**ENVIRONMENTAL
RESTORATION
PROGRAM**

**Sampling and Analysis Plan for Treatment
Water and Creek Water for the Lower
East Fork Poplar Creek Operable
Unit, Oak Ridge, Tennessee**

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Energy Systems Environmental Restoration Program

**Sampling and Analysis Plan for Treatment Water
and Creek Water for the Lower East Fork
Poplar Creek Operable Unit,
Oak Ridge, Tennessee**

Date Issued—April 1996

Prepared by
Science Applications International Corporation
Oak Ridge, Tennessee
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OAK RIDGE Y-12 PLANT
Oak Ridge, Tennessee 37831-8169
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
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PREFACE

This *Sampling and Analysis Plan for the Treatment Water and Creek Water for the Lower East Fork Poplar Creek Operable Unit, Oak Ridge, Tennessee* (Y/ER-261) was prepared in support of the *Phase II Remedial Design Report* (DOE/OR/01-1449&D1) and in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to present the plan for sampling and analysis practices to be followed for the water treatment system influent and effluent water and creek water during the remediation. This work was performed under Work Breakdown Structure 1.4.12.3.1.04, Activity Data Sheet 9304 "Lower East Fork Poplar Creek." This document provides the Environmental Restoration Program with information about the methodology, organizational structure, quality assurance and health and safety practices to be employed during the water sampling and analysis activities associated with the remediation of the Lower East Fork Poplar Creek Operable Unit.

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ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	(EPA) Contract Laboratory Procedure
CRF	Central Records Facility
DOE	U.S. Department of Energy
DOE-OR	U.S. Department of Energy Field Office in Oak Ridge
DOT	U.S. Department of Transportation
EFPC	East Fork Poplar Creek
Energy Systems	Lockheed Martin Energy Systems, Inc.
EPA	U.S. Environmental Protection Agency
ESAMS	Energy Systems Action Management System
FCOs	field change orders
FFA	Federal Facilities Agreement
FID	flame ionization detector
FP	flash point
GFAA	Graphite Furnace Atomic Absorption
HASP	Health and Safety Plan
IDLH	immediately dangerous to life and health
IP	ionization potential
IVC	independent verification contractor
JEG	Jacobs Engineering Group
LCS	laboratory control sample
M&TE	monitoring and testing equipment
MS	matrix spike
NA	not available
NBS	National Bureau of Standards
NCR	nonconformance report
NIOSH	National Institute of Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
OU	operable unit
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCU	perimeter confirmation unit
PEM	project environmental measurement system
PEL	permissible exposure limit
PID	photoionization detector
POTW	publicly owned treatment works
ppm	parts per million
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
QC	quality control

RAC	remedial action contractor
RPD	relative percent difference
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SHSO	Site Health and Safety Officer
SOP	standard operating procedures
SOW	statement of work
TBD	to be determined
TDEC	Tennessee Department of Environment and Conservation
TLV	threshold limit value
TWA	time-weighted average
VP	vapor pressure
WMP	Waste Management Plan

1. FIELD SAMPLING AND ANALYSIS PLAN

1.1 INTRODUCTION

This document presents sampling and analysis plan for creek and treated water sampling work plan for the Lower East Fork Poplar Creek (EFPC) remedial action in Oak Ridge, Tennessee. Creek water sampling is being conducted to ensure remediation activities are not adversely affecting EFPC. Treatment water sampling is being conducted to ensure treated water will meet discharge permit criteria.

On December 21, 1989, the U.S. Environmental Protection Agency (EPA) placed the Oak Ridge Reservation (ORR) (the Reservation) of the U.S. Department of Energy (DOE) on the National Priorities List (NPL). On January 1, 1992, a Federal Facilities Agreement (FFA) between the DOE Field Office in Oak Ridge (DOE-OR), EPA Region IV, and the Tennessee Department of Environment and Conservation (TDEC) went into effect. This FFA establishes the procedural framework and schedule by which DOE-OR will develop, coordinate, implement, and monitor environmental restoration activities on the ORR in accordance with applicable federal and state environmental regulations. The DOE-OR Environmental Restoration Program (ER) for ORR addresses the remediation of areas both within and outside ORR boundaries, including Oak Ridge National Laboratory (ORNL), managed by Lockheed Martin Energy Research Corporation; the former Oak Ridge Gaseous Diffusion Plant (the Oak Ridge K-25 Site); the Oak Ridge Y-12 Plant; Oak Ridge Associated Universities (ORAU); the Clinch River; and East Fork Poplar Creek.

This sampling and analysis plan focuses on characterizing stream water and treatment water during confirmation of the cleanup of the stretch of EFPC flowing from Lake Reality at the Y-12 Plant, through the city of Oak Ridge, to Poplar Creek on the Reservation and its associated floodplain. Both EFPC and its floodplain have been contaminated by releases from the Y-12 Plant since the mid-1950s. Because the EFPC site—designated as an ORR operable unit (OU) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—is included on the NPL, its remediation must follow the specific procedures mandated by CERCLA, as amended by the Superfund Amendments and Reauthorization Act in 1986.

In accordance with CERCLA, a feasibility study was prepared to assess alternatives for remediation, and a proposed plan was issued to the public in which a preferred alternative was identified. In response to public input, this plan was modified and DOE issued a record of decision in 1995 committing to excavation of all soil in the lower EFPC floodplain exceeding a concentration of 400 parts per million (ppm) of mercury.

1.2 CHARACTERIZATION DATA

1.2.1 Site Description

EFPC is a perennial stream located in Anderson and Roane Counties in Oak Ridge, Tennessee, ~ 40 km (25 miles) west of Knoxville. Its headwaters are contained in 137- to 183-cm (54- to 72-in.) underground collection pipes that extend from the west end to the central area of the Y-12 Plant, where the above-ground portion of the creek begins. From the Y-12 Plant site, EFPC flows northward through a gap in Pine Ridge and enters Gamble Valley and the city of Oak Ridge. From there, the stream flows

northwestward along Illinois Avenue through commercial and light industrial areas in Oak Ridge, then trends generally westward, parallel to the Oak Ridge Turnpike in East Fork Valley, through primarily residential, agricultural, and undeveloped forest areas, until it joins Poplar Creek. EFPC waters, after entering Poplar Creek, flow into the Clinch River, which is impounded behind Watts Bar Dam.

From the point at which it exits Lake Reality to its confluence with Poplar Creek, EFPC measures ~ 23 km (14.5 miles). Stream depths range from <1 m to 3 m (3 to 9 ft). The 100-year floodplain bounding the creek varies in width from several meters in its upper reaches to ~ 500 m (1640 ft) and encompasses ~2.71 km² (670 acres).

1.2.2 Source of Contamination

Beginning in 1952, the Y-12 Plant began production-scale separation of lithium isotopes, which required the use of millions of kilograms of mercury. This process released 108,000 to 212,000 kg (239,000 to 470,000 lb) of mercury into EFPC.

Although the primary discharges from the Y-12 Plant were eliminated in 1963, mercury continues to be released into EFPC from Y-12 Plant secondary sources (e.g., building drain systems, sewers, and connecting lines). The current release is ~ 20 g/d (0.7 oz/d), down from 100 g/d (3.5 oz/d) in 1985.

1.2.3 Nature and Extent of Contamination

The remedial investigation (SAIC 1994) concluded that mercury was the principal contaminant of concern in the EFPC floodplain. The highest concentrations of mercury are in a visually distinct black layer of soil that typically lies 15 to 30 cm (6 to 12 in.) below the surface. Mercury contamination was found to be situated in distinct areas along the floodplain, and generally at depths >20 cm (8 in.) below the surface. Based on the cleanup standard of 400 ppm mercury and on sampling conducted by the Jacobs Engineering Group (JEG) since the remedial investigation, specific areas have been identified that require remediation. These consist of eight areas at the National Oceanographic and Atmospheric Administration (NOAA) site along Illinois Avenue (see Fig. 1.1) and seven areas at the Bruner site along the Oak Ridge Turnpike (see Fig. 1.2). The mercury contamination exceeding 400 ppm at the NOAA site extends to a depth of ~ 40 cm (16 in.), while at the Bruner site, the depth extends to 80 cm (32 in.) in isolated locations. The total identified in-situ volume of contaminated floodplain soils is ~ 19,100 m³ (25,000 yd³).

1.3 PROJECT ORGANIZATION

EFPC remedial action is being conducted for DOE-OR, as part of the ER Program, by Lockheed Martin Energy Systems, Inc. (Energy Systems). For the purposes of this remedial action, Energy Systems is also the Remedial Action Contractor (RAC). MK-Ferguson, a subcontractor reporting to Energy Systems, will be responsible for the construction activities. Science Applications International Corporation (SAIC) will provide confirmation sampling services as an Energy Systems subcontractor reporting to MK-Ferguson. JEG will be the Independent Verification Contractor (IVC), who independently verifies that the cleanup has met the cleanup standard and then reports the results directly to DOE-OR. Key Energy Systems personnel and SAIC personnel affiliated with this remediation are listed in Table 1.1.

Table 1.1. Roles and responsibilities of the sampling team

Roles	Person	Responsibility
EFPC Project Manager (ER Program)	Jerome Miller	Manages the overall EFPC remediation project, coordinates all activities associated with this sampling plan, authorizes sampling and analytical work, and tracks project schedule and budget.
MK-Ferguson EFPC Construction Manager	John McCollum	Oversees day-to-day operations of the remedial action.
EFPC Technical Manager	Tim Myrick	Oversees technical activities of EFPC team, assists the Energy Systems Project Manager, and provides point of contact for SAIC personnel.
EFPC QA Manager	Hugh Newsome	Approves project QA plan, procedures manual, and FCOs. Performs QA surveillances.
EFPC Waste Certification Officer	Jeff Henderson	Responsible for approving WMP and obtaining necessary permits for waste staging.
EFPC Health and Safety Manager	Rudy Weigel	Oversees Health and Safety activities of EFPC team.
SAIC Sampling Project Manager, Field Sampling Coordinator, FCO Coordinator	Greg Schank	Responsible for planning and implementation of the task. Responsible for cost and schedule performance of the SAIC project team. Directs technical implementation of the sampling plan at the sampling location, directs activities of the sampling team, and verifies that requirements of the sampling plan are met by field crews.
MK-Ferguson Site Health and Safety Officer	Todd Potts	Monitors activities of the sampling team as defined in the SAP and QAPjP to monitor that activities are conducted safely and in accordance with applicable regulations.
SAIC Data Manager	Dan Land	Creates and maintains the project data base.
SAIC Data Validator	Pat Ryan	Responsible for verification of analytical results of samples.

FCOs = field change orders
 QA = quality assurance
 QAPjP = Quality Assurance Project Plan
 SAP = Sampling and Analysis Plan
 TBD = to be determined
 WMP = Waste Management Plan

Fig. 1.1. Location of NOAA sites

Fig. 1.2. Location of Bruner sites

1.4 SAMPLING APPROACH

1.4.1 Sampling Objective

Treatment water sampling is being conducted to ensure treated water will meet permit requirements for discharge to the Oak Ridge city treatment system. Creek water sampling is being conducted to ensure remediation activities are not adversely impacting the creek.

1.4.2 Sampling Design

- **Treatment Water.** Water that is collected for treatment, which includes water used for decontaminating equipment pumped from excavation or generated by soil dewatering, will be staged in holding tanks (influent) prior to being treated. Following treatment, water will be staged in holding tanks (effluent) prior to discharge. Samples will be collected from holding tanks directly into sample bottles either from a valve on the tank, if one is present, or by submerging sample bottles into the tank. Two samples will be initially collected during each phase of remediation from the influent water and corresponding effluent water and analyzed for a full suite of analytes as outlined in Table 1.2. This initial sampling will help determine the effectiveness of the treatment system. Following the first two samples, samples will be collected weekly from the influent and effluent waters and analyzed for total metals and mercury.
- **Stream Water.** Stream water samples will be collected upstream and downstream of remediation activities on a daily basis when remediation is active. Exact sampling locations will be determined in the field, described in the field logbook, and, once set, will remain the same throughout each phase of remediation. Sample locations will be set 50 to 75 yards upstream and downstream of remediation activities. An effort will be made to collect samples as close to the same time each day as possible. Analytes and frequency for surface water samples are listed in Table 1.3.

1.4.3 Sampling Methods

Surface water and treatment water samples will be collected directly into the sample bottles. Procedure BCV OU4-579, "Water Sampling Using the Bottle Submersion Method", will be followed for the surface water samples. Treatment water samples will either be collected from a valve on the tank or by submerging sample bottles into the tank. Applicable parts of sample procedure BCV OU4-579 will be used if treatment water samples are collected from a valve on the tank.

1.4.3.1 Chain of custody

Sample chain of custody will be maintained in accordance with procedure ESP-500. Sample custody will be initiated at the time of sample collection. Field samples will be identified by sample tags and labels. Descriptions of sampling activities and sample identification data will also be recorded in field logbooks. Field chain-of-custody forms containing the same information will be completed for each set of samples. A line item on the sample chain-of-custody form will be completed for each sample, and the sample collector will confirm the completeness and accuracy of all information entered on the form by the sampling team. Each individual who assumes custody of the samples will sign and date the chain-of-custody form.

Table 1.2. Treatment water sampling analytes and frequency

Analyte	Frequency
Volatile Organics	Initial two batches per set up. Influent and Effluent
Semivolatile Organics	Initial two batches per set up. Influent and Effluent
Pesticides/PCBs	Initial two batches per set up. Influent and Effluent
Gamma	Initial two batches per set up. Influent and Effluent
Alpha	Initial two batches per set up. Influent and Effluent
Total Metals	Initial two batches per set up. Influent and Effluent
Mercury	Initial two batches per set up. Influent and Effluent
Cyanide	Initial two batches per set up. Influent and Effluent
Total Metals	Weekly influent and effluent after initial two batches
Mercury	Weekly influent and effluent after initial two batches

Table 1.3. Surface water sampling analytes and frequency

Analyte	Frequency
Metals	Two daily: one upstream/one downstream during remediation and restoration
	Proposed weekly during site preparation
Mercury	Two daily: one upstream/one downstream during remediation and restoration
	Proposed weekly during site preparation
Volatile Organics	None
Semivolatile Organics	Two weekly: one upstream/one downstream during remediation and restoration
PCBs	Two weekly: one upstream/one downstream during remediation and restoration
Pesticides	Two monthly: one upstream/one downstream during remediation and restoration
Gross Gamma	Two weekly: one upstream/one downstream during remediation and restoration
	Isotopic (Co-60, Cs-137) weekly
Gross Alpha	Two weekly: one upstream/one downstream during remediation and restoration
	Isotopic (Th-228,230,232, Pa-233, U-234,235,238, Np-237, Am-241) weekly
Anions	Once per week and after rain events: one upstream/one downstream during remediation and restoration
Total Phosphorous	Once per week and after rain events: one upstream/one downstream during remediation and restoration
Total Kjeldahl N	Once per week and after rain events: one upstream/one downstream during remediation and restoration
Total Suspended Solids	Once per week and after rain events: one upstream/one downstream during remediation and restoration
Dissolved Oxygen	Two weekly: one upstream/one downstream during remediation and restoration
BOD	Two weekly: one upstream/one downstream during remediation and restoration

Field custody procedures include the following steps:

- Before sampling begins, the Quality Assurance/Quality Control (QA/QC) Officer or designee will instruct sampling personnel on the chain-of-custody and sample labeling procedures.
- A chain-of-custody form will be initiated at the time of collection of each sample.
- Each time sample custody is transferred, the person relinquishing the sample and the new custodian will sign the chain-of-custody form and record the date and time of transfer.
- The analyses to be performed for each sample will be recorded on the chain-of-custody form accompanying the samples to the laboratory.
- The field team leader will confirm that proper custody procedures are followed during the field work in the field logbook.

1.4.3.2 Sample packaging and transportation

Samples taken for shipment to the off-site laboratory will be classified, handled, and packaged in accordance with ER/C-P2302. The off-site laboratory used for this remediation will be a qualified analytical laboratory. Samples will be shipped in accordance with U.S. Department of Transportation (DOT) regulations on a daily basis, when collected, by a member of the field team.

1.4.3.3 Sample containers, sample preservatives, and holding times

The selection criteria for appropriate sample containers, sample preservatives, and holding times will be in accordance with ESP-701. Types of sample containers and preservatives used will be documented in the sampling logbook. Field and laboratory records will indicate the holding times before analysis.

1.4.3.4 Sample identification and traceability

Portable energy monitors (PEMS) will be used for data management activities. Using this system, sampling locations will be assigned a unique station number and unique sample identification numbers will be assigned for each bottle collected for analysis. The sample ID's consist of an alphanumeric character assigned to the project and a sequential number that is five digits long. Information about the sample, such as date and time collected, chain-of-custody numbers, etc., will be added to PEMS after sample collection and will be tracked within PEMS from that point on.

1.4.3.5 Field documentation

An integral part of the QA/QC plan for the field activities will be to maintain current, accurate, and complete field records, including logbooks and chain-of-custody forms. Field logbooks will be of hardcover construction with consecutively numbered pages. Information pertaining to the field activities and information required in procedure ESP-501, Sect. VII, Part D, will be recorded. Entries in the logbooks and on chain-of-custody forms will be made in black indelible ink. Corrections will be marked out with a single line, initialed, and dated. To maintain dual storage of records, field logbooks will be photocopied once a week, and the copies will be maintained at the SAIC office. When field work is complete, copies will be made of the completed logbooks, the copies entered into the SAIC Central Records Facility and the project file, and the original forwarded to the Y-12 Plant ER Records Center. MK-Ferguson will also receive copies of the completed logbooks.

1.4.4 Decontamination

All sample containers used will be new and will be accompanied by certificates of analysis. Therefore, sample containers will not require decontamination. The decontamination of sampling devices will follow Attachment II, Sect. VI of ESP-801, "Cleaning and Decontamination of Sample Containers and Sampling Devices." This procedure requires the following:

- cleaning with tap water and phosphate-free laboratory detergent, using a brush if necessary to remove particulate matter and surface films;
- rinsing thoroughly with tap water;
- rinsing thoroughly with deionized or organic-free water;
- rinsing twice with pesticide-grade isopropyl alcohol;
- rinsing thoroughly with organic-free water and allowing equipment to air dry as long as possible; and
- wrapping with aluminum foil (dull side in) if appropriate, to prevent contamination, if equipment is to be stored or transported.

Decontamination of sampling equipment will be conducted at a decontamination line established near the on-site laboratory trailer. Sampling equipment will be decontaminated prior to sampling at each location and at the completion of sampling. The management of decontamination wastes is discussed in a separate waste management plan for this remediation.

2. QUALITY ASSURANCE PROJECT PLAN

2.1 INTRODUCTION

This QAPjP has been developed to define quality-related requirements for the EFPC Remedial Action surface water and treatment water analysis. This document has been prepared in accordance with DOE Order 5700.6C and includes the following elements: project description, organization and responsibilities, functional activities, and specific protocols that will be followed for sampling, chain of custody, calibration, laboratory analysis, data reduction, verification/validation, and data reporting. Table 2.1 provides a comparison matrix of this QAPjP to DOE Order 5700.6C.

2.2 PROJECT DESCRIPTION

2.2.1 Background

The lower EFPC floodplain sediments were contaminated with mercury as a result of historical Y-12 Plant operations and practices. Through implementation of CERCLA investigations, contamination has been characterized, its extent has been documented, remedial alternatives have been evaluated, and remedial action has been selected. This remediation will excavate soils within the floodplain from locations identified near the NOAA facility and the Bruner site.

2.2.2 Project Scope

This study will be conducted to monitor creek water during excavation and confirm achievement of discharge criteria established for treatment waters, which includes waters used for decontaminating equipment, either pumped from excavation areas or generated by soil dewatering. Data will be used to document that excavation activities are not impacting creek water content and that the water treatment system effluent is suitable for acceptance by the local publicly owned treatment works (POTW). The scope of this work will include the collection and analysis of daily upstream and downstream waters plus water treatment system influent and effluent holding tank analysis.

2.3 PROJECT ORGANIZATION AND RESPONSIBILITIES

SAIC will conduct this operation under the direction of Energy Systems and the DOE-OR ER Program. SAIC will use an integrated team of staff professionals to accomplish the objectives of this work. The project organization is identified in Sect. 1.3 and roles and responsibilities are provided in Table 1.1.

Table 2.1. Comparison of QAPjP to DOE Order 5700.6C

QAPjP Section	DOE Order 5700.6C
Title Page	General 4. Documents and Records
Table of Contents	General 4. Documents and Records
Project Description, Sect. 2.2	General 2. Personnel Training 7. Procurement
Project Organization and Responsibilities, Sect. 2.3	General 2. Personnel Training
QA Objectives, Sect. 2.6	1. Management Program
Field Activity Procedures, Sect. 2.7	4. Documents and Records 6. Design
Calibration Procedures and Frequency, Sect. 2.9	5. Work Processes 7. Procurement 8. Inspection and Test
Analytical Procedures, Sect. 2.10	6. Design 7. Procurement
Data Reduction, Verification, Validation, and Reporting, Sect. 2.11	5. Work Processes 6. Design
Internal Quality Control, Sect. 2.12	5. Work Processes 6. Design
Assessments, Sect. 2.13	9. Management Assessment 10. Independent Assessment
Preventive Maintenance Procedures and Schedules, Sect. 2.14	5. Work Processes 8. Inspection and Test
Investigation Criteria, Sect. 2.6.2	5. Work Processes 8. Inspection and Test
Corrective Action Procedures, Sect. 2.15	3. Quality Improvement 9. Management Assessment 10. Independent Assessment
QA Reports to Management, Sect. 2.16	4. Document and Records 9. Management Assessment 10. Independent Assessment

Bold type indicates primary corresponding requirement in 5700.6C.

Non-bold type indicates topic contained within context of criteria but not specifically the same requirement.

2.4 READINESS REVIEW

Approximately three weeks prior to mobilization for the sampling effort, SAIC will conduct a readiness review following SAIC's Quality Assurance Program Plan (QAPP), Sect. 2.2. The readiness review will be attended, at a minimum, by the SAIC Sampling Project Manager, QA/QC Officer (or designee), Health and Safety Manager (or designee), and Analytical Laboratory Coordinator. Appropriate representatives of DOE-OR, Energy Systems, and MK-Ferguson, may also attend.

The readiness review follows a checklist and determines project readiness by documenting that work plans and procedures are approved, controlled, and distributed; that site logistics have been handled; that proper equipment, materials, and resources are available; that the laboratory is ready to accept samples; that the field laboratory operation is prepared to operate; and that the QA system will be implemented during field and analytical activities.

Prior to the readiness review, the SAIC Project Manager will prepare a list of participants and submit a readiness review notification to the affected personnel. The readiness review checklist will be completed during the review meeting and objective documentation of readiness will be attached. The checklist will be reviewed by the QA/QC Officer and submitted to the SAIC Central Records Facility (CRF) and the DOE-OR and Energy Systems Project Manager.

2.5 PROJECT TRAINING

Training required for this remediation includes that related to health and safety, site access, and project-specific procedures. Training will be completed prior to the commencement of field activities. Training in project-specific procedures will be completed by reading assignments or classroom lectures in accordance with SAIC QAPP 2.1 *Indoctrination and Training*, and demonstrating required knowledge and skills by satisfactorily completing a test on the subject matter or demonstrating performance. Training of this type will be documented by the completion of Training Assignment Records that will be signed by all field personnel. Documentation of required training will be maintained in the CRF, the ER Document Center, the ER Project Manager's project file, and in the field during the remediation.

2.6 QA OBJECTIVES FOR DATA MEASUREMENT

2.6.1 Intended Uses of Acquired Data

Data generated by this remediation are intended to document attainment of water quality criteria during implementation of remedial activities.

2.6.2 Remediation Criteria

To collect data that are suitable for their intended use, remediation criteria were determined based on current water quality standards and local POTW requirements. Remediation criteria include the number of samples to be collected, analyses to be performed, level of QA/QC in sampling and analysis, and data validation/verification criteria. Justification for the number and locations of samples is provided in Sect. 1.4. Validation/verification criteria are presented in Sect. 2.11. The level of QC for this remediation is presented in Sect. 2.12 of this QAPjP. To satisfy remediation criteria, data collected in this remediation will be accurate, scientifically valid, and legally defensible. To accomplish this, data will

be collected or developed in accordance with established and approved QA procedures. Additionally, the data collected will be of measurable precision, accuracy, representativeness, completeness, and comparability (PARCC). Remediation objectives for the PARCC parameters are defined in the following sections. The values associated with these parameters are included here as goals and will be subject to continuous review by the SAIC data manager.

2.6.2.1 Precision

Precision is a measure of the reproducibility or degree of agreement between individual measurements of the same property under prescribed similar conditions. Precision will be expressed in terms of the relative percent difference (RPD) from the average value obtained from duplicate analyses. For this remediation, the precision goal is an RPD of <20% or an absolute difference of $\pm 2 \times$ the detection level for values $< 5 \times$ the detection level for the analyte. Analytical duplicates will be performed for 5% of the samples analyzed. Additionally, one field duplicate will be collected for every ten investigative samples to assess the precision of sample collection procedures. The precision goal for analytes in field duplicates is an RPD of <30% or an absolute difference of $\pm 3 \times$ the detection level for values $< 10 \times$ the detection level.

2.6.2.2 Accuracy

Accuracy is a measure of the potential bias in a measurement system, or the degree of agreement of a measurement "X" with an accepted reference or true value "T." Standards, spiked samples, and reference samples will be used to assess the accuracy of results. The accuracy goal for this project is no more than 20% difference between measured and true values for each analyte.

2.6.2.3 Representativeness

A sample should represent the composition of the medium at the sampling point so that the analytical results can be used to evaluate analyte concentration at the site. A sample's representativeness can be obtained by using standard field-sampling collection and handling procedures and by properly decontaminating sampling equipment before samples are collected. Standard operating procedures have been established and will be followed for this remediation. The periodic sampling approach defined for these water analyses will provide confidence that creek waters are not impacted by excavation activities and that the water treatment system effluent is suitable for discharge to the local POTW.

2.6.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be collected under normal conditions. For this remediation, the completeness objective for sampling is 95% of samples planned, and the completeness objective for analysis is 95% of the samples collected.

2.6.2.5 Comparability

Consistency in the acquisition, handling, and analysis of samples is used to compare the results with other remediations. For comparability of analytical results with those obtained in other remediations, the samples will be collected and analyzed by standard EPA and DOE methodology.

2.6.2.6 Sensitivity

Analytical sensitivity (detection limit) goals are listed in Table 2.4 of Sect. 2.10.

2.7 FIELD ACTIVITY PROCEDURES

This remediation will consist of the collection of surface water samples and containerized water treatment system influent and effluent. For quality and consistency of data, specific approved sample collection and handling procedures from Energy Systems *Environmental Surveillance Procedures Quality Control Program* ES/ESH/INT-4 (Kimbrough et. al 1990), from Y-12 Plant ER Program Operating Instructions, and from the SAIC Field Technical Procedures Manual will be followed. Specific procedures that will be implemented are listed in Table 2.2.

Table 2.2. Field procedures for the EFPC remediation water analysis

Procedure	Procedure title
<i>Sample Collection</i>	
BCV OU4-579	Water Sampling Using the Bottle Submersion Method
<i>Sample Handling</i>	
ESP-501	Chain of Custody
ER/C-P2302	Sample Classifying, Packaging, Labeling and Shipping for Analysis through the K-25 and Y-12 ER Programs
ESP-701	Sample Preservation and Container Materials
ESP-801	Cleaning and Decontamination of Sample Containers and Sampling Devices
<i>Other</i>	
ER/C-P1719	Controlling and Documenting Field Changes to Approved Field Sampling Plans

Prior to mobilization, SAIC will prepare a manual that will include all procedures to be implemented in the field. Modifications to any procedures will be indicated on cover sheets attached to each procedure. The procedures manual, including the procedure modifications, will be submitted to the Energy Systems ER Project Manager and ER QA Specialist for approval. The procedure manual will be controlled by and will be distributed to all appropriate project personnel, the ER Document Center, and MK-Ferguson.

2.7.1 Field Variance System

Procedures cannot fully encompass all conditions encountered during a field remediation. Variances from the operating procedures, the SAP, and/or the SAIC Site and Task Specific Health and Safety Plan (HASP), therefore, may be necessary. To document variances and variance approval, procedure ER/C-P1719 "Controlling and Documenting Field Changes to Approved Sampling Plans" will be followed as described below.

ER/C-P1719 classifies Field Change Orders (FCOs) as "Minor," "Major," or "other." During the remediation, any FCO requests that are thought to be classified as "Major" or "Other" will be routed and handled as described in ER/C-P1719.

FCO requests that are classified as "Minor" will be handled in the following manner. Upon recognition of the need for a variance, the SAIC sampling project manager will complete an FCO Form and will contact the DOE ER Project Manager or designee for verbal approval of the FCO. If the FCO is approved, the SAIC sampling project manager will note approval, the nature of the FCO, and the FCO number in the field activities logbook, and a copy of the unsigned FCO form will be maintained in the FCO control log in the field. The variance may then be implemented. Within 24 h, the field team leader will route an additional copy of the unsigned FCO Form to the FCO Coordinator. The SAIC FCO Coordinator will log the FCO and route it to the DOE Project Manager and ER QA Specialist for signature approval. A copy of the approved FCO form will be routed to the Field Team Leader, who will replace the unsigned FCO with the approved, signed copy. All FCOs that request variance from the HASP, regardless of classification, will be approved by the Health and Safety Manager.

2.8 SAMPLE CUSTODY PROCEDURES

2.8.1 Field Sample Custody

Samples will be collected by field sampling personnel and sample custody will be initiated at the time of sample collection. Field samples will be identified with appropriate labels. Descriptions of all sampling activities and sample identification data will be recorded in field logbooks. Field chain-of-custody forms containing all relevant information will be completed for each sample. The sampling technician will confirm by signature the completeness of the information on the form. Each subsequent individual who assumes responsibility for the samples will sign and date the chain-of-custody form.

Field chain-of-custody forms will accompany the samples from the sampling point to the on-site laboratory. Upon receipt, the on-site laboratory will verify the information on the custody form and the sample container, accept custody, and sign the custody form. The on-site laboratory will maintain custody of all samples until sample disposal or until samples are transferred to the off-site laboratory for analysis. At this time, samples will be appropriately packaged and shipped with COCs.

2.8.2 Laboratory Sample Custody

Selected samples will be shipped in accordance with DOT regulations to a qualified laboratory. Upon receipt, a member of the off-site laboratory will accept custody of the samples and will document the following:

- seals on the transportation container are unbroken;
- individual sample containers within the sample transportation container are intact and properly preserved;
- identification on the sample containers correspond to the entire description on the chain-of-custody form; and
- number of sample containers received is equal to the number listed on the chain-of-custody form(s).

If discrepancies are found, the SAIC Project Manager or designee shall be called immediately to rectify them. Discrepancies will be recorded on appropriate forms and on the chain-of-custody form (if appropriate), with incorrect information marked out with a single line, initialed, and the correct information added. Once samples are in the custody of the laboratory, their internal chain-of-custody and sample handling procedures will be followed.

2.8.3 Sample Containers, Preservatives, and Holding Times Sample containers, preservatives, and holding times are presented in Table 2.3.

2.9 CALIBRATION PROCEDURES AND FREQUENCY

2.9.1 Field Instrument Calibration

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. All field instruments used in the field for this purpose will have unique identifiers and each instrument will be logged in the Material and Testing (M&TE) Log Book prior to use in the field. The site safety and health officer or his/her designate will be responsible for performing and documenting daily calibration/checkout records for instruments used in the field.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that notations on any prior equipment problem are not overlooked, and all necessary repairs to equipment have been carried out.

Calibration of field instruments is governed by the specific Standard Operating Procedure (SOP) for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer, or more frequently as conditions dictate. Field instruments may include a pH meter, thermometer, specific conductivity meter, turbidity meter, flame ionization detector (FID) or photoionization detector (PID) for organic vapor detection, and a combustible gas detection meter capable of determining lower explosive limits, upper explosive limits, and/or oxygen levels. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service and a back-up instrument will be used in its place.

Detailed instructions on the proper calibration and use of each field instrument follow the guidelines established by the manufacturer. The technical procedures for each instrument used on this project include the manufacturer's instructions detailing the proper use and calibration of each instrument. Project personnel responsible for calibrating and operating field instruments will receive training in the proper use of each instrument. Documentation of current training records for all project field personnel will be maintained in the training records data base for the project.

- **pH Meter Calibration.** The pH meter will be calibrated according to the manufacturer's instructions using traceable standard buffer solutions prior to work in the field. Prior to use in the

Table 2.3. Requirements for surface water, treatment water, and water QC samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	2 - 40 mL glass vials with Teflon®-lined septum (no headspace)	80 mL	HCl to pH <2 Cool, 4°C	14 d
Semivolatile Organic Compounds	1 - L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Pesticide/PCB Compounds	1 - L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Metals (other than Hg)	1 - L polybottle	500 mL	HNO ₃ to pH <2 Cool, 4°C	180 d
Mercury	use same container as other metals	200 mL	HNO ₃ to pH <2 Cool, 4°C	28 d
Cyanide	500 mL polybottle	500 mL	NaOH to pH >12 Cool, 4°C	14 d
Anions (NO ₃ /NO ₂ - N, NH ₃ - N, and PO ₄ - total)	500 mL glass bottle	500 mL	H ₂ SO ₄ to pH <2 Cool, 4°C	28 d
Anions (Cl, F, Br, SO ₄)	500 mL glass bottle	500 mL	Cool, 4°C	28 d
Alkalinity, TDS, TSS	1 - L glass bottle	1 L	Cool, 4°C	7 d
BOD - 5 day	1 - L glass bottle	1 L	Cool, 4°C	48 hrs
Radiochemical	1 - 1 gal. plastic container	4 L	HNO ₃ to pH <2	180 d

field, calibration of the pH meter will be checked against two standard buffer solutions. Calibration procedures, lot numbers of buffer solutions, and other pertinent calibration or checkout information will be recorded in the M&TE Log Book for the project.

- **Temperature.** Temperature measurements are carried out using a thermometer. The thermometer must be inspected before use to ensure there is no mercury separation. The thermometers should be rechecked in the field before and after each use to see if the readings are logical and the mercury is still intact. The thermometers should be checked biannually for calibration, by immersing them in a bath of known temperature until equilibrium is reached. Thermometers should be discarded in an appropriate manner if found to have more than 10% error. The reference thermometer used for bath calibration should be National Bureau of Standards (NBS) traceable. Temperatures will be recorded in the M&TE Log Book, the Sample Log Book, or the Cooler Log Book, as appropriate.
- **Specific Conductance.** The conductivity cells of the specific conductivity meter will be cleaned according to manufacturer's recommendations and specifications and checked against known conductivity standard solutions before each field trip. The instrument will be checked daily with NBS traceable standard solutions. If the instrument is more than 10% out of calibration when compared with standard solutions, the instrument will be recalibrated. If this cannot be done in the field, the instrument will be returned to the manufacturer or supplier for recalibration and a back-up instrument will be used in its place. Daily calibration readings and other relevant information will be recorded daily in the M&TE Log Book.
- **Turbidity.** The turbidity meter will be calibrated each day against a known and traceable standard supplied by the manufacturer prior to use in the field. In the field, the instrument will be checked against the standard and adjusted each time the instrument is turned on. Calibration information will be recorded in the M&TE Log Book; checks made in the field will be recorded in the Sample Log Book.
- **Organic Vapor Detection.** Organic vapor detectors will be checked daily according to the manufacturer's instructions. FIDs will be checked daily by use of the internal calibration mechanism. PIDs will be calibrated daily with a gas of known concentration. All daily calibration information will be recorded in the M&TE Log Book.
- **Combustible Gas and Oxygen Detection.** Combustible gas calibration checks should be made daily using the gas recommended by the manufacturer. Calibration of the oxygen system should be checked daily while the combustible gas sensor is being checked. All appropriate calibration check data will be recorded in the M&TE Log Book.

2.9.2 Laboratory Instrument Calibration

Laboratory equipment will be calibrated according to the procedures specified in the analytical methods and in the operating procedures for the particular instrument. Calibration frequency will be based on the analytical methods employed, type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience. Calibration and maintenance records will be kept with the equipment. Calibration control charts shall be maintained for instruments used in analyses of samples. Copies of control charts will be transmitted with data packages to demonstrate control of these instruments. Calibration data for each instrument used in analysis will be transmitted to data validators for verification. Calibration frequencies and procedures as designated in the CLP routine analytical services statement of work (SOW), applicable SW-846 methods, and assigned laboratory SOPs will be followed.

For laboratory equipment, Class A volumetric glassware will be used to prepare calibration standards, bench standards, samples for analysis, etc.

2.10 ANALYTICAL PROCEDURES

Samples collected during these remediations will be analyzed by an Energy Systems and a DOE-OR approved laboratory. Methods published by EPA and DOE will be used as the basis for all analyses when such methods exist. Individual parameters, analytical methods, and quantitation levels are listed in Table 2.4. Analytical requirements are specified in each methodology.

If analyte concentrations are high, or for matrices other than waters, the protocols cited may be inadequate. In this case, sample analysis methodology will follow laboratory SOPs specifically prepared for such high-level samples.

2.11 DATA REDUCTION, VERIFICATION, VALIDATION, AND REPORTING

2.11.1 Data Reduction and Verification

Field data and observations recorded in the field logbooks will be verified daily by a sample team member other than the member who originally recorded the data. Once the sampling logbooks have been completed in the field, they will be transferred to the SAIC Project Manager. The SAIC Project Manager will review the data from the sampling logbooks and chain-of-custody records and verify that the data are recorded correctly and completely and that all field instruments were properly calibrated. Any problems with the field data will be documented by the completion of a nonconformance report (NCR).

Laboratory analytical data will be reduced and reviewed by the laboratory in accordance with the analytical procedures and the internal QA program of the laboratory. As data packages are received, they will be copied, logged in, and the sample delivery group information will be linked to the field sample IDs. SAIC project staff will verify the data by (1) recording the receipt of analytical results from the laboratory, (2) verifying that the analyses were performed for the desired parameters using proper analytical methods, (3) verifying that the results were reported in proper measurement units and are within known method-specific ranges, and (4) verifying that the laboratory data packages are complete and contain required QC forms and documentation. Problems with the analytical data will be documented by the completion of NCRs.

2.11.2 Data Validation

Data validation will be consistent with the specifications as outlined in *Requirements for Quality Control of Analytical Data for the Environmental Restoration Program* (ES/ER/TM-16). All project data will be evaluated to ensure a complete, consistent, and usable project data set. All project mercury data will be validated based on validation criteria as described below. The data validation criteria listed below have been determined as critical in the evaluation of analytical data usability. These are based on analytical process knowledge and known to contribute significantly to the potential analytical qualification and associated uncertainty of the reported results. Evaluation will allow identification of potential false positive or negative results.

Table 2.4. Analytical methods, parameters, and quantitation limit goals for surface water, treatment water, and field QC water samples

Parameters	Analytical Methods	Quantitation Limit Goals ^a
	Water	Water (µg/L)
Volatile Organic Compounds	SW-846 8260	
Chloromethane		10
Bromomethane		10
Vinyl Chloride		10
Chloroethane		10
Methylene chloride		5
Acetone		10
Carbon disulfide		5
1,1-Dichloroethene		5
1,1-Dichloroethane		5
cis-1,2-Dichloroethene		5
trans-1,2-Dichloroethene		5
Chloroform		5
1,2-Dichloroethane		5
2-Butanone		10
1,1,1-Trichloroethane		5
Carbon Tetrachloride		5
Bromodichloromethane		5
1,2-Dichloropropane		5
cis-1,3-dichloropropene		5
Trichloroethene		5
Dibromochloromethane		5
1,1,2-Trichloroethane		5
Benzene		2
trans-1,3-dichloropropene		5
Tribromomethane (bromoform)		5
4-Methyl-2-pentanone		10
2-Hexanone		10
Tetrachloroethene		5
Toluene		2

Table 2.4 (continued)

Parameters	Analytical Methods	Quantitation Limit Goals ^a
	Water	Water (µg/L)
1,1,2,2-Tetrachloroethane		5
Chlorobenzene		2
Ethylbenzene		2
Styrene		5
Xylenes (total)		2
2-Chloroethyl vinyl ether		5
1,2-Dichlorobenzene		4
1,3-Dichlorobenzene		4
1,4-Dichlorobenzene		3
Trichlorofluoromethane		5
Semivolatile Organic Compounds	SW-846 8270	
Phenol		10
bis(2-chloroethyl) ether		10
2-Chlorophenol		10
1,3-Dichlorobenzene		10
1,4-Dichlorobenzene		10
1,2-Dichlorobenzene		10
2-Methylphenol		10
2,2'-oxybis(1-Chloropropane)		10
4-Methylphenol		10
N-nitroso-di-n-dipropylamine		10
Hexachloroethane		10
Nitrobenzene		10
Isophorone		10
2-Nitrophenol		10
2,4-Dimethylphenol		10
bis(2-chloroethoxy) methane		10
2,4-Dichlorophenol		10
1,2,4-Trichlorobenzene		10
Naphthalene		10

Table 2.4 (continued)

Parameters	Analytical Methods	Quantitation Limit Goals ^a
	Water	Water ($\mu\text{g/L}$)
4-Chloroaniline		10
Hexachlorobutadiene		10
4-chloro-3-methylphenol		10
2-Methylnaphthalene		10
Hexachlorocyclopentadiene		10
2,4,6-Trichlorophenol		10
2,4,5-Trichlorophenol		25
2-Chloronaphthalene		10
2-Nitroaniline		25
Dimethylphthalate		10
Acenaphthylene		10
2,6-Dinitrotoluene		10
3-Nitroaniline		25
Acenaphthene		10
2,4-Dinitrophenol		25
4-Nitrophenol		25
Dibenzofuran		10
2,4-Dinitrotoluene		10
Diethylphthalate		10
4-Chlorophenyl-phenyl ether		10
Fluorene		10
4-Nitroaniline		25
4,6-Dinitro-2-methylphenol		25
N-nitrosodiphenylamine		10
4-bromophenyl-phenylether		10
Hexachlorobenzene		10
Pentachlorophenol		25
Phenanthrene		10
Anthracene		10
Carbazole		10

Table 2.4 (continued)

Parameters	Analytical Methods	Quantitation Limit Goals ^a
	Water	Water (µg/L)
Di-n-butylphthalate		10
Fluoranthene		10
Pyrene		10
Butylbenzylphthalate		10
3,3'-Dichlorobenzidine		10
Benzo(a)anthracene		10
Chrysene		10
bis(2-Ethylhexyl)phthalate		10
Di-n-octylphthalate		10
Benzo(b)fluoranthene		10
Benzo(k)fluoranthene		10
Benzo(a)pyrene		10
Indeno(1,2,3-cd)pyrene		10
Dibenzo(a,h)anthracene		10
Benzo(g,h,i)perylene		10
PCBs	SW-846 8080	
Aroclor-1016		1.0
Aroclor-1221		2.0
Aroclor-1232		1.0
Aroclor-1242		1.0
Aroclor-1248		1.0
Aroclor-1254		1.0
Aroclor-1260		1.0
Metals	SW-846 6010 or 7000 series method	
Aluminum		45
Antimony		3
Arsenic		5
Barium		2
Beryllium		0.3
Boron		5

Table 2.4 (continued)

Parameters	Analytical Methods	Quantitation Limit Goals ^a
	Water	Water (µg/L)
Cadmium		4
Calcium		10
Chromium		7
Cobalt		7
Copper		6
Iron		7
Lead		3
Magnesium		30
Manganese		2
Molybdenum		8
Mercury CVAA		0.2
Nickel		15
Potassium		500
Selenium		5
Silica (SiO ₂)		50
Silver		7
Sodium		29
Thallium		10
Vanadium		8
Zinc		20
Cyanide	SW-846 9010	10
Alkalinity (total, HCO ₃ , CO ₃)	EPA 310.0 ^b	NA
Anions		(mg/L)
Nitrate/Nitrite - Nitrogen	EPA 353.2 ^b	0.2
Ammonia - Nitrogen	EPA 350.3 ^b	0.05
Chloride	EPA 300.0 ^b	1.0
Sulfate	EPA 300.0 ^b	5
Fluoride	EPA 300.0 ^b	0.1
Phosphate	EPA 300.0 ^b	0.1
Dissolved Oxygen	EPA 360.1 ^b	NA

Table 2.4 (continued)

Parameters	Analytical Methods	Quantitation Limit Goals ^a
	Water	Water (µg/L)
Biological Oxygen Demand (5 day)	EPA 405.1 ^b	NA
Total Suspended Solids	EPA 160.1 ^b	10
Total Dissolved Solids	EPA 160.2 ^b	4
Radionuclides		(pCi/L)
Alpha Spectrometry	EPA 907.0 ^c	
Americium-241		0.4
Thorium-228, 230, 232		0.4
Uranium-234,235,238		0.4
Neptunium-237		0.5
Gamma Spectrometry Scan	EPA 901.1 ^c	^d

^a These are expected quantitation limits based on reagent grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume and dilution factor, if any.

^b *Methods for Chemical Analysis of Water and Wastes*, U.S. EPA. EPA-600/4-79-020, March 1983.

^c "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," U.S.EPA, EPA-600/4-80-032. The laboratory will implement their own SOP based on these methods.

^d The subcontracted laboratory shall resolve and quantify non-specified gamma-emitting radionuclides. These non-specified gamma-emitting radionuclides should be detected and semi-quantitatively determined based on photon yield and energy relative to the Cs-137 standard and detection level. Cs-137 and Co-60 shall be quantitatively determined in all samples. Cs-137 quantitation level goals are 10 pCi/L (water) and 10 pCi/g (soil), Co-60 shall also be quantitated at the same levels.

Analytical Validation Categories

Holding times
Blanks
Laboratory control sample
Initial calibration
Continuing calibration
Duplicate analysis
Sample reanalysis
Matrix spike analysis
Secondary dilutions
Case narrative

2.11.3 Data Validation Criteria

- **Holding Times.** Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation. Analytical holding times and preservation requirements are identified in Table 2.3.
- **Blanks.** The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples, including field, trip, equipment, and method blanks. Contamination during sampling or analysis, if not discovered, results in false positive data.
- **Calibration.** The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Relative instrument response is used to quantify the analyte results. If the relative response factor is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.
- **Sample Reanalysis.** When instrument performance-monitoring standards indicate an analysis is out of control, the laboratory is required to reanalyze the sample. If the reanalysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.
- **Secondary Dilutions.** When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.
- **Laboratory Control Samples.** The laboratory control sample (LCS) serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based

on a measurement of process control during each sample analysis. LCS analysis should fall within $\pm 15\%$ of the mean for the measurement process.

- **Duplicate Analysis.** Both field and laboratory duplicate samples will be evaluated. Field duplicate samples will be collected and containerized from co-located locations during sampling operations. Laboratory duplicates are identical splits of individual samples that are analyzed by the laboratory to evaluate analytical reproducibility and sample homogeneity. These samples are split in the laboratory during sample preparation. Field duplicates will be collected at a 10% frequency for each analyte of interest while one laboratory duplicate will be performed per 20 samples of similar matrix. The precision goal for mercury in field duplicates is an RPD $< 30\%$ or an absolute difference of $3 \times$ the detection level for values $< 5 \times$ the detection level. The precision goal for laboratory duplicates is an RPD $< 20\%$ or an absolute difference of $2 \times$ the detection level for values $< 5 \times$ the detection level.
- **Matrix Spike Analysis.** A matrix spike (MS) is an aliquot of a sample spiked with a known quantity of analyte and subjected to the entire analytical procedure. It is used to indicate the appropriateness of the method for the matrix by measuring recovery. This measurement will provide an indication of the potential sample matrix effect on the sample quantification.

2.11.4 Data Reporting

Field data and on-site laboratory data will be recorded in field logbooks, collated into data tables, and reported both in interim progress reports and in the final Remedial Action Report. Laboratory analysis will provide comprehensive data deliverables as identified in Table 2.5. Rapid turnaround preliminary data values will be provided in many instances. All such reports will be followed by comprehensive data reports.

2.12 INTERNAL QUALITY CONTROL

2.12.1 Field Quality Control Samples

Field blanks are samples of site source water used for the decontamination of sampling equipment. One field blank consisting of the potable water used during the remediation will be collected for analysis. Another field blank of the ASTM Type II water used will also be collected and analyzed.

Equipment rinsate samples are used as a measure of the effectiveness of the decontamination process. For this remediation, equipment rinsates will be collected by pouring ASTM Type II water through or over one complete set of decontaminated sampling equipment. The equipment rinsate samples will be analyzed for all analytes of interest.

Field duplicate samples will be collected and analyzed at a frequency of 10% to assess the precision of sampling. The duplicate sample will be analyzed for the same parameters as the environmental sample collected at that location and time.

2.12.2 Laboratory Quality Control

Laboratory QC will include analysis of method blanks, laboratory duplicates, and LCSs, and matrix spikes at a frequency of 1 per 20 samples analyzed.

2.13 ASSESSMENTS

The objective of assessments is to (1) verify that the QA program developed for this project is being implemented according to the specified requirements, (2) assess the effectiveness of the QA program, (3) identify nonconformances/variances, and (4) verify that identified deficiencies are corrected.

2.13.1 Audits

No audits are presently scheduled for this remediation.

Table 2.5. Comprehensive data deliverables

Method Requirements	Deliverables
Requirements for all methods:	
Holding time information and methods requested	Signed chain-of-custody forms
Discussion of laboratory analysis, including any laboratory problems	Case narratives
LCS (run with each batch of samples processed)	Results (control charts when available)
Organics: GC/MS analysis	
Sample results, including TICs	CLP Form 1 or equivalent
Surrogate recoveries	CLP Form 2 or equivalent
Matrix spike/spike duplicate data	CLP Form 3 or equivalent
Method blank data	CLP Form 4 or equivalent
GC/MS tune	CLP Form 5 or equivalent
GC/MS initial calibration data	CLP Form 6 or equivalent
GC/MS continuing calibration data	CLP Form 7 or equivalent
GC/MS internal standard area data	CLP Form 8 or equivalent
Complete raw data	All chromatograms, preparation logs, run logs, calculations, etc.
Organics: GC analysis	
Sample results	CLP Form 1 or equivalent
Surrogate recoveries	CLP Form 2 or equivalent
Matrix spike/spike duplicate data	CLP Form 3 or equivalent
Method blank data	CLP Form 4 or equivalent
Initial calibration data	CLP Form 6 or equivalent
If calibration factors are used	A form listing each analyte, the concentration of each standard, the relative calibration factor, the mean calibration factor, and the %RSD
Calibration curve if used	Calibration curve and correlation coefficient
Continuing calibration data	CLP Form 9 or equivalent
Positive identification (second column confirmation)	CLP Form 10 or equivalent
Complete raw data	All chromatograms, preparation logs, run logs, calculations, etc.
Metals	
Sample results	CLP Form 1 or equivalent
Initial and continuing calibration	CLP Form 2 or equivalent, dates of analyses and calibration curve, and the correlation coefficient factor

Table 2.5 (continued)

Method Requirements	Deliverables
Method blank	CLP Form 3 or equivalent and dates of analyses
ICP interference check sample	CLP Form 4 or equivalent and dates of analyses
Spike sample recovery	CLP Form 5A or equivalent
Postdigestion spike sample recovery for ICP metals	CLP Form 5B or equivalent
Postdigestion spike for GFAA	CLP Form 5B or equivalent
Duplicates	CLP Form 6 or equivalent
LCS	CLP Form 7 or equivalent
Standard additions (when implemented)	CLP Form 8 or equivalent
Holding times	CLP Form 13 or equivalent
Run log	CLP Form 14 or equivalent
Complete Raw Data	All preparation logs, run logs, instrument output, calculations, etc.
Radiochemistry	
Sample results	Report results
Initial calibration	Efficiency determination
Efficiency check	% Difference from calibration
Background determinations	Report results
Minimum detectable activity	Report results
Matrix spike recovery	% Recovery
Matrix spike duplicate or duplicate	% Recovery and %RPD
Method blank	Report results
Internal standard results (tracers or carriers)	Standard added and % recovery
Self absorption factors	Report factors
Cross-talk factors	
LCS	LCS result and control criteria
Run log	Copy of run log
Complete raw data	All preparation logs, run logs, instrument output, calculations, etc.

CLP = Contract laboratory procedure

GC = Gas chromatograph/chromatography

GFAA = Graphite furnace atomic absorption

2.13.2 Surveillance Activities

Surveillance activities include the monitoring and inspecting of documents and work activities. Surveillance provides a real-time means of evaluating the adequacy and effectiveness of methods for achieving quality and for assessing the quality of final results. Surveillance for this project may be performed by DOE-OR, Energy Systems, MK-Ferguson, or SAIC personnel. Surveillance conducted by SAIC will be performed in accordance with SAIC QAPPs 18.1, 18.2, and 18.3. The SAIC QA/QC Officer will determine the scope and schedule for each surveillance performed by SAIC. A minimum of one field sampling surveillance will be performed by SAIC for this remediation. Nonconformances will be reported to the DOE ER Project Manager who will determine if the severity requires notifying TDEC and EPA.

2.13.3 Project Data Quality Assessment

The data quality indicator PARCC parameters will be used to evaluate data quality and quantity. Reviewers are responsible for ensuring that data reduction calculations follow appropriate data calculation procedures, are documented, and are checked by qualified personnel.

Both qualitative and quantitative criteria are used as indicators of the quality of the data. In determining data usability, especially in the decision-making process, the integrity and authenticity of the data must be evaluated and the analytical uncertainty must be determined. Parameters used to assess data quality for this remediation are precision, accuracy, representativeness, comparability, completeness, and sensitivity. These parameters will be evaluated for all project data.

The following procedures will be used to assess data precision, accuracy, and completeness. These equations apply to both field and laboratory measurements.

2.13.3.1 Precision

Precision is defined as the reproducibility or degree of agreement between duplicate measurements under a given set of conditions. The closer the measurements approach each other, the more precise the measurement. Precision level is determined by calculating the RPD between the two measurements using the equation below. Precision is determined using either duplicates or LCS analytes.

$$RPD = \frac{|S - D|}{(S+D/2)} \times 100\%$$

where—

- S = analyte concentration of the original sample,
- D = analyte concentration of the duplicate sample.

2.13.3.2 Accuracy

Accuracy is defined as the degree of difference between measured values and the true values. Sampling accuracy will be maximized by adhering to the QAPjP. All procedures used will be documented as SOPs. Analytical measurement accuracy is evaluated through implementation of analyte

MS or standard reference material determinations. The following equation will be used to calculate percent recovery (%R):

$$\%R = \frac{A_r - A_o}{A_f} \times 100\%$$

where—

- A_r = total compound or element concentration detected in the spiked sample,
- A_o = concentration of the compound or element detected in the unspiked sample, and
- A_f = concentration of the compound or element added to the sample.

For situations in which a standard reference material (SRM) is used rather than or in addition to MS analyses, the following equation will be used:

$$\%R = \frac{C_m}{C_{srn}} \times 100\%$$

where—

- C_m = measured concentrate of SRM,
- C_{srn} = actual concentration of SRM.

2.13.3.3 Representativeness

Representativeness expresses the relative degree to which the data depict the characteristics of a population, parameter, sampling point, process condition, or environmental condition. The objective of this study is to accurately represent the chemical concentrations of target analytes in creek waters and infiltration waters.

Representative samples for this remediation will be acquired through implementation of approved sampling and analytical procedures that will generate data representative of the sample population. Sampling procedures are designed to minimally impact the sample obtained, so that conditions representative of the sampling location will be maintained. Analytical methods will be selected that most accurately represent the true concentration of the parameter of interest. The accumulation of QC procedures and information (i.e., RPD values, blank QC concentrations, MS percent recoveries, etc.) employed for a given analysis combine to exhibit the representativeness of the data generated. The goal for representative sample data will therefore be met through the proper documentation of field and analytical protocols.

2.13.3.4 Completeness

Completeness is the measure of the amount of data obtained from a measurement process that achieves the project goals compared to the amount of data planned to be obtained by the project.

The following are three measures of completeness determined for this remediation.

Sample Collection:

$$\text{Completeness} = \frac{\text{Number of Sample Points Sampled}}{\text{Number of Sample Points Planned}} \times 100\%$$

Field Measurements:

$$\text{Completeness} = \frac{\text{Number of Valid Field Measurements Made}}{\text{Number of Field Measurements Planned}} \times 100\%$$

Laboratory Analysis:

$$\text{Completeness} = \frac{\text{Number of Valid Laboratory Measurements Made}}{\text{Number of Laboratory Measurements Planned}} \times 100\%$$

Completeness goals established for this project for sample collection and field measurements are 95%. If these goals are not met, the necessity for resampling will be determined on a case-by-case basis. The completeness goal for laboratory analysis for this project is also 95%.

2.13.3.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of the data generated in this remediation will be obtained through the implementation of the identified protocols for sampling and analysis of samples. Use of traceable reference materials as laboratory standards, expression of results in standard concentration units, and successful participation by the laboratories in external performance evaluation programs will enable the data produced through this remediation to be compared with further data sets, if required.

2.14 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES**2.14.1 Field Instruments and Equipment**

The field equipment for this project may include thermometers, pH meters, conductivity meters, turbidity meters, organic vapor detectors (FID or PID), and combustible gas detectors capable of measuring the lower explosive limit, upper explosive limit, and/or oxygen levels. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturers. These procedures are included in the technical procedures governing the use of these instruments.

Field instruments will be checked and/or calibrated before they are shipped or carried to the field. Each field instrument will be checked daily against a traceable standard or referenced with a known concentration to ensure the instrument is in proper calibration. Instruments found to be out of calibration will be recalibrated by the Site Health and Safety Officer (SHSO) prior to use in the field. If the SHSO cannot calibrate the instrument, the instrument will be returned to the supplier or manufacturer for recalibration and a back-up instrument will be used in its place. Calibration checks and calibrations will be documented on the Field Meter/Calibration Log Sheets in the M&TE Log Book.

Critical spare parts such as tapes, papers, pH probes, electrodes, and batteries will be kept on site to minimize down time of malfunctioning instruments. Back-up instruments and equipment should be available on site or within one-day shipment to avoid delays in the field schedules.

2.14.2 Laboratory Instruments

As part of their QA/QC Program, a routine preventive maintenance program is conducted by the laboratory to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments are maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service log book for each instrument. Emergency repair or scheduled manufacturers' maintenance is provided under a repair and maintenance contract with factory representatives.

2.15 CORRECTIVE ACTION PROCEDURES

Energy Systems corrective actions to audit/surveillance findings and nonconformances will be managed in accordance with ESS-QA-16.0, 16.1, 16.2 16.3, 16.4, and ESS-QA-15.0 and 15.1. SAIC corrective actions to audit/surveillance findings and nonconformances will be managed in accordance with SAIC QAPPs 15.1 and 16.1. The ER Project Manager will be notified when an NCR is documented and will be furnished a copy as soon as possible. Copies of NCRs and their dispositions will be forwarded to the ER Project Manager for placement in the records center and for reporting to Energy Systems Action Management System (ESAMS), as appropriate. NCRs issued as a result of an audit or surveillance finding will identify the root cause of the problem.

2.16 QA REPORTS TO MANAGEMENT

Monthly project status reports will include the following information:

- assessments of measurement data accuracy, precision, and completeness as applicable;
- results of any performance or systems audits or surveillance;
- any significant QA problems and recommended solutions.

The SAIC Project Manager is responsible for preparing these monthly reports. The Preliminary Assessment/Site Remediation report will include a separate QA section that summarizes data quality information.

2.17 QA RECORDS

QA records concerning the project (e.g., internal and external correspondence, work plans, field logbooks and forms, chain-of-custody forms, data packages, audit reports, surveillance reports, NCRs, corrective action reports, etc.) will be submitted to the SAIC Central Records Facility for dual storage and retrieval. Records concerning the project will be forwarded to the ER Project Manager for placement in the ER Document Center during the project. A complete copy of the project file will be submitted to the ER Project Manager at the end of the period of performance for the sampling phase of the project.

3. SITE AND TASK-SPECIFIC HEALTH AND SAFETY PLAN FOR WATER SAMPLING

3.1 SITE HEALTH AND SAFETY PERSONNEL

The Lower East Fork Poplar Creek remedial action will be conducted by MK-Ferguson, and MK-Ferguson is responsible for overall site control and site safety. MK-Ferguson will provide the overall site HASP and the SHSO. SAIC will not control the site and SAIC on-site personnel will have no health and safety responsibilities other than performing their work safely, complying with this document, and complying with the applicable portions of the MK-Ferguson Site HASP. Only SAIC personnel are listed in this section.

3.1.1 SAIC Sampling Project Manager

The SAIC Sampling Project Manager (Gregory Schank) is responsible for overall execution of SAIC's responsibilities on this project. Specific responsibilities include the following:

- coordinating with Energy Systems and MK-Ferguson staff, and
- ensuring that SAIC field work is performed in a safe manner and that field personnel comply with the MK-Ferguson and SAIC HASPs.

3.1.2 SAIC Health and Safety Manager

The SAIC Health and Safety Manager (Steve Davis, CIH, CSP) is responsible for the SAIC health and safety program. Specific responsibilities include the following:

- coordinating with MK-Ferguson and Energy Systems health and safety personnel and
- reviewing and approving SAIC health and safety plans and changes to those plans

3.1.3 Field Project Personnel

Project personnel involved in on-site operations are responsible for the following:

- performing only those (and related support activities) addressed in this document;
- performing only those tasks that they believe they can do safely;
- notifying the SHSO of any medical conditions (e.g., allergies, diabetes, pregnancy) that require special consideration;
- reporting all symptoms of overexposure to chemical and physical hazards to the SHSO and SAIC management immediately; and
- abiding by a buddy system while on the site so that each on-site worker is responsible for keeping track of his or her partner in the event of an incident.

3.2 SAFETY RISK ANALYSIS

MK-Ferguson, the remedial contractor, is responsible for the assessment and control of site-wide hazards. This responsibility includes the production and enforcement of a site-wide HASP that addresses the entire project. The SAIC plan presented herein is a second tier document subject to the requirements of the MK-Ferguson plan. The hazard analyses and controls presented in this document are specific to the tasks to be performed by SAIC personnel. Should there be a conflict between the site-wide MK-Ferguson HASP and the SAIC task-specific requirements, the more protective will apply. The following are tasks to be performed by SAIC personnel:

- sampling surface water from the creek at locations upstream and downstream from the remedial activities, and
- sampling wastewater generated by remedial activities.

These tasks pose a potential for overexposure to site contaminants and sample preservatives, and contact with heavy equipment. The potential for overexposure to mercury during sampling appears to be very low. The potential for harm because of contact with corrosive sample preservatives is low but requires specific controls. The potential for contact with moving equipment is low because SAIC personnel will not operate heavy equipment, will remain at a safe distance from operating heavy equipment, and will not perform remedial tasks. Table 3.1 summarizes the hazards and control measures for each site task to be performed by SAIC. Table 3.2 lists expected site contaminants and hazardous chemicals used in site activities.

3.3 TRAINING REQUIREMENTS

SAIC personnel who perform these and any other on-site tasks are subject to the training requirements presented in Table 3.3. Note that these requirements are the minimum and that the MK-Ferguson HASP may include additional training requirements.

3.4 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE for general site activities will be specified in the MK-Ferguson HASP. SAIC personnel will use at least Level D PPE. This section emphasizes the programmatic requirements for PPE. Levels of protection that may be used to protect against chemical and physical hazards at this site include the following:

- Level D+ Protective Equipment
 - coated Tyvek® coveralls
 - chemical-resistant disposable gloves
 - safety boots
 - hard hat (if overhead hazards are present)
 - safety glasses with side shields

Table 3.1. Hazards analysis

Safety and health hazards	Controls	Monitoring	Probability
<i>Surface water sampling from the creek</i>			
General water sampling hazards (heavy equipment, slips, falls)	<ul style="list-style-type: none"> • Maintain 50 foot distance from operating heavy equipment • PPE (level D) Minimum for task is: <ul style="list-style-type: none"> - Hard hat (if overhead hazards are present) - Safety glasses with side shields - Safety boots - Field work clothes 		Low
Exposure to chemicals (see Table 3.2)	<ul style="list-style-type: none"> • HAZWOPER training • Nitrile or similar gloves for handling potentially contaminated materials • Minimal contact • 15 minute eyewash nearby when pouring corrosive sample preservatives • 1 liter or similar squeeze bottle eyewash nearby when adding water to pre-preserved sample containers or otherwise handling corrosives 	None	Low
Drowning	<ul style="list-style-type: none"> • Buddy system • Personal flotation device if in or near water deeper than 3 feet 	Visual for water depth	Very low
Animal hazards (bees, ticks, wasps, snakes)	<ul style="list-style-type: none"> • PPE (boots, work clothes), tape pant legs or tuck into socks or boots • Insect repellent if necessary, inspect for ticks • Snake chaps if entering heavy underbrush during warm weather 	Visual survey	Low
Temperature extremes	<ul style="list-style-type: none"> • Administrative controls to include <ul style="list-style-type: none"> - self-pacing, - rest breaks in temperature-controlled areas, and - adequate fluid replacement 	None	Varies by season

Table 3.1 (continued)

Safety and health hazards	Controls	Monitoring	Probability
<i>Wastewater sampling</i>			
General waste water sampling hazards (heavy equipment, slips, falls)	<ul style="list-style-type: none"> • Maintain 50 foot distance from operating heavy equipment • PPE (level D) Minimum for task is: <ul style="list-style-type: none"> - Hard hat (if overhead hazards are present) - Safety glasses with side shields - Safety boots - Field work clothes 		Low
Exposure to chemicals (see Table 3.2)	<ul style="list-style-type: none"> • HAZWOPER training • Nitrile or similar gloves for handling potentially contaminated materials • Minimal contact • 15 minute eyewash nearby when pouring corrosive sample preservatives • 1 liter or similar squeeze bottle eyewash nearby when adding water to pre-preserved sample containers or otherwise handling corrosives 	None	Low
Confined space entry	<ul style="list-style-type: none"> • No container entry 	None	Very low
Animal hazards (bees, ticks, wasps, snakes)	<ul style="list-style-type: none"> • PPE (boots, work clothes), tape pant legs or tuck into socks or boots • Insect repellent if necessary, inspect for ticks 	Visual survey	Low
Temperature extremes	<ul style="list-style-type: none"> • Administrative controls to include: <ul style="list-style-type: none"> - self-pacing, - rest breaks in temperature-controlled areas, and - adequate fluid replacement 	None	Varies by season

Table 3.2. Potential exposures

Chemical ^a	TLV/PEL/IDLH ^b	Health effects/ potential hazards ^c	Chemical and physical properties ^c	Exposure route(s) ^c
Hydrochloric acid (sample preservative)	TLV/TWA: C5 ppm IDLH: 50 ppm	Irritation of eyes, skin, mucous membranes; choking	Liquid with pungent irritating odor; FP: NA; IP: 12.74 eV	Inhalation Ingestion Contact
Mercury (site contaminant)	TLV/TWA: 0.025, A4 mg/m ³	Irritation of eyes; chest pain; tremors; headache	Silver liquid in the pure state; VP: 0.0012 mm; FP: none	Inhalation Ingestion Absorption Contact
Nitric acid (sample preservative)	TLV/TWA: 2 ppm IDLH: 25 ppm	Corrosive; irritation of eyes, nose, throat; delayed pulmonary edema; may increase the combustibility of organic materials; generates heat in contact with water	Liquid with acrid suffocating odor; VP: 48 mm; FP: NA; IP: 11.85 eV	Inhalation Ingestion Contact
Sulfuric acid (sample preservative)	TLV/PEL: 1 mg/m ³ IDLH: 15 mg/m ³	Corrosive; irritation of eyes, skin, respiratory system; skin burns; pulmonary edema; may react violently with water or organic materials	Oily liquid; VP: 0.001 mm; FP: none	Inhalation Ingestion Contact

^a The contaminants were obtained from the Lower East Fork Remedial Investigation report.

^b From 1995-1996 Threshold Limit Values, 1994 *NIOSH Pocket Guide to Chemical Hazards*.

^c From 1994 *NIOSH Pocket Guide to Chemical Hazards*.

C = ceiling limit

FP = flash point

IDLH = immediately dangerous to life and health

IP = ionization potential

NA = not available

PEL = permissible exposure limit

TLV = threshold limit value

NIOSH = National Institute of Occupational Safety and Health

TWA = time-weighted average

VP = vapor pressure

Table 3.3. Training requirements

Training	Worker	Supervisor
OSHA (40 hour, 3 day on the job training)	✓	✓
OSHA Annual Refresher (8 hour)	✓	✓
OSHA Supervisors Training (8 hour)	×	✓
General Hazard Communication Training (Contained in 40 hour)	✓	✓
Respiratory Protection (required only if respirators are worn; contained in 40 hour)	✓	✓
Site Access Briefing (conducted by MK Ferguson)	✓	✓
Safety Briefings (conducted by MK Ferguson)	✓	✓

✓ = required

× = not required

OSHA = Occupational Safety and Health Administration

- safety boots
- safety glasses with side shields
- hard hat (if overhead hazards are present)

If site conditions require that other levels of PPE be used, the SAIC Health and Safety Manager will be contacted by the SAIC on-site personnel for consultation.

3.5 MEDICAL SURVEILLANCE

Employees performing hazardous waste related work may be exposed to hazardous chemicals, various forms of radiation, noise hazards, biological hazards, and safety hazards. SAIC employees performing on-site work as part of this project will, as a minimum, be enrolled in a medical surveillance program to comply with 29 *CFR* 1910.120.

3.6 MONITORING AND SAMPLING

MK-Ferguson, as the remedial contractor, will be responsible for conducting exposure assessment to verify that on-site personnel are not overexposed to site contaminants. SAIC personnel will comply with any monitoring requirements prescribed by the MK-Ferguson health and safety staff.

3.7 SITE CONTROL MEASURES

The remedial contractor, MK-Ferguson, will be responsible for establishing the site control zones, as necessary, around areas that present physical, chemical, and/or radiological hazards. SAIC personnel will comply with the site control zones established by the MK-Ferguson health and safety staff.

3.8 DECONTAMINATION PROCEDURES

MK-Ferguson, the remedial contractor, is responsible for establishing decontamination procedures, as necessary, to protect on-site personnel from adverse effects due to contamination. At a minimum, SAIC personnel will wash hands and faces upon leaving any contaminated area or handling potentially contaminated/hazardous material, and prior to taking anything by mouth.

3.9 SITE OPERATING PROCEDURES

This section presents those general safety rules that apply to SAIC activities conducted as part of this project:

- SAIC personnel will attend MK-Ferguson site-specific safety training and "Tailgate" safety meetings.
- Contact with potentially contaminated substances will be avoided. Site personnel in the exclusion zone will avoid walking through puddles, pools, mud; kneeling on the ground; and leaning or sitting on equipment or the ground.

- All injuries will be reported to the MK-Ferguson SHSO and SAIC management.
 - All on-site workers will abide by a buddy system. Members of a buddy team will maintain contact and be able to render aid if necessary. Note that frequent radio contact or interaction with nearby MK-Ferguson personnel will satisfy this requirement.
- Copies of material safety data sheets for all hazardous chemicals (chemicals brought on site) will be maintained in the SAIC work area. Copies will also be made available to the MK-Ferguson SHSO.
- All containers of hazardous chemicals will be labeled to comply with the requirements of 29 *CFR* 1910.1200, the Hazard Communication standard. Labels will display at least the identity of the contents and the primary hazard.

3.10 CONTINGENCY PLAN

The remedial contractor, MK-Ferguson, is responsible for developing contingency plans to address potential site emergencies. SAIC personnel will become familiar with site contingency plans by attending MK-Ferguson on-site training and will comply with the requirements of these plans. At a minimum, the SAIC personnel will be supplied with the following emergency equipment:

- a first aid kit suitable to treat minor injuries such as cuts and abrasions;
- a fifteen minute eye wash for when corrosive materials are being poured; and
- a telephone.

REFERENCES

- ACGIH (American Conference of Governmental Industrial Hygienists). 1995-1996. *1995-1996 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, ISBN: 0-936712-99-6.
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- SAIC (Science Applications International Corporation). 1994. *East Fork Poplar Creek—Sewer Line Beltway Remedial Investigation Report*, DOE/OR/02-1119&D2&V1-4.

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