and conditions. An alpha-numeric system is considered appropriate and will be used by field personnel to assign each sample with a unique sample identification number. The sample identification number will begin with a two-letter prefix indicating the sample type and two digits indicating the sequential sample number collected from the location.

The samples types (if applicable) will be designated using the following codes:

- Soil Sample – "SS"
- Surface Water Sample – "SW"
- Sediment Sample – "SD"
- Private Well Sample – "PW"
- Groundwater Sample – "GW" or "MW"
- Soil Gas Sample – "SG"
- Indoor Air Sample – "IA"
- Trip Blank Sample – "TB"
- Field Duplicate Sample – "DUP"

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- Equipment Blank Sample – "EB"
- Matrix Spike and Matrix Spike Duplicate – "MS" and MSD"

The location code, consisting of a two to five digit designation, will follow the sample type code. For subsurface soil samples, the designation will also consist of the sample depth in feet (ft). For example, a subsurface soil sample collected from a depth of 2 to 4 ft from SB-02 would be designated SS-SB-02 (2-4). For groundwater and surface water samples, the sample code will also be a six-digit number indicating the month, day and year the sample was obtained. For example a groundwater sample collected from NS-2 on July 30, 2011 will be designated MW-NS-2(073011).

QA/QC samples will be designated by a three-letter code followed by the six-digit sample collection date. For field and equipment blanks, a two-letter sample type code will precede the blank designation to indicate which medium the blank was intended to represent. For example, a field blank collected on July 30, 2011 during surface soil samples collection would be designated SS-FB1-073011. The sampling point associations for field duplicates must be recorded in the field log.

6.3 Field Documentation

Field personnel will provide comprehensive documentation covering various aspects of field sampling, field analysis, and sample COC. This documentation consists of a record that allows reconstruction of field events to aid in the data review and interpretation process. Documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained throughout the investigation include:

- Daily Production Documentation – A field notebook(s) consisting of a waterproof, bound notebook(s) that will contain a record of all activities performed at the Site.
- Sampling Information – Detailed notes will be made as to the exact sampling location, physical observations, and weather conditions (as appropriate).
- Sample COC – COC forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. COC forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of

sampling by field personnel responsible for sample custody. In the event that samples are relinquished by the designated sampling person to other sampling or field personnel, the COC form will be signed and dated by the appropriate personnel to document the sample transfer. The original COC form will accompany the samples to the laboratory, and copies will be forwarded to the project files. A sample COC form is included as Appendix B of this QAPP.

Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

- Field Equipment, Calibration, and Maintenance Logs – To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment that is not factory calibrated.

6.4 Laboratory Documentation Files

6.4.1 Laboratory Project Files

The laboratory will establish a file for pertinent data. The file will include correspondence, faxed information, phone logs, and COC forms. The laboratory will retain project files and data packages for a period not less than five years.

6.4.2 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and to document important aspects of the work, including the associated QCs. As such, logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory.

Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages of logbooks that are not used will be completed by lining out unused portions.

Information regarding the sample, analytical procedures performed, and the results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated and will also identify the analyst, the instrument used, and the instrument conditions.

Laboratory notebooks will be periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance with this QAPP. All entries and calculations will be verified by the laboratory group leader. If all entries on the pages are correct, the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

6.4.3 Computer Tape and Hard Copy Storage

All electronic files and deliverables will be retained by the laboratory for not less than five years; hard copy data packages (or electronic copies) will also be retained for not less than five years.

6.5 Data Reporting Requirements

Data will be reported both in the field and by the analytical laboratory, as described below.

6.5.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets and/or on forms. Such data will be reviewed by the appropriate Task Manager for adherence to the Work Plan and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and (as necessary) incorporated into the data evaluation process.

If applicable, field data forms and calculations will be processed and included in appendices to the appropriate reports (when generated). The original field logs, documents, and data reductions will be kept in the project file.

6.5.2 Laboratory Data Reporting

The laboratory is responsible for preparing Level 2 data packages for all samples.

Data reports for all parameters will include, at a minimum, the following items:

Narrative: Summary of activities that took place during the course of sample analysis, including the following information:

- Laboratory name and address.
- Date of sample receipt.
- Cross reference of laboratory identification number to sample identification.
- Analytical methods used.
- Deviations from specified protocol.
- Corrective actions taken.

Included with the narrative will be any sample handling documents, including field and internal COC forms, air bills, and shipping tags.

Analytical Results: These will be reported according to analysis type and include the following information, as applicable:

- Sample ID
- Laboratory ID
- Date of collection
- Date of receipt
- Date of extraction
- Date of analysis
- Dilution factor
- Detection limits

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Sample results on the report forms will be corrected for dilutions. Unless otherwise specified, all results will be reported uncorrected for blank contamination.

The analytical results will be reported by the laboratory in the electronic data deliverable format outlined in EQuIS SOP in Appendix A and of the Form Is (results sheets) in a PDF or electronic spreadsheet format within 15 working days from date of receipt. The Level 2 data packages from the laboratory will be due within 15 working days from date of receipt.

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6.6 Project File

Project documentation will be placed in project files according to the environmental consultant's requirements. Generally, field data and laboratory reports are filed by calendar year and task.

Documents and records are retained on Site or in the environmental consultant's offices, and off site at project sites, and storage facilities (*e.g.,* Document Systems, Inc.). All corporate records and documents, regardless of where they are retained, are filed utilizing a standard filing system. The most current and frequently used records are kept on site in filing cabinets or other record storage areas. Records accessed less frequently than once per month may be sent to storage and retrieved, as needed. When boxed for off-site storage, these records must be segregated by category and record retention dates. Duplicate copies are to be discarded. Records must be stored in facilities that provide a suitable environment to prevent loss and minimize deterioration, tampering, or damage. Such facilities may have controlled access. Electronic documents, data, databases, and electronic communication are stored within files and folders located on computerized hard disk servers.

7. Sampling Process Design

The sampling process design is based on the AO required monitoring, testing, analysis and reporting for the Site. The Work Plans present the sampling location selection rationale for the sampling program.

Surface water, groundwater, sediment, soil gas and indoor air samples will be collected, as described in the Work Plan. The approximate sample quantities and field QC samples are shown in Table 1. Field investigation activities will be conducted according to the appropriate Field Branches Quality System and Technical Procedures (Field Measurement Procedures and Field Sampling Procedures, USEPA) and the USEPA Science and Ecosystem Support Division (SESD) guidance document SESDPROC-305-R1.

8. Sample Handling and Custody Requirements

8.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for the samples are shown in Table 4.

The analytical laboratory will supply appropriate sample containers and preservatives, as necessary. The bottles will be purchased pre-cleaned to USEPA Office of Solid Waste and Emergency Response Directive 9240.05A requirements. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). The field personnel will be responsible for properly labeling containers. Sample labeling procedures are discussed in Section 8.2.2.

8.2 Field Custody Procedures

The objective of field sample custody is to protect samples from tampering from the time of sample collection through time of transport to the analytical laboratory. Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

Field custody documentation consists of both field logbooks and field COC forms.

8.2.1 Field Logbooks

Field logbooks will provide the means of recording the data collecting activities that are performed. As such, entries will be described in as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in a secure location when not in use. Each logbook will be identified by the project specific document number. The title page of each logbook will contain the following:

- Person to whom the logbook is assigned.

- Logbook number.
- Project name.
- Project start date.
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather conditions, names of all sampling team members present, level of personal protection being used, and signature of the person making the entry will be provided. The names of visitors to the site and field sampling or investigation team personnel, as well as the purpose of their visit, will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. Entries will be made in ink, with no erasures. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station will be recorded. The number of the photographs taken, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the Work Plan. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

8.2.2 Sample Labeling

Preprinted sample labels will be affixed to sample bottles prior to delivery at the sampling site. The following information is required on each sample label:

- Project name.
- Date collected.
- Time collected.

- Location.
- Sampler.
- Analysis to be performed.
- Preservative.
- Sample number.

8.2.3 Field COC Forms

Completed COC forms will be required for all samples to be analyzed. COC forms will be initiated by the sampling crew in the field. The COC forms will contain the unique sample identification number, sample date and time, sample description, sample type, preservation (if any), and analyses required. The original COC form will accompany the samples to the laboratory. Copies of the COC will be made prior to shipment (or multiple copy forms will be used) for field documentation. The COC forms will remain with the samples at all times. The samples and signed COC forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (*e.g.,* Federal Express), hand delivered to a mobile or permanent laboratory, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink. The labels will include the information listed in Section 8.2.2, above. The completed sample labels will be affixed to each sample bottle and covered with clear tape.

Whenever samples are split with a government agency or other party, a separate COC will be prepared for those samples and marked to identify the party with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

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8.3 Management of Investigation-Derived Materials and Wastes

Investigation-derived wastes (IDW) include soils, groundwater, sampling supplies, and personal protective equipment. These wastes are generated during drilling, sampling, and other sampling activities. The intent of managing IDW is to insure that impacted materials and media are not allowed to contaminate non-impacted materials and

media. An example of an impacting event would be the purging of impacted groundwater and discharging that water onto non-impacted soil and shallow groundwater. Those kinds of activities will not be allowed. Where necessary to insure the safe, efficient, and environmentally protective performance of work, management of investigation-derived materials and wastes will be performed consistent with the Management of IDW, SESDPROC-202-R2 (USEPA 2010). Disposable equipment (including personal protective equipment) and debris will be containerized, appropriately labeled during the sampling events, and disposed of accordingly. All purged groundwater and water generated during equipment decontamination will be containerized, temporarily staged onsite in 55-gallon drums or portable tanks, and disposed of appropriately based on analytical results. Equipment will be decontaminated, as appropriate.

8.4 Packing, Handling, and Shipping Requirements

Sample packaging and shipment procedures are designed so that the samples will arrive at the laboratory, with the COC, intact.

Samples will be packaged for shipment as outlined below:

- Securely affix the sample label to the container with clear packing tape.
- Check the cap on the sample container to confirm that it is properly sealed.
- Wrap the sample container cap with clear packing tape to prevent the label from becoming loose.
- Complete the COC form with the required sampling information and confirm that the recorded information matches the sample labels. NOTE: If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the COC prior to this transfer. The appropriate personnel will sign and date the COC form to document the sample custody transfer.
- Wrap glass sample containers in bubble wrap or other cushioning material.
- Place 1 to 2 inches of cushioning material at the bottom of the cooler.
- Place the sealed sample containers into the cooler.

- Place ice in plastic bags, seal the bags, and place the bags loosely in the cooler.
- Fill the remaining space in the cooler with cushioning material.
- Place COC forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid.
- Close the lid of the cooler, lock, and secure with duct tape.
- Wrap strapping tape around both ends of the cooler at least twice.
- Mark the cooler on the outside with the shipping address and return address, affix "Fragile" labels, and draw (or affix) arrows indicating "this side up." Cover the labels with clear plastic tape.
- Place a signed custody seal over the sample cooler lid.

Samples will be packaged by the field personnel and transported as low-concentration environmental samples. The samples will be hand delivered or delivered by an express carrier within 48 hours of the time of collection. In some cases, the analytical method may require analysis within a shorter holding time, and arrangements will need to be made to accommodate the laboratory requirements. Shipments will be accompanied by the COC form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records. If the samples are sent by common carrier, a bill of lading will be used. Receipts or bills of lading will be retained as part of the permanent project documentation. Commercial carriers are not required to sign off on the COC form as long as the forms are sealed inside the sample cooler, and the custody seals remain intact.

Sample custody seals and packing materials for filled sample containers will be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to eliminate the possibility of container breakage.

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8.5 Laboratory Custody Procedures

8.5.1 General

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field COC form will accompany all samples requiring laboratory analysis. The laboratory will use COC guidelines described in the USEPA guidance documents. Samples will be kept secured in the laboratory until all stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity.

8.5.2 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the integrity of the cooler seal, open the cooler, and compare the contents against the field COC. If a sample container is missing, a sample container is received broken, the sample is in an inappropriate container, or the sample has not been preserved by appropriate means, the PM will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample code, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory tracking system. Relevant custody documentation will be placed in the project file.

8.5.3 Sample Analysis

Analysis of an acceptable sample will be initiated by worksheets that contain all pertinent information for analysis. The analyst will sign and date the laboratory COC form when removing the samples from storage.

Samples will be organized into sample delivery groups (SDGs) by the laboratory. An SDG may contain up to 20 field samples (field duplicates, trip blanks, and rinse blanks are considered field samples for the purposes of SDG assignment). All field samples assigned to a single SDG will be received by the laboratory over a maximum of seven calendar days and must be processed through the laboratory (preparation, analysis, and reporting) as a group.

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8.5.4 Sample Storage Following Analysis

Samples will be maintained by the laboratory for at least 1 month after the final report is delivered. The laboratory will be responsible for the eventual and appropriate disposal of the samples. The analytical laboratory will inform the environmental consultant before any samples are disposed. Unused portions of the samples, sample extracts, and associated wastes will be disposed of by the laboratory in accordance with applicable rules and regulations, as specified in the SOP for waste disposal.

9. Analytical Method Requirements

9.1 Laboratory Parameters and Methods

The methods listed below include the range of analyses expected to be performed. The associated laboratory SOPs can be found in Appendix C. TestAmerica in Savannah, Georgia and Knoxville, Tennessee and BATCO in Hattiesburg, Mississippi will be subcontracted to perform analytical work. The QA officers at each laboratory will be responsible for conducting and reporting corrective actions if problems arise during the course of laboratory analytical procedures.

Laboratory analytical requirements presented in the sub-sections below include a general summary of requirements, specifics related to each sample medium to be analyzed, and details of the methods to be used for this project. USEPA SW-846 methods with QA/QC and reporting deliverables requirements will be used for all analytes.

9.1.1 General

The following tables summarize general analytical requirements:

Table	Title
1	Sample Quantities and Quality Control Frequencies
2	Analytical Quality Control Limits
3-a	Parameters, Methods, and Target Reporting Limits – Surface water/Groundwater
3-b	Parameters, Methods, and Target Reporting Limits – Drinking Water
3-c1 and c2	Parameters, Methods, and Target Reporting Limits – Soil/Sediment
3-d	Parameters, Methods, and Target Reporting Limits – Indoor Air
3-e	Parameters, Methods, and Target Reporting Limits – Soil Gas
4	Sample Containers, Preservation, Methods and Holding Times

9.1.2 Sample Matrices

9.1.2.1 Groundwater, Surface Water and Drinking Water

Analyses in this category will relate to groundwater, surface water, and private water well samples. Analyses will be performed following the methods and quality control

frequencies listed in Table 1 and quality control limits listed in Table 2. Results will be reported in units presented in Table 3a and 3b.

The primary sources to describe the analytical methods to be used during the investigation for water matrices are provided in the USEPA SW-846 Test Methods for Evaluating Solid Waste, Third Edition, Update IV, and QA/QC, and Clean Water Act (CWA) USEPA Method 500s and 1613 and QA/QC.

9.1.2.2 Sediments/Soil

Analyses in this category will relate to sediment and soil samples. Analyses will be performed following the methods and quality control frequencies listed in Table 1 and quality control limits listed in Table 2. Results will be reported in units presented in Table 3c as dry weight. Moisture content will be reported separately.

The primary sources to describe the analytical methods to be used during the investigation for solid matrices are provided in USEPA SW-846 Test Methods for Evaluating Solid Waste, Third Edition, Update IV, and QA/QC.

9.1.2.3 Soil Gas and Indoor Air

Analyses will be performed following the methods listed in Table 1. Results will be reported in units presented in Table 3d and 3e.

The primary sources to describe the analytical methods to be used during the investigation for air matrices are provided in USEPA TO Compendium of Methods, Second Edition, and QA/QC.

10. Quality Control Requirements

10.1 Quality Assurance Indictors

The overall QA objective for this QAPP is to develop and implement procedures for sampling, COC, laboratory analysis, instrument calibration, data reduction and reporting, internal QC, audits, preventive maintenance, and corrective action, such that valid data will be generated. These procedures are presented or referenced in the following sections. Specific QC checks are discussed in Section 10.2.

QA indicators are generally defined in terms of five parameters:

1. Representativeness.
2. Comparability.
3. Completeness.
4. Precision.
5. Accuracy.

Each parameter is defined below. Specific objectives for the Site actions are set forth in other sections of this QAPP, as referenced below.

10.1.1 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions and is dependent on sampling and analytical variability and the variability of environmental media at the site. The actions have been designed to assess the presence of the chemical constituents at the time of sampling. The Work Plan presents the rationale for sample quantities and location. This QAPP presents field sampling and laboratory analytical methodologies. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements, is intended to provide representative data.

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10.1.2 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between phases of the actions (if additional phases are required) will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP, established QA/QC procedures, and the utilization of appropriately trained personnel.

10.1.3 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results, as discussed in Section 10.6.

10.1.4 Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the Site investigations will adhere to established protocols presented in the QAPP. Checks for analytical precision will include the analysis of laboratory duplicates, and field duplicates. Checks for field measurement precision will include duplicate field measurements. Further discussion of precision QC checks is provided in Section 10.4.

10.1.5 Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, matrix spikes (MSs), blank spikes, and surrogate standards will be used to assess the accuracy of the analytical data.

10.2 Field Quality Control Checks

10.2.1 Field Measurements

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for all field measurements. A duplicate measurement will involve obtaining measurements a second time at the same sampling location.

10.2.2 Sample Containers

The bottles will be purchased pre-cleaned to USEPA Office of Solid Waste and Emergency Response Directive 9240.05A requirements.

10.2.3 Field Duplicates

Field duplicates will be collected to verify the reproducibility of the sampling methods. Field duplicate air samples for VOC analysis will constitute co-located samples. In general, field duplicates will be analyzed at a 5 percent frequency (every 20 samples) for the chemical constituents. Table 1 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix.

10.2.4 Rinse Blanks

Rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Rinse blanks will be prepared and submitted for analysis at a frequency of 1 per day (when re-useable sample equipment cleaning occurs) or once for every 20 samples collected, whichever is less. Rinse blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory), which has been routed through a cleaned sampling device. When dedicated sampling devices are used or sample containers are used to collect the samples, rinse blanks will not be necessary. Table 1 provides an estimated number of rinse blanks collected during the investigation activities.

10.2.5 Trip Blanks

Trip blanks will be used to assess whether samples have been exposed to non Site-related volatile constituents during storage and transport. Trip blanks will be analyzed at a frequency of once per day, per cooler containing samples to be analyzed for VOCs. A trip blank will consist of a container filled with analyte-free water (supplied by the laboratory), which remains unopened with field samples throughout the sampling event. Table 1 provides an estimated number of trip blanks collected for each matrix and parameter during the investigation activities.

10.3 Analytical Laboratory Quality Control Checks

10.3.1 General

Internal laboratory QC checks will be used to monitor data integrity. These checks will include method blanks, laboratory control samples, internal standards, surrogate samples and calibration standards. Project quality control limits are identified in Table 2. Laboratory control charts will be used to determine long-term instrument trends.

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10.3.2 Method Blanks

Sources of contamination in the analytical process, whether specific analyses or interferences, must be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank be initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for any potential contamination attributable to glassware, reagents, instrumentation, or other sources that could affect sample analysis. One method blank will be analyzed with each analytical series associated with no more than 20 samples.

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10.3.3 Matrix Spike/Matrix Spike Duplicates (MS/MSDs)

MS/MSDs will be used to measure the accuracy of analyte recovery from the sample matrices and will be Site-specific. MS/MSD pairs will be analyzed at a 5 percent frequency (every 20 samples or once every week, whichever comes first).

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When MS recoveries are outside quality control limits, associated control sample and surrogate spike recoveries will be evaluated, as applicable, to attempt to verify the reason for the deviation and determine the effect on the reported sample results. Table 1 presents an estimated number of MS and MSD analyses for each applicable parameter.

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10.3.4 Laboratory Control Samples

LCS are standards of known concentration and are independent in origin from the calibration standards. The intent of LCS analysis is to provide insight into the analytical proficiency within an analytical series. This includes preparation of calibration standards, validity of calibration, sample preparation, instrument set-up, and the

premises inherent in quantitation. Reference standards will be analyzed at the frequencies specified within the analytical methods.

10.3.5 Surrogate Spikes

Surrogates are compounds that are unlikely to occur under natural conditions but that have properties similar to the analytes of interest. This type of control is primarily used for organic samples analyzed by gas chromatography/mass spectrometry (GC/MS) and GC methods and is added to the samples prior to purging or extraction. The surrogate spike is utilized to provide broader insight into the proficiency and efficiency of an analytical method on a sample-specific basis. This control reflects analytical conditions that may not be attributable to sample matrix.

If surrogate spike recoveries exceed specified QC limits, the analytical results must be evaluated thoroughly in conjunction with other control measures. In the absence of other control measures, the integrity of the data may not be verifiable, and reanalysis of the samples with additional control may be necessary.

Surrogate spike compounds will be selected utilizing the guidance provided in the analytical methods.

10.3.6 Laboratory Duplicates

Laboratory duplicates will be analyzed to assess laboratory precision. Laboratory duplicates are defined as a separate aliquot of an individual sample that is analyzed as a separate sample. Table 1 presents an estimated number of laboratory duplicates for each applicable parameter.

10.3.7 Calibration Standards

Calibration check standards analyzed within a particular analytical series provide insight regarding instrument stability. A calibration check standard will be analyzed at the beginning and end of an analytical series, or periodically throughout a series containing a large number of samples.

In general, calibration check standards will be analyzed after every 12 hours or more frequently, as specified in the applicable analytical method. If results of the calibration check standard exceed specified tolerances, samples analyzed since the last acceptable calibration check standard will be re-analyzed.

Laboratory instrument calibration standards will be selected utilizing the guidance provided in the analytical methods as summarized in Section 12.

10.3.8 Internal Standards

Internal standard areas and retention times will be monitored for organic analyses performed by GC/MS methods. Method-specified internal standard compounds will be spiked into all field samples, calibration standards, and quality control samples after preparation and prior to analysis. If internal standard areas in one or more samples exceed the specified tolerances, the cause will be investigated, the instrument will be recalibrated if necessary, and all affected samples may be re-analyzed.

The acceptability of internal standard performance will be determined using the guidance provided within the analytical methods

10.4 Data Precision Assessment Procedures

Field precision is difficult to measure because of temporal variations in field parameters; however, precision will be controlled through the use of experienced field personnel, properly calibrated meters, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system, including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision for analyses will be monitored through the use of MSDs, laboratory duplicate, and field duplicates as identified in Table 1.

The precision of data will be measured by calculation of the RPD by the following equation:

$$RPD = \frac{(A-B)}{(A+B)/2} \times 100$$

Where:

A = Analytical result from one of two duplicate measurements
B = Analytical result from the second measurement

Precision objectives for duplicate analyses are identified in Table 2.

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10.5 Data Accuracy Assessment Procedures

The accuracy of field measurements will be controlled by experienced field personnel, properly calibrated field meters, and adherence to established protocols. The accuracy of field meters will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of matrix spikes, surrogate spikes, internal standards, and reference standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:

A = Value measured in spiked sample or standard
X = Value measured in original sample
B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy between the original and spiked measurements. Accuracy objectives for MS recoveries are identified in Table 2.

10.6 Data Completeness Assessment Procedures

Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated.

$$\text{Completeness} = \frac{\text{Number valid results}}{\text{Total number of results generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90 percent. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

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11. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

11.1 General

Testing and maintenance schedules have been developed for both field and laboratory instruments. A summary of the testing and maintenance activities to be performed is presented below.

11.2 Field Instruments and Equipment

Prior to field sampling, each piece of field equipment will be calibrated (if necessary) and inspected to confirm that it is operational. If the equipment is not operational, it will be serviced prior to its use. All meters that require charging or batteries will be fully charged or have fresh batteries. If instrument servicing is required, it is the responsibility of the appropriate Task Manager or field personnel to follow the maintenance schedule and arrange for timely service. Field instruments will be maintained according to the manufacturers' instructions.

Logbooks will be kept for each field instrument. Logbooks will contain records of operation, maintenance, calibration, and any problems and repairs. Logbooks for each piece of equipment will be maintained in project records. The Task Managers will review calibration and maintenance logs.

11.2.1 Equipment Maintenance

All measuring and test equipment to be used in support of the Work Plan activities that directly affect the quality of the analytical data shall be subject to preventative maintenance measures that minimize equipment downtime. Equipment will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to confirm that all maintenance requirements are being observed. Field notes from previous sampling events will be reviewed to verify that any prior equipment problems are not overlooked and that any necessary repairs to equipment have been carried out. In most cases, the environmental consultant will be using field meters maintained and calibrated by national, reputable environmental rental equipment companies; calibration and maintenance records are provided with these pieces of rental equipment and will be maintained as part of the project file.

Field equipment returned from a site will be inspected to confirm that it is in working order. The inspection will be recorded in the logbook or field notebooks, as

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appropriate. It will also be the obligation of the last user to record any equipment problems in the logbook. Non-operational field equipment will either be repaired or replaced. Appropriate spare parts for field equipment/meters will be available from the rental companies or manufacturers. Consultant-/subcontractor-owned or leased equipment will be maintained in accordance with the manufacturer's instructions.

11.3 Laboratory Instruments and Equipment

11.3.1 General

Laboratory instrument and equipment documentation procedures include details of any observed problems, corrective measure(s), routine maintenance, and instrument repair (including information regarding the repair and the individual who performed the repair).

Preventive maintenance of laboratory equipment generally will follow the guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired immediately by in-house staff or through a service call from the manufacturer.

11.3.2 Instrument Maintenance

Maintenance schedules for laboratory equipment adhere to each manufacturer's recommendations. Records reflect the complete history of each instrument and specify the time frame for future maintenance. Major repairs or maintenance procedures are performed through service contracts with the manufacturer or qualified contractors. Paperwork associated with service calls and preventative maintenance calls will be kept on file by the laboratory.

Laboratory Systems Managers are responsible for the routine maintenance of instruments used in the particular laboratory. Any routine preventative maintenance carried out is logged into the appropriate logbooks. The frequency of routine maintenance is dictated by the nature of samples being analyzed, the requirements of the method used, and/or the judgment of the Laboratory Systems Manager.

All major instruments are backed up by comparable (if not equivalent) instrument systems in the event of unscheduled downtime. An inventory of spare parts is also available to minimize equipment/instrument downtime.

12. Instrument Calibration and Frequency

12.1 Field Instruments and Equipment

The calibration of field instruments is governed by specific SOPs documented in the *Field Measurement Procedures* (USEPA Region 4) for the applicable field analysis method, and such procedures take precedence over the following discussion. Manufacturer instructions will be consulted by field staff regarding specific calibration instructions for field instruments. The measurement-specific procedures outlined in the *Field Measurement Procedures* (USEPA Region 4) will be followed for calibration of field instruments used on site. If any revisions to this QAPP, the Work Plan, or to the *Field Measurement Procedures* are made, then the revised versions shall be distributed to the field personnel by the PM or Task Manager as soon as they are available.

Field calibration solutions, standards, and gases shall be used within specified expiration dates and will be obtained from manufacturers or authorized suppliers. Calibration solutions, standards, and gases will be discarded or returned to the supplier if expiration dates have been exceeded.

Field personnel are responsible for confirming that a master calibration/maintenance log is maintained following the procedures specified for each measuring device. A calibration log for each specific field instrument (as identified by serial/instrument number) will be used to link daily calibrations to that specific field instrument. Where applicable, each log will include, at a minimum, the following information in order to link daily calibrations to specific field instruments:

- Name of device and/or instrument calibrated.
- Device/instrument serial/identification numbers.
- Calibration method.
- Tolerance.
- Calibration standard used.
- Frequency of calibration.

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- Date(s) of calibration(s).
- Name of person(s) performing calibration(s).

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated at the intervals specified by the manufacturer or more frequently, and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service. Equipment found to be out of tolerance during the period of use will be removed from the field, and measuring and testing activities performed using the equipment will be addressed via the corrective action system described in Section 16.4 of this QAPP.

12.2 Laboratory Instrument and Equipment

When analyses are conducted according to USEPA methods, the calibration procedures and frequencies specified in the applicable method will be followed, as noted in the attached SOPs (Attachment C). For analyses governed by SOPs, see the appropriate SOP for the required calibration procedures and frequencies. Records of calibrations will be filed and maintained by the laboratory. These records will be subject to QA audit. For all instruments, the laboratory will maintain trained repair staff with in-house spare parts or will maintain service contracts with vendors.

All standards used in the calibration of equipment are traceable, directly or indirectly, to National Institute of Standards and Technology. All standards received shall be logged into standard receipt logs maintained by the individual analytical groups. Each group will maintain a standards log that tracks the preparation of standards used for calibration and QC purposes.

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13. Inspection/Acceptance Requirements for Supplies and Consumables

All supplies to be used in the field and laboratory will be available when needed. They will be free of target chemicals and interferences.

All laboratory reagents will be tested for acceptability, prior to use in the analyses of samples. All standards will be verified against a second source standard. The laboratory will follow a "first in/first out" procedure for the storage and use of all consumables to minimize the risk of contamination and degradation. The various supplies and consumables required are noted in the laboratory SOPs, which is included as an attachment to this document.

14. Data Acquisition Requirements for Non-Direct Measurements

The historical data sets have been used in preparing the Work Plan.

Historical data that have been generated consistent with appropriate laboratory requirements will be used in decision making. The criteria for usable analytical data are that the data must be generated through procedures consistent with the CLP, must contain backup to facilitate validation, and must be deemed acceptable for use following validation of the supporting laboratory documentation.

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15. Data Management

The purpose of the data management is to provide for the accuracy and ready accessibility of all of the necessary data to meet the analytical and reporting objectives of the project.

The data management program established for the project includes field documentation and sample QA/QC procedures, methods for tracking and managing the data, and a system for filing all site-related information. More specifically, data management procedures will be employed to efficiently process the information collected such that the data are readily accessible and accurate. These procedures are described in detail in the following section.

The data management plan has four elements: 1) sample designation system; 2) field activities; 3) sample tracking and management; and 4) data management system.

15.1 Sample Designation System

A concise and easily understandable sample designation system is an important part of the project sampling activities. It provides a unique sample number that will facilitate both sample tracking and easy re-sampling of select locations to evaluate data gaps, if necessary. The sample designation system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events or conditions. A combination of letters and numbers will be used to yield a unique sample number for each field sampled collected, as outlined in Section 6.2.1.

15.2 Field Activities

Field activities designed to gather the information during the field investigation process require consistent documentation and accurate record keeping. During site activities, standardized procedures will be used for documenting field activities, data security, and QA. These procedures are described in further detail in the following subsections.

15.2.1 Field Documentation

Complete and accurate record keeping is a critical component of the field investigation activities. When interpreting analytical results and identifying data trends, investigators realize that field notes are an important part of the review and validation process. To provide for the thorough documentation of the field investigation, several different

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information records, each with its own specific reporting requirements, will be maintained, including:

- Field logs
- COC forms

A description of each of these types of field documentation is provided below.

Field Logs

The personnel performing the field activities will keep field logs that detail all observations and measurements made during sampling. Data will be recorded directly into site-dedicated, bound notebooks, with each entry dated and signed. So that it can be confirmed at any future date that notebook pages are not missing, each page will be sequentially numbered. Erroneous entries will be corrected by crossing out the original entry, initialing it, and then documenting the proper information. In addition, certain media sampling locations will be surveyed to accurately record their locations. The survey crew will use their own field logs and will supply the sampling location coordinates to the Database Administrator.

COC Forms

COC forms are used as a means of documenting and tracking sample possession from time of collection to the time of disposal. A COC form will accompany each field sample collected, and one copy of the form will be filed in the field office. All field personnel will be briefed on the proper use of the COC procedure.

15.2.2 Data Security

Measures will be taken during the field investigation to prevent samples and records from being lost, damaged, or altered. When not in use, all field notebooks will be stored at the field office or locked in the field vehicle. Access to these files will be limited to the field personnel who utilize them. An electronic copy (*e.g.*, scan to pdf) of all field data and laboratory data are available to all project team members.

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15.3 Sample Tracking and Management

A record of all field documentation will be maintained to provide verification of the validity of data used in the site analysis. To effectively execute such documentation, specific sample tracking and data management procedures will be used throughout the sampling program.

Sample tracking will begin with the completion of COC forms, as summarized in Section 8.2.3. The completed COC forms associated with samples collected will be faxed and/or scan and emailed to the Database Administrator. Copies of all completed COC forms will be maintained in the field office. The laboratory will verify receipt of the samples electronically (via email) on the following day.

When analytical data are received from the laboratory, the QAC or his designee will review the incoming analytical data packages against the information on the COCs to confirm that the correct analyses were performed for each sample and that results for all samples submitted for analysis were received. Any discrepancies noted will be promptly followed up by the QAC.

15.4 Data Management System

In addition to the sample tracking system, a data management system will be implemented. The central focus of the data management system will be the development of a personal computer-based project database. Additionally, the data management system will allow submission of data to USEPA and MDEQ in a format specified in the USEPA Region 4 April 23, 2010, "Data Management and Electronic Data Deliverables" memorandum. The project database, to be maintained by the Database Administrator, will combine pertinent geographical, field, and analytical data. Information that will be used to populate the database will be derived from three primary sources: surveying of sampling locations, field observations, and analytical results. Each of these sources is discussed in the following sections.

15.4.1 Computer Hardware

The database will be constructed on personal computer work stations connected through a network server. The network will provide access to various hardware peripherals, such as laser printers, backup storage devices, image scanners, and modems. Computer hardware will be upgraded to industrial and corporate standards, as necessary, in the future.

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15.4.2 Computer Software

The data will be warehoused in EQUIS 5 Enterprise system that uses a SQL Server database. Geographic information system (GIS) applications will be developed in ESRI ArcGIS, with additional customization performed with Visual Basic. Tables and other database reports will be generated through Microsoft Access in conjunction with Microsoft Excel and/or Microsoft Word. These software products will be upgraded to current industrial standards, as necessary.

15.4.3 Survey Information

In general, each location sampled will be surveyed or located using a global positioning system with sub-meter accuracy to confirm that accurate documentation of sample locations for mapping and geographic information system purposes (if appropriate) to facilitate the re-sampling of select sample locations during future monitoring programs, if needed, and for any potential remediation activities. The surveying activities that will occur in the field will consist of the collection of information that will be used to compute a northing and easting in state plane coordinates for each sample location and the collection of information to compute elevations relative to the National Geodetic Vertical Datum of 1988 for select sample locations, as appropriate. All field books associated with the surveying activities will be stored as a record of the project activities.

15.4.4 Field Observations

An important part of the information that will ultimately reside in the data management system for use during the project will originate in the observations that are recorded in the field.

During each sampling event, appropriate field documentation will be prepared by the field personnel who performed the sampling activities. The purpose of the documentation is to create a summary and a record of the sampling event. Items to be included are the locations sampled, the sampling methodologies used, blind duplicate and sample identification numbers, equipment decontamination procedures, personnel involved in the activity, and any noteworthy events that occurred.

15.4.5 Analytical Results

Analytical results will be provided by the laboratory in both digital and a hard copy format. The data packages will be examined to confirm that the correct analyses were

performed for each sample submitted and that all of the analyses requested on the COC form were performed. If discrepancies are noted, the QAC will be notified and will promptly follow up with the laboratory to resolve any issues.

Each data package will be validated in accordance with the procedures presented in Section 19. Any data that do not meet the specified standards will be flagged pending resolution of the issue. The flag will not be removed from the data until the issue associated with the sample results is resolved. Although flags may remain for certain data, the use of those data may not necessarily be restricted.

Following completion of the data validation, the digital files will be used to populate the appropriate database tables. An example of the format of electronic data deliverable (EDD) format is included in EQuIS SOP in Appendix A. As stated above in section 15.4 once the data validation is complete the data management system will allow submission of data to USEPA and MDEQ in a EDD format specified in the USEPA Region 4 April 23, 2010, "Data Management and Electronic Data Deliverables" memorandum. The EQuIS SOP in Appendix A format specifies one data record for each constituent for each sample analyzed. Specific fields include:

- Sample identification number.
- Date sampled.
- Date analyzed.
- Parameter name.
- Analytical result.
- Units.
- Detection limit.
- Qualifier(s).

The individual EDDs, supplied by the laboratory in Equis 5 file format, will be loaded into the appropriate database. Any analytical data that cannot be provided by the laboratory in electronic format will be entered manually. After entry into the database,

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the EDD data will be compared to the field information previously entered into the database to confirm that all requested analytical data have been received.

15.4.6 Data Analysis and Reporting

The database management system will have several functions to facilitate the review and analysis of the data. Routines have been developed to permit the user to scan analytical data from a given site for a given media. Several output functions are also available that can be modified, as necessary, for use in the data management system.

A valuable function of the data management system will be the generation of tables of analytical results from the project databases. The capability of the data management system to directly produce tables reduces the redundant manual entry of analytical results during report preparation and precludes transcription errors that may occur otherwise. This data management system function creates a digital file of analytical results and qualifiers for a given media. The file can then processed into a table of rows and columns that can be transferred to word processing software (*e.g.*, Microsoft® Excel) for final formatting and addition of titles and notes. Tables of analytical data will be produced as part of data interpretation tasks and the reporting of data to the USEPA.

The data management system also has the capability of producing a digital file of select parameters that exists in one or more of the databases. This type of custom function is accomplished on an interactive basis and is best used for transferring select information into a number of analysis tools, such as statistical or graphing programs.

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16. Assessment and Response Actions

16.1 General

Performance and systems audits may be completed in the field and laboratory during the sampling, as described below.

16.2 Field Audits

The following field performance and systems audits may be completed during this project.

The appropriate Task Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field activities to verify that the activities are performed according to established protocols. Field performance audits may be performed by the USEPA Project Manager (or his designee), and the environmental consultant Project Manager. The auditor(s) will review field reports and communicate concerns to the environmental consultant's Project Manager and/or Task Managers, and/or USEPA/MDEQ Project Manager, as appropriate.

The number and frequency of field performance audits conducted by the USEPA PM will be determined independently by the USEPA/MDEQ PMs. The environmental consultant Project Manager, or their designee, will conduct field performance audits at a minimum frequency of one per month during the duration of the field activities. The observations made during field performance audits and any recommended changes/deviations to the field procedures will be recorded and documented. The observations and any recommendations will be distributed to the USEPA/MDEQ PMs and the Hercules Project Team, as appropriate.

In addition, systems audits comparing scheduled QA/QC activities from this QAPP with actual QA/QC activities completed will be performed. The appropriate Task Manager and QAC will periodically confirm that work is being performed consistent with this QAPP and the Work Plan.

16.3 Laboratory Audits

Internal laboratory audits are conducted by the Laboratory QA Manager. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the laboratory QA manual and SOPs. The results of

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the audits are summarized and issued to each department supervisor, the Laboratory Manager, and the Laboratory Director. A systems audit of each laboratory may be performed by the QA Manager to determine whether the procedures implemented by each laboratory are in compliance with the QA manual and SOPs.

As a participant in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification in addition to the laboratory's internal audits. Audits are usually conducted on an annual basis and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sample handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are formally documented and submitted to the laboratory for corrective action, if necessary.

16.4 Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP or the Work Plan. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the actions are described below.

16.4.1 Field Procedures

If, during field work, a condition is noted by the field crew that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action implemented by the Field Manager or a designee will be documented on a Corrective Action Form and reported to the appropriate Task Manager, QAC, and PM.

Examples of situations that would require corrective actions are provided below:

- Protocols as defined by the QAPP and Work Plan have not been followed.
- Equipment is not in proper working order or is not properly calibrated.
- QC requirements have not been met.
- Issues resulting from performance or systems audits have not been resolved.

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Project personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

16.4.2 Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action taken will be documented and reported to the appropriate PM and QAC.

Corrective action may be initiated, at a minimum, under the following conditions:

- Protocols as defined by this QAPP have not been followed.
- Predetermined data acceptance standards are not obtained.
- Equipment is not in proper working order or calibrated.
- Sample and test results are not completely traceable.
- QC requirements have not been met.
- Issues resulting from performance or systems audits have not been resolved.

Laboratory personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities. Corrective action is initiated at the point where the problem has been identified. At whatever level this occurs (analyst, supervisor, data review, or quality control), it is brought to the attention of the Laboratory QA Manager and, ultimately, the Laboratory Director. Final approval of any action deemed necessary is subject to the approval of the Laboratory Director.

Any corrective action deemed necessary based on system or performance audits, the analytical results of split samples, or the results of data review will be implemented. The corrective action may include sample re-extraction, re-preparation, re-analysis, cleanup, dilution, matrix modification, or other activities.

17. Reports to Management

The QAC will audit the implementation of the QAPP. Each project component will result in some type of QA report or, by its absence, will indicate that no significant QA or QC deviations occurred. Items that may result in a QA report include:

- Changes or updates to the QAPP.
- Deviations from QAPP or Work Plan specification.
- Results of system and performance audits.
- Significant QA/QC problems, recommended solutions, and the results of corrective actions.
- Limitations on the use of measurement data.

17.1 Field Reports

Reporting of the quality of field sample collection and field measurements will be the responsibility of the Field Supervisor or designee. Information from the field logbooks will be compiled, and a summary report on field activity QA will be prepared for the project file.

17.2 Laboratory Reports

The laboratory will maintain QA records related to analyses, QC, and corrective action. This information will be made available to the Project Manager upon request. Routine reporting will include documenting all internal QC checks performed for this project.

18. Data Reduction and Review

18.1 General

After field and laboratory data are obtained, the data will be subject to the following:

- Reduction, or manipulation mathematically or otherwise into meaningful and useful forms.
- Data validation.
- Review.
- Organization, interpretation, and reporting.

18.2 Field Data Reduction and Review

18.2.1 Field Data Reduction

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets, and/or on forms. Such data will be reviewed by the appropriate Task Manager for adherence to the Work Plan and this QAPP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel; corrected if possible; and, as necessary, incorporated into the data evaluation process.

18.2.2 Field Data Review

Field data calculations, transfers, and interpretations will be conducted by the field personnel and reviewed for accuracy by the appropriate Task Manager and the QAC. Logs and documents will be checked for:

- General completeness.
- Readability.
- Usage of appropriate procedures.
- Appropriate instrument calibration and maintenance.

- Reasonableness in comparison to present and past data collected.
- Correct sample locations.
- Correct calculations and interpretations.

18.3 Laboratory Data Reduction and Review

18.3.1 Laboratory Data Reduction

The calculations used for data reduction will be specified in each of the analytical methods referenced previously. Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data will be entered into permanently bound laboratory notebooks. The data entered must be sufficient to document all factors used to arrive at the reported value.

Concentration calculations for chromatographic analyses will be based on response factors. Quantitation will be performed using internal standards.

Unless otherwise specified, all values will be reported uncorrected for blank contamination.

18.3.2 Laboratory Data Review

Data will be subject to multi-level review by the laboratory. The group leader will review all data reports prior to release for final data report generation. The QAC will review the final data reports, and the Laboratory Director will review a cross section of the final data reports prior to shipment to the environmental consultant.

If discrepancies or deficiencies are present in the analytical results, corrective action will be taken, as discussed in Section 17. Deficiencies discovered as a result of internal data review, as well as the corrective actions to be used to rectify the situation, will be documented on a Corrective Action Form. This form will be submitted to the environmental consultant Project Manager.

18.4 Data Validation and Verification

All data generated will be subjected to the data validation and verification procedures outlined in Section 19. Data generated for screening or disposal purposes will not be reviewed.

19. Data Validation and Verification

Data validation entails a review of the QC data and the raw data to verify that the laboratory was operating within required limits; the analytical results were correctly transcribed from the instrument read-outs; and which, if any, environmental samples were related to out-of-control QC samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

All data generated will be validated using the most recent versions of the USEPA's Function Guidelines (USEPA 1999; 2004) and USEPA Region 4 Data Validation SOPs (USEPA Region 4, 1999; 2008) for data validation available at the time of project initiation, where appropriate. These procedures and criteria may be modified, as necessary, to address project-specific and method-specific criteria, control limits, and procedures. Data validation will consist of data screening, checking, reviewing, and editing to document analytical data quality and to determine whether the quality is sufficient to meet the DQOs.

Approximately 10 percent of the samples of each matrix will be validated. Samples chosen for validation will be selected from a single SDG per matrix. Should data within the SDG require qualification as estimated, other sample results in the same SDG will be evaluated and qualified, as appropriate. If any data are qualified as rejected during the validation, other SDGs and data for the parameters rejected will be further evaluated.

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP. Any deviations from the analytical method or any special reporting requirements apart from those specified in this QAPP will be detailed on COC forms.

Upon receipt of laboratory data, the following procedures will be executed by the data validator:

- Evaluate completeness of data package;
- Verify that field COC forms were completed and that samples were handled properly;

- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis;
- Verify that parameters were analyzed according to the methods specified;
- Review QA/QC data (*i.e.,* confirm that duplicates, blanks, and LCS were analyzed on the required number of samples, as specified in the method and verify that duplicate RPD are acceptable); and
- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the PM and/or Laboratory Manager, as appropriate.

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report addressing the following topics, as applicable to each method:

- Assessment of the data package;
- Description of any protocol deviations;
- Failures to reconcile reported and/or raw data;
- Assessment of any compromised data;
- Overall appraisal of the analytical data; and
- Table of site name, sample quantities, matrix, and fractions analyzed.

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean that data must be produced without QC qualifiers. Qualified data can provide useful information.

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results will be qualified with the following codes in accordance with National Functional Guidelines:

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Concentration (C) qualifiers

U The analyte/compound was analyzed for but not detected. The associated value is the compound quantitation limit.

J The compound was positively identified; however, the associated numerical value is an estimated concentration only.

Quantitation (Q) qualifiers

Inorganics:

B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.

E The reported value is estimated due to the presence of interference.

N Spiked sample recovery not within control limits.

* Duplicate analysis not within control limits.

Organics:

B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.

N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.

JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only.

E The compound was quantitated above the calibration range.

D Concentration is based on a diluted sample analysis.

C Identification confirmed by GC/MS.

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Validation qualifiers

UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.

UB Compound considered non-detect at the listed value due to associated blank contamination.

R The sample results are rejected.

Two facts will be noted to all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant QC problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data but any value potentially contains error.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the data validator. Suggestions for reanalysis may be made by the QAC at this point.

Data validation reports will be kept in electronic format (PDF) at the environmental consultant's office.

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20. Reconciliation with User Requirements

The data results will be examined to determine the performance that was achieved for each data usability criterion. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action relating to incomplete information, questionable results, or inconsistent data may include any or all of the following:

- Retrieval of missing information;
- Request for additional explanation or clarification;
- Reanalysis of sample from extract (when appropriate); and
- Recalculation or reinterpretation of results by the laboratory.

These actions may improve the data quality, reduce uncertainty, and eliminate the need to qualify or reject data.

If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- Extrapolation of missing data from existing data points;
- Use of historical data; and
- Evaluation of the critical/non-critical nature of the sample.

  If the data gap cannot be resolved by these actions, an evaluation of the data bias and potential for false negatives and positives can be performed. If the resultant uncertainty level is unacceptable, additional sample collection and analysis may be required.

21. References

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