Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
Quality Assurance Project Plan

Date Submitted:
08/31/2010

Submitted to whom
Craig Zeller

Concurrence

Received	Not Applicable	TVA
☐	☒	Steve McCracken
☒	☐	Kathryn Nash
☒	☐	Dennis Yankee DHY
☒	☐	Bill Rogers WJ Rogers
☐	☐	_____

Received	Not Applicable	Jacobs
☒	☐	Steve Richardson
☒	☐	Paul Clay
☐	☐	_____
☐	☐	_____
☐	☐	_____
☐	☐	_____

Approvals

TVA Kathryn Nash Date 9/2/10

EPA _____ Date _____

cc:

- ☒ Anda Ray, TVA
- ☒ Barbara Scott, TDEC
- ☒ Leo Francendese, EPA
- ☒ Craig Zeller, EPA
- ☒ Dennis Yankee, TVA
- ☒ Kathryn Nash, TVA
- ☒ Cynthia Anderson, TVA
- ☒ Steve McCracken, TVA
- ☒ EDM
- ☒ Julie Pfeffer, Jacobs
- ☒ Steve Richardson, Jacobs
- ☒ Michelle Cagley, TVA
- ☒ Greg Signer, TVA
- ☒ KIF Incident Document Control
- ☒ Katie Kline, TVA
- ☒ Dannena Bowman, EPA
- ☒ Jeff Gary, Jacobs
- ☒ Robert Pullen, Jacobs
- ☒ Brenda Brickhouse, TVA
- ☒ John Dizer, TVA

Quality Assurance Project Plan (TVA-KIF-QAPP)—Revision August 2010

The *Quality Assurance Project Plan for the TVA KIF Ash Recovery Project* (December 18, 2009) was revised August 16, 2010 as described in the table below.

Section	Change
Section 3.0	Updated the distribution list to reflect changes in personnel for those receiving the QAPP.
Figure 4-1	Updated the organizational structure with more details and showing lines of authority and responsibilities.
Section 4.3 – 4.	Updated personnel and personnel titles for each organization.
Section 4.10	Added new responsibilities to the TVA Data and Records Management organization.
Section 4.11	Added new organization entitled Environmental Data Resource Team and defined their responsibilities.
Section 4.12	Added new organization entitled Environmental Scientific Interface and defined responsibilities.
Section 4.13	Added new organization entitled Human Health and Ecological Risk Assessors and defined responsibilities.
Section 4.17	Added new organization entitled Field Laboratory and defined responsibilities.
Table 4-1	Updated TVA's primary contracted laboratories.
Section 6.2	Clarified standard turn-around time.
Section 8.0	Deleted requirement that training be conducted by Environmental Standards.
Section 9.2.1	Added a paragraph on acceptable turn-around time (TAT) for laboratories during Non-Time Critical Phase of the project.
Section 9.3	Added sentence to allow substitution of simple EDD specification for laboratories lacking capabilities for generating complex EDD. Redefined contract laboratory turn-around time and required delivery of data to TVA Technical Liaison/QA Officer.
Section 12.3.1	Redefined sample equilibration timeframe.
Section 13.2	Clarified moisture basis reporting for solid and biological samples.
Section 13.2.4	Added a new section on Industrial Hygiene Monitoring which references the new appendix (J).
Section 15.1	Added references for air sampling instrument maintenance requirements in the AAMP and for industrial hygiene monitoring in the *IH Monitoring Plan*.
Section 16.1	Added references for calibration of air sampling instruments in the AAMP and of industrial hygiene monitors in the *IH Monitoring Plan*..
Section 18.0	Added requirement for uploading metals data from air sampling to the AQS database.
Section 19.3	Added information on audits that may be conducted at the discretion of the TVA Technical Liaison/QA Officer.

Section 22.0	Clarified the amount of data that will undergo data validation or verification.
Section 24.0	Updated references.
Appendix J	Added a new appendix on Industrial Hygiene Monitoring which includes three tables.

QUALITY ASSURANCE PROJECT PLAN
FOR THE TENNESSEE VALLEY AUTHORITY
KINGSTON ASH RECOVERY PROJECT

TVA-KIF-QAPP

Prepared by
Environmental Standards, Inc.
1140 Valley Forge Road
P.O. Box 810
Valley Forge, PA 19482-0810

for
Tennessee Valley Authority
Environment and Technology
Environmental Science and Resources
Knoxville, TN 37902-1499

August 16, 2010

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1.0 APPROVALS

Dennis H. Yankee
Senior Manager, Environmental Monitoring and Analysis
Tennessee Valley Authority

William J. Rogers, Ph.D.
Technical Liaison/Quality Assurance Officer
Tennessee Valley Authority

Paul Clay
Environmental Project Manager
Jacobs/RSI

Danny France
Regional Quality Assurance Manager
US EPA Region 4

Leo Francendese
On-Scene Coordinator
US EPA Region 4

Craig Zeller
Remedial Project Manager
US EPA Region 4

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2.0 TABLE OF CONTENTS

1.0 APPROVALS i
2.0 TABLE OF CONTENTS ii
3.0 DISTRIBUTION LIST vii
4.0 QUALITY ASSURANCE PROJECT PLAN DESCRIPTION 1
4.1 Background 1
4.2 Project Organization 3
4.3 EPA Region 4 and TDEC 5
4.4 TVA Management 5
4.5 TVA Environmental Oversight Manager 5
4.6 TVA Technical Liaison/Quality Assurance Officer 6
4.7 RSI Environmental Project Manager 6
4.8 Sampling and Monitoring Coordinator 7
4.9 Sample Management Personnel 7
4.10 TVA Data and Records Management 7
4.11 Environmental Data Resource Team 8
4.12 Environmental Scientific Interface 8
4.13 Human Health and Ecological Risk Assessors 8
4.14 Media-Specific Sampling Coordinators 8
4.14.1 Air Monitoring Coordinator 8
4.14.2 Aquatics Biological Monitoring Coordinator 9
4.14.3 Terrestrial Biological Monitoring Coordinator 9
4.14.4 Toxicological Monitoring Coordinator 9
4.15 Field Team Leaders 9
4.15.1 Field Teams 10
4.16 Environmental Standards Quality Assurance Manager 10
4.16.1 Environmental Standards Data Validation Task Manager 10
4.16.2 Environmental Standards Data Validators 10
4.16.3 Environmental Standards Field Oversight Coordinator 11
4.16.4 Environmental Standards Data Manager 11
4.17 Field Laboratory 11
4.18 Contract Laboratory Organization and Responsibilities 11
4.18.1 Laboratory QA Coordinator 12
4.18.2 Laboratory Project Manager 13
4.18.3 Laboratory Sample Custodian 13
4.18.4 Laboratory Analyst 14
4.19 Kingston Coordination Group 14
5.0 PROBLEM DEFINITION/BACKGROUND 14
6.0 PROJECT DESCRIPTION AND APPLICABILITY 15
6.1 Purpose and Scope 16
6.2 Schedule 16
7.0 OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA 17
7.1 Data Objectives 17
8.0 SPECIAL TRAINING/CERTIFICATIONS 18

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

9.0 DOCUMENTATION AND RECORDS 19
9.1 Field Data Documentation 20
9.2 Laboratory Data Documentation 20
9.2.1 Laboratory Data Reporting/Deliverable Package 21
9.3 Record-Keeping 22
9.4 Data Archival 22
10.0 SAMPLING PROCESS DESIGN 23
11.0 SAMPLING METHODS REQUIREMENTS 24
11.1 Sample Containers, Preservation, and Holding Times 24
11.2 Decontamination 25
12.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS 25
12.1 Sample Documentation 26
12.1.1 Chain-of-Custody Record 26
12.1.2 Sample Custody in the Field 27
12.2 Sample Packaging and Shipment 28
12.3 Sample Custody in the Laboratory 29
12.3.1 Sample Receipt 29
12.3.2 Sample Storage 29
12.3.3 Sample Tracking 30
12.4 Sample Archive 30
13.0 ANALYTICAL METHODS REQUIREMENTS 30
13.1 Field Analysis 30
13.2 Laboratory Analysis 31
13.2.1 Toxicological Analysis 32
13.2.2 Ambient Air Monitoring 32
13.2.3 Biological Analysis 33
14.0 QUALITY CONTROL REQUIREMENTS 34
14.1 General 34
14.2 Field and Laboratory Quality Control Samples 35
14.2.1 Equipment Rinsate Blanks 37
14.2.2 Air Filter Blanks 38
14.2.3 Wipe Blanks 38
14.2.4 Field Duplicate Samples 38
14.2.5 Matrix Spike/Matrix Spike Duplicate Samples 38
14.2.6 Laboratory Method Blanks 38
14.2.7 Laboratory Control Samples/Laboratory Control Sample Duplicates 39
14.2.8 Laboratory Duplicate Samples 39
14.3 Independent Research/Split Samples 39
15.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS 40
15.1 Field Equipment 40
15.2 Laboratory Equipment 41
15.2.1 Instrument Maintenance Logbooks 41
15.2.2 Instrument Calibration and Maintenance 41
16.0 INSTRUMENT CALIBRATION AND FREQUENCY 42
16.1 Field Equipment Calibration and Procedures 42

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

16.2 Laboratory Equipment Calibration 43
17.0 DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT MEASUREMENTS 45
18.0 DATA MANAGEMENT 45
19.0 ASSESSMENTS AND RESPONSE ACTIONS 46
19.1 Field Activities 46
19.2 Laboratory Analysis 47
19.2.1 Data Reduction 47
19.2.2 Laboratory Data Review 48
19.3 Performance and System Audits 49
19.3.1 Performance Audits 49
19.3.2 System Audits 50
19.4 Feedback and Corrective Action 50
19.4.1 Feedback Mechanism 51
19.4.2 Corrective Action for Field Activities 51
19.4.3 Laboratory Corrective Action 52
20.0 REPORTS TO MANAGEMENT 54
20.1 Field QA Reports 54
20.2 Laboratory QA Reports 54
20.3 Internal Performance and System Audit/Assessment Reports 55
21.0 DATA REVIEW, VERIFICATION, AND VALIDATION 55
22.0 VERIFICATION AND VALIDATION METHODS 57
22.1 Precision 58
22.2 Accuracy 58
22.3 Completeness 59
22.4 Representativeness 60
22.5 Comparability 60
23.0 RECONCILIATION OF DATA TO PROJECT OBJECTIVES 60
24.0 REFERENCES 61

Figures

Figure 4-1 Organizational Structure
Figure 19-1 Critical Path for Laboratory Correction Action

Tables

Table 4-1: TVA Primary Contracted Laboratories
Table 14-1: Field Quality Control Sample Minimum Frequency

Attachment 1: Summary of Project Documents

Attachment 2: Cross-Walk Tables

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Appendices

Appendix A: Data Package Deliverables Requirements

Appendix B: Electronic Data Deliverables Specification

Appendix C: Aqueous Sample Monitoring

1. Table C-1: Sample Containers, Preservation, and Holding Times
2. Table C-2: Analytes, Methods, and Target Reporting Limits
3. Table C-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

Appendix D: Solid Sample Monitoring

1. Table D-1: Sample Containers, Preservation, and Holding Times
2. Table D-2: Analytes, Methods, and Target Reporting Limits
3. Table D-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

Appendix E: Air Particulate Matter Sample Monitoring

1. Table E-1: Sampling Equipment and Media
2. Table E-2: Analytes, Methods, and Target Reporting Limits
3. Table E-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

Appendix F: Toxicological Monitoring

1. Table F-1: Sample Containers, Preservation, and Holding Times
2. Table F-2: Test Parameters, Methods, Acceptability Criteria, and Endpoints: Toxicological Analyses

Appendix G: Biological Sample Monitoring

1. Table G-1: Sample Containers, Preservation, and Holding Times
2. Table G-2: Analytes, Methods, and Target Reporting Limits
3. Table G-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

Appendix H: Wipe Sampling

1. Table H-1: Sample Containers, Preservation, and Holding Times
2. Table H-2: Analytes, Methods, and Target Reporting Limits
3. Table H-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

Appendix I: Oil Sampling

1. Table I-1: Sample Containers, Preservation, and Holding Times
2. Table I-2: Analytes, Methods, and Target Reporting Limits
3. Table I-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Appendix J: Industrial Hygiene Monitoring

1. Table J-1: Sampling Equipment and Media
2. Table J-2: Analytes, Methods, and Target Reporting Limits
3. Table J-3: Summary of Precision and Accuracy Objectives for Quality Control Samples

Appendix K: TVA Corrective Action Program (FPG.SPP.03.001)

Appendix L: Quality Assurance Procedure for Program Improvement for Kingston Fossil Plant Ash Event (TVA-KIF-QAP-001)

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3.0 DISTRIBUTION LIST

Name	Title	Organization	Address
Anda A. Ray aaray@tva.gov	Senior Vice President, Environment and Technology	TVA	400 West Summit Hill Dr Knoxville, TN 37902-1401
Steve McCracken shmccracken@tva.gov	General Manager, Kingston Ash Recovery Project	TVA	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
Leo Francendese francendese.leo@epa.gov	On-Scene Coordinator	US EPA Region 4	41 Forsyth Street SW Athens, GA 30303
Craig Zeller zeller.craig@epa.gov	Remedial Project Manager	US EPA Region 4	41 Forsyth Street SW Athens, GA 30303
Dennis Yankee dhyankee@tva.gov	Senior Manager, Environmental Monitoring and Analysis	TVA	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
Neil Carriker, Ph.D. necarriker@tva.gov	Program Manager, Special Projects	TVA	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
William Rogers, Ph.D. wjrogers@tva.gov	Technical Liaison/ Quality Assurance Officer	TVA	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
Rick Sherrard, Ph.D. rmsherrard@tva.gov	Toxicological Monitoring Coordinator	TVA	MS PSC 1X-C Chattanooga, TN 37402
Tyler Baker tfbaker@tva.gov	Biological Monitoring Coordinator – Aquatics	TVA	MS PSC 1X-C Chattanooga, TN 37402
Wesley K. James wkjames@tva.gov	Biological Monitoring Coordinator – Terrestrial	TVA Heritage Group	400 West Summit Hill Dr Knoxville, TN 37902-1401
Ralph L. Pope rlpope@tva.gov	Air Monitoring Coordinator	TVA	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
Paul Clay pclay@tva.gov	Environmental Project Manager	Restorations Services, Inc.	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
Jason Brown jabrown2@tva.gov	Sample Manager	Jacobs Engineering	714 Swan Pond Road, MS KPF 1T-KST Harriman, TN 37748
Rock J. Vitale, CEAC, CPC rvitale@envstd.com	Quality Assurance Manager	Environmental Standards, Inc.	1140 Valley Forge Rd P.O. Box 810 Valley Forge, PA 19482
Johnny Mitchell Johnny.mitchell@testamericainc.com	Laboratory Manager	TestAmerica, Inc.	2960 Foster Creighton Drive Nashville, TN 37204
Tod Noltemeyer tod.noltemeyer@pacelabs.com	Project Manager	Pace Analytical Services, Inc.	PACE Analytical 6409 Odana Road, Suite B Madison, WI 53719
Peter Meyer pmeyer@hydrosphere.net	Laboratory Manager	Hydrosphere Research	11842 Research Circle Alachua, FL 32615-6817
Heather Shaffer heather.shaffer@gel.com	Project Manager	GEL Laboratories, LLC	2040 Savage Road Charleston, SC 29407
Ryan Hall rhall@rjlg.com	Project Manager	RJ Lee Group, Inc.	350 Hochberg Road Monroeville,PA 15146
Tom Patten tpatten@imlinc.com	Laboratory Manager	Inter-Mountain Laboratories, Inc.	1633 & 1673 Terra Avenue Sheridan, Wyoming 82801
Misty Kennard-Mayer misty@brooksrand.com	Project Manager	Brooks Rand Laboratories, Inc.	3958 6th Ave NW Seattle, WA 98107
Patrick Garcia-Strickland PatrickS@frontiergeosciences.com	Laboratory Director	Frontier Global Sciences Inc.	414 Pontius Ave N Seattle, WA 98106
Danny France France.danny@epa.gov	Regional Quality Assurance Manager	US EPA Region 4	980 College Station Road Athens, GA 30605

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.0 QUALITY ASSURANCE PROJECT PLAN DESCRIPTION

The Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF) Ash Recovery Project is a multidisciplinary, long-term recovery project requiring interaction among TVA personnel; local, state, and federal government agencies, and academic research institutions. Due to the extensive scope of the project, a comprehensive *Quality Assurance Project Plan* (QAPP) has been developed which governs the collection, analysis, reporting, and use of all environmental data associated with this project. The primary goal of this QAPP (TVA-KIF-QAPP) is to ensure that project objectives are met through the generation of high-quality, reliable analytical data to characterize the extent of the fly ash deposition, to monitor the spill containment and remediation operations, and to assess the potential short-term and long-term health hazards and biological impact.

4.1 Background

Following the emergency response efforts, TVA began recovery actions in accordance with a Commissioner's Order from the state of Tennessee (Case No. OGC 09-0001), issued on January 12, 2009. On May 11, 2009, TVA entered into an Administrative Order and Agreement on Consent (Consent Order) with the United States Environmental Protection Agency (EPA) Region 4 to complete the response actions pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Contingency Plan (NCP).

The following discussion briefly summarizes TVA's quality assurance (QA) approach and documentation prior to the issuance of the Consent Order; and it describes how these will be transitioned to the framework of this QAPP.

Shortly after moving from emergency response into recovery, TVA initiated several actions to establish a QAPP for the environmental data collection activities that were rapidly increasing. TVA *KIF Ash Recovery Project Sampling and Analysis Plan for Phase I Dredging Operations* was prepared in March 2009 by TVA and issued to and approved by EPA and the Tennessee Department of Environment and Conservation (TDEC) to support the sampling efforts of the first phase of dredging operations. TVA also procured the services of a contractor specializing in environmental data collection and QA to assist in the preparation of QA documents including an overarching *Field Sampling Plan* (FSP) and related field Standard Operating Procedures (SOPs) for sample collection and field instrument measurements, and a QAPP. The FSP (with SOPs attached as appendices) and QAPP were issued to EPA and TDEC via posting on the regulator web site on April 15, 2009, but were not approved.

Shortly after the submission of the FSP and QAPP to EPA and TDEC, the Consent Order was signed. The EPA Consent Order defined time-critical activities associated with the Ash Recovery Project that included preventing the coal ash release from negatively impacting public health and the environment; containing and removing coal ash from the Emory River and the area East of Dike 2 as appropriate to restore flow and minimize further downstream migration of the ash material; and ensuring that coal ash material recovered during these efforts are properly

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

managed, pending ultimate disposal decisions, or, to the extent required by limited storage capacity, properly disposed. All other activities under the Order were defined as non-time-critical activities. The EPA Consent Order specified several deliverables for time-critical sampling activities including a Site Dust Control and Air Monitoring Plan, an Information/Data Management Plan, and a Surface Water Monitoring Plan for the Emory, Clinch, and Tennessee Rivers; these last two documents were submitted to and approved by EPA and TDEC. Additional sampling and analysis plans, work plans, and SOPs are continuously being developed to support both Time-Critical and Non-Time-Critical Removal Actions as needed. Attachment 1 of this QAPP includes a table that summarizes the status of TVA pre-Consent Order and current quality plans, sampling plans, and SOPs that exist as of the date of issuance of this QAPP; this table will not be updated with new revisions of the QAPP as this table is meant to provide a historical account. As new or revised sampling and analysis plans, work plans, and SOPs are prepared for post-Consent Order Time-Critical and Non-Time Critical Removal Action activities, a "cross-walk" table will be prepared for each individual document and added to Attachment 2 of the QAPP. As the sampling and analysis plans, work plans, and SOPs contain detailed information and some of the required elements of a QAPP that are not included in this QAPP (such as data quality objectives), the cross-walk table will summarize the location where the QAPP-required elements may be found in each of the revised or newly created documents. With the submission of a revised or newly-created post-Consent Order document for Agency review, a revision of Attachment 2 of the QAPP will be submitted for review and approval but the main body of the QAPP will not be revised. It should be noted that with the initial QAPP submission there are no completed tables in Attachment 2; the two aforementioned post-Consent Order documents are under revision and when the revised documents are submitted to the Agency for review, "cross-walk" tables will be prepared and submitted simultaneously.

This QAPP is intended to provide the overall framework of the TVA KIF Ash Recovery Project QA implementation and to identify the obligations of the various entities responsible for generating environmental data with respect to this QAPP. Specific details regarding the various sampling programs and project-specific data quality objectives (DQOs) are presented as an attachment in the associated Sampling and Analysis Plans, with SOPs guiding the specific activities performed under these plans. This QAPP describes the generation of all environmental data associated with the TVA KIF Ash Recovery Project and is applicable to all current and future sampling and monitoring programs associated with the project. The QAPP will be revised or amended as future sampling and monitoring programs are developed that are not addressed in this QAPP. As the project requirements emerge, additional Sampling and Analysis Plans and SOPs will be prepared as needed. Detailed quality requirements such as DQOs not addressed in this QAPP will be included as appendices in the appropriate Sampling and Analysis Plans.

The sampling design and execution for monitoring activities associated with the TVA KIF Ash Recovery Project are described in the various specific Sampling and Analysis Plans and SOPs. The project Data Management Program is described in the *Data Management Plan* (DMP) *for the Tennessee Valley Authority Kingston Ash Recovery Project* (TVA-KIF-DMP-001).

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.2 Project Organization

This section describes the organizational structure, lines of authority, and responsibilities of key individuals responsible for the implementation and administration of the TVA KIF Ash Recovery Project QA requirements. Project activities will be performed within the framework of the organization and functions described in this section.

The organizational structure showing relationships of individuals with key responsibilities is presented in Figure 4-1. The organizational structure in Figure 4.1 represents a subsection of the overall organizational structure for the project as directly related to implementation of the TVA KIF Ash Recovery Project QAPP. TVA hired Environmental Standards, Inc. as their contractor to provide independent QA support.

The organizational structure is designed to provide clear lines of responsibility and authority, regardless of the specific individual fulfilling a particular role. This control structure encompasses the following activities:

- Identifying lines of communication and coordination.
- Monitoring project schedules and performance.
- Managing key technical resources.
- Providing periodic progress reports.
- Coordinating support functions such as laboratory analysis and data management.
- Rectifying deficiencies and issues.

Field and laboratory personnel providing services in support of project efforts will perform work in strict compliance with the appropriate contract specifications for the activity.

Under the overall direction of the TVA Technical Liaison/QA Officer, QA personnel will perform the following tasks:

- Identify QA problems.
- Initiate, recommend, or provide solutions to QA problems through designated channels.
- Ensure that project activities, including processing of information, delivery of deliverables, and installation or use of equipment, are reviewed in accordance with QA objectives.
- Ensure that deficiencies/non-conformances are corrected.
- Ensure that further processing, delivery, or use of data is controlled until the proper disposition of a non-conformance, deficiency, or unsatisfactory condition has occurred.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

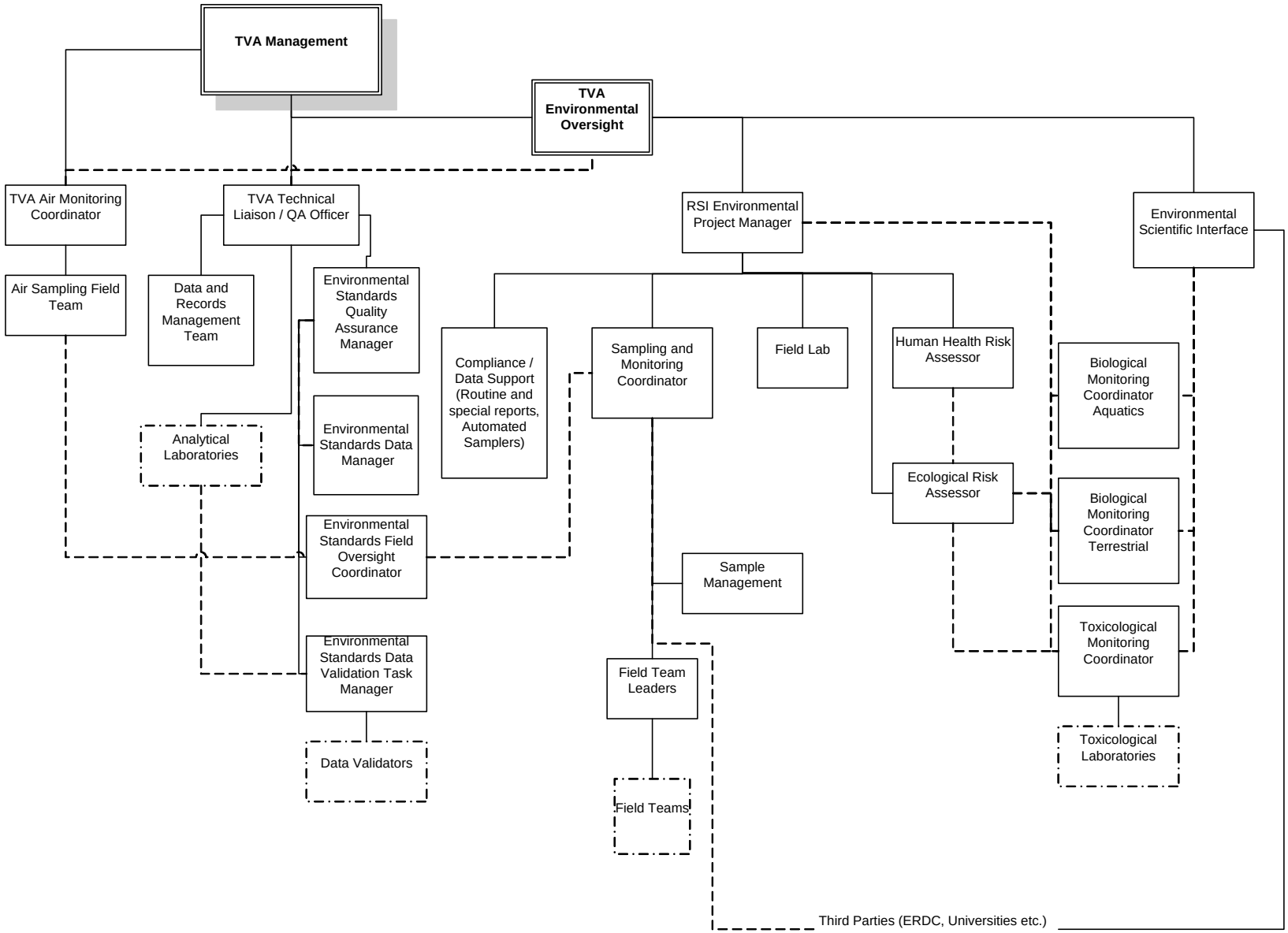

Figure 4-1: Organizational Structure

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.3 EPA Region 4 and TDEC

Leo Francendese, On-Scene Coordinator – EPA Region 4
Craig Zeller, Remedial Project Manager – EPA Region 4
Barbara Scott, On-Site Representative – TDEC

The EPA Region 4 On-Scene Coordinator (OSC), EPA Region 4 Remedial Project Manager, and TDEC On-Site Representative have regulatory oversight responsibilities for the development and approval of the documents and reports for this project. The responsibilities of the EPA Region 4 Project Manager and TDEC Project Manager include the following:

- Schedule meetings, if necessary, between agency and representatives of TVA.
- Review and approve proposed schedules.
- Review and approve documents and reports.

4.4 TVA Management

Steve McCracken, General Manager for Kingston Ash Recovery Project – TVA
Dennis Yankee, Senior Manager Environmental Monitoring & Analysis – TVA

TVA Management is responsible for implementation of the QAPP and holds overall authority of project-related decisions and activities and management responsibility for environmental activities associated with the project. TVA Management will enforce TVA's commitment to generating high-quality, legally defensible data in accordance with the QAPP. In addition, TVA Management is responsible for oversight of the TVA program improvement process.

TVA Management is also responsible for the following:

- Approve documents prior to submission to EPA Region 4, TDEC, and other regulatory agencies.
- Represent TVA at meetings.
- Define objectives for the project as a whole.
- Approve reports prior to submission.

4.5 TVA Environmental Oversight Manager

Dennis Yankee, Senior Manager Environmental Monitoring & Analysis – TVA
Michelle Cagley – TVA

The TVA Environmental Oversight Manager is responsible for overseeing contractor performance regarding the environmental aspects of the project. The TVA Environmental Oversight Manager provides input to various technical and regulatory documents, and provides technical support for litigation response. The TVA Environmental Oversight Manager additionally provides support to TVA Management.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.6 TVA Technical Liaison/Quality Assurance Officer

William Rogers, Ph.D. – TVA

The TVA Technical Liaison/QA Officer administers, develops, and implements the overall QA program. TVA Technical Liaison/QA Officer holds overall authority for the project QA and maintains that authority independently from the operational/production aspects of the project. The TVA Technical Liaison/QA Officer holds the authority to communicate at any level of the organization in order to be effective. The responsibilities and duties of the TVA Technical Liaison/QA Officer include the following:

- Review and analyze overall task performance with respect to planned requirements.
- Submit project progress reports to TVA Environmental Oversight Manager.
- Serve as point-of-contact between Environmental Standards data validation personnel and project laboratories.
- Perform general oversight of corrective action process.
- Receive and review data validation reports.
- Provide support to the analytical laboratories for sample preparation and analysis issues.
- Provide day-to-day contact for project laboratories.
- Provide quality oversight for environmental activities associated with the project.
- Serve as point-of-contact and provide quality oversight for subcontractors involved in field sampling, field measurement, and field instrument calibration.
- Initiate and direct TVA internal audits, inspections, surveillances, and observation of quality-related activities.
- Serve as technical interface for Environmental Standards audits, inspections, surveillances, data management, and observation activities.

4.7 RSI Environmental Project Manager

Paul Clay – Jacobs Engineering/RSI

The Environmental Project Manager is responsible for daily management of environmental activities at the Site. The responsibilities and duties of the Environmental Project Manager include the following:

- Coordination of daily environmental activities.
- Preparation of Sampling and Analysis Plans.
- Serve as the liaison between operational aspects, site construction or remediation activities and the QA oversight personnel.
- Interaction with subcontractor personnel regarding standard project communications.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.8 Sampling and Monitoring Coordinator

Adam Johnson – Restoration Services, Inc.

The responsibilities and duties of the TVA Sampling and Monitoring Coordinator include the following:

- Receive and review daily progress reports from Field Team Leader.
- Receive and review weekly compiled field data sets from the Field Team Leader.
- Oversee use of sample planning, including use of Sample Planning Module, and coordinate delivery of bottleware from the project laboratories.
- Notify TVA Technical Liaison/QA Officer and Environmental Standards QA Manager about field QA situations that require corrective action.
- Plan and coordinate sampling events.
- QA review of Field logbooks.
-

4.9 Sample Management Personnel

Jason Brown – Jacobs Engineering

The Sample Management Personnel coordinate field sampling events to support project objectives. The responsibility and duties of the Sample Manager include the following:

- Oversee Chain-of-Custody Management.
- Obtain sample containers and labels.
- Provide field and laboratory integration.
- Responsible for maintenance of a database that contains all environmental media sampling events.
- Manage sampling metadata.

4.10 TVA Data and Records Management

Jacqueline Broder – TVA
Sidney Whitehead – TVA
Patrick Lee, Ph.D. – TVA

The TVA Data and Records Management Team is responsible for maintaining all project records in accordance with TVA's records management program. The responsibilities of the TVA Data and Records Management Team include the following:

- Control of project documents, such as SOPs, the TVA-KIF-QAPP, and specific work plans.
- Control and distribution of revisions to project documents.
- Managing the project photograph database.
- Managing supporting documentation, including copies of field logbooks, field data sheets, surveillance reports, and field oversight memoranda.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

- Maintaining records of project personnel training relative to environmental monitoring activities.
- Management of sample retains.

4.11 Environmental Data Resource Team

Robert J. Crawford – TVA
David Greenberg – Jacobs
Patrick Lee, Ph.D. – TVA

The Environmental Data Resource Team is responsible for reviewing and maintaining data from field instrumentation. The Environmental Data Resource Team generates routine data reports to support project personnel. In addition, the Environmental Data Resource Team prepares reports to support special requests and inquiries from project management or third parties.

4.12 Environmental Scientific Interface

Neil E. Carriker, Ph.D. – TVA

The Environmental Scientific Interface is responsible for coordinating third-party research activities and delegating project resources to support these activities. The Environmental Scientific Interface participates in research advisory committees and works with media-specific sampling coordinators to plan and execute various biological and toxicological studies. The Environmental Scientific Interface participates in the Kingston Coordination Group.

4.13 Human Health and Ecological Risk Assessors

Daniel Jones – Arcadis
Mark Stack – Jacobs

The Human Health and Ecological Risk Assessors are responsible for participating in the identifying exposure pathways and participating in the design, planning, and execution of sampling efforts to support the risk assessment process. The Human Health and Ecological Risk Assessors use the data generated from environmental monitoring efforts to evaluate potential adverse effects on humans and biota resulting from the ash slide event.

4.14 Media-Specific Sampling Coordinators

4.14.1 Air Monitoring Coordinator

Ralph L. Pope – TVA

The Air Monitoring Coordinators are responsible for coordinating and overseeing all air monitoring associated with the TVA KIF Ash Recovery Project. The Air Monitoring Coordinators plan and schedule air sampling activities; coordinate with air sampling subcontractors and the analytical laboratory; coordinate with KIF plant operations; perform remedial investigations; perform outreach responses regarding air monitoring; and prepare reports associated with air monitoring.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.14.2 Aquatics Biological Monitoring Coordinator
Tyler Baker – TVA

The Biological Monitoring Coordinator – Aquatics is responsible for coordinating sampling efforts relative to aquatic biological specimens. The Biological Monitoring Coordinator – Aquatics performs oversight of the biological sampling and transmittal of biota samples to the testing laboratory and coordinates with the TVA Technical Liaison/QA Officer regarding QC issues encountered. In addition, the Biological Monitoring Coordinator – Aquatics works with the Toxicological Monitoring Coordinator to interpret analytical laboratory data. The Biological Monitoring Coordinator – Aquatics coordinates with local, state, and federal agencies to design short-term and long-term biological monitoring activities.

4.14.3 Terrestrial Biological Monitoring Coordinator
Wesley James – TVA Heritage Group

The Biological Monitoring Coordinator – Terrestrial is responsible for coordinating sampling efforts relative to terrestrial biological specimens. The Biological Monitoring Coordinator – Terrestrial performs oversight of the biological sampling and transmittal of biota samples to the testing laboratory and coordinates with the TVA Technical Liaison/QA Officer regarding QC issues encountered. In addition, the Biological Monitoring Coordinator – Terrestrial works with the Toxicological Monitoring Coordinator to interpret analytical laboratory data. The Biological Monitoring Coordinator – Terrestrial coordinates with local, state, and federal agencies to design short-term and long-term biological monitoring activities.

4.14.4 Toxicological Monitoring Coordinator
Rick Sherrard, Ph.D. – TVA

The TVA Toxicological Monitoring Coordinator is responsible for coordinating and overseeing all toxicity testing associated with the TVA KIF Ash Recovery Project, including, but not limited to, whole sediment elutriate evaluation, elutriate toxicity evaluation, plume toxicity evaluation, and polymer toxicity evaluation. The TVA Toxicological Monitoring Coordinator schedules all toxicity sampling events; serves as the point-of-contact with the toxicity laboratory; receives analytical data; and coordinates with the TVA Technical Liaison/QA Officer regarding QC issues encountered during toxicological testing.

4.15 Field Team Leaders

The Field Team Leaders are the primary contact in the field and will be responsible for all field activities, as listed below.

- Provide coordination and management of all field personnel and those subcontractors involved in field sampling or calibration activities.
- Provide coordination of field sampling activities.
- Ensure field procedures are followed to achieve the data objectives.
- Review field notebooks/logbooks for completeness, consistency, and accuracy.
- Provide coordination of delivery of samples to the project laboratories for analysis.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.15.1 Field Teams

The Field Teams are responsible for the performance of field activities as required by the project-specific work plans and the associated field SOPs. Field Teams will document compliance with project documents through recording activities/observations in the field in a field logbook. In addition, Field Teams will be responsible for collection of samples, submission of samples to the laboratory, and completion of Chain-of-Custody (COC) Records.

4.16 Environmental Standards Quality Assurance Manager

Rock J. Vitale, CEAC, CPC - Environmental Standards, Inc.

Environmental Standards is an independent consultant performing field and laboratory oversight, data quality assessment, and data management. Environmental Standards does not participate in data generation activities. Under direction of the TVA Technical Liaison/QA Officer, the Environmental Standards QA Manager will oversee all QA aspects of the Project. Specific tasks are listed below.

- Review project documents.
- Prepare QA Project Plan documents.
- Initiate frequent systems audits of the multi-media sampling activities.
- Initiate frequent performance and systems audits of the project laboratories.
- Provide technical and QA consulting on corrective action process.
- Provide technical and QA consulting to TVA and project laboratories.
- Issue reports to TVA Environmental Project Manager and TVA Technical Liaison/QA Officer.
- Provide oversight and approval of analytical data validation reports.
- Provide oversight and approval of QA reporting.

4.16.1 Environmental Standards Data Validation Task Manager

Erin E. Rodgers – Environmental Standards, Inc.

The Environmental Standards Data Validation Task Manager is responsible for assigning the validation of laboratory-produced data and issuing the data validation QA reports to the TVA Technical Liaison/QA Officer and TVA Records Custodian. The Environmental Standards Data Validation Task Manager is responsible for notifying the Environmental Standards QA Manager of issues relating to the quality or validity of the data and reporting with respect to project objectives and requirements.

4.16.2 Environmental Standards Data Validators

The Environmental Standards Data Validators are responsible for performing review and validation of all project data generated by the laboratories in accordance with the QAPP, production of the data validation reports, and notification of the Environmental Standards Data Validation Task Manager relative to specific issues.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4.16.3 Environmental Standards Field Oversight Coordinators

Stephen D. Brower, P.G. – Environmental Standards, Inc.
Bryan Smith, P.G. – Environmental Standards, Inc.

The Environmental Standards Field Oversight Coordinators are independent from field sampling activities and works with the TVA Sampling and Monitoring Coordinator and the Field Team Leaders to ensure compliance with the QAPP, project-specific sampling plans, and the associated project SOPs. The Environmental Standards Field Oversight Coordinators are responsible for training and overseeing all field sampling activities, sampling handling procedures, and sample custody as detailed in project SOPs and the project-specific Sampling and Analysis Plans. The Field Oversight Coordinators will perform audits of the Field Teams during the collection of samples for this project and will assess the procedures and performance of the Field Teams relative to the requirements in the QAPP, SOPs, and project-specific Sampling and Analysis Plans. The Field Oversight Coordinators will generate a report of findings to be distributed to the Environmental Standards QA Managers, TVA Sampling and Monitoring Coordinator, and TVA Technical Liaison/QA Officer. The Field Oversight Coordinators are responsible for reviewing COC submitted to the analytical laboratories and for reviewing field parameter data for ambient air monitoring.

4.16.4 Environmental Standards Data Manager

Dennis P. Callaghan – Environmental Standards, Inc

The Environmental Standards Data Manager is responsible for managing all data from the project laboratories and is the main point-of-contact for data-related issues. The Environmental Standards Data Manager prepares visual representation of the project data for public consumption and regulatory review. The Data Manager receives Electronic Data Deliverables (EDDs) directly from the project laboratories after sample analysis and formats the deliverables such that they can be used during the validation/verification process.

4.17 Field Laboratory

Michael Houck, Manager – Jacobs Engineering

The on-site Field Laboratory personnel are responsible for conducting physical testing to support operations and engineering activities. The on-site Field Laboratory personnel maintain instrumentation and perform testing in accordance with written procedures or guidance set forth in technical literature. The requirements set forth in the QAPP are applied in a fashion commensurate with the intended use of the measurement.

4.18 Contract Laboratory Organization and Responsibilities

The functional roles for the laboratory are described in this subsection. From the Project perspective, the structure is designed to facilitate information exchange among the laboratory, Environmental Standards, and TVA personnel relative to planning, technical requirements, schedules, and QA measures. Project information exchange specifically includes sample identification; preservation procedures; sample container requirements; sample collection

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

procedures; decontamination protocols; and sample labeling, packing, holding times, and shipping.

Although the internal laboratory structure may differ depending on the specific contractor, key functional roles will include division management, technical direction, subcontracting coordination, data review, and data management.

TVA's primary contracted laboratories and their responsibilities are presented in Table 4-1.

Table 4-1. TVA Primary Contracted Laboratories

Laboratory	Facility Location	Matrices/Analyses
TestAmerica, Inc.	Nashville, TN	Surface Water Groundwater Ash Sediment Residential Soil Wipes
TestAmerica, Inc.	Knoxville, TN	Sediment Special Studies
TestAmerica, Inc.	Pittsburgh, PA	Specialty Analyses
Pace Analytical Services, Inc.	Green Bay, WI	Biological Samples
Inter-Mountain Laboratories, Inc.	Sheridan, WY	Air Particulate Matter
RJ Lee Group, Inc.	Monroeville, PA	Air Particulate Matter
Brooks Rand Laboratories	Seattle, WA	Metals Speciation
Frontier Global Sciences	Seattle, WA	Metals Speciation
Hydrosphere Research	Alachua, FL	Toxicological Analyses
GEL Laboratories, LLC	Charleston, SC	Radiological Analyses

Additional laboratories may be contracted as project requirements and sampling program needs evolve. The primary contracted laboratories may subcontract samples for special studies or non-routine analyte lists. In the event that samples are subcontracted, the primary laboratory is responsible for ensuring that analyses conform to the QAPP and the associated project-specific Sampling and Analysis Plan. In addition, data for subcontracted analyses will be reported through the primary contracted laboratory.

4.18.1 Laboratory QA Coordinator

The Laboratory QA Coordinator will ensure conformance with authorized policies, procedures, and sound laboratory practices as necessary. The Laboratory QA Coordinator will inform the Laboratory Project Manager of any non-conformances, introduce control samples into the sample train, and establish testing lots. In addition, the Laboratory QA Coordinator will approve laboratory data before reporting or transmitting to permanent storage and will be responsible for retention of supporting information, such as control charts and other performance indicators, to demonstrate that the systems that produced the data were in control. The Laboratory QA

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Coordinator will also review results of internal QA audits and recommend corrective actions and schedules for their implementation.

The responsibilities of the Laboratory QA Coordinator include, but are not limited to, the following:

- Administering the laboratory QA Program.
- Implementing QC procedures for each test parameter.
- Reviewing analytical results, including raw data, calculations, and laboratory log books.
- Monitoring proper documentation and maintenance of the records.
- Identifying and implementing training requirements for the laboratory analytical personnel.
- Overseeing QA implementation at the laboratory on a daily basis.
- Identifying QA problems and recommending appropriate corrective action.
- Preparing status reports (progress, problems, and recommended solutions).
- Preparing reports documenting completion of corrective actions.

4.18.2 Laboratory Project Manager

The Laboratory Project Manager will be the primary contact for the Project Team. The Laboratory Project Manager will primarily schedule project analytical requirements, monitor analytical status/deadlines, approve laboratory reports, coordinate data revisions/corrections and resubmittal of packages, and communicate sample preparation and analyses issues to the Environmental Standards QA Manager and TVA Technical Liaison/QA Officer on a real-time basis. The Laboratory Project Manager will provide direction/support for administrative and technical project staff, interface with laboratory project staff on technical issues, and QA oversight of analytical data. The Laboratory Project Manager will contact the Environmental Standards QA Manager if, at any point, there is a need to deviate from the QAPP or other cited published materials. Any problems or inconsistencies identified at any time after laboratory sample receipt will be documented on a nonconformance report initiated by the Laboratory Project Manager and forwarded to the TVA Technical Liaison/QA Officer.

The Laboratory Project Manager will provide sample receipt confirmation within 24 hours from sample receipt.

The Laboratory Project Manager for aquatic toxicology laboratories will immediately communicate sample preparation and analyses issues and discuss the need to deviate from the QAPP or other cited published materials with the TVA Toxicological Monitoring Coordinator.

4.18.3 Laboratory Sample Custodian

The Laboratory Sample Custodian will receive samples from the field, sign and date COC Records, record the date and time of receipt, and record the condition of shipping containers and sample containers.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

The Sample Custodian will verify and record agreement or non-agreement of information on sample documents. If there is non-agreement, the Sample Custodian will record the problems/inconsistencies for the case file and will inform the Laboratory Project Manager.

The Sample Custodian will also label samples with laboratory sample numbers, place samples and spent samples into appropriate storage and/or secure areas, and monitor storage conditions.

4.18.4 Laboratory Analyst

The Laboratory Analyst is responsible for preparing and/or analyzing samples in accordance with this document and/or the applicable analytical methods. If there are problems encountered during sample preparation or analysis, the Laboratory Analyst will inform the Laboratory QA Coordinator and Laboratory Project Manager.

4.19 Kingston Coordination Group

TVA will facilitate an informal Interagency Sampling/Testing Coordination Group to ensure comparability of data, prevent duplication of effort, use of best scientific fundamentals, and upfront agreement of involved agencies for field data/sample collections. Participation in the Kingston Coordination Group will be voluntary and informal with meetings conducted on an as-needed basis.

The Kingston Coordination Group will provide input in the conceptual stages of plan development, review and discuss proposed sampling plans, help implement plans (if interested), review resulting data, and contribute to adaptive management decisions by evaluating implications of results on subsequent sampling/testing. The Kingston Coordination Group will focus on sampling/testing of aquatic and terrestrial biological resources. The Kingston Coordination Group, or a subcomponent of the Group, will also consider toxicity and/or surface water quality sampling/testing activities as the need arises.

5.0 PROBLEM DEFINITION/BACKGROUND

On Monday, December 22, 2008, just before 1 a.m., a coal fly ash spill occurred at TVA's Kingston Fossil Plant, allowing a large amount of fly ash to escape into the adjacent waters of the Emory River. Ash, a by-product of a coal-fired power plant, is stored in containment areas. Failure of the dredge cell dike caused about 60 acres of ash in the 84-acre containment area to be displaced. At the time of the slide, the area contained about 9.4 million cubic yards of ash. The dike failure released approximately 5.4 million cubic yards of coal ash that covered about 275 acres and affected about 40 area homes. In addition, a section of the Emory River channel was blocked by ash; the river is diverting around the blockage.

In response to the containment area discharge event, TVA initiated comprehensive measures to assess, contain, and remediate the fly ash spill. The sampling and analysis procedures used for site assessment and monitoring are described in this QAPP.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

6.0 PROJECT DESCRIPTION AND APPLICABILITY

In response to the ash release, TVA initiated the TVA KIF Ash Recovery Project. TVA's objectives for the recovery effort are listed below.

- Maintain the health and safety of the public and response personnel.
- Involve the public, affected property owners, and other agencies in the formulation of response activities.
- Restore impacted natural and public resources expeditiously.
- Make the area as good as, if not better than, it was before the ash release.

The TVA KIF Ash Recovery Project includes, without limitation, sampling, and monitoring of the following sample matrices.

- Aqueous Sampling (including, but not limited to, river surface water and groundwater).
- Solid Sampling (including, but not limited to, ash, sediment, and residential soil).
- Air (particulate) Sampling and Monitoring.
- Toxicological Monitoring (including, but not limited to, whole sediment elutriate evaluation, elutriate toxicity evaluation, plume toxicity evaluation, and polymer toxicity evaluation).
- Biological Sampling (including, but not limited to, fish tissue, bird eggs, amphibian tissue, reptile tissue/blood, mammal tissue/blood, and vegetation).

To support the objectives of the TVA KIF Ash Recovery Project, a QA program has been implemented to ensure the generation of high-quality, defensible data for use in decision making. The data generated from the project sampling and monitoring activities will be used for purposes such as operational decision-making; risk assessment and human health evaluations; delineation of the extent of contamination; and demonstration of achievement of objectives.

This QAPP provides an overall framework for QA and data management activities associated with the TVA KIF Ash Recovery Project. The QAPP is applicable to all current and future sampling and monitoring activities associated with the site. The QAPP will be revised or amended as future sampling and monitoring activities which are not currently anticipated in this QAPP are developed. As the sampling and monitoring activities are developed, additional Sampling and Analysis Plans will be prepared.

On behalf of TVA, Environmental Standards, Inc. (Environmental Standards), an independent QA firm, has prepared this QAPP, which presents the project organization, objectives, procedures, functional activities, and specific QA/quality control (QC) activities relative to the generation of environmental analytical data associated with the TVA KIF Ash Recovery Project. The requirements of the QAPP are applicable to affiliated project personnel, support groups, contractors, and subcontractors.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

TVA maintains strict document control procedures, which are distributed internally on TVA's Records and Information Management System website or other servers specifically associated with the TVA KIF Ash Recovery Project. The TVA Records Custodian will maintain a complete project file and will archive all original hardcopy and electronic versions of the QAPP in accordance with TVA records retention rules as delineated by the TVA Document Services procedures and the TVA Records Center Handbook. Once signed and finalized, the QAPP will be posted on one of the dedicated TVA KIF servers for internal staff and contractors to access as a read-only document. Only the current electronic version will be accessible for internal staff and contractors to view. Uncontrolled copies of the QAPP will be issued as a PDF on a CD to all individuals listed on the distribution list that do not have access to the TVA KIF server. The Environmental Standards Quality Assurance Manager will be responsible for ensuring that current versions are posted on the TVA KIF server and distributed to those named individuals on the distribution list.

6.1 Purpose and Scope

The QAPP is intended to establish an overall QA framework for the TVA KIF Ash Recovery Project; general requirements associated with various analysis, data generation, data reduction, and reporting activities are stipulated herein. Additional specific requirements and DQOs will be described in the applicable project-specific Work Plans and/or Sampling and Analysis Plans. The QAPP governs any project-specific quality plans.

The scope of this document is to describe the QA requirements developed for the TVA KIF Ash Recovery Project and provide the appropriate QA procedures and QC measures to be applied to all sampling and monitoring activities associated with the TVA KIF Ash Recovery Project and to address the following items:

- QA objectives.
- Laboratory procedures.
- Sample collection, handling, and preservation.
- Sample analysis, data reduction, validation, and reporting.
- Internal QC checks.
- QA performance and system audits.
- Preventive maintenance procedures and schedules.
- Data assessment procedures, including processing, interpretation, and presentation.
- Corrective actions.
- QA reports to management.

Project-specific Work Plans and/or Sampling and Analysis Plans will be developed to address project-specific requirements and to provide DQOs for the particular sampling event.

6.2 Schedule

Project-specific sampling schedules are addressed in the associated project-specific Sampling and Analysis Plans.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

In general, the anticipated schedule of activities related to analytical data generated from chemical analyses is presented below.

- The laboratory will provide analytical results and EDDs to TVA within their standard turn-around time (approximately 10 business days) from sample receipt (or sooner when expedited turn-around time is requested).
- Environmental Standards will screen the EDD for acceptability to the database and complete the initial verification within two (2) business days of EDD receipt and successful EDD loading. Verified data will be available to TVA personnel for internal use and agency reporting.
- The laboratory will provide full data deliverable packages to TVA and Environmental Standards within their standard turn-around time (approximately 20 business days) from sample receipt.
- Environmental Standards will complete data validation and generate reports following receipt of the complete data package and data validation qualifiers will be added to the database.

Data generated from toxicological assessments are reported directly to the TVA Toxicological Monitoring Coordinator for evaluation and statistical interpretation.

7.0 OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

7.1 Data Objectives

The Data Quality Objectives (DQOs) process is a series of planning steps based on a scientific method to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended application. In general, DQOs provide a qualitative and quantitative framework around which data collection programs can be designed. The qualitative aspect of DQOs seeks to encourage good planning for field investigations. The quantitative aspect of DQOs involves designing an efficient field investigation that reduces the possibility of incorrect decision-making. Elements of the DQO process are incorporated into the TVA KIF Ash Recovery Project QA Program project-specific Work Plans and/or Sampling and Analysis Plans.

The DQO process is defined in the Guidance on the Data Quality Objectives Process (EPA QA/G-4, US EPA 2000a). The DQO process consists of seven steps.

Step 1: State the Problem. Define the problem that motivates the study; identify the planning team; and examine the budget and schedule.

Step 2: Identify the Goal of the Study. State how environmental data will be used in solving the problem; identify study questions; and define alternative outcomes.

Step 3: Identify Information Inputs. Identify data and information needed to answer study questions.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Step 4: Define the Boundaries of the Study. Specify the target population and characteristics of interest and define spatial and temporal limits.

Step 5: Develop the Analytic Approach. Define the parameters of interest; specify the type of inference and develop logic for drawing conclusions from the findings.

Step 6: Specify Performance or Acceptance Criteria. Develop performance criteria for new data being collected and acceptance criteria for data already collected.

Step 7: Develop the Detailed Plan for Obtaining Data. Select the most resource-effective work plan and/or sampling and analysis plan that satisfies the performance or acceptance criteria.

The DQO process is employed during the project planning stage to ensure that data generated are appropriate relative to the project objectives. DQOs for a particular sampling and analysis event are detailed in the project-specific Work Plans and/or Sampling and Analysis Plans. Cross-walk tables referencing the location of QAPP-required elements in post-Consent Order documents may be found in Attachment 2 of the QAPP.

8.0 SPECIAL TRAINING/CERTIFICATIONS

All field personnel will complete a training course of at least 40 hours that meets the requirements specified in 29 CFR Part 1910.120(e) on safety and health at hazardous waste operations and a refresher course of at least 8 hours that meets the requirements of 29 CFR Part 1910.120(e) on safety and health at hazardous waste operations within the last 12 months.

Field personnel performing sample collection activities will be properly trained in equipment use and procedures necessary for each task prior to entering the field. Training will be conducted by TVA, Environmental Standards, Jacobs Engineering, and/or other subcontractors. Any proposed training not provided by Environmental Standards will be reviewed and approved by the Environmental Standards Field Oversight Coordinator before training is conducted. All field sampling personnel training will be fully documented and the documentation will be maintained as part of the Project Record.

All individuals who plan to participate in field activities must have current health and safety training prior to commencement of sample collection activities. The Field Team Leader will ensure that all participants who arrive on site have provided evidence of health and safety training. It will be the responsibility of the Field Team Leader to ensure that field personnel understand and comply with the applicable requirements for their individual tasks.

Field sampling personnel will be trained on applicable field QC measures associated with a particular sampling program during program-specific training. In addition, field sampling personnel will receive training based on field oversight activities and additional training sessions on applicable project SOPs.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Personnel who are responsible for performing laboratory analyses will be properly trained by the Laboratory Director or her/his designee to conduct the various laboratory analyses described in the QAPP. The laboratories participating in this project will have training programs equivalent to those required in the National Environmental Laboratory Accreditation Conference (NELAC) Standards, Section 5.0 Quality Systems. The laboratory shall have sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions.

Data verification and validation will be under the direction of the Environmental Standards Data Validation Task Manager, who will be experienced with the production, reporting, verification, and validation of analytical data.

Additional QA training will be conducted at the discretion of the TVA Technical Liaison/QA Officer. Generally, the need for QA training for project personnel will be identified through systems and performance audits and training will be conducted as part of the corrective action process. Any QA training provided to project personnel will be documented.

9.0 DOCUMENTATION AND RECORDS

Appropriate records will be maintained to provide adequate documentation of the entire data generation process, including field sampling and laboratory analysis. Field sampling records will include maintaining field logs and sample COC documentation. Field QA samples will be documented on both the field logbook and sample COC Records.

The final Project File will be the central repository for documents relevant to sampling and analysis activities as described in the QAPP and in the project-specific Work Plans and/or Sampling and Analysis Plans. The TVA Records Custodian will maintain the files for this Project, including all relevant records, correspondence, reports, logs, data, field records, pictures, subcontractor reports, analytical data, and data reviews. The file will include the following information, if generated:

- Field records
- Field data and data deliverables
- Photographs
- Drawings
- Sample logs
- Laboratory data deliverables
- Data validation reports
- Field and laboratory audit reports
- Progress reports, QA reports
- Custody documentation

TVA maintains strict document control procedures, which are distributed internally on TVA's Records and Information Management System website or other servers specifically associated with the TVA KIF Ash Recovery Project. Electronic and hardcopy data will be archived for a minimum of 10 years from the date of report. The TVA Records Custodian will maintain a

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

complete project file and will archive all hardcopy and electronic data in accordance with TVA records retention rules as delineated by the TVA Document Services procedures and the TVA Records Center Handbook. Electronic or hardcopy data associated with the TVA KIF Ash Recovery Project will not be discarded, deleted, or destroyed by any party without the written consent of the TVA Records Custodian.

9.1 Field Data Documentation

Field (that is, non-laboratory) data that will be collected during the field effort can generally be characterized as either "objective" or "subjective" data. Objective data include direct measurements of field data such as field screening/analytical parameters and water-level measurements. Subjective data include descriptions and observations such as descriptions of sampling locations and conditions and physical descriptions of samples.

Field data collected during the field activities will be evaluated for usability by conducting a QA review, which will consist of checking the procedures used and comparing the data to previous measurements. Field QC samples will be evaluated to ensure that field measurements and sampling protocols have been observed and followed. The field data will be reviewed by the TVA Sampling and Monitoring Coordinator or designee for the following:

- Use of SOPs.
- Calibration method and frequency.
- QC lot number.
- Date and time sampled.
- Preservation.
- Samplers.
- Comparisons to laboratory results.
- COC records.
- Date shipped.

Any deviations from applicable work plans and/or sampling and analysis plans, SOPs, or the QAPP will be documented in the field logbook during sampling and data collection operations.

A copy of the COC record will be delivered to the TVA Technical Liaison/QA Officer and TVA Records Custodian for inclusion in the project files. Upon receipt and log-in of the samples at the laboratory, the remaining sections of the COC record (such as description of the sample condition at the time of receipt, assigned laboratory identification number, and any special conditions) will be completed. The original COC record will be returned to the project file as part of the full hardcopy data deliverables package.

9.2 Laboratory Data Documentation

Analytical laboratories performing work on this project will retain records of the analytical data for a minimum of 10 years after project completion. Analytical data will not be disposed of without TVA's consent. In addition, all laboratory data will be provided to TVA in hardcopy or approved electronic form. TVA will retain hardcopy data in accordance with TVA Records Management requirements.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

9.2.1 Laboratory Data Reporting/Deliverable Package

During Time Critical Phase of the project, TVA had established a standard turn-around-time (TAT) of five (5) business days from sample receipt at the laboratory for all chemical parameters. In some cases, expedited TATs were required. Sample analyses were completed and results reported to TVA and Environmental Standards in hardcopy and EDD within 5 business days. The full data package was submitted to TVA and Environmental Standards within 10 business days from sample receipt at the laboratory.

During Non-Time Critical Phase of the project, TVA has requested laboratories to report data at their standard TAT; generally, approximately ten (10) business days from sample receipt at the laboratory for all chemical parameters. In some cases, expedited TATs may be required. Sample analyses will be completed and results reported to TVA and Environmental Standards in hardcopy and EDD within approximately 10 business days. The hardcopy full data package will be submitted to Environmental Standards within approximately 20 business days from sample receipt at the laboratory; a full data package will be submitted to the TVA Technical Liaison/QA Officer in electronic format (PDF) only.

Laboratories performing chemical analyses will be responsible for providing an approved electronic data deliverable (see Appendix B) as well as a hardcopy report (see Appendix A). The deliverable package will contain final results (uncorrected for blanks and recoveries), analytical methods, detection limits, method blank data, and results of QC samples. In addition, special analytical problems and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Sample data for chemical analyses are reported in the units dictated by the Method Analyte Group (MAG).

As a general statement:

- Concentrations for liquid samples are expressed in terms of weight per unit volume (such as milligrams per liter [mg/L]).
- Concentrations for solid samples (including biological samples) and oil samples are expressed in terms of weight per unit weight of sample (such as milligrams per kilogram [mg/kg]).
- Concentrations for wipe samples are expressed in terms of weight per wipe (such as mg/wipe).
- Radiological analysis results will be expressed in terms of activity per unit weight of sample (such as picocuries per gram [pCi/g]).
- Results for air filters will be expressed as a mass per volume of air (such as $\mu g/m^3$).

All data will be reported in the units specified to ensure consistent reporting among the contracted laboratories.

The format for hardcopy data deliverables is presented in Appendix A. In general, the hardcopy data deliverable will include summary forms and raw data for all calibrations, QC, and sample analyses. The format for EDDs is provided in Appendix B. QC results reported will include a

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

method blank, matrix spike/matrix spike duplicate (MS/MSD) samples, field QC samples, and laboratory control samples (LCSs). Sample data results (including QC sample results) will also be provided in the electronic format. The laboratory is responsible for reviewing the electronic data to ensure that these data are consistent with hardcopy Contract Laboratory Program (CLP)-like results. Data discrepancies between the EDD submission and hardcopy results, if any, will be reconciled at validation; the contract laboratory and TVA will be informed by the Environmental Standards QA Managers so that changes are made and the final hardcopy reports are made consistent with the EDD and archived by TVA.

9.3 Record-Keeping

The TVA KIF Ash Recovery Project is subjected to strict record-keeping requirements in anticipation of litigation related to the ash release. All written records, including but not limited to notes, logbooks, reports, draft and final documents, and forms, are collected for inclusion in the project file. In addition, electronic files including but not limited to e-mail transmissions, draft and final documents, and laboratory analytical reports are maintained as part of the electronic project file. Project document management is detailed in TVA's Document Control SOP.

Analytical data for this project will be reported in both an EDD and an analytical hardcopy package. To maintain uniformity and consistency among contract laboratories, TVA, and Environmental Standards, the EDD format for the transfer of all data associated with the TVA KIF Ash Recovery Project will be a complex EDD specification compatible with EarthSoft's EQuIS®. A simple EDD specification may be substituted for laboratories that do not possess the capabilities to generate a complex EDD. The EQuIS® data transfer parameters are discussed further in Appendix B and in TVA-KIF-DMP-001. The EDD will be generated by the laboratories and will be used by the Environmental Standards Data Manager to facilitate loading the analytical data into the Project Database.

Analytical data packages will be prepared by the laboratory for all sample analyses performed. A limited data deliverable (Appendix A) in Adobe® Acrobat® Portable Document Format (PDF) format and hardcopy will be provided by the contract laboratory within the laboratory's standard turn-around time for limited deliverables (approximately 10 business days from sample receipt). Full deliverables (Appendix A) and an EQuIS® EDD (Appendix B) will be provided by the laboratory in an Adobe Acrobat .pdf electronic format and hardcopy for all analyses within the laboratory's standard turn-around time for full data deliverables (approximately 20 business days from sample receipt). Hardcopy deliverables will be provided to the Environmental Data Validation Task Manager. Data deliverables will be provided to the TVA Technical Liaison/QA Officer in electronic format (PDF) only.

9.4 Data Archival

Applicable electronic field and laboratory data collected during sampling will be archived electronically. Backup tapes containing databases and programs or software utilities will be maintained in a secure location. All hardcopy data, including but not limited to field logbooks, laboratory data deliverables, and data validation reports, will be retained by TVA's Records Custodian and archived in accordance with TVA's Document Control protocols.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

All hardcopy and electronic analytical data generated in support of the TVA KIF Ash Recovery Project will be retained and cataloged by the TVA Records Custodian. Formal records custody procedures will be maintained in accordance with TVA's Records Custody procedures.

10.0 SAMPLING PROCESS DESIGN

Aqueous, solid, air, and biological samples may be collected in association with the TVA KIF Ash Recovery Project. These samples will be subjected to a variety of chemical, radiological, and toxicological analyses to support TVA's objectives of characterizing the extent of the fly ash deposition, monitoring spill containment and remediation operations, and assessing the potential short-term and long-term health hazards and biological impact.

Field investigation and sampling procedures will be conducted such that samples are representative of the media sampled and the resultant data can be compared to other data sets. Sampling schemes (as described in the associated Work Plans and/or Sampling and Analysis Plans) are designed to provide a statistically meaningful number of field sampling points and the rationale for the collection of these samples. A sufficient number of samples will be collected for each sampling program to adequately characterize the area and provide a sufficiently large data set such that statistical analyses can be performed. Project-specific Work Plans and/or Sampling and Analysis Plans and associated project SOPs will be employed to implement the field investigation and sampling methods, including equipment requirements and decontamination procedures, required to meet the objectives of the project.

This section briefly outlines field investigation procedures for the TVA KIF Ash Recovery Project. Detailed discussions of field protocol are provided in the various SOPs developed for the project. In addition, detailed descriptions of field activities are provided in the project-specific Work Plans and/or Sampling and Analysis Plans and the associated project SOPs.

The investigative rationale for a specific sampling and analytical program is addressed in the project-specific Work Plans and/or Sampling and Analysis Plan and/or the associated project SOPs. All sampling and monitoring activities are subject to the requirements set forth in the TVA KIF SOPs and this QAPP. Project-specific QAPPs will be developed for specific sampling and monitoring activities when QA requirements more stringent than those presented herein are required to support the DQOs for the sampling and monitoring projects.

The sampling design and execution for monitoring activities associated with the TVA KIF Ash Recovery Project are described in the various project-specific Work Plans and/or Sampling and Analysis Plans. It is anticipated that the sampling and monitoring activities for the Site will evolve as construction, remediation, and cleanup activities progress. As the sampling and monitoring programs are developed, additional work plans and/or sampling and analysis plans and project-specific SOPs will be prepared.

As the project progresses, the data generated will be used to evaluate sampling and analytical needs. Subject to regulatory approval, adjustments may be made to sampling schedules, analyte lists, and requested methods when supported by the results of field investigations.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Descriptions of the procedures for the sampling, identification, packaging, and handling of project samples; the decontamination of sampling equipment; and the maintenance of sampling equipment are presented in the associated project SOP and the project-specific Work Plans and/or Sampling and Analysis Plan. An overview of sample identification, documentation, and custody as related to site-wide data collection activities is presented in Section 12.0; complete descriptions of sample identification, documentation, and custody requirements are provided in the TVA KIF *Field Documentation SOP* (TVA-KIF-SOP-06) and the TVA KIF *Management and Implementation of EQuIS®-Based COCs SOP* (TVA-KIF-SOP-18), which may be found on the TVA KIF website.

Each project-specific Work Plan and/or Sampling and Analysis Plan will present Site maps, including sampling locations, for the various sampling and monitoring programs performed at the Site. Detailed descriptions of sampling process design and field sampling activities associated with the TVA KIF Ash Recovery Project are provided in the project-specific Work Plans and/or Sampling and Analysis Plans. Future field investigations and the DQOs associated with those activities will be addressed in project-specific Work Plans and/or Sampling and Analysis Plans and SOPs.

11.0 SAMPLING METHODS REQUIREMENTS

11.1 Sample Containers, Preservation, and Holding Times

Sample container/media, preservation, and holding time requirements for the sample matrices addressed herein are presented in Tables C-1, D-1, E-1, F-1, G-1, H-1, I-1, and J-1. Samples will be stored in accordance with the requirements set forth in the referenced analytical method and/or laboratory SOPs.

Field samples will be contained and preserved in accordance with appropriate EPA specifications. Sampling containers and preservatives will be provided by the laboratory; the supplied sampling containers will be pre-preserved by the laboratory prior to shipment. For chemical analyses, sample containers provided will be new pre-cleaned I-Chem® Series 300 (or equivalent). Samples will be placed in individual pre-cleaned containers for shipment to the laboratory. Samples intended for toxicological monitoring use will be collected and stored in accordance with EPA specifications, the TVA toxicological monitoring program requirements, laboratory SOPs, and analytical methods currently under development for this project.

Sample container orders, when shipped by the laboratory, will include a packing list that details the number and type of bottles shipped, the bottle lot numbers, chemical preservatives, and the packer's signature. The COC Records will be completed by field sampling personnel and returned to the laboratory with the samples. Sample containers will be individually custody-sealed and placed inside the sample cooler. After the cooler is sealed, sampling personnel will attach signed/dated custody seals to the outside of the cooler as described in the TVA KIF *Sample Labeling, Packaging, and Shipping SOP* (TVA-KIF-SOP-07), which is posted on the TVA KIF regulator website.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Samples will be stored according to the applicable storage criteria from the time of collection until the time of analysis by the laboratory. Field personnel will keep samples cold by placing ice in the coolers in which samples will be stored until delivery to the analytical laboratory personnel. After receipt of the samples, it is the laboratory's responsibility to store the applicable samples according to the applicable preservation conditions until preparation and analysis has been initiated.

Samples have a finite holding time (the time between sample collection, sample digestion, and sample analysis) to limit the potential for degradation of the analytes. The holding times for required analyses are measured from the verified time of sample collection. When possible, samples will be shipped by overnight carrier or delivered by same-day courier to minimize the time between collection and laboratory receipt.

11.2 Decontamination

Tools and equipment decontamination procedures are implemented to prevent cross-contamination of samples and to control potential inadvertent transport of hazardous constituents. Personnel decontamination procedures are designed to prevent personnel exposure to chemicals. Disposable sampling equipment will be utilized to the extent possible in an effort to limit the potential for cross-contamination and to reduce labor costs. The non-disposable equipment will be decontaminated using the procedures described in the TVA KIF *Decontamination SOP* (TVA-KIF-SOP-08) and/or the project-specific Sampling and Analysis Plan. General field decontamination procedures are provided in the TVA KIF *Decontamination SOP* (TVA-KIF-SOP-08), which are posted on the TVA KIF regulator website.

12.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Field sampling personnel are responsible for the collection, description, documentation, labeling, packaging, storage, handling, and shipping of samples obtained in the field. These practices are necessary to ensure sample integrity from collection through laboratory analysis and data reporting. To demonstrate and document sample integrity aspects, information relative to the collected project samples will be described and thoroughly documented. Samples will be labeled, packaged, preserved, and shipped to the laboratories for analysis in appropriate sample containers, under the recommended temperature conditions with a COC record documenting the time and day of sample collection.

Laboratory-supplied sample kits with custody seals, packing materials, and EPA-recommended sample containers and preservation methods will be used for all project samples during sample collection and transport to the designated contracted laboratory. The sample containers and preservation requirements per parameter are presented in Tables C-1, D-1, E-1, F-1, G-1, H-1, and I-1 which are included in the Appendices to the QAPP.

In general, samples collected at TVA KIF site are identified using the following nomenclature.

Sample ID: [site]-[location]-[matrix code]-[date]

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

A complete description of the sample nomenclature scheme for the TVA KIF Ash Recovery Project samples is addressed in TVA-KIF-SOP-18 (Section 3.1). The TVA-KIF-SOP-18 includes a complete list of locations and matrix codes for currently planned sampling programs as well as nomenclature for quality control samples. As additional site sampling and monitoring plans are developed, nomenclature will be developed in accordance with the sample locations and naming codes (when necessary) will be generated.

12.1 Sample Documentation

Field activity evidentiary files will be maintained by the TVA Sampling and Monitoring Coordinator and will include information that defines the Project in its entirety, including but not limited to, the information below.

- Field logbooks.
- Raw data.
- QC information.
- COC Records.
- Airbills (when used) for sample shipments.
- Photographs.

Field documentation procedures are described in the TVA-KIF-SOP-06 and in the project-specific Sampling and Analysis Plans.

12.1.1 Chain-of-Custody Record

A primary consideration for environmental data is the ability to demonstrate that samples have been obtained from specific locations and have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody while samples are in the laboratory's possession will be documented by maintaining a COC that records each sample and the individuals responsible for sample collection, shipment, and receipt at the project laboratory. Samples that are collected will be accompanied by a COC record. The following information will be recorded to complete the COC record:

- Project name and number.
- Name of sampler.
- Sample identifier/name, location, date and time collected, and sample type.
- Analyses requested.
- Special instructions and/or sample hazards, if applicable.
- Signature of sampler in the designated blocks, including date, time, and company.
- Sample condition (including temperature) upon receipt as reported by the analytical laboratory.
- Signature of the laboratory receipt personnel in the designated blocks, including date, time, and company affiliation.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Copies of COC records are maintained on site by the TVA Sampling and Monitoring Coordinator. Duplicates of all COC records are retained by the TVA Records Custodian and the Environmental Standards QA Manager as part of the Project File.

For aqueous samples, solid samples, toxicological samples for chemical analysis, air particulate matter samples, and biological samples, COC records will be initiated using the Earthsoft® EQuIS® Sample Planning Module (SPM). SPM procedures, including an example COC record, are addressed in TVA-KIF-DMP-001 and TVA-KIF-SOP-18. SPM relies on defined method analyte groups (MAGs) to communicate sample analysis requirements to the analytical laboratories. MAGs specify required methods, analyte lists, and reporting units to ensure consistent reporting of data among multiple laboratories. In addition, MAGs enable automated data completeness evaluation and data verification upon receipt of electronic data. An overview of the data management process is provided in Section 11.4.

Unused portions of samples collected in association with the TVA KIF Ash Recovery Project will be returned to TVA for on-site archive. Archived samples will be cataloged by the TVA Sample Custodian and stored in an organized manner as described in the TVA KIF S*ample Retain Archive and Maintenance SOP* (TVA-KIF-SOP-30). In the event that project DQOs are not met for a sample, any remaining portion with preparation/analytical holding time remaining may be retrieved and submitted to a contracted laboratory for additional analysis.

12.1.2 Sample Custody in the Field

The purpose of sample custody procedures is to document the history of samples (and sample extracts or digestates) from the time of sample collection through shipment, analysis, and disposal. A sample is considered to be in one's custody if one of the following conditions applies:

- The sample is in an individual's actual possession.
- The sample is in view after being in an individual's physical possession.
- It was in the physical possession of an investigator and then they secured it to prevent tampering; and/or
- It is placed in a designated secure area.

Each individual field sampler is responsible for the care and custody of the samples he/she collects until the samples are properly transferred to temporary storage or are shipped to the laboratory. The following COC procedures will be followed for samples submitted to the laboratory for analyses:

- Each individual field sampler is responsible for the care and custody of samples he/she collects until the samples are properly transferred (relinquished on the COC by a field team member) to another person ("acceptor" of the samples) or are shipped to the laboratory.
- A COC form will be completed by the sampling team for each batch of samples submitted to the laboratory.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

- If multiple coolers are needed, one COC form should accompany each cooler that contains the samples identified on the COC.
- Sample coolers will be packed sealed with custody seals for transport from field and shipment to laboratory in accordance with TVA-KIF-SOP-07.
- Each time a sample batch is transferred (field sampling personnel relinquish custody to the laboratory), signatures of the individuals relinquishing and receiving the sample batch, as well as the date and time of transfer, will be documented on the COC or courier documentation form. Note: commercial courier custody is tracked by commercial courier records and not by COC.
- A copy of the carrier air bill will be retained as part of the permanent COC documentation record.
- The laboratory will record the condition of the sample containers, and cooler temperature upon receipt, and record this information on a combination of sample receipt documentation including a sample receipt confirmation checklist and the COC. Documentation of sample preservation checks (where applicable) will be recorded in the sample preparation documentation.

Changes or corrections to the information documented by the COC record (including, but not limited to, field sample ID or requested analyses) must be changed, dated, and initialed by the person making the change. If the request for a change or correction comes from the Field Team after the COC records have been relinquished to the laboratory, a copy of the COC record will be revised, initialed, and forwarded to the laboratory, where the revised version will supersede the original COC record. The original COC record and any documented changes to the original record will be included as part of the final analytical report to the TVA Technical Liaison/QA Officer. This record will be used to document sample custody transfer from the sampler to the laboratory and will become a permanent part of the Project File.

At the end of each day samples are collected or at the end of the sampling event, sample coolers with appropriate custody seals will be shipped to the contract laboratory.

12.2 Sample Packaging and Shipment

Samples will be packed and shipped to the laboratory in accordance with applicable U.S. Department of Transportation (US DOT) regulations, consulting corporate guidelines, and International Air Transport Association (IATA) standards (as detailed in the most current edition of *IATA Dangerous Goods Regulations* for hazardous materials shipments), as applicable.

Samples requiring temperature preservation at <6°C (not frozen) will be placed immediately after sample collection on wet ice and packaged with additional wet ice (as necessary) for shipment to the analytical laboratory. Air filters requiring temperature preservation at <6°C will be packaged with blue ice for shipment to the analytical laboratory. Samples requiring temperature preservation at <-10°C will be packaged with dry ice for shipment to the analytical laboratory.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

12.3 Sample Custody in the Laboratory

The following subsections describe the COC procedures associated with sample receipt, storage, tracking, and documentation by the laboratory.

12.3.1 Sample Receipt

A designated Laboratory Sample Custodian will be responsible for samples received at the laboratory. The Laboratory Sample Custodian will be familiar with custody requirements and the potential hazards associated with environmental samples. In addition to receiving samples, the Laboratory Sample Custodian will also be responsible for documenting sample receipt, storage before and after sample analysis, and the proper disposal of samples. Upon sample receipt, the Sample Custodian will:

- Inspect the sample containers for integrity and ensure that custody seals are intact on the shipping coolers. The temperature of the samples upon receipt and the presence of leaking or broken containers will be noted on the COC record/sample receipt forms.
- Sign (with date and time of receipt) the COC/sample analysis request forms, thereby assuming custody of the samples and assign the laboratory sample identification numbers.
- Compare the information of the COC record/sample receipt with the sample labels to verify sample identity. Any inconsistencies will be resolved with the Field Team, TVA Technical Liaison/QA Officer, and Environmental Standards QA Manager before sample analysis proceeds.
- Store samples in accordance with Section 12.3.2.

The TVA Technical Liaison/QA Officer and Environmental Standards QA Manager must be notified immediately via email or documented telephone call when samples are received broken or improperly preserved. All samples received in a condition that may potentially impact results will be placed on hold pending direction from the TVA Technical Liaison/QA Officer and Environmental Standards QA Manager. In the event that aqueous samples for metals analyses are received at pH >2, acid preservative will be added by the laboratory (fully traceable via laboratory logbooks) and the samples will equilibrate in the originally received bottleware for a minimum of 24 hours prior to digestion. The equilibration period will be fully documented via laboratory logbooks.

12.3.2 Sample Storage

Analytical samples will be stored in a locked facility and maintained within the appropriate temperature range as specified in EPA SW-846 Chapter 3 and Chapter 4, or Table II of 40 CFR 136.3 sample storage requirements. The temperature will be monitored and recorded daily by laboratory personnel.

Required sample storage conditions are presented in Tables C-1, D-1, E-1, F-1, G-1, H-1, I-1, and J-1.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

12.3.3 Sample Tracking

Each sample will receive a unique laboratory sample identification number at the laboratory when the sample is logged into the laboratory information management system (LIMS).

Sample preparation/digestion records will be generated to fully document all sample handling prior to analysis. Laboratory data will be entered on the sample digestion form and permanently recorded in a laboratory logbook.

The laboratory will maintain a sample tracking system that documents the following:

- Organization/individual who performed sample analyses.
- Date of sample receipt, extraction or digestion, and analysis.
- Names of analysts.
- Sample preparation procedures.
- Analytical methods used to analyze the samples.
- Calibration and maintenance of instruments.
- Deviations from established analytical procedures, if applicable.
- QC procedures used to ensure that analyses were in control during data generation (instrument calibration, precision checks, method standards, method blanks, etc.).
- Procedures used for the calculation of precision and accuracy for the reported data.
- Statement of quality of analytical results.

12.4 Sample Archive

Archived samples will be received from the laboratory under COC and relinquished to the TVA Sample Custodian. The sample archive will be locked such that sample custody is maintained. Only the TVA Sample Custodian or those authorized by memorandum by the TVA Sampling and Monitoring Coordinator are authorized to access the sample archive.

13.0 ANALYTICAL METHODS REQUIREMENTS

Routine analytical services are performed using standard EPA-approved methodology. Analytical methods cited in the QAPP reference *The Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA SW-846); US EPA Office of Water Methods; *Standard Methods for the Evaluation of Wastewater and Waste* (Standard Methods); the *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air*; ASTM, and NIOSH methods.

13.1 Field Analysis

Surface water samples will be monitored for the following field parameters using Hydrolab® instruments as summarized below.

- Continuous monitoring of temperature, dissolved oxygen, specific conductance, pH, and turbidity by Hydrolab® instruments deployed from floating platforms.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

- Daily field monitoring via boat using Hydrolab® instruments to record field parameters for surface water samples.

Field analyses will be conducted in accordance with the associated field sampling SOPs. The results from field analyses are electronically delivered to the project database for trending and related statistical analysis. Details of the data flow process for field instrumental data is addressed in the associated Work Plans and/or Sampling and Analysis Plan.

Detailed descriptions of field monitoring activities, the field analytical equipment, and the sampling equipment utilized to perform the field activities are provided in the project-specific Work Plans and/or Sampling and Analysis Plans, and/or in the associated SOPs. Cross-walk tables referencing the location of QAPP-required elements in post-Consent Order documents may be found in Attachment 2 of the QAPP.

13.2 Laboratory Analysis

To support the objectives of the TVA KIF Ash Recovery Project, the collected samples will be tested for the methods, constituents, and reporting limits listed in Tables C-2, D-2, E-2, F-2, G-2, H-2, I-2, and J-2. Individual sample reporting limits may vary from the laboratory's routinely reported limits; this variance may be a result of dilution requirements, sample weight or volume used to perform the analysis, dry-weight adjustment for solid samples, the presence of analytical background contaminants, or other sample-related or analysis-related conditions. Additional analytical needs may be identified based on future construction or remediation activities; as needed, the appendices will be modified or QAPP addenda will be prepared to document the QC requirements associated with these additional analyses.

Dissolved metals analysis of surface water samples shall be performed on field-filtered (0.45-µm filter) water samples. Sample aliquots collected for dissolved analyses will be preserved after filtration. Preserved aqueous samples for metals analysis will be allowed to equilibrate a minimum of 24 hours between sample preservation and digestion.

The laboratory SOPs for the performance of the analytical methodology associated with the TVA KIF Ash Recovery Project are accessible for regulatory agency review on the TVA shared project website. The versions of SOPs available for review are current as of publication of this QAPP. Laboratory SOPs are reviewed and updated by the laboratories on a regular basis; newer versions of SOPs will be posted only when significant changes are made. The laboratory SOPs provided on the shared website are intended for use on this project and other uses are not permitted unless expressly allowed by the analytical laboratory.

The reporting limits indicated in the Appendices represent the maximum reporting limits (not adjusted for sample weight/volume, dilution factors, and percent moisture for non-aqueous samples). TVA's contracted laboratories will determine method detection limit (MDL) studies in accordance with 40 CFR Part 136, Appendix B on an annual basis per method and matrix. Because this method of determination of the MDL is designed to protect against false positives and the false negative rate at the 40 CFR Part 136 determined MDLs is 50 percent, TVA's contracted laboratories have been requested to report to a project MDL, which by some has been

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

defined as a Limit of Detection. Project MDLs have been established as the higher value of the 40 CFR Part 136 calculated MDL and the project MDL. Project MDLs are calculated based on historical blank concentrations as described by the equation below.

$$\text{Detection limit} = \text{avg} + 3\,\sigma$$

Where: avg = the numerical average of historical method blank concentrations per analyte
σ = standard deviation of the population of historical method blank concentrations per analyte

Project MDLs are employed to ensure that data are defensible to a concentration sufficient to achieve the lowest applicable regulatory standard for an analyte.

The laboratory will perform a percent moisture analysis on all solid and biological samples where possible in accordance with EPA SW-846 procedures for determining dry-weight basis. Solid and biological samples will be reported on a dry-weight basis unless specifically requested otherwise; biological data may be reported on a wet-weight or as-received basis when sufficient sample volume is not available to perform moisture analysis; when requested by the data end-user for comparison to historical data or screening levels; or when sample preparation is not conducive to dry-weight reporting (such as freeze-dried homogenization). The reporting basis (wet-weight, as-received, or dry-weight) will be specified in the hardcopy data and maintained as a sample attribute in the database.

13.2.1 Toxicological Analysis

As part of the evaluation of the potential biological impact of Emory River channel dredging and related activities, freshwater organisms will be used to conduct the following toxicity tests.

- Whole Sediment toxicity evaluation
- Elutriate toxicity evaluation
- Plume toxicity evaluation
- Polymer toxicity evaluation

Additional analytical methods may be required for future sampling and monitoring activities; as analytical requirements evolve, project-specific Work Plans and/or Sampling and Analysis Plans will be developed to describe DQOs and specific QC requirements.

13.2.2 Ambient Air Monitoring

Ambient air monitoring will be conducted to monitor the air quality outside of the immediate spill area. The objective of the ambient air monitoring program is to measure airborne particulates onsite and in the adjacent community and to provide operational information for site dust control measures during the remediation efforts. A description of the air monitoring program is provided in the *TVA Kingston Fossil Plant Ash Recovery Project Site Dust Control and Air Monitoring Plan* (Revision 1, May 2010); air monitoring activities will be conducted in accordance with the *Ambient Air Monitoring Plan* (Revision 1) contained in Attachment A of the document.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

13.2.3 Biological Analysis

Biological monitoring will be conducted to assess the potential short-term and long-term impact on aquatic and terrestrial wildlife resulting from the initial ash release and the ongoing construction and remediation activities at the Site. Biological monitoring will be conducted with input and guidance from TDEC, the Tennessee Wildlife Resources Agency (TWRA), and the US Fish and Wildlife Service. Proposed biological monitoring programs include, but are not limited to, the following.

- Amphibians.
- Birds and bird eggs.
- Reptiles.
- Mammals.
- Vegetation.
- Benthic invertebrates.

Additional detail regarding biological sampling at the Site is presented in the associated project-specific Work Plans and/or Sampling and Analysis Plans and SOPs. Cross-walk tables referencing the location of QAPP-required elements in post-Consent Order documents may be found in Attachment 2 of this QAPP.

13.2.4 Industrial Hygiene Monitoring

Industrial Hygiene (IH) monitoring will be conducted to evaluate worker exposure to adverse conditions resulting from project activities. IH monitoring will be performed in accordance with the *Kingston Ash Recovery Industrial Hygiene Monitoring Plan* (June 2010). The *IH Monitoring Plan* was developed as an appendix to the *TVA Kingston Fossil Plant Site Wide Safety and Health Plan* (SWSHP).

The objectives of the IH plan are as follows:

- Identify specific responsibilities for site health, safety, and environmental (HSE) staff and operations management with regard to IH program support.
- Identify the various Similar Exposure Groups (SEGs) to be monitored on site with the intent of drawing group level conclusions with regards to health exposures and controls.
- Specify the target stressors (chemical, physical, biological) that will require routine monitoring for each SEG.
- Identify specific action levels to trigger mitigation or programmatic development activities. These may include field controls, work techniques, training, medical monitoring, or utilization of personal protective equipment.
- Document the monitoring protocols for the site including frequency, specific analytes to be monitored and the sample methods to be employed.
- Establish a means to create and distribute proper IH documentation to TVA management, operational management, TVA subcontractors, and individual workers.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

14.0 QUALITY CONTROL REQUIREMENTS

This section describes the data objectives and associated data quality indicators used for the project. QA procedures are designed to ensure high quality for all environmental data associated with this project.

The subsections below are intended to provide an introduction to site-wide QA objectives and protocols and set forth minimum requirements for the TVA KIF Ash Recovery Project. Activity-specific QA requirements may be more stringent; the activity-specific requirements are addressed in the associated project-specific Work Plans and/or Sampling and Analysis Plans.

14.1 General

There are four levels of data quality that have been developed for this project. The data quality levels defined below provide general indications of measurement defensibility. The data quality level of a particular measurement is used to determine whether that measurement is sufficient to meet the project-specific DQOs.

Field Screening – This level is characterized by the use of portable analytical instruments (such as temperature probe) which can provide real-time data to assist in the optimization of sampling locations and health and safety support. Data can be generated regarding the presence or absence of certain contaminants at sampling locations.

Field Analyses - This level is characterized by the use of portable analytical instruments which can be used on site (such as Hydrolab® instrument) or in a mobile laboratory stationed near a site. Depending on the types of contaminants, sample matrix, and personnel skills, qualitative and quantitative data can be obtained.

Screening Data with Definitive Confirmation – These data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provides analyte identification and quantitation, although the quantitation may be relatively imprecise. At least 10% of the screening data should be confirmed using appropriate analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data is not considered to be data of known quality.

Definitive Data – These data are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. These methods produce tangible raw data (such as chromatograms, spectra, or digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site laboratory location, as long as the QA/QC requirements

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

are satisfied. To be definitive, either the analytical or total measurement error must be determined. For a more detailed discussion, refer to EPA's, *Data Quality Objectives Process for Superfund, Interim Final Guidance*, EPA540-R-93-071 (September 1993, pages 41-44).

Field Screening data will be obtained with portable instruments such as pH meters, temperature probes, which may be used for health and safety and field operational monitoring. In addition, these instruments or field test kits may be used to produce data for determining where to collect a sample to assess impacts and for field screening of samples to be designated for laboratory confirmation analyses. Field Analyses data will be obtained for surface water analyses performed using the Hydrolab® instrument. In addition, portable air monitors will generate Field Analyses level quality data.

A Definitive data QA Program will be executed by the laboratory for the chemical analysis specified to meet the project-specific DQOs with the exception of moisture content, grain size analysis, specific gravity, laser particle size analysis, and polarized light microscopy analysis, which will be executed as Level Screening Data with Definitive Confirmation.

Attainment of qualitative data indicators is assessed by monitoring QA measures, such as accuracy, precision, representativeness, comparability, and completeness, as discussed in Section 22.0. Specific qualitative criteria for the chemical analyses to be performed in association with the TVA KIF Ash Recovery Project are presented in detail in Section 22.0 and in Tables C-3, D-3, E-3, F-2, G-3, H-3, I-3, and J-3. Data indicators for toxicological monitoring analyses are described in Table F-2 and in the associated laboratory SOPs and referenced methods. The objectives associated with accuracy and precision of laboratory results are assessed through an evaluation of the results of QC samples. The accuracy of field measurements for temperature and other field parameters will be assessed by calibration, as described in the associated field SOPs.

14.2 Field and Laboratory Quality Control Samples

The quality of data collected in the field will be controlled, monitored, and verified by maintaining site logs, by documenting field activities, and by collecting and analyzing of QC samples concurrently with investigative samples. Field and laboratory QC samples will be used to assess accuracy and precision for chemical analyses to gauge both field and laboratory activities. Further discussion and equations for determining precision and accuracy may be found in Section 22 of the QAPP. In addition, specific requirements for comparability, completeness and representativeness of field and laboratory quality control samples may be found in Section 22 of the QAPP. QC samples will be used to assess laboratory performance and gauge the likelihood of cross-contamination associated with both field and laboratory activities.

Accuracy will be assessed for toxicological analyses by the analysis of negative control samples. Precision will be assessed for toxicological analyses through a series of dilutions and replicate analyses as described in the associated laboratory SOPs and referenced analytical methods.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

The subsections below apply to chemical analyses performed on aqueous, solid, air, and biological samples associated with the TVA KIF Ash Recovery Project. The quality of toxicity testing data will be controlled in accordance with the laboratory QA Program, laboratory SOPs, and the methods developed for this project. The *KIF Ash Recovery Project Sampling and Analysis Plan for Phase I Dredging* (March 2009) and the associated laboratory SOPs detail the toxicological evaluations that will be performed.

QC samples will be collected and analyzed in conjunction with samples designated for laboratory analysis using EPA methods. Standard analytical QC checks that may be instituted by field and laboratory personnel will include, but not be limited to, the following:

- Equipment Rinsate Blanks.
- Field Duplicate Samples.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples.
- Laboratory Method Blanks.
- Laboratory Control Samples.
- Laboratory Duplicate Samples.

These types of QC samples are discussed in the following subsections. Field QC samples will be submitted to the laboratory using the same information as the associated investigative samples.

Field QC samples will be collected at the frequency specified in Table 14-1. Laboratory QC samples will be analyzed at the frequency specified in the associated laboratory SOPs and referenced analytical methods. The analysis frequencies specified below are considered the minimum required frequencies; project-specific Work Plans and/or Sampling and Analysis Plans and/or SOPs may require more frequent collection of field QC samples. Cross-walk tables referencing the location of QAPP-required elements in post-Consent Order documents may be found in Attachment 2 of the QAPP.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table 14-1. Field Quality Control Sample Minimum Frequency

Field QC Sample	Aqueous Sampling Frequency	Solids Sampling Frequency	Air Sampling Frequency	Biological Sampling Frequency	Oil Sampling Frequency	Wipe Sampling Frequency
Equipment Rinsate Blank	1 per week when dedicated sampling equipment is utilized; 1 per sampling event when sampling equipment is reused	1 per sampling event	N/A	Prior to use for decontaminated equipment	1 per sampling event	N/A
Air Filter Blank	N/A	N/A	1 per 20 field samples	N/A	N/A	N/A
Wipe Blank	N/A	N/A	N/A	N/A	N/A	1 per sampling event
Field Duplicate*	1 per 20 field samples; minimum of 1 per sampling event	1 per 20 field samples; minimum of 1 per sampling event	1 per 20 field samples	1 per 20 field sample aliquots or 1 per species	1 per 20 field samples	1 per sampling event
Matrix Spike/ Matrix Spike Duplicate Pair	1 per 20 field samples; minimum of 1 per sampling event	1 per 20 field samples; minimum of 1 per sampling event	1 per 20 field samples	1 per 20 field sample aliquots or 1 per species	N/A	N/A

N/A Not Applicable
* True field duplicate samples are not feasible for air sampling, ash/sediment cores, wipe samples, or biological specimens; consequently, co-located samples will be collected.

14.2.1 Equipment Rinsate Blanks

Collection and analysis of equipment rinsate blanks are performed to assess the efficiency of field equipment decontamination procedures in preventing cross-contamination between samples. Analyte-free reagent water will be poured into/through/over clean (decontaminated) sampling equipment used in the collection of investigative samples and subsequently collected into prepared sample bottles. For biological specimens, equipment rinsate blanks will be used to monitor decontamination of holding tanks or similar laboratory equipment; equipment blanks associated with biological specimens will be collected prior to specimen introduction. For Vibecore® sampling, analyte-free reagent water will be poured through Lexan® tubing. Preservatives or additives will be added as required and the sample bottle will be sealed. The rinsate blank will be analyzed for the same parameters as the investigative samples.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

14.2.2 Air Filter Blanks

Analyses of air filter blanks are used to assess potential contamination of samples from the native presence of target analytes in the filters used for air sample collection. An air filter blank consists of a clean filter that is transported with associated investigative samples but is never taken out of its protective sleeve. The air filter blank will be analyzed for the same parameters as the investigative samples and will also be from the same filter lot as the associated investigative samples.

14.2.3 Wipe Blanks

Analyses of wipe blanks are used to assess potential contamination of samples from the native presence of target analytes in the solvent or the wipe media used for sample collection. A wipe blank consists of a clean wipe that has been soaked in the solvent used for sample collection. The wipe blank will be analyzed for the same parameters as the investigative samples and will also be from the same lot as the associated investigative samples.

14.2.4 Field Duplicate Samples

Field duplicate samples are used to check for sampling and analytical error, reproducibility, and homogeneity. For sediment samples, the duplicate will be obtained by collecting a sample from an area adjacent to the routine sample or by collecting a separate aliquot of sediment from within the same core (that is, co-located sample), whichever is more appropriate for the type of sample/sampling technique (surface or subsurface sediment sample). For biological specimens, the duplicate will be obtained by collecting additional specimen(s) from a particular area. For ambient air sampling, duplicates will be collected via co-located sampling instrumentation. Duplicates will be analyzed for the same parameters as the associated investigative samples.

14.2.5 Matrix Spike/Matrix Spike Duplicate Samples

MS/MSD samples are investigative samples to which known amounts of compounds are added in the laboratory before extraction/digestion and analysis. The recoveries for spiked analytes can be used to assess how well the method used for analysis recovers target analytes in the site-specific sample matrix. In the event that sufficient sample volume to perform MS/MSD analyses is not provided, the laboratory may substitute laboratory control sample/laboratory control sample duplicate (LCS/LCSD) analyses (see Section 14.2.6).

14.2.6 Laboratory Method Blanks

Method blanks consist of analyte-free materials (such as reagent water) and reagents (such as sodium sulfate) that are prepared in the same manner as the associated samples (digested, extracted, etc.) and that are analyzed and reported in the same manner as the associated investigative samples. Laboratory method blanks will be performed as indicated in the analytical method and in the associated laboratory SOPs.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

14.2.7 Laboratory Control Samples/Laboratory Control Sample Duplicates

An LCS is a sample of laboratory certified material that is fortified (spiked) with the analytes of interest or a certified reference material that is prepared and analyzed in the same manner as investigative samples. The LCS must be from a source that is different from the source of the initial calibration standards (that is, second-source). LCS data are used to monitor analytical accuracy and laboratory performance. LCSs are prepared and analyzed with each preparation batch of 20 (or less) field samples. In the event that insufficient sample volume to perform MS/MSD analyses (Section 14.2.5) is received, an LCSD will be prepared to assess laboratory precision. LCS will be performed at a minimum frequency of 1 per batch of 20 (or fewer) field samples or as required by the referenced analytical method and as specified in the associated laboratory SOPs available on the TVA shared project website.

14.2.8 Laboratory Duplicate Samples

A duplicate sample is obtained by splitting a field sample into two separate aliquots and performing separate preparation and analysis on the respective aliquots. The analysis of laboratory duplicate samples monitors precision; however, precision may be affected by sample homogeneity, particularly in the case of solid samples. Laboratory duplicates will be analyzed and reported with every batch of 20 (or fewer) field samples. MSDs may be substituted for laboratory duplicates for inorganic analyses. The laboratory will utilize a project sample for the laboratory duplicate in every batch that includes project samples.

14.3 Independent Research/Split Samples

Due to the nature of ash release at the TVA KIF site, many academic and research institutions have requested permission to collect samples for independent analysis (that is, outside of the TVA KIF Ash Recovery Project sampling and monitoring activities). To the greatest extent possible, TVA will obtain split samples for any third-party sampling for analysis by TVA's contracted laboratories for verification and comparison purposes.

Oak Ridge Associated Universities (ORAU) has established a Kingston Research Consortium to help ensure consistency and completeness of research activities. The ORAU Kingston Research Consortium will conduct peer review of proposed work plans and/or sampling and analysis plans and approve projects that meet a high standard of scientific reasoning and validity. The ORAU Kingston Research Consortium will be key in distributing resources among interested parties such that approved research projects are able to move forward with minimal disturbance to the Site.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

15.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

15.1 Field Equipment

Equipment failure will be minimized by routinely inspecting all field equipment to ensure that it is operational and by performing preventive maintenance procedures. Field sampling equipment will be inspected prior to sample collection activities by the field team members and all repairs will be made prior to decontamination and reuse of the sampling equipment. Routine preventive maintenance procedures, at a minimum, will include removal of foreign debris from exposed surfaces of the sampling equipment, storage of equipment in a cool dry place protected from the elements, inspections of the equipment each day prior to use, and verification of instrument calibrations as described in Section 16. Maintenance and operation of ambient air sampling equipment is described in the AAMP (Revision 1, May 2010). Maintenance and operation of industrial hygiene monitoring equipment is addressed in the *IH Monitoring Plan* (June 2010).

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure based on the manufacturer's instructions or recommendations. Maintenance will be performed in accordance with the schedule specified by the manufacturer to minimize the downtime of the measurement system. Maintenance work will be performed by qualified personnel.

A list of critical spare parts will be developed prior to the initiation of fieldwork. Field personnel will have ready access to critical spare parts to minimize downtime while fieldwork is in progress. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory. A listing of field equipment and critical spare parts (where applicable) may be found in the site-specific Work Plans and/or Sampling and Analysis Plans and/or associated field SOPs. Cross-walk tables referencing the location of QAPP-required elements in post-Consent Order documents may be found in Attachment 2 of the QAPP.

Non-routine maintenance procedures require field equipment be inspected prior to initiation of fieldwork to determine whether or not the equipment is operational. If not operational, the equipment will be serviced or replaced. Batteries will be fully charged or new, as applicable.

The ability to collect valid samples requires that field equipment be appropriately cleaned and maintained. The elements of an effective maintenance program are identified below.

- Pre-cleaned or certified clean equipment.
- Spare parts.
- Contingency plan.
- Maintenance and repair of non-dedicated equipment.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

15.2 Laboratory Equipment

The ability to generate valid analytical data requires that analytical instrumentation be properly maintained. The laboratory will be responsible for appropriate maintenance for major instruments. The elements of an effective maintenance program are identified below and discussed in the following subsection:

- Instrument maintenance logbooks.
- Instrument maintenance and repair.
- Available spare parts.
- Contingency plans.

Periodic preventive maintenance is required for all sensitive equipment. Instrument manuals will be kept on file for reference when equipment needs repair. The troubleshooting section of factory manuals may be used to assist personnel perform maintenance tasks.

Major instruments in the laboratory are covered by annual service contracts with manufacturers or other qualified personnel (internal or external). Under these agreements, regular preventive maintenance visits are made by trained service personnel. Maintenance is documented and maintained in permanent records by the individual responsible for each instrument.

The calibration and maintenance sections of the laboratories' SOPs will establish the schedule for servicing critical items to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule and will promptly arrange any necessary service. Qualified personnel will perform required service.

15.2.1 Instrument Maintenance Logbooks

Each analytical instrument will be assigned an instrument logbook. Maintenance activities will be recorded in the instrument logbook and the information entered will include:

- Date of service.
- Person performing the service.
- Type of service performed and reason for service.
- Replacement parts installed (if applicable).
- Miscellaneous information.

If service is performed by the manufacturer or its representative, a copy of the service record will be inserted into the page facing the logbook page where the above cited-information has been entered.

15.2.2 Instrument Calibration and Maintenance

An overview of the routine calibration procedures used for analytical instrumentation is presented in Section 16.0. Preventive maintenance and calibration by manufacturer service representatives will be provided on a routine basis.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

In addition to maintenance by manufacturer service representatives, procedures for routine maintenance in accordance with manufacturer specifications for each analytical instrument will be followed by the laboratory. These procedures will include maintaining inventories of spare parts used routinely (such as spare torches for ICP/MS). Instrument operators have the responsibility to ensure that an acceptable inventory of spare parts is maintained.

Instrument calibration and maintenance procedures will be conducted in accordance with the laboratory's QA Program and the specific calibrations sections of the laboratory's analytical SOPs available on the TVA shared project website.

16.0 INSTRUMENT CALIBRATION AND FREQUENCY

This section provides the requirements for calibration of measuring and test equipment/instruments used in field sampling and laboratory analysis. The calibration procedures stipulated in the QAPP are designed to ensure that field equipment and instrumentation are calibrated to operate within manufacturer specifications and that the required traceability, sensitivity, and precision of the equipment/instruments are maintained. Measurements that affect the quality of an item or activity will be taken only with instruments, tools, gauges, or other measuring devices that are accurate, controlled, calibrated, adjusted, and maintained at predetermined intervals to ensure the specified level of precision and accuracy.

In general, instrument calibration will be conducted in accordance with manufacturer's recommendations, method requirements, and field or laboratory SOPs.

16.1 Field Equipment Calibration and Procedures

Field instruments that may be used include, but are not limited to, the following:

- Hydrolab® Instrument.
- Oxidation Reduction Potential Meter.
- Dissolved Oxygen Meter.
- Water Flow Meter.
- Water Level Meter.

All field analytical equipment used to conduct surface water monitoring will be calibrated/standardized daily prior to use. The calibration/standardization procedures for field instrumentation are described in the calibration section of the applicable field SOPs. The calibration/standardization acceptance criteria for field instruments are provided in the applicable TVA KIF SOP. Calibration/standardization frequency and acceptance criteria for air monitoring equipment are presented in the associated Work Plans and/or Sampling and Analysis Plans or SOPs. Cross-walk tables referencing the location of QAPP-required elements in post-Consent Order documents may be found in Attachment 2 of the QAPP.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Calibration of ambient air sampling equipment is described in the AAMP (Revision 1, May 2010). Calibration of industrial hygiene monitoring equipment is addressed in the *IH Monitoring Plan* (June 2010).

Personnel performing instrument calibrations/standardizations shall be trained in its proper operation and calibration. Records of all instrument calibration/standardization will be maintained by the Field Team Leader in the field logbook and will be subject to audit by the Environmental Standards Field Oversight Coordinator. The Field Team Leader will maintain copies of all the instrument manuals on site.

The calibration records will include documentation of the following information in the field logbook:

- Instrument name and identification number.
- Name of person performing the calibration.
- Date of calibration.
- Calibration points.
- Results of the calibration.
- Manufacturer lot number of the calibration standards.
- Expiration dates for the calibration standards, when applicable.

Field equipment will be properly inspected, charged, and in good working condition prior to the beginning of each working day. Prior to the start of each working day, the Field Team Leader will inspect equipment to ensure its proper working condition. Field equipment and instruments will be properly protected against inclement weather conditions during the field work. At the end of each working day, field equipment and instruments will be properly decontaminated, taken out of the field, and appropriately placed for overnight storage and/or charging. Hydrolab® instruments used for continuous monitoring will be inspected each working day.

Calibration checks may suggest the need for maintenance or calibration by the manufacturer. Field instruments that do not meet the calibration requirements will be taken out-of-service until acceptable performance can be verified. Maintenance should be performed when the instrument will not adequately calibrate. Maintenance of field equipment should be noted in an instrument logbook or field notebook.

Field equipment calibration is addressed in greater detail in the SOPs associated with each field investigation or monitoring activity.

16.2 Laboratory Equipment Calibration

Instruments and equipment used in the laboratory will be controlled by a formal calibration program as described in the laboratory's Quality Assurance Manual. The program will verify that the equipment has the proper calibration range, accuracy, and precision to generate data comparable with specific requirements. All calibration will be performed by laboratory personnel experienced in the referenced methods for the analysis of project samples for the constituents of concern.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Instrument calibration procedures are described in the calibration section of the associated laboratory SOP. At a minimum, laboratory instrument calibration will be performed in accordance with the associated technical and quality control requirements specified in the method applicable to the associated work plans and/or sampling and analysis plans. Laboratory SOPs for the analytical methods performed in association with the TVA KIF Ash Recovery Project are available for regulatory agency review on the TVA shared project website.

The laboratory will provide all data and information to demonstrate that the analytical system was properly calibrated at the time of analysis, including calibration method, required frequency, source of standards, response factors, linear range, check standards, and applicable control limits, as part of the data deliverables.

Before any instrument is used as a measuring device, the instrument's response to reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. Preparation of reference materials used for calibration will be documented in a laboratory notebook.

The two types of laboratory instrument calibration are initial calibration and continuing calibration verification. Initial calibration procedures establish the calibration range of the instrument. Typically, multiple analyte concentrations are used to establish the calibration range and calibration data. The laboratory evaluates the resulting calibration data as detailed in the calibration section of the associated SOP.

Continuing calibration verification usually measures the instrument's response to fewer calibration standards and requires instrument response to fall within certain limits of the initial measured instrument response. Continuing calibration verification may be used within an analytical sequence to verify stable calibration throughout the sequence and/or to demonstrate that instrument response did not drift during a period of non-use of the instrument.

The QA measures in the calibration section of the associated laboratory SOP will be used for calibration, calibration verification, and subsequent sample analyses. In addition, the following procedures will be used for the calibration of balances and thermometers.

Laboratory balances will be calibrated and serviced annually by a certified contractor. Balances will undergo a calibration check prior to use each day using multiple S-Class or equivalent class weights that bracket the usage range. A record of calibrations and daily checks will be documented.

Oven and refrigerator thermometers will be calibrated annually against a National Institute of Standards and Technology (NIST)-certified thermometer in the range of interest. Annual calibrations will be documented. Daily oven and refrigerator readings will be recorded. Thermometers must be tagged with any applicable correction factors.

Records will be maintained as evidence of required calibration frequencies, and equipment will be marked suitably to indicate calibration status. If marking on the equipment is not possible, records traceable to the equipment will be readily available for reference.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

17.0 DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT MEASUREMENTS

Historical and legacy data will be gathered and evaluated to determine site conditions prior to the ash release and to establish a background for contaminants of concern. Historical and legacy data has been provided by several agencies, including TVA and ORNL. Historical and legacy data will be used quantitatively for human health and ecological risk assessments only when data are of known quality/defensibility. Data are considered of known quality/defensibility if comprehensive data deliverables are available to fully substantiate the reported analytical results and the data have been validated. Data with unknown or limited quality may be used for qualitative purposes only.

Historical and legacy data will be transmitted in its original format whenever possible. In addition, raw data and other supporting documentation will be acquired and validated as applicable.

Publications from various academic institutions will be reviewed to assist in project decision-making. Where possible, the authors of the publication will be contacted directly and may be retained for expert technical advice and collaboration.

18.0 DATA MANAGEMENT

A comprehensive data management plan has been developed for the TVA KIF Ash Recovery Project to ensure that all environmental data associated with the project are appropriately maintained and accessible to data end users. The *Data Management Plan for the TVA KIF Ash Recovery Project* (TVA-KIF-DMP-001, Revised September 2009) provides a basis for supporting a full technical data management business cycle from pre-planning of sampling events to reporting and analysis with a particular emphasis on ensuring completeness, data usability, and most importantly defensibility of the data.

Data are collected from several data streams and consolidated in a single project database. QA procedures have been implemented at each step in the data transfer process to ensure that a complete, correct data set is maintained. A detailed description of the various elements of the data management program is presented in TVA-KIF-DMP-001. In addition, TVA-KIF-DMP-001 describes sample planning and tracking process and details the flow of historical/legacy data, fixed-base laboratory data, field data, and continuous monitoring data into the project database.

The Environmental Standards Data Manager is responsible for ensuring that data are reported to the EPA's Scribe.net database. The Environmental Standards Data Manager is further responsible for ensuring that metals data are reported to the AQS database; all other AQS reporting is performed by TVA. Reporting of data from the project database to external databases is described in TVA-KIF-DMP-001.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

19.0 ASSESSMENTS AND RESPONSE ACTIONS

The primary goal of the TVA KIF Ash Recovery Project QA Program is to ensure that project data objectives are met and that defensible analytical data are generated for use decision-making processes. The TVA KIF Ash Recovery Project QA Program includes systems and performance audits to ensure that established QA procedures are properly implemented.

The QAPP will be distributed to each contractor responsible for the collection, generation, and interpretation of field and analytical data. The Environmental Standards QA Manager will be responsible for ensuring that necessary revisions are made so that the QAPP is up-to-date with actual practices and will ensure that revisions and updates are distributed to all necessary users. The document control format used in the QAPP will identify the QAPP revision number and revision date. A revision history that identifies each revision and a summary of the revision will be maintained.

19.1 Field Activities

Field QA will include (but not be limited to) the following:

- Instrument calibration.
- Documentation of sample collection and field conditions.
- Adherence to COC procedures.
- Adherence to the QAPP, the project-specific Work Plans and/or Sampling and Analysis Plans, and the associated field SOPs.
- Collection of field QC samples.

The QA review for usability of objective field data will be performed at two levels. For the first level, data will be reviewed at the time of collection by following standard procedures and QC checks. For the second level, after data reduction to table format or arrays, the data will be reviewed for inconsistent values.

Any inconsistencies identified during data review will be investigated by the TVA Sampling and Monitoring Coordinator. When possible, the TVA Sampling and Monitoring Coordinator will seek clarification from the field personnel responsible for collecting the data. Resolution of discrepancies will be documented using the corrective action process detailed in Section 19.4.

Field data will be reviewed for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made to check recorded data at that time to confirm the recorded observations. Whenever possible, peer review will also be incorporated into the QA review process in order to maximize consistency among field personnel.

Any observed discrepancies between the COC record and the samples received will be documented by the laboratory, and the TVA Technical Liaison/QA Officer and the TVA Sampling and Monitoring Coordinator will be notified.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

The field COC record information will be initially keyed into and maintained in the laboratory's database. A copy of the laboratory's COC record, referred to as sample receipt confirmation, will be sent to the TVA Technical Liaison/QA Officer following sample log-in for verification of properly entered and COC record requests and information such as sample identification numbers, analyses requested, and the quantity of samples. In case of discrepancies between the COC record and the sample receipt confirmation, the appropriate revisions will be communicated to the laboratory for the appropriate COC record corrections. Corrected information on the COC record will be recorded into the project data management system.

19.2 Laboratory Analysis

Internal laboratory QA will consist of the following:

- Instrument performance checks.
- Instrument calibration and calibration verification.
- Retrieval of documentation pertaining to instrument standards, samples, and data.
- Adherence to the QAPP and the associated laboratory SOPs.
- Documentation of sample preservation, transport, and analytical methodology.
- Adherence to the analytical methodology (at a minimum).
- Analysis of QC samples (discussed in Section 6.2).

The samples received by the laboratory will be handled in accordance with internal laboratory QC procedures. The laboratory's hardcopies, on submission to Environmental Standards, will be validated by Environmental Standards data validators with guidance from the National Functional Guidelines and EPA Region 4 SOPs. Data package completeness will be assessed and missing or incomplete information will be obtained from the laboratory. Any incorrect data will be corrected. Data usability will be evaluated and appropriate qualifiers will be added before submission to TVA. Any data rejected by data validation efforts due to imprecision, holding time exceedances, and failure of relevant QC measures will be qualified or not utilized for the project.

19.2.1 Data Reduction

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction is dependent upon the specific method and the number of discrete operations (extractions/digestion, dilutions, and levels/concentrations) involved in obtaining a sample that can be measured.

For all analytical methods, sample response will be applied to the average response factor or the regression line to obtain an initial raw result, which will then be factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result has been obtained to minimize rounding errors; results will not normally be expressed in more than three significant figures.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Copies of raw data and calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

The laboratory data reduction process is described in detail in the associated laboratory SOPs available for regulatory agency review on the TVA shared project website.

19.2.2 Laboratory Data Review

System reviews are performed at all levels. The individual analyst continuously reviews the quality of data through calibration checks, QC sample results, and performance evaluation samples. These reviews will be performed prior to submission to the Laboratory Project Manager or designee.

Criteria for analytical data review/verification include checks for internal consistency, transmittal errors, laboratory protocol, and laboratory QC. QC sample results and information documented in field notes will be used to interpret and evaluate laboratory data. The Laboratory QA Department will independently conduct a complete review of selected reports to confirm analytical results.

The laboratory will complete data verification procedures, including:

- Verifying analyses requested were analyses performed.
- Preliminary data proofing for inconsistencies; investigation and corrections, where possible.
- Reviewing laboratory data sheets for reporting/detection limits, holding times, surrogate recovery performance, and spike recovery performance.
- Double-checking computerized data entry, if applicable.

The Laboratory Project Manager or designee will review data for consistency and reasonableness with other generated data and determine whether project requirements have been satisfied. Selected hardcopy output of data (chromatograms, spectra, integrations, etc.) will be reviewed to ensure that results have been interpreted correctly. Unusual or unexpected results will be reviewed, and a determination will be made as to whether the analyses should be repeated. In addition, the Laboratory Project Manager or designee may recalculate selected results to verify the calculation procedure.

The Laboratory QA Manager will independently conduct a complete review of the Project data to determine whether laboratory and QAPP analytical requirements have been met. Discrepancies will be reported to the Laboratory Project Manager or designee for resolution.

Prior to final review/signoff by the Laboratory Project Manager or designee, the laboratory personnel will verify that the report deliverable is complete and in proper format, screen the report for compliance to laboratory and QAPP requirements, and ensure that the Case Narrative addresses any noted deficiencies. The Laboratory Project Manager or designee will perform the final laboratory review prior to reporting the results to Environmental Standards and TVA. Any discrepancy noted during laboratory review that results in sample reanalysis or data correction must be documented using the corrective action procedure addressed in Section 19.4.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

19.3 Performance and System Audits

Internal audits will be initiated by the TVA Technical Liaison/QA Officer at the discretion of the TVA Technical Liaison/QA Officer, internal audits may be conducted based upon any issues identified during various other assessment activities. The internal systems and performance audits will be planned and conducted by the TVA Technical Liaison/QA Officer and the Environmental Standards QA Manager or other appropriate QA Program personnel with the experience and competency to perform the audits/assessments. As part of the planning process for conducting internal audits, internal audits or assessments will first be scheduled. Next, the audit team will be identified, and the pertinent documentation and procedures relevant to the audit will be obtained and reviewed by the audit team. Internal audits may be announced or unannounced. The audit team members will hold a minimum of a Bachelor's degree in a scientific discipline and five or more years of QA and on-site laboratory auditing experience. As indicated in Section 4.0, the TVA Technical Liaison/QA Officer holds overall authority for the project QA Program and maintains that authority independently from the operational/production aspects of the project. Environmental Standards is an independent third-party QA organization with no affiliation to TVA and reports directly to the TVA Technical Liaison/QA Officer.

Documentation of systems and performance audits and any resulting corrective actions will be maintained as part of the Project File. Audit documentation will be reported to TVA Management and the Environmental Project Manager. In addition, audit documentation will be reported to EPA project management.

19.3.1 Performance Audits

Performance audits are quantitative evaluations of data quality produced by a particular activity or function. Performance audits of the participating laboratories performing chemical analyses of project samples will be conducted through the submission and analysis of performance evaluation (PE) samples.

PE samples may be submitted to the laboratories on a single-blind or double-blind basis. A single-blind PE sample is defined as a PE sample aliquot submitted for analysis to a laboratory that is aware that the sample is a PE sample; however, the laboratory typically does not know the actual target analytes and/or the target analyte concentrations at the time of analysis. A double-blind PE sample is defined as a PE sample aliquot submitted for analysis to a laboratory that is not aware that the sample is a PE sample at the time of analysis.

The Environmental Standards QA Manager will coordinate the manufacture and submission of performance audit samples to the laboratory. A NELAC-approved performance testing sample provider will be used to obtain the performance evaluation samples. PE sample studies may be conducted at the discretion of the TVA Technical Liaison/QA Officer for TVA contract laboratories analyzing aqueous, solid, and biological samples associated with the TVA KIF Ash Recovery Project. The PE sample matrices and requested analytes will be determined based on the nature of the work performed by that laboratory for the project.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Upon receipt of results from the PE study analyses, the Environmental Standards QA Manager will evaluate the data relative to the certified "true values" and will prepare a comprehensive report (including a discussion of non-analytical issues, such as data package preparation and presentation). If multiple laboratories are included in the PE study, a statistical evaluation of the results will be performed and a simple fencepost test will be conducted for each analyte to determine outliers; a set of warning limits and acceptance limits (based on the set of data excluding outliers) will be generated for the analytes. The PE study report will contain a detailed account of any results that are outside of the established acceptance limits. Laboratories will be contacted to explain discrepancies between the reported concentrations and the "known" (true) concentrations of the analytes in the PE samples and to provide corrective actions in accordance with the corrective action process described in Section 19.0. PE sample documentation, inclusive of corrective action responses, will be maintained as part of the Project File.

19.3.2 System Audits

System audits entail on-site observation and evaluation of participating laboratories and field sampling activities for compliance with the QAPP, SOPs, and/or project-specific Work Plans and/or Sampling and Analysis Plans. Prior to conducting an on-site audit, the Auditor will conduct a thorough examination of procedures and records. These on-site audits will also include verification of effectiveness of implemented corrective actions.

The system audits will address both field and laboratory activities, including a review of personnel qualifications, equipment, documentation, sampling techniques, analytical methods, and adherence to QA procedures. Each laboratory has its own QA Plan; therefore, the laboratory audit activities under the QAPP will entail a general review of laboratory QA practices.

Systems audits of laboratories conducting chemical analyses of project samples will be performed by the TVA Technical Liaison/QA Officer and the Environmental Standards QA Manager. Systems audits of laboratories performing toxicological testing will be conducted in accordance with the TVA's toxicological monitoring program. Field Audits will be conducted by the Environmental Standards Field Oversight Coordinator.

On-site audits of laboratories analyzing samples associated with the TVA KIF Ash Recovery Project will be conducted at the discretion of the TVA Technical Liaison/QA Officer. Field activities will be subjected to assessments and/or surveillances on a regular basis as new sampling teams, new procedures, or new sampling activities are performed. In addition, the Environmental Standards Field Oversight Coordinator may observe sampling events as appropriate given the sensitivity of the samples collected.

19.4 Feedback and Corrective Action

In general, feedback and corrective action processes for the TVA KIF Ash Recovery Project will be conducted in accordance with TVA's Corrective Action Program (Appendix K). TVA's Corrective Action Program includes various pathways depending on the nature and severity of the issue identified. Issues will be resolved using the lowest-level pathway that adequately identifies and addresses the cause of the non-conformance or deficiency and prevents recurrence.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

19.4.1 Feedback Mechanism

There are mechanisms within the project structure that allow for the identification, feedback, and control of any non-conformances or deficiencies. In general, the technical personnel involved with the project are responsible for reporting suspected technical non-conformances through standard communication channels established by the organizational structure. In the same manner, project personnel are responsible for reporting suspected QA non-conformances.

Feedback will be provided to laboratory personnel and the field team by the TVA Technical Liaison/QA Officer. Laboratories may receive feedback based on systems and performance audits and ongoing data validation. In addition, laboratories may provide feedback to the TVA Technical Liaison/QA Officer. Documentation of feedback will be maintained in the Project File.

19.4.2 Corrective Action for Field Activities

Issues arising during field sampling activities will undergo corrective action as specified in the *Quality Assurance Procedure for Program Improvement for Kingston Fossil Plant Ash Event* (TVA-KIF-QAP-001) presented in Appendix L.

Field personnel have the initial responsibility to monitor the quality of field measurements and observations. The Field Team Leader is responsible for verifying that QC procedures are followed. This responsibility requires the Field Team Leader to assess the correctness of field methods and the ability to meet QA objectives. If a problem occurs that might jeopardize the integrity of the project or that might cause a specific QA objective not to be met, the Field Team Leader will notify the TVA Sampling and Monitoring Coordinator and the TVA Technical Liaison/QA Officer. An appropriate corrective action will then be determined and implemented. The Field Team Leader will document the problem, the corrective action, and the results. A copy of the documentation form will be provided to the TVA Field Coordinator.

Field auditing is a recognized technique for evaluating the performance of field sampling teams and assessing how team performance may affect data quality. Field audits will be conducted by the Environmental Standards Field Oversight Coordinator to ensure that sampling, handling, and transportation to project laboratories provide assurance that such procedures meet QA protocols and that field documentation is sufficient to produce data of satisfactory quality, to provide a "defense" in the event that field procedures are called into question, and to identify ways to reduce sampling costs. Field audits will be conducted at a minimum of once (for one-time field collection activity) or annually (for reoccurring field activities).

The Environmental Standards Field Oversight Coordinator will ensure that all aspects of the dredging are compliant with the associated field SOPs and the project-specific Work Plans and/or Sampling and Analysis Plans. Any items identified as non-compliant will be addressed and an appropriate corrective action will be determined and implemented.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

19.4.3 Laboratory Corrective Action

Corrective action within the laboratory will be performed in accordance with the laboratory's formal QA Program.

The laboratory has the responsibility to monitor the quality of the analytical system and to provide a corrective action process adequate to address problems encountered in laboratory analysis of samples. The laboratory will verify that QC procedures are followed and that the analytical results of QC samples are within the acceptance criteria. The verification requires that the laboratory assess the correctness of the following items, as appropriate:

- Sample preparation procedure.
- Initial calibration.
- Calibration verification.
- Method blank result.
- Laboratory control sample.
- Laboratory duplicate analysis.
- Fortified sample result.
- Internal standard performance.

If the assessment reveals that the QC acceptance criteria are not met, the laboratory must immediately evaluate the analytical system and correct the problem. The analyst will notify the Laboratory Project Manager and Laboratory QA Coordinator of the problem and, if possible, will identify potential causes and suggest correct action.

When the appropriate corrective action measures have been implemented and the analytical system is determined to be "in control," the analyst will document the problem, the corrective action taken, and resultant data demonstrating that the analytical system is in control. Copies of the documentation will be provided to the Laboratory Project Manager and the Laboratory QA Coordinator.

Data generated concurrently with an out-of-control system will be evaluated for usability relative to the nature of the deficiency. If the deficiency does not adversely impact the usability of the results, data will be reported and the deficiency will be addressed in the Case Narrative. If sample results are adversely impacted, the Laboratory Project Manager will be notified and appropriate corrective action (such as reanalysis) will be taken.

Figure 19-1 presents the pathway for corrective actions.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

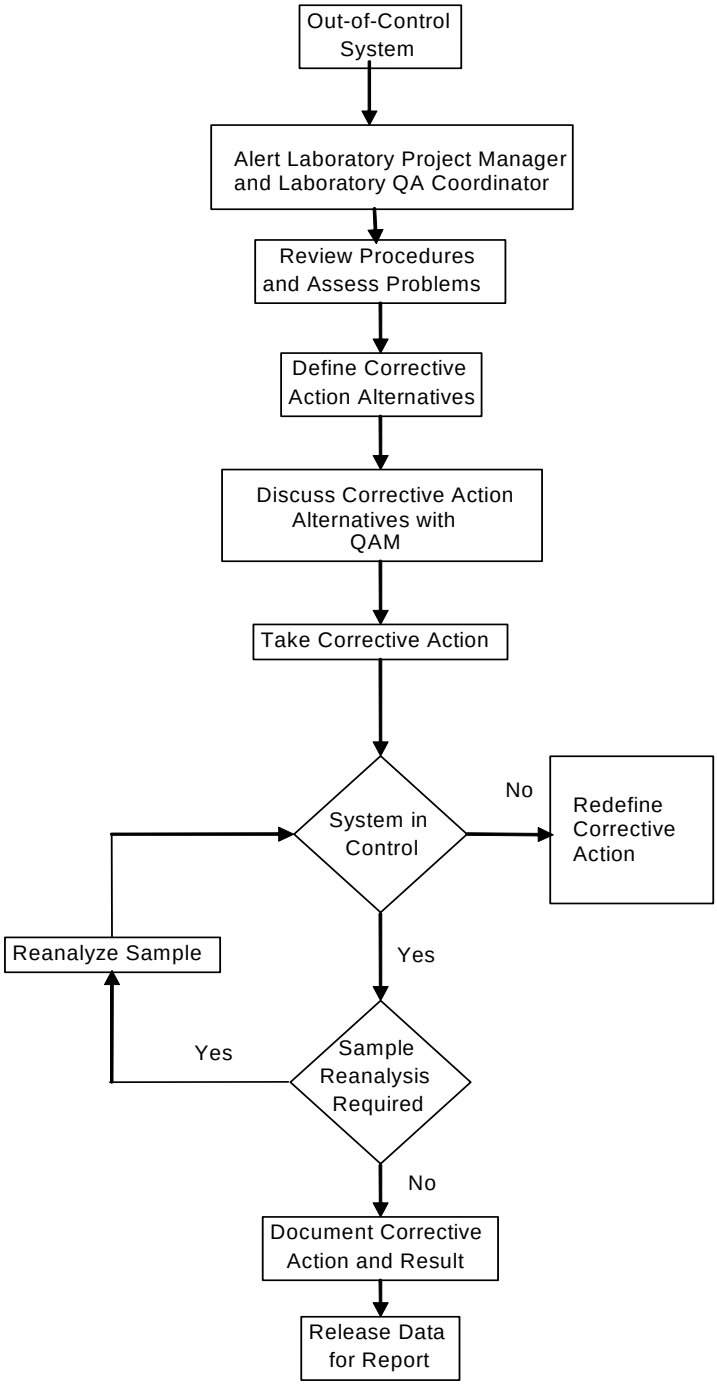

Figure 19-1. Critical Path for Laboratory Corrective Action

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

20.0 REPORTS TO MANAGEMENT

The QA activities performed by laboratories conducting analyses of TVA KIF samples will be monitored by the TVA Technical Liaison/QA Officer and the Environmental Standards QA Manager. The QA activities performed by the toxicological laboratory will be monitored by the TVA Toxicological Monitoring Coordinator in accordance with TVA's toxicological monitoring program.

Communication among TVA, Environmental Standards, and laboratory personnel is important to ensure that problems are remedied and that solutions are documented in an informed and timely manner.

Within 10 business days after the completion of a performance and systems audit, the Environmental QA Manager will submit an audit report to the TVA Technical Liaison/QA Officer. This audit report should include a list of observed field activities, a list of reviewed documents, and any observed deficiencies. The TVA Technical Liaison/QA Officer and Environmental Standards QA Manager will meet with the laboratory Project Managers of any area with observed deficiencies to review the audit findings, confirm the observations, and resolve misunderstandings. In the event that inadequacies are identified, corrective actions will be undertaken as outlined in Section 19.0.

20.1 Field QA Reports

The Field Team Leader will provide the TVA Sampling and Monitoring Coordinator with daily field progress reports and weekly compiled field data sets. The TVA Technical Liaison/QA Officer and Environmental Standards QA Manager will be immediately notified about field QA situations that require corrective action. Corrective action will be performed and documented in accordance with the protocol set forth in Section 19.0.

20.2 Laboratory QA Reports

The Laboratory QA Coordinator will provide periodic summary reports specific to the project to the Environmental Standards QA Manager. These reports will summarize QA activities for the reporting period, including results of performance audits (external and internal), results of system audits (external and internal), summaries of corrective action to remedy out-of-control situations, and recommendations for revisions of laboratory procedures to improve the analytical systems. The Laboratory Project Manager will notify the Environmental Standards QA Manager and TVA Technical Liaison/QA Officer about laboratory QA situations that appear to systematically impact data quality.

The Laboratory QA Coordinator will immediately notify the Environmental Standards QA Manager and the TVA Technical Liaison/QA Officer of any laboratory QA situations that require corrective action and ascertain if such measures meet the DQOs of the project. Corrective action will be performed and documented in accordance with the protocol set forth in Section 19.4 or internal laboratory corrective action tracking system, as appropriate.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

20.3 Internal Performance and System Audit/Assessment Reports

Documentation of systems and performance audits and any resulting corrective actions will be maintained as part of the Project File. Audit documentation will be reported to TVA Management and the Environmental Project Manager. In addition, audit documentation will be reported to EPA project management.

21.0 DATA REVIEW, VERIFICATION, AND VALIDATION

The Environmental Standards Data Validator will verify or validate data generated by the laboratories for chemical analyses of project samples. Data generated for toxicological assessments will be reviewed by the TVA Toxicological Monitoring Coordinator in accordance with TVA's toxicological monitoring program. Any issues observed during data validation will be brought to the attention of TVA personnel and the Laboratory Project Manager and an appropriate corrective action will be determined and implemented.

The purpose of analytical data validation is to eliminate unacceptable data and to qualify data for any data quality limitations identified during validation. In addition to the laboratory QA review, the CLP-like reports will be evaluated and validated by Environmental Standards for the following:

- Compliance with requested testing requirements.
- Completeness.
- Reporting Accuracy (including hardcopy to EDD).
- Confirmation of receipt of requested items.
- Traceability, sensibility, and usability of the data.

In addition to the above criteria, the data will be validated with guidance from the *US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, EPA-540-R-08-01* (June 2008); the *National Functional Guidelines for Inorganic Data Review* (US EPA, October 2004); the *US EPA Region 4 Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services* (Rev. 2.1; July 1999); the *US EPA Region 4 Data Validation Standard Operating Procedure for Organic Analysis* (Revision 3.1, June 2008); and the *US EPA Region 4 Data Validation Standard Operating Procedure*. It should be noted that these guidelines are not completely applicable to EPA and SW-846 methods referenced herein; consequently, professional judgment will be used to evaluate data usability.

Analytical data from fixed laboratories will be qualified with guidance from the National Functional Guidelines previously referenced. The data validation qualifiers listed below will be used for all project samples:

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

- Organic Data Validation Qualifiers

U*	This result should be considered "not detected" because it was detected in an associated field or laboratory blank at a similar level.
R	Unreliable positive result; compound may or may not be present in sample.
UR	Unreliable reporting or detection limit; compound may or may not be present in sample.
J	Quantitation is approximate due to limitations identified during data validation.
UJ	This compound was not detected, but the reporting or detection limit should be considered estimated due to a bias identified during data validation.

- Inorganic Data Validation Qualifiers

U*	This result should be considered "not detected" because it was detected in a rinsate blank or laboratory blank at a similar level.
R	Unreliable positive result; analyte may or may not be present in sample.
UR	Unreliable reporting or detection limit; analyte may or may not be present in sample.
J	Quantitation is approximate due to limitations identified during data validation.
UJ	This analyte was not detected, but the reporting or detection limit may or may not be higher due to a bias identified during data validation.

The EDD and full data packages for data generated from the chemical analysis of project samples will summarize the deviations from approved protocols and significant data findings in the Case Narratives. Analytical reports will be submitted to TVA and Environmental Standards as separate documents and will be transmitted in an electronic (PDF and EDD) and hardcopy formats. Environmental Standards will maintain a database of TVA data for data validation and/or verification. Environmental Standards will complete data validation and generate project reports for TVA. Data validation and project reports will be submitted to the TVA Technical Liaison/QA Officer and the TVA Records Custodian. Electronic validated data will be submitted upon approval from the TVA Technical Liaison/QA Officer. The TVA-KIF-DMP-001 details the process for appending data qualifiers in the EQuIS® database and submitting verified and validated data to the EPA database.

Data generated from toxicological testing will be submitted, reviewed, and stored in accordance with TVA's toxicological monitoring program.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

22.0 VERIFICATION AND VALIDATION METHODS

The overall QA objective for field activities, laboratory analyses, and data assessment is to produce data of sufficient and known quality to support the project-specific DQOs and to produce legally defensible data. Specifically, data will be developed using procedures appropriate for the intended use.

This data assessment activity is an on-going coordinated process with data production and is intended to ensure that all data produced during the project are acceptable for use in subsequent evaluations. Both statistical and qualitative evaluations will be used to assess the quality of the data. The primary evaluation of the data will be based upon the control samples. The blank samples will be used to evaluate whether or not the laboratory and/or field sample handling represent a possible source of sample contamination. Duplicate sample results will be used to evaluate data precision.

Initially, 100% of the chemical analysis data will be reported in full documentation data packages for independent data validation. Depending on the nature and frequency of issues identified during data validation, the percentage of data undergoing full data validation may be reduced to a lesser percentage (such as 20%) or data verification may be substituted. The reduction in full data validation may be matrix specific, laboratory specific, or analyte specific. If after the percentage of full data validation has decreased, a trend in frequency of reporting issues, method non-compliances, or data usability issues is identified, data validation will be conducted for specific data points or the percentage of full data validation percentage may be increased until the issues have been minimized to their initial frequency.

Data verification includes the review of the batch quality control summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents. Full data validation includes the review of raw data and associated quality control summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents. The nature and extent of the data package available for review is dependent on the analytical method used (such as EPA Methods, SW-846, etc.) and the reporting and deliverables requirements defined in QAPP and project-specific Work Plans and/or Sampling and Analysis Plans. After completion of either full or limited data validation, a QA report will be prepared. The QA report will address QAPP and method compliance issues, reporting errors, comments about the data, data usability issues, and data summary tables/qualified result summaries. The QA report will also address calculation errors (reported value >10% different than the value calculated by the data reviewer from the raw data). The QA report data summary tables will include all reported results and the associated data qualifiers. The QA report will be fully supported by a documentation appendix that includes a photocopied page of laboratory data to support the qualifiers and deficiencies identified in the review.

Analytical data will be available for preliminary internal use after verification. In addition, analytical data will be reported to the agencies after verification. Data will be reported to the public following data validation where data validation is requested; if data validation is not requested, data will be available for public consumption following verification.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

The data produced during the sampling tasks included in the field investigation will be compared with the defined QA objectives and criteria for precision, accuracy, representativeness, completeness, and comparability (PARCC) and sensitivity. The primary goal of these procedures is to ensure that the data reported are representative of actual conditions at the Site.

Standard procedures are used so that known and acceptable levels of PARCC are maintained for each data set. Descriptions of these criteria are presented in the following subsections.

The specific quantitative QA objectives for chemical analyses associated with the TVA KIF Ash Recovery Project are presented in Tables C-3, D-3, E-3, G-3, H-3, I-3, and J-3. QA objectives and testing endpoints associated with toxicological monitoring testing are presented on Table F-2 and in the associated project-specific Work Plans and/or Sampling and Analysis Plan, the referenced analytical methods, and the associated laboratory SOPs.

22.1 Precision

The degree of agreement between the numerical values of a set of duplicate samples performed in an identical fashion constitutes the precision of the measurement.

During the collection of data using field methods and/or instruments, precision is checked by reporting measurements at one location and comparing results. For example, soil measurements are taken in pairs at a certain point and depth and the values compared. The measurements are considered sufficiently precise only if the values are within a specified percentage of each other.

Analytical precision is calculated by expressing, as a percentage, the relative percent difference (RPD) between results of analyses of laboratory duplicate samples for a given analyte. Precision is expressed as an RPD when both results are greater than 5× the reporting limit as calculated by the following formula:

$$RPD = abs\left[\frac{\mathrm{A} - \mathrm{B}}{\left(\frac{A+B}{2}\right)}\right] \times 100$$

Where: A = Value of original sample
B = Value of duplicate sample

When at least one result is less than 5× the reporting limit, the difference between the results is used to evaluate precision.

Specific precision and difference objectives for field duplicate samples and laboratory duplicate samples (including MSDs) are presented in Tables C-3, D-3, E-3, G-3, H-3, I-3, and J-3.

22.2 Accuracy

Accuracy is the degree of agreement of a measurement, X, with an accepted reference or true value, T. Accuracy is usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100(X-T)/T; accuracy is also sometimes

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

expressed as a ratio X/T. Accuracy, which is a measure of the bias in a system, is assessed by means of reference samples and percent recoveries. Error may arise due to personal, instrumental, or method factors.

The two types of analytical check samples used are laboratory control samples (LCSs) and matrix spike samples. Analytical accuracy is expressed as the percent recovery (%R) of an analyte that has been added to the control sample or a standard matrix (such as blank soil) at a known concentration prior to analysis.

The formula used to calculate accuracy for the laboratory control sample is:

$$\% R = \left(\frac{A_T}{A_F}\right) \times 100$$

Where: A_T = Total concentration of the analyte measured or recovered
A_F = Concentration of the analyte spiked

When calculating accuracy for the matrix spike analysis, a correction for background concentration found in the unspiked sample must be made. Matrix spike recovery is calculated using the following formula:

$$\% R = \left(\frac{A_T - A_O}{A_F}\right) \times 100$$

Where: A_T = Concentration of the analyte measured or recovered
A_O = Unspiked concentration of the analyte
A_F = Concentration of the analyte spiked.

In general, the accuracy objectives are based on the requirements set forth in the referenced analytical method and in Tables C-3, D-3, E-3, G-3, H-3, I-3, and J-3.

22.3 Completeness

Completeness is a measure of the degree to which the amount of sample data collected meets the needs of the sampling program and is quantified as the relative number of analytical data points that meet the acceptance criteria (including accuracy, precision, and any other criteria required by the specific analytical method used). Completeness is defined as a comparison between actual numbers of usable data points expressed as a percentage of expected number of points.

Difficulties encountered while handling samples in the laboratory, as well as unforeseen complications regarding analytical methods, may affect completeness during sample analysis. The minimum goal for completeness is 90%; the ability to exceed this goal is dependent on the applicability of the analytical methods to the sample matrix analyzed. If data cannot be reported without qualifications, project completion goals may still be met if the qualified data (data of known quality, even if not perfect) are suitable for specified project goals. Percent completeness will be expressed as the ratio of the total number of usable results relative to the total number of analytical results. The total number of usable analytical results will be total number of results minus any results deemed unusable (or rejected) at validation.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

22.4 Representativeness

Representativeness expresses the degree to which sample data are accurate and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter associated with the proper design of the sampling program. The representativeness criterion can, therefore, be met through the proper selection of sampling locations, the collection of a sufficient number of samples and the use of EPA-approved and standardized sampling procedures to describe sampling techniques and the rationale used to select sampling locations to ensure representativeness of the sample data.

Representativeness will also be measured by the collection of field duplicates or co-located samples, as appropriate given the sample matrix. Comparison of the analytical results of field duplicates will provide a direct measure of individual sample representativeness.

22.5 Comparability

Comparability is a qualitative parameter used to express the confidence with which one data set can be compared with another. The comparability of the data, a relative measure, is influenced by sampling and analytical procedures. By providing specific protocols for obtaining and analyzing samples, data sets should be comparable regardless of who collects the sample or who performs the sample analysis.

The laboratory will be responsible providing the following controls to allow assessment of comparability:

- Adherence to current, standard EPA-approved methodology for sample preservation.
- Compliance with holding times and analysis consistent with QAPP.
- Consistent reporting units for each parameter of similar matrices.
- EPA-traceable or NIST-traceable standards, when applicable.

23.0 RECONCILIATION OF DATA TO PROJECT OBJECTIVES

The Environmental Standards QA Manager, in conjunction with the TVA Technical Liaison/QA Officer and the TVA Toxicological Monitoring Coordinator, will determine whether field and validated analytical data or data sets meet the requirements necessary for decision-making. The results of measurements will be compared to the DQO requirements set forth in the project-specific Work Plans and/or Sampling and Analysis Plans. The process of reconciling project data with the DQOs will be performed with guidance from the *Guidance for Data Quality Assessment, Practical Methods for Data Analysis* (US EPA QA/G-9R, February 2006). Specific steps for reconciling project data with the DQOs is addressed in the project-specific Work Plans and/or Sampling and Analysis Plans.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Generally, data assessment begins with verification and validation of project data to ensure that the sampling and analysis protocols specified in the associated field SOPs and Work Plans and/or Sampling and Analysis Plans were followed, and that the measurement systems were performed in accordance with the criteria specified in these documents and the TVA-KIF QAPP. Data limitations identified during data verification and validation are communicated to the project team via reports and qualification in the project database.

Following data assessment, statistical analysis is performed to determine whether the performance and acceptance criteria developed by the DQO planning process were achieved. As data are evaluated, anomalies in the data or data gaps may become apparent to the data users. Data that do not meet the data users' needs will be identified and appropriately noted so that decision-makers are aware of data limitations.

Data that do not meet the established DQOs may be used qualitatively or may be rejected depending on the project-specific requirements and the intended use of the data. The TVA Technical Liaison/QA Officer, with the support of the Environmental Standards QA Manager and Environmental Standards data validators, will assist data end users in evaluating data limitations identified and determining whether data are acceptable for their intended use.

24.0 REFERENCES

American Public Health Association, American Water Works Association, Water Environmental Federation. *Standard Methods for the Examination of Water and Wastewater,* 21st Edition, September 2005.

CTEH. *Air Monitoring and Air Sampling Plan and Quality Assurance Project Plan, TVA Fly Ash Release*. January 2009.

Environmental Standards, Inc. *Field Sampling Plan, TVA Kingston Fossil Plant Ash Recovery Project* . April 2009.

Environmental Standards, Inc. *Quality Assurance Project Plan, Phase I Emory River Dredging, Tennessee Valley Authority Kingston Fossil Plant Ash Recovery Project.* March 2009.

TVA. *Ambient Air Monitoring Plan for the TVA Kingston Fossil Plant fly Ash Release Remediation,* Revision 1, May 2010.

TVA. *Industrial Hygiene Monitoring Plan*, Appendix K of *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response*, Jacobs, June 2010.

TVA. *Kingston Fossil Plant Ash Recovery Project Sampling and Analysis Plan for Phase I Dredging Operations*, March 2009.

TVA. "Record and Document Management Program." Communications Practice 6. TVA-SPP-31.0.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

TVA. "Record Submittal for Electronic Document Management System (EDMS)." Document Services Procedure 3.

TVA. "Records Center Customer Handbook. Enterprise Document Management.

TVA. "Records Management." Document Services Procedure 1. TVA-SPP-31.1.

TVA. *Site-Wide Safety and Health Plan for the TVA Kingston Fossil Plant Ash Release Response*, Revision 04, Jacobs, February 2010.

TVA. *TVA Kingston Fossil Plant Ash Recovery Project, Time-Critical Action, Site Dust Control and Air Monitoring Plan,* Revision 1, May 2010.

TVA. "Vital Records Program Policies and Procedures." EDMRMP 0.6.

US EPA. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air,* EPA/625/R-96/010a, June 1999.

US EPA. *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review,* EPA-540-R-08-01, June 2008.

US EPA. *Data Quality Objectives Process for Superfund, Interim Final Guidance,* EPA540-R-93-071, September 1993.

US EPA Region 4. *Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services, Revision 2.1.* July 1999.

US EPA Region 4. *Data Validation Standard Operating Procedure for Organic Analysis,* Revision 3.1, June 2008.

US EPA Region 4. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. November 2001.

US EPA. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (Inland Testing Manual) http://www.epa.gov/waterscience/itm/itmpdf.html

US EPA. *Guidance on Systematic Planning Using the Data Quality Objectives Process*. US EPA QA/G-4. February 2006.

US EPA. *Guidance for Data Quality Assessment, Practice Methods for Data Analysis* .US EPA QA/G-9, July 2000.

US EPA. *National Functional Guidelines for Inorganic Data Review.* October 2004.

US EPA Region 4. *Quality Management Data Plan for EPA Region 4, Revision 2.* May 2003.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

US EPA. *QA Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations – Chemical Evaluations*. 1995.

US EPA. *Test Methods for Evaluating Solid Waste, Physical and Chemical (SW-846), 3rd Edition including Final Update IV*. November 2000.

US EPA. 40 CFR Part 136, Final Methods Update Rule. March 2008.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Attachment 1

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Summary of Project Documents

Document/ Element	"Tennessee Valley Authority Kingston Fossil Plant Ash Recovery Project Quality Assurance Project Plan" Draft April 15, 2009	"Field Sampling Plan TVA Kingston Fossil Plant Ash Recovery Project" (including SOP appendices) Draft April 15,2009	"Quality Assurance Project Plan for the Contractor Ambient Air Monitoring Plan Draft April 23, 2009	"TVA Kingston Fossil Plant Ash Recovery Project, Time-Critical Action Site Dust Control and Air Monitoring Plan" Approved by EPA August 14, 2009	"Surface Water Monitoring Plan For the Emory, Clinch, and Tennessee Rivers Kingston Fossil Plant Ash Recovery Project" Approved by EPA August 25, 2009	Field SOPs
Current Status	Draft in use	Draft in use	Draft not in use; document superseded	Signed/Approved; revision in process	Signed/Approved; revision in process	Varied – see listing for status
Required Under Consent Order?	No	No	No	Yes	Yes	SOPs referenced in Consent Order Required Plans are
Applicable to Time Critical Activities?	Yes	Yes	Yes	Yes	Yes	SOPs referenced in Time Critical Activity Plans are
Contains SOPs?	No	Yes	Yes	Yes	Yes	Not applicable
Contains Project Specific Data Quality Objectives?	No	No	No	In process of revision to add DQOs as attachment	In process of revision to add DQOs as attachment	No
Applicability	This document is applicable to all TVA environmental data collection activities until the post-Consent Order revision of the document is approved.	This document is applicable to environmental data collection activities prior to the Consent Order and/or not currently specified by the Consent Order.	This document is superseded by "TVA Kingston Fossil Plant Ash Recovery Project, Time-Critical Action Site Dust Control and Air Monitoring Plan" Approved by EPA August 14, 2009	This document supersedes "Quality Assurance Project Plan for the Contractor Ambient Air Monitoring Plan Draft April 23, 2009	This Document supersedes surface water sample collection activities listed in the "Field Sampling Plan TVA Kingston Fossil Plant Ash Recovery Project" (including SOP appendices) Draft April 15,2009	Applicability is based upon the document the SOPs are referenced in; will be maintained under configuration control on the web

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Attachment 2

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Cross-Walk Tables

Tables to be inserted here to contain the following information:

QAPP Element	Location in SAP	Location in Work Plan	Location in SOP
Data Quality Objectives			
Sampling Design			
Sampling Methods			
Sample Collection			
Data Review and Validation			
Assessments and Response Actions			

Footnotes:

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX A

DATA PACKAGE DELIVERABLE REQUIREMENTS

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

DATA PACKAGE DELIVERABLE REQUIREMENTS

1.0 Introduction

The following sections describe in detail the types of data packages designed for the Kingston Ash Recovery Project. These details are provided to all TVA Contract laboratories to produce data packages that are similar in format, order of presentation, and content.

TVA data package deliverables are categorized into two levels as follows:

Full	-	See Section 2.0
Limited	-	See Section 3.0

Full hard copy data package deliverables will be required for all sample delivery groups. Limited data package deliverables will be requested as a mechanism to report final results in an expeditious manner; when limited data package deliverables are requested, full data package deliverables must still be prepared at the standard 5-day TAT. Electronic data deliverables (EDD) must be provided for all data package deliverables via the format required for the project and should be delivered with the full hard copy data package deliverable.

The laboratory is responsible for ensuring that all electronic and hardcopy data deliverables are in parity, including but not limited to significant figures, analyte names, and any qualifiers and/or footnotes used. All electronic data and hardcopy data deliverables are the property of TVA and must be maintained for a minimum of ten years. Under no circumstances is the laboratory to discard, dispose of, alter, or destroy any electronic data or hardcopy data deliverables without the express written consent of TVA.

Prior to issuance to the client, all data must undergo at least an initial technical review by a trained analyst and a second technical review by a supervisor or another trained analyst.

2.0 General Format for Full Data Package Deliverables

The Full Sample Data Package will include data for analyses of all samples in one sample delivery group (SDG), including field samples, re-analyses, secondary dilutions, blanks, laboratory control samples, laboratory control sample duplicates, matrix spikes, matrix spike duplicates, and/or laboratory duplicates. One single set of data representing the best of results (if multiple analyses are performed) for each sample should be reported. The Full Data Package is divided into sections, each specific to an analytical fraction. A fraction-specific unit is not a required deliverable if the analysis of that fraction was not required for samples in the SDG. The Full Data Package must be completed before submission and must be single-sided and consecutively paginated. The Full Data Package will be arranged in the following order:

- Cover Letter/Letter of Transmittal signed by Technical Project Manager or designee

- Title Page
- Table of Contents
- SDG Narrative signed by Technical Project Manager or designee [The SDG Narrative must include a statement or statements relative to compliance with this document, the TVA technical requirements, and the Quality Assurance Project Plan (QAPP) and description of any deviations.]
- References to preparation and analytical methods performed and applicable project documents (*i.e.*, QAPP)
- Field and Internal Laboratory Chain-of-Custody Records
  - Sample Receipt Information
  - Project Correspondence
- For each analytical method and matrix included in the SDG, the laboratory must provide the summary of the full MDL study (seven replicates, standard concentrations, *etc.*) and the most recent single point verification summary, as applicable.

I. ICP, ICP/MS, and CVAA Metals Results and QC

A. Target Analyte Results Summaries: Target analyte results summaries are required for all samples and will be arranged in increasing alphanumeric order by TVA sample number. The target analyte results summary must include the following:

- SDG Number
- TVA sample number
- laboratory sample identifier
- matrix of the TVA sample
- date of sample collection
- sample percent solids
- name and CAS number for each target analyte
- concentration of positives and project-required detection limit (PRDL) and/or MDL for each target analyte
- any applicable flags for target analyte results (*e.g.*, “U” to designate a “not-detected” result)

- concentration units

B. QC and Quarterly Verification of Instrument Parameters Summaries

- Initial and Continuing Calibration Verification Summary: The initial and continuing calibration verification summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - names for all target analytes
  - instrument identifier
  - start and end dates and times of the analytical sequence
  - true concentrations for all target analytes for the initial calibration verification (ICV) and continuing calibration verification (CCV) standards
  - observed concentrations for all target analytes for each ICV and CCV analyses
  - calculated percent recoveries for all target analytes for each ICV and CCV analyses
  - control limits for ICV and CCV percent recoveries
  - concentration units

- Reporting Limit (RL) Standard Summary: The RL standard summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - names for all target analytes
  - instrument identifier
  - dates and times for the RL standard analyses
  - true concentrations for all target analytes
  - observed concentrations for all target analytes for each RL standard analysis
  - calculated percent recoveries for all target analytes for each RL standard analysis

- control limits for RL standard recoveries
- concentration units

- Initial and Continuing Calibration Blank Summary: The initial and continuing calibration blank summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - names for all target analytes
  - instrument identifier
  - start and end dates and times of the analytical sequence
  - observed concentration or MDL for each target analyte for each initial calibration blank (ICB) or continuing calibration blank (CCB) analysis
  - acceptance limits for ICB and CCB analyses
  - concentration units

- Preparation Blank Analytical Summary: The preparation blank analytical summaries will be arranged in chronological order, by instrument and must include the information presented in Section 1A.

- ICP and/or ICP/MS Interference Check Sample Summary: The ICP and/or ICP/MS interference check sample summaries for <u>both</u> the ICSA and ICSAB solutions will be arranged in chronological order, by instrument and must include the following: [NOTE: Aluminum, Calcium, Iron, and Magnesium results are to be reported even if these are not target analytes.]

  - SDG number
  - names for all target analytes
  - instrument identifier
  - dates and times for the ICP interference check standard analyses
  - true concentrations for all target analytes
  - observed concentrations for all target analytes observed in each ICP interference check standard analysis

- calculated percent recoveries for all target analytes for each ICP interference check standard analysis
- control limits for ICP interference check standard recoveries
- concentration units

- MS Sample Recovery Summary: The MS sample recovery summaries will be arranged in alphanumeric order by laboratory sample number and must include the following:

  - SDG number
  - TVA sample number for the spiked sample
  - percent solids for the TVA sample
  - names for all target analytes
  - analyte concentration observed in the non-spiked sample aliquot
  - true concentrations for all target analytes in the MS solution
  - observed concentrations for all target analytes in the MS sample analysis
  - calculated percent recoveries for all target analytes
  - control limits for MS sample recoveries
  - concentration units

If an MSD is performed, the summary must also include:

- MSD identifier
- observed concentration for each all target analytes in the MSD sample
- percent recovery for all target analytes
- RPD between the MS/MSD results for each analyte
- RPD limit for each analyte

- Post-Spike Sample Recovery Summary: The post-spike sample recovery summaries will be arranged in alphanumeric order by laboratory sample number and must include the following:

    - SDG number
    - TVA sample number for the post-spiked sample
    - percent solids for the TVA sample
    - names for all target analytes
    - analyte concentration observed in the non-spiked sample aliquot
    - true concentrations for all target analytes in the post-spike solution
    - observed concentrations for all target analytes in the post-spike sample analysis
    - calculated percent recoveries for all target analytes
    - control limits for post-spike sample recoveries
    - concentration units

- Duplicates Precision Summary: The duplicate precision summaries will be arranged in alphanumerical order by TVA sample number and must include the following:

    - SDG number
    - TVA sample number for the duplicate sample
    - percent solids for the TVA sample
    - names for all target analytes
    - analyte concentration observed in the original sample aliquot
    - observed concentrations for all target analytes in the duplicate sample analysis
    - calculated RPD for all target analytes
    - control limits for RPD

- concentration units

- LCS Recovery Summary: The LCS recovery summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - LCS identifier
  - names for all target analytes
  - true concentrations for all target analytes in the LCS solution
  - observed concentrations for all target analytes in the LCS analysis
  - calculated percent recoveries for all target analytes
  - control limits for LCS recoveries
  - concentration units

- ICP and/or ICP/MS Serial Dilution Summary: The ICP and/or ICP/MS serial dilution summaries will be arranged in alphanumeric order by laboratory sample number and must include the following:

  - SDG number
  - TVA sample number for the ICP or ICP/MS serial dilution sample
  - names for all target analytes
  - analyte concentration observed in the original sample aliquot
  - observed concentrations for all target analytes in the ICP or ICP/MS serial dilution analysis
  - calculated percent difference for all target analytes
  - control limits for percent difference
  - concentration units

- RL and Method Detection Limit (MDL) Summary: The RL and MDL summaries will be arranged in chronological order, by instrument and must include the following:

    - SDG number
    - instrument identifier
    - date the MDL determination was performed
    - names for all target analytes
    - determined MDL for all target analytes
    - RL for all target analytes
    - concentration units

- ICP Interelement Correction Factors Summary: The ICP interelement correction factors summaries will be arranged in chronological order, by instrument and must include the following:

    - SDG number
    - instrument identifier
    - date the ICP interelement correction factors determination was performed
    - names for all target analytes
    - determined ICP interelement correction factors concentrations for all target analytes
    - concentration units

- ICP and/or ICP/MS Linear Range Summary: The ICP and/or ICP/MS linear range summaries will be arranged in chronological order, by instrument and must include the following:

    - SDG number
    - instrument identifier
    - date the ICP linear range determination was performed
    - names for all target analytes
    - determined ICP linear range concentrations for all target analytes

- concentration units

- TCLP Preparation Logs and worksheets (if performed)

- TVA sample and QC sample preparation logs

- Analytical Sequence Form: The analytical sequence forms will be arranged in chronological order, by analyte, by instrument and must include the following:

  - SDG number

  - instrument identifier

  - TVA sample numbers associated with the sequence

  - QC sample identifiers associated with the sequence

  - analysis date and time for each TVA sample and QC sample associated with the sequence

  - identification of all target analytes reported from each TVA sample and QC sample analysis

  - dilution factor for each TVA sample and QC sample analysis

  - start and end dates and times for the sequence

- ICP/MS Data Packages will include the following forms in addition to the requirements listed above.

  - ICP/MS Tune Summary

  - ICP/MS Internal Standards Relative Intensity Summary [the summary must include the acceptance limits and reference internal standards intensity.]

C. Raw Data

For each reported value, the laboratory will provide all raw data used to obtain that value; this requirement applies to all required QA/QC measurements and instrument standardization as well as all sample analysis results. This statement does not apply to the Quarterly Verifications Parameters submitted as part of each data package. Raw data must contain all instrument readouts used for the sample results. Each exposure or instrumental reading must be provided, including those readouts that may fall below the RL but greater than the MDL. All ICP, ICP/MS, and AA instruments must provide a legible hardcopy of the direct

real-time instrument readout (*e.g.*, strip-charts, printer tapes, *etc.*). A photocopy of the instrument's direct sequential readout must be included.

II. General Chemistry Results and QC

The general chemistry data will be arranged in the following order by individual parameter requested for the samples in the SDG (as applicable).

A. Target Analyte Results Summaries: Target analyte results summaries are required for all samples and will be arranged in increasing alphanumeric order by TVA sample number. The target analyte results summary must include the following:

- SDG Number
- TVA sample number
- laboratory sample identifier
- matrix of the TVA sample
- date of sample collection
- sample percent solids
- name and CAS number for each target analyte
- concentration of positives and PRDL and/or MDL for each target analyte
- any applicable flags for target analyte results (*e.g.*, "U" to designate a "not-detected" result)
- concentration units

B. QC Summaries

- Initial and Continuing Calibration Verification Summary: The initial and continuing calibration verification summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - names for all target analytes
  - instrument identifier
  - start and end dates and times of the analytical sequence

- true concentrations for all target analytes for the ICV and CCV standards
- observed concentrations for all target analytes for each ICV and CCV analyses
- calculated percent recoveries for all target analytes for each ICV and CCV analyses
- control limits for ICV and CCV percent recoveries
- concentration units

- Initial and Continuing Calibration Blank Summary: The initial and continuing calibration blank summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - names for all target analytes
  - instrument identifier
  - start and end dates and times of the analytical sequence
  - observed concentration or MDL for each target analyte for each ICB or CCB analysis
  - acceptance limits for ICB and CCB analyses
  - concentration units

- Preparation Blank Analytical Summary: The preparation blank analytical summaries will be arranged in chronological order, by instrument and must include the information presented in Section 1.A.

- MS Sample Recovery Summary: The spike sample recovery summaries will be arranged in alphanumeric order by laboratory sample number and must include the following:

  - SDG number
  - TVA sample number for the spiked sample
  - percent solids for the TVA sample
  - names for all target analytes

- analyte concentration observed in the non-spiked sample aliquot
- true concentrations for all target analytes in the spike solution
- observed concentrations for all target analytes in the spike sample analysis
- calculated percent recoveries for all target analytes
- control limits for spike sample recoveries
- concentration units

If an MSD is performed, the summary must also include:

- MSD identifier
- observed concentration for each all target analytes in the MSD sample
- percent recovery for all target analytes
- RPD between the MS/MSD results for each analyte
- RPD limit for each analyte

- Duplicates Precision Summary: The duplicate precision summaries will be arranged in alphanumeric order by laboratory sample number and must include the following:

  - SDG number
  - TVA sample number for the duplicate sample
  - percent solids for the TVA sample
  - names for all target analytes
  - analyte concentration observed in the original sample aliquot
  - observed concentrations for all target analytes in the duplicate sample analysis
  - calculated RPD for all target analytes
  - control limits for RPD

- concentration units

- LCS Recovery Summary: The LCS recovery summaries will be arranged in chronological order, by instrument and must include the following:

  - SDG number
  - LCS identifier
  - names for all target analytes
  - true concentrations for all target analytes in the LCS solution
  - observed concentrations for all target analytes in the LCS analysis
  - calculated percent recoveries for all target analytes
  - control limits for LCS recoveries
  - concentration units

- Analytical Sequence Form: The analytical sequence forms will be arranged in chronological order, by analyte, by instrument and must include the following:

  - SDG number
  - instrument identifier
  - identification of the target analyte
  - TVA sample numbers associated with the sequence
  - QC sample identifiers associated with the sequence
  - analysis date and time for each TVA sample and QC sample associated with the sequence
  - start and end dates and times for the sequence

C. Raw Data

For each reported value, the laboratory will provide all raw data (instrument printouts or logbook pages) used to obtain that value; this requirement applies to all required QA/QC measurements and instrument standardization, as well as all sample analysis results. Raw data must contain all instrument readouts/logbooks pages used for the sample

results. Each exposure or instrumental reading must be provided, including those readouts/logbook pages that may fall below the quantitation limit. A photocopy of the instrument's direct sequential readout must be included if the instrumentation has the capability.

D. General Chemistry Preparation Logs (by parameter)

III. Radiological Data

The radiological data will be arranged in the following order by individual parameter requested for the samples in the SDG.

A. Target Analyte Results Summaries: Target analyte results summaries are required for all samples and will be arranged in increasing alphanumeric order by TVA sample number. The target analyte results summary must include the following:

- SDG Number
- TVA sample number
- laboratory sample identifier
- matrix of the TVA sample
- date of sample collection
- date of sample analysis
- sample activity, uncertainty, and the sample-specific minimum detectable concentration (MDC). The sample-specific MDC will be based on the background of the detector that the sample was counted on. The sample activity (positive or negative), uncertainty, and sample-specific MDC will be reported for positive and "not-detected" results
- any applicable flags for target analyte results (e.g., "U" to designate a "not-detected" result)
- concentration units

B. Quality Control Summaries

- Chemical Yield (Tracer/Carrier) Recovery Summary that must include the following:

  - SDG number
  - TVA sample number

- Method blank sample number
- MS sample number
- MSD sample number
- LCS identification number
- LCSD identification number (if performed)
- percent recovery for all tracers/carriers
- applicable recovery limits for each tracer/carrier

- Method Blank Summary: The method blank summaries will be arranged in chronological order, by instrument and method and must include the following:

  - SDG number
  - names for all target analytes
  - observed activity, uncertainty, and MDC for each target analyte for each method blank analysis
  - concentration units

- MS Sample Recovery Summary: The MS sample recovery summaries will be arranged by instrument and method and must include the following:

  - SDG number
  - TVA sample number for the spiked sample
  - names for all target analytes
  - analyte concentration observed in the non-spiked sample aliquot
  - true concentrations for all target analytes in the MS solution
  - observed concentrations for all target analytes in the MS sample analysis
  - calculated percent recoveries for all target analytes
  - control limits for MS sample recoveries

- concentration units

If an MSD is performed, the summary must also include:

- MSD identifier
- observed concentration for each all target analytes in the MSD sample
- percent recovery for all target analytes
- RPD/RER between the MS/MSD results for each analyte
- RPD/RER limit for each analyte

- Duplicates Precision Summary: The duplicate precision summaries will be arranged by instrument and method and must include the following:

  - SDG number
  - TVA sample number for the duplicate sample
  - names for all target analytes
  - analyte activity, uncertainty, and MDC observed in the original sample aliquot
  - observed activity, uncertainty, and MDC for all target analytes in the duplicate sample analysis
  - calculated RPD/Replicate Error Ratio (RER) for all target analytes
  - control limits for RPD/RER
  - concentration units

- LCS Recovery Summary: The LCS recovery summaries will be arranged by instrument and method and must include the following:

  - SDG number
  - LCS identifier
  - names for all target analytes
  - true concentrations for all target analytes in the LCS solution

- observed concentrations for all target analytes in the LCS analysis
- calculated percent recoveries for all target analytes
- control limits for LCS recoveries
- concentration units

- Calibration Verification Summary: The calibration verification summaries will be arranged by instrument and method and must include the following:

  - SDG number
  - names for all target analytes
  - instrument identifier
  - date the calibration verification was performed. For each method and analyte, the Contracted Laboratories will provide Calibration Verification summaries that include or bracket the analysis dates of the field and QC samples.
  - acceptance limits for the calibration verification
  - the following calibration verification summaries will be provided for Gas Flow Proportional Counter data

    a. Efficiency Checks
    b. Background Checks

  - the following calibration verification summaries will be provided for Alpha Spectroscopy data

    a. Energy Calibration Checks
    b. Efficiency Checks
    c. Background Checks (
    d. Resolution (FWHM) Checks

  - the following calibration verification summaries will be provided for Alpha Scintillation data

    a. Daily Instrument Performance Checks
    b. Background Checks

C. Raw Data

For each reported value, the Contracted Laboratories will provide all raw data (instrument printouts) used to obtain that value. This applies to all required QA/QC measurements (including tracer/carrier recoveries) as well as all sample analysis results. Raw data must contain all instrument readouts and worksheets used for the sample results. An exhibit work sheet per method (including example calculations showing how sample activity, TPU and MDA are calculated) will be provided.

D. Preparation Logs (by method)

E. Traceability Documents (by method)

3.0 General Format for Limited Data Package Deliverables

Limited Data Package Deliverables will contain data for all samples in one SDG. All Limited Data Packages will be arranged in the following order:

- Cover Letter/Letter of Transmittal signed by Technical Project Manager or designee
- SDG Narrative signed by Technical Project Manager or designee [The SDG Narrative must include a statement or statements relative to compliance with this document and any applicable QAPP or WP and description of any deviations.]
- References to preparation and analytical methods performed and applicable project documents (*i.e.,* QAPP)
- Field and Internal Laboratory Chain-of-Custody Records
- Sample Receipt Information
- Project Correspondence
- Analytical Result Summaries for all samples

APPENDIX B

ELECTRONIC DATA DELIVERABLES SPECIFICATION

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

KINGSTON FLY ASH RECOVERY PROJECT

ESI Complex EDD Specifications
4/5 File

ENVIRONMENTAL STANDARDS, INC
INFORMATION TECHNOLOGY GROUP
02/05/2009

PREPARED BY

Steven M. Sampson

Acknowledgements

This document was prepared for the Tennessee Valley Authority (TVA) by Steven M. Sampson of Environmental Standards.

TABLE OF CONTENT

Electronic Data Deliverable Requirements *4*

File Format **4**

File Naming Convention **4**

File Delivery **5**

EQuIS EDP Format ESI_v3 ..... **5**

Null Format **6**

EDD Specifications *7*

Field Sample Import Format - ESI_EFW2FSample_v2 ..... **7**

Sample Import Format -ESI_EFW2LabSMP_v2 ..... **10**

Test Import Format - ESI_EFW2LabTST_v2 ..... **12**

Result Import Format - ESI_EFW2LabRES_v2 ..... **16**

Batch Import Format - ESI_EFW2LabBCH_v2 ..... **21**

EQuIS VALID VALUES *23*

Table 1 - Sample Types **23**

Table 2 - Matrix Codes **23**

Table 3 - Unit of Measure **24**

Table 4 – Laboratory Name **27**

Chart 1 – Sample Level Required Fields **27**

Chart 2 – Result Level Required Fields **28**

Electronic Data Deliverable Requirements

The purpose of this document is to describe the specifications of the Environmental Standards, Inc. 5-file Electronic Data Deliverable (EDD) for use within the Earthsoft EQuIS system

File Format

All data from the database must be stored in an ASCII file using a tab-delimited standard format. Maximum length of text fields is indicated in the parentheses. If the information is less than the maximum length, do not pad the record with spaces.

Each record must be terminated with a carriage return/line feed (i.e., standard DOS text file). The file can be produced using any software with the capability to create ASCII files. Date is reported as MM/DD/YY (month/day/year) and time as HH:MM (hour: minute). Time uses a 24-hour clock, thus 3:30 p.m. will be reported as 15:30.

Each record in an import file must have one or more fields with values that make the row unique. These fields are indicated in the **Req.** column, along with fields that are required for other reasons. In the **Req.** column a **Y** indicates that the field is required. If a field is to be considered part of the primary key of a table, it is indicated below by the presence of "PK" in the *PK* column.

File Naming Convention

Five files are required: field sample, lab sample, lab tests, lab results, and lab batches. The filename extensions are used to indicate the file type as follows:

Type of Rows		File Name
Sample level data	Field	COC.ESI_EFW2FSample_v2.txt
	Lab	SDG.ESI_EFW2LabSMP_v2.txt
Lab test level data		SDG.ESI_EFW2LabTST_v2.txt
Analyte result level data		SDG.ESI_EFW2LabRES_v2.txt
Lab batch level data		SDG.ESI_EFW2LabBCH_v2.txt

Where SDG is the Sample Delivery Group and COC is the Chain of Custody number.

The character portion of the filenames must be the same for each group of five files. Filename conventions may be defined however the laboratory and EQuIS Chemistry project manager determine. For example, the date, sample delivery group, or project name may be encoded in the filename if desired. Although we anticipate that all five files will be prepared and loaded into EQuIS Chemistry together in one group, this is not necessary. Each file can be loaded separately if desired.

For the TVA project, all five files indicated above are required to be generated by analytical aaboratories.

File Delivery

The file must be "zipped" together using a compression program such as WinZip. The file naming convention for the zip file is as follows:

SDG.Site.ESI_v3.zip, where SDG is the Sample Delivery Group and Site is the value from the "Site ID #" block on the Chain of Custody. Example: 080209123.Station12.ESI_v3.zip

The zipped file must contain a valid EQuIS certificate obtained from Environmental Standards. Laboratories will need to request an EQuIS certificate from Environmental Standards by sending an email to ssampson@envstd.com indicating the email address for which the certificate should be linked. This email address will receive all notifications regarding the status of the EDD receipt.

The zipped file should be emailed to TVAEDD@envstd.com. Once EQuIS receives and checks the EDD, a notification will be sent to the email address supplied by the laboratory. EDD load failure notifications will be accompanied with a detailed error report outlining the errors found in the EDD. Laboratories are responsible for correcting any errors and resubmitting the EDD. The corrected EDD file name must be different from the initial file. However, laboratories need only to add a letter to the SDG to create a unique deliverable. If the resubmitted file has the same name as the initial file, it will be rejected as a duplicate submittal.

EQuIS EDP Format ESI_v3

EDDs should be tested prior to submission. The ESI_v3 EDP Format package can be obtained by contacting Environmental Standards. However, laboratories will be responsible for obtaining the appropriate Earthsoft EDP user license.

ESI_v3 EDP Format Package contains four files are follows:

- Esi_v3.xsd
- ESI_v3.vb
- ESI_v3-enum.xsd
- ESI_v3.rvf

All four files are necessary for testing EDDs and must be stored in the same folder. You will receive the four files in a zipped file from Environmental Standards along with project details.

The ESI_v3.rvf contains all the reference values for this project. All EDDs for this project must comply with the reference values in this file. A new "RVF" will be sent each time the reference values are update. Laboratories can request these reference values in a spreadsheet from Environmental Standards.

Null Format

Many fields are optional, and the list of valid values may be defined in a project or lab specific manner as determined by the laboratory and project manager. When a field is not listed as required, this means that a null or blank may be appropriate. However, tabs must still surround the blank value. In other words, the number of fields is always the same, whether or not the fields include data is optional.

EDD Specifications

EDD formats for the five individual required EDD files are described on the following tables. These files are the Field Sample file, the Sample file, the Test file, the Result file, and the Batch file.

Field Sample Import Format - ESI_EFW2FSample_v2

*Only field samples should be included in this file

Pos#	Field Name	Data Type	PK	Required?	VVL	Field Definition
1	sys_sample_code	Text (40)	PK	Y		Unique sample identifier as shown on Chain of Custody.
2	sample_name	Text (30)		Y		Same as sys_sample_code.
3	sample_matrix_code	Text (10)		Y	Table 2	Code that distinguishes between different types of sample matrices.
4	sample_type_code	Text (20)		Y	Table 1	Code that distinguishes between different types of samples.
5	sample_source	Text (10)		Y		This field identifies where the sample came from. Should be **Field** for all samples in this file.
6	parent_sample_code	Text (40)		See Chart 1		The value of "sys_sample_code" that uniquely identifies the sample that was the source of this sample.
7	sample_date	Date		Y		Date of sample collection (MM/DD/YY).

Pos#	Field Name	Data Type	PK	Required?	VVL	Field Definition
8	sample_time	Time		Y		Time of sample collection (HH:MM).
9	sys_loc_code	Text(20)		Y		Sample collection location as shown on chain of custody
10	start_depth	Double		N		Beginning depth (top) of sample.
11	end_depth	Double		N		Ending depth (bottom) of sample.
12	depth_unit	Text (15)		N	Table 3	Unit of measurement for the sample begin and end depths.
13	chain_of_custody	Text (15)		Y		Chain of custody identifier. A single sample may be assigned to only one chain of custody.
14	sent_to_lab_date	Date		N		Date sample was sent to lab (MM/DD/YY)
15	sampler	Text (30)		N		Name or initials of sampler.
16	sampling_company_ code	Text (10)		N		Name or initials of sampling company
17	sampling_reason	Text (30)		N		Reason for sampling.
18	sampling_technique	Text (40)		N		Sampling technique.
19	method_analyte_group	Text (40)		Y	Y	Field Method Analyte Group Name
20	task_code	Text (10)		N		Same as chain of custody number from chain of custody.
21	collection_quarter	Text (5)		N		Quarter of the year sample was collected (e.g., "1Q96")

Pos#	Field Name	Data Type	PK	Required?	VVL	Field Definition
22	composite_yn	Text (1)		Where applicable		Y/N field used to indicate whether a sample is a composite sample
23	composite_desc	Text (255)		Where applicable		Description of composite sample
24	sample_class	Text (10)		N		Navy sample class code.
25	comment	Text(255)		N		Sample comments as necessary.
26	tat_start_date	Date		Y		Date sample was shipped to lab (MM/DD/YY)
27	TAT	Text(2)		Y		Turn around time. <=48 hours should be reported in hours, >48 hours should be reported in days
28	matrix_spike_yn	Text(1)		Y		Y/N field used to indicate whether a matrix spike is required.
29	matrix_spike_dup_yn	Text(1)		Y		Y/N field used to indicate whether a matrix spike duplicate is required.

Sample Import Format -ESI_EFW2LabSMP_v2

*Both field and laboratory samples should be included in this file

Pos#	Field Name	Data Type	PK	Required?	VVL?	Field Definition
1	chain_of_custody	Text(15)		Y		Chain of custody identifier. A single sample may be assigned to only one chain of custody. Chain of custody identifier can be found on the chain of custody
2	sys_sample_code	Text(40)	PK	Y		Unique sample identifier. Sample Id from chain of custody. Lab sample's sys_sample_code should have the SDG appended to its value to insure uniqueness throughout the life of the EQuIS database.
3	sample_type_code	Text(20)		Y	Table 1	Code that distinguishes between different types of samples.
4	sample_matrix_code	Text(10)		Y	Table 2	Code that distinguishes between different types of sample matrices
5	sample_source	Text(10)		Y		Must be either **Field** for field samples or **Lab** for internally generated laboratory QC samples.
6	parent_sample_code	Text(40)		See Chart 1		The value of "sys_sample_code" that uniquely identifies the sample that was the source of this sample.
7	comment	Text(255)		N		Sample comments.
8	sample_date	Date		See Chart 1		Date of sample collection (MM/DD/YY).

Pos#	Field Name	Data Type	PK	Required?	VVL?	Field Definition
9	sample_time	Text(5)		See Chart 1		Time of sample collection (HH:MM).
10	sample_receipt_date	Date		See Chart 1		Date of sample receipt by laboratory (MM/DD/YY).
11	sample_delivery_group	Text(10)		Y		Sample delivery group as by defined laboratory
12	standard_solution_ source	Text(20)		N		Relevant only for laboratory-generated samples. Textual description of the source of standard solutions as needed for certain laboratory samples
13	sample_receipt_time	Text (5)		See Chart 1		Time of sample receipt by laboratory (HH:MM).

Test Import Format - ESI_EFW2LabTST_v2

Pos#	Field Name	Data Type	PK	Required?	VVL?	Field Definition
1	sys_sample_code	Text(40)	PK	Y		Unique sample identifier. Sample Id from chain of custody. Lab sample's sys_sample_code should have the SDG appended to its value to insure uniqueness throughout the life of the EQuIS database..
2	lab_anl_method_ name	Text(35)	PK	Y	Y	Laboratory analytic method name or description.
3	analysis_date	Date	PK	Y		Date of sample analysis (MM/DD/YY).
4	analysis_time	Text(5)	PK	Y		Time of sample collection (HH:MM).
5	total_or_dissolved	Text(1)	PK	Y		"T" for total [metal] concentration, "D" for dissolved or filtered [metal] concentration, "C" for TCLP, or "N" for organic (or other) constituents for which neither "total" nor "dissolved" is applicable.
6	column_number	Text(2)	PK	Y		"1C" for first column analyses, "2C" for second column analyses, or "NA" for analyses for which neither "1C" nor "2C" is applicable.
7	test_type	Text(10)	PK	Y		Type of test. Valid values include "initial", "reextract", and "reanalysis".

Pos#	Field Name	Data Type	PK	Required?	VVL?	Field Definition
8	lab_matrix_code	Text(10)		Y	Table 2	Code that distinguishes between different types of sample matrices
9	analysis_location	Text(2)		Y		Must be either "FI" for field instrument or probe, "FL" for mobile field laboratory analysis, or "LB" for fixed-based laboratory analysis.
10	basis	Text(10)		Y		Must be either "Wet" for wet-weight basis reporting, "Dry" for dry-weight basis reporting, or "NA" for tests for which this distinction is not applicable.
11	container_id	Text(30)		Where applicable		Sample container identifier.
12	dilution_factor	Single		Y		Effective test dilution factor.
13	prep_method	Text(35)		Where applicable		Laboratory sample preparation method name or description.
14	prep_date	Date		Where applicable		Date of sample preparation (MM/DD/YY).
15	prep_time	Text(5)		Where applicable		Time of sample preparation (HH:MM).
16	leachate_method	Text(15)		Where applicable		Laboratory leachate generation method name or description.
17	leachate_date	Date		Where		Date of sample leachate (MM/DD/YY).

Pos#	Field Name	Data Type	PK	Required?	VVL?	Field Definition
				applicable		
18	leachate_time	Text(5)		Where applicable		Time of sample leachate (HH:MM).
19	lab_name_code	Text(10)		Y	Table 4	Unique identifier of the laboratory
20	qc_level	Text(10)		N		Data validation QC level.
21	lab_sample_id	Text(20)		Y		Laboratory sample identifier.
22	percent_moisture	Text(5)		Y		Percent moisture of the sample portion used in this test; this value may vary from test to test for any sample. Numeric format is "NN.MM", i.e., 70.1% could be reported as "70.1" but not as "70.1%".
23	subsample_amount	Text(14)		See Chart 1		Amount of sample used for test.
24	subsample_amount_ unit	Text(15)		See Chart 1	Table 3	Unit of measurement for subsample amount.
25	analyst_name	Text(30)		N		Name or initials of laboratory analyst
26	instrument_id	Text(50)		N		Instrument identifier.
27	comment	Text(255)		N		Comments about the test.
28	preservative	Text(50)		N		Sample preservative used.
29	final_volume	Text(15)		See Chart 1		The final amount of the sample after sample preparation.

Pos#	Field Name	Data Type	PK	Required?	VVL?	Field Definition
30	final_volume_unit	Text(15)		See Chart 1	Table 3	The unit of measure that corresponds to the final_volume

Result Import Format - ESI_EFW2LabRES_v2

Pos #	*Field Name*	Data Type	PK	Required?	VVL?	Field Definition
1	sys_sample_code	Text(40)	PK	Y		Unique sample identifier. Sample Id from chain of custody. Lab sample's sys_sample_code should have the SDG appended to its value to insure uniqueness throughout the life of the EQuIS database.
2	lab_anl_method_name	Text(35)	PK	Y	Y	Laboratory analytic method name or description.
3	analysis_date	Date	PK	Y		Date of sample analysis (MM/DD/YY).
4	analysis_time	Text(5)	PK	Y		Time of sample analysis (HH:MM).
5	total_or_dissolved	Text(1)	PK	Y		"T" for total [metal] concentration, "D" for dissolved or filtered [metal] concentration, or "N" for organic (or other) constituents for which neither "total" nor "dissolved" is applicable.
6	column_number	Text(2	PK	Y		"1C" for first column analyses, "2C" for second column analyses, or "NA" for analyses for which neither "1C" nor "2C" is applicable.
7	test_type	Text(10)	PK	Y		Type of test. Valid values include "initial", "reextract", and "reanalysis".

Pos #	*Field Name*	Data Type	PK	Required?	VVL?	Field Definition
8	cas_rn	Text(15)	PK	Y	Y	Chemical Abstracts Registry Number for the parameter.
9	chemical_name	Text(60)		Y		Chemical name
10	result_value	Text(20)		Where Applicable		Analytic result reported at an appropriate number of significant digits. Must be null for non-detects.
11	result_error_delta	Text(20)		N		Error range applicable to the result value; typically used only for radiochemistry results.
12	result_type_code	Text(10)		Y		Must be either "TRG" for a target or regular result, "TIC" for tentatively identified compounds, "SUR" for surrogates, "IS" for internal standards, or "SC" for spiked compounds.
13	reportable_result	Text(10)		Y		Y/N field used to indicate whether a result is reportable.
14	detect_flag	Text(2)		Y		Y/N field used to indicate whether a result is detected
15	lab_qualifiers	Text(7)		N		Qualifier flags assigned by the laboratory.
16	organic_yn	Text(1)		Y		Y/N field used to indicate whether a result is organic.

Pos #	*Field Name*	Data Type	PK	Required?	VVL?	Field Definition
17	method_detection_limit	Text(20)		Y		Method detection limit.
18	reporting_detection_limit	Text(20)		Y		Detection limit that reflects conditions such as dilution factors and moisture content.
19	quantitation_limit	Text(20)		Y		Concentration level above which results can be quantified with confidence. It must reflect conditions such as dilution factors and moisture content.
20	result_unit	Text(15)		Y	Table 3	Units of measurement for the result.
21	detection_limit_unit	Text(15)		Y	Table 3	Units of measurement for the reporting limit(s).
22	tic_retention_time	Text(8)		N		Retention time in seconds for tentatively identified compounds.
23	result_comment	Text(255)		N		Result specific comments.
24	qc_original_conc	Text(14)		See Chart 2		The concentration of the analyte in the original (unspiked) sample.
25	qc_spike_added	Text(14)		See Chart 2		The concentration of the analyte added to the original sample.
26	qc_spike_measured	Text(14)		See Chart 2		The measured concentration of the analyte. Use zero for spiked compounds that were not detected in the sample.

Pos #	*Field Name*	Data Type	PK	Required?	VVL?	Field Definition
27	qc_spike_recovery	Text(14)		See Chart 2		The percent recovery calculated.
28	qc_dup_original_conc	Text(14)		See Chart 2		The concentration of the analyte in the original (unspiked) sample.
29	qc_dup_spike_added	Text(14)		See Chart 2		The concentration of the analyte added to the original sample. Use zero for spiked compounds that were not detected in the sample.
30	qc_dup_spike_measured	Text(14)		See Chart 2		The measured concentration of the analyte in the duplicate. Use zero for spiked compounds that were not detected in the sample.
31	qc_dup_spike_recovery	Text(14)		See Chart 2		The duplicate percent recovery calculated.
32	qc_rpd	Text(8)		See Chart 2		The relative percent difference calculated.
33	qc_spike_lcl	Text(8)		See Chart 2		Lower control limit for spike recovery.
34	qc_spike_ucl	Text(8)		See Chart 2		Upper control limit for spike recovery.
35	qc_rpd_cl	Text(8)		See Chart 2		Relative percent difference control limit.
36	qc_spike_status	Text(10)		See Chart 2		Used to indicate whether the spike recovery was within control limits. Use the "*" character to indicate failure, otherwise leave blank.

Pos #	*Field Name*	Data Type	PK	Required?	VVL?	Field Definition
37	qc_dup_spike_status	Text(10)		See Chart 2		Used to indicate whether the duplicate spike recovery was within control limits. Use the "*" character to indicate failure, otherwise leave blank.
38	qc_rpd_status	Text(10)		See Chart 2		Used to indicate whether the relative percent difference was within control limits. Use the "*" character to indicate failure, otherwise leave blank.

Batch Import Format - ESI_EFW2LabBCH_v2

Pos #	Field Name	Data Type	PK	Required?	VVL?	Field Definition
1	sys_sample_code	Text (40)	PK	Y		Unique sample identifier. Sample Id from chain of custody. Lab sample's sys_sample_code should have the SDG appended to its value to insure uniqueness throughout the life of the EQuIS database.
2	lab_anl_method_name	Text (35)	PK	Y	Y	Laboratory analytic method name or description.
3	analysis_date	Date	PK	Y		Date of sample analysis (MM/DD/YY).
4	analysis_time	Text(5)	PK	Y		Time of sample analysis (HH:MM).
5	total_or_dissolved	Text(1)	PK	Y		"T" for total [metal] concentration, "D" for dissolved or filtered [metal] concentration, or "N" for organic (or other) constituents for which neither "total" nor "dissolved" is applicable.
6	column_number	Text(2)	PK	Y		"1C" for first column analyses, "2C" for second column analyses, or "NA" for analyses for which neither "1C" nor "2C" is applicable.
7	test_type	Text(10)	PK	Y		Type of test. Valid values include "initial", "reextract", and "reanalysis".

Pos #	Field Name	Data Type	PK	Required?	VVL?	Field Definition
8	test_batch_type	Text(10)	PK	Y		Lab batch type. Valid values include "Prep", "Analysis", and "Leach".
9	test_batch_id	Text(20)		Y		Unique identifier for all lab batches. For example, the same identifier cannot be used for a prep batch and an analysis batch.

EQuIS VALID VALUES

Table 1 - Sample Types

Sample_type_code	Sample_type_desc
AB	Ambient Conditions Blank
BD	Blank Spike Duplicate
BS	Blank Spike
EB	Equipment Blank
FD	Field Duplicate
FR	Field Replicate
LB	Lab Blank
LR	Lab Replicate
MB	Method Blank
MS	Lab Matrix Spike
N	Normal Environmental Sample
RB	Material Rinse Blank
SD	Lab Matrix Spike Duplicate
TB	Trip Blank

Table 2 - Matrix Codes

Matrix_code	Matrix_desc
A	Aqueous
AIR	Air
S	Solid
W	Wipe

Table 3 - Unit of Measure

Reported_unit	Unit_desc	Reported_unit	Unit_desc
%v/v	percent by volume	g/kg	grams per kilogram
1/s	per second	g/l	grams per liter
acre ft	acre feet	g/m2/yr	grams per square meter per year
acres	acres	g/ml	grams per milliliter
admi color	admi (american dye manufacturers institute) color units	gal	gallons
bars	bars	gal/min	gallons per minute
cfs	cubic feet per second	gpd	gallons per day
cfu/100ml	colony forming units per 100 milliliters	gpd/ft	gallons per day per foot
cfu/g	colony forming units per gram	gpd/ft2	gallons per day per foot squared
cfu/ml	colony forming units per milliliters	gpm/ft	gallons per minute per foot
cm	centimeters	gpy	gallons per year
cm/hr	centimeters per hour	hrs	hours
cm/sec	centimeters per second	hrs/day	hours per day
cm/yr	centimeters per year	in	inches
cm2/sec	square centimeters per second	in(hg)	inches of mercury
colf/100ml	coliform bacteria per 100 milliliters	in/day	inches per day
colf/g	coliform bacteria per gram	in/ft	inches per foot
color unit	color unit	in/hr	inches per hour
day	days	in/in	inches per inch
deg c	degrees Celsius	in/wk	inches per week
deg c/hr	degrees Celsius per hour	in2/ft	square inches per foot
deg f	degrees Fahrenheit	jcu	jackson candle units
digits	number of digits to the right of the decimal point	jtu	jackson turbidity units
dollars	dollars	kg/1000gal	kilograms per 1000 gallons
dpy	drums per year	kg/batch	kilograms per batch
dynes/cm	dynes per centimeter	kg/day	kilograms per day
fibers/l	fibers per liter	kg/m3	kilogram per meter cubed
ft	feet	kg/m3/s	kilogram per meter cubed per second
ft candles	foot candles	kg/s	kilogram per second
ft msl	feet above mean sea level	km2	square kilometers
ft/day	feet per day	knots	knots
ft/in	feet per inch	lb/1000lb	pounds per thousand pounds
ft/min	feet per minute	lb/barrel	pound per barrel

ft/sec	feet per second	lb/in2	pounds per square inch
ft2	square feet	lb/ton	pounds per ton
ft2/day	square feet per day (cubic feet/day-foot)	lbs	pounds
ft2/min	feet squared per minute (for units of transmissivity)	lbs/day	pounds per day
ft3	cubic feet	lbs/mon	pounds per month
ft3/yr	cubic feet per year	lbs/yr	pounds per year
g/cc	grams per cubic centimeter	m	meter
g/g	grams per gram	m/day	meters per day
m/s	meter per second	pci/g	picocuries per gram
m2	meter squared	pci/l	picocuries per liter
m2/s	meter squared per second	pci/ml	picocuries per milliliters
m3 x 10(6)	meter cubed (in millions)	per loss	percent loss
m3/kg	meter cubed per kilogram	percent	percent
m3/s	meter cubed per second	pg/g	picogram per gram
meq/100g	milliequivalents per 100 grams	pg/kg	picograms per kilogram
mg/100cm2	Milligrams per 100 square centimeters	pg/l	picogram per liter
mg/flt	Milligrams per filter	pg/m3	picograms per cubic meter
mg/g	Milligrams per gram	pg/ul	picograms per microliter
mg/kg	milligrams per kilogram	ph units	ph units
mg/l	milligrams per liter	ppb	parts per billion
mg/m2	milligrams per square meter	ppbv	parts per billion by volume
mg/m2/day	milligrams per meter squared per day	ppm	parts per million
mg/m3	milligrams per cubic meter (ppbv)	ppmv	parts per million by volume
mg/ml	milligrams per milliliter	pptv	parts per trillion by volume
mgal	million gallons	psf	pounds per square foot
mgd	millions of gallons per day	psi	pounds per square inch
mgdo/l	milligrams dissolved oxygen per liter	s	second
mgm	millions of gallons per month	t.o.n.	threshold order number
mgy	millions of gallons per year	tons/acre	tons per acre
mile2	square miles	tons/day	tons per day
miles	miles	ug/100cm2	micrograms per 100 square centimeters
mill ft3	million feet cubed	ug/cm2	microgram per square centimeters
millivolts	millivolts	ug/g	micrograms per gram
min	minutes	ug/kg	micrograms per kilogram
ml	milliliter	ug/l	micrograms/liter
ml/l	milliliter per liter	ug/m3	micrograms per cubic meter
mm	millimeter	ug/yr	micrograms per year
mm/m2/hr	millimeter per meter squared per hour	um/sec	micrometer per second

mm/yr	millimeter per year	umhos/cm	umhos per centimeter
mmhos/cm	milliohms (mmhos) per centimeter	upy	units per year
mol %	mole percent		
mon	month		
mph	miles per hour		
mpn/100ml	most probable number per 100 ml		
ms/cm	microsiemens per centimeter		
naut.mile	nautical mile		
ng/100cm2	nanograms per 100 square centimeters		
ng/g	nanograms per gram		
ng/kg	nanogram per kilogram		
ng/l	nanogram per liter		
ng/m3	nanogram per cubic meter		
ng/ml	nanograms per milliliter		
none	no unit of measure		
ntu	nephelometric turbidity units		
pcf	pounds per cubic foot		

Table 4 – Laboratory Name

Lab Code	Lab name
ESC	ESC Lab Sciences
MB-KNOX	Microbac - Knoxville Division
TA	TEST AMERICA
TAA	TEST AMERICA - ANCHORAGE
TAK	Test America Knoxville
TAN	Test America Nashville
TAP	TEST AMERICA PORTLAND
TAPitt	Test America Pittsburgh

Chart 1 – Sample Level Required Fields

	AB	BD	BS	EB	FD	FR	LB	LR	MB	MS	N	RB	SD	TB
parent_sample_code		X	X					X		X			X	
sample_date	X			X	X	X					X	X		X
sample_time	X			X	X	X					X	X		X
sample_receipt_date	X			X	X	X					X	X		X
sample_receipt_time	X			X	X	X					X	X		X
subsample_amount	X			X	X	X	X		X	X	X	X	X	X
subsample_amount_unit	X			X	X	X	X		X	X	X	X	X	X
final_volume	X			X	X	X	X		X	X	X	X	X	X
final_volume_unit	X			X	X	X	X		X	X	X	X	X	X

Chart 2 – Result Level Required Fields

	TRG												
	AB	BD	BS	EB	FD	FR	LB	LR	MS	N	RB	SD	TB
qc_original_conc					X	X		X	X				
qc_spike_added			X						X				
qc_spike_measured			X						X				
qc_spike_recovery			X						X				
qc_dup_original_conc		X										X	
qc_dup_spike_added		X										X	
qc_dup_spike_measured		X										X	
qc_dup_spike_recovery		X										X	
qc_rpd		X						X				X	
qc_rpd_cl		X						X				X	
qc_spike_lcl		X	X						X			X	
qc_spike_ucl		X	X						X			X	
qc_spike_status			X						X				

	SUR												
	AB	BD	BS	EB	FD	FR	LB	LR	MS	N	RB	SD	TB
qc_original_conc													
qc_spike_added	X		X	X	X	X	X	X	X	X	X		X
qc_spike_measured	X		X	X	X	X	X	X	X	X	X		X
qc_spike_recovery	X		X	X	X	X	X	X	X	X	X		X
qc_spike_recovery													
qc_dup_spike_added		X										X	
qc_dup_spike_measured		X										X	
qc_dup_spike_recovery		X										X	
qc_rpd													
qc_rpd_cl													
qc_spike_lcl	X	X	X	X	X	X	X	X	X	X	X	X	X
qc_spike_ucl	X	X	X	X	X	X	X	X	X	X	X	X	X
qc_spike_status	X		X	X	X	X	X	X	X	X	X		X
qc_dup_spike_status		X										X	
qc_rpd_status													

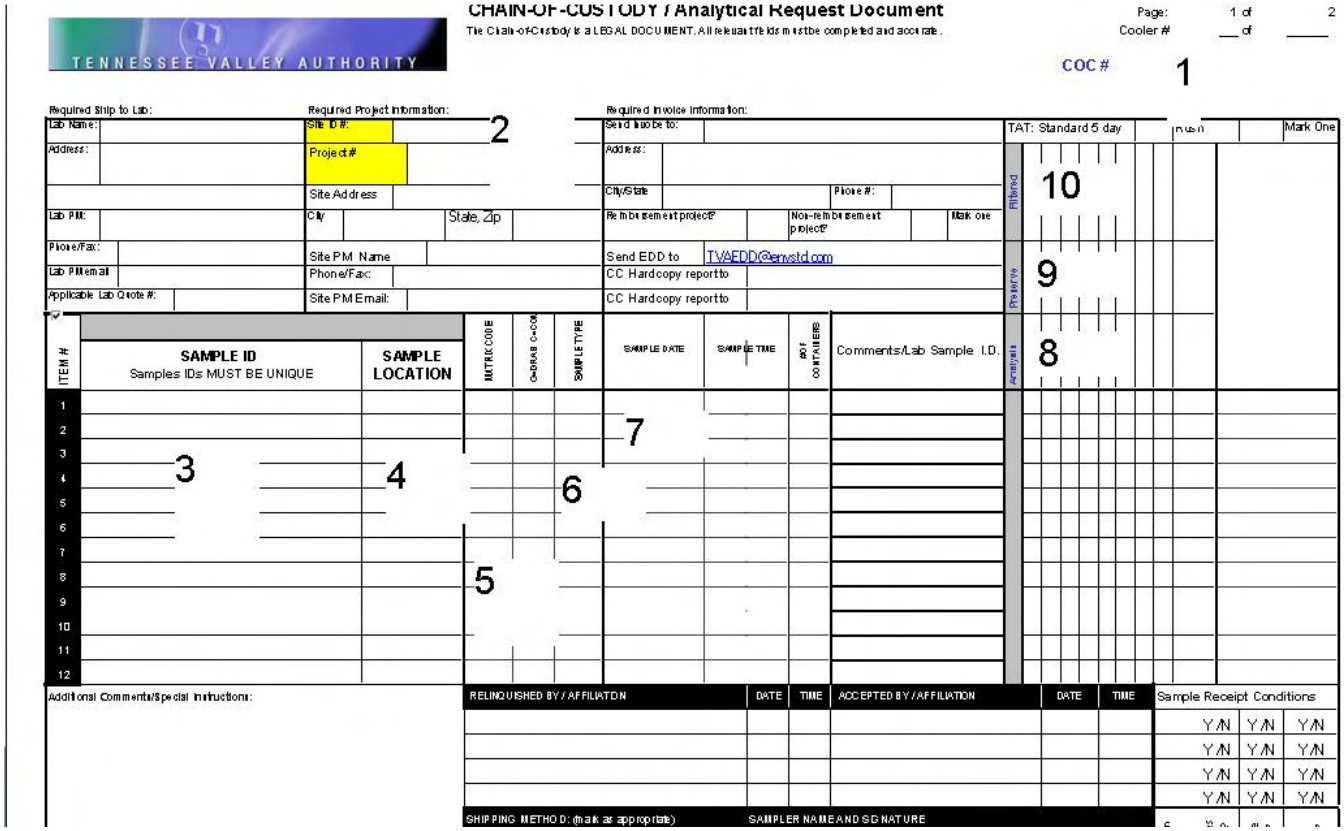

Figure 1: Chain of Custody

Chain of Custody/EDD Match

Chain of Custody Field	EDD Format File	EDD Column
1. Chain of Custody	- ESI_EFW2FSample_v2	Chain_of_custody
		Task_code
	- ESI_EFW2LabSMP	Chain_of_custody
2. Site #	EDD Zip File Deliverable	Site Name
3. Sample ID	ALL EDD Format Files	Sys_sample_code
	- ESI_EFW2FSample_v2	Sample_name
4. Sample Location	- ESI_EFW2FSample_v2	Sys_loc_code
5. Matrix Code	- ESI_EFW2FSample_v2 - ESI_EFW2LabSMP	Sample_matrix_code
6. Sample Type	- ESI_EFW2FSample_v2 - ESI_EFW2LabSMP	Sample_type_Code
7. Sample Date & Time	ALL EDD Format Files	Sample Date, Sample Time

Chain of Custody Field	EDD Format File	EDD Column
8. Analysis	- ESI_EFW2FSample_v2	Method_analyte_group

APPENDIX C

AQUEOUS SAMPLE MONITORING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sample Containers, Preservation, and Holding Times

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-1. Sample Containers, Preservation, and Holding Times
Aqueous Samples

Parameter	Method	Suggested Volume	Container	Preservative	Holding Time
Total Metals	EPA 200.7/200.8 SW-846 6010B/6020	1 L	P, G	HNO_3 to pH < 2	6 months
Dissolved Metals	EPA 200.7/200.8 SW-846 6010B/6020	1 L	P, G	HNO_3 to pH < 2 after filtration	6 months
Total Mercury	EPA 245.1 SW-846 7470A	1 L	P, G	HNO_3 to pH < 2	28 days
Dissolved Mercury	EPA 245.1 SW-846 7470A	1 L	P, G	HNO_3 to pH < 2 after filtration	28 days
Low-Level Mercury	EPA 245.7	1 L	P, G	12 N HCl to pH < 2 Cool to ≤6°C	28 days
Alkalinity	SM 2320B	1 L	P, G	Cool to ≤6°C	14 days
Total Hardness	EPA 200.7/200.8 SM 2340B	1 L	P, G	HNO_3 to pH < 2 Cool to ≤6°C	6 months
Total Suspended Solids (TSS)	EPA 160.2 SM2540D	1 L	P, G	Cool to ≤6°C	7 days
Total Dissolved Solids (TDS)	SM 2540C	1 L	P, G	Cool to ≤6°C	7 days
pH	EPA 150.2 SM 4500H^+B	1 L	P, G	Cool to ≤6°C	24 hours
Anions	EPA 300.0	1 L	P, G	Cool to ≤6°C	28 days
Nitrate-nitrite	EPA 353.2	1 L	P, G	H_2SO_4 to pH < 2 Cool to ≤6°C	28 days
Phosphorus	EPA 365.4	1 L	P, G	H_2SO_4 to pH < 2 Cool to ≤6°C	28 days
Ammonia	EPA 350.1	1 L	P, G	H_2SO_4 to pH < 2 Cool to ≤6°C	28 days
Total Kjeldahl Nitrogen	EPA 351.2	1 L	P, G	H_2SO_4 to pH < 2 Cool to ≤6°C	28 days
Oil and Grease	EPA 1664	I L	P, G	HCL to pH < 2 Cool to ≤6°C	28 days
Ortho-phosphate	SM4500-PE	1 L	P, G	Cool to ≤6°C	48 hours
Total Inorganic Carbon	SM5310B	1 L	G	Cool to ≤6°C	14 days
Total Organic Carbon	SM5310B	1 L	P, G	H_2SO_4 to pH < 2 Cool to ≤6°C	28 days
Dissolved Organic Carbon	SM5310B	125 mL	P	H_2SO_4 to pH < 2 Cool to ≤6°C	28 days

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-1. Sample Containers, Preservation, and Holding Times
Aqueous Samples

Parameter	Method	Suggested Volume	Container	Preservative	Holding Time
Turbidity	EPA 180.1 SM2130B	1 L	P, G	Cool to ≤6°C	48 hours
Radium-226	EPA 903.0	1 L	P	None	6 months
Radium-228	EPA 904 Modified	1 L	P	None	6 months
Total Uranium	ASTM D5174-D	1 L	P	None	6 months
Uranium Isotopes	EPA 908.0	1 L	P	None	6 months
Gamma Spectroscopy Isotopes	EPA 901.1 Modified	1 L	P	None	6 months
Thorium Isotopes	EML Th-01 Modified/Alpha Spec	1 L	P	None	6 months
Total Arsenic and Selenium	EPA 1638	250 mL	P	HNO_3 to pH < 2 Cool to ≤6°C	6 months
As(III) As(V)	EPA 1632	250 mL	P	HCl to pH < 2 Cool to ≤6°C	28 days
Se(IV) Se(VI)	BR-0061	250 mL	P	HCl to pH < 2 Cool to ≤6°C	14 days
Methylmercury	EPA 1630	250 mL	FLPE	Cool to ≤6°C	6 months
Inorganic mercury	EPA 1630 EPA 1631	250 mL	FLPE	Cool to ≤6°C	6 months
Total Mercury	EPA 1631	500 mL	FLPE	Cool to ≤6°C	90 days
Hexavalent Chromium	SW-846 7199	500 mL	P	Cool to ≤6°C	24 hours[1]

G = Glass container.
P = Plastic container (polyethylene container used for metals).
FLPE = fluorinated polyethylene.

[1] The holding time for hexavalent chromium may be extended to 28 days from sample collection to analysis if the sample is preserved with ammonia sulfate buffer to between pH 9.3 to 9.7.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-2. Analytes, Methods, and Target Reporting Limits: Aqueous Samples

Sample Type(s)	Test Parameter	Preparation Method	Test Method	Reporting Limit[1]
Surface Water Stilling Pond Discharge Elutriate	**General Chemistry**			
	pH	NA	EPA 150.1/SM 4500	0.1 pH Units
	Alkalinity	NA	SM 2320B	10 mg/L
	Total Hardness	NA	EPA 200.7/200.8/ SM 2340B	6.62 mg/L
	Total Suspended Solids (TSS)	NA	SM 2540D	1.0 mg/L
	Total Dissolved Solids (TDS)	NA	SM 2540C	10 mg/L
Surface Water Elutriate	**Metals—Total and Dissolved**			
	Aluminum	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.100 mg/L
	Antimony	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Arsenic	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Barium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.01 mg/L
	Beryllium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Boron	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.01 mg/L
	Cadmium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.001 mg/L
	Calcium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Chromium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Cobalt	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Copper	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L
	Iron	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.05 mg/L
	Lead	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Magnesium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Manganese	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L
	Mercury	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.0002 mg/L
	Molybdenum	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L
	Nickel	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-2. Analytes, Methods, and Target Reporting Limits: Aqueous Samples

Sample Type(s)	Test Parameter	Preparation Method	Test Method	Reporting Limit[1]
Surface Water Elutriate	Potassium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Selenium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Silver	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Sodium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Thallium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Vanadium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.004 mg/L
	Zinc	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.050 mg/L
Groundwater	**Metals – Total and Dissolved**			
	Aluminum	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.100 mg/L
	Antimony	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Arsenic	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Barium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.01 mg/L
	Beryllium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Boron	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.01 mg/L
	Cadmium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.001 mg/L
	Calcium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Chromium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Cobalt	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Copper	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L
	Iron	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.05 mg/L
	Lead	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Magnesium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Manganese	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-2. Analytes, Methods, and Target Reporting Limits: Aqueous Samples

Sample Type(s)	Test Parameter	Preparation Method	Test Method	Reporting Limit[1]
Groundwater	Mercury	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.0002 mg/L
	Molybdenum	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L
	Nickel	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.005 mg/L
	Potassium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Selenium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Silver	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Sodium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	1.0 mg/L
	Strontium	EPA 200.7/ SW-846 3010A	EPA 200.7/ SW-846 6010	0.002 mg/L
	Thallium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.004 mg/L
	Vanadium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.050 mg/L
	Zinc	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.050 mg/L
	General Chemistry			
	Chloride	NA	EPA 300.0	1.0 mg/L
	Fluoride	NA	EPA 300.0	0.100 mg/L
	Sulfate	NA	EPA 300.0	1.0 mg/L
	Ammonia Nitrogen	NA	EPA 350.1	0.100 mg/L
	Total Kjeldahl Nitrogen	NA	EPA 351.2	0.100 mg/L
	Nitrate-nitrite Nitrogen	NA	EPA 353.2	0.100 mg/L
	Total Inorganic Carbon	NA	SM 5310B	1.0 mg/L
	Total Suspended Solids (TSS)	NA	SM 2540D	1.0 mg/L
	Total Dissolved Solids (TDS)	NA	SM 2540C	10.0 mg/L
Stilling Pond Discharge	**Metals—Total and Dissolved**			
	Aluminum	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.100 mg/L
	Arsenic	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Cadmium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.001 mg/L
	Selenium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L
	Thallium	EPA 200.8/ SW-846 3010A	EPA 200.8/ SW-846 6020	0.002 mg/L

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-2. Analytes, Methods, and Target Reporting Limits: Aqueous Samples				
Sample Type(s)	**Test Parameter**	**Preparation Method**	**Test Method**	**Reporting Limit[1]**
Stilling Pond Discharge	Mercury	EPA 245.1/ SW-846 7470	EPA 245.1/ SW-846 7470	0.0002 mg/L
	Mercury, low-level	EPA 245.7	EPA 245.7	0.000005 mg/L
Surface Water	Radium-226	NA	EPA 903.0	1 pCi/L
	Radium-228	NA	EPA 904 Modified	1 pCi/L
	Total Uranium	NA	ASTM D5174-D	1 pCi/L
	Uranium-234	NA	EPA 908.0	1 pCi/L
	Uranium-235	NA	EPA 908.0	1 pCi/L
	Uranium-238	NA	EPA 908.0	1 pCi/L
	Thorium-230	NA	EML Th-01 Modified/Alpha Spec	1 pCi/L
	Thorium-228	NA	EML Th-01 Modified/Alpha Spec	1 pCi/L
	Thorium-232	NA	EML Th-01 Modified/Alpha Spec	1 pCi/L
	Gamma Spectroscopy Isotopes	NA	EPA 901.1 Modified	1 pCi/L

[1] Reporting limits represent the laboratory quantitation limits. Samples analyzed by TVA's contracted laboratories may be reported to the project method detection limit (MDL).

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-3. Summary of Precision and Accuracy Objectives for Quality Control Samples Aqueous Matrices

Analyte	Prep/Analytical Method	Chemical Yield (%)	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision (RPD)	Field Duplicate Precision**
Total Metals	EPA 200.7/200.8 SW-846 6010/6020	NA	85-115 80-120	75-125	20	20	20	RPD < 20% difference < the RL
Dissolved Metals	EPA 200.7/200.8 SW-846 6010/6020	NA	85-115 80-120	75-125	20	20	20	RPD < 20% difference < the RL
Total Mercury	EPA 245.1 SW-846 7470	NA	85-115 80-120	75-125	20	20	20	RPD < 20% difference < the RL
Dissolved Mercury	EPA 245.1 SW-846 7470	NA	85-115 80-120	75-125	20	20	20	RPD < 20% difference < the RL
Low-Level Mercury	EPA 245.7	NA	85-115	75-125	20	20	20	RPD < 20% difference < the RL
Alkalinity	SM 2320B/ EPA 310.2	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Total Hardness	SM 2340B/ EPA 200.7	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Total Dissolved Solids	SM 2540C	NA	80-120	NA	20	NA	20	RPD < 20% difference < the RL
Total Suspended Solids	SM 2540 D/ EPA 160.2	NA	80-120	NA	20	NA	20	RPD < 20% difference < the RL
pH	EPA 150.2/ SM 4500PE	NA	NA	NA	NA	NA	±0.1 pH units	±0.1 pH units
Anions (Chloride, Fluoride, and Sulfate)	EPA 300.0	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table C-3. Summary of Precision and Accuracy Objectives for Quality Control Samples Aqueous Matrices

Analyte	Prep/Analytical Method	Chemical Yield (%)	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision (RPD)	Field Duplicate Precision**
Nitrate-nitrite	EPA 353.2	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Phosphorus	EPA 365.4	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Ammonia	EPA 350.1	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Total Kjeldahl Nitrogen	EPA 351.2	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Oil and Grease	EPA 1664	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Ortho-phosphate	SM4500-PE	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Total Inorganic Carbon	SM5310B	NA	85-115	75-125	20	20	20	RPD < 20% difference < the RL
Total Organic Carbon	SM5310B	NA	80-120	75-125	20	20	20	RPD < 20% difference < the RL
Turbidity	EPA 180.1 SM2130B	NA	NA	NA	NA	NA	±0.1 NTU units	±0.1 NTU units
Radiological Parameters	EPA 901.1/903.0/ 904.0/ 908.0/ ASTM D5174-D/ EML Th-01 Modified	30 -110	80-120	70-130	NA	NA	RPD < 20% or RER < 3%	RPD < 20% difference < 2× the RL

** When both field duplicate results are > 5× the RL, the RPD must be < 20%. When at least one result is < 5× the RL, the difference must be < the RL.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

4. Laboratory Standard Operating Procedures

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Laboratory SOPs available upon request.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX D

SOLID SAMPLE MONITORING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sample Containers, Preservation, and Holding Times

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table D-1. Sample Containers, Preservation, and Holding Times
Solid Samples

Parameter	Suggested Volume	Container	Preservative	Holding Time
Metals	50 g	WM, no brass	None	6 months
Mercury	50 g	WM, no brass	Cool to ≤6°C	28 days
Acid Volatile Sulfide	50 g	WM	Cool to ≤6°C	14 days
Simultaneously Extracted Metals	50 g	WM	Cool to ≤6°C	14 days
Ammonia	50 g	WM	Cool to ≤6°C	28 days
Sulfides	50 g	WM	Cool to ≤6°C	7 days
Total Organic Carbon	50 g	WM	Cool to ≤6°C	14 days
Grain Size	500 g	WM	Cool to ≤6°C	N/A
Total Solids	50 g	WM	Cool to ≤6°C	N/A
Specific Gravity of Soils	100 g	WM	None	N/A
Laser Particle Size	50 g	WM	Cool to ≤6°C	N/A
Radiological Parameters	100 g	WM	Cool to ≤6°C	6 months
TCLP Metals (except mercury)	100 g	WM	Cool to ≤6°C	6 months from collection to TCLP extraction/ 6 months from TCLP extraction to analysis
TCLP Mercury	100 g	WM	Cool to ≤6°C	28 days from collection to TCLP extraction/ 28 days from TCLP extraction to analysis
Free Liquids	100 g	WM	None	N/A
Polynuclear Aromatic Hydrocarbons	100 g	WM	Cool to ≤6°C	14 days from collection to extraction/ 40 days from extraction to analysis

WM = Wide-mouth glass jar with Teflon®-lined cap. Brass or stainless steel ring with Teflon®-lined cap may be used for sediment borings.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table D-2. Analytes, Methods, and Target Reporting Limits: Solid Samples

Sample Type(s)	Test Parameter	Preparation Method	Test Method	Reporting Limit[1, 2]
Sediment	**Metals**			
	Aluminum	SW-846 3015A	SW-846 6010B	40 mg/kg
Residential Soil	Antimony	SW-846 3015A	SW-846 6010B	6.0 mg/kg
	Arsenic	SW-846 3015A	SW-846 6010B	2.0 mg/kg
Released Ash	Barium	SW-846 3015A	SW-846 6010B	1.0 mg/kg
	Beryllium	SW-846 3015A	SW-846 6010B	1.0 mg/kg
Cenospheres	Boron	SW-846 3015A	SW-846 6010B	20 mg/kg
	Cadmium	SW-846 3015A	SW-846 6010B	0.5 mg/kg
	Calcium	SW-846 3015A	SW-846 6010B	500 mg/kg
	Chromium	SW-846 3015A	SW-846 6010B	1.5 mg/kg
	Cobalt	SW-846 3015A	SW-846 6010B	5.0 mg/kg
	Copper	SW-846 3015A	SW-846 6010B	2.5 mg/kg
	Iron	SW-846 3015A	SW-846 6010B	20 mg/kg
	Lead	SW-846 3015A	SW-846 6010B	1.5 mg/kg
	Magnesium	SW-846 3015A	SW-846 6010B	500 mg/kg
	Manganese	SW-846 3015A	SW-846 6010B	1.5 mg/kg
	Molybdenum	SW-846 3015A	SW-846 6010B	4.0 mg/kg
	Nickel	SW-846 3015A	SW-846 6010B	4.0 mg/kg
	Potassium	SW-846 3015A	SW-846 6010B	500 mg/kg
	Selenium	SW-846 3015A	SW-846 6010B	1.5 mg/kg
	Silver	SW-846 3015A	SW-846 6010B	3.0 mg/kg
	Sodium	SW-846 3015A	SW-846 6010B	500 mg/kg
	Thallium	SW-846 3015A	SW-846 6010B	3.5 mg/kg
	Vanadium	SW-846 3015A	SW-846 6010B	2.5 mg/kg
	Zinc	SW-846 3015A	SW-846 6010B	6.0 mg/kg
	Mercury	SW-846 7471	SW-846 7471	0.02 mg/kg
Sediment	**General Chemistry**			
	Ammonia	deionized water leach	EPA 350.1	5 mg/kg
	Sulfides	deionized water leach	SW-846 9030	5 mg/kg
	Total Organic Carbon	deionized water leach	SW-846 9060	100 mg/kg
	Acid Volatile Sulfide –Simultaneously Extracted Metals			
	SEM Cadmium	EPA 821-R-91-100	SW-846 6020	0.001112 umoles/g
	SEM Copper	EPA 821-R-91-100	SW-846 6020	0.009835 umoles/g
	SEM Lead	EPA 821-R-91-100	SW-846 6020	0.0007239 umoles/g
	SEM Mercury	EPA 821-R-91-100	SW-846 6020	0.00006232 umoles /g
	SEM Nickel	EPA 821-R-91-100	SW-846 6020	0.01704 umoles/g
	SEM Zinc	EPA 821-R-91-100	SW-846 6020	0.03823 umoles/g
	Acid Volatile Sulfide	EPA 821-R-91-100	SW-846 9034	0.499 umoles/g
	Physical Parameters			
	Grain Size	ASTM D422	ASTM D422	1.0 %
	Total Solids	ASTM D2216	ASTM D2216	1.0 %
	Specific Gravity of Soils	ASTM D-854-00	ASTM D-854-00	0.01
	Laser Particle Size	ASTM D4464	ASTM D4464	1.0%

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table D-2. Analytes, Methods, and Target Reporting Limits: Solid Samples

Sample Type(s)	Test Parameter	Preparation Method	Test Method	Reporting Limit[1, 2]
Cell Ash	**Semivolatile Organic Parameters**			
	Acenaphthene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Acenaphthylene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Anthracene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Benzo(a)anthracene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Benzo(a)pyrene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Benzo(b)fluoranthene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Benzo(g,h,i)perylene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Benzo(k)fluoranthene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Chrysene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Dibenz(a,h)anthracene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Fluoranthene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Fluorene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Indeno(1,2,3-cd)pyrene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Naphthalene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Phenanthrene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Pyrene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	2-Methylnaphthalene	SW-846 3550B	SW-846 8270C	0.067 mg/kg
	Radiological Parameters			
	Radium-226	EPA 903.0 Modified		1.0 pCi/g
	Thorium-228	EML Th-01 Modified		1.0 pCi/g
	Thorium-230	EML Th-01 Modified		1.0 pCi/g
	Thorium-232	EML Th-01 Modified		1.0 pCi/g
	Uranium-234	EML U-02 Modified		1.0 pCi/g
	Uranium-235	EML U-02 Modified		1.0 pCi/g
	Uranium-238	EML U-02 Modified		1.0 pCi/g
	Gamma Spectroscopy Isotopes	LANL ER-130		1.0 pCi/g
Released Ash	TCLP Arsenic	SW-846 1311	SW-846 6010B	0.100 mg/L
	TCLP Barium	SW-846 1311	SW-846 6010B	0.100 mg/L
	TCLP Cadmium	SW-846 1311	SW-846 6010B	0.0100 mg/L
	TCLP Chromium	SW-846 1311	SW-846 6010B	0.0500 mg/L
	TCLP Copper	SW-846 1311	SW-846 6010B	0.100 mg/L
	TCLP Lead	SW-846 1311	SW-846 6010B	0.0500 mg/L
	TCLP Nickel	SW-846 1311	SW-846 6010B	0.100 mg/L
	TCLP Selenium	SW-846 1311	SW-846 6010B	0.100 mg/L
	TCLP Silver	SW-846 1311	SW-846 6010B	0.0500 mg/L
	TCLP Zinc	SW-846 1311	SW-846 6010B	0.500 mg/L
	TCLP Mercury	SW-846 1311	SW-846 7470	0.0100 mg/L
	Free Liquids	n/a	SW-846 9095	*

[1] Reporting limits for solid matrices are dry-weight corrected assuming 100% solids; sample-specific reporting limits may be higher based upon dry-weight correction.

[2] Reporting limits represent the laboratory quantitation limits. Samples analyzed by TVA's contracted laboratories will be reported to the project method detection limit (MDL).

* Free liquids results are reported as presence/absence.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples
Solid Matrices

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table D-3. Summary of Precision and Accuracy Objectives for Quality Control Samples Solid Matrices

Analyte	Method	Surrogate Compound Recoveries/ Chemical Yield (%)	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision (RPD)	Field Duplicate Precision**
Metals	SW-846 6010/6020	NA	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
Mercury	SW-846 7471	NA	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
Acid Volatile Sulfide	EPA 821-R-91-100/ SW-846 9034	NA	85-115	75-125	20	20	20	RPD < 35% difference < 2× the RL
Simultaneously Extracted Metals	EPA 821-R-91-100/ SW-846 6010/7470	NA	85-115	75-125	20	20	20	RPD < 35% difference < 2× the RL
Ammonia	EPA 350.1 mod.	NA	80-120	75-125	35	35	20	RPD < 35% difference < 2× the RL
Sulfides	SW-846 9030 mod.	NA	80-120	75-125	35	35	20	RPD < 35% difference < 2× the RL
Total Organic Carbon	SW-846 9060 mod.	NA	80-120	75-125	35	35	20	RPD < 35% difference < 2× the RL
Grain Size	ASTM D422	NA	NA	NA	NA	NA	20	RPD < 35% difference < 2× the RL
Percent Solids	ASTM D2216	NA	NA	NA	NA	NA	10	RPD < 35% difference < 2× the RL
Specific Gravity of Soils	ASTM D854-00	NA	NA	NA	NA	NA	20	RPD < 35% difference < 2× the RL
Radiological Parameters	EPA 903.0 Modified/ EML Th-01 Modified/ EML U-01 Modified/ LANL ER-130	30-110	80-120	70-130	NA	NA	RPD < 35% or RER < 3%	RPD < 35% difference < 2× the RL
TCLP Metals	SW-846 1311/6010	NA	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
TCLP Mercury	SW-846 1311/7470	NA	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
Polynuclear Aromatic Hydrocarbons	SW-846 8270C	50-130	50-130	50-130	35	35	35	RPD < 35% difference < 2× the RL

** When both field duplicate results are > 5× the RL, the RPD must be < 35%. When at least one result is < 5× the RL, the difference must be < 2× the RL.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX E

AIR PARTICULATE MATTER SAMPLE MONITORING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sampling Equipment and Media

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table E-1: Sampling Equipment and Media
Air Samples

Equipment	Method	Parameter(s)	Filter Type
BGI PQ200 FRM $PM_{2.5}$	40 CFR Appendix L * EPA IO-3.5 by ICP/MS	FRM $PM_{2.5}$ -Mass * FRM PM2.5 /Arsenic	46.2 mm PTFE
TISCH High Volume PM_{10}	40 CFR Appendix J, EPA IO-3.5 by ICP/MS	High Volume PM_{10}- Arsenic	8x10 in glass filter
SKC PCXR8	NIOSH 7500 modified	Low Volume Crystalline Silica (Quartz)	37 mm, 5 um PVC filter
TISCH TSP	40 CFR Appendix B, EPA IO-3.5 by ICP/MS	High Volume TSP – Metals	8x10 in glass filter

* Contingent analysis. Analysis of arsenic from the 46.2 mm FRM filter will be implemented for a FRM PM2.5 or FRM PM10 sample the observed sample result exceeds the NAAQS (≥ 35 µg/m3 or ≥ 150 µg/m3, respectively).

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table E-2. Analytes, Methods, and Target Reporting Limits: Air Samples (Updated 10/27/10)		
Test Parameter	**Test Method**	**Reporting Limit**
Aluminum	EPA IO-3.5 by ICP/MS	123 μg/filter
Arsenic	EPA IO-3.5 by ICP/MS	5.20 μg/filter
Barium	EPA IO-3.5 by ICP/MS	6.50 μg/filter
Beryllium	EPA IO-3.5 by ICP/MS	3.60 μg/filter
Cadmium	EPA IO-3.5 by ICP/MS	3.27 μg/filter
Chromium	EPA IO-3.5 by ICP/MS	14.7 μg/filter
Lead	EPA IO-3.5 by ICP/MS	2.82 μg/filter
Manganese	EPA IO-3.5 by ICP/MS	3.15 μg/filter
Selenium	EPA IO-3.5 by ICP/MS	4.45 μg/filter
Thallium	EPA IO-3.5 by ICP/MS	1.07 μg/filter
Vanadium	EPA IO-3.5 by ICP/MS	8.50 μg/filter
$PM_{2.5}$	40 CFR Appendix L	2 $\mu g/m^3$*
Crystalline Silica, Quartz	NIOSH 7500 Modified	10 μg/filter

* The Federal Reference Method for $PM_{2.5}$ specifies an estimated detection limit of 2 mg/m^3. The actual detection limit may vary depending on the air volume.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table E-3. Summary of Precision and Accuracy Objectives for Quality Control Samples
Air Particulate Matter

Analyte	Method	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision**	Field Duplicate Precision**
Metals	EPA IO-3.5 by ICP/MS	80-120	75-125	20	20	20% RPD	RPD < 20% difference < the RL
$PM_{2.5}$	40 CFR Appendix L	80-120	NA	20	NA	RPD < 10% ±0.01 mg	RPD < 10% ±0.01 mg
Crystalline Silica (Quartz)	NIOSH 7500 Modified	80-120	NA	20	NA	20% RPD	RPD < 20% difference < the RL

** When at least one duplicate result is < 5× the RL, the difference between the results must be used for comparison.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX F

TOXICOLOGICAL MONITORING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sample Containers, Preservation, and Holding Times

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table F-1. Sample Containers, Preservation, and Holding Times
Toxicological Analyses

Parameter	Matrix	Method	Suggested Volume	Container	Preservative	Holding Time*
Toxicity Evaluation Whole Sediment Elutriate Plume Polymer	River Surface Water	Inland Testing Manual/ EPA 821/R-02/012 EPA 600/R-99/064 EPA 821/R-02/013	variable with test min. 2.5 gal	2.5 & 5 gal cubitainers	Cool to < 6°C (must not be frozen)	14 days
Toxicity Evaluation Whole Sediment Elutriate	River Sediment	Inland Testing Manual/ EPA 600/R-99/064 (Method 100.1/100.3) EPA 821/R-02/012	min. 30 gal per location	5 gal Plastic bucket (pre-washed)	Cool to < 6°C (must not be frozen)	8 weeks

* Holding time from sample collection until initiation of assay.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Test Parameters, Methods, Acceptability Criteria, and Endpoints Toxicological Evaluations

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table F-2. Test Parameters, Methods, Acceptability Criteria, and Endpoints: Whole Sediment and Elutriate Toxicity Tests

Test Parameter	Test Method	Test Acceptability Criteria	Test Endpoints
Whole Sediment Toxicological Monitoring			
Hyalella azteca 10-day Survival and Growth Test	EPA-600/R-99/064	Mean control survival ≥ 80% and measurable growth of test organisms in the control sediment. Additional performance-based criteria as outlined in table 11.3 of method.	Survival and growth (dry weight)
Five-day Freshwater Juvenile Mussel Survival Test	N/A	≥ 90% survival in controls	Survival (foot movement/ciliary action)
Ten-day Freshwater Acute Juvenile Mussel Survival Test	EPA/COE Inland Testing Manual, Appendix E (pages 29-30)	≥ 90% survival in controls	Survival (foot movement/ciliary action)
Lumbriculus variegates and *Corbicula fluminea* Bioaccumulation Test	EPA-600/R-99/064, 2nd ed.; Method 100.3 Pgs 63 - 71	No notable reduction in number of organisms in a test sediment relative to the control; Additional Performance based criteria outlined in Table 13.4 of method	Bioaccumulation
Sediment Elutriate Acute Toxicity Evaluation			
Ceriodaphnia dubia 96-hour Survival Test	EPA-821-R-02-012, Method 2002; EPA/ACOE Inland Testing Manual	≥ 90% survival in river control and negative control	Survival
Pimephales promelas 96-hour Survival Tests	EPA-821-R-02-012, Method 2000; EPA/ACOE Inland Testing Manual	≥ 90% survival in river control and negative control	Survival
Mussels	Based on EPA/ACOE Inland Testing Manual (table E-29) the paper pondshell freshwater mussel test with clean sediment used as substrate for elutriate (instead of ash)	≥ 90% survival in controls	Survival (foot movement/ciliary action)

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table F-2. Test Parameters, Methods, Acceptability Criteria, and Endpoints: Whole Sediment and Elutriate Toxicity Tests

Test Parameter	Test Method	Test Acceptability Criteria	Test Endpoints
Plume Water Chronic Toxicity Evaluation			
Ceriodaphnia dubia Survival and Reproduction Test (*Hyalella azteca* if too turbid)	EPA-821-R-02-013, Method 1002.0	≥ 80% survival of all control organisms and average of 15 or more young per surviving female in the control solutions. ≥ 60% of surviving control females must produce three broods.	Survival and reproduction
Pimephales promelas Larval Survival and Growth Test	EPA-821-R-02-013 Method 1000.0	≥ 80% survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25 mg.	Survival and growth
Polymer Toxicity Evaluation			
Ceriodaphnia dubia Survival and Reproduction Test (*Hyalella azteca* if too turbid)	EPA-821-R-02-013 Method 1002.0	≥ 80% survival of all control organisms and average of 15 or more young per surviving female in the control solutions. ≥ 60% of surviving control females must produce three broods.	Survival and reproduction
Pimephales promelas Larval Survival and Growth Test	EPA-821-R-02-013, Method 1000.0	≥ 80% survival in controls; average dry weight per surviving organism in control chambers ≥ 0.25 mg.	Survival and growth

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX G

BIOLOGICAL SAMPLE MONITORING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sample Containers, Preservation, and Holding Times

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table G-1. Sample Containers, Preservation, and Holding Times
Biological Samples

Sample Type	Parameter	Method	Suggested Minimum Volume	Container	Preservative	Holding Time
Fish tissue homogenate	Metals/mercury	SW-846 6020	10 - 15 g	8-oz WM jar	Freeze to < -10°C	1 year*
Fish tissue fillets	Metals/mercury	SW-846 6020	10 - 15 g	Zip-lock bag	Freeze to < -10°C	1 year*
Mayflies Snails	Metals/mercury	SW-846 6020	10 - 15 g	8-oz WM jar	Freeze to < -10°C	1 year*
Bird Eggs Nestlings	Metals/mercury	SW-846 6020	10 - 15 g	8-oz WM jar	Freeze to < -10°C	1 year*
Reptile Blood Mammal Blood	Metals/mercury	SW-846 6020	1 mL	Flat-top Heparinized vials	Freeze to < -10°C	1 year*
Mammal tissues/organs	Metals/mercury	SW-846 6020	10 - 15 g	8 oz WM jar	Freeze to < -10°C	1 year*
Vegetation	Metals/mercury	SW-846 6020	10 - 15 g	Zip-lock bag	Freeze to < -10°C	1 year*

* Holding time is 1 year when samples are frozen to < -10°C.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table G-2. Analytes, Methods, and Target Reporting Limits: Biological Samples

Test Parameter	Preparation Method	Analysis Method	Reporting Limit[1,2]
Aluminum	SW-846 3050B	SW-846 6020	25 mg/kg
Antimony	SW-846 3050B	SW-846 6020	0.1 mg/kg
Arsenic	SW-846 3050B	SW-846 6020	0.1 mg/kg
Barium	SW-846 3050B	SW-846 6020	0.1 mg/kg
Beryllium	SW-846 3050B	SW-846 6020	0.1 mg/kg
Boron	SW-846 3050B	SW-846 6020	0.5 mg/kg
Cadmium	SW-846 3050B	SW-846 6020	0.1 mg/kg
Calcium	SW-846 3050B	SW-846 6020	100 mg/kg
Chromium	SW-846 3050B	SW-846 6020	0.1 mg/kg
Cobalt	SW-846 3050B	SW-846 6020	0.1 mg/kg
Copper	SW-846 3050B	SW-846 6020	0.5 mg/kg
Iron	SW-846 3050B	SW-846 6020	25 mg/kg
Lead	SW-846 3050B	SW-846 6020	0.1 mg/kg
Magnesium	SW-846 3050B	SW-846 6020	100 mg/kg
Manganese	SW-846 3050B	SW-846 6020	0.5 mg/kg
Molybdenum	SW-846 3050B	SW-846 6020	1.0 mg/kg
Nickel	SW-846 3050B	SW-846 6020	0.1 mg/kg
Potassium	SW-846 3050B	SW-846 6020	100 mg/kg
Selenium	SW-846 3050B	SW-846 6020	0.2 mg/kg
Silver	SW-846 3050B	SW-846 6020	0.05 mg/kg
Sodium	SW-846 3050B	SW-846 6020	100 mg/kg
Strontium	SW-846 3050B	SW-846 6020	0.1 mg/kg
Thallium	SW-846 3050B	SW-846 6020	0.1 mg/kg
Vanadium	SW-846 3050B	SW-846 6020	0.2 mg/kg
Zinc	SW-846 3050B	SW-846 6020	2.0 mg/kg
Mercury	SW-846 3050B	SW-846 6020	0.02 mg/kg

[1] Reporting limits for biological matrices are dry-weight corrected assuming 100% solids; sample-specific reporting limits may be higher when sample results are corrected for sample moisture.

[2] Reporting limits represent the laboratory quantitation limits. Samples analyzed by TVA's contracted laboratories will be reported to the project method detection limit (MDL).

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table G-3. Summary of Precision and Accuracy Objectives for Quality Control Samples Biological Samples

Analyte	Method	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision (RPD)	Field Duplicate Precision**
Metals	SW-846 6020	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
Mercury	SW-846 6020	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL

** When both field duplicate results are > 5× the RL, the RPD must be 35%. When at least one result is < 5× the RL, the difference must be < 2× the RL.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX H

WIPE SAMPLING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sample Containers, Preservation, and Holding Times

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table H-1. Sample Containers, Preservation, and Holding Times
Wipe Samples

Parameter	Analytical Method	Suggested Volume	Container	Preservative	Holding Time
Metals	SW-846 6010B	10cm x 10cm wipe	WM	None	6 months
Mercury	SW-846 7471	10cm x 10cm wipe	WM	Cool to ≤6°C	28 days

WM = Wide-mouth glass jar with Teflon®-lined cap.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table H-2. Analytes, Methods, and Target Reporting Limits: Wipe Samples

Sample Type	Test Parameter	Preparation Method	Test Method	Reporting Limit
Wipes	Aluminum	SW-846 3050	SW-846 6010B	40 mg/kg
	Antimony	SW-846 3050	SW-846 6010B	6.0 mg/kg
	Arsenic	SW-846 3050	SW-846 6010B	2.0 mg/kg
	Barium	SW-846 3050	SW-846 6010B	1.0 mg/kg
	Beryllium	SW-846 3050	SW-846 6010B	1.0 mg/kg
	Boron	SW-846 3050	SW-846 6010B	20 mg/kg
	Cadmium	SW-846 3050	SW-846 6010B	0.5 mg/kg
	Calcium	SW-846 3050	SW-846 6010B	500 mg/kg
	Chromium	SW-846 3050	SW-846 6010B	1.5 mg/kg
	Cobalt	SW-846 3050	SW-846 6010B	5.0 mg/kg
	Copper	SW-846 3050	SW-846 6010B	2.5 mg/kg
	Iron	SW-846 3050	SW-846 6010B	20 mg/kg
	Lead	SW-846 3050	SW-846 6010B	1.5 mg/kg
	Magnesium	SW-846 3050	SW-846 6010B	500 mg/kg
	Manganese	SW-846 3050	SW-846 6010B	1.5 mg/kg
	Molybdenum	SW-846 3050	SW-846 6010B	4.0 mg/kg
	Nickel	SW-846 3050	SW-846 6010B	4.0 mg/kg
	Potassium	SW-846 3050	SW-846 6010B	500 mg/kg
	Selenium	SW-846 3050	SW-846 6010B	1.5 mg/kg
	Silver	SW-846 3050	SW-846 6010B	3.0 mg/kg
	Sodium	SW-846 3050	SW-846 6010B	500 mg/kg
	Thallium	SW-846 3050	SW-846 6010B	3.5 mg/kg
	Vanadium	SW-846 3050	SW-846 6010B	2.5 mg/kg
	Zinc	SW-846 3050	SW-846 6010B	6.0 mg/kg
	Mercury	SW-846 7471	SW-846 7471	0.02 mg/kg

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table H-3. Summary of Precision and Accuracy Objectives for Quality Control Samples Wipes

Analyte	Method	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision (RPD)	Field Duplicate Precision**
Metals	SW-846 6010	85-115	75-125	35	35	35	RPD < 35% difference < 2× the RL
Mercury	SW-846 7471	85-115	75-125	35	35	35	RPD < 35% difference < 2× the RL

** When both field duplicate results are > 5× the RL, the RPD must be < 35%. When at least one result is < 5× the RL, the difference must be < 2× the RL.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX I

OIL SAMPLING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sample Containers, Preservation, and Holding Times

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table I-1. Sample Containers, Preservation, and Holding Times
Oil Samples

Parameter	Method	Suggested Volume	Container	Preservative	Holding Time
Total Metals	SW-846 6010	10g	P	none	6 months
PCBs	SW-846 8082	10mL/10g	40ml G vial	Cool to ≤6°C	7 days
Total Halides	SW-846 9076	10g	AG/T	Cool to ≤6°C	28 days
Flashpoint	SW-846 1010	200mL/100g	P, G	Cool to ≤6°C	14 days

G = Glass container.
P = Plastic container (polyethylene container used for metals).
AG/T = Amber glass with Teflon®-lined cap.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table I-2. Analytes, Methods, and Target Reporting Limits: Oil Samples				
Sample Type(s)	**Test Parameter**	**Preparation Method**	**Test Method**	**Reporting Limit**
Oil	PCBs	SW-846 3550	SW-846 8082	0.05 mg/kg
	Total Halides	n/a	SW-846 9076	100 mg/kg
	Flashpoint	n/a	SW-846 1010	20°F
	Metals			
	Arsenic	SW-846 3050	SW-846 6010	2.0 mg/kg
	Cadmium	SW-846 3050	SW-846 6010	0.5 mg/kg
	Chromium	SW-846 3050	SW-846 6010	1.5 mg/kg
	Lead	SW-846 3050	SW-846 6010	1.5 mg/kg

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table I-3. Summary of Precision and Accuracy Objectives for Quality Control Samples
Oil

Analyte	Method	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision (RPD)	Field Duplicate Precision**
Metals	SW-846 6010	85-115	75-125	35	35	35	RPD < 35% difference < 2× the RL
PCBs	SW-846 8082	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
Total Halogens	SW-846 9056	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL
Flashpoint	SW-846 1010A	80-120	75-125	35	35	35	RPD < 35% difference < 2× the RL

****** When both field duplicate results are > 5× the RL, the RPD must be < 35%. When at least one result is < 5× the RL, the difference must be < 2× the RL.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX J

INDUSTRIAL HYGIENE MONITORING

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1. Sampling Equipment and Media

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table J-1. Sampling Media Industrial Hygiene Monitoring		
Parameter(s)	**Method**	**Filter Type**
Total Particulates	NIOSH 0500	37 mm MWMCE[1]
Respirable Particulates	NIOSH 0600	37 mm PVC[2]
Metals Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron Oxide, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Sodium, Thallium, Vanadium, Zinc Oxide	NIOSH 7300	37 mm MWMCE
Crystalline Silica Quartz, Cristobalite, Trydimite	NIOSH 7500	37 mm PVC
Radiological Parameters	EPA 903.0 Modified/ EPA 904.0/EML Th-01 Modified/ EML Th-01 Modified/HASL 300/EPA 901.1	37 mm MWMCE

[1] **Matched-weight mixed cellulose ester**

[2] **Polyvinyl chloride**

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

2. Analytes, Methods, and Target Reporting Limits

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table J-2. Analytes, Methods, and Target Reporting Limits: Industrial Hygiene Monitoring

Test Parameter	Test Method	Reporting Limit
Aluminum	NIOSH 7300	7.5µg
Antimony	NIOSH 7300	0.9µg
Arsenic	NIOSH 7300	0.3µg
Barium	NIOSH 7300	0.15µg
Beryllium	NIOSH 7300	0.15µg
Cadmium	NIOSH 7300	0.15µg
Calcium	NIOSH 7300	75µg
Chromium	NIOSH 7300	3µg
Cobalt	NIOSH 7300	0.45µg
Copper	NIOSH 7300	0.3µg
Iron Oxide	NIOSH 7300	11µg
Lead	NIOSH 7300	0.38µg
Magnesium	NIOSH 7300	7.5µg
Manganese	NIOSH 7300	0.15µg
Molybdenum	NIOSH 7300	0.15µg
Nickel	NIOSH 7300	0.3µg
Potassium	NIOSH 7300	15µg
Selenium	NIOSH 7300	0.3µg
Sodium	NIOSH 7300	75µg
Thallium	NIOSH 7300	1.5µg
Vanadium	NIOSH 7300	0.45µg
Zinc Oxide	NIOSH 7300	1.9µg
Crystalline Silica, Quartz	NIOSH 7500 Modified	0.20 mg
Crystalline Silica, Cristobalite	NIOSH 7500 Modified	0.20 mg
Crystalline Silica, Trydimite	NIOSH 7500 Modified	0.20 mg
Total Particulates	NIOSH 0500	10µg
Respirable Particulates	NIOSH 0600	10µg
Radium-226	EPA 903.0 Modified	1.0 pCi/filter
Radium-228	EPA 904.0 Modified	1.0 pCi/filter
Thorium-228	EML Th-01 Modified	1.0 pCi/filter
Thorium-230	EML Th-01 Modified	1.0 pCi/filter
Thorium-232	EML Th-01 Modified	1.0 pCi/filter
Uranium-234	EML U-02 Modified	1.0 pCi/filter
Uranium-235	EML U-02 Modified	1.0 pCi/filter
Uranium-238	EML U-02 Modified	1.0 pCi/filter

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

3. Summary of Precision and Accuracy Objectives for Quality Control Samples

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

Table J-3. Summary of Precision and Accuracy Objectives for Quality Control Samples
Industrial Hygiene Monitoring

Analyte	Method	Chemical Yield	LCS Accuracy (% Recovery)	MS/MSD Accuracy (% Recovery)	LCS/LCSD Precision (RPD)	MS/MSD Precision (RPD)	Laboratory Duplicate Precision**	Field Duplicate Precision**
Metals	NIOSH 7300	NA	80-120	75-125	20	20	20% RPD	RPD < 20% difference < the RL
Crystalline Silica	NIOSH 7500 Modified	NA	80-120	NA	20	NA	20% RPD	RPD < 20% difference < the RL
Total Particulates	NIOSH 0500	NA	80-120	NA	20	NA	RPD < 10% ±0.01 mg	RPD < 10% ±0.01 mg
Respirable Particulates	NIOSH 0600	NA	80-120	NA	20	NA	RPD < 10% ±0.01 mg	RPD < 10% ±0.01 mg
Radiological Parameters	EPA 903.0 Modified/ EML Th-01 Modified/ EML U-01 Modified/ LANL ER-130	30-110	80-120	70-130	NA	NA	RPD < 35% or RER < 3%	RPD < 20% difference < the RL

** When at least one duplicate result is < 5× the RL, the difference between the results must be used for comparison.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPENDIX K

TVA CORRECTIVE ACTION PROGRAM (FPG.SPP.03.001)

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

FPG Standard Processes and Procedures	**TITLE** **Corrective Action Program**	**FPG.SPP.03.001** **Rev. 0005** **Page 1 of 28** Effective Date 11-21-2008

Responsible Peer Team: Plant Manager Peer Team

Concurred by:	Ronald Hall Peer Team Chair	11/18/08 Date
Approved by:	John McCormick Peer Team Sponsor	11/18/08 Date
Approved by:	Mike Kealey FPG Process Manager	11/18/08 Date

Current Revision Description

Initial issue. This document replaces FPG.SPP.07.004.

R1 Added reference to TVA-SPP-5.12 Corrective and Preventive Action Process, Guidelines for Potential Environmental Issue (Appendix M) and clarification on phased approach in Section 2.0.

R2 Added Root Cause Failure Analysis Guidance as Appendix “N”. Addition of NOTE 4 under section 2.0 that addresses removing the requirement to add repeat event's as PER's. Addition of NOTE to section 3.2.6 (R3 changed to 3.2.1) (Generic Reviews) temporally suspending the requirement to send Generic Reviews.

R3 Revised to delete all reference to eCAP, to allow the use of other PER software. Deleted several Appendices and referred to TVA.SPP.1.6 and 3.1. Re-lettered remaining Appendices. Simplified procedure. Implementation Plan: Existing PER’s created in eCAP shall continue to be processed and closed in eCAP. New PERs shall be created in Plant View Event Reporting effective no later than July 01, 2007.

R4 Lowers PER threshold to include the requirement to all levels of PER’s A - D with criteria established for all levels. Also re-instates the Generic review process (Section 3.2.2), and provides for all employees to create a PER (Section 2.0 Scope).

R5 Approval changes required in (Return to Service Guidelines) Appendix E.

Table of Contents

1.0 PURPOSE 4

2.0 SCOPE 4

3.0 PROCESS 6

3.1 Roles and Responsibilities 6

3.2 Instructions 7

3.2.1 Corrective Action Implementation 8

3.2.2 Generic Review 8

3.2.3 Extension Request 9

3.2.4 Trending and Program Monitoring (may be performed at a site/facility) 10

3.2.5 Escalation 10

3.3 Evaluation Criteria 10

3.3.1 Indicators 10

3.3.2 Indicator Formulas/Criteria for Defect: 11

3.4 References 11

3.5 Training 11

4.0 RECORDS 12

5.0 DEFINITIONS 12

Appendix A: Guidelines for Potential Operability Determinations 14

Appendix B: Problem Evaluation Report (PER) Closure 15

Appendix C: Independent Team Leader Guidelines 16

Appendix D: MRC Guidelines 17

Appendix E: Return to Service Guidelines 19

Appendix F: Appropriate Use of Work Order and PER 21

Appendix G: Problem Evaluation Report Form 22

Appendix H: Guidelines for Potential Environmental Issue 23

Appendix I: Root Cause Failure Analysis Forms (Optional) 24

1.0 PURPOSE

This SPP describes the Fossil Power Group Corrective Action Program, and establishes the processes and responsibilities for documenting and resolving problems, including adverse conditions, identified via the Problem Evaluation Report (PER).

2.0 SCOPE

This program is designed to address problems in a manner consistent with the nature of the condition, its importance to safety, equipment reliability, and anything that does not meet expectations. This SPP contains the detailed requirements for PERs. FPG will implement TVA procedure TVA.SPP-3.1 Regulatory Corrective Action, and TVA.SPP - 1.6 Cause Analysis except as delineated herein.

Work Request/Work Order (WR/WO) is the method used to identify and correct routine hardware deficiencies on equipment, structures, or spare components (i.e., replace packing, correct seat leakage, replace motor bearings, etc.), or to perform other work activities such as preventive maintenance. However, a PER may be initiated in addition to the WR/WO depending on the significance of the issue (see Appendix F).

Initially the Fossil Power Group (FPG) implemented this process in a phased approach, beginning with a defined subset of significant Level A and B events. <u>This revision provides the requirements to enter PER's for all levels A through D as identified below for all FPG locations. It also provides the expectation that anyone can enter a PER as needed. Managers down to Supervisors will enter them electronically into the CAP program (Plant View until MAXIMO is available), while hard copy format (see appendix "G") will be made available to all employees below supervisor level with instructions provided on how to submit a PER to have them entered in the system.</u>

A. As a minimum, the following significant events SHALL have a Level A PER initiated;

   1. A significant industrial safety event, including a fatality or serious accident/injury.

   2. A condition that represents the highest risk to safe, reliable operation or to personnel safety.

   3. A significant finding from a regulatory body, including OSHA, EPA, or other federal, state or local body.

   4. Equipment damage greater than $500,000.

B. As a minimum, the following significant events SHALL have a Level B PER initiated;

   1. Forced Outages except for trips

   2. Forced Outages caused by trips (see NOTE 1)

   3. Startup Failures (see NOTE 2)

   4. Maintenance Outages - (see NOTE 3)

   5. Recordable Injuries

2.0 SCOPE (continued)

6. Reportable Environmental Events

7. Planned Outage Extensions, based on official schedule on start date of outage (based on Asset Availability when the high side of breaker is opened)

8. Fire Damage > $50,000

NOTES

1) A trip is defined as a unit being removed from service by a trip device and will not include operator manually initiated trips.

2) A startup failure is defined as an outage that results when a unit is unable to synchronize within a specified startup time following an outage or Reserve Shutdown. The startup period for each unit is determined by the operating utility. It is unique for each unit, and depends on the condition of the unit at the time of startup (hot, cold, standby, etc.). A startup period begins with the command to start and ends when the unit is synchronized. A startup failure begins when the problem preventing the unit from synchronizing occurs. The startup failure ends when the unit is synchronized, another startup failure occurs, or the unit enters another permissible state.

3) For maintenance outages, the intent is to perform an analysis for outages that are a result of degrading conditions that will likely cause a forced outage (i.e. condition must be resolved before the next planned outage). The required scope of the analysis is to address the driving condition that caused the maintenance outage.

4) Repeat Events where the root cause has been previously determined and the solutions are planned, should be entered as D level PER's. Repeat Events are defined as an event with the same repeat failure mechanism where the root cause has been previously determined (e.g. boiler tube failures). Most of these events are related to generation and are already captured in GADS. Repeat Events where the root cause has been previously determined and the solutions have been implemented are required to be entered. The solutions for these events were not adequate and the analysis needs to be performed again.

C. As a minimum, the following events SHALL have a Level C PER initiated:

1. Forced Derates that are greater than 30% of unit generation and last longer than 30 minutes.

2. Human errors (inappropriate actions), which could have, under different circumstances, caused a significant plant event or serious personnel injury.

3. A First Aid injury.

4. Repeat or Recurring events not classified as significant adverse conditions, which retain the potential for causing a plant/facility event or personnel injury.

5. Adverse trends which indicate the potential for substantial safety, reliability or regulatory risk.

2.0 SCOPE (continued)

6. Events or conditions which require cause analysis to support required recurrence control.

7. Discovery of a deficiency in an area such as design or analysis, operation, maintenance, testing, procedures, or training that is likely to cause a significant event.

8. A substantial extent of condition.

9. A serious near miss, which could have, under different circumstances, caused a significant plant event or serious personnel injury

10. Conditions where structures, systems and components are degraded to the point they cannot meet design intent.

11. Equipment failures where the maintenance strategy (i.e. maintenance basis) for that equipment is not run-to-failure (i.e. maintenance basis violations).

12. Environmental Audit Findings - Environmental events that are level C. Refer to TVA-SPP-5.12 Corrective and Preventive Action Process.

D. As a minimum, the following events SHALL have a Level D PER initiated:

1. Conditions that do not meet the criteria specified in Levels A, B, or C.

2. Conditions which are not reportable and are not potentially generic.

3. Human performance problems of less importance but require documenting and trending.

4. An audit nonconformance / finding which was correctable with a “quick fix.”

5. Drawing deviations where the facility is correct. Drawing deviations should be resolved as their priority dictates.

6. Repeat Events (see Note # 4 on pg. 5 above)

7. A Near Miss not covered as a Level C above.

8. Environmental events that are level D. Refer to TVA-SPP-5.12 Corrective and Preventive Action Process.

3.0 PROCESS

3.1 Roles and Responsibilities

It is the responsibility of all personnel to immediately report problems and adverse conditions to the appropriate supervision/management for evaluation and corrective action.

3.1 Roles and Responsibilities (continued)

Operations Supervisor and /or Manager

Review event to determine if adverse condition exist, determines operability report ability and make appropriate notifications. Take steps to preserve event conditions, gather personnel statements, and initiate the PER before the end of the shift in which event occurred. Develop a return to service plan utilizing the returns to service guidelines (Appendix E) before returning the unit to service.

Initiator

Promptly initiate Problem Evaluation Reports (PERs), make appropriate notifications when problems are identified, take precautions to preserve event conditions, and submit PER to supervisor for review. TVA Form 17795 may be used if the electronic system is not available.

Supervisor (Initiator)

Review Per to determine if adverse condition exists and make appropriate notifications, take precautions to preserve event conditions, ensure PER is entered in appropriate reporting system, and obtain MRC approval of PER within 7 calendar days of initiation.

Management Review Committee (MRC)

Review PERs to assign level, assign category, assign cause analysis method, and assign responsible organization including determination to use Independent Team Leader. Review and approve corrective action plans as necessary.

Responsible Organization

Develop corrective action plan (CAP), using a structured process (reference TVA.SPP.1.6 Cause Analysis) within 30 calendar days of assignment from MRC including approvals, implement and/or monitor implementation of CAP, process CAP changes and revisions, and close PER including supervisor (responsible organization) review.

Action Organizations

Process all assigned actions within approved schedules

Technical Support/Components & System Engineering (C&SE)/Other Organizations

Support analysis teams as requested, provide/coordinate process oversight as requested, and track and trend FPG indicators. Take lead in analysis activities when appropriate and requested, especially for events caused by support organizations.

3.2 Instructions

- Follow the instructions in TVA.SPP-3.1 Section 3.2 and complete the Cause Analysis per TVA.SPP-1.6.

- The Root Cause Analysis (RCA) Handbook may be used as a reference. The RCA Handbook can be accessed from the plant homepage under Reference Information.

3.2 Instructions (continued)

- Prior to returning a unit to service, ensure the guidelines in Appendix E are met.
- Determine if the condition that resulted in the PER is a potential Environmental issue (See Appendix H).

3.2.1 Corrective Action Implementation

- Action Organization / Individual

Complete assigned actions by the due date and close in the electronic system. Ensure any supporting documentation providing evidence of CAP action completion is either inserted, attached, or referenced. If the documentation is not inserted, or attached ensure it is referenced and is retrievable.

- Responsible Organization / Individual

Review actions taken and complete the action item status.

3.2.2 Generic Review

NOTE

We will be using PlantView Event reporting Software until MAXIMO is rolled out. In PlantView the Generic Review is called “Event Assessment”

Unless covered by the exceptions below, a generic review should be sent for any level A through C PERs to ensure awareness, information sharing (lessons learned) and replication where applicable to the appropriate Plant, Program (e.g. Boiler Tube Failure Program, Water Chemistry Program), or appropriate Peer Team.

Level D PERs are not generally sent for generic review, but may be sent as information only at the option of the Responsible Organization.

A. Responsible Organization

It is important to determine generic applicability during the corrective action plan development. If the affected facilities cannot be determined or the issue is programmatic the appropriate Corporate Functional Area Manager CFAM should perform the generic review.

B. Affected Facility MRC Coordinator

Notify the affected sites/organizations M&P Manager to perform the generic review and change the action in the CAP system (PlantView or MAXIMO) to the responsible person. Transmit information only documentation to the appropriate personnel (affected organization).

C. Affected Organization

1. Evaluate the PER for generic applicability within 30 calendar days of assignment.

3.2.2 Generic Review (continued)

2. If a generic condition is determined to exist, initiate a PER for the affected facility and record the site specific PER number on the generic review screen. A CFAM performing a generic review may initiate one PER to address a generic condition at multiple facilities or may issue separate PERs for the affected facilities.

3. If a generic condition is determined not to exist, document the justification in the response to the generic review action in the appropriate PlantView or MAXIMO CAP system.

4. If the generic review reveals additional pertinent information not addressed in the PER, note the supplemental information in the generic evaluation and on any resulting PER.

D. Exceptions to the Generic Review Requirement:

1. PERs initiated as a result of previous generic reviews which are identical to the original document.

2. PERs for which the normal corrective action process will resolve any generic implications for other sites or location.

3. PERs which are known to be isolated to one site (e.g. one of-a-kind equipment, first time technology).

4. PERs that list additional examples of a previous corrective action program document, already reviewed for generic applicability.

5. PERs documenting damage from accidents for which the cause is known to have no significant potential of occurrence at other sites.

6. PERs documenting an expected failure (e.g. run to failure)

E. Guidelines for determining organization to perform Generic Review:

1. If issue is programmatic, program owner (e.g. Boiler Tube Failure Program, Water Chemistry Program), should perform generic review

2. If all affected facilities are known, each affected facility should perform the generic review for their facility

3. If all affected facilities are not known, the appropriate corporate organization should perform the generic review. A reasonable effort should be made to identify the affected locations before a corporate organization is assigned the generic review.

3.2.3 Extension Request

- Action Organization

A. Extensions are approved by the responsible organization and changed in the electronic system.

3.2.4 Trending and Program Monitoring (may be performed at a site/facility)

- Each Division/Strategic Business Unit

  1. Assemble trend data on a quarterly basis (or as requested) utilizing an appropriate rolling interval to compare data.

  2. Organize the data in a manner for comparing the current period with previous periods, then analyze the data and identify potential adverse trends or trend-related issues requiring action such as programs/processes areas, a pattern in causal codes including common cause analysis, and others as appropriate.

  3. Include information concerning outstanding program key areas such as quantity, age (backlog/timeliness), and others as appropriate.

  4. Issue a quarterly report (or as requested) to key site organizations which includes providing analysis, describing any detected trends, and substantiating data.

  5. Notify the affected organization manager when potential adverse trends or trend-related issues are identified.

3.2.5 Escalation

PERs may be escalated by anyone as needed. Individuals who do not agree with the response or resolution of a PER may escalate the issue to Management, or initiate another PER.

3.3 Evaluation Criteria

3.3.1 Indicators

The Quality and Process Indicators monitored via this procedure will include as a minimum those failures defined in the bullets listed in Section 2.0 items A-H, “Scope”. This procedure should be evaluated using the following indicators:

A. Outcome (Quality) Indicators (Q):

- **Q1-** Total number of significant events
- **Q2-** Total number of repetitive forced outages and unit trips
- **Q3-** Total number of significant human performance events

B. Process Indicators (P):

- **P1 -** Total number of significant events where the corrective action plan was not approved in $\leq$ 30 calendar days from MRC assignment of responsible organization
- **P2 -** Average age of C and D PERs
- **P3** - Total number of late action items (for significant events)

3.3.2 Indicator Formulas/Criteria for Defect:

Q1 Total number of significant events = sum of plant events (as defined in procedure step 2.0, items A-H). Number of significant plant events is tracked and trended by the Methods & Processes Manager at each plant monthly by event category. Number of significant FPG events is monitored and trended (by event category, plant and FPG wide) by Technical Support.

Q2 Total number of repetitive forced outages and unit trips = sum of plant repetitive forced outages and unit trips due to inadequate root cause analysis, ineffective corrective actions, or untimely corrective actions. Number of repetitive forced outages and unit trips is tracked and trended by the Methods & Processes Manager at each plant monthly.

Q3 Total number of significant human performance events = sum of plant significant human performance events. Number of significant human performance events is tracked and trended by the Methods & Processes Manager at each plant monthly.

P1 Sum of significant events where the corrective action plan was not approved in $\leq$ 30 calendar days. This indicator is tracked by the plant's Methods & Processes Manager for plant failures and by Technical Support for FPG failures.

P2 Total number of late action items = total number of action items not completed by the due date (for significant events). This is tracked by the Methods & Processes Manager and reported to Technical Support monthly.

3.4 References

A. TVA-SPP-3.1 - "Regulatory Corrective Action"

B. TVA-SPP-1.6 - "Cause Analysis"

C. TVA-SPP-5.12 Corrective and Preventive Action Process

D. FPG Root Cause Analysis Handbook

E. Plant View Event Reporting application

3.5 Training

Training on this process within FPG shall consist of the following:

A. Online Cause Analysis Training for those performing an analysis.

B. Classroom Cause Analysis training for those performing an analysis.

C. Orientation to the electronic PER system used by FPG for those performing extensive data entry.

4.0 RECORDS

Document the PER in the electronic system including additional attachments (Appendix G, Appendix etc.) as deemed appropriate by the responsible organization. Any records generated as a result of this process shall be filed and retained in accordance with the fossil power group (FPG) Comprehensive Records Schedule (CRS). Processes and procedures referenced in this document will prescribe any specific record requirements within those documents.

5.0 DEFINITIONS

Adverse Trend - An undesirable change in a quality indicator statistic of such magnitude as to require analysis of the information to ascertain if it requires management attention

Common Cause - A process is considered stable and predictable when only normal distribution of process variation is present. The failure mechanism is inherent in the process and failures occur randomly but are predictable in frequency on like components and like failure modes.

Facility - A TVA site, location, organization, business unit, or asset

Failure - Equipment not meeting the defined operating parameters.

Failure, Functional - When a component fails to meet the desired capacity for which it was designed.

Component and Process Analysis - Identifies WHAT failed and the contributors-the failed component and/or the failed process.

Failure / Error Mode Analysis - Identifies HOW the component and/or process failed and what caused it to fail-the failure/error mode(s) and verified failure mechanisms.

Cause Analysis - Identifies WHY the component and/or process failed-the verified root cause (s) and causal factors of the identified failure / error mechanism.

Operable / Operability - A system, subsystem, train, component, or device is considered operable when it is capable of performing its specified function(s). Implicit in this definition is the assumption that necessary attendant instrumentation, controls, normal or emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment required for the system, subsystem, train, component, or device to perform its specified function(s) are also capable of performing their related support function(s). Additional guidelines are given in Appendix A.

Repeat Event - A subsequent non-conformance or other recurrent previously identified problem where resolution/corrective action was ineffective.

Reportable Environmental Event (REE) - An occurrence at a TVA facility that violates regulatory requirements and triggers a notification to, or enforcement action by, a regulatory agency.

5.0 DEFINITIONS (continued)

Repetitive Failures - When the same piece of equipment or same process has repeated failure of the same failure/error mode and failure/error mechanism (at the same or different FPG plant/organization

Responsible Organization - The organization with lead responsibility for resolving a PER, including developing the corrective action, determining potential generic applicability, implementing corrective action, and closing.

Significant Problem - A condition or trend meeting the criteria for a Level A or B PER.

Special Cause - This occurs when variation in the process is unstable and unpredictable. The failure mechanism is unpredictable and the frequency of occurrence on like components varies. Process improvement cannot be made until the special causes are identified and removed.

Trend Analysis - A formal evaluation of data to determine the direction of movement in the course of time of a statistically detectable change. Also, trend analysis is the evaluation of compiled data grouped such that the prevailing tendency of selected parameters can identify areas requiring improvement and areas of past successes.

Appendix A
(Page 1 of 1)

Guidelines for Potential Operability Determinations

A. Generally, to determine potential effect on operability is to ascertain if the condition described in the PER affects the capability of a system or component such that it cannot perform its function.

B. Design-related deficiencies are to be investigated through calculations, evaluation, communication with vendors, or other means to determine whether the deficiency renders the affected equipment inoperable unless it is known emphatically the situation does or does not affect operability.

C. Confirmed degradation, damage, failure, malfunction, or loss of plant equipment important to safety.

D. Failure to follow or create standards to comply with governing regulations or TVA criteria is not in itself a condition potentially affecting operability.

Appendix B
(Page 1 of 1)

Problem Evaluation Report (PER) Closure

PERs involving hardware corrective action may be closed when field work is complete or the PER may be closed to a WO provided:

1. The PER and WR/WO are cross-referenced on each document (in their respective software programs),

2. Documented justification for any subsequent cancellation of the WR/WO is approved by the organization responsible for the WR/WO and the department manager who approved the corrective action plan, and

3. The PER closure receives the appropriate management approval.

Actions to provide training may be closed when the target audience specified receives the required training. Training rosters may serve as documentation.

Actions to provide instruction (e.g., counseling, briefings, memorandums, night/standing orders, lessons learned) may be closed when a statement of completion is documented.

PERs not involving hardware which are to be resolved through issuance of new or revised procedures or design output documents may be closed when the affected procedures or design output documents have been approved.

The PER may be closed if the only action(s) remaining is an effectiveness review and/or an enhancement that is to be performed at a future date.

Appendix C
(Page 1 of 1)

Independent Team Leader Guidelines

MRC determines if an independent team leader is required. MRC considers the following:

- Multiple unit outages were caused by a single failure
- The significant failure is a repeat failure
- The failure may not be objectively analyzed by the originating organization.

The following steps occur when an independent team leader is required:

- FPG Senior Management will be consulted for the selection of a team leader
- Team lead will be dispatched to the site of the failure as soon as possible
- Team lead will contact the plant and assure failure is quarantined and data collection has begun
- Team lead will establish with the plant, the appropriate plant personnel and FE&TS technical support needed to perform the investigation and have them at the site to begin as soon as possible. The team will be comprised of a team leader and, as needed, two investigating team members, two plant team members, and two technical experts (FE&TS engineers).
- Team lead will establish the necessary schedule (24 hour coverage if necessary) for the team members to adequately support the data collection, evaluation, interviews, and analysis so the restoration process can begin as soon as possible after the appropriate information is collected.
- Team lead must provide the plant with a plan and schedule for the investigation as well as be involved in the final decision for the beginning of restoration of the unit.

Appendix D
(Page 1 of 2)

MRC Guidelines

The Management Review Committee (MRC) is a committee of Site Senior Managers which provides oversight review of all newly initiated problem evaluation reports (PERs) and selected corrective action plans.

The MRC is composed of the following primary members or their alternates as a minimum (see Note):

- Plant Manager (Chairperson)
- Assistant Plant Manager
- Operations Manager
- Method And Process Manager
- Engineering Manager
- Maintenance Managers
- Yard Operations Supervisor
- Any Shift Operations Supervisor

The Plant Manager can designate one or more of his direct reports as Alternate Chairpersons. When the primary member cannot attend, the department manager should appoint an alternate to attend in their place. The administrator for the Corrective Action Program or MRC coordinator will also attend to ensure MRC actions are recorded and to advise the MRC on programmatic matters.

A quorum will consist of at least four of the primary members or their alternates in attendance. No more than two alternates may be counted towards a quorum. The Chairperson or Alternate Chairperson must be in attendance. MRC may establish subcommittees to perform specific functions as directed by MRC. The MRC must review its subcommittee reports.

The initial MRC review of PERs includes:

- Classification level of the PER (A, B, C, or D).
- Determination of Category (People, Process, or Equipment)
- Assignment of Program Codes
- Completeness and clarity of the PER description.
- Responsible organization assignment.
- Determination of whether a why staircase is required.

Appendix D
(Page 2 of 2)

- Determination of whether a root cause analysis is required.
- Determination of whether additional interim actions are required.
- Determination of whether extent of condition is required for Level C PER.
- Consideration of trends or recurring conditions.
- Determination of whether an issue should be submitted as Experience Review to potentially prevent occurrence at other facilities.
- Other responsibilities as stated in FPG.SPP.03.001

The MRC also reviews corrective action plans for designated and selected PERs for the following:

- Adequacy of cause analysis
- Whether the proposed corrective actions will be effective at correcting and preventing recurrence of the problem
- Other responsibilities as stated in FPG.SPP.03.001

Occasionally, MRC will assign actions to specific Departments or subcommittees which are associated with the Corrective Action Program, but not a specific PER. These actions are tracked and reported on in future MRC meetings.

Appendix E
(Page 1 of 1)

Return to Service Guidelines

Before returning the unit to service, the analysis team/individual is to develop a return-to-service plan that must include the following minimum requirements:

- All data is collected that will not be available after the unit is returned to service
- Sequence of events including any problems/abnormalities with unit shutdown
- Written statements are collected from employees involved in the event
- Identification of short-term immediate corrective actions
- Identification of apparent or root cause(s) to the extent that corrective actions can be implemented to allow for restart and to prevent recurrence
- Approval of Plant Manager that all items above are secured and ready to return the unit to service
- For equipment Issues: Approval of VP Technical Support or Manager of Components & Systems Engineering.

NOTE

Under no circumstance is the unit/equipment to be returned to service without assessing the risks/liabilities, identifying root causes and contributing factors, and a plan to ensure functional capability of the production unit without damaging other equipment, creating unacceptable personnel risk, or allowing environmental non-compliance's.

Restart of a unit without determination of root cause and action to prevent recurrence must be approved by the SVP, FPG Operations (or designee). This approval shall only be considered where extenuating circumstances dictate; examples of those types of situations include the following:

- Severe system power demand (e.g., power system alert) and high confidence that actions taken will prevent near term recurrence, damage to equipment or injury to personnel
- Inability to confirm root cause or effective solution until after unit operational conditions are achieved - compensatory mitigation controls should be established as possible
- Inability to confirm root cause following comprehensive efforts - in case approval is contingent upon establishing appropriate monitoring/instrumentation of conditions to determine the cause and predict/prevent recurrence as possible.

The basis for this type of decision including the associated return to service plan shall be documented.

Appendix E
(Page 2 of 2)

The return-to-service plan should also consider past solutions and failure history to prevent impending failures from occurring while the permanent process improvement is being implemented.

All information collected and documentation generated should be included in the PER

Appendix F
(Page 1 of 1)

Appropriate Use of Work Order and PER

WO only: situations where

- Low significance/impact (e.g., no impact to generation)
- Expected degradation
- Broke/fix
- Trend level of failures to determine if as expected/desired - if adverse trend identified, may initiate PER to investigate cause and actions needed (e.g., process, training, human performance) to prevent recurrence.
- Example - replace gasket due to normal wear

PER only: situations where

- Significant events due to non-hardware issues (e.g., human performance or process only, no hardware broken/malfunctioning) - do full root cause (Level A & B)
- Non-hardware problems - do apparent cause (Level C)
- Minor non-hardware problems - document found/fixed (level D).
- Trend for precursors for more significant or recurring problems - if identify adverse trend, may initiate higher level PER to determine cause and corrective action (trending action applies to all level of PER's but particularly for C's and D's where less time is spent looking at underlying causes, extent of condition, etc.)
- Example: unit trip due to operator shutting off wrong ID fan

WO and PER: - Similar to how handled under Prevent Recurrence analysis for significant events where WO written to fix hardware and analysis performed to determine root cause and actions to prevent recurrence.

- Significant failures involving hardware - WO to fix, PER to determine root cause Level A & B.
- Significant event involving both hardware and human performance or process Level A & B.
- Failure/event involving hardware and human performance where need additional review beyond WO to fix specific situation (Level C).
- Example: forced outage due to leak on #1 HP Heater A head at welded flange. Write PER to determine cause (weld defect) and write work order to repair.

Appendix G
(Page 1 of 1)

Problem Evaluation Report Form

Fossil Power Group

Problem Evaluation Report (PER)

***Initiator:** _____ ***Date:** _____

Organization: _____

***Worksite where problem occurred:** _____

***Date of Occurrence:** _____

***Problem Description:**

Probable Reason/Solution:

Corrected Immediately? ☐ Yes ☐ No

Immediate/Interim Actions:

Affected Resources:

Unit(s): _____ **System(s):** _____

Equipment: _____ **Document(s):** _____

After completion of required information, please submit PER to your supervisor.

***REQUIRED INFORMATION**

TVA 17795 [9-2003]

EXAMPLE

Appendix H
(Page 1 of 1)

Guidelines for Potential Environmental Issue

Use the questions below as guidelines to answer the Potential Environmental Issue questions for the Supervisor PER review. If any of the questions are answered yes, the Potential Environmental Issue question should be answered yes.

1. Did the event result in nonconformance with any air, Title IV, NPDES or solid waste permit?
2. Did the event trigger any reporting requirements to any local, state or federal regulatory agency?
3. Did the event result in a spill to the environment as defined in the IPP Plan?
4. Did the event result in the release of any asbestos or PCBs?
5. Did the event result in any missed inspection, recordkeeping or reporting required by any local, state or federal regulatory agency?
6. Did the event involve any activity for which a local, state or federal permit should have been obtained prior to the activity?
7. Did the event involve improper handling or disposal of hazardous waste?
8. Did the event result in a Notice of Violation?
9. Did the event result in a Reportable Environmental Event (REE)?
10. Did the event result in an environmental audit finding?
11. Did the event result in a significant potential for any of the above events to occur?

Appendix I
(Page 1 of 5)

Root Cause Failure Analysis Forms (Optional)

PER Worksheet (Cover Sheet)

PER Initiator	Date of Occurrence			PER Level					
Work Site	Unit	System							
Problem Description :									
Corrected Immediately?	Yes	No	If "Yes", describe Immediate Actions Taken.						
Immediate Actions Taken :									
Responsible Organization :			**Responsible Organization Employee :**						
Causing Organization :		**Analysis Type**	Root			Apparent			
Category:	Equipment	Process	People	**Event Class**	FO	MO	RI	REE	Other
IF F.O.	No Trip	Trip	Start Up	Failure	Planned Outage Extension		Fire Damage		
Cause Description (Apparent or Root):									
Previous Similar Event:									
Extent of Condition :									
Recurrence Control :									
Comments :									

Appendix I
(Page 2 of 5)

Fossil Power Group Failure Analysis Worksheets

Personnel Statement

Fossil Power Group Failure Analysis Worksheet
Personnel Statement

Event Name:	**Event No.:**

Prepare a written statement describing the event sequence and plant response as you remember it. Include the plant coordinators prior to the event, your indications that a malfunation or inadequacy exists. And any identified procedure deficiencies. Also, include any information you consider important to the review of the event. Use as many sheets as necessary.

Preparer :	**Title :**	**Phone:**

Describe procedure problems, communication problems, etc. that may have contributed to this event. Include your recommendations and ideas for preventing similar events in the future.

Signature: _____ **Date:** _____

TVA 17883 [7-2004]

EXAMPLE

Appendix I
(Page 3 of 5)

Detailed Sequence of Events

Fossil Power Group Failure Analysis Worksheet
Detailed Sequence of Events

Sequence of Events:

Date	Time	Activity / Event / Action

TVA 17884 [7 - 2004]

EXAMPLE

Appendix I
(Page 4 of 5)

Equipment and Process Root Cause Analysis

Fossil Power Group Failure Analysis Worksheet
Equipment and Process Root Causes Analysis

Process Definition (Level I & II Root Cause Analysis Procedure)

Explain what happened and which process indicator was impacted:

Function Failure:

Component Failure:

Failure Mode:

Failure Mechanism:

Process Indicator:

Process Failure:

Process Step Failure:

Error Mode:

Error Mechanism/Causal Factor:

Process Indicator:

Problem Statement:

Root Cause Analysis (Level III Root Cause Analysis Procedure)

Fishbone, Structure Tree, Fault Tree, FMEA, EMEA, etc.

P otential Cause	Method of Verification	Root Cause	CF	Findings
		☐ yes	☐ yes	
		☐ yes	☐ yes	
		☐ yes	☐ yes	
		☐ yes	☐ yes	
		☐ yes	☐ yes	

TVA 17885 [7 - 2004]

EXAMPLE

Appendix I
(Page 5 of 5)

Human Performance Evaluation

Fossil Power Group Failure Analysis Worksheet
Human Performance Evaluation

Inappropriate Action Number:
Human Performance Problem During Event - Repeat as needed for each inappropriate action:
Equipment Condition/Failure Affecting this Inappropriate Action:
Behavior Analysis - How this inappropriate action happened:
Causal Analysis - Why this inappropriate action happened:
Method of Verification:
Corrective Action for this Inappropriate Action:
Comments:
Inappropriate Action Number:
Human Performance Problem During Event - Repeat as needed for each inappropriate action:
Equipment Condition/Failure Affecting this Inappropriate Action:
Behavior Analysis - How this inappropriate action happened:
Causal Analysis - Why this inappropriate action happened:
Method of Verification:
Corrective Action for this inappropriate action:
Comments:
Inappropriate Action Number:
Human Performance Problem During Event - Repeat as needed for each inappropriate action:
Equipment Condition/Failure Affecting this inappropriate action:
Behavior Analysis - How this inappropriate action happened:
Causal Analysis - Why this inappropriate action happened:
Method of Verification:
Corrective Action for this Inappropriate Action:
Comments:

EXAMPLE

TVA 17886 [7 – 2004]

APPENDIX L

QUALITY ASSURANCE PROCEDURE FOR PROGRAM IMPROVEMENT FOR KINGSTON FOSSIL PLANT ASH EVEN (TVA-KIF-QAP-001)

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

QUALITY ASSURANCE PROCEDURE FOR

PROGRAM IMPROVEMENT
FOR KINGSTON FOSSIL PLANT ASH EVENT

TVA-KIF-QAP-001

Prepared by

Tennessee Valley Authority

Office of Environment and Research

Environmental Resources and Services

March 2009

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

APPROVAL PAGE

Approved by: ____*Signature on File*_____ _____

Paul LaPointe, VP Environmental Resources and Services Date

Approved by: ____*Signature on File*_____ _____

Neil Carriker, Senior Environmental Specialist Date

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

TABLE OF CONTENTS

Page

1.0 PURPOSE 1

2.0 SCOPE 1

3.0 RESPONSIBILITIES 1

4.0 REQUIREMENTS 2

4.1 Prerequisites 2
4.2 Limitations and Actions 2
4.3. Apparatus/Equipment 3
4.4 Reagents and Standards 3

5.0 PROCEDURES 3

5.1 Initiation and Initial Evaluation of Program Improvement Reports 3
5.2 Determination of Root Cause 4
5.3 Corrective Actions / Program Improvements 5
5.4 Preventive Measures 5
5.5 Verification 6
5.6 Closure 6

6.0 SAFETY 6

7.0 DEFINITIONS 6

8.0 REFERENCES 7

9.0 ATTACHMENTS AND APPENDICES 7

9.1 Program Improvement Report Form 7
9.2 Tracking Log 7

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA.

1.0 PURPOSE

This Quality Assurance Procedure (QAP) provides guidelines for determination and identification of non-conforming items (see Section 7.0 for definition) and other items noted for program improvement which occur during field sampling events associated with the Kingston Fossil Plant (KIF) Ash Event. This QAP also provides for identification, approval, implementation, and documentation of corrective actions and preventive measures in addition to providing a decision point to determine whether the TVA Problem Evaluation Report (PER) system must be used.

2.0 SCOPE

This QAP applies to all aspects of KIF Ash Event field sampling activities and processes except for corrective actions given in individual procedures for routine troubleshooting of instruments. This procedure is not intended to replace the TVA PER system, but to provide an equivalent system to address problems which may be corrected or prevented rapidly by training, paperwork changes, or employee counseling.

All actions with regard to program improvement are documented and tracked to completion by use of a form and a tracking log (provided in Section 9.0).

3.0 RESPONSIBILITIES

It is the responsibility of the Field Sampling Manager to ensure that identified non-conformances and proposed corrective actions are handled and tracked in accordance with this procedure or the TVA PER process if required under FPG.SPP.03.001 or Environmental Management Procedure 12: *Environmental Event Corrective and Preventive Action Process* (see Section 8.0). The Field Sampling Manager shall ensure that identified non-conformances are documented, that corrective actions are developed, and that assigned tasks are carried to closure.

It is the responsibility of the Quality Assurance (QA) Officer to ensure that identified non-conformance items have a corrective action proposed, that items are tracked to closure, and that corrective actions are verified when they are completed.

It is the responsibility of all field sampling team members to identify non-conformances and areas for program improvement as soon as they are observed. It is the responsibility of the Environmental Manager to serve as final reviewer and provide final closure for Program Improvement forms.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

4.0 REQUIREMENTS

4.1 Prerequisites

None

4.2 Limitations and Actions

Any staff member may identify and report a non-conformance or area for program improvement.

Non-conformance reports or program improvement forms (see an example in Attachment 9.1) shall provide for the following:

- identification and description of the non-conformance,
- acceptance or rejection of the non-conformance,
- traceability to the item involved,
- a unique identifying number,
- assignment and documentation of corrective actions,
- assignment and documentation of preventive measures,
- determination of root cause,
- assessment of significance,
- supervisory review, and
- verification of completion.

The program improvement Tracking Log (see Attachment 9.2 for an example) shall provide for the following:

- a method of following non-conformances from initiation to closure,
- the unique identifying number assigned to the non-conformance,
- the person to whom the non-conformance is assigned,
- date of initiation, and
- date of closure.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

The following items are examples of occurrences that shall be considered **non-conformances:**

- Inspection or audit findings pertaining to procedural deficiencies or deviations from procedures;
- Use of measuring or test equipment that fails to meet operational or calibration criteria, and
- Equipment, material, methods, services, documentation, or activities that do not conform to requirements or that leave the item or activity in an indeterminate state.

The following items are examples of occurrences that shall be considered opportunities for **program improvement**:

- Sample collection information that must be corrected after shipment of samples offsite,
- Failures in sample preservation or failure to take correct sample volumes so that re-sampling is required,
- Misunderstanding or poor communication regarding sample collection points, processes, or planning, and
- Failure to obtain correct quantities of collection or shipping containers prior to sample collection.

4.3. Apparatus/Equipment

None

4.4 Reagents and Standards

None

5.0 PROCEDURES

The procedures are provided for initiation and initial evaluation of Program Improvement Reports, determination of root cause, corrective actions and program improvements, preventative measures, verification, and closure.

5.1 Initiation and Initial Evaluation of Program Improvement Reports

a. When a problem or area for improvement has been identified, the individual noting the problem or improvement area shall report it to the QA Officer or Field Sampling Manager.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

b. The QA Officer or Field Sampling Manager shall prepare a tentative Program Improvement Report (see Attachment 9.1).

c. The Field Sampling Manager or QA Officer shall then accept or reject the report, determine if it requires emergency action, determine if the situation has associated reporting or notification requirements, and determine whether it should be escalated to the TVA PER system in accordance with paragraph 2.0 of FPG.SPP.03.001 and TVA Environmental Management Procedure 12.

d. The Field Manager shall determine if a non-conforming item is involved which must be removed from inadvertent service by applying a tag or label and/or by physical segregation. This is recorded on the *Tag and Segregate* section of the form as appropriate.

e. If the Program Improvement Report is rejected, a reason for this conclusion shall be written on the Program Improvement Report form and the form shall be routed to the Environmental Manager for closure. The Environmental Manager may reverse this conclusion or ask for further justification as necessary.

f. Tentative Program Improvement Reports shall be further evaluated for applicability of the TVA PER System. If required, the item shall be documented accordingly on the TVA PER System, and the Program Improvement Report will be closed.

g. The Field Sampling Manager or QA Officer shall assign the responsibility for the corrective and preventive measures to an appropriate staff member and record the assignment on the form.

h. The item shall be logged on the Tracking Log (see example in Section 9.2).

5.2 Determination of Root Cause

In an attempt to ensure that an issue does not reoccur, efforts must be made to identify its root cause using the following steps.

a. Either at the time the Program Improvement Report is accepted or after corrective actions have been completed, the QA Officer or Field Sampling Manager shall determine the root cause and document it on the form. Root cause and preventive measures should correspond logically.

b. The QA Officer shall mark Root Cause as “Not Applicable” when no preventive measures are addressed.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

5.3 Corrective Actions and Program Improvements

Note: Complex corrective actions must be managed by use of the TVA PER System.

Note: The QA Officer may determine that the corrective action portion of the form is "Not Applicable" when only preventive measures apply.

a. The individual or team to whom corrective action or program improvement is assigned shall investigate the issue and determine proper actions to remedy the problem or implement the improvement. This individual or team may consult with other staff members, the QA Officer, the Field Sampling Manager, or other management to determine proper action.

b. The proposed method for corrective action shall be written on the Program Improvement Report and approved by the Field Sampling Manager.

c. In the course of completing the corrective action, additional actions may be discovered or recognized. These should also be documented on the form and approved by the Field Sampling Manager as they are discovered. Again, escalation to the TVA PER system may be required or warranted in such a situation.

d. When the Field Sampling Manager proposes a corrective action or program improvement, a manager at equal or higher organizational stature or the QA Officer shall provide the approval.

5.4 Preventive Measures

Note: Complex preventive measures must be managed by the TVA PER system.

a. Like corrective actions, proposed preventive measures shall be written on the form and approved by the Field Sampling Manager. When the Field Sampling Manager proposes a preventive measure, a manager at equal or higher organizational stature or the QA Officer shall provide approval.

b. The preventive measures should address the root cause, when it is known.

c. The QA Officer may conclude Preventive Measures are "Not Applicable" when the Corrective Actions / Program Improvement section of the form appears to address the situation completely.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

5.5 Verification

Once corrective and preventive measures are complete, the QA Officer shall verify that they are complete and properly documented. Actions taken in the verification shall be noted on the form. Documentary evidence of completion should be appended to the non-conformance report.

5.6 Closure

The QA Officer and Environmental Manager shall review the form, and the Environmental Manager shall approve the form. The Program Improvement Form is closed by recording the date on the tracking log and routing all records for proper handling in accordance with TVA record control rules and procedures.

6.0 SAFETY

None

7.0 DEFINITIONS

Program Improvement consists of those actions taken to repair or prevent situations that adversely affect quality (of a minor nature). Actions must be on an immediate basis.

Non-conformances consist of equipment, material, methods, services, documentation, or activities that do not conform to requirements or that leave the item or activity in an indeterminate state.

Corrective actions are those actions taken to rectify, rework, amend, or repair situations adverse to quality or to bring them into compliance. Corrective actions may range from an immediate task involving one person to a very time-consuming effort by many people. They may require the preparation of new procedures, training, employee counseling, modification of computer programs, development of new test conditions, or modification of equipment. Proper corrective action may require extensive discussion or planning among team members before it is taken.

Preventive measures are those actions taken to ensure non-conformances do not reoccur.

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

8.0 REFERENCES

Tennessee Valley Authority. FPG.SPP.03.001 *Corrective Action Program*, TVA Fossil Power Group (FPG), FPG Standard Processes and Procedures, 11-21-2008.

Tennessee Valley Authority. Environmental Management Procedure 12: *Environmental Event Corrective and Preventive Action Process.*

9.0 ATTACHMENTS AND APPENDICES

9.1 Program Improvement Report Form

9.2 Tracking Log

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

Attachment 9.1: Program Improvement Report **Number _____**

Description of Problem or Proposed Improvement (this section must contain sufficient details to allow independent tracking/observing of problem or proposed improvement)

Identified by _____ Date _

Person Responsible for Implementing Corrective Actions and Preventive Measures

_____

Review: Accept ( ) Reject ( )

If rejected, reason for rejection:

Escalate to TVA PER System: Yes ( ) No ( )

Reoccurrence of previous problem: Yes ( ) No ( ) (If yes, escalate to TVA PER System)

Not Reportable ( ) or Reportable to _____

If reportable, report is assigned to _____ Date _____

Tag and Segregate assigned to _____ Date _____

Corrective actions or Program Improvement and Preventive Measures assigned to

_____ Date _____

Reviewed by _____ Date _____

Root Cause:

Assessed by _____ Date _____

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

Attachment 9.1: Program Improvement Report (Continued) **Number _____**

Corrective Action or Program Improvement:

Proposed by _____ Date _____

Concurred _____ Date _____

Preventive Measures:

Proposed by _____ Date _____

Concurred _____ Date _____

Verification of Corrective Actions or Program Improvements and Preventive Measures

Verified by _____ Date _____

Reviewed by Manager _____ Date _____

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA

Attachment 9.2: Example of a Tracking Log for Non-Conformance for Program Improvement

ID Number	Description	Responsible Supervisor	Assigned to	Corrective Action	Preventative Measures	Date Initiated	Date Closed

End of Procedure

This document, in part or in whole, is the property of the Tennessee Valley Authority (TVA) for sole use by TVA employees or TVA contractors or as otherwise consented to in writing by the TVA