ARKEMA EARLY ACTION
EE/CA WORK PLAN

Work Plan Addendum

Appendix B
Quality Assurance Project Plan

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SECTION A: PROJECT MANAGEMENT

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QUALITY ASSURANCE PROJECT PLAN
ENGINEERING EVALUATION/COST ANALYSIS
ARKEMA IN-WATER REMOVAL ACTION
PORTLAND, OREGON

Quality Assurance Plan Approvals

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U.S. EPA Project QA Manager	TBD	_____	Date: _____
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Integral Project Manager:	David Livermore	_____	Date: _____
Integral QA Manager:	Laura Jones	_____	Date: _____
TestAmerica Project Manager:	Katie Downie	_____	Date: _____
TestAmerica Laboratory QA Manager:	Christina Mott	_____	Date: _____
Kleinfelder Project Manger	Jeremy Mason	_____	Date: _____
Kleinfelder QA Manager	Jeff Revard	_____	Date: _____

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LIST OF ACRONYMS

ACG	analytical concentration goal
ASTM	American Society for Testing and Materials
CLP	Contract Laboratory Program
COC	chain-of-custody
COI	constituent of interest
CPT	cone penetration test
DDx	total of 2,4'- and 4,4'-DDD, DDE, DDT
DEQ	Oregon Department of Environmental Quality
DQO	data quality objective
EDD	electronic data deliverable
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
FSP	field sampling plan
GC/ECD	gas chromatography/electron capture detector
GC/MS	gas chromatography/mass spectrometry
HAZWOPER	Hazardous Waste Operations and Emergency Response
HRGC/ HRMS	high resolution gas chromatography/high resolution mass spectrometry
ICP/AES	inductively coupled plasma/atomic emission spectrometry
ICP/MS	inductively coupled plasma/mass spectrometry
Integral	Integral Consulting Inc.
LIMS	laboratory information management system
LSS	Legacy Site Services LLC
MDL	method detection limit
MRL	method reporting limit
NTCRA	non-time critical removal action
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl

PCDD/F	polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran
QA/QC	quality assurance and quality control
QAPP	quality assurance project plan
RAA	removal action area
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	standard operating procedure
SPT	standard penetration test
SVOC	semivolatile organic compound
TCLP	toxicity characteristic leaching procedure
TIC	tentatively identified compound
TOC	total organic carbon
VOC	volatile organic compound
ZHE	zero headspace extraction

A3 DISTRIBUTION LIST

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Integral Project Manager:	David Livermore
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Integral Data Manager:	Tom Schulz
TestAmerica Project Manager:	Katie Downie
TestAmerica QA Manager:	Christina Mott
Kleinfelder Project Manager:	Jeremy Mason
Kleinfelder QA Manager:	Jeff Revard

A4 INTRODUCTION AND PROJECT ORGANIZATION

A4.1 Introduction

This quality assurance project plan (QAPP) describes quality assurance and quality control (QA/QC) procedures that will be used for characterization activities to complete the engineering evaluation/cost analysis (EE/CA) for non-time critical removal action (NTCRA) at the Arkema site (Site), located in Portland, Oregon. This QAPP is Appendix B to the EE/CA Work Plan Addendum (Work Plan Addendum). The Work Plan Addendum modifies and updates the May 11, 2007 U.S. Environmental Protection Agency (EPA)/Parametrix Arkema Early Action EE/CA Work Plan (EPA/Parametrix Work Plan) pursuant to agreements between EPA and Legacy Site Services LLC (LSS), agent for Arkema Inc., between May 2007 and May 4, 2009, and findings by EPA (USEPA 2008a). Together, the EPA/Parametrix Work Plan, the Work Plan Addendum, and this and other revised appendices encompass the Final EE/CA Work Plan for the Site. This QAPP has been prepared in accordance with EPA guidance for the preparation of QAPPs (USEPA 2002a).

The Site is located in Portland, Oregon on the northwest bank of the lower Willamette River between approximately river mile 6.9 and 7.6 (Parametrix 2007, Figure 1-1). The upland portion of the Site encompasses approximately 54 acres of land. The in-water portion of the Site is defined as the land below mean high water (18.1 ft City of Portland datum)[1]; however, the NTCRA evaluation will include portions of the riverbank to the top of bank, as the riverbank cannot easily be subdivided for construction purposes. The EE/CA NTCRA is primarily focused on the in-water portion of the Site; however, elements of the removal action will be integrated with the upland portion of the Site. The portions of the riverbank (to the top of bank) that are deemed to be recontamination sources or to impact the removal and/or remedial action alternatives may be addressed by the NTCRA, while the remainder of the riverbank may be addressed directly with the Oregon Department of Environmental Quality (DEQ) in accordance with the Agreed Order on Consent dated October 31, 2008. Ultimately, the timing and coordination between the Upland and NTCRA projects will dictate under which program the NTCRA-affected riverbank portions will ultimately be addressed in the field.

This QAPP along with the associated field sampling plan (FSP; Appendix A), provides specific methodology and quality assurance procedures that will be followed by Integral Consulting Inc. (Integral) and its subcontractors during the removal action characterization activities associated with the EE/CA. Additional information about the sampling design and rationale is provided in the associated FSP (Appendix A) which accompanies this document.

[1] The in-water portion of the Site below mean low tide is leased from the Oregon Division of State Lands.

The primary objective of this field effort is to collect sufficient additional sediment characterization data to complete the EE/CA for the NTCRA at the Site. The primary objective of the EE/CA characterization activities is to fill data gaps to further refine the 5 mg/kg preliminary removal action area (RAA) boundary, especially at depth, as cited in the May 23, 2008 Final Decision on Disputes from Dan Opalski, Director, Office of Environmental Cleanup (Opalski Decision). EPA's seven step data quality objective (DQO) process (USEPA 2006) was used to guide the requirements and design rationale for data collection activities presented in this QAPP and associated FSP. A summary of the output from this DQO process is provided in Table A4-1 for the sediment quality characteristics and in Table A4-2 for the physical and engineering testing. Detailed discussions of the various study components are presented in subsequent sections of this QAPP and associated FSP.

The field effort will include collection of sediments (from boreholes) for various test characteristics (e.g., sediment quality characteristics, physical and engineering characteristics, and waste characterization), as detailed in Table A4-3. Additional information is provided in the FSP (Appendix A).

A4.2 Project and Task Organization

This section presents the organizational structure for activities associated with the Arkema EE/CA, including project management and oversight, fieldwork, sample analysis, and data management. Integral is conducting this work under contract with LSS, with direction from EPA and DEQ. The organizational structure for this project is illustrated in Figure A4-1. Contact information is provided in Table A4-4. Project and QA responsibilities are described in detail in Section 10 of the Final EE/CA Work Plan (Parametrix 2007; Integral 2008a,b).

A4.2.1 EPA Organization and Responsibilities

EPA will oversee activities associated with the Arkema EE/CA and will coordinate all Trustee, Tribe, and State input regarding the development of technical and decision documents. The project manager for EPA is Sean Sheldrake. The EPA QA manager will be assigned by EPA.

A4.2.2 Key Task Personnel

Personnel involved in the Arkema EE/CA are listed below.

EE/CA Project Manager—David Livermore, a registered geologist in Oregon, is the Integral principal-in-charge and project manager and will serve as the point of contact for LSS. He will be responsible for implementing and executing the technical, quality assurance, and administrative aspects of the EE/CA, including the overall management of the project team. Mr. Livermore will be responsible for the quality and timeliness of Integral documents.

EE/CA Task Manager—Mike Martin is the EE/CA task manager, and is responsible for conducting the EE/CA. He will work closely with the project manager and the task QA manager to ensure the objectives of the study are achieved. In the event that changes in the FSP or QAPP are needed, he will discuss proposed changes with LSS and EPA's project managers or other designated EPA staff. Changes to the FSP and QAPP will not be made without prior approval from the EPA project manager unless conditions in the field or laboratory require immediate response.

Field Operations Manager—Eron Dodak (Integral) is the field operations manager for the EE/CA. He will be responsible for the following activities:

- Oversee planning and coordination for all sampling efforts
- Oversee all aspects of sampling activities to ensure that the appropriate sampling, QA, and documentation procedures are used.

Mr. Dodak will work closely with the task manager and will be notified immediately if problems occur in the field. If changes to the FSP or QAPP are warranted, he will immediately notify the task manager.

Quality Assurance Manager—Laura Jones (Integral) will be the QA manager for the EE/CA. She will be responsible for the following activities:

- Provide QA support for the EE/CA
- Ensure that the QAPP and FSP contain all components necessary to meet EPA guidance (USEPA 2002a)
- Verify that the laboratories implement the requirements of the FSP and QAPP and address quality assurance issues related to laboratory analyses
- Coordinate the activities of the laboratories and track laboratory progress
- Direct the validation of the chemical data
- Communicate data quality issues to the data users
- Work with data users and EPA to address any data limitations.

Database Administrator—Tom Schulz (Integral) will have primary responsibility for data management and database maintenance and development. Mr. Schulz will be responsible for the following activities:

- Work with the field crew to ensure field data entries are correct and complete
- Work with the laboratories to ensure that data are delivered in the correct format for entry into the Environmental Quality Information System (EQuIS) database

- Work with data validators and the QA manager to ensure correct and efficient entry of data qualifiers
- Take all necessary measures to develop and maintain the integrity and completeness of the database
- Provide various data summaries to data users in the required formats for interpretation and for importing into EPA's database.

A4.2.3 Chemical Laboratories

Laboratory Project Manager—The laboratory project manager carries overall responsibility for the successful and timely completion of sample analyses for this project. The laboratory project manager will be responsible for the following tasks:

- Ensure that samples are received and logged in correctly, that the correct methods and modifications are used, and that data are reported within specified turnaround times
- Review analytical data to ensure that procedures were followed as required in this QAPP, the cited methods, and laboratory standard operating procedures (SOPs)
- Keep the QA manager apprised of the schedule and status of sample analyses and data package preparation
- Notify the QA manager if problems occur in sample receiving, analysis, or scheduling, or if control limits cannot be met
- Take appropriate corrective action as necessary
- Report data and supporting QA information as specified in this QAPP.

Laboratory Quality Assurance Manager—The Laboratory QA manager is responsible for overseeing the QA activities in the laboratory and ensuring the quality of the data for this project. Specific responsibilities include the following:

- Oversee and implement the laboratory's QA program
- Maintain QA records for each laboratory production unit
- Ensure that QA/QC procedures are implemented as required for each method and provide oversight of QA/QC practices and procedures
- Review and address or approve non-conformity and corrective action reports
- Coordinate response to any QC issues that affect this project with the laboratory project manager.

A5 PROBLEM DEFINITION AND BACKGROUND

The primary objective of the EE/CA characterization activities is to fill data gaps in order to further refine the preliminary RAA boundary, especially at depth, as cited in the Opalski Decision. The additional characterization falls into two general categories:

- Defining sediment quality characteristics
- Defining sediment physical and engineering characteristics.

The rationale for sample collection is summarized in Table 2-3 of the FSP. Sampling during this field effort will consist of surface and subsurface sediment sampling. Integral will collect sediment samples and will prepare the samples for delivery to the laboratories. This QAPP addresses QA/QC activities, laboratory procedures, and data management procedures for sediment core samples. The analytical requirements and any additional QA/QC activities for any future sampling will be addressed in future QAPP addenda.

A6 TASK DESCRIPTION

The tasks to be completed for the Arkema EE/CA include sample collection, laboratory analyses, data quality evaluation, data management, and report preparation. Summaries of these tasks and references to detailed descriptions are provided in this section.

A6.1 Field Tasks

Tasks that will be completed in the field, including related documentation and QA/QC activities, are described in detail in Section 3 of the FSP (Appendix A). Field tasks will include the collection of sediment from nearshore to the western edge of the navigation channel of the lower Willamette. The rationale for the field sampling is discussed in Section 2 and Table 2-3 of the FSP. The constituents of interest (COIs) to be analyzed and the anticipated sampling schedule are discussed in the following sections. The following activities are addressed in the FSP:

- Horizontal and vertical control methods
- Sampling equipment and methods
- Sample identification
- Sediment processing methods
- Sample containers and labels
- Field documentation and shipping procedures
- Decontamination procedures

- Handling and disposal of investigation-derived wastes.

A6.1.1 Sediment Chemistry

A total of 37 sediment chemistry boreholes are proposed (WB-30 through WB-66; FSP Figure 2-1) and will be completed to basalt (or refusal) to evaluate the horizontal and vertical extent of COIs within and adjacent to the 5 mg/kg RAA boundary for DDx (the total of 2,4'- and 4,4'-DDT, DDD, and DDE). Samples will be collected for chemical analyses and/or archived at all proposed sampling locations. The proposed sampling, analysis, and archiving plan and rationale for each borehole location is summarized in FSP Table 2-3. Proposed sediment samples are distributed at representative locations within the vicinity of the preliminary RAA boundary to measure the vertical and horizontal extent of DDx and other chemicals. In addition to characterizing the broader Site conditions, this sampling will focus on the perimeter of the 5 mg/kg preliminary RAA boundary contour where the majority of DDx mass is located. Selected samples will be archived for possible subsequent analysis, depending on the analytical results from samples collected at nearby boreholes (FSP Table 2-3; FSP Figure 2-1).

Most samples will be analyzed for the standard analyte list, which includes the following:

- Conventional analytes (grain size, total solids, and total organic carbon [TOC]) by American Society for Testing and Materials (ASTM) Method D-422, EPA Method 160.3 modified, and EPA Method SW846-9060A, respectively
- DDx by EPA Method SW846-8081A.

Other samples, as identified in FSP Table 2-3, will be analyzed for an expanded analyte list to better characterize the nature and extent of river-wide COIs inside and adjacent to the preliminary RAA. The expanded analyte list includes the following:

- Standard analyte list (described above)
- Semivolatile organic compounds (SVOCs) by EPA Method SW846-8270C
- Polychlorinated biphenyl (PCB) Aroclors by EPA Method SW846-8082
- Volatile organic compounds (VOCs) by EPA Method SW846-8260B
- Organochlorine pesticides by EPA Method SW846-8081A
- Polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran (PCDD/Fs) by EPA Method 1613B.

A6.1.2 Physical and Engineering Characteristics

The geotechnical investigation program will consist of 3 mud-rotary sediment borings and 13 cone penetration test (CPT) explorations to evaluate geotechnical properties and subsurface

conditions within and adjacent to the RAA boundary (FSP Figure 2-1). As described in Section 2.2.2 of the FSP, the selection of samples for geotechnical testing will be determined on the basis of observed lithology, as required to characterize the observed range of lithologies and associated geotechnical conditions critical to the selection, evaluation, and design of candidate removal action technologies (FSP Table 2-1). Target sample intervals in the standard penetration test (SPT) borehole will be determined in the field based on the interpretation of the collocated CPT exploration, which will be advanced prior to the SPT geotechnical boring. The geotechnical testing program will include the following parameters:

- Grain-size analysis by ASTM-D422
- Atterberg limits by ASTM-D4318
- Specific gravity by ASTM-D854
- Moisture content by ASTM-D2216
- Organic content by ASTM-D2974
- Consolidation by ASTM-D2435 Method B
- Unconsolidated, undrained triaxial shear stress by ASTM-D2850
- Consolidated, undrained triaxial shear stress by ASTM-D4767
- Torvane shear strength testing (field test)
- Unconfined compressive strength (rock) by ASTM-D7012
- Point load index (rock) by ASTM-D5731
- Hydraulic conductivity by ASTM-D5084.

Laboratory vane shear strength testing for the Shelby tube samples will be conducted by using the Torvane test rather than the "mini" vane test. Integral was unable to locate a geotechnical laboratory in the area with the necessary equipment required to perform the laboratory "mini" vane test per ASTM D4648.

In addition to the above laboratory tests, the following tests will be performed *in situ* by the drilling subcontractor (to be selected) during the field sampling program.

- CPT by ASTM-D5778
- Pore Pressure Dissipation by ASTM-D5778.

A6.1.3 Waste Characterization Testing

The assessment of offsite landfill disposal will be performed with landfill-specific acceptance criteria including hazardous waste determinations, such as the toxicity characteristic leaching procedure (TCLP) test.

Two large-volume samples will be composited from each of seven boreholes located between Dock 1 and Dock 2 (WB-35, WB-36, WB-37, WB-39, WB-41, WB-42, and WB-43; FSP Table 2-3). These areas are within or immediately downstream of the highest DDx concentrations in sediments within the RAA boundary. The composite sample analyses will provide data for sediment that could require disposal as part of the removal action. The FSP Figure 2-1 presents the proposed boring locations for each composite sample. The FSP Table 2-3 shows the compositing intervals for each large-volume sample. A total of 14 composite samples will be collected, two from each borehole.

A representative sample of each composite sediment described above will be analyzed for hazardous waste determination and used to assess landfill disposal. The composite sediment samples will be analyzed for the following:

- TCLP for standard TCLP VOCs, SVOCs, metals, pesticides, and herbicides (42 individual chemicals using EPA SW-846 methods)
- Asbestos by EPA Method 600/R-93-116.

Additional testing associated with disposal at a solid waste landfill may also be performed. These analyses may include the following:

- PCB Aroclors by EPA Method SW846-8082
- PCDD/Fs by EPA Method 1613B.

A6.2 Laboratory Analyses and Deliverables

Chemical analysis of surface sediment, subsurface sediment, and associated field QC samples will be completed by four laboratories. TestAmerica (Tacoma, Washington; Burlington, Vermont; Knoxville, Tennessee; West Sacramento, California) will complete all chemistry analyses. Waste characterization (i.e., TCLP analyses) will be performed at TestAmerica (Tacoma). Kleinfelder (Redmond, Washington and Beaverton, Oregon) will perform geotechnical and physical testing of subsurface sediments. All rock testing methods (ASTM D7012 and ASTM D5731) will be performed at the Kleinfelder Redmond location. All other geotechnical and engineering laboratory analyses can be performed at either Kleinfelder location; however, it is anticipated that the majority of these analyses will be performed at the Kleinfelder Beaverton laboratory. In particular, all geotechnical sediment samples collected in Shelby tubes will be tested at the Kleinfelder Beaverton laboratory in order to minimize any disturbance to the samples prior to testing. The CPT and pore pressure dissipation testing will be performed in the field by the drilling subcontractor, who has not yet been selected. A laboratory has not yet been selected for completion of the asbestos analysis. Laboratories and analysis methods are provided in Tables A6-1 to A6-3. Complete analyte lists with analytical concentration goals (ACGs) as applicable and method reporting limits (MRLs) have been

provided in Table A6-4 (sediment), Table A6-5 (field blanks), and Table A6-6 (waste characterization analyses).

Analyses will be completed using EPA methods (USEPA 2008b) and other established methods as indicated in Tables A6-1 to A6-3. Full laboratory data reports will be provided in hard-copy and electronic data deliverables (EDDs) will be provided in spreadsheet format as required for importing into the database. A list of hard copy data deliverables from the laboratory is provided in Section A9.2.

A6.3 Data Quality Evaluation

Data quality evaluation includes the components of data verification and data validation (USEPA 2002b). Data verification involves verifying that correct procedures were followed and that control limits were met. Data validation involves evaluating the quality and usability of the data in the context of project objectives. Data verification will initially be completed by the laboratories that generate the data. Integral's field staff will verify data generated in the field, and each laboratory will verify data generated at the laboratory in accordance with its SOPs and QA manual. The accuracy and completeness of the final database will be verified by Integral under the direction of the database administrator.

Third-party data validation and data verification will be completed by Environmental Standards, Inc. of Valley Forge, Pennsylvania. Verification and validation procedures are described in Section D2 of this QAPP.

A6.4 Data Management

Integral is responsible for data management for the Arkema EE/CA. The EQuIS database application is used as the final repository for all data related to the Arkema EE/CA and will be used to manage the field and laboratory data. Field data will by necessity be entered manually. Data will be provided electronically by the laboratories and imported directly into the database. Data management procedures are discussed in Section B10.

A6.5 Reports

A removal action characterization report will be prepared by Integral after the sampling event and will be provided to EPA after laboratory analyses and the data quality review have been completed and the data are final. Reports are described in Section C2.

A6.6 Project Schedule

The start date for field sampling will be determined following EPA approval of this QAPP and FSP. However, for illustrative purposes, it is anticipated that 2009 field sampling efforts will begin in August 2009. Sample analysis and data validation for all laboratory analyses are each

expected to require 4 to 6 weeks for completion, for a total of 8 to 12 weeks from the time that sample collection is completed until finalization of the database. The field and reporting schedules are discussed further in Section 9 of the Work Plan Addendum (Integral 2008a).

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

DQOs were developed for the Arkema EE/CA using EPA's DQO process (USEPA 2000) to describe data and data quality needs for the project. DQOs are designed to ensure that the type, quality, and quantity of environmental data used in decision making are appropriate for their intended application. Data quality indicators such as the PARCC (precision, accuracy, representativeness, completeness, and comparability) parameters (USEPA 2002a) and analytical sensitivity will be used to assess conformance of data with quality control criteria. DQOs and quality control criteria are described in this section.

A7.1 The Data Quality Objective Process

As part of the development of the Final EE/CA Work Plan (Parametrix 2007; Integral 2008a,b), data needs were evaluated. The primary objective is to conduct additional characterization to fill data gaps for refinement of the RAA boundary. Characterization activities are divided into two general categories:

- Defining sediment quality characteristics
- Defining sediment physical and engineering characteristics.

A summary of the outputs of the DQO process are provided in Table A4-1 (sediment chemistry) and Table A4-2 (geotechnical, physical, and engineering testing). Details of the sample collection are summarized in Section 3 of the FSP. The rationale for sample collection is summarized in Tables 2-3 and 2-4 of the FSP.

Low-level reporting limits for selected analytes for sediment samples will be required. ACGs have been established to identify analytical sensitivity levels that will be sufficient for all data uses (Table A6-4). Although ACGs can be met for many analytes, modifications to optimize laboratory MRLs are not sufficient to meet the ACGs in all cases. The listed reporting limits reflect the use of method modifications (e.g., large volume injector, smaller extract volume) the laboratories plan to implement to achieve the corresponding project method detection limits (MDLs) and MRLs. The MRLs and ACGs for sediment, field blanks, and waste characterization analyses are provided in Tables A6-4 to A6-6. Analytical sensitivity is discussed further in the following section.

A7.2 Data Quality Indicators

The overall quality objective for the Arkema EE/CA is to develop and implement procedures that will ensure the collection of representative data of known and acceptable quality. The quality procedures and measurements that will be used for this project are based on EPA methods (USEPA 2008b) and on established laboratory methods from other sources (ASTM 2004).

PARCC parameters are commonly used to assess the quality of environmental data.

Bias represents the degree to which a measured concentration conforms to the reference value. The results for matrix spikes, laboratory control samples, field blanks, and method blanks will be reviewed to evaluate bias of the data. The following calculation is used to determine percent recovery for a matrix spike sample:

$$\%R = \frac{M - U}{C} \times 100$$

%R = Percent recovery
M = Measured concentration in the spiked sample
U = Measured concentration in the unspiked sample
C = Concentration of the added spike

The following calculation is used to determine percent recovery for a laboratory control sample or reference material:

$$\%R = \frac{M}{C} \times 100$$

%R = Percent recovery
M = Measured concentration in the reference material
C = Established reference concentration

Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Any analytes detected in field or method blanks will be evaluated as potential indicators of bias.

Precision reflects the reproducibility between individual measurements of the same property. Precision will be evaluated using the results of matrix spike duplicates, laboratory duplicates, field splits, and field replicates. Precision is expressed in terms of the relative standard deviation for three or more measurements and the relative percent difference (RPD) for two measurements. The following equation is used to calculate the RPD between measurements:

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} \times 100$$

RPD = Relative percent difference
C_1 = First measurement
C_2 = Second measurement

The relative standard deviation is the ratio of the standard deviation of three or more measurements to the average of the measurements, expressed as a percentage.

Completeness will be calculated as the ratio of usable data (i.e., unqualified data and U- or J-qualified data) to generated data, expressed as a percentage. Completeness will be calculated for each suite of analytes for each sample type and sampling event.

Additional laboratory QC results will be evaluated to provide supplementary information regarding overall quality of the data, performance of instruments and measurement systems, and sample-specific matrix effects.

QC samples and procedures are specified in each method protocol that will be used for this project. Methods are summarized in Table A6-1 to A6-3. All QC requirements will be completed by each laboratory as described in the protocols, including the following (as applicable to each analysis):

- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Calibration or instrument blanks
- Method blanks
- Laboratory control samples
- Internal standards
- Surrogate spikes
- Serial dilutions

- Matrix spikes
- Matrix spike duplicates or laboratory duplicates.

To alert the data user to possible bias or imprecision, data qualifiers will be applied to reported analyte concentrations when associated QC samples or procedures do not meet control limits. Laboratory control limits for the methods that will be used for this site investigation are provided in Tables A7-1 through A7-6 and in the laboratory QA manuals (Attachment A). The laboratory control limits presented in these tables are current as of the writing of this document. Control limits are periodically updated by the laboratory, and the control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. Data validation criteria and procedures are described in Sections D1 and D2 of this QAPP.

MRLs reflect the sensitivity of the analysis. Target MRLs for this study are summarized in Tables A6-4 to A6-6. Method modifications are described in Section B4.

MDLs have been determined by each laboratory for each analyte, as required by USEPA (2008b; Tables A6-4 toA6-6). MDLs are statistically derived and reflect the concentration at which an analyte can be detected in a clean matrix (e.g., sand or distilled water) with 99 percent confidence that a false positive result has not been reported. MRLs are established by the laboratories at levels above the MDLs for the project analytes. The MRL values are based on the laboratories' experience analyzing environmental samples and reflect the typical sensitivity obtained by the analytical system in environmental samples. The concentration of the lowest standard in the initial calibration curve for each analysis is at the level of the MRL. This allows reliable quantification of concentrations to the MRL in the absence of matrix interferences.

For all chemical analyses except high-resolution gas chromatography/high-resolution mass spectrometry (HRGC/HRMS) analysis of chlorinated dioxins/furans, analyte concentrations for this investigation will be reported to the MDL. Analytes detected at concentrations between the MRL and the MDL will be reported with a J qualifier to indicate that the value is an estimate (i.e., the analyte concentration is below the calibration range). Non-detects will be reported at the MDL. The MDL will be adjusted by each laboratory, as necessary, to reflect sample dilution or matrix interference. MDLs are updated periodically by the laboratories, and the MDLs that are in effect at the laboratory at the time of analysis will be used. The use of the MDL to report data for non-detects will be evaluated during data quality review. For analysis of chlorinated dioxins/furans by EPA Method 1613B, sample-specific detection limits will be reported as described in the EPA method. Results for all physical and engineering characteristics will be reported as specified in the applicable methods and according to the laboratory's SOPs.

Representativeness and comparability are qualitative QA/QC parameters. Representativeness is the degree to which data represent a characteristic of an environmental condition. In the field, representativeness will be addressed primarily in the sampling design by the selection of sampling sites and sample collection procedures. In the laboratories, representativeness will be

ensured by the proper handling and storage of samples and initiation of analysis within holding times.

Comparability is the qualitative similarity of one data set to another (i.e., the extent to which different data sets can be combined for use). Comparability will be addressed through the use of field and laboratory methods that are consistent with methods and procedures recommended by EPA and commonly used for sediment studies.

A8 SPECIAL TRAINING/CERTIFICATION

Integral has assembled a project team with the requisite experience and technical skills to successfully complete the Arkema EE/CA. All consultant team personnel involved in sample collection have extensive environmental sampling experience. Minimum training and certification requirements for laboratory personnel are described in the laboratory QA manuals (Attachment A of this QAPP).

The Superfund Amendments and Reauthorization Act of 1986 required the Secretary of Labor to issue regulations providing health and safety standards and guidelines for workers engaged in hazardous waste operations. In response to this requirement, the U.S. Occupational Safety and Health Administration developed regulation 29 CFR§1910.120, the "Hazardous Waste Operations and Emergency Response" standard (HAZWOPER). This standard includes requirements for workers engaged in hazardous waste operations to complete a 40-hour training course and annual 8-hour refresher courses. The training provides employees with knowledge and skills that enable them to perform their jobs safely and with minimum risk to their personal health. All sampling personnel will have completed the 40-hour HAZWOPER training course and 8-hour refresher courses, as necessary. Documentation of course completion will be maintained in personnel files.

A9 DOCUMENTS AND RECORDS

Records will be maintained documenting all activities and data related to sample collection and to laboratory analyses and bioassays. Results of data verification and validation activities will also be documented. Procedures for documentation of these activities are described in this section.

The field sampling plan, this QAPP, and the health and safety plan will be provided to every project participant listed in Section A3. Any revisions or amendments to any of these documents will also be provided to these individuals.

A9.1 Field Documentation

The following field records will be maintained throughout the duration of sampling activities:

- Field logbooks
- Photographic documentation
- Sample collection information forms
- Sample summary logs
- Sediment borehole logs
- Sample labels
- Sample chain-of-custody (COC) forms
- Custody seals.

The content and use of these documents are described in Sections 3.2, 3.3, 3.5 and 3.6 of the FSP (Integral 2008b). Field documentation related to sample collection will be maintained in the project file in Integral's Portland office. The laboratories will return original completed COC forms to Integral. These will also be maintained in the project file.

The following reports will be completed, as necessary, to document an audit or a deviation from the FSP or the QAPP:

- Corrective action reports will be used, as necessary, to document any problems encountered during field activities and corrective actions taken
- Field change request forms will be used, as necessary, to document the need for a procedural change or a station location change
- System and performance audit reports will be used, as necessary, to document review or audit of field sampling activities.

The QA manager will ensure that the field team receives the final approved version of each FSP and this QAPP prior to the initiation of field activities.

A9.2 Laboratory Documentation

All activities and results related to sample analysis will be documented at each laboratory. Internal laboratory documentation procedures are described in the laboratory QA manuals (Attachment A to this QAPP).

Each laboratory will provide a data package for each sample delivery group or analysis batch that is comparable in content to a full Contract Laboratory Program (CLP) package. The format

of the data may differ from CLP requirements. Each data package will contain all information required for a complete QA review, including the following:

- A cover letter discussing analytical procedures and any difficulties that were encountered
- A case narrative referencing or describing the procedures used and discussing any analytical problems and deviations from SOPs and this QAPP
- COC and cooler receipt forms
- A summary of analyte concentrations (to two significant figures, unless otherwise justified), MRLs, and MDLs
- Laboratory data qualifier codes appended to analyte concentrations, as appropriate, and a summary of code definitions
- Sample preparation and cleanup logs
- Instrument tuning check data
- Initial and continuing calibration data, including instrument printouts and quantification summaries, for all analytes
- Results for method and calibration blanks
- Results for all QA/QC checks, including but not limited to surrogate spikes, internal standards, laboratory control samples, matrix spike samples, matrix spike duplicate samples, and laboratory duplicate or triplicate samples provided on summary forms
- Instrument data quantification reports for all analyses and samples
- Florisil® check data and gel permeation chromatography calibration data
- Copies of all laboratory worksheets and standards preparation logs.

Data will be delivered in both hard-copy and electronic format to the Integral QA manager, who will be responsible for oversight of data verification and validation and for archiving the final data and data quality reports in the project file. A copy of the first data package for each sample type and method will be provided to the EPA QA manager upon receipt from each laboratory. Integral will maintain data packages and EDDs for chemical analyses.

EDDs will be compatible with Integral's EQuIS database.

Laboratory data will be maintained by each laboratory for a period of at least 5 years. These data will include the original instrument data files, reduced and verified data stored in the laboratory information management system (LIMS), and final hard-copy and EDDs. The laboratories will obtain approval from Arkema/LSS prior to discarding these data.

A9.3 Data Quality Documentation

Data validation reports will be prepared by the contracted validation firm and provided to the QA manager. Results of the validation reports will be summarized in the summary report for the sampling event. Any limitations to the usability of the data will also be discussed in this report.

All electronic database entries provided by each laboratory will be verified against the validated hard-copy data in the data package. All changes to the database will be documented in an electronic log file that automatically enters a current time stamp when opened and allows the data editor to enter notes about changes to the database. Any data tables prepared from the database for data users will include all qualifiers that were applied by the laboratories and during data validation, unless otherwise requested.

SECTION B: DATA GENERATION AND ACQUISITION

B1 SAMPLING PROCESS DESIGN

This section presents the sampling design for a tiered approach to complete the Arkema EE/CA field investigation (see Section 2 in the FSP). The design is based on Integral's understanding of historical site data and professional judgment. Specific issues related to sampling methods and sample handling procedures are addressed in Section 3 of the FSP.

Sediment boreholes will be advanced and sampled to evaluate the nature and extent of contamination within and immediately outside the 5 mg/kg DDx preliminary RAA boundary, to support the evaluation of vertical and horizontal extent of the DDx removal action, and to provide a baseline for monitoring remedial activities. A testing program will be performed to determine the sediment index properties and geotechnical engineering parameters within and adjacent to the removal action boundary. The physical characteristics of sediments are important in the evaluation of dredging, capping, and containment technologies; dredged material transport and disposal; dredged material behavior in a disposal site; potential short-term impacts at the dredge and disposal sites; and the capacity of the sediments to support capping materials. The complete sampling design (including station locations, types, and numbers of samples that will be collected; the rationale for collection; and the analyses that will be performed), as well as detailed sample collection and handling methods, are described in the Arkema EE/CA FSP.

B1.1 Nature and Extent of Contamination

A total of 37 sediment chemistry boreholes are proposed (WB-30 through WB-66; Figure 2-1) and will be completed to basalt (or refusal) to evaluate the horizontal and vertical extent of COIs within and adjacent to the 5 mg/kg DDx RAA boundary. Samples will be collected for chemical analyses and/or archived at all proposed sampling locations. The proposed sampling, analysis, and archiving plan and rationale for each borehole location is summarized in Table 2-3. Proposed sediment samples are distributed at representative locations within the vicinity of the preliminary RAA boundary to measure the vertical and horizontal extent of DDx and other chemicals. In addition to characterizing the broader site conditions, this sampling will focus on the perimeter of the 5 mg/kg preliminary RAA boundary contour where the majority of DDx mass is located. Selected samples will be archived for possible subsequent analysis, depending on the analytical results from samples collected at nearby boreholes (FSP Table 2-3; FSP Figure 2-1).

Sediment quality samples will be collected using a barge-mounted hollow-stem auger drill rig (or equivalent) advanced to basalt or refusal. Samples will be collected continuously at 2- to 3-ft intervals in accordance with FSP Table 2-3 for the entire length of the borehole, using a variety of samplers, depending on the sample location and bottom conditions. Sampling equipment

may include split-spoon samplers, Gregory Undisturbed Sampler or Osterberg sampler, and/or Shelby tubes. The number of field samples and associated field QC samples are summarized in Table B1-1.

B1.2 Physical and Engineering Characteristics

The geotechnical investigation program will consist of three mud-rotary sediment boreholes and 13 CPT explorations to evaluate geotechnical properties and conditions within and adjacent to the RAA boundary (FSP Figure 2-1). The three mud-rotary boreholes (SPT on FSP Figure 2-1) will be collocated with three of the CPTs (CPT on FSP Figure 2.1) to allow development of site-specific correlations between CPT parameters and parameters based on sampling and laboratory testing. The collocated explorations were selected strategically based on existing subsurface information such that correlations for both cohesive and granular soils can be established. Laboratory testing consisting of index property testing for soil/sediment classification will be conducted on selected split-spoon samples. Relatively undisturbed, thin-wall tube samples (Shelby tubes) will also be collected in the mud-rotary boreholes for advanced laboratory testing (consolidation and shear strength testing) and index property testing on selected samples.

The selection of samples for geotechnical testing will be determined on the basis of observed lithology as required to characterize the observed range of lithologies and associated geotechnical conditions critical to the selection, evaluation, and design of candidate removal action technologies (FSP Table 2-1). Target sample intervals in the SPT borehole will be determined in the field based on the interpretation of the collocated CPT exploration, which will be advanced prior to the SPT geotechnical boring. For planning purposes, it was assumed that a maximum of four representative samples will be analyzed from each borehole location for geotechnical index properties. An estimated total of up to 24 relatively undisturbed samples will be collected for shear strength and consolidation testing.

The proposed rationale, sample intervals, and test parameters for each geotechnical boring is presented in FSP Table 2-4

B1.3 Waste Characterization Testing

The assessment of offsite landfill disposal will be performed with landfill-specific acceptance criteria, including hazardous waste determinations, such as TCLP tests.

Two large-volume samples will be composited from each of seven boreholes located between Dock 1 and Dock 2 (WB-35, WB-36, WB-37, WB-39, WB-41, WB-42, and WB-43; FSP Table 2-3). These areas are within or immediately downstream of the highest DDx concentrations in sediments within the RAA boundary. The composite sample analyses will provide data for sediment that could require disposal as part of the removal action. FSP Figure 2-1 presents the

proposed boring locations for each composite sample. FSP Table 2-3 presents the compositing scheme for each large-volume sample. A total of 14 composite samples will be collected, two from each borehole.

B2 SAMPLING METHODS

Field sampling methods are described in Section 3 of the FSP (Appendix A) and include the following topics:

- Horizontal and vertical control methods (Section 3.1)
- Sampling methods (Section 3.2)
- Sample identification (Section 3.3)
- Sediment processing (Section 3.4)
- Sample containers and labels (Section 3.5)
- Field documentation procedures (Section 3.6)
- Decontamination procedures (Section 3.7)
- Investigation-derived wastes (Section 3.8).

SOPs for each sampling method are provided in Attachment A to the FSP.

In the event that unanticipated or changed circumstances occur in the field that require a major departure from the FSP, the change will be documented on a field change request form (see FSP Appendix A, Attachment B). The field operations manager will complete the field change request form, obtain approval from the Integral project manager, institute the necessary corrective actions, and ensure that the appropriate procedures are followed. In any other circumstances where sampling conditions are unanticipated, the appropriate sampling actions consistent with this task's objectives will be conducted. These changes will be noted in the field log. Any problems that cannot be easily resolved or that affect the final quality of the work product will be brought to the attention of the Integral and LSS project managers. EPA will be notified of any problems that may affect the final outcome of this task. Additional information regarding corrective actions and related documentation is provided in Section C1.

B3 SAMPLE HANDLING AND CUSTODY

B3.1 Field to Laboratory Sample Handling and Custody

Detailed descriptions of procedures for sample identification, handling, documentation, custody, and ultimate disposal are presented in the FSP (Integral 2008b).

From the time of collection, all samples and sediment cores will be stored on ice or refrigerated at an approximate temperature of 4°C prior to processing. Requirements for sample containers, sample preservation, and holding times are summarized in Table B3-1.

The field task leader, or the designated field sample custodian, will be responsible for sample tracking in the field. Samples will remain in Integral's custody until COC forms and final sample inventory are completed in the field or at the field sample processing facility. COC forms will be used for samples that are in transit from the field site to the testing laboratories. The custodian will relinquish the samples to a designated analytical laboratory courier service or commercial transport company (e.g., Federal Express). Custody of samples in the field or at the field processing facility will be documented in the field logs.

Samples are considered to be in custody if they are 1) in the custodian's possession or view, 2) in a secured location (under lock) with restricted access, or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). The principal documents used to identify samples and to document possession are COC records, field logbooks, and field tracking forms. COC procedures will be used for all samples at all stages in the analytical or transfer process and for all data and data documentation whether in hard-copy or electronic format. An example of a COC form is provided in Attachment B.

Sample packing and shipping procedures are detailed in the FSP (Integral 2008b). Samples will be shipped to the laboratory in ice chests sealed with custody seals. Trip blanks will be included in all coolers containing samples for volatile analyses. Each ice chest will have three seals, one on the front of the chest and one on each side. The laboratory sample custodian will establish the integrity of the seals at the laboratory. The way bill of the carrier used to ship samples will provide additional custody and sample tracking information. The way bills will be maintained in the project file.

The sample custodian at each laboratory will accept custody and log samples into the LIMS. The sample custodian will check that the COC forms were properly completed and signed, that a sample receipt form is completed for each cooler, and that samples are stored under the required temperature conditions. Each laboratory will deliver a copy of the COC and sample receipt form to the chemistry QA manager. Any breaks in the COC or nonconformances will be noted and reported in writing to the chemistry QA manager within 24 hours of receipt of samples.

Specific laboratory COC procedures are described in the laboratory QA manual for each of the designated laboratories (Attachment A).

B3.2 Intralaboratory Sample Transfer

The laboratory project manager will ensure that a sample-tracking record is maintained that follows each sample through all stages of laboratory processing. The sample-tracking record

must contain, at a minimum, the names of individuals responsible for performing the analysis; dates of sample extraction, preparation, and analysis; and the type of analysis being performed.

B3.3 Archived Samples

Archive samples will be collected for all of the sediment samples (i.e., surface sediment and sediment core samples). Up to 16 ounces of sediment will be collected for archiving for samples that are scheduled for analysis, as available. In addition, any sample remaining in the sample jars after aliquots are removed for analysis by the laboratory will be archived. For sediment core samples that are not scheduled for analysis, 32 ounces will be collected for archiving.

All archive samples will be submitted to TestAmerica and will be stored at -20±4°C. Sediment remaining after analysis will be archived by the laboratory that completed the analysis. The laboratories will maintain COC documentation and proper storage conditions for the entire time that the samples are in their possession. All laboratories for this project will store the archive and excess samples for 12 months following completion of data validation. Archive samples will only be disposed of upon written authorization from LSS.

B4 ANALYTICAL METHODS

Laboratory methods to be used for the Arkema EE/CA are consistent with requirements provided in SW-846 (USEPA 2008b), ASTM (ASTM 2004), and other established and widely accepted protocols. For analysis of sediment samples, modifications will be made to these methods, as necessary and technically feasible, to improve MRLs. Method modifications are not anticipated for the analysis of field blanks and TCLP leachates. Analytes, MRLs, and ACGs (if applicable) are provided in Table A6-4 for sediment samples, in Table A6-5 for field blanks, and in Table A6-6 for waste characterization samples. Method modifications will not be sufficient to reduce MRLs to the level of the ACGs for several analytes for sediments, and ACGs will not be attained in these cases. Laboratory methods are described below for sediment samples.

Sediment samples to be collected include surface sediment and sediment cores. In addition, some sediment samples will be composited to assess waste characteristics. The methods described in this section apply to all of these sediment types. Sediment samples may be analyzed for the following:

- Conventional analyses
- Organochlorine pesticides
- PCB Aroclors
- SVOCs

- VOCs
- Chlorinated dioxins and furans
- Physical and engineering characteristics.

For waste characterization purposes, composite sediment samples will be analyzed by the TCLP. The corresponding TCLP leachate will be tested for the following:

- Metals (Resource Conservation and Recovery Act [RCRA] list)
- VOCs (RCRA list)
- SVOCs (RCRA List)
- Pesticides (RCRA list)
- Herbicides (RCRA list)

In addition to the TCLP analyses, asbestos analysis of composite sediment samples will also be performed.

The total number of samples and the analyses that will be conducted on each sample are summarized in Table B1-1. The laboratory methods for sample preparation and analysis are summarized in Tables A6-1 to A6-3.

B4.1 Conventional Analyses in Sediment

Conventional analyses of sediment samples will include total solids, grain-size distribution, and TOC. EPA methods will be used as shown in Table A6-1.

Total solids will be determined according to EPA Method 160.3. These results will be used to calculate analyte concentrations on a dry-weight basis and will also be reported in the database.

Grain-size analysis will also be completed using ASTM protocols. Grain-size analysis will also be completed using ASTM Method D 422. Sieve sizes 3/4", 3/8", 4, 10, 20, 40, 60, 140, and 200 will be used to determine gravel and sand fractions, and the silt and clay fractions will be determined by hydrometer.

TOC will be analyzed by EPA Method 9060. Samples will be pretreated with hydrochloric acid to remove inorganic carbon, dried at 70°C, and analyzed by combustion in an induction furnace. Quadruplicate TOC analyses, as specified in the method, will not be required for this project. Instead laboratory duplicate analyses will be performed at a frequency of 5 percent, one duplicate analysis per 20 samples.

B4.2 Organochlorine Pesticides in Sediment

Organochlorine pesticides will be extracted from sediment samples using sonication extraction procedures (EPA SW-846 Method 3550B) and analyzed by gas chromatography/electron capture detector (GC/ECD; EPA SW-846 Method 8081A). In order to achieve the project MRL/MDLs specified in Table A6-4, 20 grams of sample will be extracted and taken to a final extract volume of 2.0 mL. The surrogate compounds tetrachloro-*m*-xylene and decachlorobiphenyl will be added to every sample, quality control sample, and selected instrument standards. Florisil column cleanup (EPA SW-846 Method 3620), sulfur removal with mercury (EPA SW-846 Method 3660B modified), and gel permeation chromatography cleanup (EPA SW-846 Method 3640A) will be performed on the extract if necessary to achieve the MRL/MDLs specified in Table A6-4.

All pesticide analyses will be performed in accordance to EPA Region 10 Guidance for Data Deliverables for Laboratories Utilizing SW-846 Methods 8081 and 8082 for the Analyses of Pesticides and PCB Aroclors (USEPA 2005). Pesticide detections will be confirmed using the instrument data for the gas chromatography/ mass spectrometry (GC/MS) analysis when concentrations are 2 mg/kg or above. In addition, the laboratories will analyze Aroclor standards during the initial calibration for organochlorine pesticides to evaluate the effects of Aroclor interferences on pesticide identification. The chromatograms and instrument data quantification reports for these Aroclor standards will be provided with each organochlorine pesticide data package.

B4.3 PCB Aroclors in Sediment

For PCB Aroclor analysis, samples will be extracted using sonication extraction procedures (EPA SW-846 Method 3550B) and analyzed by GC/ECD (EPA SW-846 Method 8082). In order to achieve the project MRL/MDLs specified in Table A6-4, 10 grams of sample will be extracted and taken to a final volume of 10.0 mL. The surrogate compounds tetrachloro-*m*-xylene and decachlorobiphenyl will be added to every sample, quality control sample, and selected instrument standards. Acid cleanup (EPA SW-846 Method 3665) and sulfur removal with mercury (EPA SW-846 Method 3660B modified) will be performed on the extract if necessary to achieve the MRL/MDL specified in Table A6-4. Multiple acid cleanups are not necessarily expected, but will be employed if necessary. The extracts will be run against a low-level calibration curve to produce the specified MRLs.

B4.4 SVOCs in Sediment

Sample extractions for SVOCs will be completed using sonication extraction procedures (EPA SW-846 Method 3550B) and analyses will use GC/MS (EPA SW-846 Method 8270C). In order to achieve the project MRL/MDLs specified in Table A6-4, 50 grams of sample will be extracted and taken to a final volume of 5.0 mL. The GC/MS analysis of semivolatiles will be performed

using GC/MS quadruple instruments. None of the SVOC analyses will be performed using an ion trap GC/MS. The mass spectrometer will be operated in full-scan mode. Tentatively identified compounds (TICs) will not be reported. The surrogates compounds, nitrobenzene-d5, phenol-d5, terphenyl-d14, 2-fluorophenol, 2-fluorbiphenyl, and 2,3,6-tribromophenol, will be added to every sample, quality control sample, and selected instrument standards. Gel permeation chromatography cleanup (EPA SW-846 Method 3640A) will be performed on the extract if necessary to achieve the MRL/MDLs specified in Table A6-4.

B4.5 VOCs in Sediment

VOCs will be analyzed by purge and trap extraction (EPA SW-846 Method 5035) and GC/MS (EPA SW-846 Method 8260B). The mass spectrometer will be operated in full-scan mode. TICs will not be reported. The surrogate compounds (toluene-d8, ethylbenzene-d10, and 4-bromofluorobenzene) will be added to every sample, quality control sample, and selected instrument standards. The project MRL/MDLs are specified in Table A6-4.

B4.6 Chlorinated Dioxins and Furans in Sediment

Chlorinated dioxins and furans in sediment samples will be extracted with toluene in a Soxhlet/Dean Stark extractor. Cleanup procedures will include an acid extraction; additional cleanup procedures will be used as necessary. Samples will be analyzed by HRGC/HRMS. As described in EPA Method 1613B, detection limits are calculated on an individual compound and sample basis and depend on the signal-to-background ratio for the specific labeled isomer. The detection limits listed in Table A6-4 are representative of MDLs typically obtained when using the described procedure and sample mass.

B4.7 Analyses in Field Blanks

Field blanks will be analyzed for TOC, organochlorine pesticides, PCB Aroclors, SVOCs, VOCs, and dioxin and furans using EPA methods as shown in Table A6-2. Method modifications are not anticipated for the analysis of field blanks. For each analytical method, the analysis of field blank samples will be performed at the same TestAmerica laboratory location that analyzes the associated sediment samples.

Organochlorine pesticides, PCB Aroclors, and SVOCs in the field blanks will be extracted by separatory funnel (EPA Method SW-846 3510C). Subsequent analysis will be performed by GC/ECD for pesticides (EPA Method SW-846 8081A) and PCB Aroclors (EPA SW- 846 8082) or by GC/MS for SVOCs (EPA SW-846 8270C). Surrogate compounds will be added to every sample, quality control sample, and selected instrument standards as specified in the appropriate method.

Chlorinated dioxins and furans in field blanks will be extracted by separatory funnel and analyzed by HRGC/HRMS as specified in EPA Method 1613B. Cleanup procedures may include an acid extraction; additional cleanup procedures will be used as necessary.

B4.8 Physical and Engineering Characteristics

The physical and engineering characteristics of the sediment samples will be evaluated for grain size (excluding hydrometer); Atterberg limits; specific gravity; moisture content/density; consolidation behavior; shear strength (unconsolidated, undrained and consolidated, undrained triaxial testing and Torvane testing); and hydraulic conductivity. Rock (basalt) samples will also be analyzed for unconfined compressive strength and point load index (rock) tests. Additional tests consisting of CPT and pore pressure dissipation tests will be performed in the field by the drilling/CPT subcontractor. ASTM methods will be used as shown in Table A6-1.

B4.9 Waste Characterization Analyses

B4.9.1 TCLP Analyses

Sediment samples for TCLP leachate analyses will be prepared and analyzed using EPA methods as shown in Table A6-3. Method modifications are not anticipated for the analysis of TCLP leachates. The TCLP leachate for metals, semivolatiles, and pesticides will be created following EPA Method 1311. Samples will be evaluated for choice of the proper buffered solution, and enough volume will be created to complete all the analyses and meet reporting limits listed in Table A6-6.

The TCLP leachate for volatile analysis will be created by zero headspace extraction (ZHE) per EPA Method 1311.

B4.9.2 Metals

Two methods will be used to analyze TCLP leachate samples for total metals (Table A6-3). Digestion with nitric and hydrochloric acids will be used to prepare samples for analysis of metals other than mercury. Analysis for these metals will be completed by EPA Method 6010B inductively coupled plasma/atomic emission spectrometry (ICP/AES). Mercury samples will be digested using sulfuric acid and nitric acid. Analysis will be completed by cold vapor atomic absorption spectrometry.

B4.9.3 Volatiles

The TCLP volatiles leachates created using ZHE will be analyzed using purge-and-trap GC/MS by EPA method 8260C for target TCLP compounds only, as shown in Table A6-6.

B4.9.4 Other Organic Compounds

Herbicides will be extracted from samples using solid phase extraction procedures. Esters of the phenoxy acid herbicides in the sample will be hydrolyzed to the acid form by the addition of sodium hydroxide. The sample will then be acidified and the acid herbicides extracted using methylene chloride. The acids will then be converted to their methyl esters using diazomethane. Extracts will be analyzed by ion trap GC/MS for TCLP target compounds only, as shown in Table A6-6.

Organochlorine pesticides will be extracted from samples using separatory funnel extraction procedures. Samples will be analyzed by GC/ECD. Silica gel cleanup may be performed on the sample extracts. Analyses will be completed for target TCLP compounds only, as shown in Table A6-6.

Semivolatile sample preparation will be completed using continuous liquid-liquid extraction or separatory funnel extraction. TICs will not be reported. Analyses will be completed by GC/MS for target TCLP compounds only, as shown in Table A6-6.

B4.9.5 Asbestos in Sediment

The sediment samples will be evaluated for asbestos using EPA Method 600/R-93-116. This procedure uses visual estimations of asbestos content with a technique called point counting. In point counting, the sediment sample is homogenized, a portion of the sample is placed on a glass slide, and 400 microscopic fields are counted and examined for asbestos fibers using a polarized light microscope, with the results reported in percent asbestos by volume.

B5 QUALITY CONTROL

Quality control samples will be prepared in the field and at the laboratories to monitor the bias and precision of the sample collection and analysis procedures.

B5.1 Field Quality Control Samples

Field quality control samples for this study will include field duplicates, equipment rinse blanks (field blanks), trip blanks, and temperature blanks. The frequency of collection of field duplicates and equipment rinse blanks is summarized in Table B1-1.

Field duplicates are generated by the field team by splitting the sediment sample into two aliquots for laboratory analysis. Data for field duplicates are used to evaluate sample handling and analysis procedures and used in the evaluation of precision of the results.

Equipment rinse blanks (field blanks) are collected by pouring water over the sample homogenization equipment (i.e., for sediment samples). Equipment rinse blanks are used to

monitor equipment decontamination procedures and to check for other sources of contamination.

Trip blanks are used to monitor for cross-contamination during sample shipment and storage. Trip blanks will be included in all coolers containing samples for volatile analyses. Trip blanks are used only for samples that will be analyzed for volatile constituents.

A temperature blank (a jar filled with water) is included with each cooler of samples. The laboratory sample custodian measures the temperature of the water in the jar to determine the temperature of the cooler upon receipt at the laboratory.

Procedures for preparing field quality control samples are provided in the FSP (Integral 2008b). Validation criteria and procedures for field quality control samples are described in Sections D1 and D2.

B5.2 Laboratory Quality Control

Extensive and detailed requirements for laboratory quality control procedures are provided in the method protocols that will be used for this study (Tables A6-1, A6-2, and A6-3). Every method protocol includes descriptions of quality control procedures, and many incorporate additional quality control requirements by reference to separate quality control chapters. Quality control requirements include control limits and, in many cases, requirements for corrective action. Quality control procedures will be completed by the laboratories, as required in each method protocol and as indicated in this QAPP.

The frequency of analysis for laboratory control samples, matrix spike samples, matrix spike duplicates or laboratory duplicates, and method blanks will be one for every 20 samples or one per extraction batch, whichever is more frequent. Surrogate spikes and internal standards will be added to every field sample and quality control sample, as required by the method. Calibration procedures will be completed at the frequency specified in each method description. As required for EPA SW-846 methods (USEPA 2008b), performance-based control limits have been established by each laboratory. These and all other control limits specified in the method descriptions will be used by the laboratories to establish the acceptability of the data or the need for reanalysis of the samples. Control limits for surrogate compounds, laboratory control samples/laboratory control sample duplicates, and matrix spike/matrix spike duplicates are provided for all matrices in Tables A7-1 through A7-6.

Where discrepancies exist between this QAPP and laboratory SOPs and QA manuals, this QAPP will take precedence.

Storage blanks for VOCs in sediment will be prepared and analyzed at the laboratory according to standard laboratory procedures. A pair of VOC blanks will be prepared for each cooler at the laboratory, but only one of the blanks will be shipped to the field. This blank will become a trip

blank in a cooler of samples. The second blank will be retained at the laboratory and will become the storage blank when the cooler is received at the laboratory. A storage blank will be randomly selected for analysis on a weekly basis. In addition, the storage blank associated with a given cooler will be analyzed if results for the trip blank indicate that samples may be contaminated. Results for the storage blank will indicate whether contamination is related to field and shipping conditions or to laboratory storage conditions.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Analytical instrument testing, inspection, maintenance, setup, and calibration will be conducted by each laboratory in accordance with the requirements identified in the laboratory SOPs and manufacturer instructions. Instrument maintenance and repair will be documented in maintenance logs or record books.

B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Laboratory instruments will be properly calibrated, and the calibration will be verified with appropriate check standards and calibration blanks for each parameter before beginning each analysis. Instrument calibration procedures and schedules will conform to analytical protocol requirements and descriptions provided in the laboratories' QA manuals and SOPs.

All calibration standards will be obtained from either the EPA repository or a commercial vendor, and the laboratory will maintain traceability to the National Institute of Standards and Technology. Stock standards will be used to make intermediate standards and calibration standards. Special attention will be given to expiration dating, proper labeling, proper refrigeration, and prevention of contamination. Documentation relating to the receipt, mixing, and use of standards will be recorded in a laboratory logbook. All calibration and spiking standards will be checked against standards from another source.

Field instruments will not be used in connection with this sampling.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

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

During sample collection, solvents of appropriate, documented purity will be used for decontamination. Solvent containers will be dated and initialed when they are opened. The quality of laboratory water used for decontamination will be documented at the laboratory that provides that water. As discussed in Section B2, cleaned and documented sample containers will be provided by the laboratories. All containers will be visually inspected prior to use, and any suspect containers will be discarded.

Reagents of appropriate purity and suitably cleaned laboratory equipment will also be used for all stages of laboratory analyses. Details for acceptance requirements for supplies and consumables at the laboratories are provided in the laboratory SOPs and QA manuals (Attachment A). All supplies will be obtained from reputable suppliers with appropriate documentation or certification. Supplies will be inspected to confirm that they meet use requirements, and certification records will be retained by Integral (i.e., for supplies used in the field) or the laboratories.

B9 NON-DIRECT MEASUREMENTS

Non-direct measurements will not be needed for the completion of the EE/CA activities.

B10 DATA MANAGEMENT

Data for the Arkema EE/CA will be generated in the field and at the laboratories. The final repository for all sample information will be an EQuIS database. Procedures to be used to transfer data from the point of generation to the EQuIS database are described in this section.

B10.1 Field Data

Daily field records (a combination of field logbooks and field data sheets) and navigational records will make up the main documentation for field activities. The records and procedures most applicable to field activities are summarized in Section 3.6.1 (field logbooks), Section 3.6.3 (sample collection information form), and Section 3.6.2 (photo documentation; see Attachment B of FSP for field forms) of the FSP (Integral 2008b).

Data that are generated during sample collection and sample preparation will be manually entered into the field logbook and core logs. Data from these sources will be entered into a Microsoft® Excel workbook template directly from the field logbook and core logs. These data include station location coordinates, station names, sampling dates, sample identification codes, and additional station and sample information (e.g., water depth, sample type, field split number). A second individual will review all entries for accuracy and completeness, and any errors will be corrected before the data are uploaded to the EQuIS database and approved for release to data users.

COC forms will be generated in the field at the time that samples are packaged for delivery to analytical laboratories.

B10.2 Laboratory Data

A wide variety of manually entered and electronic instrument data are generated at the laboratories. Data are manually entered into:

- Standard logbooks
- Storage temperature logs
- Balance calibration log
- Instrument logs
- Sample preparation and analysis worksheets
- Maintenance logs
- Individual laboratory notebooks
- Results tables for conventional analyses (i.e., grain-size distribution, total solids, and TOC).

The LIMS is the central data management tool for each laboratory. All manual data entry into the LIMS is proofed at the laboratory. All data collected from each laboratory instrument, either manually or electronically, are reviewed and confirmed by analysts before reporting. The LIMS is used for every aspect of sample processing, including sample log-in and tracking, instrument data storage and processing, generation of data reports for sample and quality control results, and preparation of EDDs.

Laboratory data will be entered directly into the EQuIS database from the EDD. A database printout will be used to verify database entries against the hard-copy laboratory data packages.

SECTION C: ASSESSMENT AND OVERSIGHT

This task will rely on the knowledge and expertise of the technical team, as described in the Final EE/CA Work Plan (Parametrix 2007; Integral 2008a,b). The field team and laboratories will stay in close verbal contact with the task manager and the task QA manager during all phases of this task. This level of communication will serve to keep the management team apprised of activities and events, and will allow for informal but continuous task oversight. Few scheduled assessment activities are planned for this task because the scope of the sampling and analysis effort and the size of the team are relatively small.

C1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment activities will include readiness reviews prior to sampling and prior to release of the final data to the data users, and internal review while work is in progress. An informal technical systems audit may be conducted if problems are encountered during any phase of this project.

Readiness reviews are conducted to ensure that all necessary preparations have been made for efficient and effective completion of each critical phase of project work. The first readiness review will be conducted prior to field sampling. The field operations manager will verify that all field equipment is ready for transfer to the Site. The field operations manager will also verify that the field team and subcontractors have been scheduled and briefed and that the contracts for the subcontractors have been signed by both parties. Any deficiencies noted during this readiness review will be corrected prior to initiation of sampling activities.

The second readiness review will be completed before final data are released for use. The database administrator will verify that all results have been received from the laboratories, data validation and data quality assessment have been completed for all of the data, and data qualifiers have been entered into the database and verified. Any deficiencies noted during this review will be corrected by the data manager, the Integral QA manager, or their designee. Data will not be released for final use until all data have been verified and validated. No report will be prepared in conjunction with the readiness reviews. However, the project manager and data users will be notified when the data are ready for use.

Technical review of intermediate and final work products generated for this project will be completed throughout the course of all sampling, laboratory, data validation, data management, and data interpretation activities to ensure that every phase of work is accurate and complete and follows the QA procedures outlined in this QAPP. Any problems that are encountered will be resolved between the reviewer and the person completing the work. Any problems that cannot be easily resolved or that affect the final quality of the work product will

be brought to the attention of the Integral and LSS project managers. EPA will be notified of any problems that may affect the final outcome of the project.

The laboratories have implemented a review system that serves as a formal surveillance mechanism for all laboratory activities. Each phase of work is reviewed by a supervisor before it is approved for release. Details are provided in the laboratory QA plans (Attachment A).

Technical system audits may be conducted if serious problems are encountered during sampling or analysis operations. If completed, these audits will be conducted by the Integral QA manager or designee or by the laboratory QA managers. These audits may consist of onsite reviews of any phase of field or laboratory activities or data management. Results of any audits will be provided in the EE/CA report.

Any project team member who discovers or suspects a nonconformance is responsible for reporting the nonconformance to the project manager, the Integral QA manager, or the laboratory project or QA manager, as applicable. The project manager will ensure that no additional work dependent on the non-conforming activity is performed until a confirmed non-conformance is corrected.

C2 REPORTS TO MANAGEMENT

A removal action characterization report will be prepared and submitted to EPA following completion of sample collection, laboratory analysis, and data validation activities. The removal action characterization report will summarize field sampling activities, including sampling locations (maps), requested sample analyses, sample collection methods, and a discussion of any deviations from the FSP and QAPP, and a discussion of the data quality.

Data packages and EDDs will be prepared by the laboratory upon completion of analyses for each sample delivery group. The case narrative will include a description of any problems encountered, control limit exceedances, and a description and rationale for any deviations from protocol. Copies of corrective action reports generated at the laboratory will also be included with the data package.

A data validation report will be prepared for each data package by the data validation firm. These reports and the validated data will be provided to the QA Manager when validation is completed for each package. A summary of any significant data quality issues will be provided to EPA with the removal action characterization report.

SECTION D: DATA VALIDATION AND USABILITY

Data generated in the field and at the laboratories will be verified and validated according to criteria and procedures described in this section. Data quality and usability will be evaluated, and a discussion will be included in the applicable site characterization summary report for each sampling event.

D1 CRITERIA FOR DATA REVIEW, VERIFICATION, AND VALIDATION

Field and laboratory data for this project will undergo a formal verification and validation process. All entries into the database will be verified. All errors found during the verification of field data, laboratory data, and the database will be corrected prior to release of the final data.

Data verification and validation will be conducted in accordance with *Guidance on Environmental Data Verification and Validation* (USEPA 2002b). Data verification and validation for organic compounds and metals will be completed according to methods described in the EPA guidance for data review (USEPA 1996, 1999, 2002c). Performance-based control limits established by the laboratory and control limits provided in the method protocols will be used to evaluate data quality and determine the need for data qualification. Current laboratory control limits for surrogate compounds, laboratory control samples and duplicates, and matrix spikes and duplicates are provided in Tables A7-1 through A7-6. Control limits are updated periodically by the laboratories, and the control limits that are in affect at the laboratory at the time of analysis will be used for data validation.

No guidelines are available for validation of data for conventional analyses. These data will be validated using procedures described in the functional guidelines for inorganic data review (USEPA 2002c), as applicable.

Data from the physical and engineering characteristic testing will not be validated. Results from these tests will undergo verification at the time the data are entered into the project database.

Results for field duplicates will be evaluated against a target control limit of 50 RPD. Data will not be qualified as estimated if this control limit is exceeded, but RPD results will be tabulated, and any exceedances will be discussed in the applicable QA report. Equipment rinse blanks will be evaluated and data qualifiers will be applied in the same manner as method blanks, as described in the applicable EPA guidance documents for data review (USEPA 1996, 1999, 2002c).

Data will be rejected if control limits for acceptance of data are not met, as described in USEPA (1996, 1999, 2002c).

D2 VERIFICATION AND VALIDATION METHODS

Field data will be verified during preparation of samples and COCs. Field data and COCs will be reviewed by the field task manager on a daily basis. After field data are entered into the project database, 100 percent verification of the entries will be completed by a second party to ensure the accuracy and completeness of the database. Any discrepancies will be resolved before the final database is released for use.

Procedures for verification and validation of laboratory data and field quality control samples will be completed as described in the following EPA guidance documents for data validation:

- *Guidance on Environmental Data Verification and Validation* (USEPA 2002b)
- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1999)
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 2002c)
- *EPA Region 10 SOP for the Validation of Polychlorinated Dibenzodioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Data* (USEPA 1996)
- *EPA Region 10 Guidance for Data Deliverables Utilizing SW-846 Methods 8081 and 8082 for the Analyses of Pesticides and PCB Aroclors* (USEPA 2005).

Control limits that will be used to qualify data are described in Section D1, above.

The first data package generated for each sample type and analysis method will be fully validated by a data validation firm under contract to Arkema/LSS. If no major problems are encountered during validation of this package, full validation will be completed at a rate of approximately 10 percent of the samples analyzed by each method. Validation for the remaining data will be based on review of the summary forms for sample and QC data. However, all chromatograms will be reviewed for PCBs to verify the identity of the reported Aroclor, and for pesticides to evaluate any effects of interference by PCBs.

MRL goals for this project are provided in Tables A6-4 through A6-6. Reporting limits for non-detects will be compared to the method reporting limit goals to evaluate method sensitivity for each sample. Any exceedance of actual MRLs over the target MRLs will be discussed in the applicable site characterization summary report for each sampling event.

In addition to verification of field and laboratory data and information, data qualifier entries into the database will be verified. Any discrepancies will be resolved before the final database is released for use. The accuracy and completeness of the database will be verified at the laboratory and again as part of data validation. All entries to the database from the laboratory EDDs will be checked against the hard-copy data packages.

D3 RECONCILIATION WITH USER REQUIREMENTS

The goal of data validation is to determine the quality of each data point and to identify data points that do not meet the project criteria. Nonconforming data may be qualified as undetected, estimated, or rejected as unusable during data validation if criteria for data quality are not met. Rejected data will not be used for any purpose. An explanation of the rejected data will be included in the applicable site characterization summary report for each sampling event.

Data qualified as estimated will be used for all intended purposes (Section A5) and will be appropriately qualified in the final project database. These data may be less precise or less accurate than unqualified data. The data users, including EPA, in cooperation with Integral project management staff and the QA manager, will evaluate the effect of the inaccuracy or imprecision of the qualified data on site assessment and risk assessment procedures used to evaluate the Site.

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FIGURES

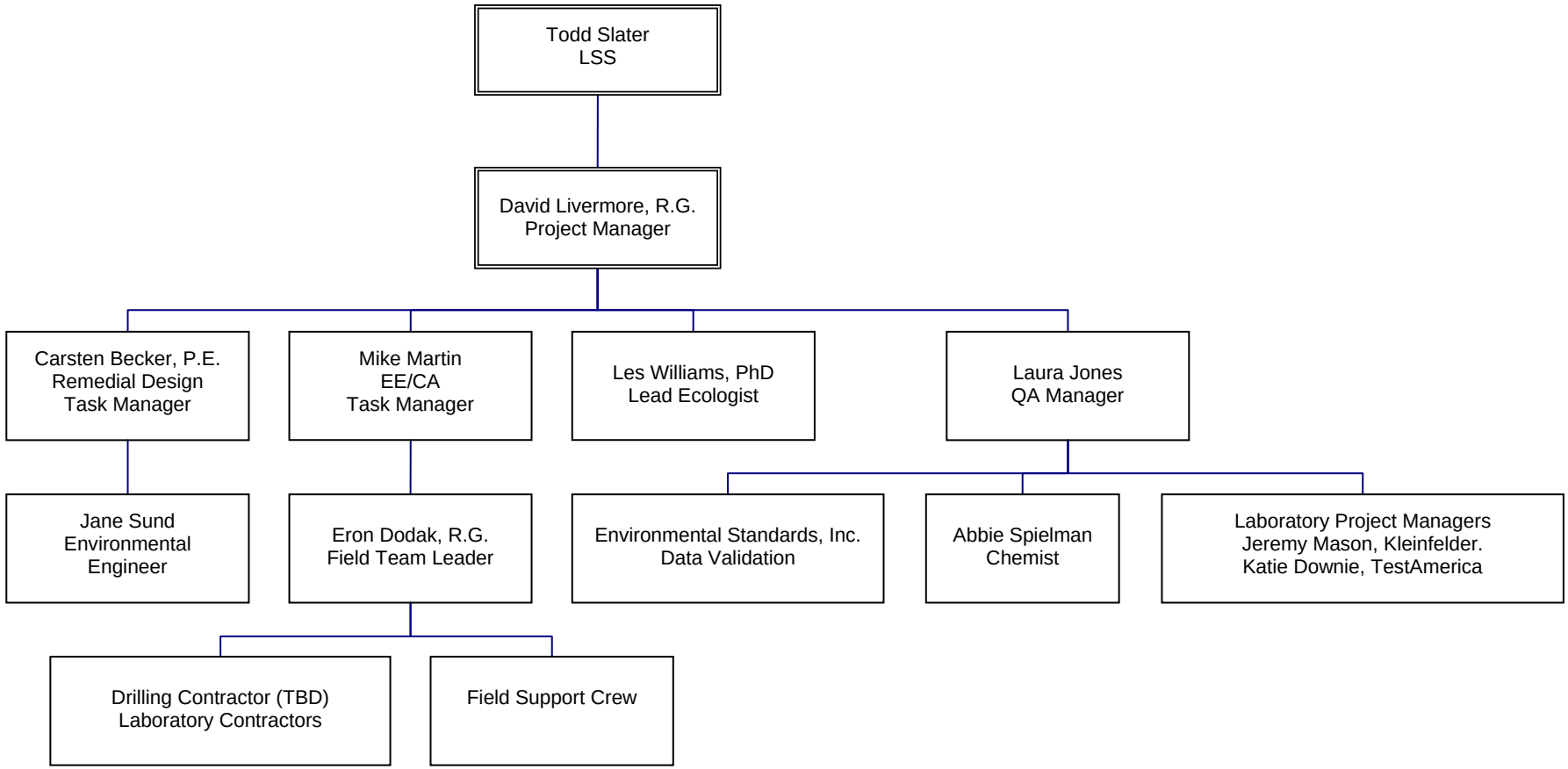

Figure A4-1. Arkema EE/CA Project Team

TABLES

Table A4-1. Data Quality Objectives for Sediment Quality Characteristics

DQO Step	Description
1. State the problem	A historic release of DDx occurred between Docks 1 and 2 at the Site, located adjacent to the Willamette River in Portland, Oregon. DDx and other COI data will be collected in support of the EE/CA for a NTCRA at the Site. The primary objective of the EE/CA characterization activities is to fill data gaps in order to further refine the 5 mg/kg DDx preliminary RAA boundary. Once the preliminary RAA boundary is established, the vertical extent of DDx will be delineated down to the SLVs or the PQLs for DDx or until bedrock is encountered (whichever comes first). Once defined based upon DDx concentrations, other COI concentrations will be evaluated below the vertical DDx contour to assess residual risk. Detailed conceptual site models are presented in Integral's revised draft EE/CA work plan (Integral 2006) and the Parametrix EE/CA work plan (Parametrix 2007).
2. Identify the goals of the study	Delineate DDx concentrations to establish the RAA boundary. The horizontal and vertical extent of the RAA boundary will be delineated by: 1) Measure DDx concentrations in sediment to further refine the contiguous 5 mg/kg DDx contour (horizontal RAA boundary) described in the Opalski Decision and generally located in and around the area of the Arkema docks. 2) Measure DDx concentrations at depth within the horizontal RAA boundary to concentrations that range from 5 mg/kg down to DDx SLVs or PQLs for DDx, or until bedrock is encountered (whichever comes first). The depth of the RAA within the horizontal RAA boundary will be defined after further analysis of the data and in accordance with the Opalski Decision in consultation with EPA. 3) After refining the RAA boundary using the DDx data distribution, select and analyze archive samples to measure the concentration of other harborwide COIs in sediment to SLVs or to PQLs to better understand of the concentrations of these other COIs (Arkema and harborwide) that may remain in place after the DDx removal action is completed. 4) Within the RAA boundaries (both horizontal and vertical), obtain some additional harborwide COI concentration data to preliminarily identify potential sediment disposal issues.
3. Identify information inputs	DDx concentration data within and immediately adjacent to the contiguous 5 mg/kg DDx contour (i.e., preliminary horizontal RAA boundary defined in the Opalski Decision). Selected samples will be analyzed for other COIs.
4. Define the boundaries of the study	The preliminary boundaries of the study area have been approximately defined in the AOC dated June 27, 2005 (Docket No. CERCLA 10-2005-0191) as the nearshore in-water area extending from the salt dock to downstream of Dock 2. The preliminary horizontal RAA boundary was defined by the Opalski Decision as the horizontal extent of the contiguous 5 mg/kg DDx concentration contour. The depth of the preliminary RAA boundary will be defined after further analysis of the data and in accordance with the Opalski Decision in consultation with EPA.
5. Develop the analytic approach	Sediment samples will be analyzed for DDx and other COIs in accordance with FSP Table 2-3. Samples will be analyzed for either a standard or expanded list of analytes using methodology shown in QAPP Tables A6-1 to A6-3. ACGs have been established to identify analytical sensitivity levels that will be sufficient for all data uses, and these values are listed in QAPP Tables A6-4 to A6-6.
6. Specify performance or acceptable criteria	Samples will be collected and analyzed in accordance with EPA-approved QA/QC requirements as detailed in the appropriate analytical methods (QAPP Tables A6-1 to A6-3). Target analytical methods were selected to ensure that detection limits are sufficiently low to meet project ACGs as shown in QAPP Tables A6-4 to A6-6. Additional quality control criteria for specific analytes and methods is provided in QAPP Tables A7-1 to 7-6.

Table A4-1. Data Quality Objectives for Sediment Quality Characteristics

DQO Step	Description
7. Develop the plan for obtaining data	Sediment samples will be collected using a hollow-stem auger, mud-rotary, roto-sonic, or equivalent drill rig. Details on sample collection techniques, boring locations, and analysis are presented in the EE/CA FSP (Appendix A to the EE/CA Work Plan Addendum) and in this QAPP. The sediment samples will either be analyzed for DDx and other COIs or archived in accordance with Table 2-3 of the FSP. The archived samples will be analyzed, as needed, in accordance with the Table 2-3.

Notes:
ACG - analytical concentration goal
AOC - Administrative Order on Consent
COI - chemical of interest
DDx - total of 2,4'- and 4,4'-DDD, DDE, and DDT
DQO - data quality objective
EE/CA - engineering evaluation/cost analysis
EPA - U.S. Environmental Protection Agency
FSP - field sampling plan
NTCRA - non-time critical removal action
PQL - practical quantitation limit
QAPP - quality assurance project plan
QA/QC - quality assurance/quality control
RAA - removal action area
SLV - screening level value

Table A4-2. Data Quality Objectives for Sediment Geotechnical, Physical, and Engineering Testing

DQO Step	Description
1. State the problem	Various technologies will be evaluated as part of the EE/CA for a NTCRA at the Arkema site. Remedial alternatives will be developed to a conceptual level. Engineering data consisting of subsurface information and physical characteristics of the subsurface materials at the Site will be needed to evaluate the feasibility of these alternatives.
2. Identify the goals of the study	The subsurface conditions at the site, consisting of subsurface stratigraphy and physical characteristics of the subsurface materials, form the basis for the feasibility evaluation of the remedial alternatives. Parameters collected as part of this study will be used in an engineering analysis as part of the evaluation. This study will support the EE/CA and the evaluation of a number of selected alternatives. The data collected for this study will not necessarily cover all parameters required for final design. Additional data may need to be collected for final design of the selected alternative. This study is designed to allow evaluation of overall feasibility of the alternatives.
3. Identify information inputs	To improve the understanding of subsurface conditions and provide engineering data for feasibility evaluations, the following information needs to be collected: 1) subsurface stratigraphy, sediment thickness, bedrock elevation; 2) physical characteristics and engineering behavior of subsurface materials including consistency/density and strength.
4. Define the boundaries of the study	The boundaries of the overall study area are based on sediment quality (refer to QAPP Table A4-1). Furthermore, the location of the explorations were selected based on preliminary locations of structures whose feasibility need to be evaluated as part of the EE/CA (e.g., the CDF containment wall and sheet pile enclosure in the river channel).
5. Develop the analytic approach	Engineering data will be collected using a combination of drilling, sampling, laboratory testing, and *in situ* testing. The testing will generally be performed in accordance with ASTM test methods. The majority of testing will consist of CPT, which is an *in situ* test method without samples collected. CPT allows collection of soil stratigraphy information and measurement of CPT parameters that can be correlated with soil parameters used in engineering design and analysis. A limited number of borings will be performed to collect sediment/soil samples for laboratory testing (index properties, consolidation and strength testing). The borings will be collocated with three of the CPTs such that existing, published correlations between CPT and soil parameters can be refined and site-specific correlations can be developed. The locations of the collocated explorations were selected strategically based on existing subsurface information to target a range of conditions that exist at the site. Samples for laboratory testing will be selected by a licensed engineer based on actual subsurface conditions encountered during the field program and engineering judgment. Disturbed (split spoon samples) and relatively undisturbed (thin-walled Shelby tube samples) will be collected. Shelby tubes will be collected in cohesive soils for advanced laboratory testing (consolidation and shear strength testing). The number and depths of the Shelby tube samples will selected based on conditions encountered in the field and on engineering judgment.
6. Specify performance or acceptable criteria	Testing will generally be performed in accordance with ASTM methods by a qualified geotechnical laboratory. The testing will be performed under the oversight of a licensed civil engineer with experience in the field of geotechnical engineering. The engineer will review the data and eliminate invalid data.
7. Develop the plan for obtaining data	As outlined above under step 5, data will be collected using field methods in combination with laboratory testing. Soil/sediment samples will be collected using split spoon samplers during SPT in mud-rotary boreholes. Additionally, CPT will be conducted. No samples will be collected during CPT.

Notes:
ASTM - American Society for Testing and Materials
CDF - contained disposal facility
CPT - cone penetration testing
DQO - data quality objective
EE/CA - engineering evaluation/cost analysis
NTCRA - non-time-critical removal action
QAPP - quality assurance project plan
SPT - standard penetration testing

Table A4-3. Sample Scheme for Arkema EE/CA

Test Characteristics	Sample Matrix	Analysis
Sediment Quality	Surface and subsurface sediments	TOC, grain size, total solids Organochlorine pesticides PCB Aroclors SVOCs VOCs PCDD/Fs
Physical and Engineering	Surface and subsurface sediments	Grain size, Atterberg limits, specific gravity, moisture content/density Consolidation, UU triaxial shear stress, CU triaxial shear stress, hydraulic conductivity, Torvane shear strength, CPT, and pore pressure dissipation testing Unconfined compressive strength and point load index (rock) tests
Waste Characterization	TCLP leachate	TCLP Metals TCLP Pesticides TCLP SVOCs TCLP VOCs TCLP Herbicides
	Subsurface sediments	Asbestos

Notes:
CPT - cone penetration testing
CU - consolidated, undrained
EE/CA - engineering evaluation/cost analysis
PCB - polychlorinated biphenyl
PCDD/F - polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran
SVOC - semivolatile organic compound
TCLP - toxicity characteristic leaching procedures
TOC - total organic carbon
UU - unconsolidated, undrained
VOC - volatile organic compound

Table A4-4. Project Team Contact Information

Name	Project Role	Phone	Fax	Email
Legacy Site Services				
Todd Slater	Project Manager	610-594-4430	610-594-4439	todd.slater@total.com
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TBD	Quality Assurance Manager	TBD	TBD	TBD
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Christina Mott	Laboratory QA Manager	253-922-2310 ext 116	253-922-5047	Christina.Mott@testamericainc.com
Kleinfelder				
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Jeff Revard	Laboratory QA Manager	425- 636-7900	425-636-7901	Jrevard@Kleinfelder.com

Notes:
EE/CA - engineering evaluation/cost analysis
EPA - U.S. Environmental Protection Agency
QA - quality assurance
TBD - to be determined

Table A6-1. Laboratory Methods for Sediment Samples

			Sample Preparation		Quantitative Analysis	
Analyte	Sample Type	Laboratory	Protocol	Procedure	Protocol	Procedure
Sediment Quality Characteristics						
Conventional Analyses						
TOC	Surface and subsurface sediments	TestAmerica Tacoma	EPA SW846-9060A	Acid pretreatment	EPA SW846-9060A (modified for sediments)	Combustion
Grain size	Surface and subsurface sediments	TestAmerica Tacoma or Burlington	NA	--	ASTM-D422-63	Sieve/Hydrometer
Total solids	Surface and subsurface sediments	TestAmerica Tacoma	EPA Method 160.3 modified	Oven drying	EPA Method 160.3 modified	Gravimetric
Organochlorine pesticides	Surface and subsurface sediments	TestAmerica Burlington or Knoxville	EPA SW846-3550B	Sonication	EPA SW846-8081A	Dual column GC/ECD
			EPA SW846-3640A	Gel permeation chromatography [a]		
			EPA SW846-3660B	Sulfur cleanup (mod to use mercury) [a]		
			EPA SW846-3620B	Florisil® cleanup [a]		
PCB Aroclors	Surface and subsurface sediments	TestAmerica Tacoma	EPA SW846-3550B	Sonication	EPA SW846-8082	Dual column GC/ECD
			EPA SW846-3665A	Sulfuric acid/permanganate cleanup [a]		
			EPA SW846-3660B	Sulfur cleanup (mod to use mercury) [a]		
SVOCs	Surface and subsurface sediments	TestAmerica Tacoma	EPA SW846-3550B	Sonication	EPA SW846-8270C	GC/MS
			EPA SW846-3640A	Gel permeation chromatography [a]		
VOCs	Surface and subsurface sediments	TestAmerica Tacoma	EPA SW846-5035	Purge & Trap	EPA SW846-8260B	GC/MS
PCDD/Fs	Surface and subsurface sediments	TestAmerica West Sacramento	EPA 1613B	Soxhlet extraction	EPA 1613B	HRGC/HRMS
				Acid extraction		
				Acid/base silica column [a]		
				Carbon/silica column [a]		
				Gel permeation chromatography [a]		
Physical and Engineering Characteristics						
Physical Characteristics						
Grain size	Subsurface sediment	Kleinfelder	NA	--	ASTM D422-63	Sieve
Atterberg limits	Subsurface sediment	Kleinfelder	NA	--	ASTM D4318-00	Wet method; moisture determination
Specific gravity	Subsurface sediment	Kleinfelder	NA	--	ASTM D854-02	Water pycnometer
Moisture content/density	Subsurface sediment	Kleinfelder	NA	--	ASTM D2216 / D2937	Gravimetric / Drive cylinder

Table A6-1. Laboratory Methods for Sediment Samples

			Sample Preparation		Quantitative Analysis	
Analyte	Sample Type	Laboratory	Protocol	Procedure	Protocol	Procedure
Engineering Characteristics						
Consolidation	Subsurface sediment	Kleinfelder	NA	--	ASTM D2435 (Method B)	Oedometer
Unconsolidated, undrained triaxial shear stress	Subsurface sediment	Kleinfelder	NA	--	ASTM D2850	Compression
Consolidated, undrained triaxial shear stress	Subsurface sediment	Kleinfelder	NA	--	ASTM D4767	Compression
Hydraulic conductivity	Subsurface sediment	Kleinfelder	NA	--	ASTM D5084	Flexible wall permeameter
Torvane shear strength testing	Subsurface sediment	Kleinfelder	NA		Torvane	Hand-held Vane Shear Device
Unconfirmed compressive strength (Rock)	Subsurface rock	Kleinfelder	NA	--	ASTM D7012	Compression
Point load index (Rock)	Subsurface rock	Kleinfelder	NA	--	ASTM D5731	Compression
Cone penetration testing (CPT)	Subsurface sediment	field[b]	NA	--	ASTM D5778	Cone Penetrometer
Pore pressure dissipation testing	Subsurface sediment	field[b]	NA	--	ASTM D5778	Piezocone Penetrometer

Notes:

[a] Cleanup procedures will be performed as necessary to achieve the method reporting limits and method detection limits listed in Table A6-4.

[b] CPT and pore pressure dissipation tests will be performed in-situ by the drilling sub-contractor during the field program.

CPT - cone penetration testing
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high resolution gas chromatography/mass spectrometry
NA - not applicable
PCB - polychlorinated biphenyl
PCDD/F - polychlorinated dibenzo*p*-dioxin and polychlorinated dibenzofuran
SVOC - semivolatile organic compound
TBD - to be determined
TOC - total organic carbon
VOC - volatile organic compound

Table A6-2. Laboratory Methods for Field Blank Samples

		Sample Preparation		Quantitative Analysis	
Analyte	Laboratory	Protocol	Procedure	Protocol	Procedure
TOC	TestAmerica Tacoma	EPA 415.1	Filtration, chemical oxidation	EPA 415.1	Infrared detector
Organochlorine pesticides	TestAmerica Burlington or Knoxville	EPA SW846-3510C	Separatory funnel	EPA SW846-8081A	Dual column GC/ECD
PCB Aroclors	TestAmerica Tacoma	EPA SW846-3510C	Separatory funnel	EPA SW846-8082	Dual column GC/ECD
SVOCs	TestAmerica Tacoma	EPA SW846-3510C	Separatory funnel	EPA SW846-8270C	GC/MS
VOCs	TestAmerica Tacoma	EPA SW846-5030B	Purge and trap	EPA SW846-8260B	GC/MS
PCDD/Fs	TestAmerica West Sacramento	EPA 1613B	Separatory funnel, acid extraction	EPA 1613B	HRGC/HRMS

Notes:

EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
HRGC/HRMS - high resolution gas chromatography/mass spectrometry
PCB - polychlorinated biphenyl
PCDD/F - polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran
SVOC - semivolatile organic compound
TOC - total organic carbon
VOC - volatile organic compound

Table A6-3. Laboratory Methods for Waste Characterization

Analyte	Sample Type	Laboratory	Sample Preparation		Quantitative Analysis	
			Protocol	Procedure	Protocol	Procedure
Toxicity Characteristic Leaching Procedure						
TCLP	Sediment	TestAmerica Tacoma	EPA 1311	Leaching test	NA	NA
Metals						
Arsenic, barium, cadmium, chromium, lead, selenium, silver	TCLP	TestAmerica Tacoma	EPA 3005A	Acid digestion	EPA 6010B	ICP/AES
Mercury	TCLP	TestAmerica Tacoma	EPA 7470A	Acid digestion/oxidation	EPA 7470A	CVAA
Organochlorine pesticides	TCLP	TestAmerica Tacoma	EPA 3510C	Separatory funnel extraction	EPA 8081A	Dual column GC/ECD
SVOCs	TCLP	TestAmerica Tacoma	EPA 3510C	Separatory funnel extraction	EPA 8270C	GC/MS
VOCs	TCLP	TestAmerica Tacoma	EPA 5035	Purge and trap	EPA 8260B	GC/MS
Chlorinated herbicides	TCLP	TestAmerica Tacoma	EPA 3535A / 8151A	Solid phase extraction, esterification	EPA 8151A Mod	IT/MS
Asbestos						
Asbestos	Subsurface sediments	TBD	US EPA Method 600/R-93-116	Point count/400 field	EPA Method 600/R-93-116	Microscopy

Notes:
CVAA - cold vapor atomic absorption spectrometry
EPA - U.S. Environmental Protection Agency
GC/ECD - gas chromatography/electron capture detection
GC/MS - gas chromatography/mass spectrometry
ICP/AES - inductively coupled plasma/atomic emission spectrometry
IT/MS - ion trap/mass spectrometry
NA - not applicable
SVOC - semivolatile organic compound
TCLP - toxicity characteristic leaching procedure
VOC - volatile organic compound

Table A6-4. Analytes and Method Reporting Limits for Sediment Samples

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL[a]	ACG[b]
Conventional Analyses						
Total organic carbon (percent)	--	EPA 9060	TestAmerica Tacoma	0.061	0.2	NE
Organochlorine Pesticides (µg/kg dry weight)						
Standard List						
2,4'-DDD	53-19-0	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.054**	**0.4**	0.04
2,4'-DDE	3424-82-6	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.058**	**0.4**	0.04
2,4'-DDT	789-02-6	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.06**	**0.4**	0.04
4,4'-DDD	72-54-8	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.05**	**0.4**	0.04
4,4'-DDE	72-55-9	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.052**	**0.4**	0.04
4,4'-DDT	50-29-3	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.052**	**0.4**	0.04
Expanded List						
a - BHC	319-84-6	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.052	0.4	360
a - Chlordane	5103-71-9	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.054	**0.4**	0.37
Aldrin	309-00-2	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.074	0.4	40
b - BHC	319-85-7	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.054	0.4	1300
d - BHC	319-86-8	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.082	0.4	NE
Dieldrin	60-57-1	EPA 8081A	TestAmerica Burlington or Knoxville[c]	**0.056**	**0.4**	0.0081
Endosulfan I	959-98-8	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.044	0.4	NE
Endosulfan II	33213-65-9	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.05	0.4	NE
Endosulfan sulfate	1031-07-8	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.054	0.4	NE
Endrin	72-20-8	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.068	0.4	2.22
Endrin aldehyde	7421-93-4	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.05	0.4	NE
Endrin ketone	53494-70-5	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.046	0.4	NE
g - BHC (Lindane)	58-89-9	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.1	0.4	2.37
g - Chlordane	5103-74-2	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.1	**0.4**	0.37
Heptachlor	76-44-8	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.056	0.4	10
Heptachlor epoxide	1024-57-3	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.058	0.4	2.47
Methoxychlor	72-43-5	EPA 8081A	TestAmerica Burlington or Knoxville[c]	0.06	0.4	3,100,000
Toxaphene	8001-35-2	EPA 8081A	TestAmerica Burlington or Knoxville[c]	2.4	10	1,600
PCB Aroclors (µg/kg dry weight)						
Aroclor 1016	12674-11-2	EPA 8082	TestAmerica Tacoma	6.4	20	530
Aroclor 1221	11104-28-2	EPA 8082	TestAmerica Tacoma	16	20	NE
Aroclor 1232	11141-16-5	EPA 8082	TestAmerica Tacoma	14	20	NE
Aroclor 1242	53469-21-9	EPA 8082	TestAmerica Tacoma	4.2	20	NE
Aroclor 1248	12672-29-6	EPA 8082	TestAmerica Tacoma	2.6	20	1,500
Aroclor 1254	11097-69-1	EPA 8082	TestAmerica Tacoma	4.2	20	300
Aroclor 1260	11096-82-5	EPA 8082	TestAmerica Tacoma	6	20	200
Aroclor 1262	37324-23-5	EPA 8082	TestAmerica Tacoma	3.8	20	NE
Aroclor 1268	11100-14-4	EPA 8082	TestAmerica Tacoma	4.2	20	NE
Semivolatile Organic Compounds (µg/kg dry weight)						
Halogenated Compounds						
1,2-Dichlorobenzene	95-50-1	EPA 8270C	TestAmerica Tacoma	1.28	10	1,700
1,3-Dichlorobenzene	541-73-1	EPA 8270C	TestAmerica Tacoma	1.44	10	300
1,4-Dichlorobenzene	106-46-7	EPA 8270C	TestAmerica Tacoma	0.66	10	300
1,2,4-Trichlorobenzene	120-82-1	EPA 8270C	TestAmerica Tacoma	2.4	10	9,200
Hexachlorobenzene	118-74-1	EPA 8270C	TestAmerica Tacoma	0.76	10	19
2-Chloronaphthalene	91-58-7	EPA 8270C	TestAmerica Tacoma	0.36	4	23,000,000
Hexachloroethane	67-72-1	EPA 8270C	TestAmerica Tacoma	2.2	20	120,000
Hexachlorobutadiene	87-68-3	EPA 8270C	TestAmerica Tacoma	1.82	10	600
Hexachlorocyclopentadiene	77-47-4	EPA 8270C	TestAmerica Tacoma	0.52	20	400
2,2'-oxybis(1-chloropropane)	108-60-1	EPA 8270C	TestAmerica Tacoma	1.34	30	7,400
Bis-(2-chloroethoxy) methane	111-91-1	EPA 8270C	TestAmerica Tacoma	0.6	20	NE
Bis-(2-chloroethyl) ether	111-44-4	EPA 8270C	TestAmerica Tacoma	1.98	20	580
4-Chlorophenyl-phenyl ether	7005-72-3	EPA 8270C	TestAmerica Tacoma	1.14	20	NE
4-bromophenyl-phenyl ether	101-55-3	EPA 8270C	TestAmerica Tacoma	0.66	20	NE
3,3'-Dichlorbenzidine	91-94-1	EPA 8270C	TestAmerica Tacoma	8	40	3,800
4-Chloroaniline	106-47-8	EPA 8270C	TestAmerica Tacoma	2.2	20	2,500,000

Table A6-4. Analytes and Method Reporting Limits for Sediment Samples

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL[a]	ACG[b]
Organonitrogen Compounds						
Nitrobenzene	98-95-3	EPA 8270C	TestAmerica Tacoma	5.8	20	100,000
Aniline	62-53-3	EPA 8270C	TestAmerica Tacoma	8.6	20	300,000
2-Nitroaniline	88-74-4	EPA 8270C	TestAmerica Tacoma	0.84	20	1,800,000
3-Nitroaniline	99-09-2	EPA 8270C	TestAmerica Tacoma	1.16	20	82,000
4-Nitroaniline	100-01-6	EPA 8270C	TestAmerica Tacoma	2.8	20	82,000
n-Nitrosodimethylamine	62-75-9	EPA 8270C	TestAmerica Tacoma	**96**	**300**	34
n-Nitroso-di-n-propylamine	621-64-7	EPA 8270C	TestAmerica Tacoma	1.94	20	250
n-Nitrosodiphenylamine	86-30-6	EPA 8270C	TestAmerica Tacoma	0.44	10	350,000
1,2-Diphenylhydrazine (as Azobenzene)	122-66-7	EPA 8270C	TestAmerica Tacoma	0.6	20	2,200
2,4-Dinitrotoluene	121-14-2	EPA 8270C	TestAmerica Tacoma	0.5	20	1,200,000
2,6-Dinitrotoluene	606-20-2	EPA 8270C	TestAmerica Tacoma	0.82	20	620,000
Carbazole	86-74-8	EPA 8270C	TestAmerica Tacoma	0.86	30	1,600
Oxygen-Containing Compounds						
Benzoic Acid	65-85-0	EPA 8270C	TestAmerica Tacoma	130	500	100,000,000
Benzyl Alcohol	100-51-6	EPA 8270C	TestAmerica Tacoma	1.92	20	100,000,000
Dibenzofuran	132-64-9	EPA 8270C	TestAmerica Tacoma	0.3	20	1,600,000
Isophorone	78-59-1	EPA 8270C	TestAmerica Tacoma	0.82	20	510,000
Phenols and Substituted Phenols						
Phenol	108-95-2	EPA 8270C	TestAmerica Tacoma	1.48	20	50
2-Methylphenol	95-48-7	EPA 8270C	TestAmerica Tacoma	1.42	20	31,000,000
3 & 4-Methylphenol	106-44-5	EPA 8270C	TestAmerica Tacoma	1.12	40	3,100,000
2,4-Dimethylphenol	105-67-9	EPA 8270C	TestAmerica Tacoma	4.2	20	12,000,000
2-Chlorophenol	95-57-8	EPA 8270C	TestAmerica Tacoma	1.48	20	240,000
2,4-Dichlorophenol	120-83-2	EPA 8270C	TestAmerica Tacoma	0.6	20	1,800,000
2,4,5-Trichlorophenol	95-95-4	EPA 8270C	TestAmerica Tacoma	0.86	20	62,000,000
2,4,6-Trichlorophenol	88-06-2	EPA 8270C	TestAmerica Tacoma	0.8	30	25,000
2,3,4,6-Tetrachlorophenol	58-90-2	EPA 8270C	TestAmerica Tacoma	1.52	200	18,000,000
2,3,5,6-Tetrachlorophenol	935-95-5	EPA 8270C	TestAmerica Tacoma	1.08	200	NE
Pentachlorophenol	87-86-5	EPA 8270C	TestAmerica Tacoma	2.4	20	250
4-Chloro-3-methylphenol	59-50-7	EPA 8270C	TestAmerica Tacoma	1.42	20	NE
2-Nitrophenol	88-75-5	EPA 8270C	TestAmerica Tacoma	0.86	20	NE
4-Nitrophenol	100-02-7	EPA 8270C	TestAmerica Tacoma	34	200	NE
2,4-Dinitrophenol	51-28-5	EPA 8270C	TestAmerica Tacoma	20	200	1,200,000
4,6-Dinitro-2-methylphenol	534-52-1	EPA 8270C	TestAmerica Tacoma	3.6	200	62,000
Phthalate Esters						
Dimethylphthalate	131-11-3	EPA 8270C	TestAmerica Tacoma	0.86	20	100,000,000
Diethylphthlalate	84-66-2	EPA 8270C	TestAmerica Tacoma	3	20	600
Di-n-butylphthalate	84-74-2	EPA 8270C	TestAmerica Tacoma	5.2	40	60
Butylbenzylphthalate	85-68-7	EPA 8270C	TestAmerica Tacoma	6.2	20	100,000,000
Di-n-octylphthalate	117-84-0	EPA 8270C	TestAmerica Tacoma	12	40	25,000,000
Bis(2-ethylhexyl)phthalate	117-81-7	EPA 8270C	TestAmerica Tacoma	8.4	300	330
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	EPA 8270C	TestAmerica Tacoma	0.44	4	176
2-Methylnaphthalene	91-57-6	EPA 8270C	TestAmerica Tacoma	0.46	4	200
Acenaphthylene	208-96-8	EPA 8270C	TestAmerica Tacoma	0.32	4	200
Acenaphthene	83-32-9	EPA 8270C	TestAmerica Tacoma	0.32	4	300
Fluorene	86-73-7	EPA 8270C	TestAmerica Tacoma	0.24	4	77.4
Phenanthrene	85-01-8	EPA 8270C	TestAmerica Tacoma	0.42	4	204
Anthracene	120-12-7	EPA 8270C	TestAmerica Tacoma	0.28	4	57.2
Fluoranthene	206-44-0	EPA 8270C	TestAmerica Tacoma	0.24	4	423
Pyrene	129-00-0	EPA 8270C	TestAmerica Tacoma	0.28	4	195
Benzo(a)anthracene	56-55-3	EPA 8270C	TestAmerica Tacoma	0.34	5	108
Chrysene	218-01-9	EPA 8270C	TestAmerica Tacoma	0.28	5	166
Benzo(b)fluoranthene	205-99-2	EPA 8270C	TestAmerica Tacoma	0.82	4	2,100
Benzo(k)fluoranthene	207-08-9	EPA 8270C	TestAmerica Tacoma	0.26	5	1,300
Benzo(a)pyrene	50-32-8	EPA 8270C	TestAmerica Tacoma	0.42	6	150
Indeno(1,2,3-cd)pyrene	193-39-5	EPA 8270C	TestAmerica Tacoma	0.84	8	100
Dibenz(a,h)anthracene	53-70-3	EPA 8270C	TestAmerica Tacoma	0.44	8	33
Benzo(g,h,i)perylene	191-24-2	EPA 8270C	TestAmerica Tacoma	0.3	5	300

Table A6-4. Analytes and Method Reporting Limits for Sediment Samples

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL[a]	ACG[b]
Volatile Organic Compounds (µg/kg dry weight)						
1,1,1,2-Tetrachloroethane	630-20-6	EPA 8260B	TestAmerica Tacoma	0.262	2	7,300
1,1,1-Trichloroethane	71-55-6	EPA 8260B	TestAmerica Tacoma	0.23	2	1,200,000
1,1,2,2-Tetrachloroethane	79-34-5	EPA 8260B	TestAmerica Tacoma	0.302	2	930
1,1,2-Trichloroethane	79-00-5	EPA 8260B	TestAmerica Tacoma	0.152	2	1,600
1,1-Dichloroethane	75-34-3	EPA 8260B	TestAmerica Tacoma	0.256	2	6,000
1,2,3-Trichloropropane	96-18-4	EPA 8260B	TestAmerica Tacoma	0.798	2	76
1,2-Dichloroethane	107-06-2	EPA 8260B	TestAmerica Tacoma	0.114	2	600
1,2-Dichloropropane	78-87-5	EPA 8260B	TestAmerica Tacoma	0.128	2	740
1,4-Dichlorobenzene	106-46-7	EPA 8260B	TestAmerica Tacoma	0.148	2	300
2-Butanone	78-93-3	EPA 8260B	TestAmerica Tacoma	1.948	10	110,000,000
2-Chloroethyl vinyl ether	110-75-8	EPA 8260B	TestAmerica Tacoma	0.672	10	NE
2-Hexanone	591-78-6	EPA 8260B	TestAmerica Tacoma	0.622	10	NE
4-Methyl-2-pentanone	108-10-1	EPA 8260B	TestAmerica Tacoma	1.042	10	47,000,000
Acetone	67-64-1	EPA 8260B	TestAmerica Tacoma	9.092	10	54,000,000
Acrolein	107-02-8	EPA 8260B	TestAmerica Tacoma	2.56	10	340
Acrylonitrile	107-13-1	EPA 8260B	TestAmerica Tacoma	1.624	10	120
Bromochloromethane	74-97-5	EPA 8260B	TestAmerica Tacoma	0.12	2	NE
Bromodichloromethane	75-27-4	EPA 8260B	TestAmerica Tacoma	0.156	2	1,800
Bromoform	75-25-2	EPA 8260B	TestAmerica Tacoma	0.406	2	220,000
Bromomethane	74-83-9	EPA 8260B	TestAmerica Tacoma	2.702	10	13,000
Carbon Disulfide	75-15-0	EPA 8260B	TestAmerica Tacoma	0.278	2	720,000
Carbon Tetrachloride	56-23-5	EPA 8260B	TestAmerica Tacoma	0.15	2	550
Chlorobenzene	108-90-7	EPA 8260B	TestAmerica Tacoma	0.14	2	530,000
Chlorodibromomethane	124-48-1	EPA 8260B	TestAmerica Tacoma	0.152	2	2,600
Chloroethane	75-00-3	EPA 8260B	TestAmerica Tacoma	4.714	10	6,500
Chloroform	67-66-3	EPA 8260B	TestAmerica Tacoma	0.174	2	2,000
Chloromethane	74-87-3	EPA 8260B	TestAmerica Tacoma	0.574	2	160,000
cis-1,3-Dichloropropene	10061-01-5	EPA 8260B	TestAmerica Tacoma	0.196	2	NE
Dibromomethane	74-95-3	EPA 8260B	TestAmerica Tacoma	0.232	2	230,000
Dichlorodifluoromethane	75-71-8	EPA 8260B	TestAmerica Tacoma	0.284	2	310,000
Iodomethane	74-88-4	EPA 8260B	TestAmerica Tacoma	0.216	10	NE
Isopropyl benzene	98-82-8	EPA 8260B	TestAmerica Tacoma	0.088	2	2,000,000
Methylene chloride	75-09-2	EPA 8260B	TestAmerica Tacoma	1.262	2	21,000
Naphthalene	91-20-3	EPA 8260B	TestAmerica Tacoma	0.198	2	176
Styrene	100-42-5	EPA 8260B	TestAmerica Tacoma	0.252	2	1,700,000
trans-1,4-Dichloro-2-butene	110-57-6	EPA 8260B	TestAmerica Tacoma	2.04	10	NE
Trichlorofluoromethane	75-69-4	EPA 8260B	TestAmerica Tacoma	0.112	2	2,000,000
Vinyl Acetate	108-05-4	EPA 8260B	TestAmerica Tacoma	0.284	10	1,400,000
1,1-Dichloroethene	75-35-4	EPA 8260B	TestAmerica Tacoma	3	10	410,000
Benzene	71-43-2	EPA 8260B	TestAmerica Tacoma	0.114	2	1400
Ethyl Benzene	100-41-4	EPA 8260B	TestAmerica Tacoma	0.112	2	400,000
m,p-Xylene	179601-23-1	EPA 8260B	TestAmerica Tacoma	0.234	4	NE
Methyl-*t*-butyl ether (MTBE)	1634-04-4	EPA 8260B	TestAmerica Tacoma	0.118	2	70,000
o-Xylene	95-47-6	EPA 8260B	TestAmerica Tacoma	0.086	2	NE
Tetrachloroethene	127-18-4	EPA 8260B	TestAmerica Tacoma	0.384	2	500
Toluene	108-88-3	EPA 8260B	TestAmerica Tacoma	0.144	2	520,000
trans-1,2-Dichloroethene	156-60-5	EPA 8260B	TestAmerica Tacoma	0.172	2	230,000
trans-1,3-Dichloropropene	10061-02-6	EPA 8260B	TestAmerica Tacoma	0.166	2	NE
Trichloroethene	79-01-6	EPA 8260B	TestAmerica Tacoma	0.094	2	2,100
Vinyl Chloride	75-01-4	EPA 8260B	TestAmerica Tacoma	0.174	2	750
Chlorinated Dioxins and Furans (pg/g dry weight)						
2,3,7,8-TCDD	1746-01-6	EPA 1613B	TestAmerica West Sacramento	**0.56**	**2.0**	0.0091
2,3,7,8-TCDF	51207-31-9	EPA 1613B	TestAmerica West Sacramento	0.50	**2.0**	0.77
1,2,3,7,8-PeCDD	40321-76-4	EPA 1613B	TestAmerica West Sacramento	**0.76**	**10.0**	0.27
1,2,3,7,8-PeCDF	57117-41-6	EPA 1613B	TestAmerica West Sacramento	0.78	**10.0**	2.6
2,3,4,7,8-PeCDF	57117-31-4	EPA 1613B	TestAmerica West Sacramento	**0.52**	**10.0**	0.03
1,2,3,4,7,8-HxCDD	39227-28-6	EPA 1613B	TestAmerica West Sacramento	1.04	**10.0**	2.7
1,2,3,6,7,8-HxCDD	57653-85-7	EPA 1613B	TestAmerica West Sacramento	1.18	**10.0**	2.7
1,2,3,7,8,9-HxCDD	19408-74-3	EPA 1613B	TestAmerica West Sacramento	1.38	**10.0**	2.7
1,2,3,4,7,8-HxCDF	70648-26-9	EPA 1613B	TestAmerica West Sacramento	1.02	**10.0**	2.7
1,2,3,6,7,8-HxCDF	57117-44-9	EPA 1613B	TestAmerica West Sacramento	1.52	**10.0**	2.7
1,2,3,7,8,9-HxCDF	72918-21-9	EPA 1613B	TestAmerica West Sacramento	1.24	**10.0**	2.7
2,3,4,6,7,8-HxCDF	60851-34-5	EPA 1613B	TestAmerica West Sacramento	1.38	**10.0**	2.7
1,2,3,4,6,7,8-HpCDD	35822-46-9	EPA 1613B	TestAmerica West Sacramento	1.22	10.0	690

Table A6-4. Analytes and Method Reporting Limits for Sediment Samples

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL[a]	ACG[b]
1,2,3,4,6,7,8-HpCDF	67562-39-4	EPA 1613B	TestAmerica West Sacramento	1.04	10.0	690
1,2,3,4,7,8,9-HpCDF	55673-89-7	EPA 1613B	TestAmerica West Sacramento	1.26	10.0	690
OCDD	3268-87-9	EPA 1613B	TestAmerica West Sacramento	5.48	20.0	23,000
OCDF	39001-02-0	EPA 1613B	TestAmerica West Sacramento	1.62	20.0	23,000
Total tetrachlorinated dioxins	41903-57-5	EPA 1613B	TestAmerica West Sacramento	NA	2.0	-
Total pentachlorinated dioxins	36088-22-9	EPA 1613B	TestAmerica West Sacramento	NA	10.0	-
Total hexachlorinated dioxins	34465-46-8	EPA 1613B	TestAmerica West Sacramento	NA	10.0	-
Total heptachlorinated dioxins	37871-00-4	EPA 1613B	TestAmerica West Sacramento	NA	10.0	-
Total tetrachlorinated furans	30402-14-3	EPA 1613B	TestAmerica West Sacramento	NA	2.0	-
Total pentachlorinated furans	30402-15-4	EPA 1613B	TestAmerica West Sacramento	NA	10.0	-
Total hexachlorinated furans	55684-94-1	EPA 1613B	TestAmerica West Sacramento	NA	10.0	-
Total heptachlorinated furans	38998-75-3	EPA 1613B	TestAmerica West Sacramento	NA	10.0	-

Notes:

MDLs are updated periodically by the laboratories. MDLs that are in effect at the laboratory at the time of analysis will be used. These may differ slightly from the MDLs shown in this table.

[a] The MRL is provided on a dry-weight basis and assumes 50% moisture in the samples. The MRL for project samples will vary with moisture content in the samples. The MRL represents the level of lowest calibration standard (i.e., the practical quantitation limit).

[b] ACG represents the minimum value from the JSCS screening levels Table 3-1 (Portland Harbor Joint Source Control Strategy, DEQ +EPA 12/2005 and 7/16/07 revision)

[c] MDL values listed for EPA 8081A Pesticide analysis are from the TestAmerica/Knoxville laboratory. MDL studies are currently in progress at the TestAmerica Burlington laboratory.

Bold indicates that the MDL or MRL is greater than the ACG.

ACG - analytical concentration goal (draft)
CAS - Chemical Abstract Services
EPA - U.S. Environmental Protection Agency
MDL - method detection limit
MRL - method reporting limit
NE - not established

Table A6-5. Analytes and Method Reporting Limits for Field Blanks

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL
Conventional Analyses - Field Blanks					
Total organic carbon (mg/L)	--	EPA 415.1	TestAmerica Tacoma	0.33	1
Organochlorine Pesticides (µg/L) - Field Blanks					
2,4'-DDD	53-19-0	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0054	0.1
2,4'-DDE	3424-82-6	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.004	0.1
2,4'-DDT	789-02-6	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0049	0.1
4,4'-DDD	72-54-8	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0054	0.1
4,4'-DDE	72-55-9	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.004	0.1
4,4'-DDT	50-29-3	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0049	0.1
a - BHC	319-84-6	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0043	0.1
a - Chlordane	5103-71-9	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0047	0.1
Aldrin	309-00-2	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0051	0.1
b - BHC	319-85-7	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0075	0.1
d - BHC	319-86-8	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0041	0.1
Dieldrin	60-57-1	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0041	0.1
Endosulfan I	959-98-8	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0094	0.1
Endosulfan II	33213-65-9	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0071	0.1
Endosulfan sulfate	1031-07-8	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0056	0.1
Endrin	72-20-8	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0047	0.1
Endrin aldehyde	7421-93-4	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0051	0.1
Endrin ketone	53494-70-5	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0044	0.1
g - BHC (Lindane)	58-89-9	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0068	0.1
g - Chlordane	5103-74-2	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.014	0.1
Heptachlor	76-44-8	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0055	0.1
Heptachlor epoxide	1024-57-3	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.0048	0.1
Methoxychlor	72-43-5	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.008	0.5
Toxaphene	8001-35-2	EPA 8081A	TestAmerica Burlington or Knoxville[a]	0.27	5
PCBs Aroclors (µg/L) - Field Blanks					
Aroclor 1016	12674-11-2	EPA 8082	TestAmerica Tacoma	0.045	0.5
Aroclor 1221	11104-28-2	EPA 8082	TestAmerica Tacoma	0.062	0.5
Aroclor 1232	11141-16-5	EPA 8082	TestAmerica Tacoma	0.041	0.5
Aroclor 1242	53469-21-9	EPA 8082	TestAmerica Tacoma	0.041	0.5
Aroclor 1248	12672-29-6	EPA 8082	TestAmerica Tacoma	0.07	0.5
Aroclor 1254	11097-69-1	EPA 8082	TestAmerica Tacoma	0.044	0.5
Aroclor 1260	11096-82-5	EPA 8082	TestAmerica Tacoma	0.039	0.5
Aroclor 1262	37324-23-5	EPA 8082	TestAmerica Tacoma	0.023	0.5
Aroclor 1268	11100-14-4	EPA 8082	TestAmerica Tacoma	0.031	0.5
Semivolatile Organic Compounds (µg/L) - Field Blanks					
Halogenated Compounds					
1,2-Dichlorobenzene	95-50-1	EPA 8270C	TestAmerica Tacoma	0.11	2
1,3-Dichlorobenzene	541-73-1	EPA 8270C	TestAmerica Tacoma	0.081	2
1,4-Dichlorobenzene	106-46-7	EPA 8270C	TestAmerica Tacoma	0.063	2
1,2,4-Trichlorobenzene	120-82-1	EPA 8270C	TestAmerica Tacoma	0.068	2
Hexachlorobenzene	118-74-1	EPA 8270C	TestAmerica Tacoma	0.079	2
2-Chloronaphthalene	91-58-7	EPA 8270C	TestAmerica Tacoma	0.029	0.3
Hexachloroethane	67-72-1	EPA 8270C	TestAmerica Tacoma	0.16	3
Hexachlorobutadiene	87-68-3	EPA 8270C	TestAmerica Tacoma	0.19	3
Hexachlorocyclopentadiene	77-47-4	EPA 8270C	TestAmerica Tacoma	0.26	10
2,2'-oxybis(1-chloropropane)	108-60-1	EPA 8270C	TestAmerica Tacoma	0.23	2
Bis-(2-chloroethoxy)methane	111-91-1	EPA 8270C	TestAmerica Tacoma	0.14	2
Bis-(2-chloroethyl)ether	111-44-4	EPA 8270C	TestAmerica Tacoma	0.096	2
4-Chlorophenyl Phenyl Ether	7005-72-3	EPA 8270C	TestAmerica Tacoma	0.087	2
4-Bromophenyl Phenyl Ether	101-55-3	EPA 8270C	TestAmerica Tacoma	0.11	2
3,3'-Dichlorobenzidine	91-94-1	EPA 8270C	TestAmerica Tacoma	0.32	10
4-Chloroaniline	106-47-8	EPA 8270C	TestAmerica Tacoma	0.094	2

Table A6-5. Analytes and Method Reporting Limits for Field Blanks

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL
Organonitrogen Compounds					
Nitrobenzene	98-95-3	EPA 8270C	TestAmerica Tacoma	0.28	2
Aniline	62-53-3	EPA 8270C	TestAmerica Tacoma	0.58	3
2-Nitroaniline	88-74-4	EPA 8270C	TestAmerica Tacoma	0.13	2
3-Nitroaniline	99-09-2	EPA 8270C	TestAmerica Tacoma	0.57	2
4-Nitroaniline	100-01-6	EPA 8270C	TestAmerica Tacoma	0.18	3
N-Nitrosodimethylamine	62-75-9	EPA 8270C	TestAmerica Tacoma	0.65	10
N-Nitrosodi-n-propylamine	621-64-7	EPA 8270C	TestAmerica Tacoma	0.29	2
N-Nitrosodiphenylamine	86-30-6	EPA 8270C	TestAmerica Tacoma	0.12	2
1,2-Diphenylhydrazine (as Azobenzene	122-66-7	EPA 8270C	TestAmerica Tacoma	0.14	5
2,4-Dinitrotoluene	121-14-2	EPA 8270C	TestAmerica Tacoma	0.094	2
2,6-Dinitrotoluene	606-20-2	EPA 8270C	TestAmerica Tacoma	0.18	2
Carbazole	86-74-8	EPA 8270C	TestAmerica Tacoma	0.13	2
Oxygen-Containing Compounds					
Benzoic Acid	65-85-0	EPA 8270C	TestAmerica Tacoma	2.1	10
Benzyl Alcohol	100-51-6	EPA 8270C	TestAmerica Tacoma	0.15	2
Dibenzofuran	132-64-9	EPA 8270C	TestAmerica Tacoma	0.095	2
Isophorone	78-59-1	EPA 8270C	TestAmerica Tacoma	0.16	2
Phenols and Substituted Phenols					
Phenol	108-95-2	EPA 8270C	TestAmerica Tacoma	0.2	3
2-Methylphenol	95-48-7	EPA 8270C	TestAmerica Tacoma	0.14	2
3 & 4-Methylphenol	106-44-5	EPA 8270C	TestAmerica Tacoma	0.1	4
2,4-Dimethylphenol	105-67-9	EPA 8270C	TestAmerica Tacoma	1.2	10
2-Chlorophenol	95-57-8	EPA 8270C	TestAmerica Tacoma	0.13	2
2,4-Dichlorophenol	120-83-2	EPA 8270C	TestAmerica Tacoma	0.09	10
2,4,5-Trichlorophenol	95-95-4	EPA 8270C	TestAmerica Tacoma	0.098	2
2,4,6-Trichlorophenol	88-06-2	EPA 8270C	TestAmerica Tacoma	0.14	3
2,3,4,6-Tetrachlorophenol	58-90-2	EPA 8270C	TestAmerica Tacoma	0.085	3.5
Pentachlorophenol	87-86-5	EPA 8270C	TestAmerica Tacoma	0.11	3.5
4-Chloro-3-methylphenol	59-50-7	EPA 8270C	TestAmerica Tacoma	0.14	2
2-Nitrophenol	88-75-5	EPA 8270C	TestAmerica Tacoma	0.14	2
4-Nitrophenol	100-02-7	EPA 8270C	TestAmerica Tacoma	4.9	10
2,4-Dinitrophenol	51-28-5	EPA 8270C	TestAmerica Tacoma	2.5	25
4,6-Dinitro-2-methylphenol	534-52-1	EPA 8270C	TestAmerica Tacoma	1.1	20
Phthalate Esters					
Dimethyl Phthalate	131-11-3	EPA 8270C	TestAmerica Tacoma	0.12	2
Diethyl Phthalate	84-66-2	EPA 8270C	TestAmerica Tacoma	0.071	2
Di-n-butyl Phthalate	84-74-2	EPA 8270C	TestAmerica Tacoma	0.53	2
Butyl Benzyl Phthalate	85-68-7	EPA 8270C	TestAmerica Tacoma	0.96	3
Di-n-octyl Phthalate	117-84-0	EPA 8270C	TestAmerica Tacoma	0.93	2
Bis(2-ethylhexyl) Phthalate	117-81-7	EPA 8270C	TestAmerica Tacoma	5.9	15
Polycyclic Aromatic Hydrocarbons					
Naphthalene	91-20-3	EPA 8270C	TestAmerica Tacoma	0.074	2
2-Methylnaphthalene	91-57-6	EPA 8270C	TestAmerica Tacoma	0.098	1
Acenaphthylene	208-96-8	EPA 8270C	TestAmerica Tacoma	0.037	0.4
Acenaphthene	83-32-9	EPA 8270C	TestAmerica Tacoma	0.038	0.5
Fluorene	86-73-7	EPA 8270C	TestAmerica Tacoma	0.037	0.3
Phenanthrene	85-01-8	EPA 8270C	TestAmerica Tacoma	0.046	0.4
Anthracene	120-12-7	EPA 8270C	TestAmerica Tacoma	0.041	0.2
Fluoranthene	206-44-0	EPA 8270C	TestAmerica Tacoma	0.064	0.25
Pyrene	129-00-0	EPA 8270C	TestAmerica Tacoma	0.053	0.3
Benz(a)anthracene	56-55-3	EPA 8270C	TestAmerica Tacoma	0.067	0.3
Chrysene	218-01-9	EPA 8270C	TestAmerica Tacoma	0.065	0.2
Benzo(b)fluoranthene	205-99-2	EPA 8270C	TestAmerica Tacoma	0.055	0.4
Benzo(k)fluoranthene	207-08-9	EPA 8270C	TestAmerica Tacoma	0.044	0.3
Benzo(a)pyrene	50-32-8	EPA 8270C	TestAmerica Tacoma	0.072	0.2
Indeno(1,2,3-cd)pyrene	193-39-5	EPA 8270C	TestAmerica Tacoma	0.051	0.3
Dibenz(a,h)anthracene	53-70-3	EPA 8270C	TestAmerica Tacoma	0.052	0.3
Benzo(g,h,i)perylene	191-24-2	EPA 8270C	TestAmerica Tacoma	0.058	0.3

Table A6-5. Analytes and Method Reporting Limits for Field Blanks

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL
Volatile Organic Compounds (µg/L) - Field Blanks					
1,1,1,2-Tetrachloroethane	630-20-6	EPA 8260B	TestAmerica Tacoma	0.085	1
1,1,1-Trichloroethane	71-55-6	EPA 8260B	TestAmerica Tacoma	0.041	1
1,1,2,2-Tetrachloroethane	79-34-5	EPA 8260B	TestAmerica Tacoma	0.062	1
1,1,2-Trichloroethane	79-00-5	EPA 8260B	TestAmerica Tacoma	0.062	1
1,1-Dichloroethane	75-34-3	EPA 8260B	TestAmerica Tacoma	0.048	1
1,2,3-Trichloropropane	96-18-4	EPA 8260B	TestAmerica Tacoma	0.12	1
1,2-Dichloroethane	107-06-2	EPA 8260B	TestAmerica Tacoma	0.076	1
1,2-Dichloropropane	78-87-5	EPA 8260B	TestAmerica Tacoma	0.14	1
1,4-Dichlorobenzene	106-46-7	EPA 8260B	TestAmerica Tacoma	0.075	1
2-Butanone	78-93-3	EPA 8260B	TestAmerica Tacoma	0.42	10
2-Chloroethyl vinyl ether	110-75-8	EPA 8260B	TestAmerica Tacoma	0.46	5
2-Hexanone	591-78-6	EPA 8260B	TestAmerica Tacoma	0.24	5
4-Methyl-2-Pentanone	108-10-1	EPA 8260B	TestAmerica Tacoma	0.29	5
Acetone	67-64-1	EPA 8260B	TestAmerica Tacoma	1.7	5
Acrolein	107-02-8	EPA 8260B	TestAmerica Tacoma	0.27	5
Acrylonitrile	107-13-1	EPA 8260B	TestAmerica Tacoma	0.3	10
Bromochloromethane	74-97-5	EPA 8260B	TestAmerica Tacoma	0.24	1
Bromodichloromethane	75-27-4	EPA 8260B	TestAmerica Tacoma	0.053	1
Bromoform	75-25-2	EPA 8260B	TestAmerica Tacoma	0.11	1
Bromomethane	74-83-9	EPA 8260B	TestAmerica Tacoma	0.091	5
Carbon disulfide	75-15-0	EPA 8260B	TestAmerica Tacoma	0.048	1
Carbon tetrachloride	56-23-5	EPA 8260B	TestAmerica Tacoma	0.1	1
Chlorobenzene	108-90-7	EPA 8260B	TestAmerica Tacoma	0.086	1
Chlorodibromomethane	124-48-1	EPA 8260B	TestAmerica Tacoma	0.32	1
Chloroethane	75-00-3	EPA 8260B	TestAmerica Tacoma	0.25	1
Chloroform	67-66-3	EPA 8260B	TestAmerica Tacoma	0.057	1
Chloromethane	74-87-3	EPA 8260B	TestAmerica Tacoma	0.18	1
cis - 1,3-Dichloropropene	10061-01-5	EPA 8260B	TestAmerica Tacoma	0.051	1
Dibromomethane	74-95-3	EPA 8260B	TestAmerica Tacoma	0.046	1
Dichlorodifluoromethane	75-71-8	EPA 8260B	TestAmerica Tacoma	0.13	1
Iodomethane	74-88-4	EPA 8260B	TestAmerica Tacoma	1.2	5
Isopropyl benzene	98-82-8	EPA 8260B	TestAmerica Tacoma	0.034	1
Methylene chloride	75-09-2	EPA 8260B	TestAmerica Tacoma	0.1	1
Naphthalene	91-20-3	EPA 8260B	TestAmerica Tacoma	0.064	1
Styrene	100-42-5	EPA 8260B	TestAmerica Tacoma	0.08	1
trans -1,4-Dichloro-2-butene	110-57-6	EPA 8260B	TestAmerica Tacoma	1.8	5
Trichlorofluoromethane	75-69-4	EPA 8260B	TestAmerica Tacoma	0.069	1
Vinyl Acetate	108-05-4	EPA 8260B	TestAmerica Tacoma	0.41	5
1,1-Dichloroethene	75-35-4	EPA 8260B	TestAmerica Tacoma	0.066	1
Benzene	71-43-2	EPA 8260B	TestAmerica Tacoma	0.057	1
Ethyl benzene	100-41-4	EPA 8260B	TestAmerica Tacoma	0.061	1
m,p -Xylene	179601-23-1	EPA 8260B	TestAmerica Tacoma	0.11	2
Methyl-*t* -butyl ether (MTBE)	1634-04-4	EPA 8260B	TestAmerica Tacoma	0.063	1
o -Xylene	95-47-6	EPA 8260B	TestAmerica Tacoma	0.08	1
Tetrachloroethene	127-18-4	EPA 8260B	TestAmerica Tacoma	0.063	1
Toluene	108-88-3	EPA 8260B	TestAmerica Tacoma	0.076	1
trans -1,2-Dichloroethene	156-60-5	EPA 8260B	TestAmerica Tacoma	0.051	1
trans -1,3-Dichloropropene	10061-02-6	EPA 8260B	TestAmerica Tacoma	0.043	1
Trichloroethene	79-01-6	EPA 8260B	TestAmerica Tacoma	0.056	1
Vinyl chloride	75-01-4	EPA 8260B	TestAmerica Tacoma	0.091	1
Chlorinated Dioxins and Furans (µg/L) - Field Blanks					
2,3,7,8-TCDD	1746-01-6	EPA 1613B	TestAmerica West Sacramento	1.2E-06	1.0E-05
2,3,7,8-TCDF	51207-31-9	EPA 1613B	TestAmerica West Sacramento	3.1E-06	1.0E-05
1,2,3,7,8-PeCDD	40321-76-4	EPA 1613B	TestAmerica West Sacramento	1.3E-05	5.0E-05
1,2,3,7,8-PeCDF	57117-41-6	EPA 1613B	TestAmerica West Sacramento	1.2E-05	5.0E-05
2,3,4,7,8-PeCDF	57117-31-4	EPA 1613B	TestAmerica West Sacramento	1.4E-05	5.0E-05
1,2,3,4,7,8-HxCDD	39227-28-6	EPA 1613B	TestAmerica West Sacramento	1.3E-05	5.0E-05
1,2,3,6,7,8-HxCDD	57653-85-7	EPA 1613B	TestAmerica West Sacramento	1.7E-05	5.0E-05
1,2,3,7,8,9-HxCDD	19408-74-3	EPA 1613B	TestAmerica West Sacramento	1.6E-05	5.0E-05
1,2,3,4,7,8-HxCDF	70648-26-9	EPA 1613B	TestAmerica West Sacramento	2.2E-05	5.0E-05
1,2,3,6,7,8-HxCDF	57117-44-9	EPA 1613B	TestAmerica West Sacramento	1.2E-05	5.0E-05

Table A6-5. Analytes and Method Reporting Limits for Field Blanks

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL
1,2,3,7,8,9-HxCDF	72918-21-9	EPA 1613B	TestAmerica West Sacramento	1.4E-05	5.0E-05
2,3,4,6,7,8-HxCDF	60851-34-5	EPA 1613B	TestAmerica West Sacramento	1.6E-05	5.0E-05
1,2,3,4,6,7,8-HpCDD	35822-46-9	EPA 1613B	TestAmerica West Sacramento	1.1E-05	5.0E-05
1,2,3,4,6,7,8-HpCDF	67562-39-4	EPA 1613B	TestAmerica West Sacramento	1.9E-05	5.0E-05
1,2,3,4,7,8,9-HpCDF	55673-89-7	EPA 1613B	TestAmerica West Sacramento	1.6E-05	5.0E-05
OCDD	3268-87-9	EPA 1613B	TestAmerica West Sacramento	3.6E-05	1.0E-04
OCDF	39001-02-0	EPA 1613B	TestAmerica West Sacramento	6.1E-05	1.0E-04
Total tetrachlorinated dioxins	41903-57-5	EPA 1613B	TestAmerica West Sacramento	NA	1.0E-05
Total pentachlorinated dioxins	36088-22-9	EPA 1613B	TestAmerica West Sacramento	NA	5.0E-05
Total hexachlorinated dioxins	34465-46-8	EPA 1613B	TestAmerica West Sacramento	NA	5.0E-05
Total heptachlorinated dioxins	37871-00-4	EPA 1613B	TestAmerica West Sacramento	NA	5.0E-05
Total tetrachlorinated furans	30402-14-3	EPA 1613B	TestAmerica West Sacramento	NA	1.0E+01
Total pentachlorinated furans	30402-15-4	EPA 1613B	TestAmerica West Sacramento	NA	5.0E-05
Total hexachlorinated furans	55684-94-1	EPA 1613B	TestAmerica West Sacramento	NA	5.0E-05
Total heptachlorinated furans	38998-75-3	EPA 1613B	TestAmerica West Sacramento	NA	5.0E-05

Notes:

MDLs are updated periodically by the laboratories. MDLs that are in effect at the laboratory at the time of analysis will be used. These may differ slightly from the MDLs shown in this table.

[a] MDL values listed for EPA 8081A Pesticide analysis are from the TestAmerica/Knoxville laboratory. MDL studies are currently in progress at the TestAmerica Burlington laboratory.

CAS - Chemical Abstract Services
EPA - U.S. Environmental Protection Agency
MDL - method detection limit
MRL - method reporting limit
NA - not applicable

Table A6-6. Analytes and Method Reporting Limits for Waste Characterization Samples

Analyte	CAS Number	Analytical Method	Laboratory	MDL	MRL	TCLP Limits
Metals (mg/L)						
Arsenic	7440-38-2	EPA 6010B	TestAmerica Tacoma	0.0047	0.06	5
Barium	7440-39-3	EPA 6010B	TestAmerica Tacoma	0.00035	0.01	100
Cadmium	7440-43-9	EPA 6010B	TestAmerica Tacoma	0.0015	0.01	1
Chromium	7440-47-3	EPA 6010B	TestAmerica Tacoma	0.0033	0.025	5
Lead	7439-92-1	EPA 6010B	TestAmerica Tacoma	0.0017	0.03	5
Mercury	7439-97-6	EPA 7470	TestAmerica Tacoma	0.000041	2	0.2
Selenium	7782-49-2	EPA 6010B	TestAmerica Tacoma	0.002	0.1	1
Silver	7440-22-4	EPA 6010B	TestAmerica Tacoma	0.00085	0.02	5
Semivolatile Organic Compounds (µg/L)						
2-Methylphenol	95-48-7	EPA 8270C	TestAmerica Tacoma	1.4	20	200,000
2,4,5-Trichlorophenol	95-95-4	EPA 8270C	TestAmerica Tacoma	0.98	20	400,000
2,4,6-Trichlorophenol	88-06-2	EPA 8270C	TestAmerica Tacoma	1.4	30	2,000
2,4-Dinitrotoluene	121-14-2	EPA 8270C	TestAmerica Tacoma	0.94	20	130
3 & 4-Methylphenol	106-44-5	EPA 8270C	TestAmerica Tacoma	1	40	200,000
Hexachlorobenzene	118-74-1	EPA 8270C	TestAmerica Tacoma	0.79	20	130
Hexachlorobutadiene	87-68-3	EPA 8270C	TestAmerica Tacoma	1.9	30	500
Hexachloroethane	67-72-1	EPA 8270C	TestAmerica Tacoma	2.0	30	3,000
Nitrobenzene	98-95-3	EPA 8270C	TestAmerica Tacoma	2.8	20	2,000
Pentachlorophenol	87-86-5	EPA 8270C	TestAmerica Tacoma	1.1	35	100,000
Pyridine	110-86-1	EPA 8270C	TestAmerica Tacoma	12	100	5,000
Volatile Organic Compounds (µg/L)						
1,1-Dichloroethene	75-35-4	EPA 8260B	TestAmerica Tacoma	6.6	100.0	700
1,2-Dichloroethane	107-06-2	EPA 8260B	TestAmerica Tacoma	7.6	100.0	500
1,4-Dichlorobenzene	106-46-7	EPA 8260B	TestAmerica Tacoma	7.5	100.0	7,500
2-Butanone (Methyl Ethyl Ketone)	78-93-3	EPA 8260B	TestAmerica Tacoma	41.6	1000.0	200,000
Benzene	71-43-2	EPA 8260B	TestAmerica Tacoma	5.7	100.0	500
Carbon Tetrachloride	56-23-5	EPA 8260B	TestAmerica Tacoma	10.2	100.0	500
Chlorobenzene	108-90-7	EPA 8260B	TestAmerica Tacoma	8.6	100.0	100,000
Chloroform	67-66-3	EPA 8260B	TestAmerica Tacoma	5.7	100.0	6,000
Tetrachloroethene	127-18-4	EPA 8260B	TestAmerica Tacoma	6.3	100.0	700
Trichloroethene	79-01-6	EPA 8260B	TestAmerica Tacoma	5.6	100.0	500
Vinyl Chloride	75-01-4	EPA 8260B	TestAmerica Tacoma	9.1	100.0	200
Pesticides (µg/L)						
a - Chlordane	5103-71-9	EPA 8081A	TestAmerica Tacoma	1.18	10	30
Endrin	72-20-8	EPA 8081A	TestAmerica Tacoma	2.86	20.0	20
g - BHC (Lindane)	58-89-9	EPA 8081A	TestAmerica Tacoma	1.07	10	400
g - Chlordane	5103-74-2	EPA 8081A	TestAmerica Tacoma	1.14	10	30
Heptachlor	76-44-8	EPA 8081A	TestAmerica Tacoma	2.86	10	8
Heptachlor epoxide	1024-57-3	EPA 8081A	TestAmerica Tacoma	1.43	10	8
Methoxychlor	72-43-5	EPA 8081A	TestAmerica Tacoma	13.2	100.0	10,000
Toxaphene	8001-35-2	EPA 8081A	TestAmerica Tacoma	92.5	500	500
Herbicides (µg/L)						
2,4,5-TP (Silvex)	93-72-1	EPA 8151A	TestAmerica Tacoma	0.049	0.25	1,000
2,4-D	94-75-7	EPA 8151A	TestAmerica Tacoma	0.019	0.25	10,000

Notes:
CAS - Chemical Abstract Services
EPA - U.S. Environmental Protection Agency
MDL - method detection limit
MRL - method reporting limit
TCLP - toxicity characteristic leaching procedure

Table A7-1. Laboratory Control Limits for Surrogate Recoveries in Sediment Samples

Analyte	Control Limits for Percent Recovery
TestAmerica Tacoma	
PCB Aroclors	
Tetrachloro-m-xylene	45 - 155
Decachlorobiphenyl	50 - 150
Semivolatile Organic Compounds	
Nitrobenzene-d5	38 - 141
Phenol-d5	38 - 149
Terphenyl-d14	42 - 151
2-Fluorophenol	36 - 145
2-Fluorobiphenyl	42 - 140
2,4,6-Tribromophenol	28 - 143
Volatile Organic Compounds	
Toluene-d8	85 - 115
Ethylbenzene-d10	75 - 125
4-Bromofluorobenzene	85 - 120
TestAmerica Burlington or Knoxville	
Organochlorine Pesticides	
Tetrachloro-m-xylene	30 - 150
Decachlorobiphenyl	30 - 150
TestAmerica West Sacramento	
Polychlorinated Dioxins and Furans	
13C-2,3,7,8-TCDD	25 - 164
13C-1,2,3,7,8-PeCDD	25 1 181
13C-1,2,3,4,7,8-HxCDD	32 - 141
13C-1,2,3,6,7,8-HxCDD	28 - 130
13C-1,2,3,4,6,7,8-HpCDD	23 - 140
13C-OCDD	17 - 157
13C-2,3,7,8-TCDF	24 - 169
13C-1,2,3,7,8-PeCDF	24 - 185
13C-2,3,4,7,8-PeCDF	21 - 178
13C-1,2,3,4,7,8-HxCDF	26 - 152
13C-1,2,3,6,7,8-HxCDF	26 - 123
13C-2,3,4,6,7,8-HxCDF	28 - 136
13C-1,2,3,7,8,9-HxCDF	29 - 147
13C-1,2,3,4,6,7,8-HpCDF	28 - 143
13C-1.2.3.4.7.8.9-HpCDF	26 - 138
37Cl4-2,3,4,7,8-TCDD	35 - 197

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

PCB - polychlorinated biphenyl

Table A7-2. Laboratory Control Limits for Surrogate Recoveries in Field Blanks

Analyte	Control Limits for Percent Recovery
TestAmerica Tacoma	
PCB Aroclors	
Tetrachloro-m-xylene	60 - 150
Decachlorobiphenyl	40 - 135
Semivolatile Organic Compounds	
Nitrobenzene-d5	40 - 110
Phenol-d5	10 - 115
Terphenyl-d14	50 - 135
2-Fluorophenol	20 - 110
2-Fluorobiphenyl	50 - 110
2,4,6-Tribromophenol	40 - 125
Volatile Organic Compounds	
Toluene-d8	85 - 120
Ethylbenzene-d10	80 - 120
4-Bromofluorobenzene	75 - 120
TestAmerica Burlington or Knoxville	
Organochlorine Pesticides	
Tetrachloro-m-xylene	30 - 150
Decachlorobiphenyl	30 - 150
TestAmerica West Sacramento	
Polychlorinated Dioxins and Furans	
13C-2,3,7,8-TCDD	25 - 164
13C-1,2,3,7,8-PeCDD	25 - 181
13C-1,2,3,4,7,8-HxCDD	32 - 141
13C-1,2,3,6,7,8-HxCDD	28 - 130
13C-1,2,3,4,6,7,8-HpCDD	23 - 140
13C-OCDD	17 - 157
13C-2,3,7,8-TCDF	24 - 169
13C-1,2,3,7,8-PeCDF	24 - 185
13C-2,3,4,7,8-PeCDF	21 - 178
13C-1,2,3,4,7,8-HxCDF	26 - 152
13C-1,2,3,6,7,8-HxCDF	26 - 123
13C-2,3,4,6,7,8-HxCDF	28 - 136
13C-1,2,3,7,8,9-HxCDF	29 - 147
13C-1,2,3,4,6,7,8-HpCDF	28 - 143
13C-1.2.3.4.7.8.9-HpCDF	26 - 138
37Cl4-2,3,4,7,8-TCDD	35 - 197

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

PCB - polychlorinated biphenyl

Table A7-3. Laboratory Control Limits for Surrogate Recoveries in TCLP Leachate Samples

Analyte	Control Limits for Percent Recovery
TestAmerica Tacoma	
Organochlorine Pesticides	
Tetrachloro-meta-xylene	43-129
Decachlorobiphenyl	19-157
Semivolatile Organic Compounds	
1,2-Dichlorobenzene-d4	
2,4,6-Tribromophenol	47-158
2-Chlorophenol-d4	
2-Fluorobiphenyl	44-157
2-Fluorophenol	44-148
Nitrobenzene-d5	49-154
Phenol-d6	33-147
Terphenyl-d14	27-177
Volatile Organic Compounds	
Fluorobenzene	80-120
Ethylbenzene-d10	80-120
4-Bromofluorobenzene	75-120
Toluene-d8	85-120
Herbicides	
2,4-Dichlorophenylacetic acid	40-135

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

TCLP - toxicity characteristic leaching procedure

Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples for Sediment Samples

	Accuracy		Precision	
Analyte	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
TestAmerica Tacoma				
Conventionals				
Total organic carbon	76 - 128	NA	MSD	28
Grain size	NA	NA	Triplicate	10[a]
PCB Aroclors				
PCB-1016	57 - 128	57 - 128	MSD	20
PCB-1260	65 - 132	65 - 132	MSD	20
SVOC				
Halogenated Compounds				
1,2-Dichlorobenzene	68 - 118	68 - 118	MSD	60
1,3-Dichlorobenzene	64 - 124	64 - 124	MSD	60
1,4-Dichlorobenzene	62 - 132	62 - 132	MSD	32
1,2,4-Trichlorobenzene	63 - 128	63 - 128	MSD	28
Hexachlorobenzene	61 - 136	61 - 136	MSD	60
2-Chloronaphthalene	69 - 129	69 - 129	MSD	25
Hexachloroethane	56 - 131	56 - 131	MSD	60
Hexachlorobutadiene	59 - 134	59 - 134	MSD	60
Hexachlorocyclopentadiene	30 - 132	30 - 132	MSD	60
2,2'-oxybis(1-chloropropane)	44 - 140	44 - 140	MSD	60
Bis-(2-chloroethoxy) methane	63 - 128	63 - 128	MSD	60
Bis-(2-chloroethyl) ether	57 - 122	57 - 122	MSD	60
4-Chlorophenyl-phenyl ether	65 - 130	65 - 130	MSD	60
4-Bromophenyl-phenyl ether	64 - 134	64 - 134	MSD	60
3,3'-Dichlorbenzidine	73 - 163	73 - 163	MSD	60
4-Chloroaniline	20 - 181	20 - 181	MSD	60
Organonitrogen Compounds				
Nitrobenzene	59 - 134	59 - 134	MSD	60
Aniline	67 - 158	67 - 158	MSD	60
2-Nitroaniline	58 - 133	58 - 133	MSD	60
3-Nitroaniline	80 - 165	80 - 165	MSD	60
4-Nitroaniline	70 - 150	70 - 150	MSD	60
n-Nitrosodimethylamine	38 - 133	38 - 133	MSD	60
n-Nitroso-di-n-propylamine	52 - 127	52 - 127	MSD	28
n-Nitrosodiphenylamine	88 - 153	88 - 153	MSD	60
1,2-Diphenylhydrazine (as Azobenzene)	68 - 132	68 - 132	MSD	50
2,4-Dinitrotoluene	57 - 122	57 - 122	MSD	31
2,6-Dinitrotoluene	65 - 125	65 - 125	MSD	60
Carbazole	88 - 158	88 - 158	MSD	60
Oxygen-Containing Compounds				
Benzoic acid	10 - 130	10 - 130	MSD	60
Benzyl alcohol	42 - 147	42 - 147	MSD	60
Dibenzofuran	70 - 125	70 - 125	MSD	60
Isophorone	53 - 118	53 - 118	MSD	60
Phenols and Substituted Phenols				
Phenol	66 - 126	66 - 126	MSD	26
2-Methylphenol	56 - 121	56 - 121	MSD	25
3 & 4-Methylphenol	61 - 126	61 - 126	MSD	27
2,4-Dimethylphenol	58 - 133	58 - 133	MSD	60
2-Chlorophenol	65 - 125	65 - 125	MSD	27

Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples for Sediment Samples

	Accuracy		Precision	
Analyte	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
2,4-Dichlorophenol	59 - 124	59 - 124	MSD	60
2,4,5-Trichlorophenol	64 - 124	64 - 124	MSD	60
2,4,6-Trichlorophenol	66 - 131	66 - 131	MSD	60
2,3,4,6-Tetrachlorophenol	41 - 141	41 - 141	MSD	60
2,3,5,6-Tetrachlorophenol	50 - 150	50 - 150	MSD	60
Pentachlorophenol	29 - 124	29 - 124	MSD	68
4-Chloro-3-methylphenol	58 - 128	58 - 128	MSD	27
2-Nitrophenol	58 - 128	58 - 128	MSD	60
4-Nitrophenol	47 - 172	47 - 172	MSD	33
2,4-Dinitrophenol	53 - 168	53 - 168	MSD	60
4,6-Dinitro-2-methylphenol	38 - 143	38 - 143	MSD	60
Phthalate Esters				
Dimethylphthalate	65 - 125	65 - 125	MSD	60
Diethylphthlalate	64 - 129	64 - 129	MSD	26
Di-n-butylphthalate	69 - 124	69 - 124	MSD	60
Butylbenzylphthalate	65 - 140	65 - 140	MSD	60
Di-n-octylphthalate	58 - 148	58 - 148	MSD	31
Bis(2-ethylhexyl)phthalate	64 - 144	64 - 144	MSD	60
Polycyclic Aromatic Hydrocarbons				
Naphthalene	64 - 129	64 - 129	MSD	26
2-Methylnaphthalene	65 - 125	65 - 125	MSD	27
Acenaphthylene	69 - 129	69 - 129	MSD	28
Acenaphthene	65 - 130	65 - 130	MSD	27
Fluorene	68 - 128	68 - 128	MSD	31
Phenanthrene	65 - 125	65 - 125	MSD	28
Anthracene	73 - 123	73 - 123	MSD	27
Fluoranthene	61 - 121	61 - 121	MSD	36
Pyrene	54 - 134	54 - 134	MSD	31
Benzo(a)anthracene	64 - 124	64 - 124	MSD	27
Chrysene	71 - 126	71 - 126	MSD	26
Benzo(b)fluoranthene	66 - 136	66 - 136	MSD	31
Benzo(k)fluoranthene	63 - 143	63 - 143	MSD	31
Benzo(a)pyrene	68 - 128	68 - 128	MSD	30
Indeno(1,2,3-cd)pyrene	59 - 139	59 - 139	MSD	29
Dibenz(a,h)anthracene	57 - 142	57 - 142	MSD	30
Benzo(g,h,i)perylene	57 - 142	57 - 142	MSD	28
VOC				
1,1,1,2-Tetrachloroethane	75 - 125	75 - 125	MSD	30
1,1,1-Trichloroethane	70 - 135	70 - 135	MSD	30
1,1,2,2-Tetrachloroethane	55 - 130	55 - 130	MSD	30
1,1,2-Trichloroethane	60 - 125	60 - 125	MSD	30
1,1-Dichloroethane	75 - 125	75 - 125	MSD	30
1,2,3-Trichloropropane	65 - 130	65 - 130	MSD	30
1,2-Dichloroethane	70 - 135	70 - 135	MSD	30
1,2-Dichloropropane	70 - 120	70 - 120	MSD	30
1,4-Dichlorobenzene	70 - 125	70 - 125	MSD	30
2-Butanone	30 - 160	30 - 160	MSD	30
2-Chloroethyl vinyl ether	60 - 150	60 - 150	MSD	30
2-Hexanone	45 - 145	45 - 145	MSD	30
4-Methyl-2-pentanone	45 - 145	45 - 145	MSD	30

Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples for Sediment Samples

	Accuracy		Precision	
Analyte	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
Acetone	20 - 160	20 - 160	MSD	30
Acrolein	10 - 98	10 - 98	MSD	30
Acrylonitrile	74 - 117	74 - 117	MSD	30
Bromochloromethane	70 - 125	70 - 125	MSD	30
Bromodichloromethane	70 - 130	70 - 130	MSD	30
Bromoform	55 - 135	55 - 135	MSD	30
Bromomethane	30 - 160	30 - 160	MSD	30
Carbon Disulfide	45 - 160	45 - 160	MSD	30
Carbon Tetrachloride	65 - 135	65 - 135	MSD	30
Chlorobenzene	75 - 125	75 - 125	MSD	30
Chlorodibromomethane	65 - 130	65 - 130	MSD	30
Chloroethane	40 - 155	40 - 155	MSD	30
Chloroform	70 - 125	70 - 125	MSD	30
Chloromethane	50 - 130	50 - 130	MSD	30
cis -1,3-Dichloropropene	70 - 125	70 - 125	MSD	30
Dibromomethane	75 - 130	75 - 130	MSD	30
Dichlorodifluoromethane	35 - 135	35 - 135	MSD	30
Iodomethane	44 - 148	44 - 148	MSD	30
Isopropyl benzene	75 - 130	75 - 130	MSD	30
Methylene chloride	55 - 140	55 - 140	MSD	30
Naphthalene	40 - 125	40 - 125	MSD	30
Styrene	75 - 125	75 - 125	MSD	30
trans -1,4-Dichloro-2-butene	10 - 79	10 - 79	MSD	30
Trichlorofluoromethane	25 - 185	25 - 185	MSD	30
Vinyl acetate	19 - 144	19 - 144	MSD	30
1,1-Dichloroethene	65 - 135	65 - 135	MSD	30
Benzene	75 - 125	75 - 125	MSD	30
Ethyl benzene	75 - 125	75 - 125	MSD	30
m,p -Xylene	80 - 125	80 - 125	MSD	30
Methyl-*t* -butyl ether (MTBE)	65 - 125	65 - 125	MSD	30
o -Xylene	75 - 125	75 - 125	MSD	30
Tetrachloroethene	65 - 140	65 - 140	MSD	30
Toluene	70 - 125	70 - 125	MSD	30
trans -1,2-Dichloroethene	65 - 135	65 - 135	MSD	30
trans -1,3-Dichloropropene	65 - 125	65 - 125	MSD	30
Trichloroethene	75 - 125	75 - 125	MSD	30
Vinyl Chloride	60 - 125	60 - 125	MSD	30
Bromobenzene	65 - 120	65 - 120	MSD	30
Ethylene Dibromide	70 - 125	70 - 125	MSD	30
Hexachlorobutadiene	55 - 140	55 - 140	MSD	30
TestAmerica Burlington				
Conventionals				
Grain size	NA	NA	Triplicate	10 [a]
TestAmerica Burlington or Knoxville				
Organochlorine Pesticides				
2,4'-DDD	50 - 150	50 - 150	MSD	30
2,4'-DDE	40 - 150	40 - 150	MSD	30
2,4'-DDT	50 - 150	50 - 150	MSD	30
4,4'-DDD	50 - 150	50 - 150	MSD	30
4,4'-DDE	50 - 150	50 - 150	MSD	30
4,4'-DDT	50 - 150	50 - 150	MSD	30

Table A7-4. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples for Sediment Samples

	Accuracy		Precision	
Analyte	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
a - BHC	50 - 130	50 - 130	MSD	30
a - Chlordane	50 - 125	50 - 125	MSD	30
Aldrin	50 - 125	50 - 125	MSD	30
b - BHC	50 - 125	50 - 125	MSD	30
d - BHC	50 - 140	50 - 140	MSD	30
Dieldrin	30 - 130	30 - 130	MSD	30
Endosulfan I	20 - 125	20 - 125	MSD	30
Endosulfan II	30 - 140	30 - 140	MSD	30
Endosulfan sulfate	40 - 135	40 - 135	MSD	30
Endrin	50 - 135	50 - 135	MSD	30
Endrin aldehyde	25 - 135	25 - 135	MSD	30
Endrin ketone	50 - 125	50 - 125	MSD	30
g - BHC (Lindane)	50 - 130	50 - 130	MSD	30
g - Chlordane	30 - 130	30 - 130	MSD	30
Heptachlor	50 - 130	50 - 130	MSD	30
Heptachlor epoxide	40 - 150	40 - 150	MSD	30
Methoxychlor	50 - 150	50 - 150	MSD	30
TestAmerica West Sacramento				
Polychlorinated Dioxins and Furans				
2,3,7,8-TCDD	67 - 158	67 - 158	MSD	50
2,3,7,8-TCDF	75 - 158	75 - 158	MSD	50
1,2,3,7,8-PeCDD	70 - 142	70 - 142	MSD	50
1,2,3,7,8-PeCDF	80 - 134	80 - 134	MSD	50
2,3,4,7,8-PeCDF	68 - 160	68 - 160	MSD	50
1,2,3,4,7,8-HxCDD	70 - 164	70 - 164	MSD	50
1,2,3,6,7,8-HxCDD	76 - 134	76 - 134	MSD	50
1,2,3,7,8,9-HxCDD	64 - 162	64 - 162	MSD	50
1,2,3,4,7,8-HxCDF	72 - 134	72 - 134	MSD	50
1,2,3,6,7,8-HxCDF	84 - 130	84 - 130	MSD	50
1,2,3,7,8,9-HxCDF	78 - 130	78 - 130	MSD	50
2,3,4,6,7,8-HxCDF	70 - 156	70 - 156	MSD	50
1,2,3,4,6,7,8-HpCDD	70 - 140	70 - 140	MSD	50
1,2,3,4,6,7,8-HpCDF	82 - 122	82 - 122	MSD	50
1,2,3,4,7,8,9-HpCDF	78 - 138	78 - 138	MSD	50
OCDD	78 - 144	78 - 144	MSD	50
OCDF	63 - 170	63 - 170	MSD	50

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

[a] RPD control limit is not applicable for grain size. Laboratory control limit is ±10% in the weight of the fraction.

LCS - laboratory control sample
MSD - matrix spike duplicate
NA - not applicable
PCB - polychlorinated biphenyl
RPD - relative percent difference
SVOC - semivolatile organic compound
VOC - volatile organic compound

Table A7-5. Laboratory Control Limits for Laboratory Control Samples for Field Blanks

Analyte	Accuracy LCS Recovery (percent)	Precision Type of Duplicate	Precision Control Limit RPD
TestAmerica Tacoma			
Conventionals			
Total organic carbon	80 - 120	LCSD	20
PCB Aroclors			
PCB-1016	25 -145	LCSD	27
PCB-1260	30 - 145	LCSD	22
SVOC			
Halogenated Compounds			
1,2-Dichlorobenzene	35 - 100	LCSD	30
1,3-Dichlorobenzene	30 - 100	LCSD	30
1,4-Dichlorobenzene	30 - 1002	LCSD	30
1,2,4-Trichlorobenzene	35 - 105	LCSD	30
Hexachlorobenzene	50 - 1108	LCSD	30
2-Chloronaphthalene	50 - 105	LCSD	30
Hexachloroethane	30 - 95	LCSD	30
Hexachlorobutadiene	25 - 105	LCSD	30
Hexachlorocyclopentadiene	45 - 125	LCSD	30
2,2'-Oxybis(1-chloropropane)	46 - 131	LCSD	30
Bis-(2-chloroethoxy) methane	45 - 105	LCSD	30
Bis-(2-chloroethyl) ether	35 - 110	LCSD	30
4-Chlorophenyl-phenyl ether	50 - 1107	LCSD	30
4-bromophenyl-phenyl ether	50 - 115	LCSD	30
3,3'-Dichlorbenzidine	20 - 110	LCSD	30
4-Chloroaniline	15 - 110	LCSD	30
Organonitrogen Compounds			
Nitrobenzene	45 - 110	LCSD	30
Aniline	20 - 150	LCSD	30
2-Nitroaniline	50 - 115	LCSD	30
3-Nitroaniline	35 - 120	LCSD	30
4-Nitroaniline	35 - 120	LCSD	30
n-Nitrosodimethylamine	25 - 110	LCSD	30
n-Nitroso-di-n-propylamine	35 - 130	LCSD	30
n-Nitrosodiphenylamine	50 - 110	LCSD	30
1,2-Diphenylhydrazine (as Azobenzene)	55 - 115	LCSD	30
2,4-Dinitrotoluene	50 - 120	LCSD	30
2,6-Dinitrotoluene	50 - 115	LCSD	30
Carbazole	50 - 115	LCSD	30
Oxygen-Containing Compounds			
Benzoic acid	0 - 125	LCSD	30
Benzyl alcohol	30 - 110	LCSD	30
Dibenzofuran	55 - 105	LCSD	30
Isophorone	50 - 110	LCSD	30
Phenols and Substituted Phenols			
Phenol	0 - 115	LCSD	30
2-Methylphenol	40 - 110	LCSD	30
3 & 4-Methylphenol	30 - 110	LCSD	30
2,4-Dimethylphenol	30 - 110	LCSD	30
2-Chlorophenol	35 - 105	LCSD	30
2,4-Dichlorophenol	50 - 105	LCSD	30

Table A7-5. Laboratory Control Limits for Laboratory Control Samples for Field Blanks

	Accuracy	Precision	
Analyte	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
2,4,5-Trichlorophenol	50- 110	LCSD	30
2,4,6-Trichlorophenol	50 - 115	LCSD	30
2,3,4,6-Tetrachlorophenol	50 - 150	LCSD	30
2,3,5,6-Tetrachlorophenol	50 - 150	LCSD	30
Pentachlorophenol	40 - 115	LCSD	30
4-Chloro-3-methylphenol	45 - 110	LCSD	30
2-Nitrophenol	40 - 115	LCSD	30
4-Nitrophenol	0 - 125	LCSD	30
2,4-Dinitrophenol	15 - 140	LCSD	30
4,6-Dinitro-2-methylphenol	40 - 130	LCSD	30
Phthalate Esters			
Dimethylphthalate	25 - 125	LCSD	30
Diethylphthlalate	40 - 120	LCSD	30
Di-n-butylphthalate	55 - 115	LCSD	30
Butylbenzylphthalate	45 - 115	LCSD	30
Di-n-octylphthalate	35 - 135	LCSD	30
Bis(2-ethylhexyl)phthalate	40 - 125	LCSD	30
Polycyclic Aromatic Hydrocarbons			
Naphthalene	40 - 100	LCSD	30
2-Methylnaphthalene	45 - 105	LCSD	30
Acenaphthylene	50 - 105	LCSD	30
Acenaphthene	45 - 110	LCSD	30
Fluorene	50 - 110	LCSD	30
Phenanthrene	50 - 115	LCSD	30
Anthracene	55 - 110	LCSD	30
Fluoranthene	55 - 115	LCSD	30
Pyrene	50 - 130	LCSD	30
Benzo(a)anthracene	55 - 110	LCSD	30
Chrysene	55 - 110	LCSD	30
Benzo(b)fluoranthene	45 - 120	LCSD	30
Benzo(k)fluoranthene	45 - 125	LCSD	30
Benzo(a)pyrene	55 - 110	LCSD	30
Indeno(1,2,3-cd)pyrene	45 - 125	LCSD	30
Dibenz(a,h)anthracene	40 - 125	LCSD	30
Benzo(g,h,i)perylene	40 - 125	LCSD	30
VOC			
1,1,1,2-Tetrachloroethane	80 - 130	LCSD	30
1,1,1-Trichloroethane	65 - 130	LCSD	30
1,1,2,2-Tetrachloroethane	65 - 130	LCSD	30
1,1,2-Trichloroethane	75 - 125	LCSD	30
1,1-Dichloroethane	70 - 135	LCSD	30
1,2,3-Trichloropropane	75 - 125	LCSD	30
1,2-Dichloroethane	70 - 130	LCSD	30
1,2-Dichloropropane	75 - 125	LCSD	30
1,4-Dichlorobenzene	75 - 125	LCSD	30
2-Butanone	30 - 150	LCSD	30
2-Chloroethyl vinyl ether	38 - 165	LCSD	30
2-Hexanone	55 - 130	LCSD	30
4-Methyl-2-pentanone	60 - 135	LCSD	30
Acetone	40 - 140	LCSD	30

Table A7-5. Laboratory Control Limits for Laboratory Control Samples for Field Blanks

	Accuracy	Precision	
Analyte	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
Acrolein	10 - 112	LCSD	30
Acrylonitrile	74 - 122	LCSD	30
Bromochloromethane	65 - 130	LCSD	30
Bromodichloromethane	75 - 120	LCSD	30
Bromoform	70 - 130	LCSD	30
Bromomethane	30 - 145	LCSD	30
Carbon disulfide	35 - 160	LCSD	30
Carbon tetrachloride	65 - 140	LCSD	30
Chlorobenzene	80 - 120	LCSD	30
Chlorodibromomethane	60 - 135	LCSD	30
Chloroethane	60 - 135	LCSD	30
Chloroform	65 - 135	LCSD	30
Chloromethane	40 - 125	LCSD	30
cis -1,3-Dichloropropene	70 - 130	LCSD	30
Dibromomethane	75 - 125	LCSD	30
Dichlorodifluoromethane	30 - 155	LCSD	30
Iodomethane	41 - 120	LCSD	30
Isopropyl benzene	75 - 125	LCSD	30
Methylene chloride	55 - 140	LCSD	30
Naphthalene	55 - 140	LCSD	30
Styrene	65 - 135	LCSD	30
trans -1,4-Dichloro-2-butene	10 - 100	LCSD	30
Trichlorofluoromethane	60 - 145	LCSD	30
Vinyl acetate	17 - 144	LCSD	30
1,1-Dichloroethene	70 - 130	LCSD	30
Benzene	80 - 120	LCSD	30
Ethyl Benzene	75 - 125	LCSD	30
m,p -Xylene	75 - 130	LCSD	30
Methyl-*t* -butyl ether (MTBE)	65 - 125	LCSD	30
o -Xylene	80 - 120	LCSD	30
Tetrachloroethene	45 - 150	LCSD	30
Toluene	75 - 120	LCSD	30
trans -1,2-Dichloroethene	60 - 140	LCSD	30
trans -1,3-Dichloropropene	55 - 140	LCSD	30
Trichloroethene	70 - 125	LCSD	30
Vinyl chloride	50 - 145	LCSD	30
Bromobenzene	75 - 125	LCSD	30
Ethylene dibromide	80 - 120	LCSD	30
Hexachlorobutadiene	50 - 140	LCSD	30
TestAmerica Burlington or Knoxville			
Organochlorine Pesticides			
2,4'-DDD	50 - 150	LCSD	30
2,4'-DDE	40 - 150	LCSD	30
2,4'-DDT	50 - 150	LCSD	30
4,4'-DDD	50 - 150	LCSD	30
4,4'-DDE	50 - 150	LCSD	30
4,4'-DDT	50 - 150	LCSD	30
a - BHC	50 - 130	LCSD	30
a - Chlordane	50 - 125	LCSD	30
Aldrin	50 - 125	LCSD	30
b - BHC	50 - 125	LCSD	30

Table A7-5. Laboratory Control Limits for Laboratory Control Samples for Field Blanks

	Accuracy	Precision	
Analyte	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
d - BHC	50 - 140	LCSD	30
Dieldrin	30 - 130	LCSD	30
Endosulfan I	20 - 125	LCSD	30
Endosulfan II	30 - 140	LCSD	30
Endosulfan sulfate	40 - 135	LCSD	30
Endrin	50 - 135	LCSD	30
Endrin aldehyde	25 - 135	LCSD	30
Endrin ketone	50 - 125	LCSD	30
g - BHC (Lindane)	50 - 130	LCSD	30
g - Chlordane	30 - 130	LCSD	30
Heptachlor	50 - 130	LCSD	30
Heptachlor epoxide	40 - 150	LCSD	30
Methoxychlor	50 - 150	LCSD	30
TestAmerica West Sacramento			
Polychlorinated Dioxins and Furans			
2,3,7,8-TCDD	67 - 158	LCSD	30
2,3,7,8-TCDF	75 - 158	LCSD	30
1,2,3,7,8-PeCDD	70 - 142	LCSD	30
1,2,3,7,8-PeCDF	80 - 134	LCSD	30
2,3,4,7,8-PeCDF	68 - 160	LCSD	30
1,2,3,4,7,8-HxCDD	70 - 164	LCSD	30
1,2,3,6,7,8-HxCDD	76 - 134	LCSD	30
1,2,3,7,8,9-HxCDD	64 - 162	LCSD	30
1,2,3,4,7,8-HxCDF	72 - 134	LCSD	30
1,2,3,6,7,8-HxCDF	84 - 130	LCSD	30
1,2,3,7,8,9-HxCDF	78 - 130	LCSD	30
2,3,4,6,7,8-HxCDF	70 - 156	LCSD	30
1,2,3,4,6,7,8-HpCDD	70 - 140	LCSD	30
1,2,3,4,6,7,8-HpCDF	82 - 122	LCSD	30
1,2,3,4,7,8,9-HpCDF	78 - 138	LCSD	30
OCDD	78 - 144	LCSD	30
OCDF	63 - 170	LCSD	30

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

LCS - laboratory control sample
LCSD - laboratory control sample duplicate
PCB - polychlorinated biphenyl
RPD - relative percent difference
SVOC - semivolatile organic compound
VOC - volatile organic compound

Table A7-6. Laboratory Control Limits for Matrix Spike and Laboratory Control Samples for TCLP Leachate Samples

Analyte	Accuracy		Precision	
	Matrix Spike Recovery (percent)	LCS Recovery (percent)	Type of Duplicate	Control Limit RPD
TestAmerica Tacoma				
Metals				
Arsenic	75 - 125	80 - 120	MSD or LCSD	30
Barium	75 - 125	80 - 120	MSD or LCSD	30
Cadmium	75 - 125	80 - 120	MSD or LCSD	30
Chromium	75 - 125	80 - 120	MSD or LCSD	30
Lead	75 - 125	80 - 120	MSD or LCSD	30
Mercury	75 - 125	75 - 125	MSD or LCSD	30
Selenium	75 - 125	80 - 120	MSD or LCSD	30
Silver	75 - 125	80 - 120	MSD or LCSD	30
SVOC				
2,4,5-Trichlorophenol	64 - 124	30-173	MSD or LCSD	50
2,4,6-Trichlorophenol	62 - 127	50-142	MSD or LCSD	50
2,4-Dinitrotoluene	57 - 128	42-138	MSD or LCSD	50
2-Methylphenol	35 - 106	42-174	MSD or LCSD	50
3 & 4-Methylphenol	21 - 102	35-171	MSD or LCSD	50
Hexachlorobenzene	67 - 128	58-142	MSD or LCSD	50
Hexachlorobutadiene	54 - 135	30-176	MSD or LCSD	50
Hexachloroethane	60 - 125	24-173	MSD or LCSD	50
Nitrobenzene	66 - 131	47-169	MSD or LCSD	50
Pentachlorophenol	43 - 118	23-166	MSD or LCSD	50
Pyridine	1-106	1-106	MSD or LCSD	50
VOC				
1,1-Dichloroethene	70 - 130	70 - 130	MSD or LCSD	30
1,2-Dichloroethane	70 - 130	70 - 130	MSD or LCSD	30
1,4-Dichlorobenzene	75 - 125	75 - 125	MSD or LCSD	30
2-Butanone	30 - 150	30 - 150	MSD or LCSD	30
Benzene	80 - 120	80 - 120	MSD or LCSD	30
Carbon tetrachloride	65 - 140	65 - 140	MSD or LCSD	30
Chlorobenzene	80 - 120	80 - 120	MSD or LCSD	30
Chloroform	65 - 135	65 - 135	MSD or LCSD	30
Tetrachloroethene	45 - 150	45 - 150	MSD or LCSD	30
Trichloroethene	70 - 125	70 - 125	MSD or LCSD	30
Vinyl chloride	50 - 145	50 - 145	MSD or LCSD	30
Pesticides				
g - BHC (Lindane)	30 - 150	71-113	MSD or LCSD	50
a - Chlordane	30 - 150	40-131	MSD or LCSD	50
g - Chlordane	30 - 150	46-131	MSD or LCSD	50
Endrin	30 - 150	80-102	MSD or LCSD	50
Heptachlor	30 - 150	69-106	MSD or LCSD	50
Heptachlor epoxide	30 - 150	71-109	MSD or LCSD	50
Methoxychlor	30 - 150	68-131	MSD or LCSD	50
Toxaphene	30 - 145	30-145	MSD or LCSD	50
Herbicides				
2,4,5-TP (Silvex)	35-110	52-124	MSD or LCSD	30
2,4-D	50-130	50-130	MSD or LCSD	28

Notes:

Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

LCS - laboratory control sample
LCSD - laboratory control sample duplicate
MSD - matrix spike duplicate
TCLP - toxicity characteristic leaching procedure
RPD - relative percent difference
SVOC - semivolatile organic compound
VOC - volatile organic compound

Table B1-1. Summary of Samples and Analyses

Analysis	Number of Samples			
	Field Samples	Field Duplicates	Equipment Rinse Blanks	Total
Sediments for Chemistry				
TOC	225	12	0	237
Grain Size	225	12	0	237
Total solids	225	12	0	237
Organochlorine pesticides (DDx only)[a]	211	11	11	233
Organochlorine pesticides	14	1	1	16
PCB Aroclors	14	1	1	16
SVOCs	14	1	1	16
VOCs	14	1	1	16
PCDD/Fs	14	1	1	16
Sediments for Physical and Engineering Properties				
Physical Characteristics				
Grain Size	10	0	0	10 [b]
Atterberg limits	14	0	0	14 [b]
Specific gravity	4	0	0	4 [b]
Moisture content/density	50	0	0	50 [b]
Engineering Characteristics				
Consolidation	4	0	0	4 [b]
UU triaxial sheer stress	4	0	0	4 [b]
CU triaxial sheer stress	9	0	0	9 [b]
Hydraulic conductivity	3	0	0	3 [b]
Torvane sheer strength testing	4	0	0	4 [b]
Unconfirmed compressive strength	3	0	0	3 [b]
Point load index	5	0	0	5 [b]
Sediments for Waste Characterization				
RCRA TCLP				
TCLP Metals	14	0	0	14
TCLP Organochlorine pesticides	14	0	0	14
TCLP SVOCs	14	0	0	14
TCLP VOCs	14	0	0	14
TCLP Herbicides	14	0	0	14
Asbestos				
Asbestos	14	0	0	14

Notes:

Field duplicate and blank samples will be analyzed at the same laboratory as the primary field samples.

[a] DDx only = 2,4'- and 4,4'-isomers of DDT, DDD, and DDE.

[b] Final total will depend on the heterogeneity of materials encountered.

CU - consolidated, undrained
PCB - polychlorinated biphenyl
PCDD/F - polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofuran
RCRA - Resource Conservation and Recovery Act
SVOC - semivolatile organic compound
TCLP - toxicity characteristic leaching procedure
TOC - total organic carbon
UU - unconsolidated, undrained
VOC - volatile organic compound

Table B3-1. Sample Containers and Preservation Requirements

Analysis	Laboratory	Container Type	Container Size	Preservation	Holding Time
Sediment Quality Characteristics					
Grain size	TestAmerica Tacoma or Burlington	WMG	16 oz.	4 ± 2°C	6 months
Total organic carbon	TestAmerica Tacoma	WMG	8 oz.	4 ± 2°C	28 days
Semivolatile organic compounds	TestAmerica Tacoma	WMG	inc.	4 ± 2°C	14 days/40 days [a]
PCBs	TestAmerica Tacoma	WMG	inc.	4 ± 2°C	14 days/40 days [a]
Total solids	TestAmerica Tacoma	WMG	inc.	4 ± 2°C	6 months
Volatile organic compounds	TestAmerica Tacoma	WMG with Septa	2 oz.	No headspace, 4 ± 2°C Do not freeze	14 days
Organochlorine pesticides	TestAmerica Burlington or Knoxville	WMG	8 oz.	4 ± 2°C	14 days/40 days [a]
Chlorinated dioxins/furans	TestAmerica West Sacramento	WMG	8 oz.	4 ± 2°C	1 year
Archive	TestAmerica Tacoma	WMG	16 oz.[b]	Deep frozen (-20°C)	TBD
Physical and Engineering Characteristics					
Subsurface Sediments					
Physical Characteristics					
Grain size	Kleinfelder	WMG	16 oz.[c]	4 ± 2°C	6 months
Atterberg limits	Kleinfelder	WMG		4 ± 2°C	--
Specific gravity	Kleinfelder	WMG		4 ± 2°C	--
Moisture content/density	Kleinfelder	WMG		4 ± 2°C	--
Engineering Characteristics					
Consolidation	Kleinfelder	Sealed Shelby Tube	--	4 ± 2°C	--
Unconsolidated undrained triaxial shear stress	Kleinfelder	Sealed Shelby Tube	--	4 ± 2°C	--
Consolidated undrained triaxial shear stress	Kleinfelder	Sealed Shelby Tube	--	4 ± 2°C	--
Hydraulic conductivity	Kleinfelder	Sealed Shelby Tube	--	4 ± 2°C	--
Torvane shear strength testing	Kleinfelder	Sealed Shelby Tube	--	4 ± 2°C	--
Unconfirmed compressive strength (Rock)	Kleinfelder Redmond	TBD	--	NA	--
Point load index (Rock)	Kleinfelder Redmond	TBD	--	NA	--

Table B3-1. Sample Containers and Preservation Requirements

Analysis	Laboratory	Container Type	Container Size	Preservation	Holding Time
Sediments for Waste Characterization					
Toxicity Characteristic Leaching Procedure					
TCLP testing	TestAmerica Tacoma	WMG	8 oz.	4 ± 2°C	14 days
Asbestos					
Asbestos	TBD	WMG	8 oz.	--	180 days
Field Blanks					
Total organic carbon	TestAmerica Tacoma	HDPE	250 mL	4 ± 2°C; H_2SO_4 to pH < 2	28 days
Organochlorine pesticides	TestAmerica Burlington or Knoxville	AG	2 x 1 L	4 ± 2°C	7 days/40 days[d]
PCB Aroclors	TestAmerica Tacoma	AG	1 L	4 ± 2°C	7 days/40 days[d]
Semivolatile organic compounds	TestAmerica Tacoma	AG	2 x 1 L	4 ± 2°C	7 days/40 days[d]
Volatile organic compounds	TestAmerica Tacoma	VOA vial	3 x 40 oz. w/ septum	No headspace; HCl to pH < 2; 4 ± 2°C	14 days
Chlorinated dioxins/furans	TestAmerica West Sacramento	AG	2 x 1 L	4 ± 2°C in the dark	1 year

Notes:
[a] Holding time is 14 days to extraction and extracts must be analyzed within 40 days from extraction.
[b] Two 16 oz jars will be collected for sample intervals chosen for archive.
[c] One 16 oz. jar will be collected for all physical characteristics.
[d] The holding time is 7 days from collection to extraction and 40 days from extraction to analysis.

AG - amber glass
HDPE - high density polyethylene
NA - not applicable
PCB - polychlorinated biphenyl
TBD - to be determined
TCLP - toxicity characteristic leaching procedure
VOA - volatile organic analysis
WMG - wide mouth glass