Site-Wide Quality Assurance Project Plan for the Natural Resource Damage Assessment of the Anniston PCB Site, Anniston, Alabama

Version 1.5

Prepared for:

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Alabama Field Office - Birmingham Sub-Office
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Prepared – September, 2013 – by:

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A PROJECT MANAGEMENT

A.1 QUALITY ASSURANCE PROJECT PLAN APPROVAL PAGE

This document has been prepared in accordance with the United States Environmental Protection Agency (USEPA) Requirements for Quality Assurance Project Plans (QAPP), USEPA QA/R-5 (March 2001; USEPA 2001a), as adapted to meet the requirements of the Natural Resource Damage Assessment of the Anniston Polychlorinated Biphenyl (PCB) Site. The following individuals have reviewed the QAPP and find that the procedures outlined in this document will result in data that can be used for evaluating the chemistry and toxicity of environmental samples collected at the Anniston PCB Site, Alabama.

Karen W Marlowe 7-29-13

Karen Marlowe, United States Fish and Wildlife Service Date
Case Manager

Carl E Orazio July 24, 2013

Carl Orazio, United States Geological Survey Date
Quality Assurance Officer

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A.3 DISTRIBUTION LIST

The Anniston PCB Site Case Manager will be responsible for distribution of this QAPP and maintain a list of those to whom it was distributed.

A.4 PROJECT/TASK ORGANIZATION

The roles and responsibilities of key project personnel are defined in this section of the QAPP. More specifically, the roles and responsibilities of personnel representing the following organizations are defined:

1. U.S. Fish and Wildlife Service (USFWS);
2. U.S. Geological Survey (USGS);
3. U.S. Army Corps of Engineers - Engineer Research and Development Center (USACE-ERDC);
4. Alabama Department of Conservation and Natural Resources (ADCNR);
5. Geological Survey of Alabama (GSA);
6. Jacksonville State University; and,
7. MacDonald Environmental Sciences Ltd. - Pacific Environmental Research Centre (MESL-PERC).

A.4.1 United States Fish and Wildlife Service (USFWS)

A list of USFWS staff members involved in the project and their specific responsibilities is provided in Table 1. USFWS is responsible for the design, planning, implementation, and oversight of all studies conducted under this QAPP. The USFWS staff associated with this project can be reached at the following addresses:

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A.4.2 United States Geological Survey (USGS)

A list of USGS staff members involved in the project and their specific roles is provided in Table 1. USGS will be responsible for the design, planning, implementation, and/or oversight of various studies conducted under this QAPP. The USGS office is located at the following address:

U.S. Geological Survey, Columbia Environmental Research Center
4200 New Haven Rd, Columbia, MO 65201

The contact information for the staff associated with this project at USGS is the following:

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A.4.3 United States Army Corps of Engineers - Engineer Research and Development Center (USACE-ERDC)

A list of USACE-ERDC staff members involved in the project and their specific roles is provided in Table 1. USACE-ERDC will be responsible for the design, planning, implementation, and/or oversight of various studies conducted under this QAPP. The USACE-ERDC office is located at the following address:

U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road, Vicksburg, MS 39180

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A.4.4 Alabama Department of Conservation and Natural Resources (ADCNR)

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A.4.5 Geological Survey of Alabama (GSA)

A list of GSA staff members involved in the project and their specific roles is provided in Table 1. GSA will be responsible for the design, planning, implementation, and/or oversight of various studies conducted under this QAPP. The GSA staff associated with this project can be reached at the following addresses:

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A.4.6 Jacksonville State University

The Jacksonville State University staff member involved in the project and his specific roles is provided in Table 1. Jacksonville State University will be responsible for the design, planning, implementation, and/or oversight of the evaluation of exposure of avian receptors to bioaccumulative substances, conducted under this QAPP. The Jacksonville State University staff associated with this project can be reached at the following address:

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A.4.7 MacDonald Environmental Sciences Ltd. - Pacific Environmental Research Centre (MESL-PERC)

MESL-PERC is the USFWS consultant for this project. A list of MESL-PERC staff members involved in the project and their specific responsibilities is provided in Table 1. MESL-PERC will be responsible for the design, planning, implementation, and/or oversight of various projects conducted under this QAPP. MESL-PERC will also review all project data and compile it in the project database. The MESL-PERC office is located at the following address:

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The contact information for the staff associated with this project at MESL-PERC is following:

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A.5 PROBLEM DEFINITION/BACKGROUND

The Anniston PCB Site is located in the north-eastern portion of Alabama in the vicinity of the municipality of Anniston in Calhoun County. Although there are a variety of land use activities within the Choccolocco Creek watershed, environmental concerns in the area have focused primarily on releases of polychlorinated biphenyls (PCBs). PCBs were manufactured by Monsanto, Inc. at the Anniston facility from 1935 to 1971. During production, PCBs may have been released from the facility in production waste effluent discharges, uncontrolled releases from landfills, accidental spills, stormwater runoff, and other sources. The total mass of PCBs released from the Anniston facility is uncertain, however.

In response to public concerns, a remedial investigation/feasibility study (RI/FS) is being conducted to assess risks to human health and ecological receptors and to evaluate remedial options for addressing environmental contamination in the Anniston PCB Site. The human health risk assessment is being conducted by the U.S. Environmental Protection Agency (USEPA), while the ecological risk assessment and the evaluation of the nature and extent of contamination are being conducted by Solutia, Inc. Based on the data that were reported by BBL (2003), environmental media from the Anniston facility to Logan Martin Dam have been contaminated by PCBs and, hence, pose potential risks to ecological receptors. Fish tissue chemistry data collected by the Alabama Department of Environmental Management (ADEM 2011) indicate that fish collected in Lay Lake, Mitchell Lake, and/or Jordon Lake have accumulated PCBs to levels that pose potential risks to fish, piscivorous wildlife, and human health.

In addition to posing risks to human health and the environment, PCBs and other hazardous substances that occur at the Anniston PCB Site have the potential to injure natural resources, including surface water resources, groundwater resources, geologic resources, air resources, and/or biological resources. To address concerns regarding the potential effects of hazardous substance releases on trust resources, the State of Alabama, acting through the ADCNR and the Geological Survey of Alabama (GSA), and the Secretary of the Interior, as represented by the Regional Director of the Southeast Region of the U.S. Fish and Wildlife Service (USFWS; collectively referred to as the Natural Resources Trustees, NRTs; hereafter referred to as the Trustees) are in the process of assessing injuries to, loss of, or destruction of natural resources from releases of hazardous substances from the Anniston PCB Site (the Site).

In conducting the natural resource damage assessment (NRDA), the Trustees are relying, to the extent possible, on the data and information that have been collected to support the RI. However, the RI was not designed to provide the Trustees with all of the data needed to conduct the NRDA. For this reason, the Trustees will need to conduct a number of NRDA-specific investigations to address certain limitations of the data generated to support the RI/FS. This QAPP is intended to provide a basis for integrating the technical and quality aspects of studies that are conducted to support the NRDA, in a manner that ensures that any studies that are conducted generate the type and quality of data needed to support the assessment.

A.5.1 Study Area

The Anniston PCB Site is located in the north-eastern portion of Alabama in the vicinity of the municipality of Anniston in Calhoun County. In response to public concerns, an RI/FS is being conducted to assess risks to human health and ecological receptors and to evaluate remedial options for addressing environmental contamination in the Anniston PCB Site. For the purposes of the RI/FS, the USEPA has defined the Site as consisting of the area where hazardous substances, including PCBs (associated with the historical and ongoing operations at the Anniston Plant by Solutia, Monsanto Company, and their predecessors), have come to be located. However, the area currently under investigation under the RI/FS extends from the Anniston facility to the mouth of Choccolocco Creek. This portion of the site was divided into four operable units, including the Solutia, Inc. facility (OU-3), Anniston non-residential (OU-2), Anniston residential (OU-1), and Choccolocco Creek (OU-4; BBL 2003). Subsequently, OU-1 and OU-2 were combined to include all of the affected aquatic and floodplain areas within the Snow Creek watershed.

The nature and extent of contamination at the Site has not been fully characterized and the boundaries of the assessment area remain uncertain. Based on information available to the Trustees, the boundaries will likely encompass uplands in the vicinity of the Solutia Anniston facility and aquatic and riparian areas associated with portions of Snow Creek, Choccolocco Creek, and the Coosa River from Neely Henry Dam to Lay Dam (Figure 1). At this time, it is uncertain if significant levels of contamination persist in surface waters downstream of the Coosa River, including the Alabama River, Mobile River, Mobile-Tensaw River Delta, and Mobile Bay. The nature and extent of contamination of terrestrial wildlife habitat is also uncertain at present. For the purposes of the NRDA, the Trustees have defined the Site as the 11th Street ditch, Snow Creek, Choccolocco Creek, Coosa River (including, but not limited to, Lay Lake and Lake Logan Martin), and associated floodplains.

A.5.2 Sources and Releases of Hazardous Substances

Operations at the Anniston facility began in 1917 with the production of ferro-manganese, ferro-silicon, and ferro-phosphorous compounds by the Southern Manganese Corporation (BBL 2000). The Southern Manganese Corporation began production of organic compounds, including biphenyls, in 1927. In 1927, the Southern Manganese Corporation became the Swann Chemical Company. In the same year, Swann Chemical Company initiated biphenyl production at the Anniston facility. However, information available at this time does not indicate whether the biphenyls were chlorinated to form PCBs. Monsanto purchased the Swann Chemical Company in 1935. Following the acquisition, Monsanto produced PCBs, parathion, phosphorous pentasulfide, paranitrophenol, and polyphenyl. PCB production continued until the early 1970s (USEPA 2001b). Production of parathion and phosphorous pentasulfide ceased in the mid-1980s. Monsanto spun off its chemical division into a new corporation, named Solutia, Inc., in 1997 (USEPA 2001b). Solutia currently produces paranitrophenol and polyphenyl compounds at the Anniston facility.

Identification of chemicals of potential concern (COPCs) represents an essential element of the problem formulation process (USEPA 1998). To initiate this process, Golder Associates Ltd. (1998) developed a preliminary list of COPCs by reviewing:

- Historical data associated with previous investigations and remediation programs;
- Production and waste processes at the Solutia, Inc. facility;
- Potential aerobic and anaerobic degradation products related to the production and waste processes; and,
- Previously identified constituents at the Solutia, Inc. facility.

The preliminary list of COPCs that were identified by Golder Associates Ltd. (1998) was further reviewed to eliminate those that posed low health or environmental risks, with the primary selection criterion being frequency of detection. If a candidate COPC was not confirmed to be present, it was eliminated from further consideration (BBL 2003). Substances were considered to pose a low health risk if measured concentrations were below human health risk-based and regulatory values (e.g., USEPA Maximum Contaminant Levels; MCLs). Application of these procedures resulted in the identification of a total of 28 COPCs, including (BBL 2003):

- **Metals**
  - Arsenic (As)
  - Barium (Ba)
  - Beryllium (Be)
  - Cadmium (Cd)
  - Chromium (Cr)
  - Cobalt (Co)
  - Lead (Pb)
  - Manganese (Mn)
  - Mercury (Hg)
  - Nickel (Ni)
  - Vanadium (V)

- **Organophosphate (OP) Pesticides**
  - Parathion
  - Methyl Parathion
  - Tetraethyldithiopyrophosphate (Sulfotep)

- **Semi-Volatile Organic Compounds (SVOCs)**
  - 1,2-dichlorobenzene
  - 1,4-dichlorobenzene
  - 2,4-dichlorophenol
  - 2,4,5-trichlorophenol
  - 2,4,6-trichlorophenol
  - 4-nitrophenol (paranitrophenol; PNP)
  - o,o,o-triethylphosphorothioate

- PCBs (Aroclors)
- Phenol
- Pentachlorophenol (PCP)

• **Volatile Organic Compounds (VOCs)**
- 1,1,2,2-tetrachloroethane
- Chlorobenzene
- Isopropyl benzene (Cumene)
- Methylene chloride

While the list of COPCs developed by BBL (2003) provides a reasonable starting point for identifying COPCs, there are a number of other substances that may have been released into Snow Creek or Choccolocco Creek, including:

- Polycyclic aromatic hydrocarbons (PAHs; 13 parent PAHs and alkylated PAHs);
- PCBs (congeners);
- Polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs);
- Other metals (copper - Cu, silver - Ag, zinc - Zn);
- Other chlorophenols; and,
- Sodium fluoroacetate (Compound 1080).

A list of all COPCs considered during projects conducted under this QAPP is provided in Table 2. During the course of the NRDA, the Trustees may conduct a number of investigations to determine if releases of one or more of these COPCs have injured natural resources in the study area.

A.5.3 Purpose and Scope

The purpose of the QAPP is to document the steps that will be taken to ensure that good quality data are generated during the studies that are undertaken to support the NRDA process. These steps include:

- Documentation of data quality objectives (DQOs);
- Establishment of performance criteria for measurement data; and,
- Identification of the quality assurance/quality control measures that will be followed in the field to ensure data quality.

Each of these steps in the project data quality assurance/quality control plan are discussed in the following sections of this document.

A.6 TASK DESCRIPTIONS

To provide the data and information needed to evaluate injury to natural resources, the Trustees will, to the extent possible, rely upon the results of investigations conducted under the RI/FS. Because the RI was not designed to support the NRDA process, the Trustees will also need to conduct a number of additional studies to provide the data and information needed to evaluate and quantify injuries to natural resources. Design and implementation of such NRDA-specific studies will necessitate completion of a number of tasks, including:

- Development of conceptual sampling plans;
- Development of field sampling plans (FSPs);
- Implementation of sampling programs;
- Provision of oversight on analytical laboratories;
- Evaluation and/or validation of study-generated data;
- Development of a project database;
- Evaluation of injury to natural resources;
- Quantification of injury to natural resources; and,
- Determination of damages associated with natural resource injuries.

Each of these tasks is briefly described in the following sections of this document.

A.6.1 Development of Conceptual Sampling Plans

The conceptual site model represents a particularly important component of the problem formulation process because it enhances the level of understanding regarding the relationships between human activities and ecological receptors at the site under consideration. Specifically, the conceptual site model describes key relationships between stressors and receptors at the site. In so doing, the conceptual site model provides a framework for predicting effects on ecological receptors and a template for generating testable hypotheses (USEPA 1997; 1998). The conceptual site model also provides a means of highlighting what is known and what is not known about a site. In this way, the conceptual site model provides a basis for identifying data gaps and designing sampling programs to acquire the information necessary to complete the assessment.

The Trustees, in conjunction with USEPA, have developed a conceptual site model that describes the possible relationships between releases of COPCs and potential effects on receptors at the site (MESL and CanTox 2004). The Trustees have also acquired, evaluated, and compiled data and information relevant to the NRDA of the Anniston PCB Site. By integrating this information, the Trustees have been able to identify a number of critical data gaps relative to the injury determination and quantification process. For each of the studies that are intended to fill critical data gaps, the Trustees expect to develop a conceptual sampling plan that:

- Describes the goals and objectives of the investigation;
- Identifies the scope of the study area;
- Lists the selection criteria for candidate sampling locations;
- Describes the proposed sampling methods; and,
- Establishes the budget for completing the sampling program.

The conceptual sampling program design will provide the technical basis for developing a field sampling plan to guide the implementation of the investigation.

A.6.2 Development of Field Sampling Plans

For each of the NRDA-specific investigations that are conducted by the Trustees, a detailed FSP will be developed and included as an appendix to the site-wide QAPP. The FSPs that are so developed will, at minimum, include the following elements:

- Introduction;
- Study Purpose and Objectives;
- Sampling Plan Design;
- Sampling Timing;
- Composition, Roles and Responsibilities of Sampling Team;
- Sample Designation;
- Sampling Methods and Equipment;
- Sample Handling, Preparation, and Transport Methods;
- Decontamination Procedures;
- Procedures for Avoiding Sample Contamination;
- Procedures for Avoiding Exposure to Contamination;
- Chemicals of Concern; and,
- Sampling Program Logistics.

The FSPs that are developed to support the implementation of each specific study will be developed by or in conjunction with the Principal Investigator and will be reviewed by the members of the study team.

A.6.3 Implementation of Sampling Plans

During the course of the NRDA, the Trustees will conduct a number of investigations to address the critical data gaps that are identified. The implementation of each of these studies will be guided by the corresponding FSP and the site-wide QAPP (i.e., this document). In addition, the site-wide Health and Safety Plan will be adhered to during the implementation of each of these studies.

A.6.4 Provision of Oversight on Analytical Laboratories

The Trustees may utilize a number of laboratories to generate the data and information needed to complete the NRDA. To ensure that the data generated by these facilities are provided on time and according to specifications, the Trustees will maintain an active laboratory oversight program. More specifically, the Trustees will work with the laboratories to ensure that:

- The appropriate facilities to store and prepare samples are available;
- The appropriate instrumentation and staff are applied to provide data of the required quality within the required time period;
- All operations are governed by good laboratory practices;
- Laboratory personnel have the appropriate training or certification;
- Scheduled maintenance is conducted on analytical balances, laboratory equipment and instrumentation;
- Analytical balances are routinely calibrated using a set of standard reference weights (ASTM class, National Institute of Standards and Technology (NIST) Class S-1, or equivalents);
- All analytical data are recorded in logbooks, with each entry signed and dated by the analyst; and,
- The temperatures of cold storage areas and freezer units are monitored and documented.

Laboratory operations will be evaluated internally by laboratory quality assurance (QA) personnel through technical systems audits, performance evaluation studies, and performance in the NIST-managed inter-laboratory comparison program. The results of such evaluations should be provided to the project QA Officer for review. Personnel in any laboratory performing analyses for this damage assessment should be well-versed in good laboratory practices, including standard safety procedures. It is the responsibility of the laboratory manager and/or supervisor to ensure that safety training is mandatory for all laboratory personnel. The laboratory is responsible for maintaining a current safety manual in compliance with the Occupational Safety and Health Administration (OSHA) or equivalent state or local regulations. Proper procedures for safe storage, handling and disposal of chemicals should be followed at all times. Each chemical should be treated as a potential health hazard and good laboratory practices should be implemented accordingly. The results of audits, studies, and other QA-related activities will be submitted to the Trustees for review and evaluation.

A.6.4.1 Quality Assurance Documentation

All laboratories participating in Trustee-led studies must be signatories to the latest revision of the Anniston NRDA QAPP. In addition, the following documents and information must be current and available to all laboratory personnel participating in the processing of the Anniston samples:

- Laboratory Standard Operating Procedures (SOPs) - Detailed instructions for performing routine laboratory procedures; and,
- Control charts or data tables - These must be developed and maintained throughout the project for appropriate analyses and measurements.

A.6.4.2 Laboratory Systems Audits

Prior to sample analysis, QA systems audits will be performed. The laboratory audits will be conducted by laboratory QA personnel. The checklists used for the laboratory audits are based on requirements outlined in "Good Laboratory Practice Standards" (*40 CFR Part 792*) and audit procedures of the USEPA National Enforcement Investigations Center, "NEIC Procedures Manual for the Contract Evidence Audit and Litigation Support for EPA Enforcement Case Development" (*EPA 330/9-89-002*). The Laboratory Project Managers will be informed of the findings and recommendations of the audit before the auditors leave the facility. A written report discussing the audits will be submitted to the Case Manager. Laboratory audits may be requested at any time throughout the duration of the NRDA.

A.6.4.3 Participation in Inter-Laboratory Comparison Exercises

Each analytical laboratory performing PCB and other analyses is required to participate in the inter-laboratory comparison exercises managed by NIST. A variety of samples including sample extracts and representative matrices (e.g., sediment or tissue samples) are utilized in these exercises, which typically take place once a year. Laboratories are required to analyze the sample(s) in the same manner as specified in this QAPP. Laboratories that fail to achieve acceptable performance will be required to provide an explanation to the Laboratory QA Coordinator and the Case Manager, and/or undertake appropriate corrective actions.

A.6.5 Evaluation and Validation of Project Data

The purpose of this QAPP is to guide the generation and documentation of analytical data of known, acceptable, and defensible quality. The quality of the data is described using a set of statements that establish, in precise quantitative terms, the level of uncertainty that can be associated with the data without compromising their intended use. These statements are contained within the performance criteria for measurement data and are typically expressed in terms of precision, accuracy, representativeness, completeness, and comparability. These terms are described in detail in Section A.7 of this document. The data collected during the NRDA-specific investigation will be evaluated and/or validated to determine their usability in the NRDA.

A.6.6 Development of the Project Database

A database will be developed in MS Access or similar format to store all the data that will be used in the NRDA. The project database will be a relational database, which means that the database consists of several tables that can be linked together (i.e., through relationships that have been defined) to facilitate retrieval of the data in a wide variety of ways. The purpose of defining relationships is to coordinate the retrieval of information from the different tables in the database (i.e., different types of data on a single sample). The main advantage of a relational database is that queries, forms, and reports can be created to display information from several tables at once. A relationship works by matching data in key fields in the data tables to provide a unique identifier for each data record. The types of data that will be targeted for inclusion in the project database are as follows:

- Surface water chemistry data;
- Whole-sediment chemistry data;
- Pore-water chemistry data;
- Soil chemistry data;
- Tissue chemistry data for fish, invertebrates, and birds/bird eggs;
- Acute and chronic sediment toxicity data;
- Bioaccumulation data;
- Geographic coordinate information for each sampling site; and/or,
- Quality Assurance/Quality Control (QA/QC) data for each chemical, physical, and biological parameter.

A.7 QUALITY OBJECTIVES AND PERFORMANCE CRITERIA FOR MEASUREMENT DATA

The characteristics that are typically used to define data quality are accuracy, precision, completeness, comparability, representativeness, and method sensitivity. The definition and application of these parameters to this project are discussed below. The Data Quality Objectives (DQOs) for the individual studies that are conducted by the Trustees to support the NRDA will be included in the FSP for each study. The performance criteria for measurement data, expressed in terms of sensitivity, accuracy, precision, and completeness, are listed in:

- Table 3 for surface water and pore water;
- Table 4 for sediments;
- Table 5 for soils; and,
- Table 6 for biological tissues.

The precision and accuracy objectives specified in Tables 3-6 are based on standard method performance information, when available, and historical laboratory performance. Lists of the parameters that may be analyzed in environmental samples, along with applicable chemical analytical methods, sample volume requirements, and holding times are listed in:

- Table 7 for surface water;
- Table 8 for pore water;
- Table 9 for sediments;
- Table 10 for soils; and,
- Table 11 for biological tissues.

The analytical methods and Standard Operating Procedures (SOPs) that will be used during the various studies that are conducted by the Trustees are listed in:

- Table 12 for surface water and pore water;
- Table 13 for sediments;
- Table 14 for soils; and,
- Table 15 for biological tissues.

Definitions of the parameters that will be used to evaluate data quality and the methods that will be used to achieve the performance criteria for measurement data are provided in the following sections.

A.7.1 Accuracy

Accuracy is a measure of the bias of a system or measurement. It is the closeness of agreement between an observed value and an accepted value. For this project, accuracy of chemical measurements will be determined through the analysis of standard reference materials, spiked samples, and method blanks. Recovery of target analytes will be assessed by comparison to reference values or historical recoveries (for partial extraction methods). Spikes will be added at both low and high concentration ranges for recovery assessment.

Method blanks will be prepared with each set of samples during chemical preparation to assess contamination associated with laboratory processing.

For toxicity tests, no true accuracy measurements are possible because of the lack of true values. Instead, test acceptability is addressed through:

- Measurement of water quality parameters within acceptable ranges relative to standard methods for conducting toxicity tests (e.g., ASTM 2012);
- Test acceptability for organisms in the negative control (without the addition of the test chemical) will be in accordance with performance-based criteria outlined in ASTM (2012), Mount (2011), and USEPA (2000); and,
- Reference toxicant tests (i.e., positive controls) will be performed to evaluate the sensitivity of culture organisms to select chemicals.

A.7.2 Precision

Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. For the studies conducted under this QAPP, measures of analytical precision will be determined by the analysis of laboratory duplicates. Laboratory duplicates will be prepared by splitting a sample in the laboratory, and carrying the sub-samples through the entire analytical process. Precision will be expressed in terms of the relative percent difference (RPD) for all analyses for which duplicates are performed. RPD is calculated as follows:

$$RPD = \frac{(C1 - C2)}{(C1 + C2)/2} \times 100$$

C1 = larger measured value; and,
C2 = smaller measured value.

A.7.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Target completeness values are 90% for chemical analyses of surface water, pore water, sediment, soil, and biological tissues. For toxicity testing and toxicity test ancillary measurements, target completeness is also 90%. Completeness is defined as follows for all measurements:

$$\%C = 100 \times \frac{V}{n}$$

%C = percent completeness;
V = number of measurements judged valid; and,
n = total number of measurements necessary to achieve a specified statistical level of confidence in decision making.

A.7.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness will be addressed primarily in the experimental design and through the selection of appropriate analytical and toxicity testing procedures. Representativeness also will be ensured by the proper handling and storage of samples and analysis within the accepted holding times so that the material analyzed reflects the material collected as accurately as possible. Representativeness of data will be discussed, when appropriate, in the final reports that are prepared to summarize the results of the various Trustee-led studies.

A.7.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another. For the data compiled to support the NRDA of the Anniston PCB Site, the results of chemical analyses of surface water, pore water, whole-sediment, soil, or biological tissues will be considered to be comparable if the measured concentrations generated by one laboratory are within 20% of the concentrations measured by the second laboratory. For whole-sediment toxicity, the control-adjusted response measured by one laboratory should be within 10% of the control-adjusted response measured by the second laboratory for the survival, growth, and biomass endpoints; results within ±20% will be considered to be comparable for all other endpoints. Comparability of other data will be discussed, when appropriate, in the final reports that are prepared to summarize the results of the various Trustee-led studies.

A.7.6 Sensitivity

Sensitivity is the capability of methodology or instrumentation to discriminate among measurement responses for quantitative differences of a parameter of interest. Sensitivity for this project will be defined as detection limits that are achieved for chemical analyses of surface water, pore-water, sediment, soil, or biological tissues. The detection limit is the minimum concentration of a substance that can be measured and reported. Target detection limits for the analytes of interest are presented in Tables 3 to 6, and are based on the applicable methods.

A.8 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

The purpose of this section is to ensure that any specialized training requirements necessary to complete this project are described in enough detail to ensure that specific skills can be verified, documented, and updated as necessary.

A.8.1 Training

Each of the individuals selected to participate in the Trustee-led studies conducted under this QAPP has the specialized training and experience needed to fulfill their role and responsibilities. Hence, no additional formal training is needed to fulfill the objectives of this assessment. However, informal training will be provided to ensure that project participants are afforded all of the information that they need to engage effectively in project-related activities, including:

- To ensure that all personnel participating in a field sampling program fully understand the goals, objectives, and methods of the study, copies of the site-wide QAPP and the associated FSP will be distributed for review several weeks prior to the initiation of the sampling program. In addition, a field sampling orientation meeting will be convened on the first full day of each sampling program to ensure that all participants are familiar with the equipment and methods that will be used to collect and process water, sediment, soil, and/or tissue samples in the field;
- All individuals participating in field sampling will be provided with a copy of the Health and Safety Plan for review and signature. In addition, a health and safety orientation meeting will be convened on the first full day of the sampling program to ensure that all participants are familiar with health and safety requirements and procedures. Furthermore, a health and safety briefing will be convened each day before the sampling teams initiate sampling efforts; and,
- All individuals participating in the analysis of water, sediment, soil, and/or tissue samples or toxicity testing have been appropriately trained and will be following established standard operating procedures and standard methods. Laboratory-specific health and safety plans are already in place for these facilities.

A.8.2 Certification

No formal certification is needed to fulfill the objectives of the studies conducted under this QAPP.

A.9 DOCUMENTATION AND RECORDS

The documents and records that will be produced or collected as part of the studies conducted under this QAPP are itemized in this section. In addition, the process and responsibilities for managing the documents that are associated with the entire project are described.

A.9.1 Quality Assurance Project Plan Document Control

This document, and all subsequent updates, will have an associated revision number displayed on the title page and the header of each subsequent page. The QAPP will be distributed in electronic format (Adobe PDF files) by the Case Manager.

A.9.2 Field Documentation

The USFWS Case Manager will ensure that the members of field teams receive the approved version of the QAPP and the associated FSP before the start of field-related activities. Minimum field records that will be maintained include:

- Field log books;
- Photo documentation;
- Field data forms; and,
- Sample tracking/Chain-of-custody (COC) forms.

Examples of the field data forms, field COC forms, and laboratory COC forms that will be used during this project are presented in Appendices 1 and 2.

A.9.3 Laboratory Documentation

Full laboratory data reports will be provided in electronic format to the USFWS Case Manager following the completion of chemical analyses and/or toxicity testing. The Case Manager will be responsible for any data evaluation or validation that is conducted on the surface-water chemistry, pore-water chemistry, sediment chemistry, soil chemistry, biological tissue chemistry, and whole-sediment toxicity data. In addition, the Case Manager will be responsible for archiving the data and associated final reports that are produced during the course of the study.

At the conclusion of all chemical analyses, a report will be prepared that, at minimum, includes the following information:

- A cover letter briefly describing analytical procedures and discussing any difficulties that were encountered;
- Sample receipt and analysis dates;
- Description of pore-water sampling methods;
- Description of analytical methods;
- Final analyte concentration data, including reporting limits, data qualifiers, and re-analyses;
- Results of analyses conducted to evaluate analytical accuracy (i.e., results for matrix spike [MS] and standard reference materials);
- Results of analyses conducted to evaluate analytical precision (i.e., results for MS/MS duplicates [MSD] and laboratory control samples/laboratory control sample duplicates [LCS/LCSD] samples);
- Results of analyses conducted to evaluate sample contamination (i.e., results for method blanks);
- Case narrative;
- Summary of any problems encountered and corrective actions taken; and,
- Description of any deviations from prescribed laboratory protocols.

At the conclusion of all toxicity testing, a report will be prepared that, at minimum, includes the following information:

- A cover letter briefly describing toxicity testing procedures and discussing any difficulties that were encountered;
- Sample receipt and test initiation dates for each toxicity test;
- Description of toxicity testing methods;
- A summary of toxicity test results, including results for negative control and positive control (reference toxicant) samples;
- A summary of overlying water quality measurements;
- An evaluation of the acceptability of each toxicity test, by batch (if relevant);
- Case narrative;
- Summary of any problems encountered and corrective actions taken;
- Description of any deviations from prescribed laboratory protocols; and,
- Original data reports and laboratory worksheets, as applicable.

All project-supporting records and documents will be archived with USFWS and the data-generating laboratory after completion of the final data report.

A.9.4 Data Quality Verification

All data packages generated during this study will be evaluated by the USFWS study team to ensure data quality. Data evaluations will be conducted to determine accuracy, precision, sensitivity, and completeness of surface-water chemistry, sediment-chemistry, pore-water chemistry, soil chemistry, and biological tissue chemistry data. In addition, sediment-toxicity data will be evaluated to determine test acceptability. USFWS will coordinate data validation, as required, for all of the data packages that are prepared during the course of the studies conducted under this QAPP.

A.9.5 Data Reporting Package Archiving and Retrieval

The Natural Resource Damage Assessment and Restoration (NRDAR) activities for the Anniston PCB Site are under a Litigation Hold. As such, all information concerning the NRDAR must be preserved until the USDOI Solicitor directs otherwise. Types of information to be preserved include paper documents, electronically stored information, other materials such as maps, calenders, charts, and similar items, as well as any communications concerning the subject matter of the litigation.

B DATA GENERATION AND ACQUISITION

B.1 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

The design of each study conducted under the site-wide QAPP for the Annistion PCB Site will be described in the associated FSP and included as an Appendix to this QAPP.

B.2 SAMPLING METHODS

The sampling methods that are to be used in each of the studies that are undertaken by the Trustees under this QAPP will be described in the associated FSP for the study. The FSP for each study will be included as an Appendix to this QAPP.

B.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The methods that will be used handle, store, ship, and prepare surface water, pore water, sediment, soil, and/or biological tissue samples will be described in the associated FSP for the study. Field COC forms will be used to document the transfer of all surface water, pore water, sediment, soil, and/or biological tissue samples in the field to track the collection, transport, and storage of those samples. Laboratory COC forms will be used to document the transfer of samples from field personnel to the various analytical and/or toxicity testing laboratories. All COC forms will be scanned and maintained in the USFWS project database.

B.4 ANALYTICAL METHODS REQUIREMENTS

Lists of the variables that will be measured in environmental samples, along with applicable chemical analytical methods, sample volume requirements, and holding times are listed in:

- 7 for surface water;
- 8 for pore water;
- 9 for sediments;
- 10 for soils; and,
- 11 for biological tissues.

B.5 QUALITY CONTROL REQUIREMENTS

Quality control (QC) is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards (USEPA 2001c). This process verifies that the results meet the stated requirements established by the customer. To meet requirements, laboratories will evaluate technical performance (i.e., laboratory variability) using quality control measures such as:

- Split Samples (i.e., laboratory duplicates) - Two or more samples collected from a common source material. The purpose of a split sample is to estimate the variability in measurements of the concentration of a given contaminant. A split sample will be collected at a 10% frequency of samples collected per media or partial set of samples (whichever is more frequent).
- Matrix-Spike and Matrix-Spike-Duplicate (MS and MSD) Samples - MS/MSD will be prepared to support evaluations of analytical accuracy and analytical precision (i.e., at the rate of one MS and one MSD sample for every 20 field-collected samples analyzed).
- Standard Reference Material - In addition to the results of chemical analyses conducted on duplicate samples (i.e., that are prepared in the wet laboratory), data quality will be evaluated using the data generated by each analytical laboratory as part of their routine QA/QC programs. More specifically, each laboratory will run at least one standard reference material with each batch

of field-collected samples to provide the data needed to evaluate analytical accuracy.

- Surrogate-Spiked Samples - Each field-collected sample will be spiked in the lab prior to analysis with surrogate compounds to support recovery of target analytes from the environmental matrix.
- Laboratory Blank Sample - At least one laboratory blank sample will be run with each batch of samples to support evaluations of the potential for contamination of samples in the lab.
- Negative and Positive Control Samples - To evaluate the acceptability of toxicity tests, both negative and positive controls will be run with each batch of samples submitted for testing.

To ensure data quality, standard QA measures will be included in the analytical programs for the studies undertaken under this QAPP. Key performance criteria for measurement data are discussed in Section A.7 of this QAPP, with the values presented in Tables 3 to 6. In addition, a reference toxicity test with sodium chloride will be performed along with toxicity tests, using procedures outlined in USEPA (2000) and in ASTM (2012; Table 16).

B.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Instruments used to measure water quality, sediment quality, soil quality and/or tissue residue characteristics will be maintained to ensure that they are in proper working order during the conduct of the studies conducted under this QAPP. Preventative maintenance requirements described by the manufacturer in the instrumentation manuals will be followed. Instruments and equipment will be inspected and maintained in basic accordance with USEPA Superfund contract laboratory program (CLP) guidance document ILM06.X - exhibit D (USEPA 2005).

B.7 INSTRUMENT CALIBRATION AND FREQUENCY

All instruments used during this project will be traceable to the data collected and will be calibrated before use. Instruments and equipment will be inspected and maintained in basic accordance with USEPA Superfund CLP guidance document ILM06.X - exhibit D (USEPA 2005). At a minimum, calibrations will include:

- Standards that are traceable to nationally recognized standard organization(s);
- Standards that are within their expiration date; and,
- Using standard concentrations that bracket the expected concentration of the sample(s).

B.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The quality of supplies and consumables used during sample collection and laboratory analysis can affect the quality of the data. All equipment that comes into contact with the samples and extracts must be sufficiently clean to prevent detectable contamination. In addition, analyte concentrations must be accurate in all standards used for calibration and quality control purposes.

The quality of waters used at the analytical and toxicity testing laboratories will be documented. In addition, all containers will be visually inspected before use and any suspect containers will be discarded. Reagents of appropriate purity and suitably cleaned equipment will be used for all stages of laboratory analysis. All certifications for standards used to calibrate instruments and all certifications for sample container cleanliness will be maintained as part of the project record. Upon receipt of the certifications, an inspection will be performed to accept the certifications. At a minimum, this inspection will include:

- A verification that the certificate matches the standard or sample container; and,
- A signature on the certificate indicating acceptance.

B.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

The data and information that will be obtained from non-measurement sources are described in this section. In addition, the intended uses of the data are described and the data quality acceptability criteria that will be used to identify high quality data are presented.

B.9.1 Past Data Collection Activities

The historic data that has been collected at the Anniston PCB Site will be compiled in database format to support the overall objectives of the project. The RI/FS represents one of the most important sources of data for use in the NRDA. All of the relevant data generated and/or compiled during the RI have been obtained from USEPA. Data from other sources will also be accessed as appropriate.

B.9.2 Intended Data Usages

The project database will represent the primary repository for the data and information that are compiled during the course of the NRDA. The primary applications of the project database are to:

- Standardize the format of the existing data sets so the data are comparable and can be combined for the purposes of data analyses;
- Allow access to the existing surface water chemistry, pore water chemistry, sediment chemistry, sediment toxicity, soil chemistry, and tissue chemistry data;
- Support evaluation of existing data for the Anniston PCB Site, including the identification of data gaps;
- Allow the data to be viewed spatially, along with other GIS-related watershed data;
- Facilitate evaluation of historic and baseline conditions;
- Support the evaluation and quantification of injury to Trust resources; and,
- Support the development of a long-term restoration monitoring program.

B.9.3 Criteria for Evaluating Candidate Data Sets

Candidate data sets from multiple sources will be evaluated to identify the highest quality data for assessing conditions in the Anniston PCB Site study area. All data sets will be evaluated according to the performance criteria for measurement data established for studies conducted under this QAPP. An example of screening criteria for evaluating candidate data sets is provided in Appendix 3. The data evaluation process is designed to be flexible to ensure that professional judgment can be used when necessary in the evaluation process. In this way, it will be possible to include as many data sets as possible and, subsequently, use them to the extent that the data quality and quantity dictates. During this QA/QC process, the methods used for sample collection, handling, and analysis in each study will be scrutinized. The results of the data evaluation process will be entered into a detailed electronic worksheet. Any outstanding data quality issues or questions will be resolved by consulting original sources and/or contacting the study authors. Finally, all decisions and assumptions that are made relative to data acceptability and data treatment will be recorded electronically in the project database or associated metadata files.

B.10 DATA MANAGEMENT

All of the data collected, generated, or produced during this project will be managed in basic accordance with USEPA recommendations (USEPA 2002). Hard copies of all daily log sheets and data sheets will be maintained in secure locations, as designated by the Case

Manager. All project-supporting records and documents will be archived until directed otherwise by the USDOI Solicitor.

This section presents an overview of the data management procedures that will be employed for this project. This includes all operations and analyses performed on raw data to change their form of expression, location, quantity, or dimensionality. For this project, these operations include data transmittal, translation, verification, reduction, conversion, analysis, tracking, storage, and retrieval.

B.10.1 Data Transmittal

Data transmittal occurs when data are transferred from one person or location to another or when data are copied from one form to another. Some examples of data transmittal are:

- Copying raw data from a notebook onto a data entry form for keying into a computer file; and,
- Electronic transfer of data over a computer network.

The Principal Investigators for each study will verify the transmittal of electronic data files to USFWS (e.g., that they have been received and that data files were not corrupted during electronic transmittal).

B.10.2 Data Translation

Data translation occurs when electronic data are converted from one format to another (e.g., from a flat-file spreadsheet in MS Excel to a vertical format in an MS Access database table). The specific QA/QC procedures that will be applied to verify translated data are presented in Appendix 4 (Data Quality Check Sheet).

B.10.3 Data Verification

All water, sediment, soil, and tissue data sets will be verified against the original data source (i.e., checked to ensure that data have been accurately translated from the original source). The specific QA/QC procedures that will be used to verify translated data and manually entered data are provided in Appendix 4 (Data Quality Check Sheet). Subsequent to verifying that the data have been incorporated into the database without introducing errors, the data will be further evaluated. This will involve an auditing process which includes:

- An analysis of outliers (i.e., to identify inconsistencies with units) and completeness (i.e., to identify missing samples or missing data);

- An examination of data qualifier fields (i.e., to ensure internal consistency); and,
- An evaluation of sample identification numbers (i.e., to ensure that data were not duplicated).

B.10.4 Data Reduction

Data reduction includes all processes that change the number of data items. For this project data reduction may involve calculating:

- The arithmetic mean of analytical duplicates;
- Various total concentrations of COPCs (e.g., total PAHs, total PCBs);
- Chemical mixture models (e.g., mean PEC-Qs);
- Toxicity test combinations (e.g., *Hyalella azteca* biomass); and,
- Benthic community structure metrics (e.g., species richness).

All procedures that involve data reduction will be carried out in electronic files separate from the main database file to avoid the possibility of introducing an error into the main database. Each calculated parameter will undergo a QA/QC check to ensure that the calculation was conducted correctly. The QA/QC check will be independent (i.e., the calculation and the QA/QC check are performed by different staff members) and involve checking either 10% or 100% of the calculated values (i.e., depending on the procedures used to perform the calculation). The specific procedures by which the various totals will be calculated are provided in Smorong *et al.* (2004). The World Health Organization (WHO) Toxic Equivalency Factors (TEFs) for humans and/or fish will be used to calculate Toxic Equivalent (TEQ) values (van den Berg *et al.* 1998). TEQs will not be calculated for samples that only have results for PCB congeners (i.e., PCDD/PCDF results are also required to support TEQ calculations).

B.10.5 Data Conversion

Data conversion, as defined for this project, is the conversion from one way of encoding data to another way. For example, converting sample results for chemical substances from units of ppb to ppm. For this project data conversion may involve:

- Converting the units of the reported sample results; and,
- Converting the geographic projection of the reported coordinate system.

All procedures that involve data conversion will be carried out in electronic files separate from the main database file to avoid the possibility of introducing an error into the main database. Each converted result will undergo a QA/QC check to ensure that the conversion was conducted correctly. The QA/QC check will be independent (i.e., the conversion calculation and the QA/QC check are performed by different staff members) and involve checking either 10% or 100% of the converted values (i.e., depending on the procedures used to perform the conversion calculation).

B.10.6 Data Analysis

The data analysis methods used in each study will be selected based on the data quality objectives that were established for the study. The results of these analyses will be summarized in tables, figures, and maps, as appropriate. Data analyses will be conducted using the following software programs: MS Excel, MS Access, SPSS, SigmaPlot, and ESRI ArcMap 10.0. All procedures that involve data analyses will be carried out in electronic files separate from the main database file to avoid the possibility of introducing an error into the main database. Each table and figure that is produced as a result of data analysis will undergo a QA/QC check to ensure that the analysis was conducted correctly. The QA/QC check will be independent (i.e., the analysis and the QA/QC check are performed by different staff members) and involve checking either 10% or 100% of the calculated values (i.e., depending on the procedures used to perform the analysis).

B.10.7 Data Tracking

The USFWS Case Manager will track the status of entering data into the project database by updating an Excel spreadsheet developed for the purpose of describing the individual data sets and recording important decisions and milestones relative to incorporating the data into the project database.

B.10.8 Data Storage

Data will be stored in a relational project database in MS Access format, as well as in Excel files that were used to calculate totals or do other analyses. All data will be backed up from the server onto external hard drives on a daily basis to ensure they are not accidentally lost or corrupted. All project-supporting records and documents will be archived for a period of at least seven years at the participating labs and USFWS after completion of the final report for the study.

B.10.9 Data Retrieval

The project database will be a relational database, which means that the database consists of several tables that can be linked together (i.e., relationships have been defined) to facilitate retrieval of the data in a wide variety of ways. The purpose of defining relationships is to coordinate the retrieval of information in the different tables (i.e., different types of data on a single sample). The main advantage of a relational database is that queries, forms, and reports can be created to display information from several tables at once. A relationship works by matching data in key fields (usually a field with the same name in both tables), and these matching fields provide a unique identifier for each data record. Hence, the data compiled in the project database will be retrieved by designing and implementing specific database queries.

C ASSESSMENT/OVERSIGHT

Effective communication is the key to providing effective assessment and oversight of project-related activities. The field and laboratory teams will stay in close contact with the USFWS Case Manager during all phases of the project. This level of communication will serve to keep the management team apprised of activities and allow for effective oversight as the project proceeds.

C.1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment and response actions will be done in basic accordance with USEPA SOP 2440.5 U.S. EPA Laboratory Quality Assurance Operating Plan. Assessments that will be performed for this project include:

- Verification of proficiency training of technicians participating on project. This will be performed by the Principal Investigators and will be conducted before starting testing or analyses;
- Data quality audit to verify QA/QC requirements were met. This will be conducted by the Laboratory QA Officer and will be conducted before submission of final report; and,
- Technical review of raw data. This will be conducted by Principal Investigators and the USFWS Case Manager. This review will ensure that all laboratory records related to the test are completed and reviewed for completeness and accuracy.

All non-conforming conditions will be documented and corrective action will be documented and completed as necessary to ensure that data quality issues are minimized.

C.2 REPORTS TO MANAGEMENT

The Principal Investigators will provide periodic written reports and a final report to the USFWS Case Manager (in accordance with agreements or contracts). These reports will include the project status, any quality, budget, schedule, or scope changes, and any quality issues that may affect the integrity of the project. In addition, non-scheduled reports may be provided from time to time to apprise management of any issues that arise and the actions that have been taken to resolve these issues.

D DATA VALIDATION AND USABILITY

Data generated in the field and in the laboratory will be verified according to the criteria and procedures described in this section. Data quality and usability will be evaluated using the procedures described in this section. The results of this evaluation will be discussed in project-related reports.

D.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

The USFWS Case Manager will maintain responsibility for data review, verification, and, as required, validation. During the review process, the performance criteria for measurement data established in Section A.7 will be used to evaluate the measurement data. When the reviewers identify suspect data, those data will be investigated to determine if the reported values are correct (e.g., by comparing raw data to the data compiled in the project database). The investigation will be documented. If the value in question is determined to be an error, the source of the error will be investigated, the correct value established if possible, and the erroneous value replaced with the correct value. If the investigation concludes that the value is suspect (possibly in error) but a correct value cannot be determined, the value will be flagged to indicate its suspect status. This process will determine whether the data can be accepted, rejected or qualified.

D.2 VALIDATION AND VERIFICATION METHODS

Validation, as required, and verification of data will be done in basic accordance with USEPA (2002; 2008; 2010). For example, a series of reviews by technical personnel will be implemented to ensure that the data generated for this project meet the data quality objectives. These reviews will include the following:

- Data will be reviewed by laboratory personnel at the end of each working day to ensure that toxicity testing or analytical activities are completely and adequately documented;
- About 10% of all calculations performed manually will be checked for accuracy by someone other than the person who performed the original calculation. Checking will be performed by qualified persons who did not participate in performing the calculations; and,
- Verification of all data entry into spreadsheets will be performed. The staff member performing the verification will ensure correct entry into the spreadsheets by comparing data with the hard copy of the data listing. If errors are discovered, the errors will be corrected and a new data listing will be generated.

The Case Manager will be responsible for determining the need for validation of each data set that is generated to support the NRDA. Any data validation that is undertaken will be conducted in accordance with USEPA (2002; 2008; 2010) procedures.

D.3 RECONCILIATION AND USER REQUIREMENTS

Any data that do not comply with the data quality objectives identified in the appropriate FSP will be flagged and discussed in the final report. Any limitations on the use of the data will also be reported. USFWS will be responsible for resolving any outstanding issues discovered during the validation and verification process.

E REFERENCES CITED

ADEM (Alabama Department of Environmental Management). 2011. Fish Tissue Monitoring Program. Data received from Michael Len, Senior Environmental Scientist, ADEM.

Anniston PCB Site Trustee Council. 2010. Anniston PCB Site Stage I Assessment Plan. Prepared by: Alabama Department of Conservation and Natural Resources, Montgomery, Alabama; Geological Survey of Alabama, Tuscaloosa, Alabama; United States Department of the Interior, and United States Fish and Wildlife Service, Birmingham, Alabama.

ASTM (American Society for Testing and Materials). 2008. Guide for collection, storage, characterization, and manipulation of sediments for toxicological testing and for selection of samplers used to collect benthic invertebrates. ASTM E1391-03 (2008). Annual Book of ASTM Standards Volume 11.06. West Conshohocken, Pennsylvania.

ASTM (American Society for Testing and Materials). 2012. Standard test method for measuring the toxicity of sediment-associated contaminants with freshwater invertebrates (ASTM E1706-05). Annual Book of ASTM Standards Volume 11.06, West Conshohocken, PA.

BBL (Blasland, Bouck, and Lee, Inc.). 2000. Off-Site RCRA Facility Investigation (RFI) Report. Prepared for Solutia, Inc. Anniston, Alabama.

BBL (Blasland, Bouck, and Lee, Inc.). 2003. Phase I - Conceptual Site Model Report for the Anniston PCB Site. Volume 1 of 2. Prepared for Solutia, Inc. Anniston, Alabama.

Brumbaugh, W.G., M.A. Mora, T.W. May, and D.N. Phalen. 2010. Metal exposure and effects in voles and small birds near a mining haul road in Cape Krusenstern National Monument, Alaska. Environmental Monitoring and Assessment 170: 73-86.

Golder Associates Limited. 1998. RFI/CS Work Plan for the Anniston, Alabama facility. (As cited in BBL 2003).

MESL (MacDonald Environmental Sciences Ltd.) and Cantox (Cantox Environmental, Inc.). 2004. Anniston PCB site remedial investigation/feasibility study (RI/FS): Ecological risk assessment (ERA). Prepared for: United States Environmental Protection Agency. Edison, New Jersey. Prepared by MESL, Nanaimo, British Columbia and Cantox, Ottawa, Ontario.

Mount, D.R.. 2011. Suggested requirements and performance criteria for laboratories conducting sediment toxicity tests. Memorandum dated November 23, 2011 to D.S. Ireland, Great Lakes National Program Office, Chicago IL. U.S. Environmental Protection Agency, Duluth, MN.

Smorong, D.E., C.L. Mackenzie, J.L. Crane, D.D. MacDonald, L.J. Fisher, and C.A. Huntington. 2004. Phase II GIS-based sediment quality database for the St. Louis River Area of Concern (AOC). Technical documentation. MacDonald Environmental Sciences Ltd., Nanaimo, BC and Minnesota Pollution Control Agency, St. Paul, Minnesota.

USEPA (United States Environmental Protection Agency). 1997. Ecological risk assessment guidance for Superfund: Process for designing and conducting ecological risk assessments. Environmental Response Team. Edison, New Jersey.

USEPA (United States Environmental Protection Agency). 1998. Guidelines for ecological risk assessment. Risk Assessment Forum. EPA/630/R-95/002F. Washington, District of Columbia.

USEPA (United States Environmental Protection Agency). 2000. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. Second Edition. EPA 600/R-99/064. Duluth, Minnesota and Washington, District of Columbia.

USEPA (United States Environmental Protection Agency). 2001a. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. EPA/240/B-01/003. March 2001. Office of Environmental Information, Washington, District of Columbia.

USEPA (United States Environmental Protection Agency). 2001b. U.S. EPA Fact Sheet: Anniston Site, Anniston, Calhoun County, Alabama. United States Environmental Protection Agency, Atlanta, Georgia. 823-B-94-004. 4 p.

USEPA (United States Environmental Protection Agency). 2001c. EPA Requirements for Quality Management Plans. EPA QA/R-2. EPA/240/B-01/002. March 2001. Office of Environmental Information, Washington, District of Columbia.

USEPA (United States Environmental Protection Agency). 2002. Guidance on Environmental Data Verification and Data Validation. EPA QA/G-8. EPA/240/R-02/004. U.S. Environmental Protection Agency. Washington, District of Columbia.

USEPA (United States Environmental Protection Agency). 2005. USEPA Contract Laboratory Program statement of work for inorganic analysis; Multi-media, multiconcentration inorganic analysis, ILM06.X. Exhibit D - Analytical Methods. Draft, November 2005. Superfund Analytical Services, Contract Laboratory Program.

USEPA (United States Environmental Protection Agency). 2008. National functional guidelines for Superfund organic methods data review. USEPA 540-R-08-01. OSWER 9240.1-48. USEPA Contract Laboratory Program. Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, District of Columbia.

USEPA (United States Environmental Protection Agency). 2010. National functional guidelines for inorganic Superfund data review. USEPA 540-R-10-011. OSWER 9240.1-51. USEPA Contract Laboratory Program. Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, District of Columbia.

van den Berg, M., L. Birnbaum, A.T.C. Bosveld, B. Brunström, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leeuwen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environmental Health Perspective 106:775-792.

Tables

Table 1. List of staff members involved in the project and their specific responsibilities.

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Table 2. Chemicals of potential concern for the Natural Resource Damage Assessment of the Anniston PCB Site.

Group/Substance	Surface Water	Pore Water	Sediment	Soil	Biological Tissues
Metals					
Arsenic	✓	✓	✓	✓	
Barium	✓	✓	✓	✓	
Beryllium	✓	✓	✓	✓	
Cadmium	✓	✓	✓	✓	
Chromium	✓	✓	✓	✓	
Cobalt	✓	✓	✓	✓	
Copper	✓	✓	✓	✓	
Lead	✓	✓	✓	✓	✓
Mangenese	✓	✓	✓	✓	
Mercury (total)	✓	✓	✓	✓	✓
Mercury (methyl)	✓	✓	✓	✓	✓
Nickel	✓	✓	✓	✓	
Silver	✓	✓	✓	✓	
Vanadium	✓	✓	✓	✓	
Zinc	✓	✓	✓	✓	
Orthophosphate & Other Pesticides					
Methyl Parathion	✓	✓			
Parathion	✓	✓			
Sodium fluoroacetate	✓	✓			
Tetraethyldithiopyrophosphate (Sulfotep)	✓	✓			
Semi-Volatile Organic Compounds (SVOCs)					
1,2-dichlorobenzene			✓	✓	
1,4-dichlorobenzene			✓	✓	
2,4,5-trichlorophenol			✓	✓	
2,4,6-trichlorophenol			✓	✓	
2,4-dichlorophenol			✓	✓	
4-nitrophenol			✓	✓	
o,o,o-triethylphosphorothioate	✓	✓			
Pentachlorophenol (PCP)			✓	✓	✓
Phenol			✓	✓	
Volatile Organic Compounds (VOCs)					
1,1,2,2-tetrachloroethane	✓	✓	✓		
Chlorobenzene	✓	✓	✓		
Isopropyl benzene (cumene)	✓	✓	✓		
Methylene chloride	✓	✓	✓		
Polychlorinated Biphenyls (PCBs)					
PCBs (Aroclors)			✓	✓	✓
PCBs (Homologs)			✓	✓	✓

Table 2. Chemicals of potential concern for the Natural Resource Damage Assessment of the Anniston PCB Site.

Group/Substance	Surface Water	Pore Water	Sediment	Soil	Biological Tissues
Polychlorinated Biphenyls (PCBs; cont.)					
PCB Coplanar Congeners (77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)			✓	✓	✓
Additional PCB Congeners (5/8,8,15,18,18/17,28,29,31,37,44,45,47,49,52, 56,58,60,61/70,66,70,74,77/110,79,80,87,87/ 115,90/101,95,99,101,108,108/118/149,110, 127,128,132/153,138/160,138,146,149,151, 153,158,159/182/187,162,170,170/190,174, 177,180,183,187,194,195,195/208,201,201/ 157/173,206,209)			✓	✓	✓
Parent and Alkylated Polycyclic Aromatic Hydrocarbons (PAHs)					
Acenaphthene			✓	✓	
Acenaphthylene			✓	✓	
Anthracene			✓	✓	
Benz(a)anthracene			✓	✓	
Benzo(a)pyrene			✓	✓	
Benzo(b)fluoranthene			✓	✓	
Benzo(e)pyrene			✓	✓	
Benzo(g,h,i)perylene			✓	✓	
Benzo(k)fluoranthene			✓	✓	
C1-chrysenes			✓	✓	
C1-fluorenes			✓	✓	
C1-naphthalenes			✓	✓	
C1-phenanthrenes/anthracenes			✓	✓	
C1-pyrenes/fluoranthenes			✓	✓	
C2-chrysenes			✓	✓	
C2-fluorenes			✓	✓	
C2-naphthalenes			✓	✓	
C2-phenanthrenes/anthracenes			✓	✓	
C3-chrysenes			✓	✓	
C3-fluorenes			✓	✓	
C3-naphthalenes			✓	✓	
C3-phenanthrenes/anthracenes			✓	✓	
C4-chrysenes			✓	✓	
C4-naphthalenes			✓	✓	
C4-phenanthrenes/anthracenes			✓	✓	
Chrysene			✓	✓	
Dibenz(a,h)anthracene			✓	✓	
Fluoranthene			✓	✓	
Fluorene			✓	✓	
Indeno(1,2,3-c,d)pyrene			✓	✓	

Table 2. Chemicals of potential concern for the Natural Resource Damage Assessment of the Anniston PCB Site.

Group/Substance	Surface Water	Pore Water	Sediment	Soil	Biological Tissues
Parent and Alkylated Polycyclic Aromatic Hydrocarbons (PAHs; cont.)					
Naphthalene			✓	✓	
Perylene			✓	✓	
Phenanthrene			✓	✓	
Pyrene			✓	✓	
Dioxins & Furans					
2,3,7,8-TCDD			✓	✓	✓
1,2,3,7,8-PeCDD			✓	✓	✓
1,2,3,4,7,8-HxCDD			✓	✓	✓
1,2,3,6,7,8-HxCDD			✓	✓	✓
1,2,3,7,8,9-HxCDD			✓	✓	✓
1,2,3,4,6,7,8-HpCDD			✓	✓	✓
OCDD			✓	✓	✓
2,3,7,8-TCDF			✓	✓	✓
1,2,3,7,8-PeCDF			✓	✓	✓
2,3,4,7,8-PeCDF			✓	✓	✓
1,2,3,4,7,8-HxCDF			✓	✓	✓
1,2,3,6,7,8-HxCDF			✓	✓	✓
1,2,3,7,8,9-HxCDF			✓	✓	✓
2,3,4,6,7,8-HxCDF			✓	✓	✓
1,2,3,4,6,7,8-HpCDF			✓	✓	✓
1,2,3,4,7,8,9-HpCDF			✓	✓	✓
OCDF			✓	✓	✓

Table 3. Chemicals of potential concern and associated performance criteria for surface water and pore water measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Conventionals						
Water Temperature (°C)	NA	YSI Pro 2030 Meter (in situ)	NA	±0.2 °C	10	100
Dissolved Oxygen (mg/L)	NA	YSI Pro 2030 Meter (in situ)	NA	±0.2 mg/L	10	100
Alkalinity (mg/L $CaCO_3$)	NA	Orion EA940 Meter or APHA standard method 2320	NA	±5 mg/L	10	100
Hardness (mg/L $CaCO_3$)	NA	USEPA 130.2	NA	±5 mg/L	10	100
Conductivity (µS/cm)	NA	USEPA 120.1	NA	±5µS/cm	10	100
pH (units)	NA	Orion EA 940	NA	±0.1 unit	10	100
DOC (mg/L)	0.1	USEPA 415.1	0.1 - 0.2 [a]	±0.1 mg/L	10	90
Total ammonia (NH_3; mg/L)	0.387	Orion EA 940 Meter	0.1 [a]	±0.1 mg/L	20	90
Hydrogen sulfide (H_2S; mg/L)	0.2	Orion Model 94-16	0.1 [a]	±0.1 mg/L	20	90
Major Anions (mg/L)						
Chloride	23	USEPA 300.0	0.02 [b]	80-120%	10	90
Fluoride	0.12	USEPA 300.0	0.01 [b]	80-120%	10	90
Nitrate-N	2.9	USEPA 300.0	0.002 [b]	80-120%	10	90
Nitrite-N	0.06	USEPA 300.0	0.004 [b]	80-120%	10	90
Sulfate	10	USEPA 300.0	0.02 [b]	80-120%	10	90
Major Cations (mg/L)						
Calcium	0.4	USEPA 200.7	0.03 [a]	80-120%	10	90
Magnesium	NBA	USEPA 200.7	0.03 [a]	80-120%	10	90
Potassium	37	USEPA 200.7	0.7 [a]	80-120%	10	90
Sodium	NBA	USEPA 200.7	0.029 [a]	80-120%	10	90
Strontium	0.02	USEPA 200.7	0.00077 [a]	80-120%	10	90

Table 3. Chemicals of potential concern and associated performance criteria for surface water and pore water measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Metals (μg/L)						
Arsenic	15.4	ICPMS; USEPA 200.8; USEPA 6020A	1 [c]	80-120%	20	90
Barium	100	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Beryllium	0.53	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Cadmium	0.039	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Chromium III	7.92	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Chromium VI	1.08	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Cobalt	0.4	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Copper	0.417	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Lead	0.116	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Mangenese	80	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Mercury (total)	0.0182	CVAFS; USEPA 1631E	0.0002 [b]	80-120%	20	90
Mercury (methyl)	0.000277	CVAFS; USEPA 1630	0.00002 [b]	80-120%	20	90
Nickel	6.05	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Silver	0.0098	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Vanadium	1.77	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Zinc	6.08	ICPMS; USEPA 200.8; USEPA 6020A	<0.1 [c]	80-120%	20	90
Orthophosphate & Other Pesticides (μg/L)						
Methyl Parathion	0.2	GC/MS; USEPA 1657A	0.018 [b]	50-130%	30	90
Parathion	0.013	GC/MS; USEPA 1657A	0.01 [b]	50-130%	30	90
Sodium fluoroacetate	NBA	TBD	TBD	50-130%	30	90
Tetraethyldithiopyrophosphate (Sulfotep)	NBA	GC/MS; USEPA 8270C	TBD	50-130%	30	90

Table 3. Chemicals of potential concern and associated performance criteria for surface water and pore water measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Semi-Volatile Organic Compounds (SVOCs; µg/L)						
o,o,o-triethylphosphorothioate	NBA	GC/MS; USEPA 8270C	TBD	50-130%	30	90
Volatile Organic Compounds (VOCs; µg/L)						
1,1,2,2-tetrachloroethane	37.8	GC/MS; USEPA 8260B	0.04 [b]	50-130%	30	90
Chlorobenzene	5.7	GC/MS; USEPA 8260B	0.04 [b]	50-130%	30	90
Isopropyl benzene (cumene)	0.26	GC/MS; USEPA 8260B	0.15 [b]	50-130%	30	90
Methylene chloride	164	GC/MS; USEPA 8260B	0.03 [b]	50-130%	30	90

CVAFS = cold vapour atomic fluoresence spectroscopy; DOC = dissolved organic carbon; GC/MS = gas chromatography/mass spectrometry; ICPMS = inductively coupled plasma mass spectrometry; NA = not applicable; NBA = no benchmark available; SD = standard deviation; TBD = To be determined; USEPA = United States Environmental Protection Agency.

[a] Estimated detection limit (EDL)

[b] Method detection limit (MDL)

[c] Estimated quantitation limit (EQL)

Table 4. Chemicals of potential concern and associated performance criteria for sediment measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Conventionals						
Total Organic Carbon (%)	0.1	Lloyd Kahn Method	0.01 [b]	NA	NA	90
Moisture (%)	0.2	Dry Weight Determination (Calculation)	NA	NA	NA	90
Grain size (% sand, silt, clay)	0.5	Wentworth Scale Method; ASTM D422	0.1 [b]	NA	NA	90
Total Recoverable Metals (µg/g DW) [a]						
Arsenic	0.715	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Barium	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Beryllium	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Cadmium	0.0991	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Chromium	2.02	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Cobalt	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Copper	2.52	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Lead	3.53	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Mangenese	46	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Mercury (total)	0.0158	CVAFS low level; USEPA 7471	0.001 [b]	80-120%	20	90
Mercury (methyl)	0.00158	CVAFS; USEPA 1630 (modified)	0.001 [b]	80-120%	20	90
Nickel	1.87	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Silver	0.05	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Vanadium	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Zinc	12.4	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Semi-Volatile Organic Compounds (SVOCs; µg/g DW)						
1,2-dichlorobenzene	0.0173	GC/MS-SIM; USEPA 8270C	0.0005 [b]	50-130%	30	90
1,4-dichlorobenzene	0.0247	GC/MS-SIM; USEPA 8270C	0.0005 [b]	50-130%	30	90

Table 4. Chemicals of potential concern and associated performance criteria for sediment measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Semi-Volatile Organic Compounds (SVOCs; µg/g DW; cont.)						
2,4,5-trichlorophenol	NBA	GC/MS-SIM; USEPA 8270C	0.66 [c]	50-130%	30	90
2,4,6-trichlorophenol	NBA	GC/MS-SIM; USEPA 8270C	0.66 [c]	50-130%	30	90
2,4-dichlorophenol	0.00817	GC/MS-SIM; USEPA 8270C	0.66 [c]	50-130%	30	90
4-nitrophenol	NBA	GC/MS-SIM; USEPA 8270C	3.3 [c]	50-130%	30	90
Pentachlorophenol (PCP)	0.0733	GC/MS-SIM; USEPA 8270C	3.3 [c]	50-130%	30	90
Phenol	0.00667	GC/MS-SIM; USEPA 8270C	0.045 - 0.14 [b]	50-130%	30	90
Volatile Organic Compounds (VOCs; µg/g DW)						
1,1,2,2-tetrachloroethane	0.0921	GC/MS; USEPA 8260B	0.0021 [b]	50-130%	30	90
Chlorobenzene	0.0363	GC/MS; USEPA 8260B	0.025 [c]	50-130%	30	90
Isopropyl benzene (cumene)	NBA	GC/MS; USEPA 8260B	0.005 [c]	50-130%	30	90
Methylene chloride	0.0279	GC/MS; USEPA 8260B	0.004 [b]	50-130%	30	90
Polychlorinated Biphenyls (PCBs; ng/g DW)						
PCBs (Aroclors)	4.04	GC; USEPA 8082A	7 [b]	50-125%	30	90
PCBs (Homologs)	0.01	HRGC/HRMS; USEPA 1668A	0.002 [b]	50-125%	30	90
PCB Coplanar Congeners (77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)	0.001	HRGC/HRMS; USEPA 1668A	0.002 [b]	50-125%	30	90

Table 4. Chemicals of potential concern and associated performance criteria for sediment measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Polychlorinated Biphenyls (PCBs; ng/g DW; cont.)						
Additional PCB Congeners (5/8,8,15,18,18/17,28,29,31,37,44,45, 47,49,52,56,58,60,61/70,66,70,74, 77/110,79,80,87,87/115,90/101,95,99,101,108,108/118/149,110,127,128,132/153,138/160,138,146,149,151,153, 158,159/182/187,162,170,170/190, 174,177,180,183,187,194,195,195/208, 201,201/157/173,206,209)	0.001	HRGC/HRMS; USEPA 1668A	0.002 [b]	50-125%	30	90
Parent and Alkylated Polycyclic Aromatic Hydrocarbons (PAHs; µg/g DW)						
Acenaphthene	0.00983	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Acenaphthylene	0.00783	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Anthracene	0.0151	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benz(a)anthracene	0.0132	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(a)pyrene	0.0205	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(b)fluoranthene	0.474	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(e)pyrene	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(g,h,i)perylene	0.0252	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(k)fluoranthene	0.0139	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-fluorenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-pyrenes/fluoranthenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C2-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90

Table 4. Chemicals of potential concern and associated performance criteria for sediment measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Parent and Alkylated PAHs (µg/g DW; cont.)						
C2-fluorenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C2-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C2-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-fluorenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C4-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C4-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C4-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Chrysene	0.0195	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Dibenz(a,h)anthracene	0.00596	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Fluoranthene	0.0505	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Fluorene	0.00841	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Indeno(1,2,3-c,d)pyrene	0.0193	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Naphthalene	0.0176	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Perylene	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Phenanthrene	0.0234	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Pyrene	0.036	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Dioxins & Furans (ng/g DW)						
2,3,7,8-TCDD	0.000138	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8-PeCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,7,8-HxCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90

Table 4. Chemicals of potential concern and associated performance criteria for sediment measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Dioxins & Furans (ng/g DW; cont.)						
1,2,3,6,7,8-HxCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8,9-HxCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,6,7,8-HpCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
OCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
2,3,7,8-TCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8-PeCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
2,3,4,7,8-PeCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,7,8-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,6,7,8-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8,9-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
2,3,4,6,7,8-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,6,7,8-HpCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,7,8,9-HpCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
OCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90

ASTM = American Society for Testing and Materials; CVAFS = cold vapour atomic fluoresence spectroscopy; DW = dry weight; GC = gas chromatography; GC/MS-SIM = gas chromatography/mass spectrometry-selected ion monitoring; HRGC/HRMS = high resolution gas chromatography/high resolution mass spectrometry; ICPMS = inductively coupled plasma mass spectrometry; NA = not applicable; NBA = no benchmark available; SD = standard deviation; USEPA = United States Environmental Protection Agency.

[a] Metals are first subjected to microwave heating and acid digestion according to method USEPA 3051A before the analytical method shown in the table is used.

[b] Method detection limit (MDL)

[c] Estimated quantitation limit (EQL)

Table 5. Chemicals of potential concern and associated performance criteria for soil measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Conventionals						
Total Organic Carbon (%)	0.1	Lloyd Kahn Method	0.01 [b]	NA	NA	90
Moisture (%)	0.2	Dry Weight Determination (Calculation)	NA	NA	NA	90
Grain size (% sand, silt, clay)	0.5	Wentworth Scale Method; ASTM D422	0.1 [b]	NA	NA	90
Total Recoverable Metals (µg/g DW) [a]						
Arsenic	0.715	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Barium	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Beryllium	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Cadmium	0.0991	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Chromium	2.02	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Cobalt	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Copper	2.52	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Lead	3.53	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Mangenese	46	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Mercury (total)	0.0158	CVAFS low level; USEPA 7471	0.001 [b]	80-120%	20	90
Mercury (methyl)	0.00158	CVAFS; USEPA 1630 (modified)	0.001 [b]	80-120%	20	90
Nickel	1.87	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Silver	0.05	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Vanadium	NBA	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Zinc	12.4	ICPMS; USEPA 6020A	0.1 [b]	80-120%	20	90
Semi-Volatile Organic Compounds (SVOCs; µg/g DW)						
1,2-dichlorobenzene	0.0173	GC/MS-SIM; USEPA 8270C	0.0005 [b]	50-130%	30	90
1,4-dichlorobenzene	0.0247	GC/MS-SIM; USEPA 8270C	0.0005 [b]	50-130%	30	90

Table 5. Chemicals of potential concern and associated performance criteria for soil measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Semi-Volatile Organic Compounds (SVOCs; µg/g DW; cont.)						
2,4,5-trichlorophenol	NBA	GC/MS-SIM; USEPA 8270C	0.66 [c]	50-130%	30	90
2,4,6-trichlorophenol	NBA	GC/MS-SIM; USEPA 8270C	0.66 [c]	50-130%	30	90
2,4-dichlorophenol	0.00817	GC/MS-SIM; USEPA 8270C	0.66 [c]	50-130%	30	90
4-nitrophenol	NBA	GC/MS-SIM; USEPA 8270C	3.3 [c]	50-130%	30	90
Pentachlorophenol (PCP)	0.0733	GC/MS-SIM; USEPA 8270C	3.3 [c]	50-130%	30	90
Phenol	0.00667	GC/MS-SIM; USEPA 8270C	0.045 - 0.14 [b]	50-130%	30	90
Volatile Organic Compounds (VOCs; µg/g DW)						
1,1,2,2-tetrachloroethane	0.0921	GC/MS; USEPA 8260B	0.0021 [b]	50-130%	30	90
Chlorobenzene	0.0363	GC/MS; USEPA 8260B	0.025 [c]	50-130%	30	90
Isopropyl benzene (cumene)	NBA	GC/MS; USEPA 8260B	0.005 [c]	50-130%	30	90
Methylene chloride	0.0279	GC/MS; USEPA 8260B	0.004 [b]	50-130%	30	90
Polychlorinated Biphenyls (PCBs; ng/g DW)						
PCBs (Aroclors)	4.04	GC; USEPA 8082A	7 [b]	50-125%	30	90
PCBs (Homologs)	0.01	HRGC/HRMS; USEPA 1668A	0.002 [b]	50-125%	30	90
PCB Coplanar Congeners (77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)	0.001	HRGC/HRMS; USEPA 1668A	0.002 [b]	50-125%	30	90

Table 5. Chemicals of potential concern and associated performance criteria for soil measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Polychlorinated Biphenyls (PCBs; ng/g DW; cont.)						
Additional PCB Congeners (5/8,8,15,18,18/17,28,29,31,37,44,45, 47,49,52,56,58,60,61/70,66,70,74, 77/110,79,80,87,87/115,90/101,95,99,101,108,108/118/149,110,127,128,132/153,138/160,138,146,149,151,153, 158,159/182/187,162,170,170/190, 174,177,180,183,187,194,195,195/208, 201,201/157/173,206,209)	0.001	HRGC/HRMS; USEPA 1668A	0.002 [b]	50-125%	30	90
Parent and Alkylated Polycyclic Aromatic Hydrocarbons (PAHs; µg/g DW)						
Acenaphthene	0.00983	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Acenaphthylene	0.00783	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Anthracene	0.0151	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benz(a)anthracene	0.0132	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(a)pyrene	0.0205	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(b)fluoranthene	0.474	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(e)pyrene	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(g,h,i)perylene	0.0252	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Benzo(k)fluoranthene	0.0139	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-fluorenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C1-pyrenes/fluoranthenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C2-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90

Table 5. Chemicals of potential concern and associated performance criteria for soil measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Parent and Alkylated PAHs (µg/g DW; cont.)						
C2-fluorenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C2-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C2-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-fluorenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C3-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C4-chrysenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C4-naphthalenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
C4-phenanthrenes/anthracenes	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Chrysene	0.0195	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Dibenz(a,h)anthracene	0.00596	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Fluoranthene	0.0505	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Fluorene	0.00841	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Indeno(1,2,3-c,d)pyrene	0.0193	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Naphthalene	0.0176	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Perylene	0.01	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Phenanthrene	0.0234	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Pyrene	0.036	GC/MS-SIM; USEPA 8270C	0.005 [b]	50-130%	30	90
Dioxins & Furans (ng/g DW)						
2,3,7,8-TCDD	0.000138	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8-PeCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,7,8-HxCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90

Table 5. Chemicals of potential concern and associated performance criteria for soil measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Dioxins & Furans (ng/g DW; cont.)						
1,2,3,6,7,8-HxCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8,9-HxCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,6,7,8-HpCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
OCDD	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
2,3,7,8-TCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8-PeCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
2,3,4,7,8-PeCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,7,8-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,6,7,8-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,7,8,9-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
2,3,4,6,7,8-HxCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,6,7,8-HpCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
1,2,3,4,7,8,9-HpCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90
OCDF	0.0005	USEPA 8290A/USEPA 1613B	0.000067 - 0.0025 [b]	70-130%	30	90

ASTM = American Society for Testing and Materials; CVAFS = cold vapour atomic fluoresence spectroscopy; DW = dry weight; GC = gas chromatography; GC/MS-SIM = gas chromatography/mass spectrometry-selected ion monitoring; HRGC/HRMS = high resolution gas chromatography/high resolution mass spectrometry; ICPMS = inductively coupled plasma mass spectrometry; NA = not applicable; NBA = no benchmark available; SD = standard deviation; USEPA = United States Environmental Protection Agency.

[a] Metals are first subjected to microwave heating and acid digestion according to method USEPA 3051A before the analytical method shown in the table is used.

[b] Method detection limit (MDL)

[c] Estimated quantitation limit (EQL)

Table 6. Chemicals of potential concern and associated performance criteria for biological tissues measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Metals (µg/g WW) [a]						
Lead	0.3	ICPMS; USEPA 6020A	0.033 [b]	80-120%	20	90
Mercury (total)	0.0016	CAAAS; USEPA 7473	0.00002 [c]	80-120%	20	90
Mercury (methyl)	0.001	CVAFS; USEPA 1630 (modified)	0.002 [d]	80-120%	20	90
Semi-Volatile Organic Compounds (SVOCs; µg/g WW)						
Pentachlorophenol (PCP)	0.28	GC/MS; USEPA 8270C [e]	3.3 [d]	80-120%	20	90
Polychlorinated Biphenyls (PCBs; ng/g WW)						
PCBs (Aroclors)	11	GC; USEPA 8082A	8 [b]	80-120%	20	90
PCBs (Homologs)	0.01	HRGC/HRMS; USEPA 1668A	0.002 [b]	80-120%	20	
PCB Coplanar Congeners (77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)	0.001	HRGC/HRMS; USEPA 1668A	0.002 [b]	80-120%	20	90
Additional PCB Congeners (5/8,8,15,18,18/17,28,29,31,37,44,45, 47,49,52,56,58,60,61/70,66,70,74, 77/110,79,80,87,87/115,90/101,95,99,101,108,108/118/149,110,127,128,132/153,138/160,138,146,149,151,153, 158,159/182/187,162,170,170/190, 174,177,180,183,187,194,195,195/208, 201,201/157/173,206,209)	0.001	HRGC/HRMS; USEPA 1668A	0.002 [b]	80-120%	20	90
Dioxins & Furans (ng/g WW)						
2,3,7,8-TCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,7,8-PeCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90

Table 6. Chemicals of potential concern and associated performance criteria for biological tissues measurement data for the Anniston PCB Site.

Group/Substance	Target Detection Limit	Expected Analytical Method	Typical Detection Limit	Target Mean Accuracy (range of result or % recovery)	Target Precision (Relative SD %)	Target Completeness (%)
Dioxins & Furans (ng/g WW; cont.)						
1,2,3,4,7,8-HxCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,6,7,8-HxCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,7,8,9-HxCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,4,6,7,8-HpCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
OCDD	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
2,3,7,8-TCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,7,8-PeCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
2,3,4,7,8-PeCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,4,7,8-HxCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,6,7,8-HxCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,7,8,9-HxCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
2,3,4,6,7,8-HxCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,4,6,7,8-HpCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
1,2,3,4,7,8,9-HpCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90
OCDF	0.0001	HRGC/HRMS; USEPA 1613B	0.000067 - 0.0025 [b]	80-120%	20	90

CAAAS = combustion amalgamation atomic absorption spectrophotometry; CVAFS = cold vapour atomic fluoresence spectroscopy; GC/MS = gas chromatography/mass spectrometry; HRGC/HRMS = high resolution gas chromatography/high resolution mass spectrometry; ICPMS = inductively coupled plasma mass spectrometry; SD = standard deviation; USEPA = United States Environmental Protection Agency; WW = wet weight.

[a] Metals are first subjected to microwave heating and acid digestion according to method USEPA 3051A and 3050B before the analytical method shown in the table is used.

[b] Method detection limit (MDL)

[c] Instrument detection limit (IDL)

[d] Estimated quantitation limit (EQL)

[e] Method does not specify use for tissue samples; typical detection limit listed is for sediment/soil samples.

Table 7. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of surface water samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[2]	Recommended Holding Time[3]
Water Temperature (°C)	YSI Pro 2030 Meter (in situ)	NA	NA	NA	NA
Conductivity (µS/cm)	YSI Pro 2030 Meter (in situ)	NA	NA	NA	NA
Dissolved Oxygen (mg/L)	YSI Pro 2030 Meter (in situ)	NA	NA	NA	NA
Alkalinity (mg/L $CaCO_3$)	Orion EA940 Meter or APHA standard method 2320	Glass or HDPE	500 mL	0 - 6°C	24 hours
Total ammonia (NH_3; mg/L)	Orion EA 940 Meter	Glass or HDPE	250 mL	None; or 0 - 6°C pH<2 w/ H_2SO_4	ASAP; 7 days with preservation method
pH	Orion EA 940 Meter	*Same containers as Alkalinity*	NA	None	ASAP
Hardness (mg/L $CaCO_3$)	USEPA 130.2	HDPE	150 mL	0 - 4°C pH <2 w/HNO_3	6 months
Hydrogen sulfide (H_2S; mg/L)	Orion Model 94-16; H_2S calculated from measure of total dissolved sulfide and pH	Glass vial	20 mL	0 - 6°C; pH >10 w/NaOH +EDTA	7 days
DOC (mg/L)	USEPA 415.1	*Same containers as Total Ammonia*	NA	0 - 6°C; pH<2 w/ H_2SO_4	28 days
Major Anions (mg/L)	USEPA 300.0	*Same containers as Alkalinity*	NA	0 - 4°C; may require preservatives[4]	28 days
Major Cations (mg/L)	USEPA 200.7	*Same containers as Hardness*	NA	0 - 4°C; pH<2 w/ HNO_3	6 months
TAL Metals (except mercury and hexavalent chromium)	USEPA 200.8; USEPA 6020A	*Same containers as Hardness*	NA	1 - 4°C pH<2 w/HNO_3	6 months
Mercury (total)	USEPA 1631E	*Same containers as Hardness*	NA	2 - 4°C pH<2 w/HNO_3	28 days
Methylmercury	USEPA 1630	PTFE plastic or Brown borosilicate glass	125 mL	0 - 4°C; add HCl within 48 hours	6 months

Table 7. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of surface water samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[2]	Recommended Holding Time[3]
Methyl Parathion	USEPA 8270C	Brown borosilicate glass with PTFE-lined septum cap	1 L	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
Parathion	USEPA 8270C	*Same container as above*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
Sodium fluoroacetate	USEPA 8270C	Brown borosilicate glass with PTFE-lined septum cap	1 L	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
Tetraethyldithiopyrophosphate (Sulfotep)	USEPA 8270C	*Same container as Methyl Parathion*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
o,o,o-triethylphosphorothioate	USEPA 8270C	*Same container as Sulfotep*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
1,1,2,2-tetrachloroethane	USEPA 8260B	Brown borosilicate glass with PTFE-lined septum cap	2 x 40 mL	0 - 6^{o}C pH<2 w/H_2SO_4, HCl, or solid $NaHSO_4$	14 days
Chlorobenzene	USEPA 8260B	*Same container as above*	NA	0-6^{o}C pH<2 w/H_2SO_4	14 days
Isopropyl benzene (cumene)	USEPA 8260B	Brown borosilicate glass with PTFE-lined septum cap	2 x 40 mL	0-6^{o}C pH<2 w/H_2SO_4	14 days
Methylene chloride	USEPA 8260B	*Same container as above*	NA		14 days

Table 7. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of surface water samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[2]	Recommended Holding Time[3]

APHA = American Public Health Association; ASAP = as soon as possible; DOC = dissolved organic carbon; HDPE = high-density polyethylene; NA = not applicable; PTFE = polytetrafluoroethylene; USEPA = United States Environmental Protection Agency.

[1] Approximated volumes to be submitted to the lab for analyses. Additional containers will be required for Quality Control samples.

[2] Samples may also be frozen and held at <-10^{o}C to extend the recommended holding times for chemical analyses (headspace required). All samples should be stored in the dark. Preservatives may be added in the lab.

[3] A longer holding time may be appropriate if it can be demonstrated that the reported analyte concentrations are not adversely affected by preservation, storage, and analyses performed outside the recommended holding times.

[4] Preservation and recommended holding times dependent on analyte (see USEPA method 300.0).

[5] Days pre-extraction / Days post-extraction.

Table 8. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of pore water samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[2]	Recommended Holding Time[3]
Water Temperature (°C)	ASTM-calibrated thermometer	Glass or HDPE	150 mL	None	None
Conductivity (µS/cm)	USEPA 120.1	*Same containers as above*	NA	0 - 4°C	7 days
Dissolved Oxygen (mg/L)	YSI 54a Meter/ YSI 5739 Probe	*Same containers as above*	NA	None	None
Alkalinity (mg/L $CaCO_3$)	Orion EA940 Meter or APHA standard method 2320	*Same containers as above*	NA	0 - 6°C	24 hours
Total ammonia (NH_3; mg/L)	Orion EA 940 Meter	*Same containers as above*	NA	None; or 0 - 6°C pH<2 w/ H_2SO_4	ASAP; 7 days with preservation method
pH	Orion EA 940 Meter	*Same containers as above*	NA	None	ASAP
Hardness (mg/L $CaCO_3$)	USEPA 130.2	*Same containers as above*	NA	0 - 4°C pH <2 w/HNO_3	6 months
Hydrogen sulfide (H_2S; mg/L)	Orion Model 94-16; H_2S calculated from measure of total dissolved sulfide and pH	Glass vial	20 mL	0 - 6°C; pH >10 w/NaOH +EDTA	7 days
DOC (mg/L)	USEPA 415.1	Glass or HDPE	25 mL	0 - 6°C; pH<2 w/ HCl or H_2SO_4	28 days
Major Anions (mg/L)	USEPA 300.0	Glass or HDPE	25 mL	0 - 4°C; may require preservatives[4]	28 days
Major Cations (mg/L)	USEPA 200.7	Glass or HDPE	25 mL	0 - 4°C; pH<2 w/ nitric acid	6 months
TAL Metals (except mercury and hexavalent chromium)	USEPA 200.8; USEPA 6020A	HDPE or PTFE plastic with PTFE-lined cap	25 mL	0 - 6°C pH<2 w/HNO_3	6 months
Mercury (total)	USEPA 1631E	HDPE or PTFE plastic with PTFE-lined cap	25 mL	0 - 6°C pH<2 w/HNO_3	28 days
Methylmercury	USEPA 1630	PTFE plastic or Brown borosilicate glass	25 mL	0 - 4°C; add HCl within 48 hours	6 months

Table 8. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of pore water samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[2]	Recommended Holding Time[3]
Methyl Parathion	USEPA 8270C	Brown borosilicate glass with PTFE-lined septum cap	100 mL	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
Parathion	USEPA 8270C	*Same container as above*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
Sodium fluoroacetate	USEPA 8270C	*Same container as above*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
Tetraethyldithiopyrophosphate (Sulfotep)	USEPA 8270C	*Same container as above*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
o,o,o-triethylphosphorothioate	USEPA 8270C	*Same container as above*	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	7 days / 40 days[5]
1,1,2,2-tetrachloroethane	USEPA 8260B	Brown borosilicate glass with PTFE-lined septum cap	80 mL	0 - 6^{o}C pH<2 w/H_2SO_4, HCl, or solid $NaHSO_4$	14 days
Chlorobenzene	USEPA 8260B	*Same container as above*	NA	0-6^{o}C pH<2 w/H_2SO_4	14 days
Isopropyl benzene (cumene)	USEPA 8260B	*Same container as above*	NA	0-6^{o}C pH<2 w/H_2SO_4	14 days
Methylene chloride	USEPA 8260B	*Same container as above*	NA	0-6^{o}C pH<2 w/H_2SO_4	14 days

Table 8. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of pore water samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[2]	Recommended Holding Time[3]

APHA = American Public Health Association; ASAP = as soon as possible; DOC = dissolved organic carbon; HDPE = high-density polyethylene; NA = not applicable; PTFE = polytetrafluoroethylene; USEPA = United States Environmental Protection Agency.

[1] Approximated volumes to be submitted to the lab for analyses. Additional containers will be required for Quality Control samples.

[2] Samples may also be frozen and held at <-10°C to extend the recommended holding times for chemical analyses (headspace required). All samples should be stored in the dark. Preservatives may be added in the lab.

[3] A longer holding time may be appropriate if it can be demonstrated that the reported analyte concentrations are not adversely affected by preservation, storage, and analyses performed outside the recommended holding times.

[4] Preservation and recommended holding times dependent on analyte (see USEPA method 300.0).

[5] Days pre-extraction / Days post-extraction.

Table 9. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of large-volume sediment samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[1]	Recommended Holding Time[2]
TAL Metals (except mercury and hexavalent chromium)	USEPA 3051A; USEPA 200.7 or 6020A	HDPE or PTFE plastic with PTFE-lined cap	500 mL	0 - 6°C	6 months
Hexavalent chromium	USEPA 7196A	*Same container as TAL metals* [3]	NA	0 - 6°C	30 days / 7 days[4]
Mercury	USEPA 1631 (Appendix) and USEPA 1631B	*Same container as TAL metals* [3]	NA	0 - 6°C	28 days
Methylmercury	USEPA 1630 (modified)[5]	*Same container as TAL metals* [3]	NA	0 - 4°C; add HCl within 48 hours[5]	6 months[5]
SEM/AVS	USEPA 821/ R-91-100	*Same container as TAL metals* [3]	NA	0 - 4°C; sealed container with no headspace; minimize aeration	21 days
Volatile Organic Compounds	USEPA 8260B (with USEPA 5030 or 5035)	Brown borosilicate glass with PTFE-lined septum cap	2 x 4 oz jars, full	0 - 6°C, sealed container with no headspace; methanol or $NaHSO_4$	48 hours with no preservative; 14 days with preservative
Semi-Volatile Organic Compounds	USEPA 8270C	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	14 days / 40 days[4]
PCB Aroclors	USEPA 8082A	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6 °C	7 days / 40 days at 0 - 6 °C[4]; up to 1 year if frozen
PAHs (Parent & Alkylated)	USEPA 8270C	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6°C; sealed container with no headspace; store extracts at -10°C	14 days / 40 days[4]
Total Organic Carbon	USEPA 9060	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6 °C	28 days

Table 9. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of large-volume sediment samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[1]	Recommended Holding Time[2]
% Moisture	Lab SOP	*Same container as Volatile Organic Compounds*[3]	NA	0 - 6°C	As practical
Grain Size	Wentworth Scale Method; ASTM D422	Plastic Bag	As appropriate (500 g)	NA	As practical
PCB Congeners[6]	USEPA 1668A	Brown borosilicate glass with PTFE-lined cap	2 x 500 mL (full container)	0 - 6°C	7 days / 40 days at 0 - 6 °C[4]; up to 1 year if frozen
PCB Homologs[6]	USEPA 1668A	*Same container as PCB congeners*[3]	NA	0 - 6°C	7 days / 40 days at 0 - 6 °C[4]; up to 1 year if frozen
PCDDs/PCDFs	USEPA 8290A/ USEPA 1613B	*Same container as PCB congeners*[3]	NA	0 - 6°C	30 days / 45 days[4]; may be stored at ≤ 6°C up to 6 months

AVS = acid-volatile sulfide; HDPE = high density polyethylene; NA = not applicable; PAHs = polycyclic aromatic hydrocarbons; PCB = polychlorinated biphenyl; PCDDs/PCDFs = polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans; PTFE = polytetrafluoroethylene; SEM = simultaneously extracted metals; SOP = standard operating procedure; TAL = target analyte list; USEPA = United States Environmental Protection Agency.

[1] Samples may also be frozen and held at <-10°C to extend the recommended holding times for chemical analyses. All samples should be stored in the dark. Preservation additives may be added in the lab.

[2] A longer holding time may be appropriate if it can be demonstrated that the reported analyte concentrations are not adversely affected by preservation, storage, and analyses performed outside the recommended holding times.

[3] Sample aliquots for multiple analyses may come from the same container.

[4] Days pre-extraction / Days post-extraction.

[5] Method for determination of methylmercury in water samples; requires modification for sediment samples.

[6] Individual homolog totals will be derived from the reported PCB congener data and included in the final analytical report.

Table 10. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of large-volume soil samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[1]	Recommended Holding Time[2]
TAL Metals (except mercury and hexavalent chromium)	USEPA 3051A; USEPA 200.7 or 6020A	HDPE or PTFE plastic with PTFE-lined cap	500 mL	0 - 6°C	6 months
Hexavalent chromium	USEPA 7196A	*Same container as TAL metals* [3]	NA	0 - 6°C	30 days / 7 days[4]
Mercury	USEPA 1631 (Appendix) and USEPA 1631B	*Same container as TAL metals* [3]	NA	0 - 6°C	28 days
Methylmercury	USEPA 1630 (modified)[5]	*Same container as TAL metals* [3]	NA	0 - 4°C; add HCl within 48 hours[5]	6 months[5]
SEM	USEPA 821/ R-91-100	*Same container as TAL metals* [3]	NA	0 - 4°C; sealed container with no headspace; minimize aeration	21 days
Volatile Organic Compounds	USEPA 8260B (with USEPA 5030 or 5035)	Brown borosilicate glass with PTFE-lined septum cap	2 x 4 oz jars, full	0 - 6°C, sealed container with no headspace; methanol or $NaHSO_4$	48 hours with no preservative; 14 days with preservative
Semi-Volatile Organic Compounds	USEPA 8270C	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6°C, sealed container with no headspace; store extracts at -10°C	14 days / 40 days[4]
PCB Aroclors	USEPA 8082A	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6 °C	7 days / 40 days at 0 - 6 °C[4]; up to 1 year if frozen
PAHs (Parent & Alkylated)	USEPA 8270C	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6°C; sealed container with no headspace; store extracts at -10°C	14 days / 40 days[4]
Total Organic Carbon	USEPA 9060	*Same container as Volatile Organic Compounds* [3]	NA	0 - 6 °C	28 days

Table 10. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of large-volume soil samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Preservation Method[1]	Recommended Holding Time[2]
% Moisture	Lab SOP	*Same container as Volatile Organic Compounds*[3]	NA	0 - 6°C	As practical
Grain Size	Wentworth Scale Method; ASTM D422	Plastic Bag	As appropriate (500 g)	NA	As practical
PCB Congeners[6]	USEPA 1668A	Brown borosilicate glass with PTFE-lined cap	2 x 500 mL (full container)	0 - 6°C	7 days / 40 days at 0 - 6 °C[4]; up to 1 year if frozen
PCB Homologs[6]	USEPA 1668A	*Same container as PCB congeners*[3]	NA	0 - 6°C	7 days / 40 days at 0 - 6 °C[4]; up to 1 year if frozen
PCDDs/PCDFs	USEPA 8290A/ USEPA 1613B	*Same container as PCB congeners*[3]	NA	0 - 6°C	30 days / 45 days[4]; may be stored at ≤ 6°C up to 6 months

AVS = acid-volatile sulfide; HDPE = high density polyethylene; NA = not applicable; PAHs = polycyclic aromatic hydrocarbons; PCB = polychlorinated biphenyl; PCDDs/PCDFs = polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans; PTFE = polytetrafluoroethylene; SEM = simultaneously extracted metals; SOP = standard operating procedure; TAL = target analyte list; USEPA = United States Environmental Protection Agency.

[1] Samples may also be frozen and held at <-10°C to extend the recommended holding times for chemical analyses. All samples should be stored in the dark. Preservation additives may be added in the lab.

[2] A longer holding time may be appropriate if it can be demonstrated that the reported analyte concentrations are not adversely affected by preservation, storage, and analyses performed outside the recommended holding times.

[3] Sample aliquots for multiple analyses may come from the same container.

[4] Days pre-extraction / Days post-extraction.

[5] Method for determination of methylmercury in water samples; requires modification for soil samples.

[6] Individual homolog totals will be derived from the reported PCB congener data and included in the final analytical report.

Table 11. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of biological tissue samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Minimum Sample Mass (WW)[1]	Preservation Method[2]	Recommended Holding Time[3]
Lead	USEPA 6020A	HDPE or PTFE plastic with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C until receipt at lab; < -15°C at lab	1 year
Mercury	USEPA 7473	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 4°C until receipt at lab; < -15°C at lab	1 year
Methylmercury	USEPA 1630 (modified)[4]	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 4°C until receipt at lab; < -15°C at lab[4]	1 year[4]
Pentachlorophenol (PCP)	USEPA 8270C[5]	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C, sealed container with no headspace; store extracts at -10°C	14 days / 40 days[6]
Percent lipids	Percent lipid determination	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C until receipt at lab; < -10°C at lab	24 hours at <6°C; up to 1 year at < -10°C
Percent moisture	Dry weight determination	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C until receipt at lab; < -10°C at lab	24 hours at <6°C; up to 1 year at < -10°C
PCB Aroclors	USEPA 8082A	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C until receipt at lab; < -10°C at lab[7]	24 hours at <6°C; up to 1 year at < -10°C[7]
PCB Homologs[8]	USEPA 1668A	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C until receipt at lab; < -10°C at lab	24 hours at <6°C; up to 1 year at < -10°C
PCB Congeners[8]	USEPA 1668A	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 6°C until receipt at lab; < -10°C at lab	24 hours at <6°C; up to 1 year at < -10°C
PCDDs/PCDFs	USEPA 1613B	Brown borosilicate glass with PTFE-lined cap	120 mL	2 - 200 g	0 - 4°C until receipt at lab; ≤ -10°C at lab	up to 1 year at ≤ -10°C

HDPE = high density polyethylene; PCB = polychlorinated biphenyl; PTFE = polytetrafluoroethylene; USEPA = United States Environmental Protection Agency; WW = weight wet.

Footnotes continued on next page…

Table 11. Analytical methods, sample volume requirements, container materials and size, preservation methods, and holding times for the sub-samples of biological tissue samples from the Anniston PCB Site.

Analyte Group	Expected Analytical Method	Container Material	Container Volume	Minimum Sample Mass (WW)[1]	Preservation Method[2]	Recommended Holding Time[3]

[1] Approximated mass to be submitted to the lab for analyses (WW). Dependant on tissue type (e.g. 2 g for egg tissue, 200 g for fish tissue). Additional containers will be required for Quality Control samples.

[2] All samples should be stored in the dark. If not analyzed upon receipt at the lab, samples may be freeze-dried prior to homogenization and storage (may be stored unrefrigerated for up to 1 year in a low-mercury atmosphere).

[3] A longer holding time may be appropriate if it can be demonstrated that the reported analyte concentrations are not adversely affected by preservation, storage, and analyses performed outside the recommended holding times.

[4] Method for determination of methylmercury in water samples; requires modification for tissue samples. Preservation method and holding time are based on USEPA method 1631 (Appendix).

[5] Method for sediment analysis. May require modification for tissue samples.

[6] Days pre-extraction / Days post-extraction.

[7] Preservation and holding time specifications from USEPA method 1668A since this information was not available for USEPA method 8082A.

[8] Individual homolog totals will be derived from the reported PCB congener data and included in the final analytical report.

Table 12. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of surface water and pore water quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
pH		Ion Analyzer	Procedure for pH Determination	Jackson SOP: F20.P12	6/30/97
Ammonia		Ion Analyzer	Orion EA 940 Users Manual (pp15-20)		
Hydrogen Sulfide		Ion specific electrode	Determining Hydrogen Sulfide Concentrations of Aqueous Samples using the Silver/Sulfide electrode	NFCRC SOP: B5.234	7/23/91

Table 13. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of sediment quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
Preliminary Evaluation					
SemiVolatile Organic Extraction Procedure		USEPA 3570 - MSE	Microscale Solvent Extraction	OP-016, Rev # 2	2/12/08
PCB homologs (total PCBs by summation)		USEPA 8270 mod.- LRMS SIM	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS-SIM	O-015, Rev # 2	6/19/06
Total Organic Carbons		USEPA 9060 - Combustion	Total Organic Carbon in Soil, Sediment and Water	W-028, Rev # 2	1/22/03
Chemistry					
SemiVolatile Organic Extraction Procedure		USEPA 3570 - MSE	Microscale Solvent Extraction	OP-016, Rev # 2	2/12/08
SemiVolatile Organic Extraction Procedure		USEPA 3540C - Soxhlet	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	MLA-010, Rev #10	11/14/08
PCB congeners		USEPA 1668A - HRGC/HRMS	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	MLA-010, Rev #10	11/14/08
PCDDs/PCDFs		USEPA 1613B - HRGC/HRMS	Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by USEPA Method 1613B, USEPA Method 8290/8290A, Env. Canada EPS 1/RM19 or USEPA Method DLMO 2.0	MLA-017, Rev #15	10/31/08
OC Pesticides + toxaphene		Lab SOP - HRGC/HRMS	Analytical Procedures for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS	MLA-028, Rev# 5	4/11/08
PAHs (Parent and alkylated)		USEPA 8270 mod.- LRMS SIM	Analysis of Parent and Alkylated Polynuclear Aromatic Hydrocarbons, Selected Heterocyclic Compounds, Steranes and Triterpanes By GC/MS-SIM	O-008, Rev # 3	6/19/06

Table 13. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of sediment quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
Chemistry (cont.)					
Metals Sample Preparation		USEPA 3050B; 3051A	Acid Digestion of Solid Samples for Metals Analysis	MP-001, Iss # 5.1	5/2/08
Total Metals (TAL - 22)		USEPA 6020A - ICP/MS	Inductively Coupled Plasma - Mass Spectrometry	M-001, Rev # 4.1	4/29/08
Total Mercury		USEPA 7474 - CVAF	Mercury Determination in Tissue and Soil/Sediment Samples by Cold Vapor Atomic Fluorescence Technique (CVAF)	M-014, Iss # 1.1	5/5/08
AVS/SEM (Cd, Cu, Ni, Pb, Zn)		Lab SOP, USEPA 6020A	Acid Volatile Sulfides and Simultaneously Extracted Metals in Sediments	AVSSEM, Rev # 1	3/6/00
Grain Size		ASTM D422 - hydrometer/sieves	Particle Size Analysis of Soils - With/Without Hydrometer and Liquid Limit, Plastic Limit, and Plasticity Index	W-029, Rev # 0.0	7/17/06
Percent moisture		Lab SOP	Percent Solids Determination	W-001 Rev #3	5/4/07
Percent moisture		Lab SOP	Moisture Determination	SLA-015	5/12/06
Ecotoxicity					
Toxicity Studies		ASTM 2008, USEPA 2000	Chronic toxicity testing of Hudson River sediment samples with the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*	Study Code: 08-20-21	9/24/08
Bioavailability					
SPME - PCB congeners		USEPA 1668A	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	TBD	TBD
SPME - PCB homologs		USEPA 8270 mod.- LRMS SIM	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS-SIM	TBD	TBD

TBD = to be determined

Table 14. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of soil quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
Preliminary Evaluation					
SemiVolatile Organic Extraction Procedure		USEPA 3570 - MSE	Microscale Solvent Extraction	OP-016, Rev # 2	2/12/08
PCB homologs (total PCBs by summation)		USEPA 8270 mod.- LRMS SIM	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS-SIM	O-015, Rev # 2	6/19/06
Total Organic Carbons		USEPA 9060 - Combustion	Total Organic Carbon in Soil, Sediment and Water	W-028, Rev # 2	1/22/03
Chemistry					
SemiVolatile Organic Extraction Procedure		USEPA 3570 - MSE	Microscale Solvent Extraction	OP-016, Rev # 2	2/12/08
SemiVolatile Organic Extraction Procedure		USEPA 3540C - Soxhlet	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	MLA-010, Rev #10	11/14/08
PCB congeners		USEPA 1668A - HRGC/HRMS	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	MLA-010, Rev #10	11/14/08
PCDDs/PCDFs		USEPA 1613B - HRGC/HRMS	Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by USEPA Method 1613B, USEPA Method 8290/8290A, Env. Canada EPS 1/RM19 or USEPA Method DLMO 2.0	MLA-017, Rev #15	10/31/08
OC Pesticides + toxaphene		Lab SOP - HRGC/HRMS	Analytical Procedures for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS	MLA-028, Rev# 5	4/11/08
PAHs (Parent and alkylated)		USEPA 8270 mod.- LRMS SIM	Analysis of Parent and Alkylated Polynuclear Aromatic Hydrocarbons, Selected Heterocyclic Compounds, Steranes and Triterpanes By GC/MS-SIM	O-008, Rev # 3	6/19/06

Table 14. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of soil quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
Chemistry (cont.)					
Metals Sample Preparation		USEPA 3050B	Acid Digestion of Solid Samples for Metals Analysis	MP-001, Iss # 5.1	5/2/08
Total Metals (TAL - 22)		USEPA 6020A - ICP/MS	Inductively Coupled Plasma - Mass Spectrometry	M-001, Rev # 4.1	4/29/08
Total Mercury		USEPA 7474 - CVAF	Mercury Determination in Tissue and Soil/Sediment Samples by Cold Vapor Atomic Fluorescence Technique (CVAF)	M-014, Iss # 1.1	5/5/08
AVS SEM (Cd, Cu, Ni, Pb, Zn)		Lab SOP Lab SOP, USEPA 6020A	Acid Volatile Sulfides and Simultaneously Extracted Metals in Sediments	AVSSEM, Rev # 1	3/6/00
Grain Size		ASTM D422 - hydrometer/sieves	Particle Size Analysis of Soils - With/Without Hydrometer and Liquid Limit, Plastic Limit, and Plasticity Index	W-029, Rev # 0.0	7/17/06
Percent moisture		Lab SOP	Percent Solids Determination	W-001 Rev #3	5/4/07
Percent moisture		Lab SOP	Moisture Determination	SLA-015	5/12/06
Ecotoxicity					
Toxicity Studies		ASTM 2008, USEPA 2000	Chronic toxicity testing of Hudson River sediment samples with the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*	Study Code: 08-20-21	9/24/08
Bioavailability					
SPME - PCB congeners		USEPA 1668A	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	TBD	TBD
SPME - PCB homologs		USEPA 8270 mod.-LRMS SIM	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS-SIM	TBD	TBD

TBD = to be determined

Table 15. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of biological tissue quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
Preliminary Evaluation					
SemiVolatile Organic Extraction Procedure		USEPA 3570 - MSE	Microscale Solvent Extraction	OP-016, Rev # 2	2/12/08
PCB homologs (total PCBs by summation)		USEPA 8270 mod.- LRMS SIM	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS-SIM	O-015, Rev # 2	6/19/06
Chemistry					
SemiVolatile Organic Extraction Procedure		USEPA 3570 - MSE	Microscale Solvent Extraction	OP-016, Rev # 2	2/12/08
SemiVolatile Organic Extraction Procedure		USEPA 3540C - Soxhlet	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	MLA-010, Rev #10	11/14/08
PCB congeners		USEPA 1668A - HRGC/HRMS	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	MLA-010, Rev #10	11/14/08
PCDDs/PCDFs		USEPA 1613B - HRGC/HRMS	Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by USEPA Method 1613B, USEPA Method 8290/8290A, Env. Canada EPS 1/RM19 or USEPA Method DLMO 2.0	MLA-017, Rev #15	10/31/08
OC Pesticides + toxaphene		Lab SOP - HRGC/HRMS	Analytical Procedures for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS	MLA-028, Rev# 5	4/11/08
Metals Sample Preparation		USEPA 3050B	Acid Digestion of Solid Samples for Metals Analysis	MP-001, Iss # 5.1	5/2/08
Total Lead		USEPA 200.8; 6020A - ICPMS	Inductively Coupled Plasma - Mass Spectrometry	M-001, Rev # 4.1	4/29/08
Total Mercury		USEPA 7473 - CAAA	Mercury Determination in Tissue and Soil/Sediment Samples by Cold Vapor Atomic Fluorescence Technique (CVAF)	M-014, Iss # 1.1	5/5/08

Table 15. Summary of analytical methods and Standard Operating Procedures (SOPs) for measurement data for the investigation of biological tissue quality conditions at the Anniston PCB Site.

Analysis	Laboratory	Method/Technique	SOP Title	ID	Issued
Bioavailability					
SPME - PCB congeners		USEPA 1668A	Analytical Method for the Determination of 209 PCB Congeners by USEPA Method 1668A or USEPA Method CBC01	TBD	TBD
SPME - PCB homologs		USEPA 8270 mod.- LRMS SIM	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS-SIM	TBD	TBD

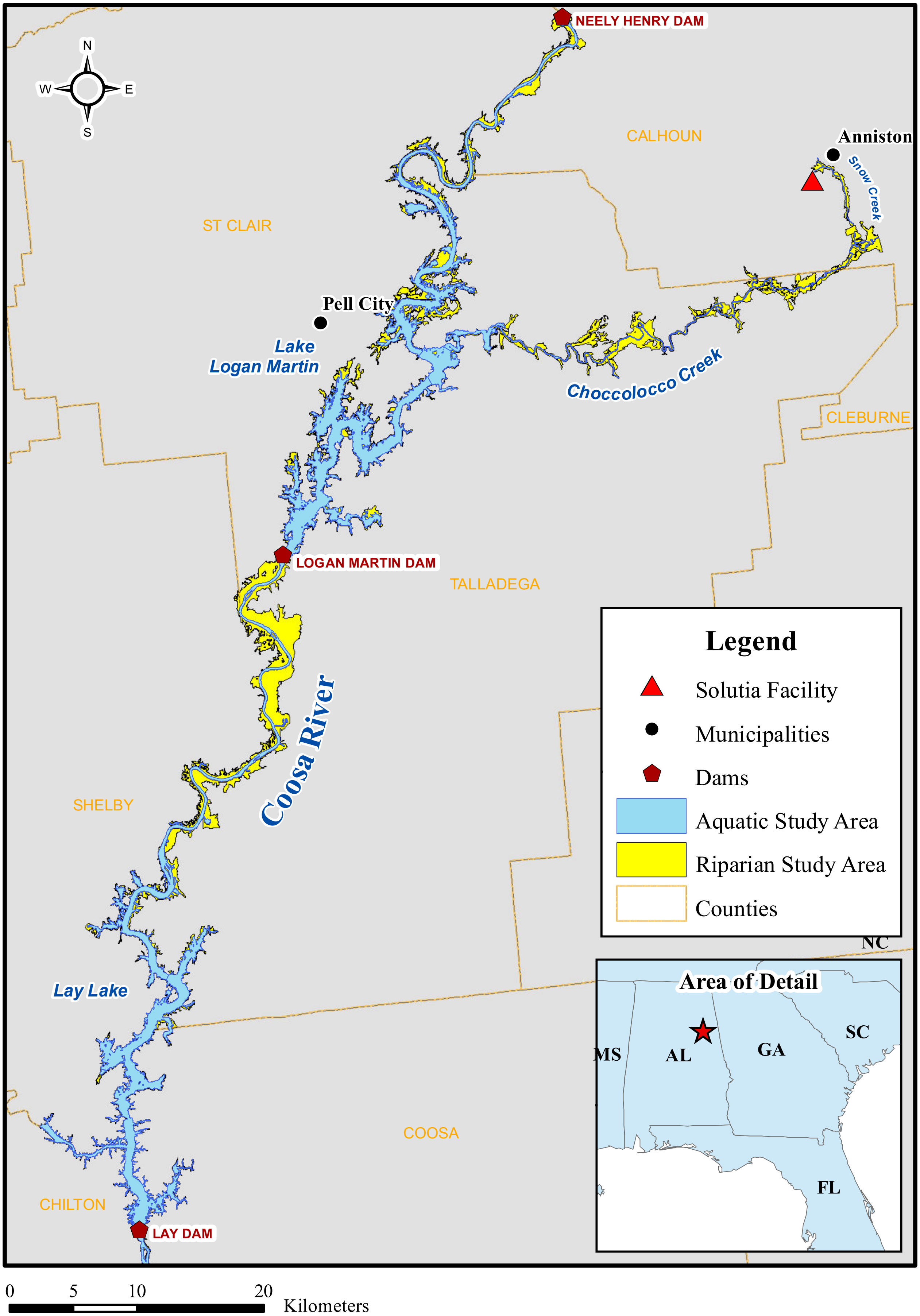
TBD = to be determined

Table 16. Summary of test conditions for conducting reference toxicant tests (in basic accordance with ASTM 2012 and USEPA 2000).

Parameter	Conditions
Test Chemical	Sodium chloride (NaCl)
Test type	Static
Test Duration	48 hours
Temperature	23°C
Light quality	Ambient laboratory light
Light Intensity	About 500 lux
Photoperiod	16L:8D
Test Chamber Size	Amphipod: 50 mL (with thin layer of quartz sand) Midge: 30 mL
Test Solution Volume	Amphipod: 30 mL Midge: 15 mL
Renewal of Solution	None
Age of Test Organism	Representative of organisms at the start of the toxicity tests: About 7-day-old.
No. Organisms per Test Chamber	Amphipods: 5 Midge: 1
No. Replicate chambers per Concentration	Amphipods: 4 Midge: 10
Feeding	No feeding
Chamber Cleaning	None
Aeration	None
Dilution Water	ASTM reconstitued hard water (170 mg/L as $CaCO_3$; ASTM 2012). Dilution factor: 0.5
Test Concentration	0, 0.63, 1.25, 2.5, 5, and 10 g NaCl/L
Chemical Residues	Salinity and conductivity in each NaCl solution will be measured at the beginning and the end of test.
Water Quality	Dissolved oxygen, pH, hardness, and alkalinity will be determined at the control, medium, and high NaCl concentrations at the beginning and the end of test.
Endpoint	Survival
Test Acceptability Criterion	≥ 90% control survival

Figures

Figure 1. Map of the study area for the Anniston PCB Site.



Appendix 1

Example Field Data Collection Forms

Table of Contents

Anniston PCB Site Assessment - Example Surface Water Sample Data Collection Form

General Information

Names of sampling personnel	
Sampling date and time	
General weather conditions	
Precipitation	
Wind speed and direction	
Notes	

Location Information

Reach	
Station	
Target coordinates (UTM zone 18N)	
Actual coordinates (UTM zone 18N)	
GPS Error (+/- m)	
Location notes	

Sample Information

Sample depth (location in water column)	
Type of sampler used	
Sample volume collected (target)	
Sample volume collected (actual- estimate)	
Number and volume of samples collected	
Unusual events during sampling (e.g., sampler did not close)	
Water temperature (°C)	
Salinity	
Dissolved oxygen	
Conductivity	
Sample odor (if readily apparent)	
Fauna observed in vicinity of stations	
Fauna collected	
Notes (e.g., problems encountered)	

Anniston PCB Site Assessment - Example Sediment Sample Data Collection Form

General Information

Names of sampling personnel	
Sampling date and time	
General weather conditions	
Precipitation	
Wind speed and direction	
Sample location wet or dry?	
Notes	

Location Information

Reach	
Station	
Target coordinates (UTM zone 18N)	
Actual coordinates (UTM zone 18N)	
GPS Error (+/- m)	
Location notes	

Sample Information

Sample depth (sediment surface to bottom of sampler)	
Type of sampler used	
Sample volume collected (target)	
Sample volume collected (actual- estimate)	
Number and volume of grabs collected	
Unusual events during sampling (e.g., sampler did not close)	
Presence or absence of overlying water in sampler	
Water characteristics (temperature, DO)	
Sediment type (e.g. clay, silt, sand, shells)	
Sediment color	
Sample odor (if readily apparent)	
Fauna observed in vicinity of station	
Fauna collected	
Description of surface biology (molluscs, crustacea, worms, etc.)	
Notes (e.g., problems encountered)	

Anniston PCB Site Assessment - Example Soil Sample Data Collection Form

General Information

Names of sampling personnel	
Sampling date and time	
General weather conditions	
Precipitation	
Wind speed and direction	
Sample location wet or dry?	
Notes	

Location Information

Reach	
Station	
Target coordinates (UTM zone 18N)	
Actual coordinates (UTM zone 18N)	
GPS Error (+/- m)	
Location notes	

Sample Information

Sample depth (soil surface to bottom of sampler)	
Type of sampler used	
Sample volume collected (target)	
Sample volume collected (actual-estimate)	
Number and volume of grabs collected	
Unusual events during sampling	
Presence or absence of overlying water	
Soil class (e.g. sandy clay, loamy sand, silty clay, etc.)	
Soil color	
Sample odor (if readily apparent)	
Fauna observed in vicinity of stations	
Fauna collected	
Description of surface biology (molluscs, crustacea, worms, etc.)	
Notes (e.g., problems encountered)	

Anniston PCB Site Assessment - Example Fish Sample Data Collection Form

General Information

Names of sampling personnel	
Sampling date and time	
General weather conditions	
Precipitation	
Wind speed and direction	
Water depth	
Notes	

Location Information

Reach	
Station	
Target coordinates (UTM zone 18N)	
Actual coordinates (UTM zone 18N)	
GPS Error (+/- m)	
Location notes	

Sample Information

Type of sampler used	
Number of organisms collected	
Unusual events or observations during sampling	
Notes (e.g., problems encountered)	

Observations

Sample ID	Species Name	Length (cm)	Weight (g)	Notes

Anniston PCB Site Assessment - Example Invertebrate Sample Data Collection Form

General Information

Names of sampling personnel	
Sampling date and time	
General weather conditions	
Precipitation	
Wind speed and direction	
Sample location wet or dry	
Water depth	
Notes	

Location Information

Reach	
Station	
Target coordinates (UTM zone 18N)	
Actual coordinates (UTM zone 18N)	
GPS Error (+/- m)	
Location notes	

Sample Information

Type of sampler used	
Number of organisms collected	
Unusual events or observations during sampling	
Description of substrate type (e.g. silt, sand, clay, mud, shells, detritus, soil class)	
Notes (e.g., problems encountered)	

Observations

Sample ID	Species Name	Length (cm)	Weight (g)	Notes

Anniston PCB Site Assessment - Example Avian Sample Collection Form

General Information

Names of sampling personnel	
Sampling date and time	
General weather conditions	
Precipitation	
Wind speed and direction	
Notes	

Location Information - Nesting Boxes

Exposure Area	
Nesting box number	
Species present	
Notes (e.g. description of avian or other wildlife activites within or in the vicininty of the nesting box)	

Location Information - Other Nesting Locations

Exposure Area	
Coordinates (UTM zone 18N)	
GPS Error (+/- m)	
Location notes (e.g. detailed description of nest placement)	

Sample Information

Bird species	
Number of eggs present in clutch	
Number of eggs collected	
Position of eggs in laying sequence	
Approximate age of eggs (e.g. within 1 day, within 3 days, cannot be determined)	
Notes (e.g., problems encountered)	

Station ID	Sample ID	Egg Number	Egg Weight (mg)	Egg Length (mm)	Shell Weight (mg)	Shell Thickness (mm)

Appendix 2

Example Chain-of-Custody Forms

Table of Contents

Project Name:	Anniston PCB Site Sampling Program

Sample ID#	Sample Type	Sample Description/Comments	
Transfer of Samples from Sampling Team to Sample Runner			
Relinquished By:			
Print Name	**Signature**	**Date**	**Time**
Received By:			
Print Name	**Signature**	**Date**	**Time**
Transfer of Samples from Sample Runner to Truck Inventory Team			
Relinquished By:			
Print Name	**Signature**	**Date**	**Time**
Received By:			
Print Name	**Signature**	**Date**	**Time**
Transfer of Samples from Truck Inventory Team to CERC Laboratory			
Relinquished By:			
Print Name	**Signature**	**Date**	**Time**
Received By:			
Print Name	**Signature**	**Date**	**Time**

science for a changing world

U.S. Department of the Interior
U.S. GEOLOGICAL SURVEY

Chain-of-Custody Record

Attachment 1

Study No.	Study Name	Control No.
Samplers: (Signatures)		page___ of ____

Sample Identification	Date	Time	Type *	Remarks and Observations

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)

Relinquished by: (Signature)	Date/Time	Received for Laboratory by:(Signature)	Date/Time	Remarks

* W=water, S=sediment, P=plant, F=fish, B=benthos, O=other, define in remarks[1]

For lab use only	Project number	Date
	Client	Sample Number

Reporting and Billing Information

Results to:		Invoice to (if different):	
Name		Name	
Company		Company	
Address		Address	
City	Province	City	Province
Country	Zip Code	Country	Zip code
Telephone	Fax	Telephone	Fax

Sample Information

Sample Name

Sampling Method	Special Instructions **See project QAPP**

Sampled by

Date	**Time**	

Container Type and Number

Toxicity Tests Required

Protocol		**100% screen (Pass/fail)**	**Concentration Range**	**Comments**
Acute	*Daphnia magna* 48-h static acute			
	Rainbow trout 96-h static acute			
Chronic	Salmonid 7d Embryo Viability			
	Fathead minnow 7-d survival and growth			
	Ceriodaphnia dubia 7-d survival and reproduction			
	Selenastrum growth 72-h inhibition			
Sediment	*Hyalella azteca* 10-d survival and growth			
	Hyalella azteca 28-d survival and growth			
	Chironomus dilutus 10-d survival and growth			
Other				Whole sediment (see QAPP)

Chain of Custody Record

Relinquished by: **Received by:**

Name	Date	Time	Name	Date	Time

USGS science for a changing world

Columbia Environmental Research Lab
4200 New Haven Road, Columbia, MO 65201
http://www.cerc.usgs.gov

For lab use only	Project number	Date
	Client	Sample Number

Reporting and Billing Information

Results to:		Invoice to (if different):	
Name		Name	
Company		Company	
Address		Address	
City	Province	City	Province
Country	Zip Code	Country	Zip code
Telephone	Fax	Telephone	Fax

Sample Information

Sample Name		
Sampling Method	Special Instructions **See project QAPP**	
Sampled by		
Date	**Time**	
Container Type and Number		

Chemistry Tests Required

Protocol	100% screen (Pass/fail)	Concentration Range	Comments
			Whole sediment (see QAPP)

Chain of Custody Record

Relinquished by:			Received by:		
Name	Date	Time	Name	Date	Time

USGS
science for a changing world

Columbia Environmental Research Lab
4200 New Haven Road, Columbia, MO 65201
http://www.cerc.usgs.gov

Columbia Analytical Services

800.695.7222
www.caslab.com

Client:

CHAIN of CUSTODY

Page ___ of ___

Project:

Method of Shipment

Project Manager

Telephone No.

Fax No.

Special Detection Limit/Reporting

Sample I.D.	Lab Sample No.	No. of Containers	Matrix: Soil	Matrix: Water	Matrix: Air	Matrix: Other	Prsv.: Yes	Prsv.: No	Sampling Date	Sampling Time															Turn Around Time (working days)

REMARKS

Sample Received Intact: Yes No

Temperature received: Ice No ice

Relinq. by sampler (Sign & Print Name)	Date	Time	Received by (Sign & Print Name)		
Relinquished by	Date	Time	Received by		
Relinquished by	Date	Time	Received by		
Relinquished by	Date	Time	Received by laboratory	Date	Time

Lab Work No.

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
DIVISION OF LAW ENFORCEMENT

CHAIN OF CUSTODY RECORD

FILE NO.
INV.

DATE AND TIME OF SEIZURE:	REGION	EVIDENCE/PROPERTY SEIZED BY:
	-	

SOURCE OF EVIDENCE/PROPERTY (person and/or location):	CASE TITLE AND REMARKS
☐ TAKEN FROM: ☐ RECEIVED FROM: ☐ FOUND AT:	

ITEM NO.	DESCRIPTION OF EVIDENCE/PROPERTY (include Seizure Tag Numbers and any serial numbers):

ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:

FORM 3-2063 (3/90)

☐ ADDITIONAL TRANSFERS ON REVERSE SIDE

ATTORNEY-CLIENT PRIVILEGED ATTORNEY WORK PRODUCT -- LITIGATION SENSITIVE

CHAIN OF CUSTODY RECORD
(continued)

FILE NO.

INV.

ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:
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	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:
ITEM NO.	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	☐ U.S. MAIL ☐ IN PERSON ☐ OTHER:

★ U.S. G.P.O.: 2000 592-561

Appendix 3

Example Screening Criteria for Evaluating Candidate Data Sets for the Anniston PCB Site

Appendix 3. Example Screening Criteria for Evaluating Candidate Data Sets for the Anniston PCB Site

A remedial investigation/feasibility study (RI/FS) is being conducted by the United States Environmental Protection Agency (USEPA) and Solutia/Pharmacia (S/P) to assess risks to human health and ecological receptors and to evaluate remedial options for addressing environmental contamination at the Anniston PCB Site. In addition to the RI/FS, the Natural Resources Trustees (NRTs; including United States Fish and Wildlife Service, Geological Survey of Alabama, and Alabama Department of Conservation and Natural Resources) are conducting a Natural Resource Damage Assessment (NRDA) to evaluate injuries to, loss of, or destruction of natural resources associated with releases of hazardous substances from the Anniston PCB Site. As indicated in the Stage 1 Assessment Plan, the NRTs will utilize data and information from the RI, from Trustee-led studies, and from other sources to determine if injuries to natural resources have resulted from releases of hazardous substances in the vicinity of the Anniston PCB Site. The NRTs will then evaluate the magnitude and extent (both spatially and temporally) of any natural resource injuries that are identified to support damage determination and restoration planning.

MacDonald Environmental Sciences Ltd.- Pacific Environmental Research Centre (MESL-PERC) is working collaboratively with the NRTs to evaluate injuries to natural resources in the study area associated with releases of hazardous substances from the Anniston PCB Site. This project includes the development of a project database compiling the historical biota, sediment, soil, toxicity, and water quality data that has been collected in the study area (1980 to present). The project database is being coupled with GIS information to facilitate spatial analyses and generate visual techniques for presenting complex data in an understandable format. The project database will be comprised of whole sediment data, sediment toxicity data, soil data, water quality data, and tissue chemistry data. The following screening criteria are intended to provide a means of evaluating candidate data sets and ensuring general consistency in the information included in the project database. However, the screening criteria are not necessarily recommended for applications beyond their intended purpose.

Criteria for Evaluating Data Set Acceptability

1. Samples must be located within the study area for the Anniston PCB Site. For the purposes of the NRDA, the Trustees have defined the Site as the 11th Street ditch, Snow Creek, Choccolocco Creek, Coosa River (including, but not limited to, Lay Lake and Lake Logan Martin), and associated floodplains.

2. Data sets that include data generated from dilution series (e.g., elutriate tests of bulk sediments) are not acceptable for incorporation into the database because there is too little connection between the chemistry and laboratory toxicity data. However, data from the 100% dilution series are acceptable to include in the database.

3. Data sets should include the location of sampling sites, preferably by georeference coordinates (i.e., longitude and latitude or UTM). Otherwise, the georeference coordinates can be estimated using GIS software and maps of the sample site locations. Data sets for which sample locations cannot be georeferenced should be qualitatively described as to the waterbody and reaches within the study area.

4. Acceptable procedures for collecting, handling and storing samples must be employed. If standard procedures (i.e., those developed by ASTM or USEPA) are not utilized, the alternative methods must be clearly stated and may be evaluated using best professional judgement. The rationale for decisions regarding procedure acceptability must be documented.

5. Any sediment or soil horizon (i.e., surficial sediments, cored sediment sections, etc.) can be incorporated into the database and can potentially be used to assess toxicity, bioaccumulation, and/or chemical indicators. However, the sample depth must be reported, or be able to be estimated or inferred from sampling methodology.

6. The analytical methods used in the study must be reported, must meet minimum data quality requirements/objectives, and detection limits must be reported. Data quality is considered acceptable if the author has stated that QA/QC procedures were followed and data quality objectives were met. If the author has not stated this clearly, data quality may be evaluated using various protocols and best professional judgement. The rationale for decisions regarding data acceptability must be documented.

7. Data acceptability must be further assessed by screening laboratory qualifier codes after all data have been incorporated. Each result is categorized as detected, undetected, undetected (detection limit not specified), and unacceptable.

8. Data that were generated using screening methods [e.g., X-ray fluorescence for metals; laser induced fluorescence (LIF) or other fluorometric screening methods for PAHs; immunoassay method for PCBs, etc.] are not acceptable for inclusion in the project database.

9. Concentrations of SEM metals (e.g., Cd, Cu, Pb, Ni, and Zn) may be included in the database, although data on the concentrations of total metals (i.e., strong acid digestion) are preferred.

10. Acceptable environmental conditions must be maintained throughout the toxicity/bioaccumulation tests (as defined in the protocols for the

toxicity/bioaccumulation test). Consequently, the temperature, pH, alkalinity, hardness, conductivity, and DO of the overlying water should have been measured during the test. Acceptable conditions are considered to be achieved if the author states that standard methods were employed and that acceptable environmental conditions were maintained in the bioassay chambers. Alternatively, if the authors have not explicitly assessed the overlying water quality conditions, and the raw overlying water quality data is provided in the report, the data should be assessed for acceptable conditions. Subsequently, any toxicity/bioaccumulation results associated with environmental conditions outside the acceptable ranges should be flagged.

11. For toxicity/bioaccumulation tests, the responses of the test organisms exposed to negative controls must be reported and be within acceptable limits (i.e., as defined in ASTM or USEPA test methods). For toxicity/bioaccumulation tests for which a negative control sediment is not available, then the selected field reference sediment must be shown to be functionally-equivalent to a negative control sediment, as indicated by non-toxicity (as defined by acceptable control sample criteria), concentrations of measured contaminants in matching sediment samples should not exceed their respective Level I Sediment Quality Targets (SQTs), and the particle size distribution and total organic carbon (TOC) levels should be similar to that in the basin area under investigation.

12. Standard toxicity/bioaccumulation test laboratory procedures must be employed. If procedures other than those developed by ASTM or USEPA are utilized, the acceptability of the test procedure may be evaluated using best professional judgement. Preference will be given to novel test procedures that have been published in the peer-reviewed literature. The rationale for decisions regarding procedure acceptability must be documented.

13. Sediment samples must not be frozen prior to biological testing.

14. For toxicity tests, samples must be designated as toxic or non-toxic based on statistical comparisons with the negative control or a suitable reference site (see #11 for a definition of what constitutes a suitable reference site). Results from the negative control and/or reference samples must be included in the database. The USEPA's decision tree for statistical analysis of survival, growth, and reproduction data subjected to hypothesis testing should be used for evaluating sediment toxicity data (USEPA 2000). Significant difference ($p<0.05$) in toxicity/bioaccumulation test results from test samples compared to negative control or reference samples must be determined using a pair-wise 1-tailed statistical test.

15. Data sets generated using organic extracts may be included in the database (e.g., Microtox®), provided they are available with other toxicity data. Microtox® and Mutatox® data are not being targeted for inclusion in the database because the linkage between the toxicity data and effects on sediment-dwelling organisms is tenuous.

Suggested Guidance Documents

ASTM (American Society for Testing and Materials). 2012. 2012 Annual Book of Standards. Volume 11.06. Biological effects and environmental fate; biotechnology. West Conshohocken, Pennsylvania.

ASTM (American Society for Testing and Materials). 2012. Standard guide for determination of bioaccumulation of sediment-associated contaminants by benthic invertebrates. E1688-10. In Annual Book of Standards, Vol 11.06, West Conshohocken, Pennsylvania.

USEPA (Unites States Environmental Protection Agency). 2000. Methods for measuring the toxicity and bioaccumulation of sediment-associated contaminants with freshwater invertebrates. Second Edition. U.S. Environmental Protection Agency, Office of Research and Development, Washington, District of Columbia. EPA/600/R-99/064.

Appendix 4

Data Quality Check Sheet for Data for the Anniston PCB Site Database

STUDY NAME/LIBNO: ____
DATA ENTRY/TRANSLATION DATE: ____
QA/QC DATE: ____
NAME OF FILE PRINTED & VERIFIED: ____
DESCRIPTION OF DATA SOURCE USED FOR DATA CHECKING (be specific):
____
____

STEP #1 QA/QC CHECKS FOR <u>TRANSLATED</u> DATA COMPLETED:

Name of Reviewer #1 (print): ____________________ Initials/Date:________________________

Name of Reviewer #2 (print): ____________________ Initials/Date:________________________

STEP #2 QA/QC CHECKS FOR <u>MANUALLY</u>-ENTERED DATA COMPLETED:

Name of Reviewer #1 (print): ____________________ Initials/Date:________________________

Name of Reviewer #2 (print): ____________________ Initials/Date:________________________

Initial and date to verify that changes incorporated: ___________________________________

Initial and date to verify that changes checked: ___________________________________

STEP #3: DOCUMENTATION

Verify if the following documentation is available.

Approved QAPP or SAP ______
Copy of the Laboratory Data Report Package ______
(either electronic or hard copy).
Data validation summary, files, report, etc. ______

Name of Reviewer (print): ____________________ Initials/Date:_____________________

STEP #4: QA/QC PROCEDURES FOR VERIFYING TRANSLATED DATA

The following steps are required as part of the QA/QC check of the data translation process, *after* data have been translated from spreadsheet format into MS Access format.

- Use a random number generator to select x stations and y chemicals to check (determine x and y to ensure that at least 10% of the data are checked). This ensures that all data for a chemical and/or station were not excluded in the translation process.

- One person reads the information from a printed copy of the original data file or hard copy: site number, chemical name, analysis result, units, and qualifiers.

- Another person verifies the information by putting a checkmark on a hard copy.

- If any errors are encountered, the reason for the error is investigated. Usually the error is associated with:
  - A shift in the data (across or down or both). In this case the data are re-translated and data-checking would start from step 1, or
  - An omission of a chemical or station or both. In this case the missing data are added and the data-checking process starts from step 1, *ensuring that the missing data are included as part of the data-checking step,* or
  - Data fields have been truncated. In this case the data are re-translated and data-checking would start from step 1, or
  - There are problems with the assigned data type (i.e., text vs. values; double number field vs. single number field). In this case the compatibility with the data types is resolved and tested, to ensure that the translated data represents exactly what was in the original data file. Then the data are re-translated and data-checking would start from step 1.

- The hard copies of the signed and dated data-checking sheets and the completed Data Quality Check Sheet are retained on file for an indefinite time period.

- An electronic list is maintained of the QA/QC checks conducted. Any errors and subsequent changes made are recorded in this list. This list is maintained in an MESL sub-directory that has an on-site and off-site back-up.

STEP #5: QA/QC PROCEDURES FOR VERIFYING MANUALLY ENTERED DATA

The following steps are required as part of the QA/QC check of the data entry process, after data have been manually entered in a spreadsheet or MS Access. Each cell that has manually entered data or information will be 100% verified.

- One person reads the information from a printed copy of the original data file or hard copy. This will include, at a minimum: site number, chemical name, analysis result, units, and qualifiers. Information entered in other fields that may be entered globally (e.g., DW or WW basis) do not have to be checked for each record.

- Another person verifies the information by putting a checkmark on a hard copy. Required corrections are recorded CLEARLY and NEATLY on the hard copy

- If any errors are encountered, the reason for the error is investigated. If the error is systemic, the data entry person corrects the errors and prints another hard copy before data-checking resumes.
- One person incorporates the corrections into the data file.

- Another person checks that the corrections have been correctly incorporated, indicating this with a different colored checkmark on the hard copy. This person also signs and dates the hard copy (indicating changes have been incorporated).

- The hard copy of the signed and dated data-checking sheets and the completed Data Quality Check Sheet are retained on file for an indefinite time period.

- An electronic list is maintained of the QA/QC checks conducted. Any errors and subsequent changes made are recorded in this list. This list is maintained in an MESL sub-directory that has an on-site <u>and off-site</u> back-up.

- All data sets should be double-checked to ensure that changes were incorporated and the Data Quality Check Sheet should be signed and dated to confirm that this step was completed.