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Appendix C

Quality Assurance Project Plan

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Infrastructure · Water · Environment · Buildings

Imagine the result

HERCULES

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

14 July 2011

ARCADIS

Quality Assurance Project Plan

USEPA RCRA 3013(a)
Administrative Order
Hattiesburg, Mississippi

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Hercules Incorporated.
Execution Manager (Bruce J. Hough)

Project Manager (John Ellis)
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Date:
14 July 2011

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Tables

Appendices

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USEPA	Chief, Corrective Action Section	Restoration and Underground Storage Tank Branch RCRA Division 61 Forsyth Street, S.W. Atlanta, GA 30303-3104		404.562.8651
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	Dennis Capria	6723 Towpath Road Syracuse, NY 13214-0066	dennis.capria@arcadis-us.com	315.671.9299
Analytical Laboratory – TestAmerica Savannah	Lidya Gulizia	5102 LaRoche Avenue Savannah, GA 31404	Lidya.Gulizia@testamericainc.com	912.354.7858

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Company/ Organization	Name	Address	Email	Phone Number
Bonner Analytical Testing Company (BATCO)	Dr. Micheal Bonner	2703 Oak Grove Road Hattiesburg, MS 39402	msbonner@batco.com	601.264.2854

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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

FINAL

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

FINAL

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

FINAL

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.

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- 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.

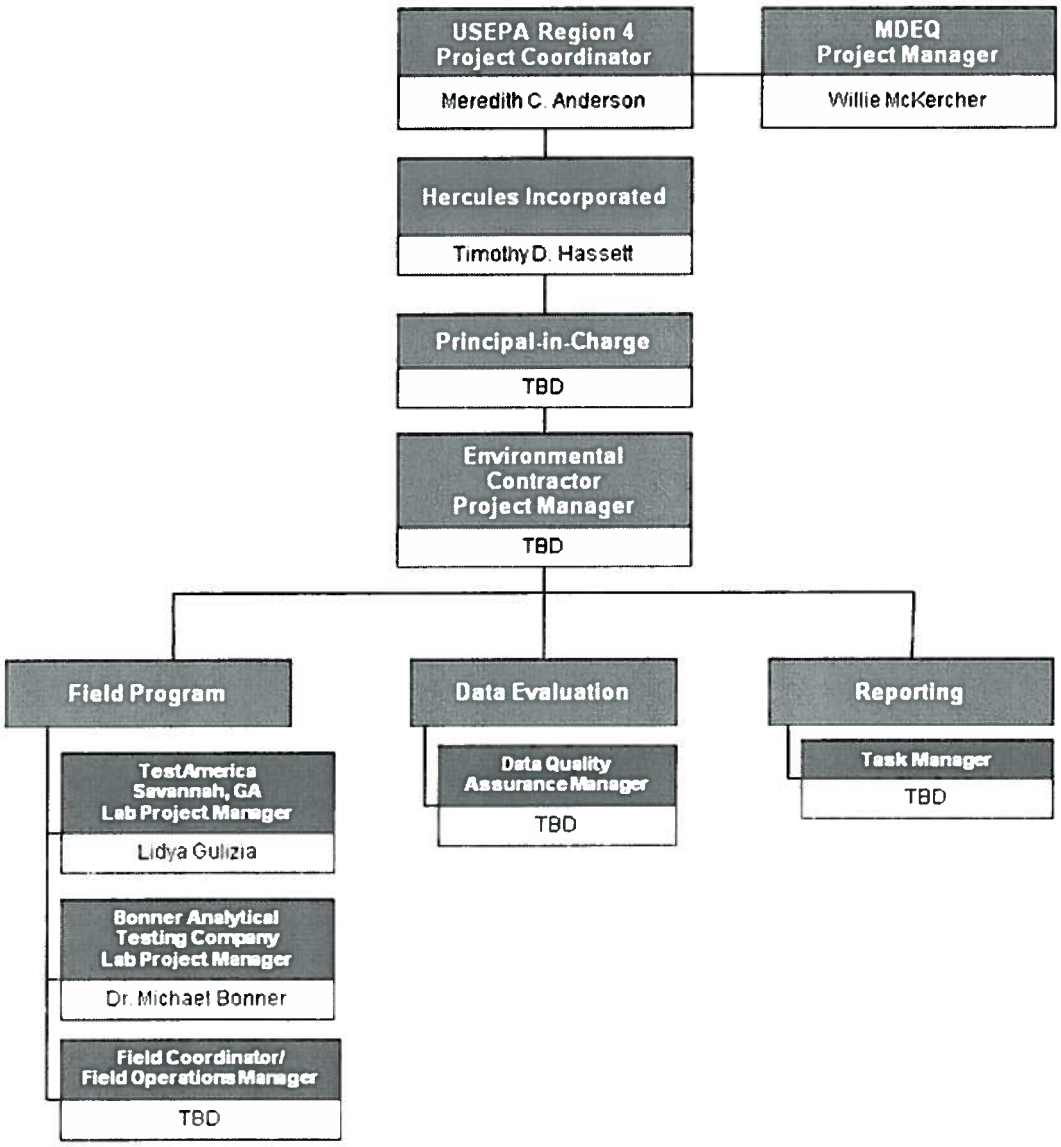
- Monitor progress of site activities.

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 .

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 ($1x10^{-4}$ or $1x10^{-5}$) 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

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, 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.

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

Water well samples will be analyzed for the following:

- Appendix IX Volatile Organic Compounds (VOCs) by SW-846 8260
- Appendix IX Semivolatile Organic Compounds (SVOCs) by SW-846 8270
- Appendix IX Pesticides by SW-846 8081
- Appendix IX Polychlorinated Biphenyls (PCBs) by SW-846 8082
- Appendix IX Herbicides by SW-846 8151

FINAL

- Dioxins and Furans by USEPA method 1613
- 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.

4.2.2 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.

FINAL

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.

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"

FINAL

- 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.

FINAL

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

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.

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.

FINAL

- 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.

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.

FINAL

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.

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-c	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 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.

FINAL

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.

FINAL

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.

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.

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).

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.

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.

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.

FINAL

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

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.

- 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.

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.

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

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

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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. This 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, 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.

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 (or designee). 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

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.

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.

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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:

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.

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.

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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Tables

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Table 1. Sample Quantities and Quality Control Frequencies, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Parameter	Estimated Environmental Sample Quantity	Field QC Analyses						Laboratory QC Sample						Total
		Trip Blank		Rinse Blank		Field Duplicate		Matrix Spike		Matrix Spike Duplicate		Lab Duplicate		
		Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Surface Water														
Volatile Organic Compounds (SW846-8260B)	15	1/cooler	1	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	20
Semivolatile Organic Compounds (SW846-8270C)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Organochlorine Pesticides (USEPA 8081A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
PCBs (USEPA 8082)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Herbicides (USEPA 8151A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
PCDD/PCDFs SW-846(8290)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Total Metals (including Mercury) (SW846-6020, 7470A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Cyanide, Total (USEPA 9012A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Sulfide, Total (USEPA 9034)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Dioxathion/Dioxenethion (BATCO 088.1)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Groundwater														
Volatile Organic Compounds (SW846-8260B)	10	1/cooler	1	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	15
Semivolatile Organic Compounds (SW846-8270C)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Organochlorine Pesticides (USEPA 8081A)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
PCBs (USEPA 8082)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Herbicides (USEPA 8151A)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
PCDD/PCDFs SW-846(8290)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Total Metals (including Mercury) (SW846-6020, 7470A)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Cyanide, Total (USEPA 9012A)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Sulfide, Total (USEPA 9034)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Dioxathion/Dioxenethion (BATCO 088.1)	10	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	14
Drinking Water														
Volatile Organic Compounds (USEPA 8260)	40	1/cooler	1	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	49
Semivolatile Organic Compounds (SW846-8270C)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Organochlorine Pesticides (USEPA 8081A)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
PCBs (USEPA 8082)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Herbicides (USEPA 8151A)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
PCDD/PCDFs (USEPA 1613)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Total Metals (including Mercury) (SW846-6020, 7470A)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Cyanide, Total (USEPA 9012A)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Sulfide, Total (USEPA 9034)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Dioxathion/Dioxenethion (BATCO 088.1)	40	NA	–	1/day	2	1/20	2	1/20	2	1/20	2	NA	–	48
Sediment														
Volatile Organic Compounds (SW846-8260B)	15	1/cooler	1	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	20
Semivolatile Organic Compounds (SW846-8270C)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Organochlorine Pesticides (USEPA 8081A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
PCBs (USEPA 8082)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Herbicides (USEPA 8151A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
PCDD/PCDFs SW-846 (8290)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Total Metals (including Mercury) (SW846-6020, 7470A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Cyanide, Total (USEPA 9012A)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Sulfide, Total (USEPA 9034)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Dioxathion/Dioxenethion (BATCO 088.1)	15	NA	–	1/day	1	1/20	1	1/20	1	1/20	1	NA	–	19
Soil Gas/Indoor Air														
Volatile Organic Compounds (USEPA TO-15)	30	NA	–	NA	–	1/20	1	NA	–	NA	–	1/20	2	33

Note: Sample Counts are an approximation.

BATCO Bonner Analytical Testing Company
Freq Frequency.
N/A Not Applicable.
No. Number.
PCDD Polychlorinated dibenzodioxins.
1/day One rinse blank per day or one per 20 samples, whichever is more frequent. Rinse blanks not required when dedicated sampling equipment is used.
PCDF Polychlorinated dibenzofurans.
PCBs Polychlorinated biphenyls.
QC Quality Control.
TBD To Be Determined.
USEPA U.S. Environmental Protection Agency.

ARCADIS

Table 2. Analytical Quality Control Limits[1], Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

	Accuracy - % Recovery			Precision - RPD		
Parameter	Surrogate	MS/MSD	LCS	MS/MSD	Lab Duplicate	Field Duplicate
Surface Water/Groundwater						
Volatile Organic Compounds	70-130	60-135	70-140	30	–	50
Semivolatile Organic Compounds	25-135	50-130	60-130	50	–	50
Organochlorine Pesticides	38-130	40-150	30-150	50	–	50
PCBs	38-130	40-150	30-150	50	–	50
Herbicides	52-151	60-130	60-130	50	–	50
PCDD/PCDFs	40-135	65-147	65-147	20	–	50
Total Metals (including Mercury)	–	75-125	80-120	20	–	50
Cyanide, Total	–	75-125	85-115	20	–	50
Sulfide, Total	–	75-125	75-125	30	–	50
Dioxathion	40-97	69-104	69-104	25	–	50
Dioxenethion	40-97	63-100	63-100	25	–	50
Drinking Water						
Volatile Organic Compounds	70-130	60-135	70-140	30	–	50
Semivolatile Organic Compounds	25-135	50-130	60-130	50	–	50
Organochlorine Pesticides	38-130	40-150	30-150	50	–	50
PCBs	38-130	40-150	30-150	50	–	50
Herbicides	52-151	60-130	60-130	50	–	50
PCDD/PCDFs	40-135	65-147	65-147	20	–	50
Total Metals (including Mercury)	–	75-125	80-120	20	–	50
Cyanide, Total	–	75-125	85-115	20	–	50
Sulfide, Total	–	75-125	75-125	30	–	50
Dioxathion	40-97	69-104	69-104	25	–	50
Dioxenethion	40-97	63-100	63-100	25	–	50
Sediment						
Volatile Organic Compounds	65-130	60-140	60-135	50	–	100
Semivolatile Organic Compounds	45-130	30-130	20-130	50	–	100
Organochlorine Pesticides	45-130	30-130	20-130	50	–	100
PCBs	45-130	30-130	20-130	50	–	100
Herbicides	35-137	30-130	30-130	50	–	100
PCDD/PCDFs	40-135	58-143	58-143	50	–	100
Total Metals (including Mercury)	–	75-125	75-125	35	–	100
Cyanide, Total	–	75-125	75-125	35	–	100
Sulfide, Total	–	50-150	50-150	50	–	100
Dioxathion	40-97	69-104	69-104	35	–	100
Dioxenethion	40-97	63-100	63-100	35	–	100
Soil Gas/Indoor Air						
Volatile Organics	60-140	–	70-130	–	–	50

Note:

[1]The listed QC limits are based on SW-846 guidance and are advisory. The actual limits are determined based on laboratory performance. Frequent failure to meet the QC limits; however, warrant investigation of the laboratory.

LCS Laboratory Control Sample.
MS Matrix Spike.
MSD Matrix Spike Duplicate.
PCBs Polychlorinated biphenyls.
PCDD Polychlorinated dibenzodioxins.
PCDF Polychlorinated dibenzofurans.

Table 3a. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Groundwater/Surface Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Volatile Organic Compounds (Method 8260)				
Acetone	67-64-1	608	5	25
Acetonitrile	75-05-8	125	10	40
Acrolein	107-02-8	0.042	7.4	20
Acrylonitrile	107-13-1	0.037	7.2	20
Benzene	71-43-2	5.0	0.25	1
Dichlorobromomethane	75-27-4	0.168	0.25	1
Bromoform	75-25-2	8.48	0.5	1
Bromomethane	74-83-9	8.52	0.8	1
2-Butanone (MEK)	78-93-3	1906	1	10
Carbon disulfide	75-15-0	1043	0.6	2
Carbon tetrachloride	56-23-5	5.0	0.5	1
Chlorobenzene	108-90-7	100	0.25	1
2-Chloro-1,3-butadiene	126-99-8	14.3	0.3	1
Chloroethane	75-00-3	3.64	1	1
Chloroform	67-66-3	0.155	0.14	1
Chloromethane	74-87-3	1.43	0.33	1
3-Chloro-1-propene	107-05-1	NE	0.2	1
Chlorodibromomethane	124-48-1	0.126	0.1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.20	0.44	1
1,2-Dibromoethane	106-93-4	0.05	0.25	1
Dibromomethane	74-95-3	60.8	0.2	1
trans-1,4-Dichloro-2-butene	110-57-6	NE	0.5	2
Dichlorodifluoromethane	75-71-8	348	0.25	1
1,1-Dichloroethane	75-34-3	798	0.25	1
1,2-Dichloroethane	107-06-2	5	0.1	1
cis-1,2-Dichloroethene	156-59-2	70	0.15	1
trans-1,2-Dichloroethene	156-60-5	100	0.2	1
1,1-Dichloroethene	75-35-4	7	0.11	1
1,2-Dichloropropane	78-87-5	5	0.13	1
cis-1,3-Dichloropropene	10061-01-5	0.084	0.11	1
trans-1,3-Dichloropropene	10061-02-6	0.084	0.21	1
Ethylbenzene	100-41-4	700	0.11	1
Ethyl methacrylate	97-63-2	548	0.25	1
2-Hexanone	591-78-6	1460	1	10
Iodomethane	74-88-4	NE	1	5
Isobutyl alcohol	78-83-1	1825	11	40
Methacrylonitrile	126-98-7	1.04	3.3	20
Methylene Chloride	75-09-2	5.0	1	5
Methyl methacrylate	80-62-6	1419	0.48	1
4-Methyl-2-pentanone (MIBK)	108-10-1	139	1	10
Pentachloroethane	76-01-7	NE	1.2	5
Propionitrile	107-12-0	NE	4.6	20
Styrene	100-42-5	100	0.11	1
1,1,1,2-Tetrachloroethane	630-20-6	0.406	0.33	1
1,1,2,2-Tetrachloroethane	79-34-5	0.053	0.18	1
Tetrachloroethene	127-18-4	5.0	0.15	1
Toluene	108-88-3	1000	0.33	1
1,1,1-Trichloroethane	71-55-6	200	0.5	1
1,1,2-Trichloroethane	79-00-5	5.0	0.13	1
Trichloroethene	79-01-6	5.0	0.13	1
Trichlorofluoromethane	75-69-4	1288	0.25	1
1,2,3-Trichloropropane	96-18-4	0.0062	0.41	1
Vinyl acetate	108-05-4	412	0.28	2
Vinyl chloride	75-01-4	2.0	0.18	1
Xylenes, Total	1330-20-7	10000	0.2	2
Semivolatile Organic Compounds (Method 8270)				
Acenaphthene	83-32-9	365	0.76	10
Acenaphthylene	208-96-8	2190	0.85	10
Acetophenone	98-86-2	0.0416	0.57	10
2-Acetylaminofluorene	53-96-3	NE	1.6	10
alpha,alpha-Dimethyl phenethylamine	122-09-8	NE	35	2000
4-Aminobiphenyl	92-67-1	NE	1.2	10

Table 3a. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Groundwater/Surface Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Semivolatile Organic Compounds (Method 8270) continued				
Aniline	62-53-3	11.7	2.1	20
Anthracene	120-12-7	43.4	0.69	10
Aramite, Total	140-57-8	NE	0.91	10
Benzo[a]anthracene	56-55-3	0.092	0.55	10
Benzo[a]pyrene	50-32-8	0.20	0.71	10
Benzo[b]fluoranthene	205-99-2	0.092	2.6	10
Benzo[g,h,i]perylene	191-24-2	1095	0.87	10
Benzo[k]fluoranthene	207-08-9	0.92	1.2	10
Benzyl alcohol	100-51-6	10950	1.1	10
1,1'-Biphenyl	92-52-4	304	0.58	10
Bis(2-chloroethoxy)methane	111-91-1	NE	0.94	10
Bis(2-chloroethyl)ether	111-44-4	0.009	1.1	10
bis(chloroisopropyl) ether	108-60-1	0.26	0.78	10
Bis(2-ethylhexyl) phthalate	117-81-7	6	1.6	10
4-Bromophenyl phenyl ether	101-55-3	NE	0.77	10
Butyl benzyl phthalate	85-68-7	2690	1.2	10
4-Chloroaniline	106-47-8	146	2.2	20
4-Chloro-3-methylphenol	59-50-7	73000	1	10
2-Chloronaphthalene	91-58-7	487	0.8	10
2-Chlorophenol	95-57-8	30.4	0.87	10
4-Chlorophenyl phenyl ether	7005-72-3	NE	0.84	10
Chrysene	218-01-9	9.17	0.51	10
Diallate	2303-16-4	NE	0.78	10
Dibenz(a,h)anthracene	53-70-3	0.009	1	10
Dibenzofuran	132-64-9	24.3	0.79	10
1,2-Dichlorobenzene	95-50-1	600	0.53	10
1,3-Dichlorobenzene	541-73-1	5.48	0.59	10
1,4-Dichlorobenzene	106-46-7	75	0.54	10
3,3'-Dichlorobenzidine	91-94-1	0.15	30	60
2,4-Dichlorophenol	120-83-2	110	1.1	10
2,6-Dichlorophenol	87-65-0	NE	0.73	10
Diethyl phthalate	84-66-2	29200	0.88	10
Dimethoate	60-51-5	NE	0.75	10
7,12-Dimethylbenz(a)anthracene	57-97-6	NE	1.2	10
3,3'-Dimethylbenzidine	119-93-7	0.007	10	20
2,4-Dimethylphenol	105-67-9	730	4	10
Dimethyl phthalate	131-11-3	365000	0.99	10
Di-n-butyl phthalate	84-74-2	3650	0.83	10
1,3-Dinitrobenzene	99-65-0	3.65	0.6	10
4,6-Dinitro-2-methylphenol	534-52-1	3.65	10	50
2,4-Dinitrophenol	51-28-5	73	10	50
2,4-Dinitrotoluene	121-14-2	73	1.2	10
2,6-Dinitrotoluene	606-20-2	36.5	1.1	10
Di-n-octyl phthalate	117-84-0	20	1.4	10
Dinoseb	88-85-7	7.0	5	10
1,4-Dioxane	123-91-1	6.09	3.4	10
Disulfoton	298-04-4	1.46	0.79	10
Ethyl methanesulfonate	62-50-0	NE	0.96	10
Ethyl Parathion	56-38-2	219	1.3	10
Famphur	52-85-7	NE	1.1	10
Fluoranthene	206-44-0	1460	0.74	10
Fluorene	86-73-7	243	0.96	10
Hexachlorobenzene	118-74-1	1.0	0.79	10
Hexachlorobutadiene	87-68-3	0.859	0.62	10
Hexachlorocyclopentadiene	77-47-4	50	2.5	10
Hexachloroethane	67-72-1	4.8	0.76	10
Hexachlorophene	70-30-4	11.0	27	5000

Table 3a. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Groundwater/Surface Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Semivolatile Organic Compounds (Method 8270) continued				
Hexachloropropene	1888-71-7	11.0	1.4	10
Indeno[1,2,3-cd]pyrene	193-39-5	0.092	1	10
Isophorone	78-59-1	70.5	0.9	10
Isosafrole	120-58-1	NE	0.5	10
Methapyrilene	91-80-5	NE	2.7	2000
3-Methylcholanthrene	56-49-5	NE	1.4	10
Methyl methanesulfonate	66-27-3	NE	0.6	10
2-Methylnaphthalene	91-57-6	122	0.78	10
Methyl parathion	298-00-0	9.13	0.88	10
2-Methylphenol	95-48-7	1825	0.89	10
3 & 4 Methylphenol	15831-10-4	1825	1.3	10
Naphthalene	91-20-3	6.20	0.7	10
1,4-Naphthoquinone	130-15-4	NE	0.62	10
1-Naphthylamine	134-32-7	NE	1.1	10
2-Naphthylamine	91-59-8	NE	1.5	10
2-Nitroaniline	88-74-4	0.417	1.3	50
3-Nitroaniline	99-09-2	NE	5	50
4-Nitroaniline	100-01-6	NE	5	50
Nitrobenzene	98-95-3	3.53	0.73	10
2-Nitrophenol	88-75-5	0.416	0.76	10
4-Nitrophenol	100-02-7	292	1.9	50
4-Nitroquinoline-1-oxide	56-57-5	NE	10	20
N-Nitro-o-toluidine	99-55-8	2.03	1.5	10
N-Nitrosodiethylamine	55-18-5	0.0004	0.93	10
N-Nitrosodimethylamine	62-75-9	0.0013	2.8	10
N-Nitrosodi-n-butylamine	924-16-3	0.0019	0.96	10
N-Nitrosodi-n-propylamine	621-64-7	0.0096	0.72	10
N-Nitrosodiphenylamine	86-30-6	13.7	0.92	10
N-Nitrosomethylethylamine	10595-95-6	0.003	3.3	10
N-Nitrosomorpholine	59-89-2	NE	0.84	10
N-Nitrosopiperidine	100-75-4	NE	0.88	10
N-Nitrosopyrrolidine	930-55-2	0.032	1	10
o,o',o'-Triethylphosphorothioate	126-68-1	NE	1	10
p-Dimethylamino azobenzene	60-11-7	NE	0.79	10
Pentachlorobenzene	608-93-5	29.2	0.52	10
Pentachloronitrobenzene	82-68-8	0.258	0.78	10
Pentachlorophenol	87-86-5	1.0	2	50
Phenacetin	62-44-2	NE	1.4	10
Phenanthrene	85-01-8	1095	0.77	10
Phenol	108-95-2	21900	0.83	10
Phorate	298-02-2	NE	0.87	10
2-Picoline	109-06-8	NE	1.4	10
p-Phenylene diamine	106-50-3	6935	10	2000
Pronamide	23950-58-5	NE	0.89	10
Pyrene	129-00-0	183	0.63	10
Pyridine	110-86-1	36.5	2.3	50
Safrole, Total	94-59-7	NE	0.8	10
Sulfotepp	3689-24-5	NE	0.53	10
1,2,4,5-Tetrachlorobenzene	95-94-3	11.0	0.76	10
2,3,4,6-Tetrachlorophenol	58-90-2	1095	0.72	10
Thionazin	297-97-2	NE	0.91	10
2-Toluidine	95-53-4	0.28	1.4	10
1,2,4-Trichlorobenzene	120-82-1	70	0.56	10
2,4,5-Trichlorophenol	95-95-4	3650	1.2	10
2,4,6-Trichlorophenol	88-06-2	6.09	0.85	10
1,3,5-Trinitrobenzene	99-35-4	1095	2	10
Organochlorine Pesticides (USEPA 8081A)				
Aldrin	309-00-2	0.004	0.007	0.05
alpha-BHC	319-84-6	0.011	0.0057	0.05
beta-BHC	319-85-7	0.037	0.0067	0.05
Chlordane	57-74-9	2	0.1	0.5
Chlorobenzilate	510-15-6	0.248	0.5	0.5

Table 3a. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Groundwater/Surface Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Organochlorine Pesticides (USEPA 8081A) continued				
4,4'-DDD	72-54-8	0.279	0.0065	0.1
4,4'-DDE	72-55-9	0.197	0.0077	0.1
4,4'-DDT	50-29-3	0.197	0.0097	0.1
delta-BHC	319-86-8	NE	0.0048	0.05
Dieldrin	60-57-1	0.004	0.0091	0.1
Endosulfan I	959-98-8	219	0.0042	0.05
Endosulfan II	33213-65-9	219	0.0098	0.1
Endosulfan sulfate	1031-07-8	NE	0.0068	0.1
Endrin	72-20-8	2.0	0.0097	0.1
Endrin aldehyde	7421-93-4	NE	0.016	0.1
Endrin ketone	53494-70-5	NE	0.0084	0.1
gamma-BHC (Lindane)	58-89-9	0.20	0.0059	0.05
Heptachlor	76-44-8	0.40	0.007	0.05
Heptachlor epoxide	1024-57-3	0.20	0.006	0.05
Isodrin	465-73-6	NE	0.05	0.05
Kepone	143-50-0	NE	1	1
Methoxychlor	72-43-5	40	0.013	0.1
Toxaphene	8001-35-2	3.0	0.5	5
PCBs (USEPA 8082)				
PCB-1016	12674-11-2	0.96	0.071	1
PCB-1221	11104-28-2	0.033	0.28	2
PCB-1232	11141-16-5	0.033	0.11	1
PCB-1242	53469-21-9	0.033	0.18	1
PCB-1248	12672-29-6	0.033	0.36	1
PCB-1254	11097-69-1	0.033	0.26	1
PCB-1260	11096-82-5	0.033	0.2	1
PCBs, Total	1336-36-3	0.500	0.36	1
Herbicides (USEPA 8151A)				
2,4-D	94-75-7	70	0.037	0.5
Silvex (2,4,5-TP)	93-72-1	50	0.062	0.5
2,4,5-T	93-76-5	365	0.062	0.5
Dioxathion/Dioxenethion (BATCO 088.1)				
cis-Dioxathion	78-34-2	54.8	NA	0.48
trans-Dioxathion	78-34-2	54.8	NA	0.31
Dioxenethion	--	NE	NA	0.22
Analyte[1]	CAS Number	Groundwater/Surface Water		
		Tier 1 TRG (pg/L)	Laboratory MDL (pg/L)	Laboratory RL (pg/L)
Dioxins and Furans (8290) (pg/L)				
2,3,7,8-TCDD	51207-31-9	4.5	2.1	10
1,2,3,7,8-PeCDD	40321-76-4	0.89	2.6	50
1,2,3,4,7,8-HxCDD	39227-28-6	4.5	1.3	50
1,2,3,6,7,8-HxCDD	57653-85-7	10.8	1.8	50
1,2,3,7,8,9-HxCDD	19408-74-3	10.8	1.6	50
1,2,3,4,6,7,8-HpCDD	35822-46-9	44.6	1.5	50
OCDD	3268-87-9	446	3.1	100
2,3,7,8-TCDF	51207-31-9	4.5	3.4	10
1,2,3,7,8-PeCDF	57117-41-6	8.9	1.3	50
2,3,4,7,8-PeCDF	57117-31-4	0.89	1.2	50
1,2,3,4,7,8-HxCDF	70648-26-9	4.5	1.4	50
1,2,3,6,7,8-HxCDF	57117-44-9	4.5	1.2	50
2,3,4,6,7,8-HxCDF	60851-34-5	4.5	1.1	50
1,2,3,7,8,9-HxCDF	72918-21-9	4.5	1.9	50
1,2,3,4,6,7,8-HpCDF	55673-89-7	NE	1.7	50
1,2,3,4,7,8,9-HpCDF	67562-39-4	NE	2.1	50
OCDF	39001-02-0	446	1.3	100

Table 3a. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Groundwater/Surface Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Total Metals (including Mercury) (SW846-6020, 7470A)				
Antimony	7440-36-0	6.0	2	5
Arsenic	7440-38-2	50	1.3	2.5
Barium	7440-39-3	2000	1.4	5
Beryllium	7440-41-7	4.0	0.15	0.5
Cadmium	7440-43-9	5.0	0.13	0.5
Chromium	7440-47-3	100	2.5	5
Cobalt	7440-48-4	2190.0	0.12	0.5
Copper	7440-50-8	1300	1.1	5
Lead	7439-92-1	15	0.5	1.5
Mercury	7439-97-6	2	0.091	0.2
Nickel	7440-02-0	730	2	5
Selenium	7782-49-2	50	1.1	2.5
Silver	7440-22-4	183	0.18	1
Thallium	7440-28-0	2.0	0.25	1
Tin	7440-31-5	21900	1.4	5
Vanadium	7440-62-2	256	3.2	10
Zinc	7440-66-6	10950	8.4	20
Cyanide, Total (USEPA 9012A)				
Cyanide, Total	57-12-5	200	0.005	0.01
Sulfide, Total (USEPA 9034)				
Sulfide, Total	18496-25-8	NE	NA	1

Notes:

[1]USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*

**TRG=MDEQ Tier 1 Target Remedial Goals per the Final Regulations Governing Brownfields Voluntary Cleanup and Redevelopment in Mississippi (MDBQ, March 2002)

BATCO Bonner Analytical Testing Company.
HpCDF Heptachlorodibenzofuran.
HxCDF Hexachlorodlbenzofuran.
MDL Method detection limit.
MEK Methyl ethyl ketone.
MIBK Methyl isobutyl ketone.
NA Not applicable.
NE TRG not yet established for the compound.
OCDD Octachlorodibenzodioxin.
OCDF Octachlorodibenzofuran.
PeCDD Pentachlorodibenzo-p-dioxin.
PeCDF Pentachlorodibenzofuran .
pg/L picograms per liter.
TCDD Tetrachlorodibenzodioxin.
TCDF Tetrafuran.
ug/L Micrograms per liter.
USEPA U.S. Environmental Protection Agency.

Table 3b. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Drinking Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Volatile Organic Compounds (Method 8260)				
Acetone	67-64-1	608	5	25
Acetonitrile	75-05-8	125	10	40
Acrolein	107-02-8	0.042	7.4	20
Acrylonitrile	107-13-1	0.037	7.2	20
Benzene	71-43-2	5.0	0.25	1
Dichlorobromomethane	75-27-4	0.168	0.25	1
Bromoform	75-25-2	8.48	0.5	1
Bromomethane	74-83-9	8.52	0.8	1
2-Butanone (MEK)	78-93-3	1906	1	10
Carbon disulfide	75-15-0	1043	0.6	2
Carbon tetrachloride	56-23-5	5.0	0.5	1
Chlorobenzene	108-90-7	100	0.25	1
2-Chloro-1,3-butadiene	126-99-8	14.3	0.3	1
Chloroethane	75-00-3	3.64	1	1
Chloroform	67-66-3	0.155	0.14	1
Chloromethane	74-87-3	1.43	0.33	1
3-Chloro-1-propene	107-05-1	NE	0.2	1
Chlorodibromomethane	124-48-1	0.126	0.1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.20	0.44	1
1,2-Dibromoethane	106-93-4	0.05	0.25	1
Dibromomethane	74-95-3	60.8	0.2	1
trans-1,4-Dichloro-2-butene	110-57-6	NE	0.5	2
Dichlorodifluoromethane	75-71-8	348	0.25	1
1,1-Dichloroethane	75-34-3	798	0.25	1
1,2-Dichloroethane	107-06-2	5	0.1	1
cis-1,2-Dichloroethene	156-59-2	70	0.15	1
trans-1,2-Dichloroethene	156-60-5	100	0.2	1
1,1-Dichloroethene	75-35-4	7	0.11	1
1,2-Dichloropropane	78-87-5	5	0.13	1
cis-1,3-Dichloropropene	10061-01-5	0.084	0.11	1
trans-1,3-Dichloropropene	10061-02-6	0.084	0.21	1
Ethylbenzene	100-41-4	700	0.11	1
Ethyl methacrylate	97-63-2	548	0.25	1
2-Hexanone	591-78-6	1460	1	10
Iodomethane	74-88-4	NE	1	5
Isobutyl alcohol	78-83-1	1825	11	40
Methacrylonitrile	126-98-7	1.04	3.3	20
Methylene Chloride	75-09-2	5.0	1	5
Methyl methacrylate	80-62-6	1419	0.48	1
4-Methyl-2-pentanone (MIBK)	108-10-1	139	1	10
Pentachloroethane	76-01-7	NE	1.2	5
Propionitrile	107-12-0	NE	4.6	20
Styrene	100-42-5	100	0.11	1
1,1,1,2-Tetrachloroethane	630-20-6	0.406	0.33	1
1,1,2,2-Tetrachloroethane	79-34-5	0.053	0.18	1
Tetrachloroethene	127-18-4	5.0	0.15	1
Toluene	108-88-3	1000	0.33	1
1,1,1-Trichloroethane	71-55-6	200	0.5	1
1,1,2-Trichloroethane	79-00-5	5.0	0.13	1
Trichloroethene	79-01-6	5.0	0.13	1
Trichlorofluoromethane	75-69-4	1288	0.25	1
1,2,3-Trichloropropane	96-18-4	0.0062	0.41	1
Vinyl acetate	108-05-4	412	0.28	2
Vinyl chloride	75-01-4	2.0	0.18	1
Xylenes, Total	1330-20-7	10000	0.2	2
Semivolatile Organic Compounds (Method 8270)				
Acenaphthene	83-32-9	365	0.76	10
Acenaphthylene	208-96-8	2190	0.85	10
Acetophenone	98-86-2	0.0416	0.57	10
2-Acetylaminofluorene	53-96-3	NE	1.6	10
alpha,alpha-Dimethyl phenethylamine	122-09-8	NE	35	2000

Table 3b. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Drinking Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Semivolatile Organic Compounds (Method 8270) continued				
4-Aminobiphenyl	92-67-1	NE	1.2	10
Aniline	62-53-3	11.7	2.1	20
Anthracene	120-12-7	43.4	0.69	10
Aramite, Total	140-57-8	NE	0.91	10
Benzo[a]anthracene	56-55-3	0.092	0.55	10
Benzo[a]pyrene	50-32-8	0.20	0.71	10
Benzo[b]fluoranthene	205-99-2	0.092	2.6	10
Benzo[g,h,i]perylene	191-24-2	1095	0.87	10
Benzo[k]fluoranthene	207-08-9	0.92	1.2	10
Benzyl alcohol	100-51-6	10950	1.1	10
1,1'-Biphenyl	92-52-4	304	0.58	10
Bis(2-chloroethoxy)methane	111-91-1	NE	0.94	10
Bis(2-chloroethyl)ether	111-44-4	0.009	1.1	10
bis(chloroisopropyl) ether	108-60-1	0.26	0.78	10
Bis(2-ethylhexyl) phthalate	117-81-7	6	1.6	10
4-Bromophenyl phenyl ether	101-55-3	NE	0.77	10
Butyl benzyl phthalate	85-68-7	2690	1.2	10
4-Chloroaniline	106-47-8	146	2.2	20
4-Chloro-3-methylphenol	59-50-7	73000	1	10
2-Chloronaphthalene	91-58-7	487	0.8	10
2-Chlorophenol	95-57-8	30.4	0.87	10
4-Chlorophenyl phenyl ether	7005-72-3	NE	0.84	10
Chrysene	218-01-9	9.17	0.51	10
Diallate	2303-16-4	NE	0.78	10
Dibenz(a,h)anthracene	53-70-3	0.009	1	10
Dibenzofuran	132-64-9	24.3	0.79	10
1,2-Dichlorobenzene	95-50-1	600	0.53	10
1,3-Dichlorobenzene	541-73-1	5.48	0.59	10
1,4-Dichlorobenzene	106-46-7	75	0.54	10
3,3'-Dichlorobenzidine	91-94-1	0.15	30	60
2,4-Dichlorophenol	120-83-2	110	1.1	10
2,6-Dichlorophenol	87-65-0	NE	0.73	10
Diethyl phthalate	84-66-2	29200	0.88	10
Dimethoate	60-51-5	NE	0.75	10
7,12-Dimethylbenz(a)anthracene	57-97-6	NE	1.2	10
3,3'-Dimethylbenzidine	119-93-7	0.007	10	20
2,4-Dimethylphenol	105-67-9	730	4	10
Dimethyl phthalate	131-11-3	365000	0.99	10
Di-n-butyl phthalate	84-74-2	3650	0.83	10
1,3-Dinitrobenzene	99-65-0	3.65	0.6	10
4,6-Dinitro-2-methylphenol	534-52-1	3.65	10	50
2,4-Dinitrophenol	51-28-5	73	10	50
2,4-Dinitrotoluene	121-14-2	73	1.2	10
2,6-Dinitrotoluene	606-20-2	36.5	1.1	10
Di-n-octyl phthalate	117-84-0	20	1.4	10
Dinoseb	88-85-7	7.0	5	10
1,4-Dioxane	123-91-1	6.09	3.4	10
Disulfoton	298-04-4	1.46	0.79	10
Ethyl methanesulfonate	62-50-0	NE	0.96	10
Ethyl Parathion	56-38-2	219	1.3	10
Famphur	52-85-7	NE	1.1	10
Fluoranthene	206-44-0	1460	0.74	10
Fluorene	86-73-7	243	0.96	10
Hexachlorobenzene	118-74-1	1.0	0.79	10
Hexachlorobutadiene	87-68-3	0.859	0.62	10
Hexachlorocyclopentadiene	77-47-4	50	2.5	10
Hexachloroethane	67-72-1	4.8	0.76	10
Hexachlorophene	70-30-4	11.0	27	5000
Hexachloropropene	1888-71-7	11.0	1.4	10
Indeno[1,2,3-cd]pyrene	193-39-5	0.092	1	10
Isophorone	78-59-1	70.5	0.9	10
Isosafrole	120-58-1	NE	0.5	10

Table 3b. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Drinking Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Semivolatile Organic Compounds (Method 8270) continued				
Methapyrilene	91-80-5	NE	2.7	2000
3-Methylcholanthrene	56-49-5	NE	1.4	10
Methyl methanesulfonate	66-27-3	NE	0.6	10
2-Methylnaphthalene	91-57-6	122	0.78	10
Methyl parathion	298-00-0	9.13	0.88	10
2-Methylphenol	95-48-7	1825	0.89	10
3 & 4 Methylphenol	15831-10-4	1825	1.3	10
Naphthalene	91-20-3	6.20	0.7	10
1,4-Naphthoquinone	130-15-4	NE	0.62	10
1-Naphthylamine	134-32-7	NE	1.1	10
2-Naphthylamine	91-59-8	NE	1.5	10
2-Nitroaniline	88-74-4	0.417	1.3	50
3-Nitroaniline	99-09-2	NE	5	50
4-Nitroaniline	100-01-6	NE	5	50
Nitrobenzene	98-95-3	3.53	0.73	10
2-Nitrophenol	88-75-5	0.416	0.76	10
4-Nitrophenol	100-02-7	292	1.9	50
4-Nitroquinoline-1-oxide	56-57-5	NE	10	20
N-Nitro-o-toluidine	99-55-8	2.03	1.5	10
N-Nitrosodiethylamine	55-18-5	0.0004	0.93	10
N-Nitrosodimethylamine	62-75-9	0.0013	2.8	10
N-Nitrosodi-n-butylamine	924-16-3	0.0019	0.96	10
N-Nitrosodi-n-propylamine	621-64-7	0.0096	0.72	10
N-Nitrosodiphenylamine	86-30-6	13.7	0.92	10
N-Nitrosomethylethylamine	10595-95-6	0.003	3.3	10
N-Nitrosomorpholine	59-89-2	NE	0.84	10
N-Nitrosopiperidine	100-75-4	NE	0.88	10
N-Nitrosopyrrolidine	930-55-2	0.032	1	10
o,o',o'-Triethylphosphorothioate	126-68-1	NE	1	10
p-Dimethylamino azobenzene	60-11-7	NE	0.79	10
Pentachlorobenzene	608-93-5	29.2	0.52	10
Pentachloronitrobenzene	82-68-8	0.258	0.78	10
Pentachlorophenol	87-86-5	1.0	2	50
Phenacetin	62-44-2	NE	1.4	10
Phenanthrene	85-01-8	1095	0.77	10
Phenol	108-95-2	21900	0.83	10
Phorate	298-02-2	NE	0.87	10
2-Picoline	109-06-8	NE	1.4	10
p-Phenylene diamine	106-50-3	6935	10	2000
Pronamide	23950-58-5	NE	0.89	10
Pyrene	129-00-0	183	0.63	10
Pyridine	110-86-1	36.5	2.3	50
Safrole, Total	94-59-7	NE	0.8	10
Sulfotepp	3689-24-5	NE	0.53	10
1,2,4,5-Tetrachlorobenzene	95-94-3	11.0	0.76	10
2,3,4,6-Tetrachlorophenol	58-90-2	1095	0.72	10
Thionazin	297-97-2	NE	0.91	10
2-Toluidine	95-53-4	0.28	1.4	10
1,2,4-Trichlorobenzene	120-82-1	70	0.56	10
2,4,5-Trichlorophenol	95-95-4	3650	1.2	10
2,4,6-Trichlorophenol	88-06-2	6.09	0.85	10
1,3,5-Trinitrobenzene	99-35-4	1095	2	10
Organochlorine Pesticides (USEPA 8081A)				
Aldrin	309-00-2	0.004	0.007	0.05
alpha-BHC	319-84-6	0.011	0.0057	0.05
beta-BHC	319-85-7	0.037	0.0067	0.05
Chlordane (technical)	57-74-9	2	0.1	0.5
Chlorobenzilate	510-15-6	0.248	0.5	0.5

Table 3b. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Drinking Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Semivolatile Organic Compounds (Method 8270) continued				
4,4'-DDD	72-54-8	0.279	0.0065	0.1
4,4'-DDE	72-55-9	0.197	0.0077	0.1
4,4'-DDT	50-29-3	0.197	0.0097	0.1
delta-BHC	319-86-8	NE	0.0048	0.05
Dieldrin	60-57-1	0.004	0.0091	0.1
Endosulfan I	959-98-8	219	0.0042	0.05
Endosulfan II	33213-65-9	219	0.0098	0.1
Endosulfan sulfate	1031-07-8	NE	0.0068	0.1
Endrin	72-20-8	2.0	0.0097	0.1
Endrin aldehyde	7421-93-4	NE	0.016	0.1
Endrin ketone	53494-70-5	NE	0.0084	0.1
gamma-BHC (Lindane)	58-89-9	0.20	0.0059	0.05
Heptachlor	76-44-8	0.40	0.007	0.05
Heptachlor epoxide	1024-57-3	0.20	0.006	0.05
Isodrin	465-73-6	NE	0.05	0.05
Kepone	143-50-0	NE	1	1
Methoxychlor	72-43-5	40	0.013	0.1
Toxaphene	8001-35-2	3.0	0.5	5
PCBs (USEPA 8082)				
PCB-1016	12674-11-2	0.96	0.071	1
PCB-1221	11104-28-2	0.033	0.28	2
PCB-1232	11141-16-5	0.033	0.11	1
PCB-1242	53469-21-9	0.033	0.18	1
PCB-1248	12672-29-6	0.033	0.36	1
PCB-1254	11097-69-1	0.033	0.26	1
PCB-1260	11096-82-5	0.033	0.2	1
PCBs, Total	1336-36-3	0.500	0.36	1
Herbicides (USEPA 8151A)				
2,4-D	94-75-7	70	0.037	0.5
Silvex (2,4,5-TP)	93-72-1	50	0.062	0.5
2,4,5-T	93-76-5	365	0.062	0.5
Dioxathion/Dioxenethion (BATCO 088.1)				
cis-Dioxathion	78-34-2	54.8	NA	0.48
trans-Dioxathion	78-34-2	54.8	NA	0.31
Dioxenethion	–	NE	NA	0.22
Analyte[1]	**CAS Number**	**Drinking Water**		
		Tier 1 TRG (pg/L)	**Laboratory MDL (pg/L)**	**Laboratory RL (pg/L)**
Dioxins and Furans (1613) (pg/L)				
2,3,7,8-TCDD	51207-31-9	4.5	2.1	10
1,2,3,7,8-PeCDD	40321-76-4	0.89	2.6	50
1,2,3,4,7,8-HxCDD	39227-28-6	4.5	1.3	50
1,2,3,6,7,8-HxCDD	57653-85-7	10.8	1.8	50
1,2,3,7,8,9-HxCDD	19408-74-3	10.8	1.6	50
1,2,3,4,6,7,8-HpCDD	35822-46-9	44.6	1.5	50
OCDD	3268-87-9	446	3.1	100
2,3,7,8-TCDF	51207-31-9	4.5	3.4	10
1,2,3,7,8-PeCDF	57117-41-6	8.9	1.3	50
2,3,4,7,8-PeCDF	57117-31-4	0.89	1.2	50
1,2,3,4,7,8-HxCDF	70648-26-9	4.5	1.4	50
1,2,3,6,7,8-HxCDF	57117-44-9	4.5	1.2	50
2,3,4,6,7,8-HxCDF	60851-34-5	4.5	1.1	50
1,2,3,7,8,9-HxCDF	72918-21-9	4.5	1.9	50
1,2,3,4,6,7,8-HpCDF	55673-89-7	NE	1.7	50
1,2,3,4,7,8,9-HpCDF	67562-39-4	NE	2.1	50
OCDF	39001-02-0	446	1.3	100

Table 3b. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Analyte[1]	CAS Number	Drinking Water		
		Tier 1 TRG (ug/L)	Laboratory MDL (ug/L)	Laboratory RL (ug/L)
Total Metals (Including Mercury) (SW846-6020, 7470A)				
Antimony	7440-36-0	6.0	2	5
Arsenic	7440-38-2	50	1.3	2.5
Barium	7440-39-3	2000	1.4	5
Beryllium	7440-41-7	4.0	0.15	0.5
Cadmium	7440-43-9	5.0	0.13	0.5
Chromium	7440-47-3	100	2.5	5
Cobalt	7440-48-4	2190.0	0.12	0.5
Copper	7440-50-8	1300	1.1	5
Lead	7439-92-1	15	0.5	1.5
Mercury	7439-97-6	2	0.091	0.2
Nickel	7440-02-0	730	2	5
Selenium	7782-49-2	50	1.1	2.5
Silver	7440-22-4	183	0.18	1
Thallium	7440-28-0	2.0	0.25	1
Tin	7440-31-5	21900	1.4	5
Vanadium	7440-62-2	256	3.2	10
Zinc	7440-66-6	10950	8.4	20
Cyanide, Total (USEPA 9012A)				
Cyanide, Total	57-12-5	200	0.005	0.01
Sulfide, Total (USEPA 9034)				
Sulfide, Total	18496-25-8	NE	NA	1

Notes:

[1]USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*

**TRG=MDEQ Tier 1 Target Remedial Goals per the Final Regulations Governing Brownfields Voluntary Cleanup and Redevelopment in Mississippi (MDBQ, March 2002)

BATCO Bonner Analytical Testing Company.
HpCDF Heptachlorodibenzofuran.
HxCDF Hexachlorodibenzofuran.
MDL Method detection limit.
MEK Methyl ethyl ketone.
MIBK Methyl isobutyl ketone.
NA Not applicable.
NE TRG not yet established for the compound.
OCDD Octachlorodibenzodioxin.
OCDF Octachlorodibenzofuran.
PeCDD Pentachlorodibenzo-p-dioxin.
PeCDF Pentachlorodibenzofuran .
pg/L picograms per liter.
TCDD Tetrachlorodibenzodioxin.
TCDF Tetrafuran.
ug/L Micrograms per liter.
USEPA U.S. Environmental Protection Agency.

ARCADIS

Table 3c. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Analyte[1]	CAS Number	Soil / Sediment			
		Tier 1 TRG Restricted mg/Kg	Tier 1 TRG Unrestricted mg/Kg	Laboratory MDL mg/Kg	Laboratory RL mg/Kg
Volatile Organic Compounds (Method 8260)					
Acetone	67-64-1	103751	7821	0.011	0.05
Acetonitrile	75-05-8	111	111	0.041	0.2
Acrolein	107-02-8	40880	1564	0.024	0.1
Acrylonitrile	107-13-1	10.6	1.18	0.034	0.1
Benzene	71-43-2	1.36	0.887	0.00073	0.005
Dichlorobromomethane	75-27-4	1.89	1.24	0.00097	0.005
Bromoform	75-25-2	90.1	58.8	0.0015	0.005
Bromomethane	74-83-9	2.97	2.97	0.0015	0.005
2-Butanone (MEK)	78-93-3	84.5	84.5	0.0024	0.025
Carbon disulfide	75-15-0	7.97	7.97	0.0011	0.005
Carbon tetrachloride	56-23-5	0.569	0.371	0.00083	0.005
Chlorobenzene	108-90-7	1.19	1.19	0.00096	0.005
2-Chloro-1,3-butadiene	126-99-8	NE	NE	0.0027	0.005
Chloroethane	75-00-3	1974	220	0.0011	0.005
Chloroform	67-66-3	0.478	0.312	0.001	0.005
Chloromethane	74-87-3	440	49.1	0.0021	0.005
3-Chloro-1-propene	107-05-1	NE	NE	0.0022	0.005
Chlorodibromomethane	124-48-1	68.1	7.60	0.0014	0.005
1,2-Dibromo-3-Chloropropane	96-12-8	0.100	0.100	0.00083	0.005
Ethylene Dibromide	106-93-4	0.067	0.008	0.0017	0.005
Dibromomethane	74-95-3	20417	782	0.0044	0.01
trans-1,4-Dichloro-2-butene	110-57-6	NE	NE	0.0015	0.005
trans-1,3-Dichloropropene	10061-02-6	NE	NE	0.0033	0.025
Ethylbenzene	100-41-4	395	395	0.0018	0.005
Ethyl methacrylate	97-63-2	18375	7039	0.052	0.2
2-Hexanone	591-78-6	81760	3129	0.023	0.1
Iodomethane	74-88-4	NE	NE	0.00098	0.005
Isobutyl alcohol	78-83-1	612500	23464	0.0045	0.01
Methacrylonitrile	126-98-7	204	7.82	0.0042	0.025
Methylene Chloride	75-09-2	440	49.1	0.0063	0.025
Methyl methacrylate	80-62-6	16333	16333	0.026	0.1
4-Methyl-2-pentanone (MIBK)	108-10-1	163333	6257	0.00093	0.005
Pentachloroethane	76-01-7	NE	NE	0.0024	0.005
Propionitrile	107-12-0	NE	NE	0.0016	0.005
Styrene	100-42-5	384	384	0.0019	0.005
1,1,1,2-Tetrachloroethane	630-20-6	220	24.6	0.00084	0.005
1,1,2,2-Tetrachloroethane	79-34-5	1.00	0.656	0.0029	0.01
Tetrachloroethene	127-18-4	18.2	11.9	0.00063	0.005
Toluene	108-88-3	38.0	38.0	0.00087	0.005
1,1,1-Trichloroethane	71-55-6	1188	1188	0.00059	0.005
1,1,2-Trichloroethane	79-00-5	1.7	1.1	0.0013	0.005
Trichloroethene	79-01-6	7.92	5.17	0.0013	0.005
Trichlorofluoromethane	75-69-4	142917	23464	0.0012	0.005
1,2,3-Trichloropropane	96-18-4	0.818	0.091	0.0024	0.005
Vinyl acetate	108-05-4	9.13	9.13	0.0025	0.01
Vinyl chloride	75-01-4	0.939	0.426	0.0015	0.005
Xylenes, Total	1330-20-7	318	318	0.0011	0.01
Semivolatile Organic Compounds (Method 8270)					
Acenaphthene	83-32-9	122500	4693	0.041	0.33
Acenaphthylene	208-96-8	122640	4693	0.036	0.33
Acetophenone	98-86-2	2633	2633	0.028	0.33
2-Acetylaminofluorene	53-96-3	2042	78.2	0.028	0.33
alpha,alpha-Dimethyl phenethylamine	122-09-8	NE	NE	2.7	67
4-Aminobiphenyl	92-67-1	NE	NE	0.037	0.33
Aniline	62-53-3	1004	112	0.034	0.66
Anthracene	120-12-7	612500	23464	0.025	0.33
Aramite, Total	140-57-8	NE	NE	0.057	0.33
Benzo[a]anthracene	56-55-3	7.8	0.87	0.027	0.33
Benzo[a]pyrene	50-32-8	0.784	0.087	0.052	0.33
Benzo[b]fluoranthene	205-99-2	7.84	0.875	0.038	0.33
Benzo[g,h,i]perylene	191-24-2	61320	2346	0.022	0.33
Benzo[k]fluoranthene	207-08-9	78.4	8.75	0.065	0.33
Benzyl alcohol	100-51-6	204167	23464	0.033	0.33
1,1'-Biphenyl	92-52-4	10208.33333	3910.714286	0.74	0.33

Table 3c. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Analyte[1]	CAS Number	Soil / Sediment			
		Tier 1 TRG Restricted mg/Kg	Tier 1 TRG Unrestricted mg/Kg	Laboratory MDL mg/Kg	Laboratory RL mg/Kg
Semivolatile Organic Compounds (Method 8270) (Continued)					
Bis(2-chloroethoxy)methane	111-91-1	NE	NE	0.039	0.33
Bis(2-chloroethyl)ether	111-44-4	0.419	0.273	0.045	0.33
bis(chloroisopropyl) ether	108-60-1	9.1	5.9	0.03	0.33
Bis(2-ethylhexyl) phthalate	117-81-7	409	45.6	0.029	0.33
4-Bromophenyl phenyl ether	101-55-3	NE	NE	0.036	0.33
Butyl benzyl phthalate	85-68-7	928	928	0.026	0.33
4-Chloroaniline	106-47-8	817	313	0.052	0.66
4-Chloro-3-methylphenol	59-50-7	408333	156429	0.035	0.33
2-Chloronaphthalene	91-58-7	163520	6257	0.035	0.33
2-Chlorophenol	95-57-8	10208	391	0.04	0.33
4-Chlorophenyl phenyl ether	7005-72-3	NE	NE	0.044	0.33
Chrysene	218-01-9	784	87.5	0.021	0.33
Diallate	2303-16-4	NE	NE	0.17	0.33
Dibenz(a,h)anthracene	53-70-3	0.784	0.087	0.039	0.33
Dibenzofuran	132-64-9	8176	313	0.033	0.33
1,2-Dichlorobenzene	95-50-1	279	279	0.037	0.33
1,3-Dichlorobenzene	541-73-1	1840	70.4	0.034	0.33
1,4-Dichlorobenzene	106-46-7	238	26.6	0.035	0.33
3,3'-Dichlorobenzidine	91-94-1	12.7	1.42	0.028	0.66
2,4-Dichlorophenol	120-83-2	613	235	0.035	0.33
2,6-Dichlorophenol	87-65-0	NE	NE	0.027	0.33
Diethyl phthalate	84-66-2	1974	1974	0.037	0.33
Dimethoate	60-51-5	NE	NE	0.025	0.33
7,12-Dimethylbenz(a)anthracene	57-97-6	NE	NE	0.017	0.33
3,3'-Dimethylbenzidine	119-93-7	0.622	0.069	0.83	1.7
2,4-Dimethylphenol	105-67-9	40833	1564	0.044	0.33
Dimethyl phthalate	131-11-3	20440000	782143	0.034	0.33
Di-n-butyl phthalate	84-74-2	2279	2279	0.03	0.33
1,3-Dinitrobenzene	99-65-0	204	7.82	0.024	0.33
4,6-Dinitro-2-methylphenol	534-52-1	204	7.82	0.17	1.7
2,4-Dinitrophenol	51-28-5	408	156	0.83	1.7
2,4-Dinitrotoluene	121-14-2	408	156	0.049	0.33
2,6-Dinitrotoluene	606-20-2	2042	78	0.042	0.33
Di-n-octyl phthalate	117-84-0	4083	1564	0.029	0.33
Dinoseb	88-85-7	204	78.2	0.16	0.33
1,4-Dioxane	123-91-1	520	58.1	0.12	0.33
Disulfoton	298-04-4	8.17	3.13	0.017	0.33
Ethyl methanesulfonate	62-50-0	NE	NE	0.031	0.33
Ethyl Parathion	56-38-2	1225	469	0.022	0.33
Famphur	52-85-7	NE	NE	0.029	0.33
Fluoranthene	206-44-0	81667	3129	0.032	0.33
Fluorene	86-73-7	81667	3129	0.036	0.33
Hexachlorobenzene	118-74-1	1.65	0.399	0.039	0.33
Hexachlorobutadiene	87-68-3	0.135	0.088	0.036	0.33
Hexachlorocyclopentadiene	77-47-4	0.951	0.951	0.041	0.33
Hexachloroethane	67-72-1	93.3	45.6	0.028	0.33
Hexachlorophene	70-30-4	613	23.5	13	170
Hexachloropropene	1888-71-7	NE	NE	0.029	0.33
Indeno[1,2,3-cd]pyrene	193-39-5	7.84	0.875	0.028	0.33
Isophorone	78-59-1	4570	672	0.033	0.33
Isosafrole	120-58-1	NE	NE	0.024	0.33
Methapyrilene	91-80-5	NE	NE	0.83	67
3-Methylcholanthrene	56-49-5	NE	NE	0.041	0.33
Methyl methanesulfonate	66-27-3	NE	NE	0.017	0.33
2-Methylnaphthalene	91-57-6	40880	1564	0.038	0.33
Methyl parathion	298-00-0	408	19.6	0.026	0.33
2-Methylphenol	95-48-7	102200	3911	0.027	0.33
3 & 4 Methylphenol	15831-10-4	102200	3911	0.043	0.33
Naphthalene	91-20-3	247	194	0.03	0.33
1,4-Naphthoquinone	130-15-4	NE	NE	0.017	0.33
1-Naphthylamine	134-32-7	NE	NE	0.066	0.33
2-Naphthylamine	91-59-8	NE	NE	0.034	0.33
2-Nitroaniline	88-74-4	0.492	0.492	0.045	1.7
3-Nitroaniline	99-09-2	NE	NE	0.046	1.7

Table 3c. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Analyte[1]	CAS Number	Soil / Sediment mg/Kg			
		Tier 1 TRG Restricted mg/Kg	Tier 1 TRG Unrestricted mg/Kg	Laboratory MDL mg/Kg	Laboratory RL mg/Kg
Semivolatile Organic Compounds (Method 8270) (Continued)					
4-Nitroanillne	100-01-6	NE	NE	0.049	1.7
Nitrobenzene	98-95-3	8.41	8.41	0.026	0.33
2-Nitrophenol	88-75-5	NE	NE	0.041	0.33
4-Nitrophenol	100-02-7	16352	626	0.33	1.7
4-Nitroquinoline-1-oxide	56-57-5	NE	NE	0.83	3.3
N-Nitro-o-toluidine	99-55-8	173	19	0.026	0.33
N-Nitrosodiethylamine	55-18-5	0.038	0.004	0.028	0.33
N-Nitrosodimethylamine	62-75-9	0.112	0.013	0.12	0.33
N-Nitrosodi-n-butylamine	924-16-3	1.060	0.118	0.024	0.33
N-Nitrosodi-n-propylamine	621-64-7	0.818	0.091	0.032	0.33
N-Nitrosodiphenylamine	86-30-6	1168	130	0.033	0.33
N-Nitrosomethylethylamine	10595-95-6	0.260	0.029	0.025	0.33
N-Nitrosomorpholine	59-89-2	NE	NE	0.027	0.33
N-Nitrosopiperidine	100-75-4	NE	NE	0.021	0.33
N-Nitrosopyrrolidine	930-55-2	2.73	0.304	0.018	0.33
o,o,o-Triethylphosphorothioate	126-68-1	NE	NE	0.04	0.33
p-Dimethylamino azobenzene	60-11-7	NE	NE	0.019	0.33
Pentachlorobenzene	608-93-5	1633	62.6	0.025	0.33
Pentachloronitrobenzene	82-68-8	22.0	2.46	0.021	0.33
Pentachlorophenol	87-86-5	23.8	2.66	0.33	1.7
Phenacetin	62-44-2	NE	NE	0.033	0.33
Phenanthrene	85-01-8	61320	2346	0.027	0.33
Phenol	108-95-2	122500	46929	0.034	0.33
Phorate	298-02-2	NE	NE	0.022	0.33
2-Picoline	109-06-8	NE	NE	0.017	0.33
p-Phenylene diamine	106-50-3	388360	14861	0.83	1.7
Pronamide	23950-58-5	NE	NE	0.024	0.33
Pyrene	129-00-0	61250	2346	0.027	0.33
Pyridine	110-86-1	2042	78.2	0.029	0.33
Safrole, Total	94-59-7	NE	NE	0.024	0.33
Sulfotepp	3689-24-5	NE	NE	0.02	0.33
1,2,4,5-Tetrachlorobenzene	95-94-3	613	23	0.031	0.33
2,3,4,6-Tetrachlorophenol	58-90-2	61250	2346	0.022	0.33
Thionazin	297-97-2	NE	NE	0.023	0.33
2-Toluidine	95-53-4	30.1	3.36	0.035	0.33
1,2,4-Trichlorobenzene	120-82-1	824	782	0.031	0.33
2,4,5-Trichlorophenol	95-95-4	204400	7821	0.035	0.33
2,4,6-Trichlorophenol	88-06-2	314	58.1	0.029	0.33
1,3,5-Trinitrobenzene	99-35-4	102	102	0.17	0.33
Organochlorine Pesticides (EPA 8081A)					
Aldrin	309-00-2	0.337	0.038	0.00045	0.0017
alpha-BHC	319-84-6	0.9	0.1	0.00011	0.0017
beta-BHC	319-85-7	3.2	0.4	0.00011	0.0017
Chlordane (technical)	57-74-9	12.3	1.82	0.0029	0.017
Chlorobenzilate	510-15-6	21.2	2.37	0.017	0.017
4,4'-DDD	72-54-8	23.8	2.66	0.00024	0.0033
4,4'-DDE	72-55-9	16.8	1.88	0.00019	0.0033
4,4'-DDT	50-29-3	16.8	1.88	0.00023	0.0033
delta-BHC	319-86-8	NE	NE	0.00013	0.0017
Dieldrin	60-57-1	0.358	0.040	0.00028	0.0033
Endosulfan I	959-98-8	1225	469	0.00015	0.0017
Endosulfan II	33213-65-9	1225	469	0.00023	0.0033
Endosulfan sulfate	1031-07-8	NE	NE	0.00024	0.0033
Endrin	72-20-8	61.3	23.5	0.00073	0.0033
Endrin aldehyde	7421-93-4	NE	NE	0.0003	0.0033
Endrin ketone	53494-70-5	NE	NE	0.00027	0.0033
gamma-BHC (Lindane)	58-89-9	4.40	0.491	0.00011	0.0017
Heptachlor	76-44-8	0.195	0.127	0.000083	0.0017
Heptachlor epoxide	1024-57-3	0.629	0.070	0.00014	0.0017
Isodrin	465-73-6	NE	NE	0.0033	0.0033
Kepone	143-50-0	NE	NE	0.17	0.17
Methoxychlor	72-43-5	1021	391	0.00035	0.0033
Toxaphene	8001-35-2	5.20	0.581	0.06	0.17

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Table 3c. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Analyte[1]	CAS Number	Soil / Sediment mg/Kg			
		Tier 1 TRG Restricted mg/Kg	Tier 1 TRG Unrestricted mg/Kg	Laboratory MDL mg/Kg	Laboratory RL mg/Kg
PCBs (EPA 8082)					
PCB-1016	12674-11-2	10.0	1.0	0.0029	0.033
PCB-1221	11104-28-2	10.0	1.0	0.0048	0.067
PCB-1232	11141-16-5	10.0	1.0	0.0033	0.033
PCB-1242	53469-21-9	10.0	1.0	0.0028	0.033
PCB-1248	12672-29-6	10.0	1.0	0.0072	0.033
PCB-1254	11097-69-1	10.0	1.0	0.0023	0.033
PCB-1260	11096-82-5	10.0	1.0	0.0067	0.033
Total PCBs	1336-36-3	10.0	1.0	0.0072	0.033
Herbicides (EPA 8151A)					
2,4-D	94-75-7	2042	782	0.005	0.0083
Silvex (2,4,5-TP)	93-72-1	1633	626	0.0016	0.0083
2,4,5-T	93-76-5	20417	782	0.0023	0.0083
Dioxathion/Dioxenethion (BATCO 088.1)					
cis-Dioxathion	78-34-2	3066	117	NA	14
trans-Dioxathion	78-34-2	3066	117	NA	15
Dioxenethion	–	NE	NE	NA	17
		Soil / Sediment			
Analyte[1]	CAS Number	Tier 1 TRG Restricted pg/g	Tier 1 TRG Unrestricted pg/g	Laboratory MDL pg/g	Laboratory RL pg/g
Dioxins and Furans (8290) (pg/g)					
2,3,7,8-TCDD	51207-31-9	382	42.6	1.0	1
1,2,3,7,8-PeCDD	40321-76-4	76.3	8.5	0.4	5
1,2,3,4,7,8-HxCDD	39227-28-6	382	42.6	0.6	5
1,2,3,6,7,8-HxCDD	57653-85-7	923	103	0.4	5
1,2,3,7,8,9-HxCDD	19408-74-3	923	103	0.4	5
1,2,3,4,6,7,8-HpCDD	35822-46-9	3815	426	0.4	5
OCDD	3268-87-9	38155	4258	1.1	10
2,3,7,8-TCDF	51207-31-9	382	42.6	0.7	1
1,2,3,7,8-PeCDF	57117-41-6	763	85.2	0.7	5
2,3,4,7,8-PeCDF	57117-31-4	76.3	8.5	0.4	5
1,2,3,4,7,8-HxCDF	70648-26-9	382	43	0.5	5
1,2,3,6,7,8-HxCDF	57117-44-9	382	43	0.6	5
2,3,4,6,7,8-HxCDF	60851-34-5	382	43	0.2	5
1,2,3,7,8,9-HxCDF	72918-21-9	382	43	0.4	5
1,2,3,4,6,7,8-HpCDF	55673-89-7	NE	NE	0.4	5
1,2,3,4,7,8,9-HpCDF	67562-39-4	NE	NE	0.6	5
OCDF	39001-02-0	38155	4258	1.3	10
		Soil / Sediment mg/Kg			
Analyte[1]	CAS Number	Tier 1 TRG Restricted mg/Kg	Tier 1 TRG Unrestricted mg/Kg	Laboratory MDL mg/Kg	Laboratory RL mg/Kg
Total Metals (Including Mercury) (SW846-6020, 7471A)					
Antimony	7440-36-0	81.7	31.3	1	2
Arsenic	7440-38-2	3.82	0.426	0.2	0.5
Barium	7440-39-3	14292	5475	0.25	1
Beryllium	7440-41-7	1021	156	0.05	0.1
Cadmium	7440-43-9	1022	39.1	0.024	0.1
Chromium	7440-47-3	NE	NE	0.5	1
Cobalt	7440-48-4	12250	4693	0.03	0.1
Copper	7440-50-8	8167	3129	0.4	1
Lead	7439-92-1	1700	400	0.2	0.4
Mercury	7439-97-6	61.3	10.0	0.0082	0.02
Nickel	7440-02-0	4083	1564	0.5	1
Selenium	7782-49-2	1021	391	0.5	1
Silver	7440-22-4	1021	391	0.1	0.2
Thallium	7440-28-0	143	5.48	0.05	0.2
Tin	7440-31-5	122500	46929	5.1	20
Vanadium	7440-62-2	1429	548	0.55	1
Zinc	7440-66-6	61250	23464	1.1	4
Cyanide, Total (EPA 9012A)					
Cyanide, Total	57-12-5	4083	1564	0.21	0.5
Sulfide, Total (EPA 9034)					
Sulfide, Total	18496-25-8	NE	NE	NA	60

Table 3c. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Notes:

[1]USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*

**TRG=MDEQ Tier 1 Target Remedial Goals per the Final Regulations Governing Brownfields Voluntary Cleanup and Redevelopment in Mississippi (MDBQ, March 2002)

All results to be reported in dry weight

BATCO Bonner Analytical Testing Company.
HpCDF Heptachlorodibenzofuran.
HxCDF Hexachlorodibenzofuran.
MDL Method detection limit.
MEK Methyl ethyl ketone.
mg/Kg milligrams per kilogram.
MIBK Methyl isobutyl ketone.
NA Not applicable.
NE TRG not yet established for the compound.
OCDD Octachlorodibenzodioxin.
OCDF Octachlorodibenzofuran.
PeCDD Pentachlorodibenzo-p-dioxin.
PeCDF Pentachlorodibenzofuran .
pg/g picograms per gram.
TCDD Tetrachlorodibenzodioxin.
TCDF Tetrafuran.
ug/L Micrograms per liter.
USEPA U.S. Environmental Protection Agency.

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Table 3d. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Analyte[1]	CAS Number	Indoor Air				
		Residential Air Screening Level ug/m3	Industrial Air Screening Level ug/m3	Laboratory MDL ug/m3	Laboratory RL ug/m3	Laboratory RL(ppbv)
Volatile Organic Compounds (Method TO 15)						
Benzene	71-43-2	0.31	1.6	0.18	0.64	0.20
Benzyl Chloride	100-44-7	0.05	0.25	0.40	2.07	0.40
Bromomethane	74-83-9	5.2	22	0.12	0.78	0.20
Carbon tetrachloride	56-23-5	0.41	2	0.24	1.26	0.20
Chlorobenzene	108-90-7	52	220	0.23	0.92	0.20
Chloroethane	75-00-3	10000	44000	0.09	0.53	0.20
Chloroform	67-66-3	0.11	0.53	0.19	0.98	0.20
Chloromethane	74-87-3	94	390	0.33	1.03	0.50
1,2-Dibromoethane	106-93-4	0.0041	0.02	0.34	1.54	0.20
1,2-Dichlorobenzene	95-50-1	210	880	0.42	1.20	0.20
1,3-Dichlorobenzene	541-73-1	NE	NE	0.39	1.20	0.20
1,4-Dichlorobenzene	106-46-7	0.22	1.1	0.38	1.20	0.20
Dichlorodifluoromethane	75-71-8	100	440	0.33	0.98	0.20
1,1,Dichloroethane	75-34-3	1.5	7.7	0.11	0.81	0.20
1,2-Dichloroethane	107-06-2	0.094	0.47	0.19	0.81	0.20
1,1-Dichloroethene	75-35-4	1.5	7.7	0.13	0.79	0.20
cis-1,2-Dichloroethene	156-59-2	NE	NE	0.24	0.79	0.20
1,2-Dichloropropane	78-87-5	0.24	1.2	0.24	0.92	0.20
cis-1,3-Dichloropropene	10061-01-5	NE	NE	0.34	0.91	0.20
trans-1,3-Dichloropropene	10061-02-6	NE	NE	0.22	0.91	0.20
Ethylbenzene	100-41-4	0.97	4.9	0.29	0.87	0.20
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	NE	NE	0.22	1.40	0.20
Hexachlorobutadiene	87-68-3	0.11	0.56	0.83	11	1.0
Methylene Chloride	75-09-2	5.2	26	0.16	1.7	0.50
1,2,4-Trichlorobenzene	120-82-1	2.1	8.8	0.73	7.4	1.0
Styrene	100-42-5	1000	4400	0.25	0.9	0.20
1,1,2,2-Tetrachloroethane	79-34-5	0.042	0.21	0.42	1.4	0.20
Tetrachloroethene	127-18-4	0.41	2.1	0.27	1.4	0.20
Toluene	108-88-3	5200	22000	0.20	0.75	0.20
1,1,1-Trichloroethane	71-55-6	5200	22000	0.16	1.1	0.20
1,1,2-Trichloroethane	79-00-5	0.15	0.77	0.29	1.1	0.20
Trichloroethene	79-01-6	1.2	6.1	0.19	1.1	0.20
Trichlorofluoromethane	75-69-4	730	3100	0.13	1.1	0.20
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	31000	130000	0.24	1.5	0.20
1,2,4-Trimethylbenzene	95-63-6	7.3	31	0.31	1.0	0.20
1,3,5-Trimethylbenzene	108-67-8	NE	NE	0.32	1.0	0.20
Vinyl chloride	75-01-4	0.16	2.8	0.18	0.51	0.20
m-Xylene & p-Xylene	136777-61-	100	440	0.52	0.87	0.20
o-Xylene	95-47-6	100	440	0.26	0.87	0.20

Notes:

1 USEPA Compendium Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS)*. January 1999

2 USEPA Regional Screening Levels

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Table 3e. Parameters, Methods, and Target Reporting Limits, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi

Analyte[1]	CAS Number	Soil Gas				
		Residential Air Screening Level ug/m3	Industrial Air Screening Level ug/m3	Laboratory MDL ug/m3	Laboratory RL ug/m3	Laboratory RL(ppbv)
Volatile Organic Compounds (Method TO 15)						
Benzene	71-43-2	0.31	1.6	1.8	6.4	2.0
Benzyl Chloride	100-44-7	0.05	0.25	4	20.7	4.0
Bromomethane	74-83-9	5.2	22	1.2	7.8	2.0
Carbon tetrachloride	56-23-5	0.41	2	2.4	12.6	2.0
Chlorobenzene	108-90-7	52	220	2.3	9.2	2.0
Chloroethane	75-00-3	10000	44000	0.9	5.3	2.0
Chloroform	67-66-3	0.11	0.53	1.85	9.8	2.0
Chloromethane	74-87-3	94	390	3.3	10.3	5.0
1,2-Dibromomethane	106-93-4	0.0041	0.02	3.4	15.4	2.0
1,2-Dichlorobenzene	95-50-1	210	880	4.2	12.0	2.0
1,3-Dichlorobenzene	541-73-1	NE	NE	3.9	12.0	2.0
1,4-Dichlorobenzene	106-46-7	0.22	1.1	3.8	12.0	2.0
Dichlorodifluoromethane	75-71-8	100	440	3.3	9.8	2.0
1,1,Dichloroethane	75-34-3	1.5	7.7	1.1	8.1	2.0
1,2-Dichloroethane	107-06-2	0.094	0.47	1.9	8.1	2.0
1,1-Dichloroethene	75-35-4	1.5	7.7	1.3	7.9	2.0
cis-1,2-Dichloroethene	156-59-2	NE	NE	2.4	7.9	2.0
1,2-Dichloropropane	78-87-5	0.24	1.2	2.4	9.2	2.0
cis-1,3-Dichloropropene	10061-01-5	NE	NE	3.4	9.1	2.0
trans-1,3-Dichloropropene	10061-02-6	NE	NE	2.2	9.1	2.0
Ethylbenzene	100-41-4	0.97	4.9	2.9	8.7	2.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	NE	NE	2.2	14.0	2.0
Hexachlorobutadiene	87-68-3	0.11	0.56	8.3	110	10
Methylene Chloride	75-09-2	5.2	26	1.6	17.0	5.0
1,2,4-Trichlorobenzene	120-82-1	2.1	8.8	7.3	14.8	2.0
Styrene	100-42-5	1000	4400	2.5	8.5	2.0
1,1,2,2-Tetrachloroethane	79-34-5	0.042	0.21	4.2	14.0	2.0
Tetrachloroethene	127-18-4	0.41	2.1	2.7	14.0	2.0
Toluene	108-88-3	5200	22000	2	7.5	2
1,1,1-Trichloroethane	71-55-6	5200	22000	1.6	11.0	2.0
1,1,2-Trichloroethane	79-00-5	0.15	0.77	2.9	11.0	2.0
Trichloroethene	79-01-6	1.2	6.1	1.9	11.0	2.0
Trichlorofluoromethane	75-69-4	730	3100	1.3	11.0	2.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	31000	130000	2.4	15.0	2.0
1,2,4-Trimethylbenzene	95-63-6	7.3	31	3.1	9.8	2.0
1,3,5-Trimethylbenzene	108-67-8	NE	NE	3.2	9.8	2.0
Vinyl chloride	75-01-4	0.16	2.8	1.8	5.1	2.0
m-Xylene & p-Xylene	136777-61-	100	440	5.2	8.7	2.0
o-Xylene	95-47-6	100	440	2.6	8.7	2.0

Notes:

1 USEPA Compendium Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS)*. January 1999

2 USEPA Regional Screening Levels

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Table 4. Sample Containers, Preservation, and Holding Times, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Parameter	Method	Bottle Type	Preservation	Holding Time
Surface Water/Groundwater				
Volatile Organic Compounds	8260 [1]	3 - 40 ml glass vials with Teflon®-lined lid w/ septum	Cool <6°C; pH <2 w/HCl	14 days to analysis
Acid Sensitive VOCs		2-40 ml glass vials with Teflon®-lined lid w/ septum	Cool <6°C	7 days to analysis
Semivolatile Organic Compounds	8270 [1]	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
Organochlorine Pesticides	8081A	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
Polychlorinated biphenyls (PCBs)	8082	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
Herbicides	8151A	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
PCDDs/PCDFs	8290	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	30 days to extraction 45 days to analysis
Total Metals (including Mercury)	6020, 7470A [1]	1-250 ml plastic	pH < 2 w/ HNO3	6 months Metals 28 days Mercury
Cyanide, Total	9012A	1-250 ml plastic	Cool <6°C; pH > 10 w/ NaOH	14 days to analysis
Sulfide, Total	9034	2-250 ml plastic	Cool <6°C; Zinc Acetate & NaOH (pH > 9)	7 days to analysis
Dioxathion	BATCO 088.1	1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C Protect from Light	7 days to extraction 6 months to analysis
Drinking (Potable) Water				
Volatile Organic Compounds	8260 [1]	3 - 40 ml glass vials with Teflon®-lined lid w/ septum 1-250 clear glass bottle (for dechlorination)	Dechlorinate w/ ascorbic acid; preserve to pH < 2 w/ HCl	14 days to analysis
Acid Sensitive VOCs		2-40 ml glass vials with Teflon®-lined lid w/ septum	Cool <6°C	7 days to analysis
Semivolatile Organic Compounds	8270 [1]	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
Organochlorine Pesticides	8081A	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
Polychlorinated biphenyls (PCBs)	8082	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
Herbicides	8151A	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	7 days to extraction 40 days to analysis
PCDDs/PCDFs	1613	2 - 1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C	1 year to extraction 1 year to analysis
Total Metals (including Mercury)	6020, 7470A [1]	1-250 ml plastic	pH < 2 w/ HNO3	6 months Metals 28 days Mercury
Cyanide, Total	9012A	1-250 ml plastic	Cool <6°C; pH > 10 w/ NaOH	14 days to analysis
Sulfide, Total	9034	2-250 ml plastic	Cool <6°C; Zinc Acetate & NaOH (pH > 9)	7 days to analysis
Dioxathion	BATCO 088.1	1 liter amber glass bottle with Teflon®-lined lid	Cool <6°C Protectfrom Light	7 days to extraction 6 months to analysis

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Table 4. Sample Containers, Preservation, and Holding Times, Quality Assurance Project Plan, Hercules Incorporated, Hattiesburg Facility, Hattiesburg, Forrest County, Mississippi.

Parameter	Method	Bottle Type	Preservation	Holding Time
Sediment				
Volatile Organic Compounds	8260 [1]	**Bulk**: 1 - 4 oz. wide-mouth glass jar	Cool <6°C	14 days to analysis
		Encore: 3 - 5 g samplers	Cool <6°C; lab preserve w/in 48 hours	
		Terracore: 2-DI & 1-MeOH 40 ml glass vials w/ septum	Cool <6°C; lab preserve w/in 48 hours	
Semivolatile Organic Compounds	8270 [1]	1 - 8 oz. wide-mouth glass jar	Cool <6°C	14 days to extraction 40 days to analysis
Organochlorine Pesticides	8081A	1 - 8 oz. wide-mouth glass jar	Cool <6°C	14 days to extraction 40 days to analysis
Polychlorinated biphenyls (PCBs)	8082	1 - 8 oz. wide-mouth glass jar	Cool <6°C	14 days to extraction 40 days to analysis
Herbicides	8151A	1 - 8 oz. wide-mouth glass jar	Cool <6°C	14 days to extraction 40 days to analysis
PCDDs/PCDFs	8290	1 - 8 oz. wide-mouth glass jar	Cool <6°C	30 days to extraction 45 days to analysis
Total Metals (including Mercury)	6020, 7471A [1]	1 - 8 oz. wide-mouth plastic jar	Cool <6°C	6 months Metals 28 days Mercury
Cyanide, Total	9012A	1 - 8 oz. wide-mouth plastic jar	Cool <6°C	14 days to analysis
Sulfide, Total	9030B/9034 [1]	1 - 8 oz. wide-mouth plastic jar	Cool <6°C	7 days to analysis
Dioxathion	BATCO 088.1	1 - 8 oz. wide-mouth glass bottle with Teflon®-lined lid	Cool <6°C Protect from Light	14 days to extraction 6 months to analysis
Indoor Air/Soil Gas				
Volatile Organic Compounds	TO-15 [3]	600 L Canister	NA	30 days to analysis

Notes:

1 USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*

2 USEPA Compendium Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry (GC/MS).* January 1999

3 All holding times are measured from date of collection.

Appendix A

EQuIS Lab SOP

INTRODUCTION

ARCADIS manages and verifies/validates analytical data generated by commercial analytical laboratories in the EQuIS database (product of Earthsoft, Inc.). All laboratories contracted by ARCADIS or their clients, on a site-by-site basis, may be required to submit electronic data deliverables (EDDs) in addition to the hard copy report. This Standard Operating Procedure (SOP) describes the structure, format, and submission requirements for electronic data deliverables (EDDs) in the EQuIS EFWEDD (Sample, Test, Result, Batch) format.

This document is a general guidance for preparation of the required electronic data and associated quality control information. The structure of the EDD as defined in this document will remain constant unless Earthsoft modifies the database structure. Reference values and requirements for population of additional fields with specific information will not change from project to project.

Modification to reference value lists may NOT be made by the laboratory without authorization from ARCADIS.

Section I provides ARCADIS contact information and the procedure to submit electronic deliverables directly via e-mail. However, all EDDs will be required to be submitted in a final CD compilation for each specific sampling event or as directed by the ARCADIS Project Manager (PM).

Section II outlines the table structures and general requirements of the EDDs. The EDD structure is based on EarthSoft's EFWEDD EDD format. EarthSoft's EDD format has not been changed; however, some 'optional' fields identified in the EarthSoft EDD have been modified to be 'required' in this EDD format. Additional information regarding the EarthSoft products can be found at http://www.earthsoft.com/.

Section III presents some additional explanation and requirements for populating the table structure and population set forth in Section II.

Section IV summarizes the use of the EDP. Each laboratory **MUST** use EDP to check each EDD file set prior to submission to ARCADIS. The EDP Error Report must be submitted with the EDD. ***All errors identified by the EDP routine must be corrected prior to forwarding the files for entry into the EQuIS database. Or approval for submittal with errors must be authorized by ARCADIS.***

I. CONTACT INFORMATION

Laboratories should contact the ARCADIS National Program Lab Managers with questions regarding this document. The contact info is as follows:

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ELECTRONIC LABORATORY DATA CHECKER EDP

Prior to submitting an EDD to ARCADIS, the EarthSoft EDP must be run to check and verify the EDD structure, format and reference value compliance. The EDP report must be submitted for each file with each EDD set. The Data Checker error report, which demonstrates that the EDD files were successfully checked, must be electronically submitted with the four EDD files to ARCADIS.

REFERENCE VALUES

A specific set of values is required to be utilized in populating certain key fields of the EDD. The Reference Value Lists for the EDP will be provided for each ARCADIS subcontracted laboratory. The Reference Value Lists must be utilized as provided. Alterations or additions to the Reference Values are NOT allowed without prior written authorization by the ARCADIS Data Manager. Electronic mail may be considered written authorization.

ELECTRONIC DATA DELIVERABLE (EDD) SUBMISSION

Prior to submission to ARCADIS, each data file must also be reviewed by the laboratory to ensure that the sample IDs, dates, times and other inter-related information is consistent between all four (4) files and the EDD is complete. All parameters that are subcontracted to other laboratories must be included in the EDD for a specific SDG or Laboratory Project Number. It is not acceptable to submit separate EDDs for subcontract parameters. Manual review of the files may be necessary to complete this review.

It is **IMPERATIVE** that the EDD results match the hard copy results. If the results do not match the lab will correct the error ASAP at no additional charge. This includes issues involving various rounding routines for different electronic data management programs within the laboratory (i.e. LIMS vs. EPA CLP). Significant figures must also match hard copy and be consistent from one sampling event to the next. Reporting limits must be consistent between events as well and must be in compliance with the Laboratory Task Order or Project Statement of Work. There may be instances where diluted surrogates and unrecovered spike compounds will require population of the EDD with numeric values in lieu of data flags in the hard copy report. The ARCADIS Data Manager will provide project specific guidance for these conditions. Adherence to the SOP requirements for population of spike/surrogate recovery and RPD fields is required to allow electronic validation of the data.

The EDP Reports for each file must be submitted with the 4 files of the actual EDD.

Laboratories must submit EDDs via e-mail for verification of compatibility and completeness to the assigned ARCADIS Data Manager for the project.

The subject line of this e-mail must include the following text:

[Facility-Code] [Laboratory Project/Log/SDG Number] - EDD Submission

The e-mail should also include the laboratory contact name and phone number.

EDDs must be submitted via e-mail prior to or at the same time the final hard copy document is delivered. ARCADIS may review the EDDs prior to requesting final submittal on CD. EDDs will be returned to the laboratory for modifications until the files can be successfully imported into the EQuIS Project Database and Electronic Data Validation can be performed without field population errors. Any revisions to the EDD will be required within 24 hours of notification to the laboratory regarding observed problems with the EDD. When the EDD is acceptable to the ARCADIS Data Manager and Project Manager, a CD containing all final versions of the EDD should be submitted to ARCADIS for archiving.

Invoices for analytical work will not be approved for payment until the final EDD revisions are acceptable.

II. ELECTRONIC DELIVERABLE DATA FORMAT

This section identifies the structure and format requirements for EQuIS EFWEDD EDDs submitted by all laboratories to ARCADIS. Specific field definitions are presented for each of the four files. Laboratories should review the unique requirements for these fields. The format population and adherence to the criteria are mandatory. Data are electronically validated and errors are quickly identifiable if the EDD is incorrect.

GENERAL FORMAT REQUIREMENTS

All laboratory data must be saved as an ASCII file format using the following standard format. Each subcontracting laboratory's data must be incorporated into the primary laboratory's EDD.

Each data field must be either separated by tabs or enclosed in double quotes (") and separated by commas. Data fields that do not contain information may be represented by two commas. Maximum length of text fields is indicated in the parentheses. If the input information is less than the maximum field length, DO NOT ADD spaces to account for the difference.

Each record must be terminated with a carriage return/line feed (i.e., standard DOS text file). The file can be produced using any software with the capability to create ASCII files.

THE LABORATORY SHALL LEAVE THE HEADERS IN EACH ASCII FILE TO ASSIST IN REVIEW AND RESOLUTION OF ERRORS.

Four files are required for each SDG or Laboratory Project Number: one each for samples, tests, results, and batches. Each file must be saved as a Tab Delimited or Comma Separated file.

Enterprise EDD File Naming Conventions
EDD packages must be named using a specific naming convention. An EDD Package consists of a .zip file containing the text (.txt) EDDs and a User Certificate. The zip file and text file names must contain the specific elements listed below under file naming conventions, separated by a period. A User Certificate file will be supplied to the lab by Arcadis for inclusion in the zip file. Please include in the subject line of emailed EDD submissions the facility code and Sample Delivery Group (SDG) number.

File Naming Conventions:
ZIP File Name = Unique ID.Facility Code.Format Name.zip
Text File EDDs Name = Unique ID.EDD Section Name.txt

Unique ID = SDG number.
Facility Code = The facility code (i.e., Site Name from ENFOS)
Format Name = The EQuIS EDD format name (e.g., ESBasic, EFWEDD, etc.).
EDD Section Name = The name of the section within the EDD (e.g. EFW2FSample, EFW2LabTST, etc.).

For example, ZIP File Name = "2009001.BP-99999.EFWEDD.zip" will contain the following files: "2009001.EFW2FSample.txt", "2009001.EFW2LabTST.txt", "2009001.EFW2LabRES.txt", '2009001.EFW2LabBCH.txt' and "pfoos.usr".

Package re-submittal
In order to re-submit corrected EDDs, the .zip file and text (.txt) EDDs must each be renamed. If the example EDD package above were to be re-submitted it would have ZIP File Name = "2009001B.BP-99999.EFWEDD.zip" containing "2009001B.EFW2FSample.txt", "2009001B.EFW2LabTST.txt", "2009001B.EFW2LabRES.txt", '2009001B.EFW2LabBCH.txt' and "pfoos.usr". Note that a "B" has been appended to the SDG name in both the zip file name and each of the text file names. A subsequent re-submittal of the same SDG would require that a C be appended and so on.

Referential integrity is enforced between tables (e.g. sys_sample_code present in the result, batch, and test tables must also be present in the sample table). For example, a data record with a specific sys_sample_code found in the result table, but not in the sample table, will cause and error in the Data Import Module and the file will not be allowed to be entered into the database. Dates and times associated with each test must match in the "Test" and "Result" files or the database will not allow entry of the entire file.

Reference values must be adhered to for a variety of fields as identified in the Reference Value list and described in the following table format requirements.

FORMAT DETAILS

The following four sections provide a detailed summary and the specific layout for each field required in each of the four (4) tables of the EDD. The ARCADIS EDD has been derived from the EarthSoft EFWEDD EDD.

Date is reported as MM/DD/YY (month/day/year) and time as HH:MM (hour:minute). Time must be reported in 24-hour (military) format (3:30 p.m. = 15:30 and 8:30 AM = 08:30 not 8:30). NOTE: Make certain that the LIMS systems format the date and time the same way for all files.

The columns in the following 4 tables relate to:

"Number" Column in Tables = Column of EDD table

"Attribute Name" = Column Name
PK after attribute indicates this is a primary key within Access for the table.

"Column Data" Type = Text or Numeric values required. Parenthetical number indicates total allowable number of characters in the field.

"Required" Column:

The column titled 'Required' will contain the text 'Yes' if the field is required to be populated by the laboratory. In addition, a "condition" is added to indicate additional information applying to population of the associated field. The first number of the condition relates to the table in which the condition applies, i.e. 1 is the Sample File, 2 is the Test File, 3 is the Result File, and 4 is the Batch File. Conditions apply as follows:

Condition	Table	Description
0	ALL	Field always required
1-1	SAMPLE	Field required for field samples only not required for laboratory samples
1-2	SAMPLE	Field required (parent_sample_code) for laboratory QC samples that have 'parents'
1-3	SAMPLE	Field not required for field samples
2-1	TEST	Field required if applicable for specific test
3-1	RESULT	Field required (result_value) for detected analytes only (TRG or TICs). Must be NULL if non-detect or surrogates, internal standards or spiked compounds
3-2	RESULT	Field required if available or appropriate for result
3-3	RESULT	Field required for matrix spikes or matrix spike duplicates (NOT required for surrogate compounds or LCS samples where the original concentration is assumed to be zero).
3-4	RESULT	Field required for surrogate compounds, LCS, Blank Spikes, Matrix Spikes, and Internal Standards.
3-5	RESULT	Field required for LCS duplicates, Blank Spike Duplicates, Matrix Spike Duplicates, Lab Replicates
3-6	RESULT	Field required for LCSD, BSD, MSD, and Lab duplicate samples
3-7	RESULT	Field required for surrogates and spike compounds
4-1	BATCH	Field required if available or appropriate for result

"REQUIRED":

"YES" = Required data if applicable

"NO" = Optional information unless otherwise directed by ARCADIS Data Manager or preferred for insertion by lab except where lab is specifically directed to leave the field Null.

Parent Sample Definition

Parent Samples are base samples for duplicates or spikes. i.e. original field samples used for matrix spikes or field sample used for Lab Duplicate/Replicate. A Matrix Spike is not the Parent Sample of the Matrix Spike Duplicate.

POPULATING SPIKE FIELDS

SURROGATES: surrogate recoveries are to be populated in qc_spike_added, qc_spike_measure, and qc_spike_recovery fields. Surrogates are analyte type = SUR. Control limits for surrogate recoveries must also be populated.

INTERNAL STANDARDS: internal standard values are to be populated in qc_spike_added, qc_spike_measure, and qc_spike_recovery fields. Internal Standards are analyte type = IS.

LCS, BS, and MS COMPOUNDS: recoveries are to be populated in qc_spike_added, qc_spike_measured, and qc_spike_recovery fields. Compounds spiked to evaluate method accuracy are analyte type = SC. Control limits for spike recoveries must also be populated.

LCSD, BD, AND MSD COMPOUNDS: recoveries are to be populated in qc_dup_spike_added, qc_dup_spike_measured, and qc_dup_spike_recovery fields. The Compounds spiked to evaluate method accuracy are analyte type = SC. Control limits for spike recoveries must also be populated. Additionally, the qc_rpd and qc_rpd_cl fields must be populated for these samples.

LAB REPLICATE SAMPLE DATA: values for lab duplicates/replicates are to be populated in qc_dup_spike_measured field. The qc_rpd and qc_rpd_cl fields must be populated for these samples.

III. ADDITIONAL REQUIREMENTS

SAMPLE TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
1	sys_sample_code	Text(40)	Yes (0)	Unique sample identifier (COC Sample ID). Each sample must have a unique value, including spikes and duplicates. Unique sample identifiers **throughout** the database are an **ABSOLUTE** restriction enforced by EQuIS Chemistry. This unique identifier also carries through to each subsequent sampling event where the samples IDs must be unique for EVERY event of the project (continuing years). Laboratory QC samples must also have unique identifiers between sampling event and from 1 year to the next and between laboratories in the event subcontractors are used. For Matrix Spike, Matrix Spike Duplicate, and Laboratory Duplicates of Field Samples, add the suffix MS, MSD, and LR, respectively to create unique identifiers for these types of Lab QC samples.
2	sample_name	Text(30)	No	Additional sample identification information as necessary. Is not required to be unique (i.e., duplicates are OK).

SAMPLE TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
3	sample_matrix_code	Text(10)	Yes (0)	Code, which distinguishes between different types of sample matrix. **Examples**: Soil samples ="SO" , groundwater samples = "WG". Field Blanks, Trip Blanks, and Rinsate Blanks = "WQ". Water Method Blanks and liquid matrix spikes = "WQ" Soil Method Blanks and soil/sludge/sediment matrix spikes = "SQ' This field refers to the sample matrix not the matrix after preparation or extraction. See rt_matrix for the list of valid values.
4	sample_type_code	Text(10)	Yes (0)	Code that distinguishes between different types of samples. **For example**, normal field samples = "N" and laboratory method blank ="LB". Field QC sample types are Field Duplicates = "FD", Field Blanks = "FB", Trip Blanks = "TB". Lab QC sample types are LCS or Blank Spikes = "BS", LCSD or BS Duplicates = "BD" and Matrix Spikes = "MS" and Matrix Spike Duplicates = "SD". See rt_sample_type in Reference Values list of valid values.
5	sample_source	Text(10)	Yes (0)	Must be either "Field" for field samples **or** "Lab" for laboratory QC samples. No other values are allowed. Matrix spikes and lab duplicate/replicate are "Lab" samples, even though the parent is a "Field" and the base sample came from the field. The spiking or splitting for duplication is done in the lab. Field duplicates as submitted to the lab by field sampling teams are "Field"
6	parent_sample_code	Text(40)	Yes (1-2)	The value in the "sys_sample_code" that identifies the sample that was the source of this sample. *For example*, the Matrix Spike and the Matrix Spike Duplicate or Lab Replicates parent_sample_code is the sys_sample_code for the originating field sample that is spiked to generate the MS/MSD or split by the lab for use as the laboratory duplicate. This field is only required in the EDD for laboratory "clone" samples (e.g., matrix spikes and duplicates). Field duplicates are submitted blind to the laboratory, so this field cannot be completed by the laboratory. This field must be blank for samples that have no parent (e.g., normal field samples, method blanks, etc.).
7	sample_delivery_group	Text(10)	Yes (0)	Sample delivery group or laboratory Project/Log Number. All deliverables must reference the SDG or Lab Log-in Number. This field MUST BE POPULATED
8	sample_date	Date	Yes (1-1)	Date of sample collection in MM/DD/YY format including trip blanks. Must be blank for laboratory samples.
9	sample_time	Time	Yes (1-1)	Time of sample collection in 24-hour (military) HH:MM format. 8:45 AM = 08:45 and 3:30 PM = 15:30. Must be blank for laboratory samples.

SAMPLE TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
10	sys_loc_code	Text(20)	No	Sample collection location. To be populated by ARCADIS unless otherwise directed at project initiation.
11	start_depth	Double	No	Beginning depth (top) of soil sample. To be populated by ARCADIS unless otherwise directed at project initiation.
12	end_depth	Double	No	Ending depth (bottom) of soil sample. To be populated by ARCADIS unless otherwise directed at project initiation.
13	depth_unit	Text(15)	No	Unit of measurement for the sample begin and end depths. IRPIMS-style unit of measurement codes (see table X03) are recognized by Chem; other codes may be allowed by the Chem project manager. To be populated by ARCADIS unless otherwise directed at project initiation.
14	chain_of_custody	Text(15)	Yes (1-1)	Chain of custody identifier or number. A single sample may be assigned to only one chain of custody. The COC identifier will be provided by the field sampling team based on conventions established for a specific project.
15	sent_to_lab_date	Date	No	Date sample was sent to lab (in MM/DD/YY format for EDD).
16	sample_receipt_date	Date	Yes (1-1)	Date that sample was received at laboratory in MM/DD/YY format. Must be blank for laboratory samples.
17	sampler	Text(30)	No	Name or initials of sampler.
18	sampling_company_code	Text(10)	Yes (1-1)	Name or initials of sampling company (no controlled vocabulary). "ARCADIS" should be entered into this field unless otherwise directed at project initiation.
19	sampling_reason	Text(30)	No	Optional reason for sampling. No controlled vocabulary is enforced.
20	sampling_technique	Text(40)	No (1-1)	To be populated by ARCADIS unless otherwise directed at project initiation. Sampling technique. **For example**, low flow, bailing, MIP, etc... Must be blank for laboratory samples.
21	task_code	Text(10)	No	Code used to identify the task under which the field sample was retrieved.
22	collection_quarter	Text(5)	No	Quarter of the year sample was collected (e.g., "1Q96")
23	composite_yn	Text(1)	No	Boolean field used to indicate whether a sample is a composite sample.
24	composite_desc	Text(255)	No	Description of composite sample (if composite_yn is YES).

SAMPLE TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
25	sample_class	Text(10)	No	Navy sample class code.
26	custom_field_1	Text(255)	No	Custom sample field
27	custom_field_2	Text(255)	No	Custom sample field
28	custom_field_3	Text(255)	No	Custom sample field
29	comment	Text(255)	Yes (0)	Field required to contain the full sample ID code.
30	sample_receipt_time	Text(5)	Yes (1-1)	Time of sample receipt by laboratory in 24-hour (military) **HH:MM** format. 8:45 AM = 08:45 and 3:30 PM = 15:30

TEST TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
1	sys_sample_code (PK)	Text (40)	Yes (0)	SAME AS #1 IN SAMPLE TABLE. This value is used in enforcing referential integrity between tables. Must match sys_sample_code in Sample Table.
2	lab_anl_method_name (PK)	Text (35)	Yes (0)	Laboratory analytic method name or description. See rt_analytic_method in reference value tables for list of valid values.
3	analysis_date (PK)	Date/ Time	Yes (0)	Date of sample analysis in MM/DD/YY format. Refers to initiation of the analysis not prep method date.
4	analysis_time (PK)	Text (5)	Yes (0)	Time of sample analysis in 24-hour (military) HH:MM format. Note that this field, combined with the "analysis_date" field is used to distinguish between reextractions, reanalyses, and dilutions. Please ensure that retests have "analysis_date" and/or analysis_time" different from the original test event (and complete test_type field as appropriate).
5	total_or_dissolved (PK)	Text (1)	Yes (0)	"T" for total metal organic carbon concentration, "D" for dissolved or filtered metal or organic carbon concentration ONLY. USE "N" for organic (or other) constituents for which neither "total" nor "dissolved" is applicable including TDS.
6	column_number (PK)	Text (2)	Yes (2-1)	Applicable for GC or HPLC methods. "1C" for first column analyses, "2C" for second column analyses, or "NA" for analyses where not applicable. If any "2C" tests are listed, then there must be corresponding "1C" tests present also. Laboratories must indicate which of the two columns is to be considered "primary" by entering "Y" in the "reportable_result" field of the result table for the result presented in hard copy reports. It is NOT acceptable to identify both "1C" and "2C" reportable_result as "Y:; one must be "N" if" "1C" and "2C" are provided in the EDD.

TEST TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
7	test_type (PK)	Text (10)	Yes (0)	Type of test. Valid values include "initial", "reextract", and "reanalysis", "dilution" are acceptable. See rt_test_type for al valid values.
8	lab_matrix_code	Text (10)	Yes (0)	Code that distinguishes between different types of matrix analyzed. Soil = "SO"; groundwater = "GW" and TCLP = TCLP as a lab matrix. See rt_matrix for valid values
9	analysis_location	Text (2)	Yes (0)	"LB" for fixed-based laboratory analysis, "FI" for field instrument, "FL" for mobile field laboratory analysis, or.
10	basis	Text (10)	Yes (0)	"Wet" for wet-weight basis; or "Dry" for dry-weight basis. For tests for which this distinction is not applicable use Wet
11	container_id	Text (30)	No	Sample container identifier.
12	dilution_factor	Single	Yes (0)	Test or analytical run dilution factor. **Must** be "1" if no dilution.
13	Prep_method	Text (35)	Yes (2-1)	Laboratory sample preparation method name. See rt_std_prep_method for valid values.
14	prep_date	Date/ Time	Yes (2-1)	Date of sample preparation in MM/DD/YY format.
15	prep_time	Text (5)	Yes (2-1)	Time of sample preparation in 24-hour (military) HH:MM format
16	leachate_method	Text (15)	Yes (2-1)	Method name, e.g., SW1311 or SW1312. See rt_analytic_method for valid values.
17	leachate_date	Date/ Time	Yes (2-1)	Date of leachate preparation in MM/DD/YY format.
18	leachate_time	Text (5)	Yes (2-1)	Time of leachate preparation in 24-hour (military) HH:MM format.
19	lab_name_code	Text (10)	Yes (0)	Unique identifier of the laboratory reporting results. See rt_subcontractor for valid values.
20	qc_level	Text (10)	NO	Not populated by Lab.
21	lab_sample_ id	Text (20)	Yes (0)	Laboratory sample identifier. A field sample may have more than one laboratory lab_sample_id; however it is limited to only ONE lab_sample_id per method).
22	percent_moisture	Text (5)	Yes (2-1)	Percent moisture of the sample portion used in the specific lab_anl_methd_name test; this value may vary from test to test for any sample. The value must be NUMERIC as "NN.MM", e.g., 70.1% could be reported as "70.1" but not as 70.1%". The database assumes that the number is a "%" and units of measure are not necessary. **NOTE: This field MUST be populated for all soil, sludge, and sediment samples whether or not the value is reported in the hard copy. Use "0" for lab soil QC samples.**
23	subsample_amount	Text (14)	Yes 0)	Amount of sample used for the test. THIS FIELD MUST BE POPULATED
24	subsample_amount_unit	Text (15)	Yes (0)	Unit of measurement for subsample amount. See rt_unit for valid values.

TEST TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
25	analyst_name	Text (30)	Yes (0)	Name or initials of laboratory analyst.
26	instrument_lab	Text (50)	Yes (0)	Instrument identifier.
27	comment	Text (255)	NO	Comments about the test as necessary (Optional).
28	preservative	Text (50)	Yes (2-1)	Indicate preservative or leave blank, if none. **THIS FIELD MUST BE POPULATED IF A PRESERVATIVE WAS IN THE SAMPLE AS RECEIVED FROM THE FIELD OR IF THE SAMPLE WAS PRESERVED BY THE LABORATORY BEFORE PREPARATION AND ANALYSIS.**
29	final_volume	Text (15)	Yes (2-1)	Final amount of extract or digestate.
30	final_volume_unit	Text (15)	Yes (2-1)	Unit of measure for final_volume. See rt_unit for valid values.

RESULT TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
1	sys_sample_code (PK)	Text (40)	Yes (0)	SAME AS #1 IN SAMPLE & TEST TABLES. This value is used in enforcing referential integrity between tables.
2	lab_anl_method_name (PK)	Text (35)	Yes (0)	Laboratory analytic method name. Must be same as lab_anl_method_name in Test File. See rt _analytic_method for valid values.
3	analysis_date (PK)	Date/Time	Yes (0)	Must be the SAME AS #3 IN THE TEST TABLE. This value is used in enforcing referential integrity between tables. Date of sample analysis in MM/DD/YY format.
4	analysis_time (PK)	Text (5)	Yes (0)	Must be the SAME AS #4 IN THE TEST TABLE. This value is used in enforcing referential integrity between tables.
5	total_or_dissolved_ (PK)	Text (1)	Yes (0)	Must be the SAME AS #5 IN THE TEST FILE.
6	column_number (PK)	Text (2)	Yes (3-2)	Must be the SAME AS #6 IN THE TEST FILE
7	test_type (PK)	Text (10)	Yes (0)	Must be the SAME AS #7 IN THE TEST FILE
8	cas_rn (PK)	Text (15)	Yes (0)	Chemical Abstracts Number for the parameter if available. This must be the true CAS # and "not made up". Where CAS #s are not available, i.e. wet chem. Parameters, identifiers will be provided by ARCADIS project requirements. See notes at end of section for TIC management. See rt_analyte for valid values. The lab is not authorized to add internally developed "CAS #s" for general chemistry parameters, surrogates, internal standards, TICs. CAS#s used for TICs must be available through an outside source such as "Chemfinder".
9	chemical_name	Text (60)	Yes (0)	Chemical name associated with CAS # in #8. The cas_rn field is the only chemical identifier information actually imported in EQuIS Chemistry.

RESULT TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
10	result_value	Text (20)	Yes (3-1)	Analytical result reported for **"TRG" or "TIC"** result_type **ONLY**. Appropriate and consistent number of significant digits must be entered. **MUST BE BLANK FOR NON-DETECTS.** "SUR", "IS", and "SC" results do **NOT** populate this field (populate the QC fields).
11	result_error_delta	Text (20)	Yes (3-2) [Radiochem)	Error range applicable to the result value for radiochemistry results.
12	result_type_code	Text (10)	Yes (0)	Must be either "TRG" for a target or regular results, "TIC" for tentatively identified compounds, "SUR" for surrogates, "IS" for internal standards, or "SC" for spiked compounds.**[LCS, LCSD, MS, MSD, BS, BSD]**
13	reportable_result	Text (10)	Yes (0)	Must be either "**Yes**" for results, which are considered to be reportable, **or** "**No**" for other results. Used to distinguish between multiple results where a sample is retested after dilution or to indicate which of the first or second column result should be considered primary. For re-analyses and dilutions all results must be entered into the database if hard copy data is provided **BUT ONLY ONE RESULT FOR EACH COMPOUND/ANALYTE MAY BE FLAGGED AS REPORTABLE.**
14	detect_flag	Text (2)	Yes (0)	Either "Y" for detected analytes or "N" for non-detects. **MUST be "N" for NON-DETECTS.**
15	lab_qualifiers	Text (7)	Yes (3-2)	Qualifier flags assigned by the laboratory. See rt_qualifier for valid qualifiers that may be used.
16	Organic_ yn	Yes/No	Yes (0)	Must be either "Y" for organic constituents or "N" for inorganic constituents.
17	method_detection_ limit	Text (20)	Yes (0)	Laboratory determined MDL per 40 CFR Part 136, adjusted for dilutions and percent moisture (if it applies).
18	reporting_detection_ limit	Text (20)	Yes (0)	Detection limit that reflects sample analysis conditions including analysis volumes and dilution factors. This should be the laboratory PQL or standard reporting limits
19	quantitation_limit	Text (20)	No	NOT Currently used unless specifically defined for the project.
20	Result_unit	Text (15)	Yes (0)	Units of measure relates to **ALL** results including result_value, qc_original_concentration, qc_spike added, qc_spike_measured, qc_dup_orginal_conc, qc_dup_spike_added, qc_dup_spike_measured. See rt_unit for valid values.
21	detection_limit_unit	Text (15)	Yes (0)	Units of measure for detection limit(s). See rt_unit for valid values.
22	tic_retention_time	Text (8)	Yes (3-2)	Retention time in minutes for tentatively identified compounds (TICs). Populated only for TIC result_type
23	result_comment	Text (255)	NO	MUST BE LEFT BLANK BY THE LAB

RESULT TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
24	qc_original_conc	Text (14)	Yes (3-3)	The concentration of the analyte in the original (unspiked) sample. Populated for matrix spike samples. Not populated where original concentration is assumed to be zero, i.e. LCS or BS samples.
25	qc_spike_added	Text (14)	Yes (3-4)	The concentration of the analyte added to the original sample. Populated for ALL Surrogates, and LCS, BS, and MS samples
26	qc_spike_measured	Text (14)	Yes (3-4)	The measured concentration of the analyte. Use zero for spiked compounds that were not detected in the sample. **MUST BE NUMBERIC** even if diluted out or not recovered (use "0" if diluted, matrix interference, elevated concentrations of target compounds, etc.) Populated for **ALL** Surrogates, and LCS, BS, and MS samples
27	qc_spike_recovery	Text (14)	Yes (3-4)	The percent recovery for "SUR" and "SC" results. **MUST BE NUMERIC** even if diluted out or not recovered (use "0" if diluted, matrix interference, elevated concentrations of target compounds, etc.) Report as percentage (e.g., report "120%" as "120"); DO NOT include "%" sign in field. Populated for **ALL** Surrogates, and LCS, BS, and MS samples
28	qc_dup_original conc	Text (14)	Yes (3-5)	The concentration of the analyte in the original (unspiked) sample. Populated for matrix spike duplicate samples. Not populated where original concentration is assumed to be zero, i.e. LCSD or BSD samples.
29	qc_dup_spike_added	Text (14)	Yes (3-5)	The concentration of the analyte added to the original sample. Populated for ALL LCSD, BSD, and MSD samples.
30	qc_dup_spike_measured	Text (14)	Yes (3-5)	The measured concentration of the analyte in the duplicate. Populated for **ALL** LCSD, BSD, and MSD samples. MUST be NUMERIC. Use zero for spiked compounds that were not recovered due to dilution, matrix interference, elevated concentrations of target compounds, etc..
31	qc_dup_spike_recovery	Text (14)	Yes (3-5)	The duplicate percent recovery. Populated for **ALL** LCSD, BSD, and MSD samples. **MUST be NUMERIC.** Use zero for spiked compounds that were not recovered due to dilution, matrix interference, elevated concentrations of target compounds, etc Report as percentage (e.g., report "120%" as "120").
32	qc_rpd	Text (8)	Yes (3-6)	The relative percent difference between MS and MSD, LCS and LCSD, BS and BSD, & primary field sample result and Lab Replicate. Populated for **ALL** LCSD, BSD, MSD, and LR samples. **MUST be NUMERIC.** Use zero for RPDs that were not calculated due to elevated concentrations of target compounds, dilution, matrix interference, etc Report as percentage (e.g., report "120%" as 120").
33	qc_spike_lcl	Text (8)	Yes (3-7)	Lower control limit for spike recovery. Required for spikes, spike duplicates, surrogate compounds, LCS and any spiked sample. Report as

RESULT TABLE				
Num	**Attribute Name**	**Column Data Type**	**Required**	**Attribute Definition**
				percentage (e.g., report "120%" as "120").
34	qc_spike_ucl	Text (8)	Yes (3-7)	Upper control limit for spike recovery. Required for spikes, spike duplicates, surrogate compounds, LCS and any spiked sample. Report as percentage (e.g., report "120%" as "120").
35	qc_rpd_cl	Text (8)	Yes (3-6)	Relative percent difference control limit. Required for any duplicated sample. Report as percentage (e.g., report "120%" as "120").
36	qc_spike_status	Text (10)	Yes (3-4)	Used to indicate whether the spike recovery was within control limits. Use the "+" character to indicate failure, otherwise leave blank.
37	qc_dup_spike_status	Text (10)	Yes (3-5)	Used to indicate whether the duplicate spike recovery was within control limits. Use the "+" character to indicate failure, otherwise leave blank.
38	qc_rpd_status	Text (10)	Yes (3-6)	Used to indicate whether the relative percent difference was within control limits. Use the "+" character to indicate failure, otherwise leave blank. Required for any duplicated sample.

BATCH TABLE				
Num	**Attribute Name**	**Column Datatype**	**Required**	**Attribute Definition**
1	sys_sample_code (PK)	Text (40)	Yes (0)	SAME AS #1 IN SAMPLE , TEST TABLE. This value is used in enforcing referential integrity between tables.
2	lab_anl_method_name (PK)	Text (35)	Yes (0)	SAME AS #2 IN TEST TABLE. See rt_analytic_method for valid values.
3	analysis_date (PK)	Date	Yes (0)	SAME AS #3 IN TEST TABLE. This value is used in enforcing referential integrity between tables. Date of sample analysis in MM/DD/YY format. May refer to either beginning or end of the analysis as required by EQuIS Chemistry project manager.
4	analysis_time (PK)	Text (5)	Yes (0)	SAME AS #4 IN TEST, AND RESULT TABLES. This value is used in enforcing referential integrity between tables.
5	total_or_dissolved (PK)	Text (1)	Yes (0)	SAME AS #5 IN TEST TABLE. This value is used in enforcing referential integrity between tables.
6	column_number (PK)	Text (2)	Yes (4-1)	SAME AS #6 IN TEST TABLE. This value is used in enforcing referential integrity between tables.
7	test_type (PK)	Text (10)	Yes (0)	SAME AS #7 IN TEST TABLE. This value is used in enforcing referential integrity between tables.
8	test_batch_type (PK)	Text (10)	Yes (0)	Lab batch type. Valid values include "Prep", "Analysis", and "Leach". Additional valid values may optionally be provided by the EQuIS Chemistry project manager. This is a required field for all batches.
9	test_batch_id	Text (20)	Yes (0)	Unique identifier for all and each lab batches. Must be unique within EQuIS Chemistry database. For example, the same identifier cannot be used for a prep batch and an analysis batch and the values must be different from one sampling event to another. THIS IDENTIFIER CANNOT BE USED FROM ONE YEAR TO THE NEXT.

ADDITIONAL INFORMATION FOR PREPARING THE 4-FILE EDD

SAMPLE FILE AND SYS_SAMPLE_CODE

1. The sys_sample_code is the unique sample ID as supplied on the Chain of Custody form with the same spacing as identified on the COC or on a supplemental Sample ID list submitted to the laboratory with the Laboratory Task Order or prior to submission of samples.

2. In order to uniquely identify MS/MSD, laboratory duplicates, TCLP, and SPLP samples, the laboratory shall add a suffix to the original sample ID listed on the chain of custody:

   Matrix Spike Sample = xxxxx MS
   Matrix Spike Duplicate Sample = xxxxx MSD
   Lab Duplicate/Replicate = xxxxx LR
   TCLP Extract Sample = xxxxx TCLP
   SPLP Extract Sample = xxxxx SPLP

   These are the only characters that are allowed to be amended to ANY sample ID as listed on the COC or the sample ID list referred to above.
   The parent_sample_code shall be entered into the parent_sample_code field of the Sample File.

3. If the sample_name field is provided it must contain the full sample ID from the chain of custody.

4. Sample_Type_Code must be appropriately applied as follows:
   "N" = normal field samples
   "FD" = field duplicates samples submitted blind to the laboratory
   "TB" = trip blanks
   "FB" = field blanks
   "EB" = rinsate or equipment blanks
   "BS" = laboratory control samples or blank spikes
   "BD" = laboratory control sample duplicates or blank spike duplicates
   "MS" = matrix spikes
   "SD" = matrix spike duplicates
   "LR" = laboratory duplicates or laboratory replicates

5. The following "**matrix_type**" codes must be used ("**SQ**" = soil QC sample and "**WQ**" = water QC sample):
   Method Blank = "SQ" or "WQ"
   MS/MSDs = "SQ" or "WQ"
   LCS/LCSDs = "SQ" or "WQ"
   BS/BSDs = "SQ" or "WQ"

6. SDG Numbers or laboratory Log Numbers (per ARCADIS PM direction) **MUST** be populated in "**sample_delivery_group**" field of the **Sample File.**

QUALITY CONTROL SAMPLES AND DATA

7. The source of Lab Duplicates, Lab Replicates, Matrix Spikes, and Matrix Spike Duplicates is the Lab not the Field even if the MS/MSD are identified on the COC by the field sampling team. The samples are spiked in the laboratory not in the field.

8. Laboratory QC data, which span more than one SDG may be submitted with each appropriate SDG.

9. Laboratory LCS and LCSD should be reported as two separate samples.

10. **Matrix Spike and Matrix Spike Duplicate recoveries must be reported as "0" if the value is not calculated due to concentrations of the spiked analyte in the sample at concentrations above the 4X factor.**

11. **All laboratory method performance site-specific and batch Quality Control sample results (i.e. Method Blanks, LCS/LCSDs, Blank Spikes, Leachate Blanks as method appropriate) must be included in the EDD.** For most projects, this does **NOT** include **non-site-specific** matrix spikes and laboratory duplicates/replicates.

12. Laboratory batch sample duplicate/replicate and MS/MSD results from **non-project specific** samples (i.e. batch QC samples) shall **NOT** be included in the EDD.

13. Surrogates populate the qc_spike fields not qc_dup_spike fields or the result_value field even if the surrogates are reported for MSD, BSD, or LCSD samples.

14. QC_Spike_Added values for Spike, IS and Surrogate compounds are REQUIRED.

15. QC_Spike_Measured values for Spike, IS and Surrogate compounds are REQUIRED.

16. RPDs for LCSDs, BSDs, MSDs, and Laboratory Duplicates must be populated in the "**qc_rpd**" field. A value of "0" or "100" must be reported, as appropriate, if the RPD is not calculated due to excessive concentrations or interference present in the sample. The "**qc_rpd**" must be a numeric entry.

17. The RPD control limit must be listed in the "**rpd_cl**" field for all parameters where an RPD is reported. This includes lab duplicate/replicate samples.

SAMPLE FILE

18. The following "**matrix_type**" codes must be used for QC samples ("**SQ**" = soil QC sample and "**WQ**" = water QC sample):

    Method Blank = "SQ" of "WQ"
    MS/MSDs = "SQ" or "WQ"
    LCS/LCSDs = "SQ" or "WQ"
    BS/BSDs = "SQ" or "WQ"

19. SDG or Laboratory Project numbers must be populated in "sample_delivery_group" field.

TEST FILE

20. Percent moisture must be reported in the "**percent_moisture**" field in the **Test File** for all solid samples (i.e., soil, sediment, and sludge).

21. Subsample weights and final volumes must be listed for all parameters as appropriate.

RESULTS FILE

22. Result_value is only populated with data for "TRG" and "TIC" detections. All other data is entered in the "qc_" fields. The field must be "NULL" for non-detects and other analyte_types. The Reporting Limit must not be entered in this field.

23. Non-detected data shall have a lab_qualifier of "U" in addition to other qualifiers deemed applicable. The Detect_Flag shall be "N" and the Result_value field shall be blank.

24. The Reporting Limit must be provided for all parameters. The RL MUST be adjusted for dilutions made during analysis.

25. Surrogate recoveries MUST BE REPORTED in the qc_spike_measured and qc_spike_recovery fields, even if the surrogate had been diluted out. List "0" as the measured and recovered amount. Control Limits must also be entered for surrogates. Surrogates are "SUR" analyte_type not "TRG".

26. Surrogate, LCS, LCSD, BS, BSD, MS, and MSD detected concentrations, and percent recoveries must be populated with a numeric value. A value of "0" **must** be entered if the Spiked Compound is diluted out or not recovered. An "+" is unacceptable as this is a numeric field.

27. "**QC_original_concentration**" must be populated for matrix spikes and matrix spike duplicates

28. Valid entries for the reportable_result field are "Yes" or "No" only.

29. ONLY report compounds of interest for any method blank, sample, and sample duplicate, trip blank.

30. Laboratory Qualifier designation must be consistent. For an estimated concentration with blank contamination "BJ" must be used. Note that "JB", "B J" or "J B" cannot be used.

31. Explanation of Duplicate Qualifiers:

B	Analyte found in associated blank	Organic Analysis
B	<CRDL but >= Instrument Detection Limit	Inorganic Analysis
N	Presumptive evidence of a compound	Organic Analysis
N	Sample recovery not within control limits	Inorganic Analysis

It is preferred by ARCADIS that the laboratory not qualifiers with multiple explanations. **Any qualifiers utilized in the hard copy report or the electronic report must be defined in the hard copy report. There is no exception to this requirement for explanation of qualifiers applied to electronic data.**

32. Nomenclature for tentatively identified compounds (TIC):

Use the CAS # if it is available and **REAL (outside verifiable source)** for TICs and enter the chemical name in the chemical_name field.

For UNKNOWN TICs follow the following protocol:

cas_rn for unkown VOA TIC = VTIC 1 through VTIC 10
cas_rn for unkown SVOA TIC = SVTIC 1 through SVTIC 20

Enter "UNKNOWN", "UNKNOWN Hydrocarbon", "UNKNOWN Aliphatic", or other identifier as appropriate or applicable in "chemical_name" field.

TICs will produce errors in the ELDC/EDDP that cannot be corrected by the laboratory. These are the only acceptable errors in the data checker report unless otherwise authorized by ARCADIS.

33. TCLP or SPLP results must be submitted in units of mg/L or appropriate liquid units. **(Make sure that moisture correction is not automatically enforced).**

BATCH FILE

34. **The laboratory must use unique Batch File Names for each analytical department/method and for continuing years. Electronic validation utilizes Batch IDs to link field samples with quality control data. Overlapping Batch IDs are not acceptable.**

GENERAL ISSUES

35. Incomplete chain-of-custody (C-O-C) forms must be immediately communicated to the project manager. Some of the C-O-C information is used for completion of the Sample_Matrix_Code and Sample_Delivery_Group. These discrepancies must be rectified upon receipt of samples at the laboratory prior to log in.

36. **Duplicate sample IDs are not acceptable within the EQuIS database. It is imperative that samples including field blanks, trip blanks, equipment blanks, field duplicates have unique sample IDs for projects including ongoing sampling events such as quarterly groundwater monitoring.**

SUBCONTRACTED PARAMETERS

37. The EDD must be populated with **ALL** appropriate and applicable fields, including **ALL** QC data for any subcontracted parameters.

PLEASE CONTACT THE ARCADIS PROJECT CHEMIST, DATA MANAGER or PROJECT MANAGER IF THERE ARE ANY QUESTIONS REGARDING PREPARATION OR GENERATION OF THE EDD.

EXAMPLE EDD REPORTS

The following subsections provide examples of how the EQuIS EDD should be populated for QC data.

RESULT FILE FIELDS FOR A NORMAL FIELD SAMPLE, TRG AND TIC RESULTS

The table below shows some of the fields in the Result File for a normal field sample (i.e., Sample_type_code = N, TB, FD, etc.) and "TRG" or "TIC" analyte_type_code. NOTE: all QC fields are blank.

cas_rn	result value	qc original conc	qc spike added	qc spike measured	qc spike recovery	qc dup. original conc	qc dupl. spike added	qc dup. spike measured	qc dup. spike recovery
93-76-5	3.17								
94-75-7	1.56								
94-82-6	2.31								

RESULT FILE FIELDS FOR A NORMAL FIELD SAMPLE WITH SURROGATES

The following table shows some of the fields in the result file for a normal field sample (i.e., Sample_type_code = N, TB, etc.). Note that QC fields are blank except on surrogate Rows.

cas_rn	result value	result unit	result type code	qc original conc	qc spike added	qc spike measured	qc spike recovery
93-76-5	1.56	mg/L	TRG				
94-75-7	3.17	mg/L	TRG				
PHEN2F		mg/L	SUR		12.5	12.9	103

RESULT FILE FIELDS FOR A MATRIX SPIKE

The following table shows some of the fields in the result file for a matrix spike sample (i.e., Sample_type_code = MS). Note that all "dup" QC fields are blank, and that the result_value field is NULL. Also, the qc_rpd field would be blank for these rows. The parent_sample_code must contain the contents of the sys_sample_code of the original (parent) sample.

cas_rn	result value	qc original conc	qc spike added	qc spike measured	qc spike recovery	qc dup. original conc	qc dupl. Spike added	qc dup. spike measured	qc dup. spike recovery
93-76-5		1.56	4.18	5.36	90.9				
94-75-7		3.17	4.18	7.15	95.2				
94-82-6		2.31	4.22	5.66	79.3				

RESULT FILE FIELDS FOR A MATRIX SPIKE DUPLICATE

The following table shows some of the fields in the result file for a matrix spike/matrix spike duplicate considered as a single sample (i.e., Sample_type_code = MSD). Note that all QC fields are completed, and that the result_value field is not needed. Also, the qc_rpd field would be completed for these rows. The parent_sample_code must contain the contents of the sys_sample_code of the original (parent) sample.

cas_rn	result value	qc original conc	qc spike added	qc spike measured	qc spike recovery	qc dup original conc	qc dup. spike added	qc dup spike measured	qc dup spike recovery
93-76-5						1.56	4.23	5.70	97.8
94-75-7						3.17	4.23	7.62	105
94-82-6						2.31	4.13	5.33	73.1

RESULT FILE FIELDS FOR A LCS or BS \

The following table shows some of the fields in the result file for an LCS sample (i.e., laboratory control sample, blank spike, Sample_type_code = BS). The qc_rpd field is left blank for these rows.

cas_rn	result value	qc original conc	qc spike added	qc spike measured	qc spike recovery	qc dup original conc	qc dup spike added	qc dup spike measured	qc dup spike recovery
93-76-5		1.5	5.00	5.26	105				
94-75-7		10.2	1.00	1.02	102				
94-82-6		3.4	12.5	12.9	103				

RESULT FILE FIELDS FOR A LCS DUPLICATE OR BS DUPLICATE

The following table shows some of the fields in the result file for a laboratory control sample duplicate (i.e., Sample_type_code = BD). Note that the result_value field is not required. Also, the qc_rpd field must be completed for these rows.

cas_rn	result value	qc original conc	qc spike added	qc spike measured	qc spike recovery	qc dup original conc	qc dup spike added	qc dup spike measured	qc dup spike recovery	qc_rpd
93-76-5							5.00	4.92	98	2.0
94-75-7							1.00	0.95	95	6.6
94-82-6							12.5	11.8	94	12.3

REANALYSES, REEXTRACTIONS, DILUTIONS

The following table shows how to report retests for three different circumstances. The first example, the sample was retested (for 75-25-2) because the initial result required reanalysis due to QC failure. For the second example, the initial sample result (for 95-95-4) required dilution. The third example (for 67-66-3) required both reanalysis and dilution (reanalysis supercedes dilution). The fourth example (87-86-5) shows an initial result that require re-extraction due to QC failure or elevated concentrations that could not be diluted based on the original extraction. The other results are "turned off" by setting the reportable_result field to "No".

test_type	cas_rn	result_value	reportable_result
initial	75-25-2	1.2	No
reanalysis	75-25-2	1.1	Yes
initial	95-95-4	250E	No
dilution	95-95-4	328	Yes
initial	67-66-3	3.4	No
reanalysis	67-66-3	3.3	Yes
initial	87-86-5	980E	No
reextraction	87-86-5	1500	Yes

ANALYSES REQUIRING SECOND COLUMN CONFIRMATION

Analyte identification requiring confirmation by a second analytical technique is required by certain gas chromatography (GC) methods. A common technique used to confirm the identity of an analyte is to analyze the sample using a second GC column that is dissimilar from the GC column used for the first analysis. This confirmation technique is used routinely when analyzing samples for pesticides, herbicides, and certain volatile organic compounds (e.g., BTEX), and the two analyses often are performed simultaneously using an instrument equipped with dual GC columns connected to common injection port.

The method for reporting data from dual column GC analyses is not standard throughout the environmental laboratory industry. ARCADIS recommends that laboratories use the method described in SW-846 Method 8000B, unless project-specific requirements or the method used for analysis dictate otherwise. The following table illustrates the proper format to be used to report first and second column results. The results for the first and third constituents (75-25-2 and 95-95-4) are being reported from column 1, and the result for the second constituent (67-66-3) is being reported from column 2. The other results are "turned off" by setting the reportable_result field to "No".

column_number	cas_rn	result_value	reportable_result
1C	75-25-2	6.2	Yes
1C	67-66-3	3.4	No
1C	95-95-4	5.6	Yes
2C	75-25-2	1.3	No
2C	67-66-3	33.7	Yes
2C	95-95-4	5.4	No

REFERENCE TABLES

A number of fields in each of the EDD files must be entered to correspond exactly with reference values standardized by ARCADIS. These reference values will be updated from time to time. Each laboratory will be supplied a copy of the updated document. It is the laboratory's responsibility to submit EDDs using the most current reference tables as defined by a specific project.

The following table summarizes the EDD fields where standard reference values must be used:

EDD File	EDD Field	Reference Table
Sample	sample_type_code	rt_sample_type
	sample_matrix_code	rt_matrix
Test	lab_anl_method_name	rt_anl_mthd
	lab_matrix_code	rt_matrix
	prep_method	rt_std_prep_mthd
	subsample_amount_unit	rt_unit
	final_volume_unit	rt_unit
Result	lab_anl_method_name	rt_anl_mthd
	cas_rn	rt_analyte
	chemical_name	rt_analyte
	result_type_code	rt_result_type
	lab_qualifier	rt_qualifier
	result_unit	rt_unit
	detection_limit_unit	rt_unit
Batch	lab_anl_method_name	rt_anl_mthd

IV. EDP

The EDP data checker assists the **LABORATORY** in checking EDD files to ensure that they are error-free prior to submission to ARCADIS. All laboratories providing data to ARCADIS **must use** the EDP program to verify that EDDs are without error. The EDP error reports for each file **must be** submitted with each EDD.

The use of the EDDP helps to solve common data population problems including duplicate data, incorrectly populated fields, and incorrect methods, CAS #s, and other acceptable reference values. If an EDD is received by ARCADIS containing errors it will be rejected until the EDD report is acceptable for import into the EQuIS database. Invoice payment will not be made until the EDD is acceptable.

ARCADIS will provide laboratories with the most recent version of the EDP.

Appendix B

COC Form

ARCADIS
Infrastructure, environment, facilities

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:

Contact & Company Name:

Telephone:

Address:

Fax:

City State Zip

E-mail Address:

Project Name/Location (City, State):

Project #:

Sampler's Printed Name:

Sampler's Signature:

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix

Preservative								
Filtered (✓)								
# of Containers								
Container Information								

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: _____
G. Other: _____
H. Other: _____

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other: _____
10. Other: _____

Matrix Key:
SO - Soil
W - Water
T - Tissue
SE - Sediment
SL - Sludge
A - Air
NL - NAPL/Oil
SW - Sample Wipe
Other: _____

REMARKS

Special Instructions/Comments:

☐ **Special QA/QC Instructions(✓):**

Laboratory Information and Receipt		Relinquished By	Received By	Relinquished By	Laboratory Received By
Lab Name:	Cooler Custody Seal (✓)	Printed Name:	Printed Name:	Printed Name:	Printed Name:
☐ Cooler packed with ice (✓)	☐ Intact ☐ Not Intact	Signature:	Signature:	Signature:	Signature:
Specify Turnaround Requirements:	Sample Receipt:	Firm:	Firm/Courier:	Firm/Courier:	Firm:
Shipping Tracking #	Condition/Cooler Temp: _____	Date/Time:	Date/Time:	Date/Time:	Date/Time:

Distribution: WHITE – Laboratory returns with results YELLOW – Lab copy PINK – Retained by ARCADIS

Appendix C

Laboratory Standard Operating Procedures