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CH2M Hill Plateau Remediation Company Environmental Quality Assurance Program Plan

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

 **CH2MHILL**
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

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CH2M Hill Plateau Remediation Company Environmental Quality Assurance Program Plan

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 **CH2MHILL**
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

APPROVED

By Lee Ann Snyder at 2:59 pm, Oct 14, 2014

Release Approval

Date

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Introduction

The CH2M HILL Plateau Remediation Company (CHPRC) Environmental Quality Assurance Program Plan (EQAPP) establishes the Environmental Quality Assurance (EQA) Program requirements of the CHPRC *Quality Assurance Program* (PRC-MP-QA-599) for all Plateau Remediation Contract (PRC) environmental cleanup and restoration activities. This plan was developed to support the U.S. Department of Energy (DOE) using U.S. Environmental Protection Agency (EPA) guidance documents for application to environmental management activities (EPA 240/B-01/002, *EPA Requirements for Quality Management Plans [EPA QA/R-2]*). This plan also supports the environmental compliance (EC) aspects as to the Environmental Compliance and Quality Assurance (ECQA) function regarding EC oversight. The EQAPP interfaces with the CHPRC *Quality Assurance Program* (PRC-MP-QA-599), which includes the quality provisions of the DOE Order 414.1D, *Quality Assurance, Attachment 2* (Contractor Requirements Document [CRD]); 10 CFR 830, “Nuclear Safety Management,” Subpart A, “Quality Assurance Requirements;” EM-QA-001, *Office of Environmental Management Quality Assurance Program*, and American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME) NQA-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications*. (NOTE: A crosswalk of EPA QA/R-2; DOE O 414.1D; 10 CFR 830.122, “Nuclear Safety Management,” “Quality Assurance Criteria;” and ANSI/ASME NQA-1-2008 requirements is located on the CHPRC ECQA Webpage.

Quality assurance (QA) requirements pertaining to environmental activities include the following applicable requirement sections of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989a), also known as the Tri-Party Agreement (TPA):

- ARTICLE XXXI QUALITY ASSURANCE states in part that throughout all sample collection, preservation, transportation, and analysis activities required to implement the TPA (Ecology et al., 1989a), procedures for QA and quality control (QC) shall be used.
- Section 6.5 QUALITY ASSURANCE of the TPA Action Plan (Ecology et al., 1989b) for *Resource Conservation and Recovery Act of 1976* (RCRA) closure plans,

the RCRA permit, and any other relevant plans that may be used to describe sampling and analyses at RCRA treatment, storage, and disposal (TSD) units.

- Section 7.8 QUALITY ASSURANCE of the TPA Action Plan (Ecology et al., 1989b) for Remedial Investigation/Feasibility Study or RCRA facility investigation/corrective measures study work plans, or in other work plans that may be used to describe sampling and analyses at *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)* past-practice units or RCRA past-practice units.

The EQAPP recognizes that the environmental sampling and analysis activities performed at Hanford are required (per the contract) to comply with DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents (HASQARD)*, as implemented through this EQAPP. Commercial Laboratories will be audited to the DOE Consolidated Audit Program. These audits are based on the DOE Quality Systems for Analytical Services requirements which comply with HASQARD requirements.

Management Plan PRC-MP-QA-599, *Quality Assurance Program*, describes the CHPRC QA Plan, including the overall structure, requirements, implementation methods, and responsibilities. This EQAPP is the management tool that documents the quality system for planning, implementing, documenting, and assessing the effectiveness of the environmental activities supporting the PRC work scope, TPA (Ecology et al., 1989a) implementation, and other environmental programs. The PRC requires compliance with all environmental laws, regulations, DOE Orders, and procedures applicable to the work being performed under the contract. A complete listing of these requirement sources are found in DE-AC06-08RL14788, *CH2M HILL Plateau Remediation Company Plateau Remediation Contract*, Attachment J.2, “Requirements Sources and Implementing Documents.”

CHPRC has developed PRC-MP-EP-40182, *Environmental Management System Manual*, which documents the Environmental Management System (EMS).

CHPRC EMS implements the requirements found in the CRD (DOE Order 414.1D, *Quality Assurance*); DOE O 436.1, *Departmental Sustainability*, and the International Organization for Standardization (ISO) 14001:2004, *Environmental Management Systems—Requirements with Guidance for Use*. EMS follows the basic format of plan-do-check-act and includes each of the ISO 14001 requirements.

A crosswalk has been developed between the ISO 14001 requirements and this EQAPP and is located on the Environmental Compliance and Quality Assurance (ECQA) Webpage.

NOTE: Due to organizational name changes, EQA and ECQA are used interchangeably in this document as implementing procedures have not yet incorporated the change.

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Terms

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BTR	Buyers Technical Representative
CAA	<i>Clean Air Act of 1990</i>
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
CFR	<i>Code of Federal Regulations</i>
CHPRC	CH2M HILL Plateau Remediation Company
CRD	Contractor Requirements Document
CRRS	Condition Reporting and Resolution System
CWA	<i>Clean Water Act of 1977</i>
DOE	U.S. Department of Energy
DQA	data quality assessment
DQO	data quality objective
Ecology	Washington State Department of Ecology
EC	environmental compliance
ECQA	Environmental Compliance and Quality Assurance
EM	Environmental Manager
EMS	Environmental Management System
EP	Environmental Protection
EP&SP	Environmental Program and Strategic Planning
EPA	U.S. Environmental Protection Agency
EQA	Environmental Quality Assurance
EQAPP	Environmental Quality Assurance Program Plan
ETF	Effluent Treatment Facility
FSP	field sampling plan
HASQARD	Hanford Analytical Services Quality Assurance Requirements Document
IEP	Integrated Evaluation Plan

ISO	International Organization for Standardization
LERF	Liquid Effluent Retention Facility
MA	management assessment
MQO	model quality objective
MSA	Mission Support Alliance
NEPA	<i>National Environmental Policy Act of 1969</i>
NESHAP	“National Emissions Standards for Hazardous Air Pollutants” (40 CFR 61)
NPDES	National Pollutant Discharge Elimination System
PRC	Plateau Remediation Contract
QA	quality assurance
QAP	quality assurance program
QAPjP	quality assurance project plan
QAPP	quality assurance program plan
QC	quality control
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RL	U.S. Department of Energy, Richland Operations Office
SAP	sampling and analysis plan
SME	subject matter expert
SMP	Software Management Plan
TEDF	Treated Effluent Disposal Facility
TPA	Tri-Party Agreement
Tri-Party Agreement	<i>Hanford Federal Facility Agreement and Consent Order</i>
TSD	treatment, storage, and disposal
V&V	verification and validation

1 Management and Organization

This Environmental Quality Assurance Program Plan (EQAPP) describes the quality assurance (QA) policy, requirements, roles, responsibilities, and authorities of the CH2M HILL Plateau Remediation Company (CHPRC) Environmental Quality Assurance (EQA) Program. The EQAPP provides quality requirements for the planning, implementation, and assessment of environmental functions and activities, including environmental compliance (EC). The Environmental Compliance and Quality Assurance (ECQA) organization provides QA oversight for environmental requirements, functions, and activities. This includes, but is not limited to, environmental sampling and data collection, environmental technology programs, environmental monitoring and reporting, regulatory documentation, and other compliance activities. The ECQA organization is a direct report to Environmental Program and Strategic Planning (EP&SP). The CHPRC environmental program implements the requirements of applicable environmental regulations and requirements including, but not limited to, the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989a), also known as the Tri-Party Agreement (TPA); DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents* (HASQARD); the *Resource Conservation and Recovery Act of 1976* (RCRA); the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA); 40 CFR 61, “National Emissions Standards for Hazardous Air Pollutants” (NESHAP); National Pollutant Discharge Elimination System (NPDES); the *Clean Air Act of 1990* (CAA), the *Clean Water Act of 1977* (CWA), the *National Environmental Policy Act of 1969* (NEPA), and the requirement sources listed in Attachment J.2 of the Plateau Remediation Contract (PRC) Prime Contract (DE-AC06-08RL14788, *CH2M HILL Plateau Remediation Company Plateau Remediation Contract*).

1.1 Purpose

The purpose of this section is to document the overall policy, scope, applicability, and management responsibilities of the CHPRC environmental quality system.

This section describes the CHPRC environmental QA program and structure. It identifies the basic QA requirements imposed by the PRC for environmental programs, functions, and activities, as well as implementation of the EQAPP.

1.2 Requirements

The management and organization of CHPRC environmental QA program and functions, under the terms of the PRC, shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*, Section 5.2; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans* [[EPA QA/R-2](#)], Section 3.2, “Management and Organization;” and ISO 14001:2004, *Environmental Management Systems—Requirements with Guidance for Use*, Criteria 4.1, “General Requirements,” and 4.2, “Environmental Policy,” and is consistent with applicable QA requirements of the TPA (Ecology et al., 1989a).

Management shall establish and implement a quality policy to ensure that environmental programs produce the type and quality of results needed and expected.

Management shall regularly assess and document the adequacy of the quality system. Management shall define the objectives of the assessment process and determine the measures for ensuring that the quality system has been established, documented, and implemented effectively. Management shall determine what response actions are required as a result of independent assessments or self-assessments, and shall implement such actions in a timely manner.

Management shall ensure that organizations and individuals responsible for planning, implementing, and assessing the quality system shall have sufficient authority, organizational freedom, and access to management to identify noteworthy practices and quality problems; initiate, recommend, or provide solutions to quality problems through appropriate channels; and verify their successful implementation.

1.3 Implementation

The following table lists the applicable CHPRC procedures required to implement the program. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
EM-QA-001, <i>Office of Environmental Management Quality Assurance Program</i>
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-PRO-MS-40117, <i>Requirements Management Process</i>
PRC-MP-MS-19361, <i>CH2M HILL Plateau Remediation Company Project Execution Plan</i>
PRC-MP-MS-29238, <i>Assurance System Description</i>
PRC-MP-EP-40220, <i>Environmental Program and Strategic Planning Roles, Responsibilities, and Functions</i>
PRC-POL-EP-5054, <i>CH2M HILL Plateau Remediation Company Environmental Policy</i>
PRC-POL-SH-5053, <i>CHPRC Safety, Health, Security, Quality, and Environmental Policy</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>

1.3.1 CHPRC QA Policy

The CHPRC QA Program’s policy is to develop, implement, and assess a QA program that complies with the requirements of DOE O 414.1D, *Quality Assurance*, Attachment 2 (Contractor Requirements Document [CRD]); 10 CFR 830, “Nuclear Safety Management,” Subpart A, “Quality Assurance Requirements;” and State and Federal Environmental Regulations. The entire CHPRC QA Policy is located in PRC-MP-QA-599, *Quality Assurance Program*.

1.3.2 CHPRC Environmental Policy

The CHPRC Environmental Policy applies to anyone performing CHPRC work scope and is located in PRC-POL-EP-5054.

1.3.3 Organization

Organization charts are maintained by Human Resources and are available on their website. An organization chart that identifies all of the components of the EP&SP organization and, in particular, the organizational position and lines of reporting for the ECQA Manager and ECQA Staff is located on the Human Resources Web Page.

1.3.4 Responsibilities

All employees are responsible for performing work in accordance with the requirements set forth in this EQAPP. Those employees performing oversight and verification have the authority and responsibility to identify quality problems, recommend solutions, and verify implementation of effective corrective actions.

CHPRC is committed to performing work in accordance with requirements to ensure high quality products and services meeting or exceeding the customer's needs, and fulfilling the expectations of our customer to achieve adequate protection of workers, the public, and the environment, while taking into account the work to be performed and the associated hazards.

NOTE: All employees are responsible for and have the authority to stop work when they are convinced that a situation exists which places themselves, their coworker(s) or the environment in danger.

1.3.4.1 President and Chief Executive Officer of CHPRC

The President of CHPRC has responsibility for the quality of CHPRC activities, services, and products.

1.3.4.2 Vice President Environmental Program and Strategic Planning

The Vice President (VP) of EP&SP is responsible for the interpretation and implementation of environmental codes, standards, and regulations. The VP of EP&SP provides qualified staff to support safe and compliant work, maintains an interface with external environmental regulators, and promotes and ensures environmental regulatory compliance for CHPRC. The VP of EP&SP has overall responsibility for the Environmental Management System (EMS) and is also responsible for ensuring the following:

- EP&SP work is performed in accordance with the CHPRC EQA program.
- Organizational charts, functional responsibilities, and levels of authority are defined and documented.
- Organizational resources are made available to support an effective EQA program.

NOTE: For additional roles and responsibilities of the EP&SP VP, see PRC-MP-EP-40220, *Environmental Program and Strategic Planning Roles, Responsibilities, and Functions*.

1.3.4.3 Environmental Compliance and Quality Assurance Manager

Environmental Quality Assurance Program

The ECQA Manager assures that quality requirements are mandated and adhered to throughout the company. The ECQA Manager has the following responsibilities:

- Effectively implementing the EQA Program through quality engineering, surveillances, and assessments to assess, assure, and evaluate the effectiveness of implementation Ensuring the ECQA Manager and staff shall have access to the appropriate management levels in order to plan, assess, and identify improvements to the quality systems
- Completing all Buyers Technical Representative (BTR) activities for any EQA, EC, and/or EMS assessments
- Completing all BTR activities of subcontracted EC assessments including CH2M HILL Corporate
- Ensuring that the ECQA Manager and ECQA staff maintain independence from the group generating, compiling, and evaluating environmental data
- Serving as Technical Authority for EQA requirements
- Ensuring that EQA activities, documents, and systems are planned and needed resources are provided to meet the stated objectives
- Approving environmental documents, including the following:
 - Data quality objectives (DQOs)
 - Sampling and analysis plans (SAPs)
 - Quality assurance project plans (QAPjPs)
 - Environmental documents containing QA requirements and/or sections pertaining to QA

- Other documents, as requested or as deemed appropriate by the ECQA Manager
- Conducting programmatic independent assessments and surveillances and reporting quality issues to management
- Interfacing with other CHPRC QA organization personnel for coordination and support of environmental activities
- Interfacing with DOE QA, legal, projects, and other regulatory agencies concerning environmental QA programs and issues

Internal Environmental Compliance Assessments (Environmental Compliance and Compliance Advocate Programs)

The overall goal of the Internal Environmental Compliance Assessment Program is to provide an effective oversight function in an effort to continuously improve environmental performance through systematic evaluation of compliance. The ECQA Manager has responsibility for effective implementation of the Internal Environmental Compliance Assessment Program. The ECQA Manager will be responsible for the assessments of environmental regulations, which will include a review of targeted environmental regulatory program areas within CHPRC. This includes EMS Assessments (see Appendix F). These assessments will be performed by assessors independent of the audited activities. The ECQA Manager will ensure objective and unobstructed inquiry, observation, and reporting and will not be impaired by personal, financial, or other conflicts of interest. The ECQA Manager is the Technical Authority for Internal Environmental Compliance Assessments with the following responsibilities:

- Overseeing the development of Internal Environmental Compliance Inspection technical and administrative procedures
- Ensuring that an effective Internal Environmental Compliance Inspection Program is planned, implemented, and documented
- Ensuring that Internal Environmental Compliance Inspection documentation is maintained current
- Ensuring that Internal Environmental Compliance Inspection activities, documents, and systems are planned and needed resources are provided to meet the stated objectives
- Coordinating Internal Environmental Compliance Inspection activities
- Completing all BTR activities for any EQA, EC, and/or EMS assessments
- Completing all BTR activities of subcontracted EC inspections, including CH2M HILL Corporate
- Interfacing with DOE, legal, projects, and other regulatory agencies concerning Internal Environmental Compliance Inspection Program and issues

Company Representative to the HASQARD Focus Group

The ECQA Manager is the company representative to the Hanford Analytical Services Quality Assurance Requirements Documents (HASQARD) Focus Group. The Focus Group identifies, consolidates, and provides guidance on analytical and sampling QA requirements through HASQARD (DOE/RL-96-68). The U.S. Department of Energy (DOE), Richland Operations Office (RL) issues the HASQARD (DOE/RL-96-68), which meets the need to maintain a consistent level of quality in sampling and field and laboratory analytical services. The HASQARD (DOE/RL-96-68) applies to contractors and subcontractors supporting the Hanford Mission. The HASQARD Focus Group maintains the HASQARD (DOE/RL-96-68), provides interpretations, and modifies the HASQARD (DOE/RL-96-68) in response to

changes in applicable DOE Orders, *Code of Federal Regulations* (CFR), and regulatory and industry standards.

The Focus Group consists of representatives from Hanford Site contractors, RL, the DOE Office of River Protection, and Hanford Site regulatory agencies. The regulatory agencies at the Hanford Site include the Washington State Department of Ecology (Ecology), Washington State Department of Health, and U.S. Environmental Protection Agency (EPA), Region X.

1.3.4.4 Director of Environmental Protection

The Director of Environmental Protection (EP) is responsible for implementing environmental policies and procedures that meet applicable environmental laws, regulations, and DOE Orders. The Director of EP has the responsibility and authority for ensuring that EMS is established, implemented, and maintained in accordance with PRC-MP-EP-40182, *Environmental Management System Manual*. The roles and responsibilities of the Director of EP also include:

- Ensure regulatory compliance for CHPRC through interpretations, implementing procedures, and project support.
- Provide permitting and regulatory reporting services.
- Coordinate near-field monitoring within CHPRC and with Mission Support Alliance (MSA) and other contractors.
- Determine if company and/or facility/project-specific policies and procedures meet applicable environmental requirements based on applicable reviews.
- Act as the regulatory subject matter expert (SME) for environmental regulations.
- Track TPA (Ecology et al., 1989a) milestones and change package management.
- Perform periodic management reviews of environmental activities and functions against organizational goals and commitments, and directs actions for continuous improvement.

1.3.4.5 Project Responsibilities

Projects are responsible for implementing EQAPP requirements.

1.3.4.6 ECQA Responsibilities

ECQA ensures the direct support of quality and the effective quality program implementation associated with environmental cleanup activities through this EQAPP.

ECQA implements the CHPRC EQA Program by providing Quality Engineering support and QA assessments and Environmental Quality reviews of CHPRC environmental activities.

Quality engineering support activities include consultations with project engineers and staff personnel to ensure that quality requirements are built in during the planning stages of CHPRC environmental documents, activities, and projects. ECQA activities also include assessments, audits, and surveillances to verify that quality requirements have been assured.

ECQA is responsible for the Internal Environmental Compliance Inspection Program. The goal of this program is continuous improvement of environmental performance by systematic evaluation of compliance. ECQA will assess compliance with applicable environmental regulations. This includes a strategic, in-depth review of targeted environmental regulatory program areas within CHPRC including, but not limited to, the following:

- CERCLA
- RCRA
- NEPA
- Cultural/Ecological Resource Protection
- CAA/NESHAP (40 CFR 61)
- *Toxic Substances Control Act of 1976*
- CWA/NPDES

ECQA is responsible for providing EMS oversight, which is consistent with ISO 14001 guidelines. A crosswalk between EMS/ISO 14001 and this EQAPP is located on the ECQA website.

2 Quality System Components

2.1 Purpose

The purpose of this section is to document how CHPRC manages its quality system and defines the primary responsibilities for managing and implementing each component of the system.

This EQAPP is a component of the CHPRC QA Program, PRC-MP-QA-599 *Quality Assurance Program* (QAP) and is the implementing document of the QAP for all PRC activities involving environmental requirements, functions, and activities. Such activities include, but are not limited to, environmental sampling and data collection; environmental technology programs; environmental monitoring and reporting; risk assessments; and preparation of all other environmental documents. This EQAPP shall be reviewed periodically from its initial issue date and updated as necessary. Review of other quality system documentation is performed in accordance with approved procedures.

2.2 Requirements

CHPRC quality systems components involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*, Section 5.3; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans (EPA QA/R-2)*, Section 3.3, “Quality System Components;” and the EMS ISO 14001:2004, Criterion 4.1, “Environmental Management System Requirements.”

A quality system shall be planned, established, documented, implemented, and assessed as an integral part of a management system for environmental programs. The quality system shall include the organizational structure, policies and procedures, responsibilities, authorities, resources, requirements documents, and guidance documents necessary for implementing the quality management process.

The quality system shall include provisions to ensure that the products or results of the environmental programs are of the type and quality needed and expected. The management elements of the quality system shall be established and operational before the initiation of affected environmental projects and activities.

EPA/240/B-01/002 (*EPA Requirements for Quality Management Plans [EPA QA/R-2]*) requires an organization to document how the environmental quality system will be managed and to provide the following items, which are provided in this EQAPP:

- A description of the organization's quality system that includes the principal components of the system and the roles and implementation responsibilities of management and staff with regards to these components. These components include, but are not limited to, the following:
 - Quality system documentation
 - Annual reviews and planning
 - Management assessments (MAs)
 - Training
 - Systematic planning of projects
 - Project-specific quality documentation
 - Project and data assessments

- A list of the tools for implementing each component of the quality system including, but not limited to, the following:
 - Quality management plans (quality system documentation)
 - Quality systems audits (MAs)
 - Training plans
 - QAPjP (project-specific quality documentation)
 - Data verification and validation (V&V) (data assessments)
- A list of any components of the organization that develop Quality Management Plans (or equivalent document) in support of the organization’s Quality System and the review and approval procedures for such documentation

2.3 Implementation

All environmental activities employ the graded approach and will vary according to the nature of the activities and the intended use of the resulting information or data. Graded approach is a principal which dictates that preparation and planning will be commensurate with the degree of complexity and/or inherent risk in the work to be undertaken. The graded approach is described in PRC-PRO-QA-259, *Graded Approach*.

Processes used to implement this EQAPP are common to the overall CHPRC QA management system. Activities that affect quality, including MAs, training, project planning and execution, and data assessments, are performed in accordance with approved procedures appropriate to those activities.

The following table lists the applicable procedures required to implement the program. Procedures that implement the specific quality systems, such as procurement and documents and records, will be identified in the implementation section specific to that quality system. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-PRO-QA-259, <i>Graded Approach</i>
PRC-PRO-MS-40117, <i>Requirements Management Process</i>
PRC-MP-MS-19361, <i>CH2M HILL Plateau Remediation Company Project Execution Plan</i>
PRC-MP-MS-29238, <i>Assurance System Description</i>
PRC-MP-EP-40220, <i>Environmental Program and Strategic Planning Roles, Responsibilities, and Functions</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>

3 Personnel Qualification and Training

3.1 Purpose

The CHPRC training and qualification program provides for the development and maintenance of proficiency commensurate with the scope, complexity, and nature of each job performance activity. PRCMP-TQ-011, *CHPRC Qualification and Training Plan*, describes how training is accomplished and identifies the processes by which CHPRC will maintain a qualified and trained work force.

3.2 Requirements

CHPRC personnel qualification and training involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*, Section 5.4; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans (EPA QA/R-2)*, Section 3.4, “Personnel Qualification and Training;” and the EMS, ISO 14001:2004, Criterion 4.4.2, “Competence, Training, and Awareness.”

Personnel shall have the necessary skills and experience to perform assigned duties. Personnel needing skills to perform work shall be trained and qualified (as needed) based on project-specific requirements prior to the start of the work or activity. The need to require formal qualification or certification of personnel performing certain specialized activities shall be evaluated and implemented where necessary.

EMS auditors shall be qualified and trained in accordance with Appendix F of this document.

3.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-MP-TQ-011, <i>CHPRC Qualification and Training Plan</i>
PRC-POL-TQ-11337, <i>Employee Training</i>
PRC-PRO-TQ-164, <i>Integrated Training Electronic Matrix</i>
PRC-PRO-TQ-175, <i>Training Program Descriptions</i>
MSC-PRO-263, <i>Qualification and Certification of Inspection and Test Personnel</i>
PRC-PRO-TQ-459, <i>Environmental Training</i>
PRC-PRO-QA-9662, <i>Independent Assessment Process</i>
PRC-PRO-EN-20051, <i>Engineering Selection, Qualification, and Training</i>
PRC-PRO-OP-21712, <i>Required Reading</i>
PRC-PRO-TQ-40164, <i>Personnel Training and Qualification</i>
PRC-PRO-TQ-40165, <i>Training Program Administration</i>
PRC-STD-TQ-40201, <i>CH2M HILL Plateau Remediation Company Training Implementation Matrix</i>
PRC-STD-TQ-40221, <i>Environmental Compliance Officer Training Program Description</i>
PRC-STD-TQ-40226, <i>Integrated Disposal Facility Dangerous Waste Training Plan</i>
PRC-STD-TQ-40227, <i>Low Level Burial Grounds Dangerous Waste Training Plan</i>
PRC-STD-TQ-40228, <i>T Plant Dangerous Waste Training Plan</i>
PRC-STD-TQ-40229, <i>Central Waste Complex Dangerous Waste Training Plan</i>

CHPRC Document Number and Title
PRC-STD-TQ-40230, <i>Waste Receiving and Processing Facility Dangerous Waste Training Plan</i>
PRC-STD-TQ-40231, <i>Waste Encapsulation Storage Facility Dangerous Waste Training Plan</i>
PRC-STD-TQ-40232, <i>Liquid Effluent Retention Facility/200 Area Effluent Treatment Facility Dangerous Waste Training Plan</i>
PRC-STD-TQ-40234, <i>Soil and Groundwater Remediation Project Dangerous Waste Training Plan</i>
PRC-STD-TQ-40236, <i>Central Plateau Project Surveillance and Maintenance Dangerous Waste Training Plan</i>
PRC-STD-TQ-40245, <i>Environmental Training Program Description</i>
PRC-STD-TQ-40380, <i>Work Management Training Program Description</i>
PRC-STD-TQ-40393, <i>Emergency Preparedness and Response Organization Training Program Description</i>
PRC-PRO-QA-40102, <i>Quality Assurance Engineer Training and Qualification Program</i>

3.3.1 Training Policy

The CHPRC training policy is located in PRC-POL-TQ-11337, *Employee Training*, and applies to all employees, including management and staff. The applicable procedures listed in the table in Section 3.3 describe the processes, including the following roles, responsibilities, and authorities of management and staff:

- Identifying, ensuring, and documenting that personnel have and maintain the appropriate knowledge, skill, and statutory, regulatory, professional or other certifications, accreditations, licenses, or other formal qualification necessary
- Identifying the need for retraining based on changing requirements

4 Procurement of Items and Services

4.1 Purpose

CHPRC procured items and services are to be of acceptable quality, demonstrated by the review of objective evidence of quality for applicable items and services furnished by suppliers and subcontractors, source selection, source inspections, supplier audits, and examination of deliverables.

4.2 Requirements

CHPRC procurement of environmental items and services shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*, Section 5.5; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans* (EPA QA/R-2), Section 3.5, "Procurement of Items and Services;" and the EMS, ISO 14001:2004, Criterion 4.4.6, "Operational Control."

The procurement of purchased items and services that directly affect the quality of environmental programs shall be planned and controlled to ensure that the quality of the items and services is known, documented, and meets the technical requirements and acceptance criteria.

Procurement documents shall contain information clearly describing the item or service needed and the associated technical and quality requirements. The procurement documents shall specify the quality system elements for which the supplier is responsible and how the supplier's conformity to requirements will be verified.

Appropriate measures shall be established to ensure that procured items and services satisfy all stated requirements and specifications. When specifically stated in the procurement documents, suppliers shall have a demonstrated capability to furnish items and services that meet all requirements and specifications.

Procurement documents shall be reviewed for accuracy and completeness by qualified personnel prior to release. Changes to procurement documents shall receive the same level of review and approval as the original documents.

4.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-MP-AC-40500, <i>Acquisition Management Plan</i>
PRC-PRO-AC-40480, <i>Acquisition Planning</i>
PRC-PRO-AC-40478, <i>Procurement of Materials</i>
PRC-PRO-AC-40471, <i>Contract labor Resources</i>
PRC-PRO-AC-40496, <i>Managed Task Services</i>
PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i>
PRC-PRO-QA-301, <i>Control of Suspect/Counterfeit and Defective Items</i>
PRC-PRO-AC-335, <i>Use and Control of Purchasing Card</i>
PRC-PRO-QA-3144, <i>Supplier Quality Assurance Program Evaluation</i>
PRC-PRO-QA-9662, <i>Independent Assessment Process</i>

CHPRC Document Number and Title
PRC-PRO-QA-259, <i>Graded Approach</i>
PRC-PRO-MS-40213, <i>Subcontractor Oversight</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>

4.3.1 Requests for Material or Services

Requests for material or services are made in accordance with procedures defined in PRC-PRO-AC-40478, *Procurement of Materials*. This procedure is written specifically for end-users and requestors of materials and services to ensure that identified processes, reviews, and approvals are obtained prior to procurement. The ECQA Manager shall review and approve all environmental procurements.

4.3.2 Supplier Evaluation

PRC-PRO-QA-9662, *Independent Assessment Process*, and PRC-PRO-QA-3144, *Supplier Quality Assurance Program Evaluation*, define the requirements and processes for evaluating supplier QA programs, including their implementation of procedures prior to the supplier being placed on the Evaluated Suppliers List.

4.3.3 Acquisition Verification Services

MSA Acquisition Verification Services performs supplier evaluations and receipt inspection on behalf of CHPRC for designated procured items, as appropriate.

The procurement of items and services is controlled to ensure conformance with specified requirements. Such controls provide for the following, as appropriate:

- QA program requirements
- Design bases
- Source evaluation and selection
- Verification of supplier-furnished information
- Source inspections
- Control of nonconforming items
- Audits and surveillances

4.3.4 Analytical Services

CHPRC procures environmental analytical services from evaluated laboratories operating under a QA program. These laboratories will be listed on the MSA Evaluated Supplier's List. These services and all data validation services must be approved by the ECQA Manager prior to placing the procurement. CHPRC typically obtains onsite analytical services from the 222-S Laboratory for high activity samples. The following laboratory specific QA program plan(QAPP) is evaluated for use:

- ATL-MP-1011, *Quality Assurance Project Plan for 222-S Laboratory*

Before delivery of the samples to the analytical laboratory, the unique analytical requirements shall be communicated to the laboratory. These requirements can be provided to the laboratory through the applicable procurement or work agreement document such as a Statement of Work, Letter of Instruction, Contract, or SAP and include the following:

- Required analytical method(s) and the parameters to be measured

- Data quality needs (DQO requirements or, as a minimum, the precision, accuracy, and detection limits required)
- Types of samples to be analyzed (sample matrix)
- Types of quality control (QC) samples, frequencies, and acceptance criteria
- Sample handling requirements (e.g., holding, custody, and preservation requirements)
- Turnaround time (amount of time from sample receipt to data delivery) in the laboratory
- Data reporting requirements

CHPRC may procure environmental sampling services from offsite suppliers that are approved for use in accordance with the procurement process.

5 Documents and Records

5.1 Purpose

The purpose of the Documents and Records section is to document appropriate controls for quality-related documents and records determined to have a direct effect on the quality of environmental functions and activities.

5.2 Requirements

CHPRC documents and records involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, Section 5.6; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans (EPA QA/R-2)*, Section 3.6, “Documents and Records;” and the EMS, ISO 14001:2004, Criteria 4.4.4, “Documentation,” 4.4.5, “Control of Documents,” and 4.5.4, “Control of Records.”

The preparation, review, approval, issue, use, and revision of documents that specify quality requirements or prescribe activities affecting quality shall be controlled to ensure that correct documents are being used. Records shall be specified, prepared, reviewed, approved, and maintained. Specific record specification and retention requirements are documented in the CHPRC implementing procedures.

Sufficient records shall be specified, prepared, reviewed, authenticated, and maintained to reflect the achieved level of quality for completed work. The ECQA Manager shall review and approve all documents that directly affect the quality of environmental programs.

5.2.1 TPA Action Plan

In addition to the requirements listed in Section 5.2, all environmental documents identified in Section 9.0 of the TPA Action Plan (Ecology et al., 1989b), entitled “Documentation and Records,” must comply with the requirements of the TPA Action Plan.

5.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-GD-IRM-40128, <i>Records Inventory and Disposition Schedule (RIDS) Guide</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-MP-IRM-40119, <i>Document Control and Records Management Plan</i>
PRC-PRO-EN-440, <i>Engineering Documentation Preparation and Control</i>
PRC-PRO-EP-15334, <i>Effluent and Environmental Monitoring for Radionuclide Airborne Emissions</i>
PRC-PRO-EP-15335, <i>Environmental Permitting and Documentation Preparation</i>
PRC-PRO-EP-25415, <i>CERCLA Response Actions</i>
PRC-PRO-IRM-10588, <i>Records Management Processes</i>
PRC-PRO-IRM-232, <i>Project Files Management</i>
PRC-PRO-IRM-8310, <i>Document Control Processes</i>
PRC-PRO-IRM-9679, <i>Administrative and Technical (Non-Engineering) Document Control</i>
PRC-PRO-MS-589, <i>CHPRC Procedures</i>

CHPRC Document Number and Title
PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i>
PRC-RD-EP-15332, <i>Environmental Protection Requirements</i>
PRC-STD-IRM-40161, <i>Records Management Standard</i>

PRC-PRO-IRM-10588 *Records Management Process*, defines the records program, maintenance, use, control, and disposition requirements, and describes this process including roles, responsibilities, and authorities of management and staff for the following:

- Identifying quality-related documents and records (both printed and electronic) requiring control
- Preparing, reviewing for conformance to technical and quality system requirements, approving, issuing, using, authenticating, and revising documents and records
- Ensuring that records and documents accurately reflect completed work
- Maintaining documents and records including transmittal, distribution, retention (including retention times), access, preservation (including protection from damage, loss, and deterioration), traceability, retrieval, removal of obsolete documentation, and disposition
- Ensuring compliance with all applicable statutory, regulatory, and EPA requirements for documents and records
- Establishing and implementing appropriate chain of custody and confidentiality procedures for evidentiary records

PRC-PRO-IRM-9679, *Administrative and Technical (Non-Engineering) Document Control*, states that EQA (now ECQA) must review environmental documents establishing or demonstrating compliance with QA requirements and documents and changes to documents that provide quality affecting data of information on which decisions relative to quality are made including but not limited to data quality assessments (DQAs), DQOs, environmental permits, and SAPs.

Section 9.0 of the TPA Action Plan (Ecology et al., 1989b) contains a listing of primary and secondary documents that may be generated to implement environmental cleanup work activities, and it includes a description of the processes required to generate, review, and approve these documents.

The EQAPP incorporates the TPA (Ecology et al., 1989a), Section 9.4, “Administrative Record,” requirement that all environmental documents listed in Table 9-3 of Section 9.4 of the TPA Action Plan (Ecology et al., 1989b) be included in the TPA (Ecology et al., 1989a) Administrative Record. Administrative Record File and Public Information Repositories falls under Contract J-3 and is a service provided by MSA. As a process efficiency and to better align with the contractual language, CHPRC points to MSC-PRO-211, *Administrative Record File and Public Information Repositories*, as the implementing procedure for this requirement.

Appendix B of this EQAPP, *Environmental Clean-up Documentation*, identifies typical environmental cleanup documentation as defined in the TPA Action Plan (Ecology et al., 1989b), which may be required for CERCLA, RCRA, or facility deactivation and decommissioning. These processes are shown relative to the corresponding functions: Investigation, Alternative Analysis, Decision, Implementation of Decision, and Project Closeout. Appendix B also distinguishes that these elements are conducted under the appropriate QA program.

6 Computer Hardware and Software

6.1 Purpose

This section describes the processes used for computer hardware and software processes used to support the acquisition, control, development, testing, installation, operation, maintenance, and retirement of computer hardware and software, as applicable, to design, construction, operation, modification, repair, and maintenance of the environmental program.

6.2 Requirements

CHPRC computer hardware and software involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, Section 5.7; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans (EPA QA/R-2)*, Section 3.7, “Computer Hardware and Software,” and the EMS, ISO 14001:2004, Criterion 4.5.1, “Monitoring and Measurement.”

Software processes are in accordance with the guidance provided in DOE G 414.1-4, *Safety Software Guide for Use with 10 CFR 830 Subpart A, Quality Assurance Requirements*, and EM-QA-001, *Office of Environmental Management Quality Assurance Program*, Attachment G, “Software Quality Requirements.”

Computer hardware and/or software configurations used in environmental programs shall be installed, tested, used, maintained, controlled, and documented.

6.2.1 Software

A Software Management Plan (SMP) is required to be written, in accordance with PRC-PRO-IRM-309, *Controlled Software Management*, to provide further definition of specific requirements, procedures, or methods for a particular software application or organization. The SMP describes the quality planning required before the development, acquisition, or major modification of a software application and defines specific requirements, procedures, or methods for a particular software application or organization. The SMP provides the confidence that the software conforms to established requirements.

The software management methodology involves the application of a systematic, disciplined, quantifiable approach at each stage of the software lifecycle. The method starts with defining conceptual models of a software application or system and using these models as the basis for system specification and design. In addition, the method establishes standards for planning the work; developing design, code, test, and user documentation; verifying the completion of each lifecycle stage; and controlling changes to the baseline configuration.

Software SMEs are expected to be the project/function/facility expert about software management. SMEs should have cognizance of all software applications in use within the organization. Software owners are responsible for the following:

- Controlling individual software applications
- Completing software documentation
- Managing and training authorized users
- Assessing and documenting the impact of changes to the user requirements on the performance of the hardware and software
- Ensuring that the documents and records accurately reflect the completed work

Computer software shall include, but is not limited to, design, data handling, data analysis, modeling of environmental processes and conditions, operations, process control of environmental technology systems (including automated data acquisition and laboratory instrumentation), and databases containing environmental data (EPA/240/B-01/002, *EPA Requirements for Quality Management Plans [EPA QA/R-2]*).

CHPRC personnel employ software with appropriate hardware to collect, manage, manipulate, and record environmental information and data. The purposes for these activities include preparation and issuance of environmental reports and permit information required by the TPA (Ecology et al., 1989a), and modeling using environmental data to evaluate various risk scenarios and identify potential risk management alternatives.

The collecting, managing, manipulating, and recording of environmental information and data and the application of the data generated by these activities must also comply with the requirements of PRC-PRO-IRM-309, *Controlled Software Management*, which describes the procedure for software management, development, acquisition, testing, installation, operation, and retirement.

This EQAPP describes or references the processes, including the following roles, responsibilities, and authorities of management and staff:

- Developing, installing, testing (including V&V), using, maintaining, controlling, and documenting computer hardware and software used in environmental programs to ensure it meets technical and quality requirements and directives from management assessing and documenting the impact of changes to user requirements and/or the hardware and software on performance
- Evaluating purchased hardware and software to ensure it meets user requirements and complies with applicable contractual requirements and standards
- Ensuring that data and information produced from, or collected by, computers meet applicable information resource management requirements and standards

6.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
EM-QA-001, <i>Office of Environmental Management Quality Assurance Program</i>
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-RD-EP-15332, <i>Environmental Protection Requirements</i>
PRC-PRO-QA-301, <i>Control of Suspect/Counterfeit and Defective Items</i>
PRC-PRO-IRM-309, <i>Controlled Software Management</i>
PRC-PRO-IRM-592, <i>Unclassified Computer Security</i>
PRC-PRO-WKM-12115, <i>Work Management</i>
PRC-PRO-EP-15333, <i>Environmental Protection Processes</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-PRO-IRM-24305, <i>Use of Non-Government Owned Computers on HLAN</i>

7 Planning

7.1 Purpose

This section describes planning that will be implemented within CHPRC to ensure that data or information collected are of the needed and expected quality for their desired use.

7.2 Requirements

CHPRC planning processes involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, Section 5.8; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans* ([EPA QA/R-2](#)), Section 3.8, “Planning,” and the EMS, ISO 14001:2004, Criteria 4.3, “Planning,” 4.4.6, “Operational Controls,” and 4.4.7, “Emergency Preparedness and Response.”

Work at CHPRC shall be performed according to approved planning and technical documents and in the prescribed sequence defined therein.

7.2.1 Systematic Approach

A systematic planning process, such as the DQOs process (EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process* [QA/G-4]), shall be established, implemented, controlled, and documented as necessary to:

- Identify all relevant customers, and their needs and expectations, for the results of the work to be performed.
- Identify the technical and quality goals that meet the needs and expectations of the customer.
- Translate the technical and quality goals into specifications that will produce the desired result.
- Consider any cost and schedule constraints within which project activities are required to be performed.
- Identify acceptance criteria for the result or measures of performance by which the results will be evaluated and customer satisfaction will be determined.

All planning documentation shall be reviewed and approved for implementation by authorized personnel before the affected planned work commences. Such documentation includes, but is not limited to, work plans, schedules, standard operating procedures, and QAPjPs.

7.2.2 Planning Requirements in the TPA

Requirements relating to planning are described in the TPA (Ecology et al., 1989), in which Sections 6.5 and 7.8, “Quality Assurance,” state that the level of QA/QC for the collection, preservation, transportation, and analysis of each sample which is required for implementation of the TPA (Ecology et al., 1989a) shall be dependent upon the DQOs for the sample. Such DQOs shall be specified in RCRA closure plans, the RCRA permit, remedial investigation/feasibility study or RCRA facility investigation/corrective measures study work plans or in other work plans, or relevant plans that may be used to describe sampling and analyses at CERCLA or RCRA past-practices units, or RCRA TSD units.

The QA/QC requirements shall range from those necessary for non-laboratory field screening activities to those necessary to support a comprehensive laboratory analysis that will be used in final decision making.

Based upon the DQOs, CHPRC shall conduct QA/QC and sampling and analysis activities which are taken to implement the TPA (Ecology et al., 1989a) in accordance with the following EPA documents:

- EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process (QA/G-4)*, as revised
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)*, as revised
- SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended

Section 6.5 of the TPA (Ecology et al., 1989a) states that in some instances, RCRA TSD units are included in operable units and are scheduled for investigation and closure. CHPRC shall follow the provisions of Section 6.5 pertaining to QA/QC for sampling and analysis activities at land disposal units.

Section 7.8 of the TPA (Ecology et al., 1989a) states that in regard to quality assurance requirements for construction of land disposal facilities, CHPRC shall comply with *Technical Guidance Document Construction Quality Assurance for Hazardous Waste Land Disposal Facilities* (EPA/530-SW-86-031).

Both of these sections of the TPA (Ecology et al., 1989a) state that for analytical chemistry and radiological laboratories CHPRC shall submit laboratory QA/QC plans to EPA and/or Ecology, or the lead regulatory agency for review as secondary documents prior to use of that laboratory. In the event that it cannot be demonstrated that data generated pursuant to the TPA (Ecology et al., 1989a) were obtained in accordance with the QA/QC requirements of Sections 6 and 7, including laboratory QA/QC plans, sampling or analysis shall be repeated, as required, by the lead regulatory agency. Such action by the lead regulatory agency shall not preclude any other action which may be taken pursuant to the TPA (Ecology et al., 1989a). For other data, the lead regulatory agency may request QA/QC documentation. Any such data that do not meet the QA/QC standards required by Sections 6 and 7 of the TPA (Ecology et al., 1989a) shall be clearly flagged and noted to indicate this fact.

7.3 Implementation

7.3.1 RCRA Activities

For RCRA permitting activities, all projects identified as operating under Interim Status requirements shall follow the planning process identified in PRC-RD-EP-15332, *Environmental Protection Requirements*, Section 2.19. For those activities identified as Final Status actions, the requirements of PRC-RD-EP-15332, Section 2.20 shall be applied. RCRA closure activities shall be conducted following the requirements listed in PRC-RD-EP-15332, Section 2.46.

7.3.2 CERCLA Activities

CERCLA activities shall follow the planning process contained in PRC-PRO-EP-25415, *CERCLA Response Actions*, as referenced in PRC-RD-EP-15332, Sections 2.5, 2.50, and 2.108; PRC-PRO-EP-15333, Section 5.50; and PRC-PRO-EP-15335, Section 5.2. For CERCLA removal actions, the planning process identified in PRC-PRO-EP-25415, Sections 4.1 through 4.9, shall be employed. All CERCLA remedial actions shall be planned and conducted following the requirements listed in PRC-PRO-EP-25415, Sections 4.10 through 4.20.

7.3.3 Major Decision Elements

The major decision elements for RCRA actions, and CERCLA and RCRA past-practice actions, are identified in Section 6.0, "Treatment, Storage, and Disposal Unit (TSD) Process," and Section 7.0, "Past Practices Processes," of the TPA Action Plan (Ecology et al., 1989b), respectively. These elements

contain provisions designed to ensure collection of quality information and data and include application of the EPA DQOs process as defined in EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process* (QA/G-4), as revised, and the EPA Requirement Document (EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* [[EPA QA/R-5](#)]), as revised. Together, these documents collectively employ a graded and logical approach to systematic planning of environmental cleanup activities to all PRC cleanup activities. The elements contained in the EPA guidance documents are designed to ensure collection and analysis of quality data. Each project must adhere to this process in order to ensure that quality data are obtained to complete the project successfully. It is the intent of this EQAPP to require that all projects follow and employ both the substantive and procedural elements of the above listed EPA guidance documents.

7.3.4 Significant Activities

All significant activities that impact decision making actions require application of the DQO process as described in EPA/240/B-06/001, *Guidance on Systematic Planning Using the Data Quality Objectives Process* (QA/G-4). After a DQO document is developed, a QAPjP must then be developed by applying EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* ([EPA QA/R-5](#)). Together, these documents collectively employ a graded and logical approach to systematic planning of environmental cleanup activities to all PRC cleanup activities. The elements contained in the EPA guidance documents are designed to ensure collection and analysis of quality data.

Adherence to the process and elements listed in these documents is mandatory and incorporated by reference the QA requirements of Sections 6.5 and 7.8 of the TPA Action Plan (Ecology et al., 1989b).

7.3.5 DQO Development

The major elements of the DQO process include the following:

- State the Problem
- Identify the Goal of the Study
- Identify Information Inputs
- Define the Study Boundaries
- Develop the Analytical Approach
- Specify Performance or Acceptance Criteria
- Develop the Plan for Obtaining Data

Each project must adhere to this process, as defined in the QA/G-4 Guidance Document, in order to ensure that quality data are obtained to complete the project successfully. Adherence to the guidance will ensure that information needed as crucial input to the QAPjP and field sampling plan (FSP) has been properly obtained.

7.3.5.1 Environmental Data Validation/Assessment

CHPRC will review environmental data for project usability. DQAs are the scientific and statistical evaluation of environmental data to determine if they meet the planning objectives of the project, and thus are of the right type, quality, and quantity to support their intended use. This review will ensure that the data satisfies the DQOs specified for the project or other data quality requirements. Contract Laboratory Program type data validation is generally not required for routine waste characterization activities. The frequency and level of validation/assessment will be described in the QA project plan or other work documents. As a minimum, the following problem areas must be resolved:

- Deviations from sampling strategy/procedures as identified in the sampling plan

- Missed holding times
- Improper or inadequate sample preservation, sample containers, or other sample handling problems
- Chain of custody or other sample integrity problems
- Laboratory QC sample result problems (e.g., QC sample results outside method specific tolerances)

Problems in any of these areas may result in data being rejected or used as qualified data if the problems do not impact the data usage as defined by the DQOs or other QA objectives. The results of this review, along with the resolution of the problems, will be documented in accordance with the project's corrective action or data review/validation/assessment processes.

7.3.5.2 Planning Environmental Data Collection Activities

Prior to planning new characterization activities, acceptable or process knowledge may be used to evaluate whether additional sampling and analysis is required when the regulations do not require analytical data to support the characterization and it is determined to be adequate for that purpose. The DQO process is used to plan and design a sampling and analysis program to evaluate the physical and chemical properties of a waste stream. The EPA DQO process described in EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process* (EPA QA/G-4), can be used to satisfy this requirement or alternative methods can be used to establish data quality requirements. The DQOs must be established prior to starting sampling and analysis activities to ensure that the proper type, quantity, and quality of data are collected to support the data user's needs. Application of the DQO process is designed to be flexible depending upon the data needs; therefore, the level of rigor applied to DQO development is defined by the graded approach. Project and facility procedures, plans, or other work instructions will define their DQOs or other QA objectives along with the methods used to establish those requirements.

After completion of the DQOs or other QA objectives, SAP, waste analysis plan, or equivalent will be developed. As a minimum, the following sampling documents will be included:

- A sampling design that provides for a sufficient number of samples to support the decisions in the DQOs or other QA objectives and obtains samples that are representative of the waste being characterized. In addition, the analytical methods selected must measure the parameters of concern at the required level of detection, precision and accuracy established in the DQOs or QA objectives.
- Identification of the sampling methods and equipment to be used and methods to clean the sampling equipment if they are not single use.
- Criteria for selecting sample sites or identification of sampling locations, amounts and frequencies.
- Types of sample containers to be used along with any preservation, holding times and custody requirements that may be applicable.
- Sample identification methods and any special instructions for handling, subdividing or compositing the samples in the field that may be applicable.
- Identification of field QC samples (e.g., field duplicates, trip blanks, and field blanks) to be taken and their frequencies.
- Instructions for taking any required field measurements, or other sampling information, and methods for documenting the data collected.

7.3.6 Quality Assurance Project Plan Development

Once the DQO process has been completed, a FSP and QAPjP shall be developed incorporating the results of the DQO process. Together these documents comprise a SAP. The principal elements of the FSP include 1) Sampling Process Design, 2) Sampling Methods, 3) Sample Handling and Chain of Custody, 4) Analytical Methods, 5) Calibration, and 6) QC.

Although no specific EPA guidance document exists for FSPs, reference is found in [EPA QA/R-5](#) for the preparation of a QAPjP. The following principal components of the QAPjP are identified in [EPA QA/R-5](#):

- Project Management
- Data Generation and Acquisition
- Assessment and Oversight
- Data Validation and Usability

EPA QA/R-5 establishes the basic set of requirements by which a system of quality programs involving environmental data collection can be planned, implemented, and assessed. QAPjPs shall contain the following elements:

- Project/Task Organization
- Problem Definition/Background
- Project/Task Description
- Quality Objectives and Criteria
- Special Training/Certification
- Documents and Records
- Sampling Process Design
- Sampling Methods
- Sample Handling and Custody
- Analytical Methods
- QC
- Instrument/Equipment Testing, Inspection, and Maintenance
- Instrument/Equipment Calibration and Frequency
- Inspection/Acceptance of Supplies and Consumables
- Non-direct Measurements
- Data Management
- Assessments and Response Actions
- Reports to Management
- Data Review, Verification, and Validation
- V&V Methods
- Reconciliation with User Requirements

It is the intent of this EQAPP to require that all projects follow and employ both the substantive and procedural elements of the above listed EPA guidance documents.

7.3.7 Environmental Information and Data Collection

Data collection through sampling and analyses activities is conducted in support of most CHPRC environmental functions and activities to demonstrate compliance to applicable federal, state, and local regulations and requirements. To assure the generation of reliable data, all aspects of the environmental data collection process must be controlled to allow work to be performed in a uniform and repeatable manner. To achieve this, CHPRC performs tasks associated with data collection, data reduction, review, validation and reporting in accordance with approved work plans, procedures, or other forms of work instructions.

Analytical data reports generated by laboratories will be prepared in accordance with an approved Statement of Work, Contract, SAP, Letter of Instruction, or other procurement/work agreement documents used to acquire analytical services.

7.3.7.1 Environmental Data Management

Environmental data will be managed to ensure the integrity and quality of the data is preserved. Data processing activities will be controlled to ensure that the introduction of errors are minimized while environmental data is being collected, transferred, stored, analyzed and reviewed. CHPRC data processing work instructions will include some or all of the following controls to avoid errors during data handling and manipulation:

- Perform periodic checks/reviews to assure data is not lost or incorrectly transcribed when transferred from one format to another.
- Minimize the number of data transfer steps and the number of personnel handling the data.
- Institute access control and accountability measures to protect hardcopy and electronic database files.
- Perform periodic reviews of manual calculations to ensure that the results obtained are accurate and correct.
- Control software programs used to perform critical data reduction functions in accordance with PRC-PRO-IRM-309, *Controlled Software Management*.

The ECQA Website contains the following checklists:

- QAPjP Review
- QAPP Review
- DQO Review
- DQA Review
- V&V Review

Application of the checklist and inclusion of all the elements contained therein is required of all CHPRC personnel conducting environmental modeling activities.

7.3.8 Transportation and Packaging

The QA requirements associated with transportation and packaging activities are addressed in PRC-RD-TP-7900, *Transportation and Packaging Program Requirements*.

7.3.9 NESHAP/Radioactive Air Emissions

The NESHAP (40 CFR 61) QAPjP is located in Appendix E of this EQAPP. ECQA provides QA Program oversight to ensure the monitoring and reporting of radioactive air emissions activities are in

accordance with NESHAP (40 CFR 61); WAC 246-247, “Radiation Protection—Air Emissions;” DOE O 436.1, *Departmental Sustainability*; and DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. This oversight includes but is not limited to surveillances and the review and approval of applicable documents including NESHAP (40 CFR 61) QAPPs, QAPjPs, and programmatic assessments. ECQA is independent of the work being conducted and these assessments constitute an independent external assessment.

The activities specific to radioactive air emissions measurements include:

- Collection of laboratory analyses performed to detect the presence of radioactive materials on particulate filter media, charcoal cartridge filters, silver zeolite cartridges, sodium hydroxide media, and silica gel or Drierite cartridges
- Compilation of laboratory analyses with measured stack flow data or maximum stack flow rates to derive releases of radioactivity and average concentrations of radioactivity in sampled emissions
- Calculation of quantities of radionuclides released and average concentrations for a calendar year, for a specific discharge point or a specific area.
- Validation of acquired data
- Preparation, review, and release of the annual reports

ECQA is responsible for:

- Scheduling and conducting surveillances/assessments of air emissions activities
- Reviewing documents to assure data quality and QA objectives are met
- Verifying resolution of nonconforming items
- Reviewing sample analysis performance at laboratories
- Approving QAPPs and QAPjPs

7.3.10 Near-Facility Monitoring

Near-facility environmental monitoring provides a level of assurance that the effluent and contamination controls for the various facilities and waste sites are effective. CHPRC groundwater sampling performs environmental sampling of soil and biota for preoperational surveys of sites in preparation for construction of new facilities or modification of existing facilities. The QA Requirements associated with Near-Facility Environmental monitoring are addressed in MSC-23333, *Mission Support Contract, Environmental Quality Assurance Program Plan*; ECQA performs required surveillances and assessments.

7.3.11 State-Regulated Wastewater Discharges

The discharge of liquid effluent streams to the ground is governed by wastewater discharge permits from Ecology, as required by RCW 90.48, “Water Pollution Control,” and WAC 173-216, “State Waste Discharge Permit Program,” except for wastewaters exempted from the permits. Three state waste discharge permits apply to facilities managed by CHPRC: (1) ST 4500, for discharges of treated wastewater from the 200 Area Effluent Treatment Facility; (2) ST 4501, for discharges of cooling water from the secondary cooling loop of the Fast Flux Test Facility Cooling Towers; and (3) ST 4502, for discharges of treated wastewater from the 200 Area Treated Effluent Disposal Facility. Additionally, ST 4511 applies to all hydrotest, maintenance, and construction discharges. All four permits have expired but continue in effect until their renewal or termination. Routine sampling is required by ST 4500 and 4502,

continuous monitoring is required by ST 4501, and sampling is required by ST 4511 under certain circumstances.

ECQA provides oversight to ensure compliance with the permit conditions.

7.3.12 National Pollutant Discharge Elimination System Discharges

The requirements of the CWA (Section 301), regarding discharges to the Columbia River, are met through compliance with the water discharge permitting system. The NPDES permit program implements the CWA prohibition on unauthorized discharges to the navigable waters of the United States. NPDES Permits allow the discharge of specific pollutants from specific outfalls at specified concentrations for a certain period of time.

As of April 20, 2011, the outfall line to the Columbia River was severed and the end filled with concrete to permanently prevent any further liquids flowing into the Columbia River. As a result of these activities, CHPRC no longer requires coverage under an NPDES permit and it was therefore terminated. Consequently, the NPDES QAPjP appendix in this document was deleted.

7.3.13 Facility Decommissioning Process: Deactivation and Decommissioning Sites

The facility decommissioning process implements the approach DOE uses to take a facility from operational status to final disposition or closure. The facility decommissioning process is described in Section 8 of the Tri-Party Agreement Action Plan and applies to facilities and structures.

The decommissioning process as applied to facilities consists of three distinct phases after facility shutdown is complete: 1) transition; 2) surveillance and maintenance; and 3) disposition. During the transition phase, facility processes include stabilization, deactivation, and decontamination. After the facility has completed the transition phase, it enters a surveillance and maintenance phase until final disposition can be accomplished. Final disposition usually involves dismantlement, deactivation or demolition. It could also involve other alternatives such as partial demolition and barrier placement. The final disposition is described and authorized in a decision document such as an Action Memorandum, Record of Decision, or other agreed upon document based on a graded approach with the regulatory agencies.

7.3.14 Planning for Modeling

Planning for modeling projects ensures that a model is scientifically sound, robust, and defensible and is just as important as planning traditional environmental measurements for data collection projects. To ensure proper planning of PRC environmental modeling activities, the EQA Program shall invoke the use of the EPA guidance document for environmental modeling (EPA/240/R-02/007, *Guidance for Quality Assurance Project Plans for Modeling*, [EPA QA/G-5M](#)). This document is the companion document to the EPA Requirements Document ([EPA QA/R-5](#)), noted above in Section 7.3.6. The QAPjP for modeling is located in Appendix G of this document.

Modeling shall be in accordance with EM-QA-001, *Office of Environmental Management Quality Assurance Program*, Attachment H, “Model Development, Use, and Validation.”

7.3.14.1 Collection of Quality Data

Collection of Quality Data is critical to the success of any modeling effort. Therefore, to ensure that quality data are obtained to provide input data to a model, all PRC environmental modeling activities must employ the data quality objectives process. The quality system planning approach invokes the data quality objectives process of [QA/G-4](#) to provide quality information and data for input to proper model development as required by [QA/G-5M](#).

7.3.14.2 Modeling Development

The modeling development and application process shall contain the following elements:

- Modeling needs and requirements analysis
- Model development
- Model application

All modeling activities shall contain the following elements:

- Project management
- Measurement and data acquisition
- Assessment and oversight
- Data validation and usability

7.3.14.3 Model Quality Objectives

Systematic planning and quality objectives should be applied to modeling projects. Model quality objectives (MQOs) should be established based on the study objectives, intended use of the output, and the type of modeling to be performed.

A graded approach is used to apply a level of planning rigor, QA, and uncertainty assessment commensurate with the nature of the work being performed and the intended use of the model output data. As a result, an acceptable plan for some modeling studies may require a qualitative discussion of the process and its objectives, while others may require extensive documentation to adequately describe their complexity.

QA and uncertainty assessments are two aspects in modeling studies that are very closely linked. Based on the perception of acceptable uncertainty, manager and modeler must consider several factors that can be broadly characterized as a tradeoff between risk in model results due to uncertainty, versus the uncertainty and risk in the management decision. Several factors must be considered, including the type of modeling needed; data needed to support the modeling effort; and the assessment of modeling accuracy, costs, and schedule. However, it is the type of modeling, as well as the intended use of the modeling results, that dictates the type of uncertainty and sensitivity analyses to be performed. QA controls and uncertainty analysis both provide assurance that the modeling results are correct. Hence, these aspects play critical roles in establishing MQOs that ensure meaningful model results for decision making.

7.3.15 Environmental Calculations

Performing calculations is necessary in the process of environmental engineering to ensure systems maintaining compliance parameters of environmental regulations meet the requirements of those regulations as documented in the CFR, and that cleanup actions are evaluated appropriately for risk to human health and the environment. See PRC-PRO-EP-40205, *CHPRC Environmental Calculation Preparation and Issue*.

7.3.16 Environmental Technology QA Requirements

Environmental technologies include, but are not limited to, facilities, structures, systems, or components that are used to remediate environmental contamination; prevent, control, or remove pollutants; or treat, dispose of, or store hazardous, radioactive, or mixed wastes. For example, an engineered barrier or cap constructed over the top of a waste burial site is a form of environmental technology.

The QA requirements applicable to environmental technologies relate principally to planning, implementing, and assessing their design, construction, and operation. These requirements are established based on the guidance provided in EPA/240/B-05/001, *Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation* (EPA QA/G-11).

Processes used to design new or modified equipment, structures, systems, and components are conducted in accordance with project/facility-specific procedures. The processes include the use of sound engineering and scientific principles and standards; incorporation of applicable requirements and design bases in design work; identification and control of design interfaces; and verification of the adequacy of design outputs and products.

Following successful design verification, designs of environmental technologies are also validated. Validation requirements are documented and may be addressed in Construction QA plans or other project planning documents. Validation includes, but is not limited to, technical assessments, qualification tests, pre-operational tests, and use of models and mockups.

Sampling activities and laboratory analysis are conducted in accordance with the QA and QC requirements specified in HASQARD (DOE/RL-96-68) and analytical methods, such as EPA/SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, or other approved methods.

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
EM-QA-001, <i>Office of Environmental Management Quality Assurance Program</i>
PRC-PRO-TP-156, <i>Onsite Hazardous Material Shipments</i>
PRC-PRO-TP-157, <i>Offsite Hazardous Material Shipments</i>
PRC-PRO-IRM-309, <i>Controlled Software Management</i>
PRC-PRO-WKM-12115, <i>Work Management</i>
PRC-PRO-CN-14990, <i>Construction Management</i>
PRC-RD-EP-15332, <i>Environmental Protection Requirements</i>
PRC-PRO-EP-15333, <i>Environmental Protection Processes</i>
PRC-PRO-EP-15334, <i>Effluent and Environmental Monitoring for Radionuclide Airborne Emissions</i>
PRC-PRO-EP-15335, <i>Environmental Permitting and Documentation Preparation</i>
PRC-PRO-EP-40205, <i>CHPRC Environmental Calculation Preparation and Issue</i>
PRC-PRO-EP-40253, <i>Risk Assessment and Modeling Integration</i>
PRC-MP-EP-35271, <i>Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program Management Plan</i>
PRC-MP-EP-40220, <i>Environmental Program and Strategic Planning Roles, Responsibilities, and Functions</i>
PRC-PRO-EP-25415, <i>CERCLA Response Actions</i>
PRC-PRO-EP-31521, <i>Sampling Designs for Environmental Data Collection</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-PRO-EP-40253, <i>Risk Assessment and Modeling Integration</i>
PRC-PRO-EN-40357, <i>Engineering Software Management</i>

8 Work Processes

8.1 Purpose

This section describes that work processes will be implemented in accordance with environmental quality requirements when applied to environmental functions and activities. To achieve the requirements, work shall be performed according to approved plans and technical documents using controlled procedures. Work processes consist of a series of actions planned and carried out by qualified personnel using approved procedures, instructions, and equipment under administrative, technical, and environmental controls.

8.2 Requirements

CHPRC work processes involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, Section 5.9; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans* ([EPA QA/R-2](#)), Section 3.9, "Implementation of Work Processes;" and the EMS, ISO 14001:2004, Criterion 4.4.6, "Operational Controls," Criterion 4.4.7, "Emergency Preparedness and Response," and Criterion 4.5.1, "Monitoring and Measurement."

Work at CHPRC shall be performed according to approved planning and technical documents using controlled procedures and in the prescribed sequence defined therein. Implementation of work shall be accomplished with a level of management oversight and verification commensurate with the importance of the particular project and the intended use of the project results.

Implementation of work processes shall be monitored and include the routine measurement of performance against established technical and quality specifications to ensure continued satisfactory performance. The independence of personnel monitoring the work performance shall be commensurate with the nature and importance of the activity.

Laboratory QA/QC includes a comprehensive program that includes the use of matrix spikes, duplicates, matrix spike duplicates, laboratory control samples, surrogates, tracers, and blanks. Appendix C contains a complete description of these QC samples including sampling methods, handling and custody, information on their holding times, field and laboratory QC elements, and acceptance criteria.

Inspection and testing of specified items, services, and processes shall be conducted using established acceptance and performance criteria. Equipment used for inspections and tests shall be calibrated and maintained. Calibration of the analytical equipment (gas chromatograph, spectrophotometer, pH meter, and other analytical equipment) is performed in accordance with HASQARD (DOE/RL-96-68), Volumes 3 and 4, as well as the manufacturer's procedures for calibration.

This EQAPP describes or references the processes, including the following roles, responsibilities, and authorities of management and staff:

- Ensuring that work is performed according to approved planning and technical documents
- Identifying operations needing procedures (e.g., standardized, special, or critical operations), preparation (including form, content, and applicability), review, approval, revision, and withdrawal of these procedures; and policy for use

- Controlling and documenting the release, change, and use of planned procedures, including any necessary approvals, specific times and points for implementing changes, removal of obsolete documentation from work areas, and verification that the changes are made as prescribed

8.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-RD-EP-15332, <i>Environmental Protection Requirements</i>
PRC-PRO-IRM-309, <i>Controlled Software Management</i>
PRC-PRO-WKM-12115, <i>Work Management</i>
PRC-PRO-EP-15333, <i>Environmental Protection Processes</i>
PRC-PRO-EP-15334, <i>Effluent and Environmental Monitoring</i>
PRC-PRO-EP-15335, <i>Environmental Permitting and Documentation Preparation</i>
PRC-MP-MS-19361, <i>CH2M HILL Plateau Remediation Company Project Execution Plan</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-PRO-EP-40205, <i>CHPRC Environmental Calculation Preparation and Issue</i>
PRC-MP-EP-35271, <i>Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program Management Plan</i>
PRC-MP-EP-40220, <i>Environmental Program and Strategic Planning Roles, Responsibilities, and Functions</i>

8.4 Project Specific

8.4.1 Soil and Groundwater Remediation Project

The Soil and Groundwater Remediation Project QAPjP is located in Appendix C of this document.

8.4.2 LERF/ETF/TEDF

The Liquid Effluent Retention Facility (LERF), 200 Area Effluent Treatment Facility (ETF), and the 200 Area Treated Effluent Disposal Facility (TEDF) QAPjP is found in Appendix D of this document.

8.4.3 Other Projects

Other projects do not use a project specific QAPjP but instead use this EQAPP as their Environmental QAPjP.

9 Assessment and Response

9.1 Purpose

The purpose of this section is to document how the organization will determine the suitability and effectiveness of the implemented quality system and the quality performance of the environmental programs to which the quality system applies.

ECQA develops and maintains an audit and review program which documents how the organization determines the suitability and effectiveness of the implemented quality system, the quality performance of the environmental programs to which it applies, EC, and EMS. The adequacy of the quality system is assessed at least annually.

9.2 Requirements

The CHPRC assessment program involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, Section 5.10; EPA/240/B-01/002, *EPA Requirements for Quality Management Plans* ([EPA QA/R-2](#)), Section 3.10, "Assessment and Response;" and the EMS, ISO 14001:2004, Criteria 4.5.1, "Monitoring and Measurement," 4.5.2, "Evaluation of Compliance," 4.5.3, "Nonconformity Corrective Action, and Preventive Action," 4.5.5, "Internal Audits," and 4.6, "Management Review."

Assessments of environmental programs shall be planned, scheduled, and periodically conducted, and the results should be evaluated to determine the suitability and effectiveness of the implemented quality system and of the quality performance of the environmental programs to which it applies.

Assessments shall include an evaluation to determine and verify whether technical requirements, not just procedural compliance, are being implemented effectively. Assessments shall be performed according to approved written procedures, based on careful planning of the scope of the assessment and the information needed. Assessment results shall be documented, reported to, and reviewed by management.

This EQAPP references the processes, including the following roles, responsibilities, and authorities of management and staff, pertaining to both management and technical assessments:

- Assessing the adequacy of the quality system at least annually
- Planning, implementing, and documenting assessments and reporting assessment results to management including how to select an assessment tool, the expected frequency of their application to environmental programs, and the roles and responsibilities of assessors
- Determining the level of competence, experience, and training necessary to ensure that personnel conducting assessments are technically knowledgeable, have no real or perceived conflict of interest, and have no direct involvement or responsibility for the work being assessed
- Ensuring that personnel conducting assessments have sufficient authority, access to programs, managers, documents, and records, and organizational freedom for the following:
 - Identify both quality problems and noteworthy practices
 - Propose recommendations for resolving quality problems
 - Independently confirm implementation and effectiveness of solutions
- Reviewing and responding to findings by management

- Identifying how and when corrective actions are to be taken in response to the findings of the assessment, ensuring corrective actions are made promptly, confirming the implementation and effectiveness of any corrective action, and documenting (including the identification of root causes, the determination of whether the problem is unique or has more generic implications, and recommendation of procedures to prevent recurrence) such actions
- Addressing any disputes encountered as a result of assessments

Available assessment tools include MAs, work site assessments, Management Observation Program, audits or independent assessments, EMS assessments, and surveillances, as defined in the following subsections.

9.2.1 Management Assessments

MAs evaluate how well management processes are meeting organizational objectives and customer expectations. MAs are normally performed to determine whether organizational programs are properly established and effectively implemented and are performed in accordance with PRC-PRO-QA-246, *Management Assessment*.

9.2.2 Work Site Assessments

Work Site Assessments provide a tool to evaluate organizational processes and performance as well as procedure adequacy and compliance. Work Site Assessments will be performed in accordance with PRC-PRO-QA-40090, *Work Site Assessment*.

9.2.3 Management Observation Program

The Management Observation Program provides a tool to help establish and maintain oversight of work activities that are performed in accordance with PRC-PRO-QA-40099, *Management Observation Program*.

9.2.4 Independent Assessments/Audits

Independent assessments are planned and conducted to measure the adequacy of work performed against defined requirements and to determine the effectiveness of requirements implementation. Independent assessments evaluate the following:

- Defined requirements against applicable codes and standards sets
- Quality of items and processes to identify deviations from the assigned requirements
- Opportunities for improvements in the work activities being assessed

Independent assessments will be performed in accordance with PRC-PRO-QA-9662, *Independent Assessment Process*.

9.2.5 Environmental Management Systems Assessments

The CRD (DOE O 436.1, *Departmental Sustainability*), requires that each DOE Site implement an EMS that is certified to or conforms with ISO 14001:2004. ISO 14001, Section 4.5.5 requires internal audits of the EMS to be conducted at planned intervals. These internal audits of the EMS are performed in accordance with Appendix F of this document. Appendix F establishes the requirements for the inspection and assessment of environmental programs, processes and activities, including the EMS. Appendix F documents how Environmental Compliance Inspections and EMS Assessments will be planned, performed, and documented and who will perform them and the qualifications required to perform the assessments.

9.2.6 Surveillances

In accordance with PRC-PRO-QA-9769, *Surveillance Process*, surveillances are similar in concept to independent assessments but differ in the extent covered. Surveillances may be conducted to verify conformance with specified requirements and to evaluate the adequacy and effectiveness of activities affecting the quality of work processes and products and corrective actions taken to address identified issues. ECQA performs Surveillances of environmental functions and activities.

9.2.7 Environmental Compliance Inspections

EC inspections of CHPRC legal and other requirements will be performed as determined by the ECQA Manager. The EC inspections will determine compliance with PRC-RD-EP-15332, *Environmental Protection Requirements*, permit requirements, and project level procedures. PRC-MP-EP-40220, *Environmental Program and Strategic Planning Roles, Responsibilities, and Functions*, Section 4.2.11, defines the Environmental Compliance Advocate Program. The Environmental Compliance Advocate Program is managed by the ECQA group to provide review and evaluation of field compliance activities. This Program is intended to provide a service to CHPRC projects, to evaluate project day-to-day regulatory compliance issues and to address environmental issues that arise during the conduct of field activities. These field issues may include, for example, improper storage of chemicals, waste material, recyclable materials, and equipment.

The goals of the program are to build a positive compliance margin, to reduce overall CHPRC vulnerabilities, and to provide an environmental service to the projects for continuous improvement. Personnel assigned to support the Environmental Compliance Advocate Program may assist in performing the assessments of facilities and/or program areas as planned and scheduled. These personnel may come from CHPRC or an external organization as required. The ECQA group will be responsible for the coordination, scheduling, facilitation, and implementation of these assessments and will lead the assessment team.

9.2.7.1 EC Inspector Qualifications

EC inspections will be performed by ECQA personnel who do not have direct responsibility for the work in the areas they are inspecting and who have demonstrated capability, as determined by the ECQA Manager, based on education, training, and experience.

EC inspectors must have completed the following required reading:

- CHPRC-00189, *CH2M HILL Plateau Remediation Company Environmental Quality Assurance Program Plan*
- PRC-RD-EP-15332, *Environmental Protection Requirements*
- PRC-PRO-EP-15333, *Environmental Protection Processes*
- PRC-PRO-EP-25415, *CERCLA Response Actions*
- DOE/RL-96-68, *HASQARD*
- PRC-MP-EP-40182, *Environmental Management System Manual*
- PRC-MP-EP-40220, *Environmental Program and Strategic Planning Roles, Responsibilities, and Functions*

9.2.7.2 EC Inspection Process

The ECQA Manager or designee will select an individual to organize and lead the inspection. Hereafter, this individual is referred to as the Inspection Lead and may be the only individual performing the inspection. An SME will be involved in each inspection, as deemed necessary, by the Inspection Lead.

The Inspection Lead will notify the responsible Environmental Manager (EM) within a week of the inspection. The EMs will be the point of contact for compliance inspections. Each EM will designate and document a backup to the EM to contact when the EM is not available.

The Inspection Lead will prepare a checklist of the requirements being inspected. These checklists are guidelines and do not restrict review of other requirements relative to the inspection subject. Checklists may be retained for “Information Only” purposes and are not considered records. The EC Inspection Lead will conduct the inspection evaluating specified requirements by observing the activity, interviewing personnel associated with the performance and control of the activity, and/or reviewing pertinent documents and records associated with the activity.

Formal entrance or exit meetings will not be required. However, the Inspection Lead will immediately notify the responsible management of the following potential conditions:

- Imminent danger to personnel
- Negative environmental impacts
- Critical data errors
- Equipment damage
- Regulatory non-compliance

The Inspection Lead will evaluate the above conditions for application of Stop Work in accordance with DOE-0343, *Stop Work*.

Upon completing the EC inspection, the Inspection Lead will provide an informal outbriefing to the responsible manager of the assessed organization.

9.2.7.3 EC Inspection Reports

The EC inspection report number will be obtained from the Integrated Evaluation Plan (IEP). The IEP tracking number is assigned by the EP&SP Project Assessment Coordinator, as required, by PRC-PRO-QA-40091, *Integrated Assessment Planning*.

As required by PRC-PRO-QA-9769, *Surveillance Process*, the Inspection Lead will forward the draft inspection report to the responsible managers of the assessed organization/facility/process for factual accuracy prior to issuing the report.

The findings and opportunities for improvement identified in the report will be entered into the Condition Reporting and Resolution System (CRRS) in accordance with PRC-PRO-QA-052, *Issues Management*. ECQA will have closure authority for all CRRS items identified as findings issued in response to the EC inspection.

9.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-MP-QA-40092, <i>CHPRC Assessment Program Plan</i>
PRC-PRO-OP-055, <i>Startup Readiness</i>
PRC-PRO-QA-052, <i>Issues Management</i>
PRC-PRO-QA-246, <i>Management Assessment</i>
PRC-PRO-QA-9662, <i>Independent Assessment Process</i>
PRC-PRO-QA-9769, <i>Surveillance Process</i>
PRC-PRO-QA-40090, <i>Work Site Assessment</i>
PRC-PRO-QA-40091, <i>Integrated Assessment Planning</i>
PRC-PRO-QA-40099, <i>Management Observation Program</i>
PRC-PRO-QA-40102, <i>Quality Assurance Engineer Training and Qualification Program</i>
PRC-RD-EP-15332, <i>Environmental Protection Requirements</i>
PRC-PRO-EP-15333, <i>Environmental Protection Processes</i>
PRC-PRO-EP-25415, <i>CERCLA Response Actions</i>
DOE/RL-96-68, <i>HASQARD</i>
PRC-MP-EP-40220, <i>Environmental Program and Strategic Planning Roles, Responsibilities, and Functions</i>

10 Quality Improvement

10.1 Purpose

In accordance with [EPA QA/R-2](#), this section documents how the organization will improve the organization's quality system. The quality of PRC environmental activities is the responsibility of each CHPRC employee involved in any activity that impacts the environment. Such activities include, but are not limited to, environmental sampling and analysis and waste remediation. ECQA is responsible for monitoring and assessing all CHPRC environmental quality improvement efforts.

10.2 Requirements

CHPRC quality improvement involving environmental functions and activities shall be consistent with the QA requirements found in ANSI/ASQ E4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*, Section 5.11; *EPA Requirements for Quality Management Plans* ([EPA QA/R-2](#)), Section 3.11, "Quality Improvement;" and the EMS, ISO 14001:2004 Criteria 4.5.2, "Evaluation of Compliance," 4.5.3, "Nonconformity Corrective Action and Preventive Action," and 4.6, "Management Review."

A quality improvement process shall be established and implemented for continual development and improvement of the quality system.

Procedures shall be established and implemented to prevent as well as detect and correct problems that adversely affect quality during all phases of technical and management activities. When problems are found to be significant, the relationship between cause and effect and the root causes shall be determined. The root causes should be determined to the extent practicable before permanent preventive measures are planned and implemented. Appropriate actions shall be planned, documented, and implemented in a timely manner.

PRC-PRO-QA-052, *Issues Management*, establishes the requirements and responsibilities for identifying, planning, implementing, and evaluating the effectiveness of quality improvement activities and describes the process to ensure continuous quality improvement, including the following roles and responsibilities of management and staff:

- Ensuring that conditions adverse to quality are:
 - Prevented
 - Identified promptly including a determination of the nature and extent of the problem
 - Corrected, as soon as practical, including implementing appropriate corrective actions and actions to prevent reoccurrence
 - Documented (all corrective actions)
 - Tracked (all actions to closure)
- Encouraging staff at all levels to establish communications between customers and suppliers, identifying process improvement opportunities, and identifying and offering solutions to problems

Environmental samples are considered to be nonconforming when the quality or integrity of the sample can no longer be assured, and the nonconformance reporting process will be used to document the nonconforming condition unless another problem reporting mechanism is defined in project plans or procedures. Some examples of sample nonconformances are missing or broken chain of custody, sampling instructions not followed, lost sample traceability, or duplicated sample identification numbers.

- The QA Manager supporting a facility or activity may order a suspension of activities, if conditions affecting quality have not been addressed by cognizant management. Any suspension of subcontractor activities will be issued through the applicable CHPRC Contract Specialist.
- All organizations shall implement systematic approaches for performing their work in a manner that will achieve quality objectives while safely and effectively accomplishing missions.

10.3 Implementation

The following table lists the applicable procedures required to implement these requirements. Project specific procedures are located on the CHPRC website: <http://prc.rl.gov/pps/>

CHPRC Document Number and Title
PRC-MP-EP-40182, <i>Environmental Management System Manual</i>
PRC-MP-EP-40502, <i>CHPRC Environmental Assessment Management Plan</i>
PRC-MP-QA-40092, <i>CHPRC Assessment Program Plan</i>
PRC-MP-QA-599, <i>Quality Assurance Program</i>
PRC-PRO-EM-058, <i>Event Initial Investigation and Critique Meeting Process</i>
PRC-PRO-EM-060, <i>Reporting Occurrences and Processing Operations Information</i>
PRC-PRO-MS-067, <i>Lessons Learned</i>
PRC-PRO-QA-052, <i>Issues Management</i>
PRC-PRO-QA-246, <i>Management Assessment</i>
PRC-PRO-QA-24741, <i>Performance Analysis Process</i>
PRC-PRO-QA-298, <i>Nonconforming Items</i>
PRC-PRO-QA-40099, <i>Management Observation Program</i>
PRC-PRO-QA-40102, <i>Quality Assurance Engineer Training and Qualification Program</i>
PRC-PRO-QA-9662, <i>Independent Assessment Process</i>
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Appendix A

ECQA/EP Responsibilities Table

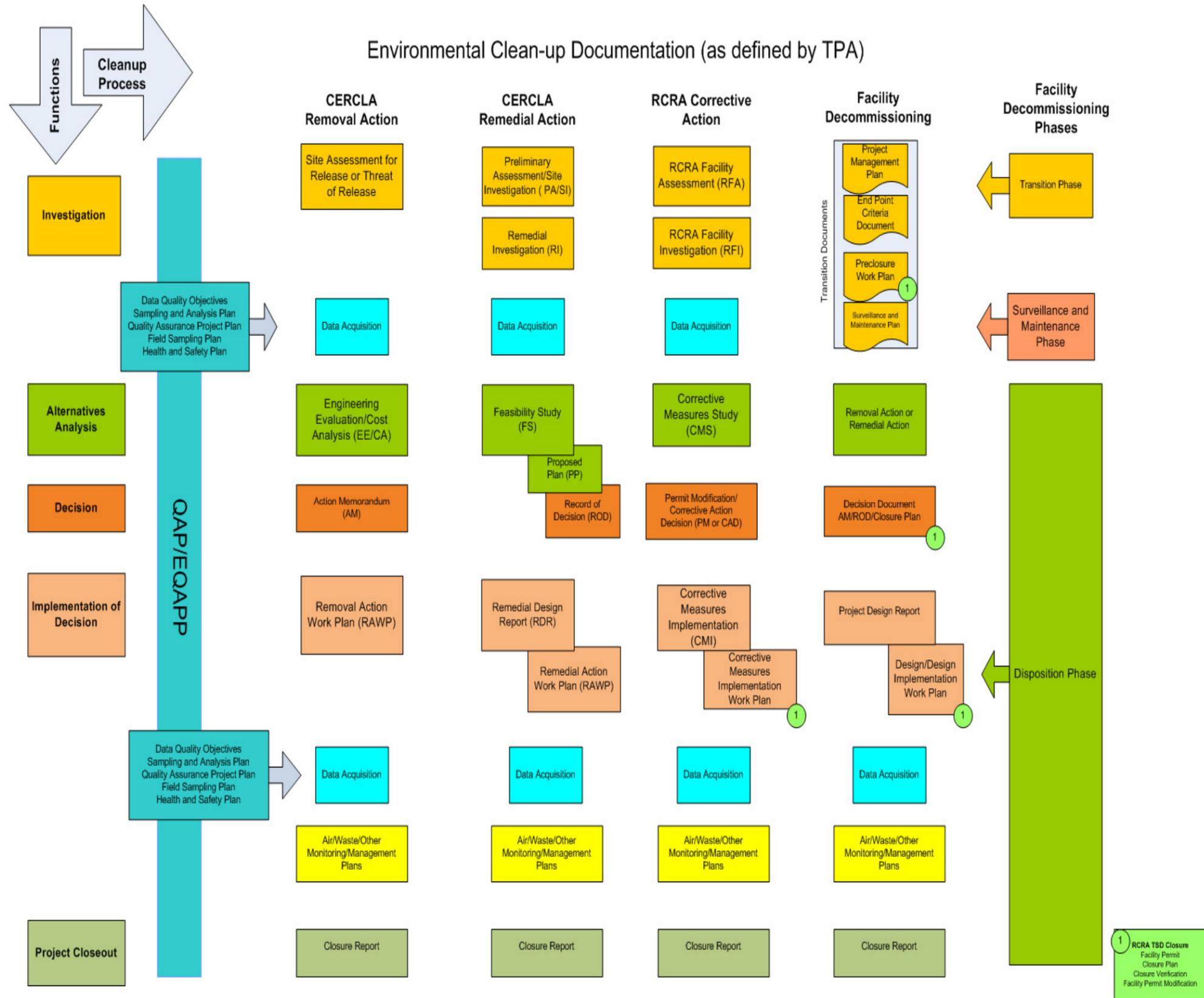
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PRC-MP-EP-40020,

***Environmental Program and Strategic Planning Roles, Responsibilities,
and Functions***

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Appendix B
Environmental Cleanup Documentation



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Appendix C

Soil and Groundwater Remediation Quality Assurance Project Plan

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Terms

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3	CHPRC	CH2M HILL Plateau Remediation Company
4	CRRS	Condition Reporting and Resolution System
5	DOE	U.S. Department of Energy
6	DQA	data quality assessment
7	DQO	data quality objective
8	DUP	field duplicate
9	DVZ	deep vadose zone
10	EB	equipment blank
11	ECQA	Environmental Compliance and Quality Assurance
12	EP	emergency preparedness
13	EPA	U.S. Environment Protection Agency
14	FS	feasibility study
15	FTB	full trip blank
16	FXR	field transfer blank
17	GC	gas chromatography
18	HEIS	Hanford Environmental Information System
19	ICP/MS	inductively coupled plasma/mass spectrometry
20	IDMS	Integrated Document Management System
21	IHEL	Industrial Hygiene Equipment Laboratory
22	LCS	laboratory control sample
23	M&TE	measuring and test equipment
24	MB	method blank
25	MDA	minimum detectable activity
26	MDL	method detection limit
27	MS	matrix spike
28	MSD	matrix spike duplicate
29	NIST	National Institute of Standards and Technology
30	OJT	on-the-job training

1	OU	operable unit
2	PCB	polychlorinated biphenyl
3	PE	performance evaluation
4	QA	quality assurance
5	QAE	quality assurance engineer
6	QAO	quality assurance objective
7	QAPjP	quality assurance project plan
8	QC	quality control
9	RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
10	RI	remedial investigation
11	RPD	relative percent difference
12	RSD	relative standard deviation
13	S&GRP	Soil and Groundwater Remediation Project
14	S&IH	Safety and Industrial Hygiene
15	SAP	sampling and analysis plan
16	SDR	Sample Data and Reporting
17	SMR	Sample Management and Reporting
18	SOW	statement of work
19	VOA	volatile organic analysis
20	VOC	volatile organic compound

C1 Background

The primary goals of the project are to prevent groundwater degradation, remediate groundwater, monitor groundwater, and remediate waste sites. Cleanup is designed to return groundwater and waste sites to beneficial use, where possible, or at least prevent further degradation.

C2 Project/Task Description

The Soil and Groundwater Remediation Project (S&GRP) is focused on the following four objectives:

- Shrink the Contaminated Area - Reduce the contaminated surface area to eliminate the threat to groundwater through removal actions on soil contamination waste sites under the purview of CH2M HILL Plateau Remediation Company (CHPRC).
- Reduce Recharge - Reduce the transport of contaminants to groundwater from water released onto the soil.
- Remediate Groundwater - Complete remedial actions at pump-and-treat sites.
- Monitor Groundwater - Determine the groundwater monitoring needs for long-term stewardship of the Central Plateau, evaluate new technologies that may be more effective, and decommission existing groundwater monitoring wells that are no longer functional or useful.

S&GRP produces a variety of products in conjunction with the listed activities. Examples of these include *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)* and *Resource Conservation and Recovery Act of 1976 (RCRA)* regulatory documents, descriptions of work for drilling and well decommissioning campaigns, statements of work (SOWs), data quality objective (DQO) reports, data quality assessments (DQAs), work plans, sampling and analysis plans (SAPs), well summary reports, test plans, remediation reports, design media for remediation facilities, quarterly and annual groundwater monitoring reports, and annual summary reports for treatment systems.

Activities conducted by S&GRP include groundwater pump-and-treat system design, construction, operation, and maintenance; well drilling/DPTs supporting groundwater remediation and waste site characterization; test pit excavation; coordination of geophysical data acquisition; sampling; aquifer testing; field screening/analysis; coordination of laboratory services; and data management.

C3 Program

The overall quality assurance (QA) program requirements for S&GRP are governed by PRC-MP-QA-599, *Quality Assurance Program*, and the Tri-Party Agreement (Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order*), Sections 6.5 and 7.8.

CHPRC implements QA requirements based upon a graded approach. The graded approach for environmental activities that involve generating, acquiring or using environmental data is based on the intended use of the data, analytical protocol selected, and parameters of accuracy, precision, comparability, completeness, and representativeness. Additional grading criteria are available in Attachment C-4 of this plan.

CHPRC-00189, *CH2M HILL Plateau Remediation Company Environmental Quality Assurance Program Plan*, encompasses all environmental activity performed by CHPRC. This S&GRP Quality Assurance Project Plan (QAPjP) is subordinate to CHPRC-00189.

1 Specific CHPRC and S&GRP implementing procedures are listed in Attachment C-3. Environmental
 2 regulations require the development of remedial investigation and feasibility study (RI/FS) work plans for
 3 CERCLA operable units (OUs) as well as RCRA facility investigation/corrective measures study work
 4 plans for RCRA past practice units. These work plans always include a SAP, or equivalent document,
 5 which in turn contains a QAPjP. Previously issued unit specific QAPjPs were not developed under a single
 6 QA program and as a result exhibit some variation and outdated citations. Unit specific QAPjPs shall
 7 comply with format and content requirements of U.S. Environmental Protection Agency (EPA) guidance
 8 (EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* [EPA QA/R-5]).
 9 This document describes how S&GRP accomplishes work in support of those unit specific QAPjPs and
 10 addresses the general QA elements applied across S&GRP waste sites and groundwater remediation
 11 activities.

12 This QAPjP defines the processes used by S&GRP to produce quality data and ensure that operations are
 13 fully compliant with all applicable quality affecting requirements. This plan provides additional QA
 14 requirements for S&GRP such as quality objectives, methods, operational approaches, and goals for
 15 performing the work scope. This plan also explains how project goals are achieved and supplements the
 16 quality management system provided in PRC-MP-QA-599.

17 Table C-1 describes the relationship between various sections of this QAPjP and EPA/240/B-01/003
 18 (EPA QA/R-5).

Table C-1. Quality Assurance Project Plan Section Descriptions

EPA QA/R-5 Criteria	Title	QAPjP Section
Project Management	Project/Task Organization	C1
	Problem Definition and Background	Background
	Project Task Description	Background
	Quality Objectives and Criteria	C5.1, Att C.2.2
	Special Training/Certification	C2, AttC-1-2, Att C-2-1
	Documents and Records	C4, Att C-1-4.1, Att C-2-4, Att C-2-12
Data Generation and Acquisition	Sample Process Design	C5, Att C-1-3.2
	Sampling Methods	C5.3, Att C-1-3.2
	Sample Handling and Custody	C5.4, Att C-1-4.1, Att C-2- 6
	Analytical Methods	C5.5 Att C-2-8
	Quality Control	C3, C5, Att C-2-10
	Instrument/Equipment Testing, Inspection and Maintenance	C8, Att C-2-14
	Instrument/Equipment Calibration and Frequency	C8, Att C-2-7, Att C-2- 11.4
	Inspection and Acceptance of Supplies and Consumables	C7, Att C-2-18
	Non Direct Measurement	C5.1, Att C-2-3

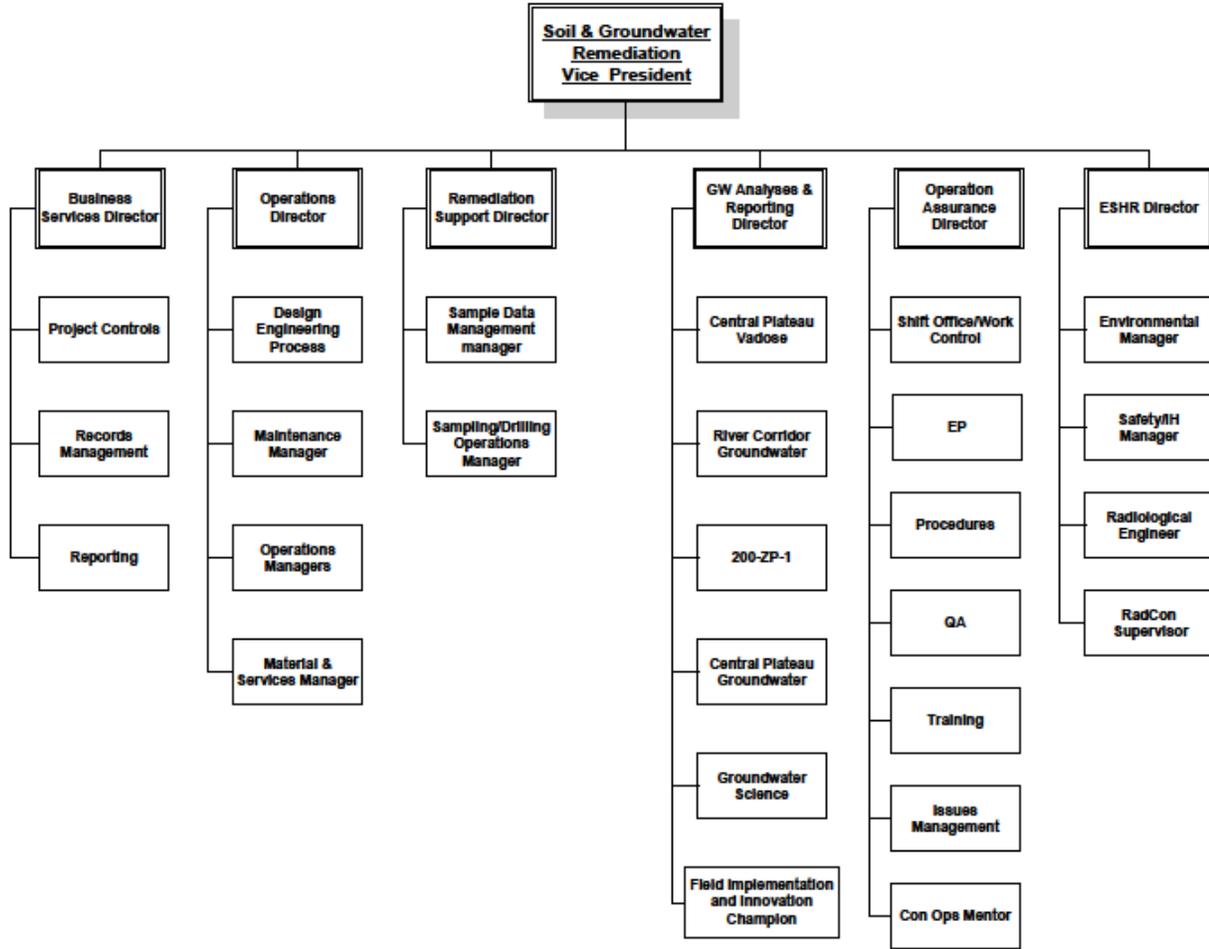
Table C-1. Quality Assurance Project Plan Section Descriptions

EPA QA/R-5 Criteria	Title	QAPjP Section
	Data Management	C 4, C5.6 Att C-2-9
Assessment and Oversight	Assessment and Response Actions	C3, C9, C10
	Reports to Management	C3, C9
Data Validation and Usability	Data Review, Verification, and Validation	C5.6, Att C-1-5, Att C-2-11.0
	Verification and Validation Methods	C5.6, Att C-2-9
	Reconciliation with User Requirements	C5.2, C5.7

1

2 The policy of CHPRC and S&GRP management is to direct activities in a manner that is cost effective and
 3 ensures that the results meet or exceed the customer’s expectations. The achievement of quality will
 4 require the total commitment of all S&GRP employees (Figure C-1) to follow PRC-RD-LEG-10348,
 5 *Legal and Ethical Conduct*. The quality management system described in this plan fosters compliance with
 6 approved standards, plans, and procedures. Those standards, plans, and procedures incorporate
 7 expectations for safety and environmentally protective work within controls to support the principles and
 8 functions of the Integrated Environment, Safety, and Health Management System. All S&GRP personnel
 9 have the authority to stop work when serious quality, safety or health conditions exist. PRC-PRO-SH-
 10 3468, *Stop Work Responsibility*, states that all employees are given the responsibility and authority to stop
 11 work when they are convinced that a situation exists which places themselves, their coworker(s), or the
 12 environment in danger.

13 This plan will be reviewed and updated, as necessary, when added work scope elements require additional
 14 QA considerations.



1

Figure C-1. Soil and Groundwater Remediation Project Organization

2

1 **C3.1 Business Services**

2 S&GRP Business Services is responsible for the overall implementation and direction of the estimating,
 3 cost engineering, and planning and scheduling functions that provide services, reporting, and methods for
 4 timely and accurate response to the client, project management, departmental, and company requirements.
 5 Business Services is also responsible for Records Management and Reporting.

6 **C3.2 Operations**

7 The Operations team runs six Pump and Treat facilities on the Hanford Site. The organization provides
 8 the necessary trained and qualified resources required to implement remediation activities at the pump and
 9 treat facilities. Operations consists of 100 Area Operations, 200 Area Operations, Engineering and
 10 Maintenance.
 11

12 **3.2.1 100 Area Operations**

13 100 Area Operations runs five Pump and Treat water treatment facilities HX, DX, KX, KR-4 and K
 14 West. The goal is to eliminate the risk of contaminated groundwater reaching the Columbia River. These
 15 facilities extract contaminated groundwater from beneath the surface via network of wells, transfer the
 16 groundwater to the treatment facility where contaminants are removed, and inject the clean, treated water
 17 back into the aquifer.

18 **3.2.2 200 Area Operations**

19 The 200W Pump and Treat consists of the two main process buildings and six transfer buildings. The
 20 289T (Bio Building, Bio Pad and Lime System/Pad) treats non-radioactive contaminants in ground water
 21 using a combination of biological, filtration and organic vapor stripping processes. The Bio Building
 22 consists of a separate administrative area with lunch room and rest rooms, control room, laboratory and
 23 electrical equipment room. Process equipment is located throughout the main process area of the Bio
 24 Building, Bio Pad and Lime System/Pad. The 289TA (Rad Building) treats radioactive contaminants in
 25 ground through the use of ion exchange media. Extractions wells are connected to the main process
 26 buildings via three extraction transfer buildings; 289TB (ETB-1), 289TC (ETB-2) and 289TF (ETB-
 27 3). Injection wells are connected to the main process buildings via three injection transfer buildings;
 28 289TD (ITB-1), 289TE (ITB-2) and 216-ZP1A (Injection Manifold Building).

29 **3.2.3 Engineering**

30 The S&GRP engineering program includes elements to assure the appropriate development and
 31 maintenance of the technical baseline for S&GRP. This includes a definition of the elements needed for a
 32 design baseline; appropriate approval authorities; technical staff. Technical direction is applied to the
 33 design of new facilities, the maintenance of existing facilities. Technical direction includes equipment
 34 specification, engineering strategy, independent review of designs, and acceptance testing
 35 strategy/oversight. Engineering staff are integrated into Project Teams to ensure that Systems, Structures,
 36 and Components (SSCs) safely and efficiently perform their defined functions.
 37 Configuration control of the design basis and baseline is a key element of the engineering program. The
 38 program implements elements to provide independent checking, assessments, evaluations, and engineering
 39 processes, including value engineering, for implementing continuous improvement.
 40 S&GRP design authorities, under the leadership of the Engineering Manager, define and maintain the
 41 design basis and verifies that the project design meets the functional design criteria, technical
 42 specifications, applicable standards, and that safety is integrated appropriately into the design. Individual
 43 design authorities will specify equipment design criteria. The CHPRC engineering requirements are
 44 captured in a number of procedures and RDs, with the overarching requirements captured in PRC-RD-EN-
 45 1819, CHPRC Engineering.

1 **3.2.4 Maintenance**

2 The maintenance department is responsible for efficiently maintaining the pump and treat facilities to
 3 include Preventive and Corrective maintenance and implementing modifications to improve the operation
 4 and reliability of the facilities. In addition to the maintenance of pump and treat facilities, the maintenance
 5 department supports other groups and projects within the SGRP, such as sampling equipment calibration
 6 and maintenance, maintaining the Automated Well Level Network, NR-2 Apatite injections etc.
 7

8 **C3.3 Remediation Support**

9 The Remediation Support Organization is responsible for the development, management, and execution of
 10 well installation and maintenance, sample collection, and data management activities within S&GRP.

11 The organization provides the necessary trained and qualified resources required to plan and implement
 12 characterization activities from the development of planning documents through field execution and
 13 managing the resultant data.

14 **C3.4 Sample Management and Reporting**

15 The Sample Management and Reporting (SMR) organization provides centralized management, planning,
 16 development and oversight of sampling and analytical activities within S&GRP; the following primary
 17 responsibilities are included:

- 18 • Ensure proper project planning for data quality through development and review of DQO reports,
 19 DQA reports, and SAPs.
- 20 • Serve as the primary interface between project data users and onsite and offsite analytical laboratories
 21 to ensure required laboratory performance levels.
- 22 • Ensure the quality of field and analytical data through implementation of multiple quality control (QC)
 23 measures.
- 24 • Ensure the integrity and traceability of data through implementation of proper and appropriate sample
 25 and data management processes.
- 26 • Evaluate and document quarterly and annual laboratory performance data.

27 **C3.5 Sampling/Drilling Operations**

28 The Sampling Operations Organization is responsible for collecting groundwater, soil, vapor, and other
 29 miscellaneous media samples, processing the samples as necessary, and shipping the samples for analysis;
 30 the following primary responsibilities are included:

- 31 • Collect representative samples through the use of quality procedures and training.
- 32 • Serve as the subject matter experts for sampling activities within CHPRC.
- 33 • Maintain a diverse inventory of sampling equipment, vehicles, and trained personnel to support current
 34 and project sampling activities.

35 The Drilling Operations Organization serves as the central site resource responsible for the installation and
 36 maintenance of groundwater wells and drilling activities on the Hanford Site. The organization is
 37 responsible for identifying, developing, and maintaining the necessary contract and CHPRC resource base

1 to support safe, efficient installation of wells and characterization borings; the following primary
2 responsibilities are included:

- 3 • Planning, coordinating, and implementing well drilling and decommissioning for Hanford Site wells
4 according to project specific requirements. This includes drilling wells to Washington State standards
5 and preparing all required submittals and notifications required by state law. It also includes providing
6 well related information for site databases. Decommissioning includes identifying all wells that are
7 surplus to monitoring needs or that represent a pathway for contaminant migration to groundwater and
8 sealing the well to Washington State standards.
- 9 • Provide maintenance and modification of existing wells, installation and removal of pumps, and
10 cleaning and remediation of wells for optimal usage. Updating of site databases when changes to well
11 configuration occur is also included.
- 12 • Operate the modular storage units that were established for purgewater management under a CERCLA
13 non-time critical removal action (i.e., DOE/RL-2009-39, *Investigation-Derived Waste Purgewater*
14 *Management Action Memorandum*, and DOE/RL-2009-80, *Investigation Derived Waste Purgewater*
15 *Management Work Plan*). The modular storage units will be operated in accordance with the
16 regulatory standards for miscellaneous units to ensure purgewater management is protective of human
17 health and the environment. Routine operation of the modular storage units includes inspection,
18 freeboard measurement, maintenance, leak detection riser water level measurements, purgewater truck
19 transfers, and inter-tank transfers. Upon completion of service, the Modular Storage Units will be
20 disassembled and dispositioned in a manner that minimizes the need for further maintenance, is
21 protective, and returns the land to appearance and use of surrounding land areas to the degree possible
22 given the nature of the activity. Design, operation, and closure standards for the removal action are
23 addressed in detail in Appendix A of DOE/RL-2009-39.

24 **C3.6 Groundwater Remediation**

25 Groundwater Remediation's mission is to restore groundwater to drinking standards and to protect the
26 Columbia River by removing contaminants of concern. Groundwater Remediation evaluates thousands of
27 samples yearly and ensures compliance with state and federal laws. The group is also responsible for
28 collecting pump-and-treat data and tracking trends to show the cleanup performance.

29 **C3.7 RCRA Groundwater Monitoring**

30 The RCRA Monitoring and Reporting group ensures that CHPRC and the U.S. Department of Energy
31 (DOE) are compliant with groundwater protection requirements, which include state and federal laws, and
32 DOE Orders. The waste sites include operating landfills and liquid effluent units; inactive cribs, ponds,
33 and ditches; and the single-shell tank farms. Scientists evaluate results of more than 600 samples and 6,000
34 analyses each year to determine the impacts of these units on groundwater quality. The evaluated results
35 are documented in a comprehensive Hanford Site report.

36 **C3.8 Groundwater Remediation Operable Units**

37 Hanford Site OUs are designated to group numerous units into manageable areas for investigation,
38 response action, and prioritizing cleanup. There are 10 groundwater OUs: 6 along the Columbia River, and
39 4 within the Central Plateau. The OU Project Managers are responsible for investigating groundwater
40 contamination and implementing remediation processes. The Project Managers coordinate the
41 characterization of groundwater plumes, development of conceptual models of contaminant distribution,
42 assessment of risk, fate and transport modeling and evaluation of remedial alternatives to support the

1 remedial action decision-making process. After remedies (e.g. pump-and-treat and barriers) are defined,
 2 the OU Project Managers also coordinate design, construction, and monitoring of the performance of
 3 groundwater remedial actions.

4 **C3.9 Deep Vadose Zone Project**

5 DOE, contractors, EPA, and the Washington State Department of Ecology are collaborating to identify
 6 solutions for characterizing, remediating, and monitoring the deep vadose zone (DVZ). The vadose zone is
 7 the area between the surface and the groundwater at Hanford's Central Plateau. It is approximately 250 ft
 8 thick. The vadose zone was contaminated during Hanford Site plutonium production operations. The DVZ
 9 is the region just above the groundwater.

10 **C3.10 Operations Assurance**

11 Operations Assurance is a structured process for executing project activities that supports improving
 12 operational efficiencies and performance. Operations Assurance consists of training, procedures, Lessons
 13 Learned, Issues Management, Shift Office, Emergency Preparedness (EP), and Project QA.

14 **C3.11 Training**

15 The S&GRP training team delivers comprehensive training programs designed for the worker and
 16 management. Therefore, every level of the project is assured to remain in compliance with DOE,
 17 Washington State, and CH2M HILL directives at all times. The training team's detailed assessments of
 18 implementation and effectiveness help track productivity and assist with opportunities within the project.

19 **C3.12 Issues Management**

20 S&GRP Issues Management provides the project with oversight of the Condition Reporting and
 21 Resolution (CRRS) process. Issues Management personnel are available to assist in completion of
 22 corrective actions.

23 CRRS is a user-friendly, intranet database that all employees can use to report and track issues, conditions,
 24 or events, positive or needing improvement, from initiation to resolution.

25 **C3.13 Work Control/Shift Office**

26 S&GRP work control provides the work management process for initiating, validating, developing
 27 instruction, approving, scheduling, releasing, performing, changing, and closing out work documents.

28 The Soil and Groundwater Remediation Project Shift Office provides consistent, updated information
 29 regarding ongoing and scheduled work activities occurring within S&GRP. The Shift Office will provide a
 30 perspective of daily work in progress and highlight potential impacts. This information is available to all
 31 project team members, visitors, and assessors. For questions or assistance, email the [^SGRP-Shift Office](#).

32 **C3.14 Emergency Preparedness**

33 S&GRP EP ensures the protection of workers, the public, and the environment. The team trains Facility
 34 Emergency Response Organizations at facilities to respond to emergency events that could happen at their
 35 projects. EP develops and maintains S&GRP emergency response procedures and plans. The team also
 36 conducts routine EP drills to evaluate the effectiveness of the program and provide constant assurance of
 37 emergency readiness.

1 **C3.15 Project Quality Assurance Engineer**

2 Project quality assurance engineers (QAEs) are responsible for integrating quality into the project
3 documents and for performing project specific surveillances to ensure the attainment of quality.
4 The Project QAE will confer with Environmental Compliance and Quality Assurance (ECQA) and resolve
5 any identified issues relating to environmental data collection, monitoring, and reporting.

6 The Project QAE, integrating with ECQA, will provide quality engineering support for project
7 documentation including, but not limited to, DQOs, SAPs, and QAPjPs for appropriate quality requirement
8 implementation. Project QAEs are responsible for maintaining their QAE qualification with regard to
9 environmental activities.

10 The CHPRC QA organization supporting a facility or activity defines the QA program and has
11 independent authority to assess the systematic implementation of requirements specified. It also has direct
12 access to management at a level necessary for effecting appropriate action. QA has sufficient authority,
13 access to work areas, and organizational freedom to accomplish the following objectives:

- 14 • Identify quality problems.
- 15 • Initiate, recommend, or provide solutions to quality problems through designated channels.
- 16 • Verify implementation of solutions and ensure that further processing, delivery, installation, or use of
17 defective materials, equipment, and services are controlled until proper disposition of the
18 nonconformance, deficiency, or unsatisfactory condition has occurred.

19 Facility/program QAEs interface with their QA Manager for assistance and technical advice on QA
20 programmatic matters and implementation issues. The CHPRC organization structure and assignment of
21 responsibility is designed to assure that quality is achieved and maintained by those who perform the work.
22 The achievement of quality is verified by persons not directly responsible for supervising or performing
23 the work.

24 **C3.16 Environmental, Safety, Health, and Radiological**

25 The Environmental, Safety, Health, and Radiological Director is responsible for project level direction and
26 coordination of environmental, safety, industrial hygiene, and radiological activities.

27 **C3.17 Environmental Manager**

28 The Environmental Manager is responsible for ensuring that environmental protection, chemical
29 management, and environmental compliance requirements are implemented.

30 **C3.18 Safety and Industrial Hygiene Manager**

31 Safety and Industrial Hygiene (S&IH) provides services to the project that include S&IH oversight. S&IH
32 is responsible for ensuring that the project follows safe work practices in accordance with state and federal
33 safety and health regulations by analyzing hazards and prescribing controls for work performed by the
34 project including subcontractors.

35 **C3.19 Radiological Engineer/RadCon Supervisor**

36 Radiological Control is responsible for implementation of the following radiological control and protection
37 requirements:

- 38 • Implement radiological control and protection requirements.

- 1 • Evaluate and prescribe appropriate radiological protection equipment for S&GRP work activities.
- 2 • Conduct hazard screening as part of the work planning process to identify radiological hazards and
3 establish necessary controls.
- 4 • Verify radiological conditions of the work area are consistent with work planning assumptions prior to
5 entry into the work area or commencement of the radiological work activity.

6 **C4 Personnel Training and Qualification**

7 Personnel shall be trained and qualified to ensure that they are capable of performing assigned work.
8 Personnel shall have continuing training to ensure that job proficiency is maintained.

9 A combination of general and job specific safety and operational training is provided to prepare employees
10 to operate and maintain S&GRP activities in a safe, effective, efficient, and environmentally sound
11 manner. PRC-PRO-TQ-459, *Environmental Training*, PRC-MP-TQ-011, *CH2M HILL Plateau*
12 *Remediation Company (CHPRC) Qualification and Training Plan*; and PRC-RD-TQ-11061, *Training*
13 *Requirements*, all form the basis for the training provided to personnel assigned or matrixed to S&GRP.
14 A training coordinator is assigned to ensure that S&GRP personnel receive the required training and
15 maintain their qualification.

16 State regulations require that drillers hold a valid State of Washington drillers license per WAC 173-162,
17 “Regulation and Licensing of Well Contractors and Operators.” Certified journeyman electricians with
18 qualifications meeting WAC 296-401B-455 subcategory 03A are required for electrical connections on
19 pumps in resource protection wells. These requirements are passed on to drilling contractors.

20 Sampling personnel are required to have training in U.S. Department of Transportation hazardous material
21 general awareness, and hazardous material driver’s training as directed by management.

22 **C5 Quality Improvement**

23 Corrective actions identified from CHPRC assessments will be processed in accordance with PRC-PRO-
24 QA-052, *Issues Management*. Nonconformances identified by CHPRC will be processed in accordance
25 with PRC-PRO-QA-298, *Nonconforming Items*. Subcontractor nonconformances will be processed in
26 accordance with contract documents and subcontractor QA Program requirements.

27 Problems with well construction, sample collection, sample custody, or data acquisition that affect the
28 quality of data or impair the ability to acquire data due to failure to meet contract requirements, or failure
29 to follow procedure shall be documented in accordance with PRC-PRO-QA-298; PRC-PRO-QA-9769,
30 *Surveillance Process*, or the condition report as described in PRC-PRO-QA-052, as appropriate. Problems
31 within the scope of the SMR Sample and Data Management group related to sampling, analytical support,
32 and data validation support processes that affect the quality of data are documented, evaluated, and
33 dispositioned in accordance with GRP-EE-01-2.7, *Sample Management and Reporting Sample Issue*
34 *Resolution*, and GRP-EE-01-2.10, *Sample Management and Reporting Request for Data Review (RDR)*, as
35 applicable.

36 QA surveillance reports are provided to project management for action or information depending on the
37 results of surveillance. Surveillance reports and assessments are processed in accordance with
38 PRC-PRO-QA-052.

1 C5.1 Field Quality Control

2 Field QC evaluations are routinely performed as part of the sampling QC program. Field QC samples
3 include field duplicates, split samples, and three types of field blanks. The three types of field blanks are
4 full trip, field transfer, and equipment blanks. Field blanks are typically prepared using high purity reagent
5 water. Silica sand should be used, instead of reagent water, when required by the SAP. Typical types of
6 field QC are described as follows:

- 7 1. Full trip blanks (FTBs), also known as trip blanks or daily's, are prepared by the sampling team prior
8 to traveling to the sampling site. The preserved bottle set is either for volatile organic analysis (VOA)
9 only or identical to the set that will be collected in the field. It is filled with high purity reagent water
10 (or dead water from well 699-S11-E12AP for low-level tritium FTBs¹). The bottles are sealed and
11 transported, unopened, to the field in the same storage containers used for samples collected that day.
12 Collected FTBs are analyzed for the same constituents as the samples. FTBs are used to evaluate
13 potential contamination of the samples due to the sample bottles, preservative, handling, storage and
14 transportation.
- 15 2. Field transfer blanks (FXRs), also known as field blanks, are preserved VOA sample bottles filled at
16 the sample collection site with high purity reagent water that has been transported to the field.
17 After collection, FXR bottles are sealed and placed in the same storage containers with the samples
18 from the associated sampling event. FXR samples are analyzed for volatile organic compounds
19 (VOCs) only. FXRs are used to evaluate potential contamination caused by conditions in the field.
- 20 3. Equipment blanks (EBs), also known as equipment rinsates, contain high purity reagent water² that is
21 passed through the pump or put in contact with the sampling surfaces of the equipment to collect blank
22 samples identical to the sample set that will be collected. EB bottles are placed in the same storage
23 containers with samples from the associated sampling event. EB samples are analyzed for the same
24 constituents as the samples from the associated sampling event. EBs are used to evaluate the
25 effectiveness of the cleaning process to ensure that samples are not cross-contaminated from previous
26 sampling events.
- 27 4. Field duplicates (DUPs), also known as replicates, are two samples that are collected as close as
28 possible to the same time and same location and are intended to be identical. VOA soil duplicates are
29 sampled as collocated samples, as described below. DUPs for soil are collected and homogenized
30 before dividing into two separate samples in the field. DUPs are stored and transported together and
31 are analyzed for the same constituents. DUPs are used to determine precision for both sampling and
32 laboratory measurements. Field split samples (SPLITs) are two samples that are collected as close as
33 possible to the same time and same location and are intended to be identical. VOA soil splits are
34 sampled as collocated samples. SPLITs are stored in separate containers and analyzed by different
35 laboratories for similar analytes. SPLITs are inter-laboratory comparison samples used to evaluate
36 comparability between laboratories.

37 Collocated samples are two samples collected as close as possible to the same time and location which are
38 not homogenized. This sampling protocol is used where homogenizing samples for split or duplicate
39 samples would impact the quality of the data. S&GRP refers to collocated samples as duplicates or splits.

¹ Because of the low detection levels achieved in the low level tritium analysis, special low-level tritium water must be used. This low level tritium water, known as "dead water," is collected yearly, or as needed, from well 699-S11-E12AP or other approved source.

² Alternative matrices may be used as appropriate, for example: vapor sampling equipment.

- 1 Using several types of field QC samples monitors the adequacy of the sampling system and the integrity of
 2 samples from field collection through laboratory analysis. Field QC samples and their typical frequencies
 3 are listed in Table C-2. SAPs and groundwater monitoring plans address project specific field QC
 4 frequency, if applicable. Typical acceptance criteria for field QC are shown in Table C-2. SAPs and
 5 groundwater monitoring plans address project specific field QC acceptance criteria, if applicable.

Table C-2. Quality Control Samples

Sample Type	Primary Characteristics Evaluated	Frequency
Field Quality Control		
Full Trip Blank (FTB)	Contamination from containers or transportation	1 per 20 well trips
Field Transfer Blank (FXR)	Contamination from sampling site	1 each day VOCs sampled (wells or boreholes)
Equipment Blank (EB)	Contamination from nondedicated equipment	As needed ^{a,b}
Replicate/Duplicate Samples (DUP)	Reproducibility/sampling precision	1 in 20 sampling events (well trips or soil samples ^c)
Field Split Samples (SPLIT)	Inter-laboratory comparability	As Needed
Laboratory Quality Control		
Method Blanks	Laboratory contamination	1 per batch
Lab Duplicates	Laboratory reproducibility and precision	^d
Matrix Spikes	Matrix effect/laboratory accuracy	^d
Matrix Spike Duplicates	Laboratory reproducibility, accuracy, and precision	^d
Surrogates	Recovery/yield	^d
Tracers	Recovery/yield	^d
Laboratory Control Samples	Laboratory accuracy	1 per batch
Laboratory Performance Evaluation		
Performance Evaluation Programs ^e	Laboratory accuracy	Annual
Double-Blind Standards	Laboratory accuracy	Quarterly ^f
Audit/Assessment	Overall laboratory performance and operations	Annually ^g or every 3 years ^h

a. For portable Grundfos pumps, EBs are collected 1 per 10 well trips. Whenever a new type of nondedicated equipment is used, an EB shall be collected every time sampling occurs until it can be shown that less frequent collection of equipment blanks is adequate to monitor the decontamination procedure for the nondedicated equipment.

b. Vendor provided borehole equipment is considered dedicated equipment and EBs are not typically performed.

c. Soil grab samples are exempted from duplicate sampling.

d. As defined in the laboratory contract or QA plan and/or analysis procedures.

e. Nationally recognized program, such as DOE Mixed Analyte Performance Evaluation Program or Environmental Resource Associates.

f. Water matrix double-blind standards are submitted quarterly. Soil matrix double-blind standards are submitted by request of Analytical Services.

Table C-2. Quality Control Samples

Sample Type	Primary Characteristics Evaluated	Frequency
g. DOE Quality Systems for Analytical Services requires annual audit of commercial laboratories. h. HASQARD (DOE/RL-96-68) does not define a frequency for assessment of onsite laboratories. Three year evaluated supplier list requirement is typically applied. DOE = U.S. Department of Energy EB = equipment blank QA = quality assurance QC = quality control VOC = volatile organic compound		

- 1
- 2 Field and laboratory QC sample results are evaluated according to criteria defined in Table C-3.
- 3 Laboratory performance is evaluated according to criteria defined in Tables C-4 and C-5.

Table C-3. Field and Laboratory Quality Control Elements and Acceptance Criteria

Analyte ^a	QC Element	Acceptance Criteria		Corrective Action
		Water	Soil	
General Chemical Parameters				
Alkalinity	MB ^b	< MDL < 5% Sample concentration		Flagged with “C”
Chemical Oxygen Demand	LCS	80-120% recovery ^c	70-130% recovery ^c	Data reviewed ^d
Conductivity	DUP	≤ 20% RPD	≤ 30% RPD	Data reviewed ^d
Hexavalent Chromium	MS ^c	75-125% recovery ^c	75-125% recovery ^c	Flagged with “N”
Oil and Grease	EB, FTB	< 2 times MDL	< 2 times MDL	Flagged with “Q”
pH	Field Duplicate	≤ 20% RPD ^f	≤ 30% RPD ^f	Flagged with “Q”
Total Residue				
Total Dissolved Solids				
Total Suspended Solids				
Total Organic Carbon				
Total Organic Halides				
Ammonia and Anions				
Ammonia	MB	< MDL < 5% Sample concentration		Flagged with “C”
Anions by IC	LCS	80-120% recovery ^c	70-130% recovery ^c	Data reviewed ^d
Cyanide	DUP	≤ 20% RPD	≤ 30% RPD	Data reviewed ^(d)
	MS	75-125% recovery ^c	75-125% recovery ^c	Flagged with “N”
	EB, FTB	< 2 times MDL	< 2 times MDL	Flagged with “Q”
	Field Duplicate	≤ 20% RPD ^(f)	≤ 30% RPD ^f	Flagged with “Q”

Table C-3. Field and Laboratory Quality Control Elements and Acceptance Criteria

Analyte ^a	QC Element	Acceptance Criteria		Corrective Action
		Water	Soil	
Metals				
ICP Metals ICP/MS Metals Mercury	MB	< RDL < 5% Sample concentration		Flagged with “C”
	LCS	80-120% recovery ^c	70-130% recovery ^c	Data reviewed ^d
	MS MSD	75-125% recovery ^c ≤ 20% RPD	75-125% recovery ^c ≤ 30% RPD	Flagged with “N” Data reviewed ^d
	EB, FTB	< 2 times MDL	< 2 times MDL	Flagged with “Q”
	Field Duplicate	≤ 20% RPD ^f	≤ 30% RPD ^f	Flagged with “Q”
Volatile Organic Compounds				
Volatiles by GC/MS Total Petroleum Hydrocarbons by GC	MB	< MDL < 5% Sample concentration		Flagged with “B”
	LCS	% Recovery ^g		Data reviewed ^d
	MS MSD	% Recovery ^g ≤ 20% RPD		Flagged with “T” if analyzed by GC/MS, otherwise “N” Data reviewed ^d
	SUR	% Recovery ^g		Data reviewed ^d
	EB, FTB, FXR	< 2 times MDL ^h		Flagged with “Q”
	Field Duplicate	≤ 20% RPD / ≤ 30% RPD ^f		Flagged with “Q”
Semivolatile Organic Compounds				
Herbicides by GC PCBs by GC Pesticides by GC Phenols by GC Semivolatiles by GC/MS	MB	< MDL < 5% Sample concentration		Flagged with “B”
	LCS	% Recovery ^g		Data reviewed ^d
	MS MSD	% Recovery ^g ≤ 20% RPD		Flagged with “T” if analyzed by GC/MS, otherwise “N” Data reviewed ^d
	SUR	% Recovery ^g		Data reviewed ^d
	EB, FTB	< 2 times MDL ^h		Flagged with “Q”
	Field Duplicate	≤ 20% RPD / ≤ 30% RPD ^f		Flagged with “Q”
Radiological Parameters				

Table C-3. Field and Laboratory Quality Control Elements and Acceptance Criteria

Analyte ^a	QC Element	Acceptance Criteria		Corrective Action
		Water	Soil	
Gamma Scan	MB	< MDA		Flagged with “B”
Gross Alpha		< 5% Sample concentration		
Gross Beta	LCS	70-130% recovery		Data reviewed ^d
Iodine-129	DUP	≤ 20% RPD / ≤ 30% RPD		Data reviewed ^d
Plutonium (isotopic)				
Strontium-89/90	MS ⁱ	60-140% recovery		Flagged with “N”
Technetium-99	EB, FTB	< 2X MDA		Flagged with “Q”
Tritium	Field Duplicate	≤ 20% RPD / ≤ 30% RPD ^f		Flagged with “Q”
Tritium (low-level)				
Uranium (isotopic)	Tracer	20-105%		Data reviewed ^d
Uranium (total)	Carrier	30-105%		Data reviewed ^d

- a. Specific analytes and methods for determination are available from the Sample Management and Reporting organization.
- b. Does not apply to pH, conductivity, total residue, total dissolved solids, total suspended solids, and alkalinity.
- c. Laboratory-determined, statistically derived control limits may also be used. Such limits are reported with the data.
- d. After review, corrective actions are determined on a case-by-case basis. Corrective actions may include a laboratory recheck or flagging the data as suspect (Y flag) or rejected (R flag).
- e. Applies to total organic carbon and total organic halides only.
- f. Applies only in cases where one or both results are greater than 5X the detection limit.
- g. Determined by the laboratory based on historical data. Control limits are reported with the data.
- h. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the acceptance criteria is < 5 times the MDL.
- i. Applies only to technetium-99 and total uranium by ICP-MS and tritium.

Data Flags:

- B, C = possible laboratory contamination (analyte was detected in the associated method blank)
- N = result may be biased (associated matrix spike result was outside the acceptance limits)
- Q = problem with associated field QC sample (blank and/or duplicate results were out of limits)
- T = semivolatile organic analyte GC/MS matrix spike outlier
- DUP = laboratory matrix duplicate
- EB = equipment blank
- FTB = full trip blank
- FXR = field transfer blank
- GC = gas chromatography
- ICP = inductively coupled plasma
- ICP/MS = inductively coupled plasma-mass spectrometry
- LCS = laboratory control sample
- MB = method blank
- MDA = minimum detectable activity
- MDL = method detection limit
- MS = matrix spike

Table C-3. Field and Laboratory Quality Control Elements and Acceptance Criteria

Analyte ^a	QC Element	Acceptance Criteria		Corrective Action
		Water	Soil	
MSD	= matrix spike duplicate			
PCB	= polychlorinated biphenyl			
RPD	= relative percent difference			
SUR	= surrogate			

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2 Laboratory Quality Control

3 Internal QA and QC programs are maintained by laboratories utilized by S&GRP. Laboratory QA includes
4 a comprehensive QC program, which includes the use of matrix spikes (MSs), matrix duplicates (DUPs),
5 matrix spike duplicates (MSDs), laboratory control samples (LCSs), surrogates (SURs), tracers, and
6 method blanks (MBs). These samples are recommended in the guidance documents and are required by
7 EPA protocol. Laboratory QC and their typical frequencies are listed in Table C3-1. Acceptance criteria
8 are shown in Table C3-2. SAPs and groundwater monitoring plans address project specific laboratory QC
9 frequency and acceptance criteria, if applicable:

- 10 1. Sample Duplicate (DUP) – An intra-laboratory replicate sample that is used to evaluate the precision
11 of a method in a given sample matrix.
- 12 2. Matrix Spike (MS) – An aliquot of a sample spiked with a known concentration of target analyte(s).
13 The MS is used to assess the bias of a method in a given sample matrix. Spiking occurs prior to sample
14 preparation and analysis.
- 15 3. Matrix Spike Duplicate (MSD) – A replicate spiked aliquot of a sample that is subjected to the entire
16 sample preparation and analytical process. MSD results are used to determine the bias and precision of
17 a method in a given sample matrix.
- 18 4. Laboratory Control Sample (LCS) – A control matrix (e.g., reagent water) spiked with analytes
19 representative of the target analytes or a certified reference material that is used to evaluate laboratory
20 accuracy.
- 21 5. Method Blank (MB) – An analyte-free matrix to which all reagents are added in the same volumes or
22 proportions as used in the sample processing. The method blank is carried through the complete
23 sample preparations and analytical procedure. The method blank is used to quantify contamination
24 resulting from the analytical process.
- 25 6. Surrogate (SUR) – A compound added to all samples in the analysis batch (field samples and QC
26 samples) prior to preparation. The surrogate is typically similar in chemical composition to the analyte
27 being determined, yet not normally encountered in most samples. Surrogates are expected to respond
28 to the preparation and measurement systems in a manner similar to the analytes of interest. Because
29 surrogates are added to all standards, samples and QC samples, they are used to evaluate overall
30 method performance in a given matrix. Surrogates are used only in organic analyses.
- 31 7. Tracer – A tracer is a known quantity of radioactive isotope that is different from that of the isotope of
32 interest but is expected to behave similarly and is added to an aliquot of sample. Sample results are
33 generally corrected based on tracer recovery.

1 8. Sample Storage blanks shall be used as appropriate. Storage blanks are used to monitor potential cross-
 2 contamination of samples due to improper storage conditions. The specifics of this type of monitoring
 3 should be described in laboratory specific standard operating procedures implemented by laboratories
 4 providing analytical services to S&GRP.

5 Laboratories are required to analyze samples within the holding time specified by SW-846, *Test Methods*
 6 *for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*. In some
 7 instances, constituents in the samples not analyzed within the holding times may be compromised by
 8 volatilizing, decomposing, or other chemical changes. Data from samples analyzed outside the holding
 9 time are flagged in the Hanford Environmental Information System (HEIS) database with an H. Holding
 10 times for constituents frequently analyzed by S&GRP are listed in Tables C-4 and C-5.

Table C-4. Groundwater Holding Times

Constituents	Holding Times
Volatile Organics	14 days*
Semivolatile Organics	7 days before extraction 40 days after extraction
Pesticides	7 days before extraction 40 days after extraction
Polychlorinated biphenyls	1 year before extraction 1 year after extraction
Chlorinated herbicides	7 days before extraction 40 days after extraction
Phenols	7 days before extraction 40 days after extraction
Oil and Grease	28 days
Metals (Except Hg and Cr+6)	6 months
Hexavalent Chromium	24 hours
Mercury	28 days
Alkalinity	14 days
Cyanide	14 days
Bromide	28 days
Chloride	28 days
Fluoride	28 days
Nitrate	48 hours
Nitrite	48 hours
Phosphate	48 hours
Sulfate	28 days
Total Organic Carbon	28 days

Table C-4. Groundwater Holding Times

Constituents	Holding Times
Total Organic Halides	28 days
Chemical Oxygen Demand	28 days

* SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B* (Table 4.1).

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Table C-5. Holding Times for Soil and Sediment Analyses

Constituents	Holding Times
Volatile Organics	14 days maximum preserved*
Semivolatile Organics	14 days before extraction 40 days after extraction
Pesticides	14 days before extraction 40 days after extraction
Polychlorinated Biphenyls	None before extraction
Chlorinated Herbicides	14 days before extraction 40 days after extraction
Phenols	14 days before extraction 40 days after extraction
Oil and Grease	28 days
Metals (except Hg and Cr+6)	6 months
Hexavalent Chromium	30 days before extraction 7 days after extraction
Mercury	28 days
Alkalinity	14 days
Cyanide	14 days
Bromide	28 days
Chloride	28 days
Fluoride	28 days
Nitrate	28 days prior to extraction 48 hours after extraction
Nitrite	28 days prior to extraction 48 hours after extraction
Phosphate	28 days prior to extraction 48 hours after extraction
Sulfate	28 days
Total Organic Carbon	28 days
Total Organic Halides	28 days
Chemical Oxygen Demand	28 days

*Refer to EPA Method 5035A for other potential preservation hold times.

1 **Laboratory Performance**

2 In addition to laboratory QC, laboratory performance is assessed through performance evaluation (PE)
3 programs, double-blind standards, and laboratory audits. PE programs are national studies in which blind
4 standards are analyzed for chemical and radiological constituents. The most common PE programs are the
5 Water Pollution and InterLaB RadCheM proficiency programs managed by Environmental Resources
6 Associates and the Mixed Analyte Performance Evaluation Program managed by DOE. PE program
7 results for each laboratory are evaluated against the evaluation criteria in Table C-2 by SMR staff.

8 In addition to the national PE programs, S&GRP maintains an internal double-blind performance
9 assessment program. Double-blind standards, which are prepared to look like groundwater samples, are
10 submitted to the laboratories in triplicate or quadruplicate on a quarterly basis. These standards provide
11 useful information on the precision and accuracy of laboratory methods. The constituent list and spiking
12 levels are subject to change to assist in the evaluation of laboratory performance and resolution of potential
13 problems. Specific information on the constituents, spiking levels, and laboratory performance is
14 maintained in the SDR project files. Results of the double-blind standard performance assessment are
15 evaluated quarterly by SDR staff. Acceptance criteria for double-blind samples are provided in Table C-6.

16 Laboratory activities are regularly assessed by surveillance and auditing processes to ensure that quality
17 problems are prevented and/or detected. Evaluation of laboratory and analytical activities is performed by
18 various oversight organizations. Audits are performed on the commercial laboratories by the DOE
19 Consolidated Audit Program. These audits are based on the DOE Quality Systems for Analytical Services
20 requirements. Assessments are performed by integrated contractor assessment teams according to
21 DOE/RL-96-68, *Hanford Analytical Quality Assurance Requirements Documents (HASQARD)*.
22 Surveillances are performed by CHPRC Environmental QA staff. They can cover any areas of interest
23 including laboratory, field, or data management processes.

24 Laboratory performance issues identified through QC evaluations are communicated to the laboratory for
25 resolution. Each laboratory implements a corrective action program that is used to track and document
26 issue resolution. S&GRP monitors laboratory corrective action and performance to ensure that the
27 corrective actions taken are adequate to resolve issues and prevent recurrence.

Table C-6. Double-Blind Standards Suggested Frequency and Acceptance Criteria

Constituent	Sample Frequency	Control Limits* (%)
General Chemical Parameters		
Specific conductance	Annual	±25
Total organic carbon (potassium hydrogen phthalate spike)	Quarterly	±25
Total organic halides (2,4,5-trichlorophenol spike)	Semiannually	±25
Total organic halides (carbon tetrachloride, chloroform, and trichloroethene spike)	Semiannually	±25
Ammonia and Anions		
Chloride	Quarterly	±25
Cyanide	Semiannually	±25
Fluoride	Quarterly	±25

Table C-6. Double-Blind Standards Suggested Frequency and Acceptance Criteria

Constituent	Sample Frequency	Control Limits* (%)
Nitrate as Nitrogen	Quarterly	±25
Nitrite as Nitrogen	Quarterly	±25
Metals		
Arsenic	Annually	±20
Barium	Annually	±20
Cadmium	Annually	±20
Chromium (Total)	Quarterly	±20
Cobalt	Semiannually	±20
Copper	Semiannually	±20
Hexavalent Chromium	Quarterly	±20
Iron	Annually	±20
Magnesium	Annually	±20
Manganese	Annually	±20
Nickel	Annually	±20
Potassium	Annually	±20
Silver	Annually	±20
Sodium	Annually	±20
Vanadium	Annually	±20
Zinc	Annually	±20
Volatile Organic Compounds		
Carbon Tetrachloride	Quarterly	±25
Chloroform	Semiannually	±25
Trichloroethene	Quarterly	±25
Radiological Parameters		
Gross Alpha (plutonium-239 spike)	Quarterly	±30
Gross Beta (strontium-90 spike)	Quarterly	±30
Cesium-137	Semiannually	±30
Cobalt-60	Semiannually	±30
Iodine-129	Semiannually	±30

Table C-6. Double-Blind Standards Suggested Frequency and Acceptance Criteria

Constituent	Sample Frequency	Control Limits* (%)
Plutonium-239	Quarterly	±30
Strontium-90	Quarterly	±30
Technetium-99	Quarterly	±30
Tritium	Semiannually	±30
Uranium-238	Quarterly	±30
Note: Blind standards are generally submitted in triplicate or quadruplicate.		
* Each result must be within the specified percentage of the known value to be acceptable.		

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Table C-7. Performance Evaluation Program Acceptance Criteria

Requirement	Frequency	Acceptance Criteria	Corrective Action
General Chemical Parameters			
Participation in National Performance Evaluation program	Annual	80%	Review laboratory corrective action plan. Divert samples to alternative laboratory, if necessary.
		No consecutive failures	Review laboratory corrective action plan. Divert samples to alternative laboratory, if necessary.
Double-Blind Performance Evaluation Program	Quarterly	80%	Notify laboratory. Review data. Divert samples to alternative laboratory, if necessary.

2

3 Field and laboratory QC and laboratory performance are reviewed quarterly, and results are compiled for
4 evaluation and trending. Results of the evaluations are documented in the quarterly and annual
5 groundwater reports.

6 **C6 Documents and Quality Records**

7 Documents shall be prepared, reviewed, approved, issued, used, and revised to prescribe processes, specify
8 requirements, or establish designs. Records shall be specified, prepared, reviewed, approved, and
9 maintained.

10 The most current version of this QA Project Plan is posted on the CHPRC Environmental Compliance and
11 Quality Assurance Website. The tasks performed by S&GRP typically result in the publication of a plan or
12 report that is subsequently retained in the Integrated Document Management System (IDMS). Records
13 associated with S&GRP will be maintained in accordance with PRC-PRO-IRM-10588, *Records*
14 *Management Processes*.

15 Specific record retention requirements will be documented in PRC-PRO-IRM-10588. Records include, but
16 are not limited to, the following documents:

- 1 • Plans or reports
- 2 • Completed procedure data sheets
- 3 • QAIP records
- 4 • Procurement documents or submittals
- 5 • Measuring and test equipment (M&TE) calibration records
- 6 • Nonconformance reports

7 Contract related documentation will be managed in accordance with PRC-PRO-AC-16405, *Submittal*
8 *Management System*.

9 Field log books are controlled and maintained in accordance with PRC-PRO-IRM-10863, *Notebooks and*
10 *Logbooks*.

11 S&GRP procedures will provide guidance on records generated for specific groundwater remediation and
12 protection activities.

13 Environmental data are controlled in the Environmental Information System and SMR system per
14 procedure series GRP-EE-1.0-2.X, GRP-EE-9.0-X.XX, and CP-GPP-EE-9.0-X.XX.

15 Documentation related to the maintenance of groundwater treatment facilities is produced and retained in
16 accordance with PRC-PRO-WKM-12115, *Work Management*.

17 **C7 Work Processes**

18 Work shall be performed in accordance with established technical standards and administrative controls
19 using approved instructions or procedures. Items shall be identified and controlled to ensure their proper
20 use. Items shall be maintained to prevent damage, loss, or deterioration. Equipment used by S&GRP
21 personnel or subcontractors for process monitoring or data collection shall be calibrated and maintained as
22 appropriate.

23 **C7.1 Quality Objectives and Criteria**

24 Data used to make environmental decisions are collected and managed in accordance with DQOs to ensure
25 that data quality is maintained. The DQO process ensures that data collected are of a type, quantity, and
26 quality commensurate with the importance and intended application for the data. Parameters of quality
27 assurance objectives (QAOs) for groundwater data include precision, accuracy, completeness,
28 comparability, and representativeness. DQOs and QAOs ensure that decisions made using the data are
29 technically and scientifically sound and legally defensible. S&GRP utilizes a DQO process adapted from
30 EPA/240/B-06/001, *Guidance on Systematic Planning Using the Data Quality Objectives Process*
31 (EPA-QA/G-4), which is described in GRP-EE-01-1.2, *Sample Management and Reporting Data Quality*
32 *Objectives*.

33 Nondirect measurement data feed into the DQO process. These data would consist of previous DQO
34 reports, existing RI/FS reports, existing SAPs, and data stored in the Waste Information Data System,
35 HEIS, Hanford Geographic Information System, and IDMS.

36 **C7.2 Customer Data Quality Requirements**

37 The following parameters that are normally used by the customer to define project data quality
38 requirements and evaluate results include precision, accuracy, comparability, and representativeness:

- 1 • Precision is a measure of the degree to which individual measurements of the same property under
2 similar conditions approach the same value. The precision of an analytical measurement is evaluated
3 using replicate standards and/or samples. Acceptance criteria are established for each applicable test
4 method.
- 5 • Accuracy refers to the degree to which a measurement agrees with an accepted reference or true value.
6 Accuracy is evaluated by the use of certified standards, control standards, and/or spiked samples to
7 calculate percent recovery. Acceptance criteria for percent recovery are established for each applicable
8 test method.
- 9 • Completeness is a measure of the amount of valid data obtained from a measurement system compared
10 to the amount that was expected to be obtained under correct normal conditions.
- 11 • Comparability expresses the degree to which one data set can be compared to another. The operating
12 conditions of instruments, consistency of analyst training, stability of the analytical environment, and
13 use of approved procedures are controlled to the extent possible to provide comparability of data.
14 Confirmatory sampling can be performed to provide another indication of comparability.
- 15 • Representativeness is the degree to which data accurately and precisely represent a characteristic of a
16 population, a parameter variation at a sampling point, a process condition, or an environmental
17 condition. Sample custody procedures are employed to maintain proper sample representativeness
18 during testing.

19 **C7.3 Sampling Methods**

20 Field sampling shall comply with HASQARD (DOE/RL-96-68), Volumes 1 and 2 requirements.

21 Sampling in support of S&GRP activities is performed in accordance with the following technical
22 procedures:

- 23 • GRP-FS-04-G-004, *Operational Monitoring Groundwater Sampling*
- 24 • GRP-FS-04-G-023, *Container Sampling*
- 25 • GRP-FS-04-G-028, *Field Characterization and Treatment Monitoring Activities Groundwater*
26 *Sampling*
- 27 • GRP-FS-04-G-029, *Non-VOC Soil and Sediment Sampling*
- 28 • GRP-FS-04-G-030, *VOC Soil and Sediment Sampling*
- 29 • GRP-FS-04-G-033, *Routine and Non-Routine Soil-Gas Sampling*

30 Samples are often obtained during implementation of the following administrative procedures:

- 31 • GRP-EE-01-5.2, *Test Pit Excavation in Contaminated Areas*
- 32 • GRP-EE-01-5.3, *Test Pit Excavation in Archeological Areas*
- 33 • GRP-EE-02-14.1, *Drilling, Remediating, and Decommissioning Resource Protection Wells, and*
34 *Geotechnical Soil Borings*
- 35 • GRP-EE-02-14.2, *Geoprobe, Casing Driving, and Push Technology Installations*

1 Failures that occur in the sampling process or sample handling are controlled in accordance with PRC-
 2 PRO-QA-9769, PRC-PRO-QA-052 (CRRS), PRC-PRO-QA-298, GRP-EE-01-2.7, or GRP-EE-01-2.10,
 3 as appropriate. Sampling methods shall include method references in the Bibliography section of sampling
 4 procedures.

5 **C7.4 Sample Handling and Custody**

6 Sample chain of custody is described in GRP-FS-04-G-016, *Chain of Custody/Sample Analysis Request*.
 7 Sample handling is addressed in GRP-FS-04-G-012, *Sample Packaging, Transporting and Shipping*, and
 8 GRP-FS-04-G-020, *Sample Storage Units*. Coordination of sampling is addressed in GRP-EE-01-2.0,
 9 *Sample Management and Reporting Sample Event Coordination*.

10 **C7.5 Analytical Methods**

11 SOWs issued to onsite and offsite laboratories specify compliance with HASQARD (DOE/RL-96-68).
 12 SOWs are issued in compliance with acquisition planning procedures.

13 Analytical methods are specified in the SAPs generated for specific OUs, waste sites, or other discrete
 14 units. When a failure occurs in the analytical system, the Task Lead and Sample and Data Management
 15 employee resolve the issue in accordance with GRP-EE-01-2.7.

16 Onsite measurements are acquired as described in field screening and field analytical procedures.
 17 Field screening shall comply with the requirements in HASQARD (DOE/RL-96-68), Volume 3.

18 **C7.6 Data Review, Verification, Validation, and Reporting**

19 Analytical data generation is governed by applicable procedures. Typically, data validation is performed
 20 by a qualified vendor. Data verification is performed in accordance with GRP-EE-01-2.4, *Sample*
 21 *Management and Reporting Data Package Verification*. Environmental analytical data are validated in
 22 accordance with GRP-EE-01-2.5, *Sample Management and Reporting Data Package Validation Process*.
 23 Similarly, other pertinent data are gathered and recorded per operating procedures. The levels of data
 24 validation and specific validation review requirements are stated in GRP-GD-003, *Data Validation*
 25 *Procedure for Chemical Analyses*, and GRP-GD-002, *Data Validation Procedure for Radiochemical*
 26 *Analyses*.

27 **C7.7 Reconciliation with User Requirements**

28 The DQA process compares field sampling activities against those proposed in sampling documents and
 29 provides an evaluation of the resulting data. This process is described in GRP-EE-01-1.22, *Data Quality*
 30 *Assessment*. DQAs are performed on a task by task basis. When a data acquisition campaign has been
 31 completed and data validation has been performed, the Task Lead implements GRP-EE-01-1.22 or hires a
 32 subcontractor to do so. DQAs are subject to independent review by the QAE.

33 Problems affecting quality such as not meeting the DQOs or DQAs will be evaluated and dispositioned per
 34 the contractor QA Program. Programmatic deficiencies shall be promptly identified and corrected in
 35 accordance with the Issues Management system as defined in PRC-PRO-QA-052.

36 Corrective maintenance, periodic/preventative maintenance, maintenance work plans, test procedures,
 37 engineering modifications, and construction activities performed within S&GRP facilities are controlled in
 38 accordance with PRC-PRO-WKM-12115.

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C8 Design

Items and processes shall be designed using sound engineering/scientific principles and appropriate standards. Design work, including changes, shall incorporate applicable requirements and design bases. Design interfaces shall be identified and controlled. The adequacy of design products shall be verified or validated by individuals or groups other than those who performed the work. Verification and validation work shall be completed before approval is granted to implement the design.

Design activities will be conducted in accordance with the QA program controls described in PRC-MP-QA-599, Section 6.0, “Design” and the technical requirements specified in PRC-RD-EN-1819, *CHPRC Engineering Requirements*, PRC-PRO-IRM-309, *Controlled Software Management*, and PRC-RD-EN-440, *Engineering Documentation Preparation and Control*. Additional design control implementing procedures are listed in Attachment C-3.

C9 Procurement

Procured items and services shall meet established requirements and shall perform as specified. Prospective suppliers shall be evaluated and selected on the basis of specified criteria as appropriate with respect to the graded approach..

Procurement will be conducted in accordance with the following implementing procedures:

- PRC-PRO-QA-268, *Control of Purchased/Acquired Items and Services*
- PR PRC-MP-AC-40500, *Acquisition Management Plan*
- PRC-PRO-AC-40480, *Acquisition Planning*
- PRC-PRO-AC-40478, *Procurement of Materials*
- PRC-PRO-AC-40471, *Contract Labor Resources*
- PRC-PRO-AC-40496, *Managed Task Services*
- PRC-PRO-QA-259, *Graded Approach*
- PRC-RD-EN-1819, *CHPRC Engineering Requirements*
- PRC-PRO-AC-16405, *Submittal Management System*
- PRC-PRO-MS-40213, *Subcontractor Oversight*

C10 Inspections and Tests

Inspection and testing of specified items, services, and processes shall be conducted using established acceptance and performance criteria. Equipment used for inspections and tests by S&GRP personnel or subcontractors shall be calibrated and maintained as appropriate.

C10.1 Instrument/Equipment Testing, Inspection, and Maintenance

Instrument and equipment testing, inspection, and maintenance of S&GRP plant equipment are controlled per PRC-PRO-WKM-12115. Instrumentation used in the field for measuring groundwater levels and groundwater quality is controlled by GRP-FS-04-G-005, *Control of Monitoring Instruments*, or GRP-EE-01-7.4, *Requirements for Use of Hydrogeologic Field Measurement Equipment*.

Calibration of analytical equipment (e.g., gas chromatograph, spectrophotometer, and pH meter) is performed analytically in accordance with HASQARD (DOE/RL-96-68), Volumes 3 and 4, as well as the manufacturer’s procedures for calibration.

1 **C10.2 Acceptance**

2 At the conclusion of well construction tasks, a final acceptance walk down is performed and documented
 3 per GRP-EE-02-14.1. If QA participates in the walk down, a work site assessment report is issued. Field
 4 activity reports, geologic logs, and other well specific records are reviewed and approved prior to
 5 publication in a borehole summary report or in IDMS. At the conclusion of construction projects that
 6 support operations, the completed or modified system is tested and inspected as directed by project design
 7 and procurement documents.

8 **C10.3 Measuring and Test Equipment**

9 M&TE used by S&GRP includes, but is not limited to, data collection equipment such as water level
 10 pressure transducers, e-tapes, steel measuring tapes, and water quality instrumentation (pH, conductivity,
 11 turbidity, and dissolved oxygen). This equipment is addressed in GRP-FS-04-G-005 and GRP-EE-01-7.4.
 12 M&TE used for activities affecting quality are controlled and calibrated, and/or adjusted at specific
 13 intervals, to maintain precision and accuracy within prescribed limits in accordance with PRC-PRO-MN-
 14 490, *Calibration Management Program*, or HASQARD (DOE/RL-96-68), Volumes 3 and 4, as
 15 appropriate. Procurement activities for M&TE are governed by PRC-PRO-QA-268.

16 The Industrial Hygiene Equipment Laboratory (IHEL) is responsible for the industrial hygiene sampling
 17 and monitoring equipment used in support of the S&GRP. IHEL is responsible for the following specific
 18 activities:

- 19 • Procuring and maintaining an inventory of sampling and monitoring equipment and associated
 20 consumables
- 21 • Calibrating and repairing sampling and monitoring equipment

22 Radiological instrumentation is purchased, maintained, and calibrated by the Pacific Northwest National
 23 Laboratory through the contract requisition process.

24 The equipment will be uniquely identified and traceable to its calibration data. Equipment will be
 25 maintained using a documented process to ensure continuing data quality and process capability.

26 **C11 Management Assessment**

27 Managers shall assess their management processes. Problems that hinder the organization from achieving
 28 its objectives shall be identified and corrected.

29 Assessments will be conducted in accordance with the process described in PRC-PRO-QA-246,
 30 *Management Assessment*, and will focus on compliance with documented requirements and procedures.
 31 The following status reports are prepared:

- 32 • Management assessment results are prepared by the Operational Assurance group in accordance with
 33 PRC-PRO-QA-246.
- 34 • Quarterly trending analysis reports of corrective action data and monthly indicators are prepared by
 35 Issues Management per PRC-PRO-QA-052.
- 36 • Nonconformance reports trended by QA Programs are in accordance with PRC-PRO-QA-298.

37 **C12 Independent Assessment**

38 Independent assessments will be conducted periodically by the ECQA organization.

1 DQAs are performed by or at the direction of the Task Lead, once a discrete body of data has been
 2 validated in accordance with GRP-EE-01-1.22. DQAs are subject to independent review by the QAE.
 3 At least 5 percent of DQAs will be reviewed by QA.

4 QA reports to management through the following methods:

- 5 • Four QA surveillances are scheduled by the S&GRP QAE per year.
- 6 • In a typical year, numerous unscheduled surveillances are performed by the S&GRP QAE.
 7 These surveillances examine programmatic and technical aspects of the S&GRP work scope.
 8 The cognizant S&GRP manager is provided with the results of such surveillances.
- 9 • When QA is assigned to verify completion of corrective actions, the verification is documented on a
 10 surveillance report transmitted to cognizant management.
- 11 • Company-wide independent assessments and surveillances are performed that examine aspects of the
 12 QA program.
- 13 • Findings and observations are reported to management for corrective action through implementation of
 14 PRC-PRO-QA-052.

15 Management assessments performed by S&GRP provide input to CRRS. CRRS data are analyzed
 16 quarterly by CHPRC Quality and Performance Assurance and fed back to management.

17 **C13 References**

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Attachment C-1

Additional Quality Assurance Requirements Specific to Field Sampling

Field Sampling Quality Assurance

This attachment is applicable to all S&GRP personnel who collect samples in support of S&GRP tasks and projects. Sample collection under RCRA, CERCLA, and RCW 70.105, "Hazardous Waste Management," as delineated in the Tri-Party Agreement (Ecology et al., 1989), shall meet the regulatory requirements through implementation of work-controlling sampling documents, procedures, and this QAPjP.

C-1-1 Personnel Qualifications – Sampling personnel must receive training from a competent person prior to being qualified to perform sampling for S&GRP. On-the-job training (OJT), administered by a qualified person, is the preferred method.

C-1-2 Quality Systems – Physical: The sample storage facility shall have controlled access. All groundwater wellheads shall have locking well caps. Sampling equipment shall be maintained and decontaminated prior to use as appropriate. Sampling operations and sample storage areas shall be maintained to prevent the spread of contamination. Adequate storage areas shall be available for reagents, solvents, standards, and reference materials to prevent cross contamination and degradation. Purge water generated shall be managed in accordance with GRP-EE-01-1.11, *Purgewater Management*.

C-1-3 Quality Systems – Technical: The design of a field sampling effort should be performed as a part of the DQO process. Details should then be incorporated into SAPs or characterization plans. Minor changes can be made to the original work scope outlined in sampling and analysis instructions and SAPs, or in the field by the Project Engineer to accommodate field conditions provided that the changes do not negatively impact the technical adequacy of the job. Such changes will be documented as a revision to the work-controlling document or with justifications in a field logbook. Sampling methods shall be based upon industry-recognized sampling methods from agency published source documents where possible. Each sampling method performed in the field shall have an applicable procedure describing the necessary equipment and collection steps for the media and contaminant to be sampled. Items, services, and processes that do not meet established requirements shall be identified in accordance with PRC-PRO-QA-298, *Nonconforming Items*, and PRC-PRO-QA-052, *Issues Management*, or GRP-EE-01-2.7, *Sample Management and Reporting Sample Issue Resolution*, as appropriate. Changes or corrections to data shall be made by drawing a single line through the incorrect information, writing the correct information, and initialing and dating the new entry.

C-1-4 Sampling Operations – The field logbook provides a daily handwritten record of sampling activities and is the primary record. Logbooks are managed in accordance with PRC-PRO-IRM-10863, *Notebooks and Logbooks*. Logbook entries shall be made in indelible and reproducible ink. Data may also be entered on pre-made data forms. Each sample has a unique number. Numbers are issued in accordance with GRP-EE-01-2.0. Sample preservation shall be consistent with regulatory requirements and as described on the sample authorization form. One member of the sampling team is designated the sample custodian. The sample custodian maintains custody until the samples are secured in a sample storage area accessible only to authorized personnel. Custody is documented and transferred in accordance with GRP-FS-04-G-016. Custody seals are placed on individual sample bottles or secondary containers such that the seal will be broken if the bottle or the secondary container is opened. Samples are shipped to analytical laboratories in accordance with GRP-FS-04-G-012.

C-1-5 Quality Control During Sampling – See Section C5.1.

1 **C-1-6 Sampling Data Review** – Frequent reviews are performed on sampling documentation for
 2 completeness, correct number and locations of samples, and confirmation that samples were shipped
 3 correctly to provide an additional aspect of QC.

4 **Attachment C-2**

5 **Additional QA Requirements Specific to Onsite Measurement**

6 **Onsite Measurements Quality Assurance**

7 **C-2-1 Personnel Qualification & Training** – Onsite measurement personnel must receive OJT from a
 8 competent person prior to being qualified to perform onsite measurements for S&GRP.

9 **C-2-2 Quality Assurance Objectives** – Basic information about the nature of the data collection and use
 10 shall be communicated between the onsite measurement team and the client before sample collection
 11 begins. The formal DQO process is the preferred method to accomplish this. In the absence of a formal
 12 DQO, the manager of Remediation Support and the Project Lead shall agree upon analytical method,
 13 detection levels, data assessment requirements, QC levels, and data management requirements for the
 14 work to be performed. Data quality requirements are commonly expressed in terms of precision, accuracy,
 15 comparability, and representativeness.

16 **C-2-3 Systems** – Commercial software used by S&GRP and vendor supplied software designed to
 17 interface with a specific instrument is exempt from acceptance testing. Other software is managed by
 18 PRC-PRO-IRM-309. Software manuals shall be made readily available to personnel using the software.
 19 Software errors found during use shall be reported to the manager of Remediation Support for resolution.

20 **C-2-4 Documentation** – Final data deliverable reports are generated using GRP-EE-05-1.7, *Preparation,*
 21 *Control and Review of Field Screening Organic/Inorganic Data Packages*. SMR shall maintain the reports
 22 as record copies until they are transferred through the information resource management service provider
 23 to the Records Holding Area.

24 **C-2-5 Technical Systems** – Technical systems are employed to ensure that the techniques used are
 25 applicable and properly employed by qualified analysts. These systems include sample exchanges,
 26 standards programs, control of standards and reagents, data reduction and reporting, data assessment, and
 27 audits. These systems include chain of custody, control of reagents and standards through labeling and
 28 tracking shelf life, internal checks of instruments, and preparation of data packages (including comparison
 29 of onsite measurement data versus laboratory data).

30 **C-2-6 Sample Traceability** – Sample traceability will be documented in the analyst's logbook when
 31 performing in situ or analyst-collected data.

32 **C-2-7 Calibration** – The performance of testing equipment is controlled through initial calibration and
 33 periodic checks to verify that the equipment remains within calibration criteria. Instruments and equipment
 34 with operations and functions that directly affect data quality are calibrated or inspected. The procedure for
 35 calibrating a specific instrument (including frequency and acceptance criteria) is described in the
 36 applicable test procedure and/or manufacturer's instruction. Results of the calibration shall be documented,
 37 and anomalies will be communicated to the customer.

38 Standards used for calibration are prepared from National Institute of Standards and Technology (NIST)
 39 certified solutions or from reagent materials that are checked against NIST certified standards as
 40 appropriate. A logbook record is maintained of standard preparation including a description of the method
 41 of preparation, date, preparer's name, and lot number of originating stock. Standards are labeled with

1 contents, preparation date, concentration, preparer's initials, unique number for traceability, and expiration
2 date.

3 Balances and scales used for onsite measurements shall be checked daily with a known check weight.
4 Check weights are to be within the range typically observed during data acquisition. Check weight results
5 are recorded in a controlled log book. Balances are to be calibrated annually.

6 **C-2-8 Procedures** – Onsite measurement procedures are processed in accordance with PRC-PRO-
7 MS-589, *CH2M HILL Plateau Remediation Company Procedures*. Administrative and technical
8 procedures are issued under the procedure series GRP-EE-01-X.XX (environmental investigation
9 procedures) and GRP-EE-05-X.XX (field screening procedures). The current version of each procedure is
10 accessible on the S&GRP website. Procedure users should verify that they have the current revision before
11 use. Test procedures shall be qualified prior to use. Qualification may be based upon comparison of split
12 sample results from approved analytical laboratories, comparison to another approved onsite method, or
13 measurement of a sufficient number of reference samples. Results of the procedure qualification shall be
14 documented and anomalies will be communicated to the customer.

15 **C-2-9 Data Management** – Data collection may occur either electronically or manually as described in
16 the applicable test procedure. Entries into logbooks shall be made in a manner that can be easily read,
17 understood and reproduced with a standard photocopier. Data reduction shall be performed in a manner
18 that ensures consistent and accurate results. This is supported by the controls established for use of
19 software. Significant figures reflect the limits of a particular test method. The basic rules associated with
20 significant figures are provided in ASTM E29-13, *Standard Practices for Using Significant Digits in Test*
21 *Data to Determine Conformance with Specifications*. Data review and reporting are performed in
22 accordance with GRP-EE-05-1.7.

23 **C-2-10 Quality Control** – QC checks provide information on the precision, accuracy, sensitivity, and
24 reliability of reported results. Two levels of QC have been established to distinguish between qualitative
25 and quantitative data needs.

- 26 • QC-1 provides identification that an analyte is present and may provide a rough order of magnitude of
27 the concentration. A minimum level of QC will be performed including a beginning standard and
28 blank with other QC as required by specific procedure.
- 29 • QC-2 provides a greater level of QC as directed by specific procedures, which may include initial and
30 continuing calibration check standards, blanks, matrix spikes, duplicates, and lab control samples.
31 These data may be quantitative.

32 The QC level will be selected with the concurrence of the customer.

33 **C-2-11.0 Data Quality Assessment** – Procedures to Assess Data Quality: This section provides various
34 formulas that are typically employed to compute QC parameters used to assess data quality. The specific
35 QC parameters will be monitored and evaluated based on customer needs and the selection of QC levels
36 (defined in Section C12.0).

37 **C-2-11.1 Precision** – Precision has been defined in Section C7.2 of this plan. If calculated from
38 duplicate measurements, the following equation is used:

1

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

2

3

where: RPD = relative percent difference

4

C_1 = larger of the two observed values

5

C_2 = smaller of the two observed values.

6

7 If calculated from three or more replicates, use relative standard deviation (RSD) rather than RPD:

8

$$RSD = (s / \bar{y}) \times 100$$

9

10

11 where:

RSD = relative standard deviation

12

s = standard deviation

13

\bar{y} = mean of replicate analyses.

14

15 Standard deviation, s , is defined as follows:

16

$$S = \sqrt{\frac{\sum_{i=1}^n (y_i - \bar{y})^2}{n-1}}$$

where:

s = standard deviation

y_i = measured value of the i^{th} replicate

\bar{y}

= mean of replicate measurements

n

= number of replicates.

1 **C-2-11.4 Control Charts** – Control charts are a graphic tool for viewing the statistical performance of a
2 method to enable early detection of outlying data points. Control charts are not used at this time. Project
3 defined recovery limits for standards are utilized instead.

4 **C-2-11.5 Collaborative Testing** – In addition to an internal QC program, the onsite measurement team
5 may participate in PE programs and collaborative sample testing programs with other laboratories as a
6 method of assessing data quality. If materials and/or programs are available, collaborative testing may be
7 performed, when required by the customer, to meet specific project needs.

8 Projects are also encouraged to perform periodic confirmation of onsite measurement test results using
9 EPA-approved or other analytical laboratory methods and QA/QC procedures.

10 **C-2-12 Records** – The following documents provide objective evidence of the quality of work and
11 associated activities conducted by S&GRP in conjunction with onsite measurement:

- 12 • Chain of custody records
- 13 • Sample analysis data sheets
- 14 • Results of reviews, audits, and corrective actions
- 15 • Project reports
- 16 • Training records
- 17 • Calibration records
- 18 • Instrument logs
- 19 • Maintenance and repair records

20 **C-2-13 Preventive Maintenance** – Analysts are responsible for complying with instrument maintenance
21 schedules and maintaining maintenance records. A logbook shall be set up to record all maintenance and
22 repairs for each instrument.

23 **C-2-14 Procurement Control** – The analyst will review received items and reagents to determine if they
24 meet specifications established in the requisition. If an item does not meet requirements, it will be
25 dispositioned in accordance with PRC-PRO-QA-298. Acceptability of new standards will be determined
26 by comparison with previously acceptable standards. New reagents and standards will be separated from
27 other reagents and standards until they have been checked and accepted.

28

Attachment C-3 Matrix of Implementing Procedures

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
SECTION 1 PROGRAM		
Quality Assurance Program Plans	CHPRC-00189, <i>CH2M HILL Plateau Remediation Company Environmental Quality Assurance Program Plan</i>	GRP-TI-0001, <i>Groundwater Remediation Project Conduct of Operations</i>
QA Requirements Flowdown	PRC-MP-MS-19361, <i>CH2M HILL Plateau Remediation Company Project Execution Plan</i> PRC-MP-MS-003, <i>Integrated Safety Management System/Environmental Management System Description (ISMSD)</i> PRC-PRO-MS-40117, <i>Requirements Management Process</i> PRC-PRO-NS-2701, <i>Authorization Agreement</i>	
Quality Planning		
Organization, Responsibilities, and Interfaces	Business Process Guide, <i>Buyers Technical Representative Assignment and Duties</i> PRC-RD-AC-10320, <i>CHPRC Acquisition System Requirements</i> PRC-RD-LEG-10348, <i>Legal and Ethical Conduct</i>	GRP-POL-0001, <i>S&GRP Integrated Environment, Safety, and Health Management Roles, Responsibilities, and Functions</i>
Readiness Reviews	PRC-PRO-OP-055, <i>Startup Readiness</i>	GRP-EE-02-14.1, <i>Drilling, Remediating and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings</i> GRP-EE-02-14.2, <i>Geoprobe, Casing Driving, and Push Technology Installations</i>
Stop Work Authority	PRC-PRO-SH-7085, <i>Safety Responsibilities</i> PRC-PRO-SH-3468, <i>Stop Work Responsibility</i>	GRP-MI-0025, <i>S&GRP Stop Work Communication Requirements</i>
Graded Application of QA Program	PRC-PRO-QA-259, <i>Graded Approach</i> PRC-PRO-NS-8317, <i>Safety Basis Implementation and Maintenance</i> PRC-PRO-NS-700, <i>Safety Basis Development</i>	
SECTION 2, PERSONNEL TRAINING AND QUALIFICATION	CHPRC-00073, <i>CH2M HILL Plateau Remediation Company Radiological Control Manual</i> PRC-RD-TQ-11061, <i>Training Requirements</i>	PRC-STD-TQ-40234, <i>Soil and Groundwater Remediation Project Dangerous Waste Training Plan</i>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
Training and Qualification Program	PRC-PRO-TQ-164, <i>Integrated Training Electronic Matrix</i> PRC-PRO-TQ-175, <i>Training Program Administration</i> PRC-PRO-TQ-40165, <i>Training Program Administration</i> MSC-PRO-263, <i>Qualification and Certification of Inspection and Test Personnel</i> PRC-PRO-TQ-459, <i>Environmental Training</i> PRC-PRO-TQ-40164, <i>Personnel Training and Qualification</i>	
Training and Indoctrination	<i>Operations Supervisor Fundamentals Training Program Description</i> PRC-PRO-TQ-164, <i>Integrated Training Electronic Matrix</i> PRC-PRO-TP-166, <i>Transportation and Packaging Training</i> PRC-PRO-TQ-179, <i>Obtaining Training Equivalencies, Waivers, and Extensions</i> MSC-PRO-263, <i>Qualification and Certification of Inspection and Test Personnel</i> PRC-PRO-TQ-459, <i>Environmental Training</i> HNF-GD-10624, <i>A Systems Approach to Training</i> PRC-RD-TQ-11061, <i>Training Requirements</i> PRC-PRO-TQ-175, <i>Training Program Descriptions</i> PRC-PRO-TQ-40165, <i>Training Program Administration</i> CHPRC-00073, <i>CH2M HILL Plateau Remediation Company Radiological Control Manual</i> PRC-PRO-TQ-40164, <i>Personnel Training and Qualification</i>	
Qualification and Certification	<i>CHPRC Welding Manual</i> PRC-PRO-TQ-40165, <i>Training Program Administration</i> MSC-PRO-263, <i>Qualification and Certification of Inspection and Test Personnel</i> CHPRC-00073, <i>CH2M HILL Plateau Remediation Company Radiological Control Manual</i> PRC-PRO-TQ-40164, <i>Personnel Training and Qualification</i>	
Training and Qualification Records	PRC-PRO-TQ-249, <i>Training Records Administration</i> MSC-PRO-263, <i>Qualification and Certification of Inspection and Test Personnel</i> PRC-PRO-TQ-459, <i>Environmental Training</i>	

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
	PRC-PRO-TQ-40164, <i>Personnel Training and Qualification</i>	
SECTION 3 QUALITY IMPROVEMENT	PRC-PRO-QA-052, <i>Issues Management</i> PRC-PRO-EM-060, <i>Reporting Occurrences and Processing Operations Information</i> PRC-PRO-QA-298, <i>Nonconforming Items</i> CHPRC-00073, <i>CH2M HILL Plateau Remediation Company Radiological Control Manual</i> PRC-PRO-QA-246, <i>Management Assessment</i> PRC-PRO-EP-15333, <i>Environment Protection Processes, Section 5.56</i>	GRP-EE-01-2.7, <i>Sample Management and Reporting - Sample Issue Resolution</i> HNF-28242, Software Management Plan
Deficiency Identification		
Corrective Action Management	PRC-PRO-QA-052, <i>Issues Management</i> PRC-PRO-QA-298, <i>Nonconforming Items</i> CHPRC-00073, <i>CHPRC Radiological Control Manual</i> PRC-PRO-QA-246, <i>Management Assessment</i>	
Nonconformance Control	PRC-PRO-EM-058, <i>Event Initials Investigation and Critique Meeting Process</i> PRC-PRO-QA-298, <i>Nonconforming Items</i>	GRP-EE-01-2.7, <i>Sample Management and Reporting – Sample Issue Resolution</i> GRP-EE-01-2.10, <i>Sample Management and Reporting – Request for Data Review</i>
Performance Data Analysis	PRC-PRO-QA-052, <i>Issues Management</i> PRC-PRO-QA-298, <i>Nonconforming Items</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-QA-24741, <i>Performance Analysis Process</i>	GRP-EE-01-1.2, <i>Data Quality Objectives</i>
Control of Suspect/ Counterfeit Items	PRC-PRO-QA-301, <i>Control of Suspect/Counterfeit and Defective Items</i>	
SECTION 4, DOCUMENTS AND RECORDS	PRC-PRO-IRM-112, <i>Forms Control</i> PRC-PRO-IRM-211, <i>Submitting Documents to the Administrative Record File and Public Information Repositories</i> PRC-PRO-IRM-232, <i>Project Files Management</i> PRC-PRO-EN-440, <i>Engineering Documentation Preparation and Control</i> PRC-PRO-EN-2001, <i>Facility Modification Package Process</i> PRC-PRO-MS-589, <i>CH2M HILL Plateau Remediation Company Procedures</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-EN-8016, <i>Design Change Notice</i>	GRP-EE-01-1.4, <i>Descriptions of Work for Well Drilling and Decommissioning</i> GRP-EE-01-2.1, <i>Sample Management and Reporting - Sample Documentation Processing</i> GRP-EE-01- 2.2, <i>Sample Management and Reporting - Data Package Receipt and Control</i> GRP-EE-09-2.11, <i>Environmental Information Systems - Hanford Environmental Information System (HEIS) Method Naming Procedure</i>
Documents		

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
	<i>Process</i> PRC-PRO-IRM-8310, <i>Document Control Processes</i>	
Records	PRC-PRO-IRM-10588, <i>Records Management Process</i> , PRC-PRO-IRM-232, <i>Project Files Management</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i>	<p>GRP-EE-01-1.16, <i>Sample Management and Reporting - Sampling Documentation Preparation and Control</i> GRP-EE-01-2.2, <i>Sample Management and Reporting – Data Package Receipt and Control</i> GRP-EE-01-2.4, <i>Sample Management and Reporting Data Package Verification</i> GRP-EE-01-2.5, <i>Sample Management and Reporting Data Package Validation Process</i> GRP-EE-01-2.6, <i>Records Management</i> GRP-EE-01-2.7, <i>Sample Management and Reporting – Sample Issue Resolution</i></p> <p>GRP-GD-003, <i>Data Validation for Chemical Analyses</i> GRP-GD-002, <i>Data Validation for Radiochemical Analyses</i> GRP-EE-01-7.0, <i>Geologic Logging</i> GRP-EE-02-14.1, <i>Drilling, Remediating and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings</i> GRP-EE-02-14.2, <i>Geoprobe, Casing Driving and Push Technology Installations.</i> GRP-EE-09-1.1, <i>Environmental Data Managements – Waste Information Data System: Site Identification, Classification and Reclassification</i> GRP-EE-09-1.3, <i>Environmental Data Management – Waste Information Data System: Data Entry</i> GRP-EE-09-1.12, <i>Environmental Information Systems – : Library Management</i> CP-15383, <i>Common Requirements of the Format for Electronic Analytical Data (FEAD)</i> GRP-PRO-023, <i>Back-up and Archiving Process Related Digital Files</i> GRP-EE-02-14.3, <i>Well Maintenance</i></p>
SECTION 5, WORK PROCESSES	PRC-RD-MN-10859, <i>Maintenance Management</i> PRC-PRO-WKM-079, <i>Job Hazard Analysis</i> PRC-PRO-TP-156, <i>Onsite Hazardous Material Shipments</i>	GRP-EE-01-1.9, <i>Naming, Numbering, and Tracking of Groundwater Resource Protection Well Geoprobe Geotechnical Soil Boring and River Substrate and Aquifer Porewater Monitoring Tubes</i>
Work Process Documents	PRC-PRO-TP-157, <i>Offsite Hazardous Material Shipments</i> PRC-PRO-RP-379, <i>External Dosimetry Program</i> PRC-PRO-RP-380, <i>Internal Dosimetry</i>	<p>GRP-EE-01-2.0, <i>Sample Management and Reporting – Sample Event Coordination</i> GRP-EE-01-1.16, <i>Sample Management and Reporting –Sampling Documentation Preparation and Control</i></p>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
	<p><i>Program</i> HNF-RD-11440, <i>Physical Protection of Property and Facilities</i> PRC-PRO-MS-589, <i>CH2M HILL Plateau Remediation Project Company Procedures</i> PRC-PRO-NS-700, <i>Safety Basis Development</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-NS-8317, <i>Safety Basis Implementation and Maintenance</i></p> <p>PRC-PRO-EP-25415, <i>CERCLA Response Actions</i></p> <p>PRC-PRO-SH-409, <i>Industrial Hygiene Monitoring, Reporting and Records Management</i> PRC-PRO-OP-40126, <i>Equipment and Piping Labeling</i> PRC-MP-MS-19361, <i>Project Execution Plan</i></p>	<p>GRP-EE-01-2.11, <i>Sample Management and Reporting – Manual Entry of Sample Analysis Data</i> GRP-EE-01-2.12, <i>Sample Management and Reporting Group Operations Plan</i> GRP-EE-01-2.13, <i>Sample Management and Reporting-Groundwater Monitoring Sample Event Scheduling and Sample Document Preparation, Reprinting and Management</i> GRP-EE-01-3.1, <i>Sample Packaging and Shipping</i> GRP-EE-01-5.2, <i>Test Pit Excavation in Contaminated Areas</i> GRP-EE-01-6.2, <i>Field Cleaning and/or Decontamination of Geoprobe and Drilling Equipment</i> GRP-EE-01-6.3, <i>Well Development and Testing</i> GRP-EE-01-7.0, <i>Geologic Logging</i> GRP-EE-01-7.4, <i>Requirements for Use of Hydrogeologic Field Measurement and Monitoring Equipment</i> GRP-FS-04-G-004, <i>Operational Monitoring Groundwater Sampling</i> GRP-FS-04-G-005, <i>Control of Monitoring Instruments</i> GRP-FS-04-FS-012, <i>Sample Packaging, Transportation and Shipping</i> GRP-FS-04-G-013, <i>Laboratory Cleaning of Sampling Equipment</i> GRP-FS-04-G-014, <i>Measurement of Groundwater Levels</i> GRP-FS-04-G-015, <i>Bottle Preservation</i> GRP-FS-04-G-016, <i>Chain of Custody/Sample Analysis Request</i> GRP-FS-04-G-017, <i>Project and Sample Identification for Sampling Services</i> GRP-FS-04-G-018, <i>Portable Grundfos Pump Decontamination,</i> GRP-FS-04-G-020, <i>Sample Storage Units</i> GRP-FS-04-G-022, <i>Biotic Sampling</i> GRP-FS-04-G-023, <i>Container Sampling</i> GRP-FS-04-G-024, <i>Collecting PCB Wipe Samples</i> GRP-FS-04-G-025, <i>Millipore Water System</i> GRP-FS-04-G-028, <i>Field Characterization and Treatment Monitoring Activities Groundwater Sampling</i> GRP-FS-04-G-029, <i>Non-VOC Soil and Sediment Sampling</i> GRP-FS-04-G-030, <i>VOC Soil and Sediment Sampling</i> GRP-FS-04-G-031, <i>Sample Compositing</i> GRP-FS-04-G-033, <i>Routine and Non-Routine</i></p>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
		<p><i>Soil-Gas Sampling</i> GRP-FS-04-G-037, <i>Field Decontamination of Sampling Equipment</i> GRP-EE-05-4.0, <i>Analysis of Volatile Organic Compounds in Vapor Samples Using the Brüel and Kjaer 1302 and Innova 1312 Multi-gas Analyzers</i> GRP-PRO-026, <i>Mobile Laboratories Chemical Hygiene Plan</i></p>
	<p>PRC-RD-TP-7900, <i>Transportation and Packaging Program Requirements</i></p>	<p>GRP-EE-01-1.22, <i>Data Quality Assessment</i> GRP-EE-05-1.7, <i>Preparation, Control and Review of Field Screening Organic/Inorganic Data Packages</i> GRP-EE-02-14.1, <i>Drilling, Remediating and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings</i> GRP-EE-02-14.2, <i>Geoprobe, Casing Driving and Push Technology Installations.</i> GRP-EE-02-14.3, <i>Well Maintenance</i> GRP-EE-02-14.4, <i>Installation, Removal, and Repositioning of Pumps In Groundwater Resource Protection Wells</i> EDM-09-1.4, <i>Environmental Database Management – Waste Information Data System: Site Walkdowns</i> EDM-09-1.5, <i>Environmental Database Management – Waste Information Data System: Interviews</i> GRP-FS-04-X-XXX-XXX, <i>Unit Specific Groundwater Operations Operating Procedures</i> 2WPT-PRO-OP-XXXX, <i>Unit Specific Groundwater Operations Operating Procedures (200 West Pump & Treat)</i> GRP-EE-05-4.0, <i>Analysis of Volatile Organic Compounds in Vapor Samples Using the Brüel and Kjaer 1302 and Innova 1312 Multi-gas Analyzers</i></p>
<p>Identification and Control of Items</p>	<p>DOE-0336 <i>Hanford Site Lockout/Tagout Procedure</i> PRC-PRO-PMT-133, <i>Tagging and Recording Property</i> HNF-PRO-140, <i>Utilizing General Supplies and Convenience Storage Inventories</i> PRC-PRO-QA-297, <i>Inspection, Test and Operating Status</i> PRC-PRO-AC-335, <i>Use and Control of Purchasing Card</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i></p>	<p>GRP-EE-01-7.4, <i>Requirements for Use of Hydrogeologic Field Measurement & Monitoring Equipment</i> GRP-FS-04-G-016, <i>Chain of Custody/Sample Analysis Request</i> GRP-FS-04-G-017, <i>Project and Sample Identification for Sampling Services</i></p>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
	PRC-PRO-QA-5432, <i>Hold Point Application in Technical Work Documents</i> PRO-PRO-OP-40126, <i>Equipment and Piping Labeling</i>	
Handling, Shipping, and Storing	PRC-RD-SH-11198, <i>Storing, Using and Handling Compressed Gasses</i> PRC-PRO-EN-129, <i>Controlling Spare Parts Inventory</i> HNF-RD-11408, <i>Property and Material Management Requirements</i> HNF-PRO-140, <i>Utilizing General Supplies and Convenience Storage Inventories</i> PRC-PRO-TP-156, <i>Onsite Hazardous Material Shipments</i> PRC-PRO-TP-157, <i>Offsite Hazardous Material Shipments</i> PRC-PRO-EP-15333, <i>Environmental Protection Processes</i> HNF-PRO-375, <i>Management of Central Warehouse Facilities and Stored Material</i> PRC-PRO-SH-40469, <i>Occupational Carcinogen Control</i> PRC-PRO-SH-10468, <i>Chemical Management Process</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-EN-8323, <i>Management of HEPA Filter Systems</i> PRC-PRO-AC-52750, <i>Control of Materials in the Field.</i>	GRP-EE-01-3.1, <i>Sample Packaging and Shipping</i> GRP-FS-04-G-012, <i>Sample Packaging, Transporting and Shipping</i> GRP-EE-01-1.11, <i>Purgewater Management</i> GRP-OP-0006, <i>Waste Packaging and Handling at S&GRP</i> GRP-FS-04-G-020, <i>Sample Storage Units</i>
Process Monitoring or Data Collection Instruments	CHPRC-00073, <i>CH2M HILL Plateau Remediation Company Radiological Control Manual</i> PRC-PRO-MN-490, <i>Calibration Management Program</i> DOE/RL-96-68, <i>HASQARD</i>	GRP-EE-01-7.4, <i>Requirements for Use of Hydrogeologic Field Measurement and Monitoring Equipment</i> GRP-FS-04-G-005, <i>Control of Monitoring Instruments</i> GRP-EE-05-1.7, <i>Preparation, Control and Review of Field Screening Organic/Inorganic Data Packages</i> PRC-PRO-RP-XXXXXX, <i>Unit Specific Radiation Protection Instrument Procedures</i>
Control of Computer Systems	PRC-PRO-IRM-309, <i>Controlled Software Management</i>	HNF-28242, <i>Software Management Plan</i>
SECTION 6, DESIGN	PRC-RD-SH-11827, <i>CHPRC Hanford Electrical Safety Program Requirements</i> PRC-PRO-EN-097, <i>Engineering Design and Evaluation (Natural Phenomena Hazard)</i>	GRP-EE-01-1.4, <i>Descriptions of Work for Well Drilling and Decommissioning</i> DOE/RL-2003-013, <i>Hanford Site Well Management Plan</i>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
Design Input	PRC-PRO-IRM-309, <i>Controlled Software Management</i> PRC-PRO-EN-440, <i>Engineering Documentation Preparation and Control</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-EN-2001, <i>Facility Modification Package Process</i> PRC-PRO-NS-8317, <i>Safety Basis Implementation and Maintenance</i> PRC-PRO-NS-700, <i>Safety Basis Development</i>	
Design Process	PRC-MP-MS-19361, <i>CH2M HILL Project Execution Plan</i> PRC-PRO-IRM-309, <i>Controlled Software Management</i> PRC-PRO-EN-440, <i>Engineering Documentation Preparation and Control</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-EP-40205, <i>CHPRC Environmental Calculation Preparation and Issue</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-EN-2001, <i>Facility Modification Package Process</i> PRC-PRO-EN-8016, <i>Design Change Notice Process</i> PRC-PRO-EP-40205, <i>CHPRC Environmental Calculation Preparation and Issue</i>	
Design Verification	PRC-PRO-EN-8336, <i>Design Verification</i> PRC-PRO-IRM-309, <i>Controlled Software Management</i> PRC-PRO-EN-440, <i>Engineering Documentation Preparation and Control</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-EN-2001, <i>Facility Modification Package Process</i> PRC-PRO-EN-8016, <i>Design Change Notice Process</i> PRC-PRO-EP-25415, <i>CERCLA Response Actions</i>	
Design Changes	PRC-PRO-IRM-309, <i>Controlled Software Management</i> PRC-PRO-EN-440, <i>Engineering</i>	GRP-MI-0024, <i>Project Drawing Red-line Process</i>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
	<p><i>Documentation Preparation and Control</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-EN-2001, <i>Facility Modification Package Process</i> PRC-PRO-EN-8016, <i>Design Change Notice Process</i></p>	
Design Documentation and Records	<p>PRC-PRO-IRM-232, <i>Project Files Management</i> PRC-PRO-IRM-309, <i>Controlled Software Management</i> PRC-PRO-EN-440, <i>Engineering Documentation Preparation and Control</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-EN-2001, <i>Facility Modification Package Process</i> PRC-PRO-EN-8016, <i>Design Change Notice Process</i> PRC-PRO-EP-25415, <i>CERCLA Response Actions</i> PRC-PRO-EN-8259, <i>CHPRC Calculation Preparation and Issue (Including OCRWM)</i> PRC-PRO-EP-40205, <i>CHPRC Environmental Calculation Preparation and Issue</i></p>	
Computer Software	<p>PRC-PRO-IRM-309, <i>Controlled Software Management</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i></p>	HNF-28242, <i>Software Management Plan</i>
SECTION 7, PROCUREMENT	<p>PRC-PRO-AC-40478, <i>Procurement of Materials</i> PRC-PRO-EN-129, <i>Controlling Spare Parts Inventory</i> PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-PRO-AC-335, <i>Use and Control of Purchasing Card</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i></p>	
Procurement Planning		
Content of Procurement Documents	<p>PRC-PRO-AC-40478, <i>Procurement of Materials</i> PRC-PRO-EN-129, <i>Controlling Spare Parts</i></p>	GRP-EE-01-1.4, <i>Descriptions of Work for Well Drilling and Decommissioning</i>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
	<i>Inventory</i> PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-PRO-EN-301, <i>Control of Suspect/Counterfeit and Defective Items</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i>	
Supplier Evaluation and Selection	PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-PRO-AC-335, <i>Use and Control of Purchasing Card</i> PRC-PRO-QA-3144, <i>Supplier Quality Assurance Program Evaluation</i>	
Control of Supplier Nonconformance	PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-PRO-CN-14990, <i>Construction Management</i>	
Acceptance of Items and Services	PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-PRO-QA-283, <i>Control of Inspections</i> PRC-PRO-EN-286, <i>Testing of Equipment and Systems</i> PRC-PRO-QA-297, <i>Inspection, Test, and Operating Status</i> PRC-PRO-AC-335, <i>Use and Control of Purchasing Card</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-EN-8323, <i>Management of HEPA Filter Systems</i>	GRP-EE-02-14.1, <i>Drilling, Remediating and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings</i> GRP-EE-02-14.2, <i>Geoprobe, Driving and Push Technology Installations.</i>
Commercial Grade Items	PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i>	
Control of Supplier-Generated Documents	PRC-PRO-IRM-232, <i>Project Files Management</i> PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i>	

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
Control of Suspect/Counterfeit Items	PRC-PRO-EM-060, <i>Reporting Occurrences and Processing Operations Information</i> PRC-PRO-QA-268, <i>Control of Purchased/Acquired Items and Services</i> PRC-PRO-QA-301, <i>Control of Suspect/Counterfeit and Defective Items</i>	
SECTION 8, INSPECTION AND ACCEPTANCE TESTING	PRC-PRO-QA-283, <i>Control of Inspections</i> PRC-PRO-EN-286, <i>Testing of Equipment and Systems</i> MSC-PRO-1607, <i>Visual Weld Inspection</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-QA-5432, <i>Hold Point Application in Technical Work Documents</i>	
Inspection and Acceptance Testing		
Inspection and Acceptance Process	MSC-PRO-263, <i>Qualification and Certification of Inspection and Test Personnel</i> PRC-PRO-QA-283, <i>Control of Inspections</i> PRC-PRO-EN-286, <i>Testing of Equipment and Systems</i> MSC-PRO-1607, <i>Visual Weld Inspections</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-CN-14990, <i>Construction Management</i> PRC-PRO-QA-5432, <i>Hold Point Application in Technical Work Documents</i>	
Inspection and Acceptance Testing Results	PRC-PRO-QA-283, <i>Control of Inspections</i> PRC-PRO-EN-286, <i>Testing of Equipment and Systems</i> MSC-PRO-1607, <i>Visual Weld Inspections</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i> PRC-PRO-QA-5432, <i>Hold Point Application in Technical Work Documents</i>	
Inspection and Testing Status	PRC-PRO-QA-283, <i>Control of Inspections</i> PRC-PRO-EN-286, <i>Testing of Equipment and Systems</i> PRC-PRO-QA-297, <i>Inspection, Test, and Operating Status</i> MSC-PRO-1607, <i>Visual Weld Inspections</i> PRC-RD-EN-1819, <i>CHPRC Engineering Requirements</i>	
Calibration of	PRC-PRO-MN-490, <i>Calibration Management</i>	GRP-EE-01-7.4, <i>Requirements for Use of</i>

S&GRP QAP IMPLEMENTATION MATRIX		
CHPRC QAP	PROJECT PROCEDURES	
	CHPRC-Wide Procedures	S&GRP Procedures
Measuring and Test Equipment	<i>Program</i>	<i>Hydrogeologic Field Measurement & Monitoring Equipment GRP-FS-04-G-005, Control of Monitoring Instruments</i>
SECTION 9, MANAGEMENT ASSESSMENT	<i>PRC-PRO-QA-246, Management Assessment CHPRC-00073, CH2M HILL Plateau Remediation Company Radiological Control Manual</i>	
Management Assessments	<i>PRC-PRO-SH-40499, Safety and Health Inspections</i>	
Corrective Action	<i>PRC-PRO-QA-052, Issues Management PRC-PRO-QA-246, Management Assessment CHPRC-00073, CH2M HILL Plateau Remediation Company Radiological Control Manual</i>	

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Attachment C-4
Safety Classification and Quality Level for S&GRP

There is currently no Quality Level 1 or 2 structures, systems, or components under the purview of S&GRP. Procurement of Environmental Analytical Laboratory Services is Quality Level 1. S&GRP also performs work and procures goods and services that are Quality Level 3, as defined in PRC-PRO-QA-259. The following are required to be at least Quality Level 3 per PRC-PRO-QA-259:

- Items where independent verification is required by a national consensus standard (AWS D1.1, ANSI B31.3, ASME Section VIII)
- Items or services with the potential to cause radiological harm
- Items and services that require additional controls beyond commercial practices based upon engineering evaluation
- Items or services that perform a safety function (defense in depth)
- Items or services that minimize impact to the environment
- Items or services that perform a function to minimize damage to a facility or its critical equipment

The following additional S&GRP items and services are Quality Level 3:

- Design and construction of critical elements of in situ groundwater barriers
- Testing of instruments used to demonstrate regulatory compliance
- Procurement of services or standards used to calibrate instruments for collecting environmental data
- Self performance or procurement of services for well drilling, well construction, well decommissioning, geotechnical test borings, environmental investigation wells, and geophysical logging
- Well maintenance (maintenance where well modification is involved requiring the filing of a resource protection well report)
- Procurement of selected materials used in self performed well construction (permanent well screens and casing)
- Procurement of services related to analytical laboratory work such as data validation or geochemical/geotechnical properties of soil
- Procurement of services related to groundwater/vadose modeling
- Procurement of services related to acquisition of geophysical data
- Procurement of items or services that could directly impact data quality (e.g., sample bottles)
- Procurement of services to develop CERCLA and RCRA response action documents that include tasks requiring the use of computational and analytical software, including spreadsheets (such tasks would include, but not be limited to, vadose zone and groundwater contaminant fate and transport modeling and the conduct of human health, ecological, and protection of groundwater risk assessments; CERCLA and RCRA response action documents include the administrative and

1 technical plans and reports developed to support the selection and implementation of removal and/or
2 remedial actions)

- 3 • Procurement of selected items that are susceptible to counterfeiting as described in DOE G 414.1-3
4 *Suspect/Counterfeit Items Guide for Use with 10 CFR 830 Subpart A, Quality Assurance*
5 *Requirements, and DOE O 414.1B, Quality Assurance* (e.g., graded fasteners, circuit breakers, ratchet
6 type tie downs and other items as determined by DQA and QA); purchase orders for such items shall
7 include clauses or statements regarding procurement of potentially suspect or counterfeit items and
8 shall require receipt inspection

Appendix D

Liquid Effluent Retention Facility (LERF), 200 Area Effluent Treatment Facility (ETF), and 200 Area Treated Effluent Disposal Facility (TEDF) Quality Assurance Project Plan

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Acronyms

ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
CHPRC	CH2M Hill Plateau Remediation Company
COC	chain of custody
DOE	U.S. Department of Energy
DOECAP	Department of Energy Consolidated Audit Program
DOT	U.S. Department of Transportation
DQOs	data quality objectives
ECO	Environmental Compliance Officer
Ecology	State of Washington, Department of Ecology
EPA	U.S. Environmental Protection Agency
ETF	Effluent Treatment Facility
FEAD	File for Electronic Analytical Data
HASQARD	Hanford Analytical Services Quality Assurance Requirements Documents (DOE 2007)
HEIS	Hanford Environmental Information System
IDMS	Integrated Data Management System
LERF	Liquid Effluent Retention Facility
MDA	minimum detectable activity
MDL	method detection limit
POP	plant operating procedure
PQL	practical quantitation limit
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QAPP	Quality Assurance Program Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act of 1976
SALDS	State Approved Land Disposal Site
SAP	Sampling and Analysis Plan

SDT	Sample Data Tracking System
S&GRP	Soil and Groundwater Remediation Project
SOM	Shift Operations Manager
SVOA	semi-volatile organic analysis
TEDF	200 Area Treated Effluent Disposal Facility
VOA	volatile organic analysis
WAC	Washington Administrative Code
WAP	Waste Analysis Plan
WDOH	Washington State Department of Health
WFMP	Waste and Fuels Management Project

D-1 Project

This Quality Assurance Project Plan (QAPjP) applies to sampling and monitoring activities at the Liquid Effluent Retention Facility (LERF), 200 Area Effluent Treatment Facility (ETF), and 200 Area Treated Effluent Disposal Facility (TEDF).

The purpose of this QAPjP is to document the project's technical planning process, providing a clear and complete plan for environmental data operations, including project organization and quality objectives. It specifies quality requirements for sampling so that key decisions can be made regarding the treatment, storage, and disposal of wastewaters on the Hanford Site. This QAPjP implements the requirements of the 10 CFR 830, Subpart A, "Quality Assurance Requirements" in conjunction with CH2M HILL Plateau Remediation Company (CHPRC) upper-tiered documents, including *Quality Assurance Program*, PRC-MP-QA-599 and *CH2M Hill Plateau Remediation Company Environmental Quality Assurance Program Plan*, CHPRC-00189.

This QAPjP was written per Environmental Protection Agency (EPA) document *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 (EPA 2002).

D-1.1 Facility Description

The LERF, ETF, and TEDF are located on the Hanford Site and operated by the Liquid Waste Facilities organization, a part of the Decommissioning, Waste, Fuels and Remediation Services within CHPRC.

D-1.1.1 Liquid Effluent Retention Facility

The LERF consists of three double-lined basins, each having a capacity of 7.8 million gallons, used to store wastewaters prior to treatment at ETF. LERF is permitted by State of Washington, Department of Ecology (Ecology) to store and treat dangerous and mixed wastes. LERF performs treatment by pH and flow equalization. LERF began operation in 1994 with receipt of process condensate from the 242-A Evaporator. Sampling is performed at LERF via eight risers which extend to the bottom of each basin.

In addition to sampling at LERF, Ecology requires sampling of the groundwater wells around LERF.

D-1.1.2 200 Area Effluent Treatment Facility

The ETF began operation in 1995 to treat contaminated aqueous solutions generated on the Hanford Site, including radioactive, dangerous and mixed wastes. The facility is permitted by Ecology to store and treat dangerous and mixed wastes. Treatment includes filtration, ultraviolet oxidation, reverse osmosis, and ion exchange. ETF receives waste from LERF, from tankers via the Load-In Station, and from containers received and stored at the facility.

Following treatment, the wastewater at ETF is stored in one of three verification tanks before disposal at the State Approved Land Disposal Site (SALDS) north of the 200 West Area. Before disposal, wastewaters stored in these tanks are sampled to verify compliance with regulatory requirements.

In addition to sampling at ETF, Ecology requires sampling and monitoring of the groundwater wells around SALDS.

D-1.1.3 200 Area Treated Effluent Disposal Facility

The TEDF system collects non-dangerous wastes from facilities in the 200 Areas of the Hanford Site and transfers them, via three lift stations, to two 5-acre disposal basins east of the 200 East Area. Flow, conductivity and pH of the stream are monitored at the 6653 Building prior to discharge to the disposal

basins. The sampling building also contains a grab sampler and a flow-proportional, refrigerated composite sampler. TEDF began operation in 1995.

D-1.2 Scope of Quality Assurance Project Plan

This QAPjP covers LERF, ETF, and TEDF activities involving sampling and monitoring for safety, environmental and process control decisions. Additional sampling and monitoring activities which are quality affecting are covered under other quality documentation:

- Groundwater sampling at LERF and SALDS: 'Soil & Groundwater Remediation Quality Assurance Project Plan', Appendix C of this document.
- ETF stack and near field monitoring station air sampling: 'CHPRC National Emission Standards for Hazardous Air Pollutants Radionuclides Quality Assurance Project Plan', Appendix E of this document.
- Calibration of field instruments: *Calibration Management Program*, PRC-PRO-MN-490.

Other quality affecting documents are listed in 'Key Quality Assurance Program Implementing Documents and ISMS Crosswalk', Appendix B to *Quality Assurance Program*, PRC-MP-QA-599. Process field sampling by Operations, such as taking a pH reading using litmus paper, is not quality-affecting, and is not discussed in this QAPjP.

D-2 Project Organization and Responsibilities

The EPA *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 (EPA 2002) requires projects define in the QAPjP organizations involved in major aspects of the project. This section addresses only organizations directly involved in sampling and monitoring at LERF/ETF/TEDF. A discussion of higher-tiered organizations in CHPRC is included in Section 1.5 of this document. For a complete organization chart, refer to the CHPRC website.

D-2.1 LERF/ETF/TEDF Organization

Overall management of LERF, ETF, and TEDF is performed by the Liquid Waste Facilities Director, who is responsible for safe operation of the facilities, including implementation of this QAPjP and compliance with all applicable permits and regulations. The Director also provides retention of project records in accordance with administrative requirements. Assisting the Director is an Environmental Compliance Officer (ECO) who monitors compliance, reviews new requirements and regulations, and interfaces with EPA and Ecology.

The following organizations support the Liquid Waste Facilities Director. Individuals in these organizations may be matrixed from a higher-tiered organization but are directed by the Director.

D-2.1.1 Operations

The Operations group consists of personnel who operate the facility, including operators performing sampling activities. The Operations group is responsible for ensuring sampling personnel are properly trained to collect, package, and transport samples to the laboratory.

The Operations group is also responsible for ensuring treated effluent in the ETF verification tanks is in compliance before discharge to SALDS. Therefore, the Operations group is the principal decision maker using environmental data.

D-2.1.2 Maintenance

The Maintenance/Work Control group is responsible for performing calibrations and preventative maintenance on equipment, including pH, conductivity, flow and level meters required by environmental permits. The Maintenance group also ensures maintenance records are retained for regulatory and quality review.

D-2.1.3 Engineering

The Engineering group performs process, system, and design engineering. Engineering personnel are involved with sampling activities at LERF, ETF and TEDF, including scheduling sampling, generating data forms, reviewing sample results, and validating data. The Engineering group drafts quarterly and annual reports for the Liquid Facilities Director to submit to Ecology and are, therefore, the primary data user of environmental data.

D-2.1.4 Radiological Control

The Radiological Control group provides radiation protection services to the facilities, including radiation surveys and releases of samples for transportation to the laboratory. The Radiological Protection organization also operates the Central Radiological Counting Facility, which screens samples where process knowledge is not available to determine the proper shipping requirements.

D-2.2 Supporting Organizations

The following organizations support LERF/ETF/TEDF either as matrixed support or through an internal agreement or external contract.

D-2.2.1 Groundwater Sampling Operations/Sample Management and Reporting

The Soil and Groundwater Remediation Project (S&GRP) of CHPRC performs monitoring and sampling at the LERF and SALDS groundwater monitoring wells. Two organizations within S&GRP support LERF/ETF/TEDF. The Sample Operations group samples the groundwater wells and packages all CHPRC samples for shipment to offsite laboratories. They also provide sample bottles and other sampling equipment to the LERF/ETF/TEDF Operations group. All sampling and sampling equipment must meet the requirements of the *Hanford Analytical Services Quality Assurance Requirements Documents* (HASQARD), DOE/RL-96-68 (DOE 2007).

The Sample Management and Reporting group of S&GRP supports Sample Operations in sampling groundwater and provides interface with offsite laboratories. These activities include:

- Generating data forms and scheduling LERF and SALDS groundwater sampling.
- Acting as the point of contact for offsite laboratories providing services to CHPRC, including the statements of work, contracts, and billing.
- Communicating sample schedules and special requests with the offsite laboratories.
- Receiving and managing Sample Issue Resolutions (SIRs) where the laboratories report off-normal events such as missed holding times, failed analytical QC, etc. The Sampling Management and Reporting group works with the LERF/ETF/TEDF Engineering to develop and document the appropriate responses to SIRs.

D-2.2.2 Environmental Data Integration

The Environmental Data Integration group maintains a database of LERF/ETF/TEDF environmental sample results. All samples taken to meet EPA and Ecology requirements are loaded into the Hanford Environmental Information System (HEIS), a database with current analytical data for soil, wastewater and groundwater samples. The Environmental Data Integration group also maintains the Sample Data Tracking System (SDT) program to allow the electronic creation of sample numbers, chains of custody, and bottle labels, and the Electronic Data Deliverable Processor to allow electronic upload of data into the HEIS database. Although not required, most process control sample results are also loaded into HEIS.

D-2.2.3 Other Organizations

The Liquid Waste Facilities Director contracts other organizations to perform activities that are beyond the expertise of LERF/ETF/TEDF personnel. In these cases, the work activities may be given to a different contractor provided the new contractor can meet the requirements of this QAPjP.

Analytical Laboratories

CHPRC contracts analytical services from four offsite laboratories:

- Test America, Inc., which has laboratories in Richland, Washington, Denver, Colorado, Knoxville, Tennessee, and St. Louis, Missouri
- GEL Laboratory in Charleston, South Carolina

- Southwest Research Institute in San Antonio, Texas
- ALS Environmental in Fort Collins, Colorado.

The offsite laboratories provide sample analyses, QA sample analyses, laboratory validation of analytical results, and preparation of quality records for archive. All four offsite laboratories are accredited environmental laboratories under the provisions of Washington Administrative Code (WAC) 173-50. Not all of these laboratories are accredited for all required methods and constituents for LERF/ETF/TEDF sampling. The laboratory capabilities must be reviewed as part of Sampling Process Design (Section D-6).

The offsite laboratories also participate in the Department of Energy Consolidated Audit Program (DOECAP). DOECAP audits are performed on laboratories to meet the requirements of DOE Order 414.1D, *Quality Assurance*, which requires thorough, rigorous assessments and effective corrective actions.

CHPRC maintains Statements of Work with the offsite laboratories per the requirement of Section 4 of this EQAPP, "Procurement of Items and Services." The Statements of Work include the requirements for analytical methods and constituents, data quality, turnaround time requirements, and reporting requirements. These requirements of the HASQARD (DOE 2007) are included in the Statements of Work.

D-3 Problem Definition and Quality Objectives

The CHPRC is contracted by DOE to operate the LERF, ETF, and TEDF so they meet 1) applicable federal, state, and local environmental regulations, environmental permits, and compliance agreements/orders; and 2) provisions of the plateau remediation prime contract, including applicable DOE orders and documents. The problem definitions and data quality objectives (DQOs) are designed to meet the requirements in these documents. *The Guidance for the Data Quality Objectives Process*, EPA QA/G-4 (EPA 2006) was used to establish DQOs.

The environmental requirements are listed in CHPRC document, *Environmental Protection Requirements*, PRC-RD-EP-15332, and are implemented through the following procedures:

- *Environmental Protection Processes*, PRC-PRO-EP-15333;
- *Effluent and Environmental Monitoring for Radionuclide Airborne Emissions*, PRC-PRO-EP-15334;
- *Environmental Permitting and Documentation Preparation*, PRC-PRO-EP-15335.

During planning and construction of LERF, ETF and TEDF, the process in PRC-PRO-EP-15335 was used to identify required environmental permits. PRC-PRO-EP-15333 addresses compliance with these permits, environmental regulations, and DOE Orders, including requirements related to management of waste generated during operations and maintenance. The permits and DOE Orders are identified in Table D1. Some of the permits include specific sampling and monitoring requirements.

PRC-PRO-EP-15334 addresses air sampling requirements, including air sampling at LERF and ETF required by the *Hanford Site Air Operating Permit* (Ecology 2010b). As discussed in Section 1.2, air sampling quality assurance is addressed in ‘CHPRC National Emission Standards for Hazardous Air Pollutants Radionuclides Quality Assurance Project Plan’, Appendix E of this document.

In addition to meeting environmental requirements, CHPRC is contracted by DOE to establish nuclear safety controls in accordance with 10 CFR 830, Subpart B. “Safety Basis Requirements”. During planning and construction, the hazard categorization documents were issued for LERF and ETF. The documents are listed in Table D1. Radionuclide sample results are used to ensure operation of these facilities is maintained within the requirements of the hazardous categorization documents.

The TEDF problem definition is: Determine whether TEDF discharges are within State of Washington, Department of Ecology (Ecology), regulatory requirements.

The LERF/ETF problem definitions are:

- Determine whether LERF and ETF operations, including influent and waste generation sampling, meet Ecology requirements.
- Determine whether ETF discharges, and SALDS groundwater results, meet DOE, Ecology and EPA requirements.
- Determine whether the radionuclide content at LERF and ETF meet DOE and State of Washington, Department of Health, requirements.
- Determine whether waste generated at LERF, ETF, and TEDF meets the requirements for disposal at the Environmental Restoration Disposal Facility, or other treatment or disposal facility.

The bases documents for TEDF, ETF, and LERF sampling are given in Table D1. These documents often specify a required sampling design, including required analytes, sampling frequency, analytical methods, and detection levels. Sampling process design is discussed in Section 6.0.

D-3.1 Quality Requirements for Sample Analysis

Quality requirements are imposed through the project and laboratory QAPjPs. Each laboratory used by LERF, ETF and TEDF will have a QAPjP or equivalent document. Five parameters are often used to define data quality for sample analysis.

D-3.1.1 Precision

Precision represents a measure of the degree of reproducibility of measurements under prescribed similar conditions. Precision is calculated on the basis of duplicate analyses. For organic analysis, the laboratory determines precision by performing matrix spike and matrix spike duplicate measurements. For inorganic, radiochemistry, and wet chemistry analysis, the laboratory determines precision by matrix spike/matrix spike duplicates or by laboratory duplicates, depending on the method. The relative percent difference (RPD), defined as the absolute value of the difference between duplicate results, divided by the average of the results, is used to estimate precision.

D-3.1.2 Accuracy

Accuracy represents the degree to which a measured value agrees to an accepted reference or the true value. Accuracy is expressed as the percent recovery of an analyte in a reference material or a spiked sample. For organic analysis, the laboratory determines accuracy by performing a matrix spike analysis. For inorganic, radiochemistry, and wet chemistry analysis, the laboratory determines accuracy by matrix spike or laboratory control sample analysis, depending on the method. The percent recovery of a spiked sample is the spiked sample result minus the sample result, divided by the spike amount. The percent recovery of a laboratory standard is the measured value divided by the known value of the standard.

D-3.1.3 Comparability

Comparability is the confidence level with which one set of data can be compared to another. Comparability is maintained by requiring the laboratories to perform EPA-defined methods, where available and appropriate, and meet the specific practical quantitation levels (PQLs) and accuracies specified in the Sampling and Analysis Plans (SAP) or the Waste Analysis Plan (WAP).

D-3.1.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total amount of data requested. The target for completeness in regulatory samples is 90 percent of the data is useable for decisions, meaning the data is not rejected due to quality concerns, and 100 percent of the requested analysis is performed.

D-3.1.5 Representativeness

Representativeness is the degree to which the sample data accurately and precisely represents the actual concentration, or distribution of the concentrations, in the process. Administrative, field and laboratory quality controls will be used to ensure representativeness. Administrative controls consist of sample event planning, such as determining the sample point location, number of samples, sampling techniques, plant conditions during sampling, etc. Field quality controls include trip blanks and field blanks to assess field contamination, and sample duplicates to assess precision in the sampling process.

Table D1. LERF, ETF and 200 Area TEDF Requirements Bases Documents

TEDF	<i>State Waste Discharge Permit Number ST0004502 (Ecology 2012)</i>
LERF/ETF	<i>Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste at the Hanford Facility (Hanford Facility RCRA Permit) WA7890008967 (Ecology 2010a)</i>
	<i>Waste Excluded from Specific Sources (Delisting Exclusion), 40 CFR 261, Appendix IX, Table 2</i>
	<i>Letter, LJ Iani, EPA, "Approval of the Toxic Substances Control Act Risk-based Disposal Approval Application for Management of Polychlorinated Biphenyl Remediation Waste at the 200 Area Liquid Waste Processing Facilities" (EPA 2004)</i>
	<i>State Waste Discharge Permit Number ST4500 (Ecology 2000)</i>
	<i>Groundwater Monitoring and Tritium-Tracking Plan for the 200 Area State-Approved Land Disposal Site, PNNL-13121 (PNNL 2000)</i>
	<i>Radiation Protection of the Public and the Environment, DOE Order 458.1</i>
	<i>Hazard Categorization for the Effluent Treatment Facility, WHC-SD-C018H-HC-002 (WHC 1995)</i>
	<i>Liquid Effluent Retention Facility Final Hazard Category Determination, HNF-SD-WM-SAD-040 (HNF 2001)</i>
	<i>Hanford Site Air Operating Permit (AOP), #00-05-006, Renewal 1, Revision F (Ecology 2010b).</i>
	<p>Licenses for radioactive air emissions at LERF/ETF:</p> <ul style="list-style-type: none"> • Letter, J. Martell, WDOH, AIR-302 for LERF Basin 44 (WDOH 2014a) • Letter, J. Martell, WDOH, AIR-303 for LERF Basin 43 (WDOH 2014b) • Letter, J. Martell, WDOH, AIR-304 for LERF Basin 42 (WDOH 2014c) • Letter, J. Martell, WDOH, AIR-305 for ETF stack (WDOH 2014d) • Letter, J. Martell, WDOH, AIR-306 for diffuse and fugitive emissions from LERF and ETF (WDOH 2014e)
	<p>Approval of Notice of Construction for nonradioactive air emissions:</p> <ul style="list-style-type: none"> • Letter, DH Hendrickson, Ecology, (includes attachment DE07NWP-003), June 6, 2007 (Ecology 2007a) • Letter, DH Hendrickson, Ecology, (includes attachment DE07NWP-003, Amendment 1), August 7, 2007 (Ecology 2007b) • Letter, DH Hendrickson, Ecology, (includes attachment DE07NWP-003, Amendment 2), September 27, 2007 (Ecology 2007c) • Letter, DH Hendrickson, Ecology, (includes attachment DE07NWP-003, Revision 1), August 10, 2010 (Ecology 2010c)
	<i>Environmental Restoration Disposal Facility Waste Acceptance Criteria, WCH-191 (WCH 2010)</i>

D-4 Personnel Training and Procedures

To ensure sampling provides quality data, Operations personnel must be properly trained and provided with procedures for sampling. The procedures and training must ensure sampling meets the requirements in the HASQARD (DOE 2007), which cites EPA and American Society for Testing and Materials (ASTM) standards for sampling.

D-4.1 Personnel Training and Certification

Training of personnel is based on their assigned job position at the facility. Current position descriptions and assigned duties are described in the *Liquid Effluent Retention Facility/200 Area Effluent Treatment Facility Dangerous Waste Training Plan*, PRC-STD-TQ-40232. Sampling, packaging samples, and transporting samples to the laboratory are some of the assigned duties performed by operators and outside sampling organizations. Transporting samples is exempt from dangerous waste shipping training per WAC 173-303-071(3)(1); however, personnel transporting samples onsite must meet the training requirements in *Transportation and Packaging Training*, PRC-PRO-TP-166. Creating sample documents and managing completed sample records are not dangerous waste activities, and may be performed by any personnel provided the activities meet the requirement of this QAPjP.

The basic requisite skills, education, experience, and other qualifications for each job position are given in *Personnel Training and Qualification*, PRC-PRO-TQ-40164. In addition to these basic qualifications, the Dangerous Waste Training Plan specifies facility-specific training courses required for specific duties, including sampling and sample packaging. Finally, after completing basic and facility training, operators must complete On the Job Training related to sampling and sample packaging procedures. CHPRC maintains comprehensive information on each employee's qualifications, including education, experience, completed training courses, and periodic retraining requirements.

D-4.2 Sampling Procedures

Samples may be obtained using several sampling techniques, including grab sampling, composite sampling, thief sampling, powder sampling, or a combination of these. The sampling technique for effluent sampling is specified in the appropriate discharge permit. Process control samples are almost always taken by grab sampling.

Procedure POP-65J-002 provides instructions for all sampling techniques used at LERF/ETF/TEDF. POP-60M-004 provides instructions for sampling from the risers at LERF, and POP-68-002 provides instructions for grab and composite sampling at TEDF. Procedure POP-65J-002 also provides instruction on packaging samples for shipment to the 6269 Building, and maintaining sample custody. These plant operating procedures (POPs) follow sampling guidance from the HASQARD (DOE 2007). Operations personnel who perform sampling receive On the Job Training on these procedures. In rare cases, such as sampling waste debris, a nonstandard sampling technique is necessary. These are addressed on a case-by-case basis, and recorded in the work planning documentation.

Sampling activities performed by other CHPRC Projects or outside contractors, such as groundwater sampling at LERF and SALDS, must be performed with procedures that meet the guidance of the HASQARD (DOE 2007).

D-4.3 Variances in Sampling Procedures

For regulatory sampling, the goal is to have no variances from sampling requirements of the HASQARD (DOE 2007), as described in the POPs. Equipment malfunctions, personnel errors, etc., may result in

variances from procedure steps. If this happens, the situation will be resolved by the Operations group, with the support of Engineering, Maintenance, and the ECO. Conditions will be restored to conform to the requirements of the applicable POP, or the POP will be revised. If necessary, the sample event will be repeated.

D-5 Sample Documentation and Records

Complete and accurate sample documentation is essential to reconstruct a sampling event to demonstrate compliance to regulatory requirements. Sampling documents include the ETF logbook and data forms. The logbook places the sampling event in the chronological context of LERF/ETF and TEDF activities, and points to the existence of sampling details recorded on data forms. Data forms provide detailed information concerning a unique sampling event, such as the requested analysis and chain of custody (COC). The operating procedures in Section 4.2 provide directions for completing sample documentation. Contract sampling organizations must use sample documentation consistent with LERF/ETF/TEDF requirements.

D-5.1 ETF Logbook

The ETF logbook is maintained in the ETF control room. It is made of bound, single-sided ruled paper, with sequentially numbered pages. The front cover bears the facility name and the start and completion dates for the logbook. The current date is recorded on each completed page of the logbook. The logbook need not be waterproof since it is retained in the ETF control room. Pages are never removed from the logbook for any reason. Logbook entries of significant plant activities are typically made promptly and sequentially by the control room operator per the instructions in *Logkeeping*, PRC PRO-OP-24382.

The logbook serves as the starting point for reconstructing a sampling event. The following items related to sampling are recorded in the ETF logbook:

- The sampling event location
- The sampling event date and approximate completion time
- The COC or sample numbers identifying the sampling event.

D-5.2 Data Forms

Data forms provide the detailed information to reconstruct the sample event, including project name, sample location, sample numbers, sample dates and times, etc. Data forms for regulatory samples are:

- Chain of Custody/Sample Analysis Request - provides record of the sampling event, including sample location, sample time, sample bottles, requested analysis, and transfers of sample custody. The COC/Sample Analysis Request is further described in Section 6.2.
- Sample Field Record - provides record of the tank sampled, including process conditions during sampling.

Completed copies of data forms are placed in the facility regulatory file. Retention of sample documentation is discussed in Section 12. While not required, identical data forms are prepared for process control sampling; this prevents misunderstandings that may result in nonconformance during regulatory sampling.

D-5.3 Laboratory Documentation and Records

Certain records related to samples are maintained by the laboratories, including analytical results, instrument outputs, laboratory QA results, calibration records, etc. Such records must be retrievable to reconstruct the laboratory analysis. An electronic copy of the analytical results is sent to the Engineering group to include in the data folder for the sample event. For more information on records management, refer to the receiving laboratory's statement of work with CHPRC.

D-5.4 Database Records

LERF, ETF, and TEDF effluent, powder and groundwater sample results are stored in the Hanford Environmental Information System (HEIS) database, which is maintained by the CHPRC Environmental Data Integration organization. Laboratory data is uploaded into HEIS by the CHPRC Sample Management and Reporting organization per *Common Requirements of the Format for Electronic Analytical Data (FEAD)* (CHPRC 2007). Although not required, much of the generator and process control results are also loaded into HEIS.

The HEIS database and the Sample Data Tracking System (SDT) are maintained by the CHPRC Environmental Data Integration group per the quality requirements in Section 6 of this EQAPP and *Controlled Software Management*, PRC-PRO-IRM-309.

D-6 Sampling Process Design

The purpose of sampling process design is to ensure sampling provides information to allow decision makers to address the project problems defined in Section 3.0. For example, the sampling of the TEDF effluent must allow ETF Operations determine if the discharge meets regulatory requirements. Sampling process design includes determining the number of samples, sample location, sampling method, required analysis, and quality control (QC) sampling.

For most regulatory sampling, the sampling process design is established in the regulatory permits discussed in Section 3.0. The permits identify the required analytes, sampling frequency, analytical methods, and detection levels. These requirements have been gathered into the *LERF, 200 Area ETF, and 200 Area TEDF Sampling Analysis Plan* (HNF 2006) and the Waste Analysis Plan in the LERF/ETF portion of the Hanford Facility RCRA Permit (Ecology 2004a). In general, sampling of effluent discharges is performed per batch or monthly, while sampling of groundwater is performed quarterly. The sampling method is grab or 24-hour composite. Characterization of influent streams to LERF/ETF is more flexible. It is based on a combination of sample results and process knowledge, as specified in the WAP.

The QC requirements for sampling are discussed in Section 3.1 and Section 8.0.

Process control samples may be requested by any personnel, but are approved and directed by Operations. Process control samples are not used to make compliance decisions and, therefore, have reduced QC requirements. The QC for process control samples is performed per the requirements in Section 8.0. Data may be accepted even if significant QC problems are noted.

D-6.1 Sample Identification

All sample events include one or more samples, each given a unique sample identification number that ensures traceability of the sample from collection through shipment and disposal. The sample identification number is marked on the sample container labels and on field forms associated with the sample. Sample numbers are assigned by Engineering. Each sample location associated with a sample event is assigned a unique sample number. Each field QC sample is also assigned a unique sample number. When a sampling event at a specific location requires multiple containers, each container may have the same sample number.

D-6.2 Sample Analysis Request

A Sample Analysis Request form is required to communicate to the laboratory what specific analyses are being requested and any special instructions to the samplers or the laboratory. At LERF/ETF/TEDF, the Sample Analysis Request form is combined with the COC form. The COC/Sample Analysis Request contains the following information:

- Project designation (for example; facility name or sampling event)
- Company contact
- Sampling origin or location
- Sample number
- Laboratory shipped to
- Analyses requested, including analytical method and analytes (unless the receiving laboratory has previously received a list of requested methods and analytes)
- Listing of number and type of sample containers

- Method of preservation (if any) for each sample container
- Matrix description (water, other liquid, other solid, etc.)
- Possible sample hazards
- Special instructions.

The COC portion of the COC/Sample Analysis Request requires the following additional information:

- Signature of the sample collector, who is the initial field custodian
- Date and time each of the samples was collected
- Date and time of each custody transfer
- Signatures and printed names of relinquishing and receiving individuals for each custody transfer
- Record of final sample disposition.

Some of the information on the Sample Analysis Request also appears on the sample bottle labels. The following information is recorded on the bottle labels:

- Project or facility name
- Name of collector
- Sample number
- Date and time each of the samples was collected
- Sample location
- Method of preservation (if any)
- Laboratory analytical methods requested

The COC/Sample Analysis Request forms and bottle labels are typically generated using the Sample Data Tracking System (SDT) program. This program allows the user to enter most of the required information (facility, company contact, sample location, sample number, laboratory, analytical methods, preservatives, etc.) and allows the user to copy existing COC/Sample Analysis Requests for upcoming sampling events. The SDT program shares information with the Hanford Environmental Information System (HEIS) database, eliminating the need to manually enter data.

The COC/Sample Analysis Request forms may also be generated using standard forms such as Hanford Site Form A-6004-842.

D-6.3 Analytical Methods

The sample analysis at LERF/ETF/TEDF is performed using the laboratory analytical methods and detection levels specified in Attachment 1. Other analytical methods may be used, with approval of the ECO, provided a specific method is not required by the regulatory permits for the sample event, and the detection levels in Attachment 1 can be achieved.

In 2007, EPA revised 40 CFR 136 to replace some EPA-defined methods for water analyses with equivalent industry-defined methods. Until they are revised, the LERF/ETF/TEDF regulatory permits still list the EPA-defined methods. Attachment 1 provides the EPA method and the equivalent industry method.

Each regulatory permit, SAP, and WAP specifies applicable analytical methods, target analytes, and Practical Quantitation Limits (PQLs). All constituents are analyzed and reported to the Method Detection

Limit (MDL), which is typically one-fifth to one-tenth of the PQL. Sample results with concentrations between the MDL and PQL are reported as "estimated values."

For radionuclide samples, a Minimum Detectable Activity (MDA) is determined and reported by the laboratory. The MDA is similar to the MDL; however, the MDA can vary because it is based on background counting, which can be affected by the sample matrix.

Permit compliance sampling and analytical methods conform to EPA guidelines, unless otherwise specified in the TEDF or LERF/ETF permits. EPA guidelines include lists of approved methods in 40 CFR 136 and 40 CFR 141, and *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 (EPA 2008). Other analyses, primarily radionuclides, are performed using laboratory specific procedures. All analytical methods for permit compliance, except field and continuous measurements, are performed at a laboratory registered or accredited under the provisions of *Accreditation of Environmental Laboratories*, WAC 173-50.

D-6.4 Sample Supplies and Consumables

A sampling event may require one or more containers, either bottles or jars, with the number and type of containers depending on the laboratory methods requested. Appropriate preservatives are added to the sample containers prior to sampling. Methods requiring the same containers and preservatives are usually combined together to reduce the number of bottles needed. All State Waste Discharge Permit compliance samples must conform to the container and preservative requirements specified in 40 CFR 136.3, Table II (EPA 2004a). Certified clean new containers are used for compliance sampling, except when a volatile organic sample must be obtained using a cleaned sample syringe functioning as a composite sampler. In this case, the sample container may be reused if cleaned using a sample container cleaning method, as found in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 (EPA 2008). Attachment 1 provides a list of sample containers and preservatives for methods typically used at LERF, ETF, and TEDF. All sample containers are labeled and stored in a secure area before use.

Sample containers for QC sampling must meet the same container and preservative requirements as actual samples. QC blanks are filled with Type II water, defined in ASTM standard D1193 (ASTM 2011). Equipment blanks and field blanks are filled in the field, while trip blanks are prepared prior to sampling and accompany the sample containers during shipment. Refer to Section 8.1 for field QC requirements.

Process control samples do not need to meet the container and preservative requirements in Attachment 1, nor are they required to have certified clean containers.

D-6.5 Sample Preservation, Holding Time and Temperature

Samples are preserved per requirements identified in SW-846, Methods for Chemical Analysis of Water and Wastes, EPA 600 (EPA 1983) and 40 CFR 136. Refer to Attachment 1 for preservatives, holding temperatures, and holding times. All samples with a holding temperature requirement are stored on ice, synthetic ice, or are refrigerated at $4 \pm 2^{\circ}\text{C}$ until analyses are completed.

Sample holding time begins at the time and date the sample is collected in the field. For composite samples, the holding time begins when the composite sampler cycle is complete and the sampler is shutdown.

The accuracies of thermometers in the refrigerators at ETF and in the composite samplers are verified annually by comparing readings of such devices with the readings of a National Institute of Standards and Technology (NIST)-traceable factory-certified thermometer. The NIST-traceable factory-certified thermometer shall also be verified at a frequency specified by the manufacturer.

D-6.6 Sample Shipment

Most LERF/ETF/TEDF samples must be shipped to offsite laboratories for analysis. Samples are packaged by Operations for shipment to S&GRP Sample Operations in the 6269 Building, also known as the groundwater 5-bay facility. The samples are unpackaged and custody is transferred to the S&GRP Sample Operations group, who packages them for offsite shipment.

S amples shipped to offsite laboratories must meet U.S. Department of Transportation (DOT) shipping regulations as described in PRC-PRO-TP-157, *Offsite Hazardous Materials Shipments*. All samples shipped to offsite laboratories must be screened to determine the proper packaging and documentation. The screening of most LERF/ETF/TEDF samples is based on process knowledge of past sampling events; for example, TEDF and ETF Verification Tank samples have consistently low radionuclide levels, so they can be shipped as DOT non-radioactive.

For samples where process knowledge is not available (typically solid waste samples), a separate screening sample is taken and shipped to the Central Radiological Counting Facility located in MO-6110 just outside the 200 West Area. The results of the screening are used to determine shipping requirements. Samples awaiting radiological screening must be stored at ETF with the required preservation as discussed in Section D-6.5.

D-7 Sampling Operations

Samples are taken using techniques to ensure representativeness, and managed to maintain traceability of the sample from the field to the laboratory. Most samples are collected, packaged, and transported to onsite laboratories by Operations per the sampling procedures discussed in Section 4.2. Once received at the laboratory, samples are controlled by the laboratory's quality assurance plan.

D-7.1 Sampling Methods

Samples required by the regulatory permits are collected as either grab or composite samples, as specified in the permits. Sampling for other purposes may be performed using grab, composite, thief, scoop, or composite liquid waste sampler (COLIWASA). Whenever possible, industry-recognized sampling methods, such as methods from the EPA and ASTM, are used. The following requirements apply to all sampling methods:

- All containers will be filled within as short a time period as reasonably achievable;
- VOA sample containers will be filled first, and prior to any subdividing of a composited sample;
- VOA samples consisting of a set of two or more sample containers will be filled sequentially. The sample containers are considered equivalent and given identical sampling times;
- All VOA sample containers must have no headspace and be free of trapped air bubbles;

Grab sampling from sample valves is the most common sampling method. Grab sample requirements include:

- Sample lines should be as short as reasonably achievable and free of traps and pockets in which solids might settle;
- If practical, the sample line will be flushed before sampling with a minimum volume equivalent to three times the sample line volume;
- Contamination to the sample from contact with the internal and external surfaces of the tap should be minimized;

A composite sample is taken over a time interval, using a flow- or time-proportional sampler, to ensure the sample is representative. Other types of compositing are possible, such as preparing a weekly composite of daily grab samples. Composite samples may be collected and subsampled by several methods while meeting the requirement for representative sampling. The samples may be: 1) collected in the individual sample containers required per the analytical methods; 2) collected in one or more containers and subsequently subdivided into the individual sample containers required per the analytical methods; 3) collected in a single container and shipped to the laboratory for the preparation of sample aliquots for analysis. Composite sampling is not appropriate for filling VOA containers.

Composite sample requirements include:

- If practical, the sample lines and composite sampler will be flushed before sampling with a minimum volume equivalent to three times the sample line/composite sampler volume;
- Samples having holding temperature requirements, must be refrigerated at $4 \pm 2^{\circ}\text{C}$ during the time the composite sample is collected;

- Contamination from other sample containers, the sample enclosure, or the sample container rack should be minimized during the period of sampling;

Thief and COLIWASA samplers are used to sample liquid waste containers such as drums. Scoop samplers are used to sample powder waste generated in the Thin Film Dryer. Sample requirements for these samples include:

- Thief and COLIWASA samplers should be lowered into the liquid slowly so the level of the liquid inside and outside the sampler tube remain about the same;
- When lifting the thief or COLIWASA samplers from the solution, the outside should be wiped down, or the excess water allowed to drip off, before filling the sample containers.

D-7.2 Sample Handling and Custody

The proper handling of sample bottles after sampling is important to ensure the samples are free of contamination and to demonstrate the samples have not been tampered with. Requirements for sample handling and custody are given in SW 846 (EPA 2008) and the HASQARD (DOE 2007). The procedures in Section 4.2 provide instructions for sample handling, custody, and sample disposal.

D-7.2.1 Sample Handling and Transfers

When performing sampling, every precaution is taken not to contaminate samples or personnel. To reduce the likelihood of contamination, the number of persons involved in collecting and handling samples is kept at a minimum. After the sample is collected and the container cover is secured, the exterior of the container is wiped clean of any dirt, grime, or liquid. The containers are placed in plastic bags to minimize contamination to the outside of the container.

The Operations person who signs as the Collector on the COC is the first custodian of the samples. The custodian directs the application of a custody seal, such as tamper tape, to each container so that any tampering can be detected. The custodian verifies that all sample containers identified on the COC have been taken.

D-7.2.2 Chain of Custody

A major consideration for the legal credibility of analytical data is the ability to demonstrate that the samples have been taken and analyzed without tampering. This is achieved by maintaining continuous custody from the time of sampling until completion of analysis in the laboratory. The steps for maintaining custody in the field are given in procedure POP-65J-002. Custody requirements in the laboratory are given in each laboratory's quality assurance documents.

The COC form, which also serves as a sample analysis request form, is used to document custody in the field. This form, described in Section 6.2, includes the signature of the sample collector, the date and time each sample was collected, the date and time each custody transfer occurred, and the signatures and printed names of relinquishing and receiving individuals.

The Operations person who signs as the Collector on the COC is the first custodian of the samples. A custodian must maintain continuous custody of sample containers at all times from the time the sample is taken until delivery to the laboratory, or until delivery to a common carrier for shipment to an off-site location. Custody is maintained by any of the following:

- First, the custodian has actual physical possession of sample.
- After having physical possession, the custodian:

- Has the sample in view; or
 - Has placed the sample in locked storage; or
 - Keeps the sample within a secured area (e.g., controlled by authorized personnel only); or
 - Has applied a tamper-indicating device, such as evidence tape, to the sample container or shipping container.
- The custodian has taken actual physical possession of the samples or the shipping container sealed with an intact tamper-indicating device, such as evidence tape.

Custody of the samples or shipping container may be transferred between Operations personnel. Each transfer of custody is documented on the COC by the signatures and printed names of the custodian relinquishing the samples and the custodian receiving the samples, including the date and time of transfer.

Sometimes a sample or shipping container must be stored over an operations shift change. In this case, the custodian places the sealed samples or shipping container in a secured area and transfers custody to the Operations Shift Operations Manager (SOM), who includes "SOM" with his receiving signature on the COC. After shift change, the oncoming SOM transfers custody, also including "SOM" with his relinquishing signature. This is the only case where the receiving custodian and the relinquishing custodian would not be the same.

Before each transfer of custody, the relinquishing custodian verifies the identification number of the sample containers or shipping container corresponds to the COC. The receiving custodian, as a minimum, inspects the COC form and samples for deficiencies. All deficiencies are noted on the COC form with initials and date. The minimum inspection criteria are:

- The shipping container is not damaged.
- The outermost tamper-indicating device is applied and intact.
- The information on the form is accurate, including descriptions of any deficiencies identified by previous custodians.

After transferring the samples to the 6269 Building or the receiving laboratory, the receiving custodian provides a copy of the COC to the relinquishing custodian. This copy is placed in a data folder in the ETF regulatory file along with other sampling documentation related to the sampling event. The original COC accompanies the sample and is retained at the laboratory as a QA record. Offsite laboratories will include a copy of the COC in the laboratory data report.

D-7.2.3 Sample Storage

To demonstrate that samples have been taken and analyzed without tampering, sample containers must be stored properly before and after sampling. Before sampling, unfilled sample bottles are labeled and stored in a secure area under key control. Empty bottles are typically stored in the ETF Laboratory Storage Room, Building 2025E, Room 112A, or at the TEDF Sample Station, Building 6653, although storage is allowed in any secure location under key control of the SOM or his designated representative.

After sampling is completed, the storage time of sample containers at ETF should be minimized by coordinating sample shipment to the laboratory. When storage is necessary, samples are typically stored in the ETF Laboratory, Building 2025E, Room 112, although storage is allowed in any predetermined location under key control where conditions commensurate with the intended analysis and regulatory requirements specific for the analyte and matrix are maintained.

All sample containers must remain capped and protected from light and heat degradation during storage. If the COC specifies the samples be preserved at 4°C, storage must be in an insulated container with ice or synthetic ice added, or in a refrigerator set to a temperature of $4 \pm 2^\circ\text{C}$. Storage temperature is documented on the Sample Field Record, discussed in Section 5.2.

Storage of filled sample containers will use custody protocol and be under key control of the SOM or his designated representative.

D-7.2.4 Sample Packaging and Shipping

Samples must be surveyed, packaged and shipped properly not only to ensure protection of personnel and the environment, but also to prevent loss of integrity of the sample. Instructions for surveying, packaging, and shipping of samples are given in the operating procedures discussed in Section 4.2. The field custodian is responsible for proper packaging of the shipping containers, including filling out, dating, and signing the appropriate portion of the COC and shipping forms, when applicable. Refer to Section 7.2.2 for proper completion of the COC.

Sample bottles obtained from posted radiation areas are surveyed by the Radiological Control group per the *CH2M Hill Plateau Remediation Company Radiological Control Manual* (CHPRC 2013) and, if required, radioactive stickers are applied. The bottles are placed in leak proof plastic bags and transported in insulated shipping containers which provide secondary containment in case the bottles should break or leak. Additional absorbent or insulating material may be included as cushioning for the bottles. If the samples are required to be preserved at 4°C, the shipping containers are filled with ice or a synthetic ice material. The shipping containers are sealed with custody tape to provide evidence of tampering during storage or transport.

Most samples from LERF, ETF, and TEDF are shipped to the 6269 Building, also known as the groundwater 5-bay facility. These shipments are considered onsite shipments, which are defined as shipments within the boundaries of a DOE site or facility to which public access is controlled. Onsite shipments are made per *Onsite Hazardous Material Shipments*, PRC-PRO-TP-156, which includes requirements for classification, labeling, training, QA, etc. Samples are typically classified as either non-radioactive material, or Department of Transportation (DOT) radioactive material, excepted package-limited quantity of material. Shipments of samples with the latter classification are made using Onsite Routine Radioactive Shipment Record forms. Although most LERF/ETF samples contain dangerous or mixed waste materials, samples are exempt from dangerous waste requirements per WAC 173-303-071(3)(1) (Ecology 2004b). Therefore, a hazardous waste manifest is not required.

After delivery to the 6269 Building, the custody of the samples is transferred to S&GRP Sample Operations, who repackage the samples for offsite shipment. Samples shipped offsite (i.e., on public roads) must meet DOT requirement in 49 CFR 171 to 177 (DOT 2004). Refer to *Offsite Hazardous Material Shipments*, PRC-PRO-TP-157.

D-7.2.5 Sample Disposal

Normally, the laboratories will dispose of the unused sample portions as part of their waste disposal programs. Although unlikely for LERF/ETF/TEDF, if the laboratory requests unused samples be returned, the requesting laboratory will notify the S&GRP Sample Management and Reporting group requesting the return, outlining the samples to be returned with all pertinent information including any radiological information. The Sample Management and Reporting group will notify LERF/ETF/TEDF and coordinate receipt. The offsite laboratory must meet the appropriate DOT shipping requirements. The original Chains of Custody will accompany the returned samples. These samples are stored in the

ETF Laboratory Storage Room, 2025E, Room 112, until disposal. Powder samples are returned to the powder drums, while liquid samples are added to the ETF process.

Custody of samples must be maintained through final sample disposal. Samples returned to ETF must be kept under custody of a field custodian per Section 7.2.2 until disposal. The final disposal method is recorded on the COC. Offsite laboratories will provide CHPRC with a record of sample disposal by transmitting an electronic copy of the completed COC.

D-8 Quality Control

In addition to the quality requirements in sampling design and operations, discussed previously, quality control samples are taken to check the accuracy and integrity of the sampling and analysis process.

D-8.1 Field Quality Control

Field QC samples check the quality of the sampling, packaging and shipping by monitoring for precision/representativeness and sample contamination. The frequencies of field QC sampling events are shown in Table D2. These frequencies may be changed at the ECO's discretions. In general, field quality control is performed once every 20 samples, based on the frequency in the HASQARD (DOE 2007). Reagent water used in field QC blanks is Type II water, defined in ASTM Standard D1193 (ASTM 2011). Required field QC samples are:

- Field duplicates are two samples produced from material collected in the same time and location using the same sampling method. The sample and the duplicate are numbered uniquely. Analysis of field duplicates provides information on the homogeneity of the matrix or, for a homogeneous matrix, the precision of the overall sampling and analysis process.
- Equipment blanks are samples using reagent water which is passed through decontaminated sampling equipment prior to use, to measure of decontamination effectiveness.
- Field blank samples are used to detect contamination as a result of the sampling and analysis process. A field blank is prepared in the field during sampling by filling an empty sample bottle with reagent water and packaging the sample along with the field sample.
- Trip blank samples are used to detect contamination during shipping and laboratory handling. Trip blanks are used when samples are analyzed using VOA or Total Paraffin Hydrocarbon methods. Trip blanks are filled with reagent water and accompany the field sample at the sampling site and the laboratory. Trip blanks are not opened in the field.

D-8.2 Laboratory Quality Control

Laboratory quality control monitors the quality of the analytical methods. The frequencies of the laboratory QC for compliance and process control samples are shown in Table D2. Not all the QC checks are performed on all methods; for example, matrix spike and matrix spike duplicate analysis is typically not performed on radiological methods. Laboratory QC includes:

- A preparation blank sample (also called a method blank sample) is used to monitor contamination resulting from the sample preparation process. Preparation blanks are generally distilled or deionized water subjected to the same processing as the field samples.
- A laboratory control sample is used to monitor the effectiveness of the sample preparation process. The laboratory control sample is a material similar in nature to the sample being processed containing the analytes of interest (e.g., standard reference material).
- A matrix spike sample is a sample that has been spiked with the analytes of interest and is processed in the same manner as the sample. The matrix spike is used to estimate method accuracy in a specific sample matrix. A surrogate sample, which is like a spike sample but uses a special analyte not normally encountered, is also performed on organic analysis.

The Waste Analysis Plan for LERF/ETF, included in the Hanford Facility RCRA Permit (Ecology 2004a), establishes accuracy targets for certain samples, including sampling to meet the delisting exclusion (EPA 2005) and Land Disposal Restriction sampling of secondary waste. Either the laboratory control sample or the matrix spike sample can be used to check the accuracy of these samples.

- Laboratory duplicate samples are two aliquots of the same sample taken through the entire analytical process. Similarly, matrix spike duplicate samples are two matrix spike aliquots of the same sample taken through the entire analytical process. The degree of agreement between duplicates represents the precision of the analytical method.
- A Practical Quantitation Limit (PQL) check standard sample is an ETF-specific sample that is similar to a matrix spike but uses a spike level equal to the PQL. This QC sample is required by the State Waste Discharge Permits ST4500 (Ecology 2000).

Sufficient sample volume must be provided so the laboratory can perform all necessary laboratory QC checks. Attachment 1 provides recommended sample volumes for each analytical method.

Table D2. Field and Laboratory Quality Control Sampling

QC Type (1)		Frequency		Target
		Compliance Samples	Process Control Samples	
Field QC	Duplicate	One in 20	None	RPD < 20% if matrix is homogenous.
	Equipment blank	One in 20, where equipment is reused.	None	Investigate if analyte is detected in blank and sample.
	Field blank/Trip blank	One in 20 or minimum one per VOA sampling event	None	Investigate if analyte is detected in blank and sample.
Laboratory QC (2)	Preparation blank (method blank)	Each batch	Each batch	Refer to laboratory QA documents.
	Laboratory control standard	Each batch	Each batch	Refer to the WAP and the laboratory QA documents.
	Matrix spike/surrogate	Each batch	None	Refer to the WAP and the laboratory QA documents.
	Duplicate/matrix spike duplicate	Each batch	None	RPD < 20%
	PQL check standard	Refer to permit ST4500	None	Accuracy:80% - 120%

RPD: Relative percent difference ST4500: (Ecology 2000)

PQL: Practical quantitation limit

WAP: Waste Analysis Plan (in the Hanford Facility RCRA Permit, Ecology 2010a)

(1) The QC frequency may be changed at the Environmental Compliance Officer's discretion.

(2) Not all QC checks can be performed for each analytical method. Consult the laboratory QAPjP to determine applicability.

D-9 Instrument Calibration and Preventive Maintenance

LERF, ETF, and TEDF use a wide variety of instruments to monitor operations and meet regulatory requirements. This includes composite samplers and continuous pH and conductivity monitors required by facility permits. All instruments are calibrated according to frequencies and tolerances established by Engineering. Calibrations and other maintenance actions are scheduled and tracked by Maintenance using a preventive maintenance database. Measuring and test equipment used for instrument calibration is controlled, calibrated at specified intervals, and maintained to established accuracy limits. All work is completed and records maintained according to the *Calibration Management Program*, PRC-PRO-MN-490.

D-10 Data Reporting and Validation

Data reduction and reporting must be performed in a manner that allows easy review of the data to make decisions related to compliance with the bases documents in Section 3.0 of this QAPjP. Data reduction is the mathematical operations applied to raw data to produce reportable results. Data reduction is specified in each laboratory's procedures and must conform with EPA analytical methods, such as the requirements in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 (EPA 2008).

D-10.1 Data Reporting

Each laboratory performing analyses provides an electronic report of the requested sample analysis which is printed out in final form for the ETF regulatory file. Environmental analytical data, including effluent and groundwater sample results, are also transferred electronically to the HEIS database, as discussed in Section D-5.4.

A constituent is reported as detected if it exceeds the method detection limit (MDL), or for radionuclides, if it exceeds the minimum detectable activity (MDA). If a constituent is undetected, it is reported with the value of the MDL/MDA along with a laboratory data qualifier of "U". In addition to the sample results, the laboratory report also provides the sample extract date and sample analysis date, and any data qualifiers.

Tentatively identified compounds discovered during organic analyses are included in the data report, except that any compounds that are suspected by the chemist to be column bleed are not reported. Tentatively identified compounds whose Chemical Abstract Numbers are not already included in the HEIS database, or are labeled in the data report as unknown, are not loaded into HEIS. Tentatively identified compounds are flagged in the HEIS database.

Copies of reports of field analysis (such as pH and conductivity analysis during groundwater sampling) will also be transmitted to Engineering. Results of continuous monitoring required for discharge monitoring reports for the State of Washington, Department of Ecology, are downloaded from the ETF Control Room computer and stored electronically.

D-10.2 Data Validation

Initial data validation is performed by the laboratory on all samples, based on the laboratory's QAPjP. Where analytical methods are based on EPA protocol, such as SW-846 (EPA 2008), the laboratory will verify the methods meet the EPA QC requirements. Data that is rejected as a result of major errors during validation will be disregarded and reanalysis performed. Minor anomalies found during data validation will be included in the sample report.

Additional data validation is performed by Engineering on compliance samples. Two levels of data validation are performed:

Level A - this level of validation applies to all compliance samples.

- Chain of custody - Verify the COC shows unbroken custody from sampling through receipt at the laboratory.
- Requested analysis - Review the sample results to verify the requested analysis was performed. If an alternate method was used, verify permit-required detection limits were met.

- Holding times - Review the sample results to verify the analyses were performed within the required holding times (time between sample collection and sample analysis) and, where applicable, extraction times (time between sample collection and sample extraction).
- PQL check standard - verify the PQL check standard was performed when required by the discharge permits.
- Blank - Review the results of trip, field, and equipment blank samples to verify the sample results are not compromised by contamination.

Level B - This level of data validation includes a Level A validation and:

- Laboratory QC - Verify the laboratory QC was completed and there are no outstanding problems.
- Field duplicate - Compare the results of the field duplicates to verify the precision/representativeness of field sampling is acceptable (see Table D2).
- Sampling plan - Review the sample analysis request (included on the COC form) to verify the analytical methods and constituents requested were those required by the bases documents (see Table D1), and the proper container types and preservations were specified.

D-10.3 Reconciliation with Requirements

If sample results of the ETF or LERF discharge exceed the applicable limits in ST4500 (Ecology 2000) or ST0004502 (Ecology 2012), Engineering and the ECO will work with Operations to determine a response. Since most discharge permit limits are monthly averages, a typical response is to resample the discharge to lower the average. Other responses include requesting the laboratory reanalyze the sample or, in the case of ETF, recycling the wastewater in the discharge tank.

If a deficiency is discovered during data validation, the response is determined on a case-by-case basis using a graded approach, depending on the relative importance of the problem. Minor QC errors, such as a low accuracy result of one constituent or missing initials on a COC, may be accepted provided the overall QC results are acceptable. Significant problems, such as failure to complete permit-required sampling, may require notification of Ecology. Problems may be addressed using established work processes or through the corrective action management system.

D-11 Assessments and Oversight

Quality programs, such as the sampling program, can only be effective if meaningful assessments are performed to monitor and respond to issues associated with program performance. Routine assessment of data is performed as part of the validation process, discussed in Section 10.2 of this QAPjP. In addition, management assessments are required by the Quality Assurance Program, PRC-MP-QA-599.

D-11.1 Management Assessments and Response Actions

Each year, management assessments are performed per an annual management assessment plan, generated by the Liquid Waste Facilities Director per Management Assessment, PRC-PRO-QA-246. Management assessments are conducted by first line management and subject matter experts, focusing on procedural adequacy, compliance, and overall effectiveness of the program.

Each management assessment has performance objectives or lines of inquiry. Examples may include:

- Completeness and adequacy of personnel training.
- Conformance of the sample program with applicable requirements of the bases documents in Section D-3.0 of this QAPjP.
- Proper performance and documentation of sampling procedures, including custody, storage, packaging and shipping of samples.
- Completeness of sampling records.

Assessments at the laboratories are performed per their quality assurance plans.

If a deficiency is discovered during an assessment, the response is determined on a case-by-case basis, as discussed in Section D-10.3 of this QAPjP. If a laboratory assessment determines there is a significant deficiency in sample data, the laboratory will notify Engineering to determine a response.

D-11.2 Reports to Management

Results of performance assessments, including any issues identified, are provided to the Liquid Waste Facilities Director in a written report. All findings and observations are entered into the corrective action management system, where they are evaluated for significance, root cause, and corrective actions per Issues Management, PRC-PRO-QA-052. Corrective actions are tracked in a CHPRC database until completion.

D-12 Document and Records Control

This section addresses the processes to control active documents, such as procedures, to ensure they are adequately reviewed, approved and distributed, and records documents, which must be retained to verify compliance.

D-12.1 Document Control System

Certain documents, such as procedures and supporting documents, must be controlled to ensure they are adequately reviewed and approved; and distributed to those responsible for performing the activity; and revised in a manner that ensures configuration is maintained and documented

CHPRC-wide procedures, which include those covering quality assurance planning, logkeeping, waste shipments, and management assessments, are controlled per *CH2M Hill Plateau Remediation Company Procedures*, PRC-PRO-MS-589. LERF/ETF/TEDF-specific operating, administrative, and maintenance procedures, such as the sampling procedures discussed in Section 4.2 of this QAPjP, are also controlled per PRC-PRO-MS-589. Supporting documents, such as this QAPjP, are issued and revised per *Engineering Documentation Preparation and Control*, PRC-PRO-EN-440. In all cases, the following elements apply:

- Each document has a unique number assigned, along with a revision number. Subsequent revisions have the same document number with a sequential revision number.
- Documents are reviewed and approved for adequacy and completeness per procedures PRC-PRO-MS-440 or PRC-PRO-EN-589, as appropriate.
- After approval, the new or revised document is placed in the field (or on the website); for procedures, the revised document replaces the earlier version.

D-12.2 Records Control and Retention

Records are information in hard copy or electronic format that furnish evidence of compliance with requirements, including quality and regulatory requirements. After generations, records are managed per *Records Management Processes*, PRC-PRO-IRM-10588. Newly-generated records are converted to electronic format and stored in the Integrated Data Management System (IDMS). The IDMS is managed by MSA and its subcontractor, Lockheed Martin Services, Inc. per the QA requirements in *Quality Assurance Program Description*, MSC-MP-599 (MSC 2013). The electronic records are considered the official records and the hardcopy materials are not maintained. Sample records at LERF, ETF and TEDF are not subject to the requirements associated with NQA-1 or the Office of Civilian Radioactive Waste Management program.

The following records for sample events performed to meet EPA and Ecology requirements are part of the Hanford Facility operating record and are placed in the ETF regulatory files:

- Sample Authorization Forms/Chains of Custody
- Analytical reports from the laboratory
- Sample Field Record data sheet, required for ETF verification tank and TEDF effluent samples
- Results of data validation checks

Although not required, records for most process control samples are also placed in the ETF regulatory files.

Records of all monitoring information required by discharge permits ST4500 (Ecology 2000) and ST0004502 (Ecology 2012) are retained for at least three years. This includes sample results, calibration and maintenance records, electronic recordings on continuous monitoring instruments, and copies of all required reports. The three-year retention period may be extended when requested by the State of Washington, Department of Ecology.

Records required by the Hanford Facility RCRA Permit (Ecology 2010a) are retained for ten years after closure of LERF and ETF. These records include annual reports, sample results required by the Waste Analysis Plan, onsite shipping records, and emergency planning documents. Records may be retained on the Hanford Site or offsite, such as at the Federal Records Center in Seattle, Washington.

D-13 References

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CHPRC Controlled Procedures

(including requirements, management plans, and procedures)

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PRC-PRO-QA-052, *Issues Management*

PRC-PRO-TP-156, *Onsite Hazardous Material Shipments*

PRC-PRO-TP-157, *Offsite Hazardous Material Shipments*

PRC-PRO-QA-246, *Management Assessment*

PRC-PRO-EN-440, *Engineering Documentation Preparation and Control*

PRC-PRO-EP-15333, *Environmental Protection Processes,*

PRC-PRO-EP-15334, *Effluent and Environmental Monitoring for Radionuclide Airborne Emissions,*

PRC-PRO-EP-15335, *Environmental Permitting and Documentation Preparation*

PRC-PRO-MN-490, *Calibration Management Program*

PRC-PRO-MS-589, *CH2M Hill Plateau Remediation Company Procedures*

PRC-PRO-TP-166, *Transportation and Packaging Training*

PRC-PRO-IRM-10588, *Records Management Processes*

PRC-PRO-OP-24382, *Logkeeping*

PRC-RD-EP-15332, *Environmental Protection Requirements*

PRC-STD-TQ-40232, *Liquid Effluent Retention Facility/200 Area Effluent Treatment Facility Dangerous Waste Training Plan*

Project-Specific Controlled Procedures

POP-60M-004, *LERF Sampling*

POP-65J-002, *Sampling*

POP-68-002, *200 Area TEDF Composite and Grab Sampling*

DOE Orders

DOE Order 414.1D, *Quality Assurance*

DOE Order 458.1, *Radiation Protection of the Public and the Environment*

State and Federal Regulations

10 CFR 830, *Nuclear Safety Management*, Subpart A, "Quality Assurance Requirements"

40 CFR 136, *Guidelines for Establishing Test Procedures for the Analysis of Pollutants*

40 CFR 141, *National Primary Drinking Water Regulations*

40 CFR 261, *Identification and Listing of Hazardous Waste*, Appendix IX, Table 2, "Waste Excluded from Specific Sources"

40 CFR 268, *Land Disposal Restrictions*

49 CFR 171 to 180, Subchapter C, *Hazardous Material Regulations*

WAC 173-50, *Accreditation of Environmental Laboratories*

WAC 173-303, *Dangerous Waste Regulations*

Appendix D Attachment D1

List of Analytical Methods and Constituent Quality Criteria

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Table D1-1. LERF/ETF/TEDF RCRA and Wastewater Analytical Methods			
EPA METHOD (1)	EQUIVALENT INDUSTRY METHOD (2)	DESCRIPTION	HEIS METHOD NAME (3)
EPA 120.1	SM 2510B	Specific Conductance, Wheatstone Bridge	120.1_CONDUCT
EPA 130.2 (4)	SM 2340B	Hardness - Total, Calculated Ca plus Mg as Carbonates from Analysis by ICP/AES	130.1_HARDNESS 2340_HARDNESS
EPA 150.1 (4)	SM 4500-H+ B	Hydrogen Ion, pH by Electrode	150.1_PH 4500B_PH
EPA 160.1 (4)	SM 2540C	Residue, Filterable (Total Dissolved Solids)	160.1_TDS 2540C_TDS
EPA 160.2 (4)	SM 2540D	Residue, Nonfilterable (Total Suspended Solids)	160.2_TSS 2540D_TSS
EPA 160.3 (4)	SM 2540B	Residue, Total (Total Solids)	160.3_TOTSOLIDS 2540B_TOTSOLIDS
EPA 200.7	SM 3120B	Metals Total by Digestion and ICP/AES	200.7_METALS_ICP
EPA 200.8	SM 3125B	Metals Total (Trace) by Digestion and ICP/MS	200.8_METALS_ICPMS
EPA 300.0	SM 4110B	Anions by Ion Chromatography	300.0_ANIONS_IC
EPA 300.7 (4)	ASTM D6919	Ammonia by Ion Chromatography	300.7_CATIONS_IC
EPA 310.1 (4)	SM 2320B	Alkalinity as CaCO ₃ by Titration	310.1_ALKALINITY 2320_ALKALINITY
EPA 310.2		Alkalinity as CaCO ₃ by Automated Colorimetry	310.2_ALKALINITY
EPA 335.2 (4)	SM 4500-CN E	Cyanide – Total by Spectrophotometry, Manual Titration	335.2_CYANIDE 4500E_CN
EPA 335.3 (4)	SM 4500-CN E	Cyanide – Total by Spectrophotometry, Automated Titration	335.3_CYANIDE 4500E_CN
EPA 350.1	SM 4500-NH ₃ G	Ammonia by Semi-Automated Colorimetry	350.1_AMMONIA
EPA 410.4	SM 5220D	Chemical Oxygen Demand by Spectrophotometry	410.4_COD
SW-846 1311/ EPA 200.8	SW-846/ ASTM D5673	Toxicity Characteristic Leaching Procedure (TCLP) Extraction, followed by Metals Total (Trace) by Digestion and ICP/MS	TCLP_200.8_MET_ICP
EPA 900.0	SM 7110B	Gross Alpha/Gross Beta by Gas Proportional Counting or Liquid Scintillation Counting	900.0_ALPHABETA_GPC
EPA 901.1	SM 7120	Gamma Emitters by Gamma Energy Spectroscopy	901.1_GAMMA_GS
EPA 903.0	SM 7500-Ra B	Radium by Precipitation and Alpha Proportional Counting	903.0_RADIUM_ALPHA
EPA 903.1	SM 7500-Ra C	Radium-226 by Radon Emanation Counting	903.1_RA226_LUC
EPA 904.0	SM 7500-Ra D	Radium-228 by Sequential Precipitation and Gas Proportional Counting	904.0_RA228_GPC
EPA 905.0	SM 7500-Sr B	Total Radioactive Strontium by Precipitation and Gas Proportional Counting	905.0_SR_GPC
EPA 906.0	SM 7500-3H B	Tritium by Distillation and Liquid Scintillation Counting	906.0ML_H3_LSC

Table D1-1. LERF/ETF/TEDF RCRA and Wastewater Analytical Methods			
EPA METHOD (1)	EQUIVALENT INDUSTRY METHOD (2)	DESCRIPTION	HEIS METHOD NAME (3)
EPA 1664	SM 5520B	Oil and Grease, n-Hexane Extractable Material	1664A_OILGREASE
SW-846 1020		Flashpoint/Ignitability, Setaflash Closed Cup	1020_FLASHPOINT
SW-846 6010		Metals by ICP/AES	6010_METALS_ICP
SW-846 6020		Metals by ICP/MS	6020_METALS_ICP
SW-846 7196		Chromium, Hexavalent by Colorimetry	7196_CR6
SW-846 8015		Non-Halogenated Volatiles by Gas Chromatography	8015_VOA_GC
SW-846 8081		Organochlorine Pesticides by Gas Chromatography	8081_PEST_GC
SW-846 8082		Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082_PCB_GC
SW-846 8260		Volatile Organic Compounds by Gas Chromatography/MS	8260_VOA_GCMS
SW-846 8270		Semivolatile Organic Compounds by Gas Chromatography/MS	8270_SVOA_GCMS
SW-846 9014		Cyanide by Titrametric or Manual Spectrophotometry	9014_CYANIDE
SW-846 9020		Total Organic Halides (TOX)	9020_TOX
SW-846 9040		pH by Electrode	9040_PH
SW-846 9045		pH of Soil and Waste	9045_PH
SW-846 9060		Total Organic Carbon	9060_TOC
SW-846 9071		Oil and Grease, n-Hexane Extractable Material for Sludge, Sediment and Solid Samples	9071_OILGREASE
SW-846 9310		Gross Alpha/Gross Beta by Gas Proportional Counting	9310_ALPHABETA_GPC
SW-846 1311/ TCLP 6010		Toxicity Characteristic Leaching Procedure (TCLP) Extraction, followed by Metals by ICP/AES	TCLP_6010_MET_ICP
SW-846 1311/ TCLP 8270		Toxicity Characteristic Leaching Procedure (TCLP) Extraction, followed by Semivolatile Organic Compounds by Gas Chromatography/MS	TCLP_8270_SVOA_GCMS
Non-Standard		Gasoline by Volatile Petroleum Products Method for Soil and Water Analyses, Washington State Dept of Ecology, NWTPH-Gx	WTPH_GASOLINE
Non-Standard		Diesel by Semivolatile Petroleum Products Method for Soil and Water Analyses, Washington State Dept of Ecology, NWTPH-Dx	WTPH_DIESEL
Non-Standard		Total Radiation Activity Screen	ACTIVITY_SCAN
Non-Standard		Americium-241/Curium Isotopics by Ion Exchange, Precipitation/Plating and Alpha Energy Analysis	AMCMISO_EIE_PLT_AEA

Table D1-1. LERF/ETF/TEDF RCRA and Wastewater Analytical Methods			
EPA METHOD (1)	EQUIVALENT INDUSTRY METHOD (2)	DESCRIPTION	HEIS METHOD NAME (3)
Non-Standard		Americium-241/Curium Isotopics by Ion Exchange, Precipitation and Alpha Energy Analysis	AMCMISO_IE_PREC_AEA
Non-Standard		Gamma Emitter by Gamma Energy Spectroscopy	GAMMA_GS
Non-Standard		Gross Alpha by Gas Proportional Counting	ALPHA_GPC
Non-Standard		Gross Alpha by Liquid Scintillation Counting	ALPHA_LSC
Non-Standard		Gross Beta by Gas Proportional Counting	BETA_GPC
Non-Standard		Gross Beta by Liquid Scintillation Counting	BETA_LSC
Non-Standard		Iodine-129 by Precipitation and Gamma Energy Analysis	I129_SEP_LEPS_GS
Non-Standard		Iodine-129 (low-level) by Precipitation and Gamma Energy Analysis	I129LL_SEP_LEPS_GS
Non-Standard		Neptunium-237 by Ion Exchange, Precipitation and Alpha Energy Analysis	NP237_IE_PRECIP_AEA
Non-Standard		Neptunium-237 by Extraction, Plating and Alpha Energy Analysis	NP237_LLE_PLATE_AEA
Non-Standard		Plutonium Isotopics by Precipitation/Plating and Alpha Energy Analysis	PUISO_PLATE_AEA
Non-Standard		Plutonium Isotopics by Ion Exchange, Precipitation and Alpha Energy Analysis	PUISO_IE_PRECIP_AEA
Non-Standard		Radioisotopes by ICP/MS	RADISOTOPES_ICPMS
Non-Standard		Radium Isotopics by Precipitation and Alpha Energy Analysis	RAISO_AEA
Non-Standard		Total Radiation Activity Screen	RADSCREEN
Non-Standard		Specific Gravity by Gravimetric Analysis	SPECIFIC_GRAVITY
Non-Standard		Total Radioactive Strontium by Precipitation, Ion Exchange, and Gas Proportional Counting	SRTOT_SEP_PRECIP_GPC
Non-Standard		Technetium-99 by Ion Exchange and Liquid Scintillation Counting	TC99_EIE_LSC
Non-Standard		Technetium-99 by Chemical Separation and Liquid Scintillation Counting	TC99_SEP_LSC
Non-Standard		Tritium by Distillation and Liquid Scintillation Counting	TRITIUM_DIST_LSC
Non-Standard		Tritium by Ion Exchange and Liquid Scintillation Counting	TRITIUM_EIE_LSC
Non-Standard		Uranium Isotopics by Ion Exchange, Precipitation/Plating and Alpha Energy Analysis	UIISO_IE_PLATE_AEA

AES: Atomic Emission Spectrometry
ICP: Inductively Coupled Plasma
MS: Mass Spectroscopy
SM : Standard Methods

Table D1-1. LERF/ETF/TEDF RCRA and Wastewater Analytical Methods			
EPA METHOD (1)	EQUIVALENT INDUSTRY METHOD (2)	DESCRIPTION	HEIS METHOD NAME (3)
<p>(1) EPA methods are specified in the following regulations/procedures: 40 CFR 136.3 “Identification of Test Procedures”, <i>Guidelines for Establishing Test Procedures for the Analysis of Pollutants</i> 40 CFR 141.23, “Inorganic Chemical Sampling and Analytical Requirements”, <i>National Primary Drinking Water Regulations</i> 40 CFR 141.25, “Analytical Methods for Radioactivity”, <i>National Primary Drinking Water Regulations SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods</i></p> <p>(2) Industry methods that are equivalent to the EPA-protocol methods are listed in the regulations cited in (1).</p> <p>(3) Method name as shown in the HEIS database.</p> <p>(4) These EPA methods numbers have been deleted from the latest versions of the CFR cited in (1) and are included for reference only.</p>			

Table D1-2. Quality Criteria for Influent Wastewater and Treated Effluent Samples – Nonradioactive Constituents(1)							
Parameter	Chemical Abstract Number	Sensitivity (ug/L)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)
Volatile Organic Compounds							
Acetone	67-64-1	40	20	60-120	3 x 40-mL amber glass with septum	HCl to pH<2; 4oC	14 days
Acetonitrile	75-05-8	820	20	60-120			
Benzene	71-43-2	5	20	60-120			
1-Butanol	71-36-3	1600	20	60-120			
Carbon disulfide	75-15-0	1500	20	60-120			
Carbon tetrachloride	56-23-5	5	20	60-120			
Chloroform	67-66-3	5	20	50-130			
Methylene chloride	75-09-2	5	20	50-150			
Tetrachloroethylene	127-18-4	5	20	65-140			
Tetrahydrofuran	109-99-9	100	20	60-120			
Total trihalomethanes(3)	NA	10	20	60-120			
Semivolatile Organic Compounds / Pesticides							
Acetophenone(3)	98-86-2	10	25	70-110	4 x 1-L amber glass	4oC	7 days for extraction; 40 days for analysis after extraction
Bis(2-ethylhexyl) phthalate(3)	117-81-7	5	25	50-120			
Carbazole	86-74-8	110	25	50-120			
p-Chloroaniline	106-47-8	76	25	50-120			
Chrysene	218-01-9	350	25	50-120			
Cresol, total (o, p, m) [Methylphenols, total]	1319-77-3	760	25	50-120			
Dichloroisopropyl ether [Bis(2-chloroisopropyl) ether]	108-60-1	38	25	50-120			
Di-n-octyl phthalate	117-84-0	300	25	50-120			
Diphenylamine	122-39-4	350	25	50-120			
Hexachlorobenzene	118-74-1	2	25	50-120			
Hexachlorocyclopentadiene	77-47-4	110	25	50-120			
Isophorone	78-59-1	2600	25	50-120			
Lindane (gamma-BHC)	58-89-9	1.9	25	50-120			
N-nitrosodimethylamine	62-75-9	10	25	50-120			
Pyridine	110-86-1	15	25	50-120			
Tributyl phosphate	126-73-8	76	25	50-120			
2,4,6-Trichlorophenol	88-06-2	230	25	50-120			

Table D1-2. Quality Criteria for Influent Wastewater and Treated Effluent Samples – Nonradioactive Constituents(1)							
Parameter	Chemical Abstract Number	Sensitivity (ug/L)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)
Polychlorinated Biphenyls (PCBs)							
Aroclor-1016	12674-11-2	0.4	25	50-110	4 x 1-L amber glass	4oC	7 days for extraction; 40 days for analysis after extraction
Aroclor-1221	11104-28-2	0.4	25	50-110			
Aroclor-1232	11141-16-5	0.4	25	50-110			
Aroclor-1242	53469-21-9	0.4	25	50-110			
Aroclor-1248	12672-29-6	0.4	25	50-110			
Aroclor-1254	11097-69-1	0.4	25	50-110			
Aroclor-1260	11096-82-5	0.4	25	50-110			
Total Metals							
Arsenic(3)	7440-38-2	2	20	70-130	1 x 500 mL glass or plastic	HNO3 to pH<2	Mercury: 28 days All others: 180 days
Barium	7440-39-3	1200	20	75-125			
Beryllium	7440-41-7	34	20	75-125			
Cadmium(3)	7440-43-9	0.5	20	70-130			
Calcium	7440-70-2	200	20	75-125			
Chromium(3)	7440-47-3	1	20	70-130			
Copper	7440-50-8	70	20	70-130			
Iron	7439-89-6	100	20	75-125			
Lead(3)	7439-92-1	0.5	20	70-130			
Magnesium	7439-95-4	400	20	75-125			
Manganese(3)	7439-96-5	1	20	70-130			
Mercury(3)	7439-97-6	1	20	70-130			
Nickel	7440-02-0	340	20	75-125			
Potassium	7440-09-7	10,000	20	75-125			
Selenium	7782-49-2	20	20	70-130			
Silicon (silica)	7440-21-3	580	20	75-125			
Silver	7440-22-4	83	20	75-125			
Sodium	7440-23-5	2500	20	75-125			
Uranium(3)	7440-61-1	30	20	70-130			
Vanadium	7440-62-2	120	20	75-125			
Zinc	7440-66-6	5100	20	75-125			

Table D1-2. Quality Criteria for Influent Wastewater and Treated Effluent Samples – Nonradioactive Constituents(1)							
Parameter	Chemical Abstract Number	Sensitivity (ug/L)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)
General Chemistry							
Chloride	16887-00-6	1000	20	70-130	1 x 60-mL glass	4oC	Nitrate & Nitrite: 48 hours All others: 28 days
Fluoride	16984-48-8	880	20	70-130			
Formate	NA	1250	20	70-130			
Nitrate (as N)	14797-55-8	100	20	70-130			
Nitrite (as N)	14797-65-0	100	20	70-130			
Phosphate (as P)	14265-44-2	500(4)	20	70-130			
Sulfate(3)	14808-79-8	500	20	70-130			
Ammonium (as N)	7664-41-7	40	20	70-130	1 x 50-mL glass or plastic	H ₂ SO ₄ to pH<2; 4oC	28 days
Cyanide	57-12-5	350	20	70-130	1 x 250- mL glass or plastic	NaOH to pH>12; 4oC	14 days
Alkalinity(5)	NA	10,000	20	80-120	1 x 50- mL glass or plastic	4oC	14 days
Total dissolved solids(3)	NA	10,000	20	80-120	1 x 500-mL glass or plastic	4oC	7 days
Total suspended solids(3)	NA	4000	20	80-120	1 x 1-L glass or plastic	4oC	7 days
Specific conductivity(3)	NA	10 umhos/cm	20	80-120	1 x 100-mL glass or plastic	4oC	28 days
pH(3)	NA	± 0.1 pH units	20	90-110	1 x 25-mL glass or plastic	None	Analyze immediately
Total organic carbon(5)	NA	600	20	75-125	1 x 250-mL glass	H ₂ SO ₄ to pH<2; 4oC	28 days
Oil & Grease(3)	NA	5,000	20	75-125	4 x 1-L glass	HCl to pH<2; 4oC	28 days
<p>1 – Information is from LERF/ETF RCRA permit (Ecology 2010a) unless otherwise noted. 2 – Sample bottle, volume and preservatives may be adjusted, as applicable for safety reasons. 3 – Sensitivities for these constituents are detection levels specified in ETF permit ST4500 (Ecology 2000b) or TEDF permit ST004502 (Ecology 2012). Accuracy and precision are reasonable values based on other constituents analyzed with the same methods. 4 – The detection level in the LERF/ETF RCRA permit is specified as 1500 ug/L as phosphate. This is converted to 500 ug/L as phosphate as P (orthophosphate). 5 – There are no detection limits, accuracy, or precision established for these constituents. Values are reasonable levels based on review of previous data.</p>							

Table D1-3. Quality Criteria for Influent Wastewater and Treated Effluent Samples – Radioactive Constituents(1)

Parameter	Chemical Abstract Number	Sensitivity (ug/L)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)
Gross alpha	12587-46-1	3	20	75-125	1 x 1-L glass or plastic	HNO ₃ to pH<2	180 days
Gross beta	12587-47-2	4	20	75-125			
Cesium-137(3)	10045-97-3	90	20	75-125	1 x 1-L plastic	HNO ₃ to pH<2	180 days
Cobalt-60(3)	10198-40-0	150	20	75-125			
Americium-241(3)	14596-10-2	0.9	20	75-125	1 x 1-L glass or plastic	HNO ₃ to pH<2	180 days
Curium-244(3)	13981-15-2	1.8	20	75-125			
Neptunium-237(3)	13994-20-2	0.9	20	75-125	1 x 1-L glass or plastic	HNO ₃ to pH<2	180 days
Plutonium-238(3)	13981-16-3	1.2	20	75-125			
Plutonium-239/240(3)	NA	0.9	20	75-125			
Strontium-90	10098-97-2	8	20	75-125	1 x 1-L glass or plastic	HNO ₃ to pH<2	180 days
Iodine-129(3)	15046-84-1	15	20	75-125	1 x 1-L glass	None	180 days
Radium-226(3)	13982-63-3	3	20	75-125	1 x 1-L glass or plastic	None	180 days
Technetium-99	14133-76-7	15	20	75-125	1 x 1-L glass	None	180 days
Tritium (high-level)(4)	10028-17-8	2000	20	75-125	1 x 1-L glass	None	180 days
Tritium (mid-level)(4)	10028-17-8	100	20	75-125			

1 – Sensitivities for these radionuclides are detection levels specified in ETF permit ST4500 (Ecology 2000b) or TEDF permit ST4502 (Ecology 2012) unless otherwise noted. Accuracy and precision are reasonable levels based on review of previous data.

2 – Sample bottle, volume and preservatives may be adjusted, as applicable for safety reasons.

3 – Sensitivities for these radionuclides are set at ~75% of the early warning value, which is 4% of the Derived Concentration Guidelines in DOE Order 5400.5.

4 – High-level tritium sensitivity is the detection level from the ETF and TEDF permits. Mid-level tritium sensitivity is for groundwater samples from the SALDS tritium monitoring network.

Table D1-4. Quality Criteria for ETF Generated Waste(1)										
Parameter	Chemical Abstract Number	Method Sensitivity (mg/kg)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)			
Liquid Matrix										
For liquid methods other than total solids, analyze using the methods and QA/QC in Table A-2.										
Total solids	NA	10,000 ug/L	20	80-120	1 x 500-mL glass or plastic	4°C	7 days			
Solid Matrix										
Volatile Organic Compounds										
1,1-Dichloroethene	75-35-4	4	20	60 - 120	1 x 40-mL amber glass with septum	4°C	14 days			
1,2-Dichloroethane	107-06-2	4	20	60 - 120						
Benzene	71-43-2	4	20	60 - 120						
Carbon tetrachloride	56-23-5	7	20	60 - 120						
Chlorobenzene	108-90-7	4	20	60 - 120						
Chloroform	67-66-3	4	20	60 - 120						
Methyl ethyl ketone	78-93-3	25	20	60 - 120						
Tetrachloroethylene	127-18-4	4	20	60 - 120						
Trichloroethene	79-01-6	4	20	60 - 120						
Semivolatile Organic Compounds										
1,4-Dichlorobenzene	106-46-7	3.5	20	50 - 120	1 x 125-mL amber glass	4°C	14 days for extraction; 40 days for analysis after extraction			
2,4,5-Trichlorophenol	95-95-4	4	20	50 - 120						
2,4,6-Trichlorophenol	88-06-2	4	20	50 - 120						
2,4-Dinitrotoluene	121-14-2	90	20	50 - 120						
Cresol, total (o, p, m) [Methylphenols, total]	1319-77-3	3.5	20	50 - 120						
Hexachlorobenzene	118-74-1	6	20	50 - 120						
Hexachlorobutadiene	87-68-3	3.5	20	50 - 120						
Hexachloroethane	67-72-1	19	20	50 - 120						
Nitrobenzene	98-95-3	9	20	50 - 120						
Pentachlorophenol	87-86-5	4	20	50 - 120						
Pyridine	110-86-1	10	20	50 - 120						
Polychlorinated Biphenyls (PCBs)(3)										
Aroclor-1016	12674-11-2	3	20	50 - 110				Amber glass – 50 g of sample	4°C	14 days for extraction;
Aroclor-1221	11104-28-2	3	20	50 - 110						

Table D1-4. Quality Criteria for ETF Generated Waste(1)							
Parameter	Chemical Abstract Number	Method Sensitivity (mg/kg)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)
Aroclor-1232	11141-16-5	3	20	50 - 110			40 days for analysis after extraction
Aroclor-1242	53469-21-9	3	20	50 - 110			
Aroclor-1248	12672-29-6	3	20	50 - 110			
Aroclor-1254	11097-69-1	3	20	50 - 110			
Aroclor-1260	11096-82-5	3	20	50 - 110			
Total Metals							
Antimony	7440-36-0	17	20	70 - 130	Glass or plastic – 10 g of sample	Mercury 4°C All others: none	28 days for extraction; Mercury 28 days for analysis after extraction; all others: 180 days for analysis after extraction
Arsenic	7440-38-2	70	20	70 - 130			
Barium	7440-39-3	100	20	75 - 125			
Cadmium	7440-43-9	1.5	20	70 - 130			
Chromium	7440-47-3	9	20	70 - 130			
Lead	7439-92-1	11	20	70 - 130			
Mercury	7439-97-6	3	20	70 - 130			
Nickel	7440-02-0	100	20	75 - 125			
Selenium	7782-49-2	80	20	70 - 130			
Silver	7440-22-4	2	20	75 - 125			
General Chemistry							
Chloride	16887-00-6	None	20	70-130	Glass or plastic – 25 g of sample	None	6 months for extraction; Nitrate & Nitrite 48 hours for analysis after extraction; all others 28 days for analysis after extraction,
Fluoride	16984-48-8	None	20	70-130			
Nitrate (as N)	14797-55-8	None	20	70-130			
Nitrite (as N)	14797-65-0	None	20	70-130			
Phosphate (as P)	14265-44-2	None	20	70-130			
Sulfate	14808-79-8	None	20	70-130			
Ammonium (as N)	7664-41-7	None	20	70-130	Glass or plastic – 25 g of sample	None	6 months for extraction; 28 days for analysis after extraction
pH	NA	± 0.1 pH units	20	90-110	Glass or plastic – 50 g of sample	None	Analyze immediately

Table D1-4. Quality Criteria for ETF Generated Waste(1)							
Parameter	Chemical Abstract Number	Method Sensitivity (mg/kg)	Precision (percent)	Accuracy (percent)	Sample container(2)	Preservative(2)	Holding time(2)
Toxicity Characteristic Leaching Procedure ³	NA	After TCLP extraction, use the methods and QA/QC in Table A-2	After TCLP extraction, use the methods and QA/QC in Table A-2	After TCLP extraction, use the methods and QA/QC in Table A-2	Refer to specific method being performed after TCLP – 125 g of sample	None (after TCLP, preserve extract per method being performed)	SVOA: 14 days for TCLP extraction; Metals: 28 days for TCLP extraction; (after TCLP, refer to specific liquid methods holding times)
<p>1 – For metals, volatile and semivolatile organics, the sensitivities are based on the treatment standards for land disposal of non-wastewaters in 40 CFR 268. Metals are multiplied by 20 to account for the TCLP dilution calculation of the solid result. The sensitivities are then set at a percentage of this level (metals: 75%, volatile organics: 70%, semivolatile organics: 65%). Maximum sensitivities are set at 100 mg/kg.</p> <p>2 – Sample bottle, volume and preservatives may be adjusted, as applicable for safety reasons.</p> <p>3 – For PCBs, sensitivities are set at 65% of the limit of 50 ppm in 40 CFR 761. This value is divided by ten to account for multiple aroclors that may be present.</p>							

Appendix E

CHPRC

National Emission Standards for Hazardous Air Pollutants; Radionuclides Quality Assurance Project Plan

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E-1 Management of Air Emissions Measurement

This Quality Assurance Project Plan (QAPjP) documents the quality assurance requirements necessary to meet state and regulatory requirements, to describe the process of monitoring and reporting radioactive air emissions from stacks and vents and from fugitive or diffuse sources, and to ensure data collected is of sufficient quality to assure permit compliance. The Plateau Remediation Contract (PRC) requires CH2M HILL Plateau Remediation Company (CHPRC) to comply with all environmental laws, regulations, DOE Orders, and procedures applicable to the work being performed under the contract, DE-AC0608RL14788. The requirement for CHPRC to conduct a NESHAP Quality Assurance Program is specified in the following regulations listed in Section J.2 of the PRC:

- 40 Code of Federal Regulations (CFR) 61 National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR 61, Appendix B, Method 114, Section 4.11 states, “The quality assurance program should be documented in a quality assurance project plan...”
- Washington Administrative Code (WAC) 246-247, Radiation Protection-Air Emissions” WAC 2246-247-075 (6) states, “Licensed facilities shall conduct and document a quality assurance program.”

NOTE: 10 CFR 830.121 (a) states, “Contractors conducting activities, including providing items or services, that affect, or may affect, the nuclear safety or DOE nuclear facilities must conduct work in accordance with the Quality Assurance criteria in Section 820.122. The QA program this statement is referring to is the CHPRC PRC-MP-QA-599, *Quality Assurance Program* (QAP). This QAPjP complies with the main document, the *Environmental Quality Assurance Program Plan* (EQAPP), CHPRC-00189, which supports and complies with the CHPRC QAP.

The individual CHPRC project offices, with support from the environmental and quality assurance (QA) organizations within the CHPRC are responsible for conducting all air emissions measurement and related quality assurance and maintenance activities associated with air emissions sample collection, sample handling, and chain-of-custody. The organizations implementing the measurement program are described in the PRC-MP-QA-599, QAP and the EQAPP, CHPRC-00189. The QAP states, “PRC-MP-MS-19361, *CH2M HILL Plateau Remediation Company Project Execution Plan* contains the official CHPRC organizational chart; PRC-MP-MS-19361 is the official source for CHPRC roles and responsibilities. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220. The CHPRC *Project Management Plan* further defines the organizational alignments and the roles and responsibilities for the implementation of the CHPRC mission.”

CHPRC responsibility for chain-of-custody extends through transport of the required samples to the delivery location for analytical laboratory contracted by the Mission Support Alliance (MSA) contractor under contract with the U.S. Department of Energy (DOE), Richland Operations Office (RL). When custody of the air emissions samples is taken by the laboratory, the MSA’s Effluent and Near Facility Monitoring program assumes responsibility for laboratory analysis of the samples, and management of the resulting data, providing applicable quality assurance for the analysis process and associated estimates of emissions for annual reporting of emissions (MSC-23333, latest revision, *Environmental Quality Assurance Program Plan*). The CHPRC project offices and environmental support organizations participate in the verification and validation of the sample data as part of final approval before reporting. The objective of this QAPjP is to describe the elements of monitoring and reporting radioactive air emissions from stacks and vents (referred to only as stacks in the balance of this QAPjP) and from

fugitive or diffuse sources which will ensure data collected is of sufficient quality to assure permit compliance.

E-1.1 CHPRC Projects

CHPRC projects are responsible for design, procurement, inspection, calibration, and maintenance of systems used for collecting stack emission samples, associated sampling information, and stack flow rate measurements at facilities they manage. Stack samples are submitted to the MSA-managed Contract Laboratory for analysis, and the flow rate measurements are provided to MSA Environmental Integration (EI), the group responsible for reviewing various information and reports cited in this Quality Assurance Project Plan (QAPjP) and retaining required records. CHPRC stack emission monitoring activities, such as sample collection, are addressed in this CHPRC QAPjP and procedures.

E-1.2 Environmental Compliance Officers

CHPRC environmental compliance officers (ECOs) or their delegates have responsibility for project environmental compliance, and technical and engineering aspects are delegated to project engineers. ECOs or their delegates review the stack flow data from measurements performed by ventilation and balance (V&B) personnel. ECOs are responsible for monitoring stack emissions data for their facilities and assisting in evaluating concerns over elevated emissions, which might require notification to regulators as well as corrective actions. They also review the MSA internal statement of work issued annually by MSA EI that lists laboratory analytical services and sampling schedules. As changes in operating conditions and/or source terms at facilities occur, ECOs may, in consultation with and with approval of CHPRC technical and project engineering, direct the addition or deletion of specific radionuclides identified for sampling and analysis.

E-1.3 Health Physics Personnel

CHPRC Health physics personnel perform the sampling of radionuclide air emissions under the technical direction of the project ECO or their delegate(s). The Automated Bar Coding of All Samples at Hanford 2 (ABCASH 2, or more commonly, ABCASH as described in [MSC-PRO-IE-0605, Section 7.2](#)) computer program affords users automated data acquisition and tracking of air filter sampling information. Collection, tracking, and handling requirements for effluent samples are specified in PRC-PRO-EP-15334, *Effluent and Environmental Monitoring for Radionuclide Airborne Emissions*. CHPRC projects maintain procedures for sample collection and the sample tracking system used by the health physics organizations. Sampling activities are performed in accordance with stack monitoring and sampling requirements of 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants*, Appendix B, *Test Methods*, Method 114, *Test Methods for Measuring Radionuclide Emissions from Stationary Sources*. In accordance with their own procedures, CHPRC projects collect and send the radioactive air emission samples to the MSA-managed Contract Laboratory.

E-1.4 Ventilation and Balance

V&B personnel measure stack flow rates and are responsible for ensuring that stack flow measurement equipment is adequate and appropriately calibrated in accordance with PRC-PRO-EN-8323, *Management of HEPA Filter Systems*. V&B is responsible to ensure that Pitot tubes used for measuring stack flows are either calibrated to a National Bureau of Standards (NBS)-traceable standard or are designed and constructed in accordance with Method 2 specifications of 40 CFR 60, Appendix A, to ensure appropriate coefficients are applied when calculating stack flow. Generally, Pitot tubes that are used on the Hanford Site are Dwyer 160 series, manufactured to an American Society of Mechanical Engineers (ASME) design that meets American National Standards Institute (ANSI)/Air Movement and

Control Association (AMCA) 210-99 [ANSI/ American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 51-1999] codes and comply with 40 CFR 60 Appendix A Method 2 construction specifications. Dwyer 160-series Pitot tubes have baseline coefficients of 1.0 for standard Pitot tubes and 0.84 for type S Pitot tubes. Measurements are made on a periodic schedule established by the facilities.

E-1.5 Instrumentation and Control Technicians

CHPRC instrumentation and control technicians personnel perform the inspection and calibration of instrumentation that measures stack flow, sample flow, stack and sample flow temperature, and the mass flow controllers that maintain sample flow at a constant preselected value.

E-1.6 MSA Environmental Integration

The Environmental Integration (EI) group within the MSA manages the radioactive air emissions sample analysis and compliance reporting for facilities managed by CHPRC and for facilities managed by other prime contractors to RL and DOE, Office of River Protection (ORP). Responsibilities include managing radioactive air emissions data, advising on engineering and regulatory matters, and submitting required reports to EPA, WDOH, and DOE. EI is responsible for assuring the required quality assurance related to the sample analysis and reporting aspects.

The MSA's EI group works with the CHPRC points of contact to address identification of known or suspected elevated emissions from normal or unplanned operations, as well as any further emissions sample or data analyses supporting investigation of the elevated emissions. The CHPRC Environmental Quality Assurance group is responsible for independent assessments of the CHPRC radioactive air emissions monitoring program adherence to CHPRC-00189.

E-2 Radioactive Air Emissions Data Generation and Acquisition

CHPRC projects operate and maintain required air monitoring equipment at CHPRC facilities, and transport the resulting air samples to the analytical laboratory using chain-of-custody procedures. CHPRC supports the verification and validation of sample data and input to the required reporting and certification, for annual reporting of emissions to EPA, WDOH, and DOE RL. These actions are carried out by implementing the requirements listed in the internal procedure on effluent and environmental monitoring, PRC-PRO-EP-15334, for radioactive air emissions measurement and sampling systems. The project identifies sample analytes of interest, required minimum detectable quantities, and assures performance of required compliance assessments of radioactive air emissions sampling and measurement equipment and records.

The CHPRC projects and environmental protection support group address concerns over known or suspected elevated emissions from normal or unplanned operations. To ensure an appropriate and prompt response to such situations, CHPRC relies on subject matter experts and internal procedures such as PRC-PRO-EP-15333, *Environmental Protection Processes* and PRC-PRO-EP-15334. Prompt response is also supported by CHPRC radiation protection procedures which require immediate field surveys of the collected samples using hand held instruments, with any abnormal results being identified to management. Responses to any indications of unplanned elevated emissions may include such actions as notifications to regulatory agencies, testing and repair of emissions control or monitoring equipment, or review of operations producing the emissions.

The MSA analytical laboratory conducts the sample analyses, sample data compilation, internal reporting, and overall sample and data quality assurance.

MSA's EI group validates the radioactive air emissions sample analyses, compiles stack flow-rate data, performs as-needed final emission release calculations, oversees radiological dose calculations, and prepares the annual radionuclide air emissions report for the Hanford Site. The CHPRC contributes descriptive content and data review as part of the reporting effort. In support of CHPRC, the MSA EI group establishes sampling schedules and identifies the analytical laboratory technical requirements for radioactive air sample analyses, including identifying specific radionuclides to be analyzed and limits of analytical detection. CHPRC cooperates with MSA to assist with field sample data and verification and validation of laboratory data results. MSA portions of the activities are performed in accordance with MSC-PRO-15334 and procedure MSC-PRO-EI-0605, *Environmental Protection Monitoring and Reporting*. CHPRC portions of the activities are performed in accordance with the PRC-PRO-EP-15334 and this QAPjP.

E-2.1 Radioactive Air Emissions Measurement Program

The CHPRC is responsible for implementing the requirements listed in its internal procedure on effluent and environmental monitoring, PRC-PRO-EP-15334 for radioactive air emissions monitoring and sampling systems. Additional CHPRC responsibilities include providing the MSA with laboratory analysis needs for each emissions sample, including analytes of interest and required minimum detectable quantities. The CHPRC is responsible for conducting the required compliance assessments of radioactive air emissions sampling and monitoring equipment and records.

Responsibilities assigned for sampling, analysis, data compilation, reporting, and oversight are described in the following subsections, as required by Method 114 §4.1.

Sampling, sample collection and stack monitoring procedures are described in Method 114 Section 2, *Stack Monitoring and Sample Collection Methods*.

Table E-1 lists the major stacks managed by CHPRC and the Attachments that describe the monitoring methods for each relative to requirements in Method 114 §4. Attachment E-10 describes the monitoring methods relative to the requirements in Method 114 §4 for non-stack Permit required locations (e.g. LERF Basin, CWC, etc).

Table E-1. Major Stacks Index

Major Stack	Attachment	Hanford Site Radioactive Air Emissions License #FF-01, Emission Unit ID
105-KW Air Sparger	Attachment E-1	*
291-A-1 (PUREX)	Attachment E-2	369
291-T-1 (T Plant)	Attachment E-3	314
291-Z-1 (PFP)	Attachment E-4	*
296-B-1 (B Plant)	Attachment E-5	402
296-B-10 (WESF)	Attachment E-6	340
296-H-212 (CSB)	Attachment E-7	435
296-K-142 (CVDF)	Attachment E-8:	**
296-W-4 (WRAP)	Attachment E-9	193

*Transitioned to CERCLA – See reference AIR 09-1003

** Transitioned to CERCLA – See reference 13-NWP-102 Reissue

E-2.2 Radioactive Air Emissions Monitoring Data Management

MSA’s Effluent and Near Facility Monitoring program (ENFM) has responsibility for verifying and validating radioactive air emissions data, compiling stack flow-rate data, performing as-needed final calculations, and preparing the annual radionuclide air emissions report for the Hanford Site, with contribution by CHPRC. For CHPRC, the MSA ENFM establishes sampling schedules and identifies the analytical laboratory technical requirements for radioactive air sample analyses, including identifying specific radionuclides to be analyzed and limits of analytical detection. CHPRC cooperates with the MSA ENFM to assist with field sample data and laboratory data results validation and verification. The MSA portions of the activities are performed in accordance with MSC-PRO-15334 and MSC-PRO-EI-0605, *Environmental Protection Monitoring and Reporting*. The CHPRC portions for the activities are performed in accordance with the PRC-PRO-EP-15334 and this QAPjP.

The MSA ENFM has responsibility for compiling site-wide radioactive air emissions sampling and stack flow data for regulatory reports. Additional responsibilities include verifying sample analysis parameters received from laboratories and providing sampling schedules. The MSA ENFM assigns electronic data processing (EDP) codes (also known as location codes) for tracking samples and in support of CHPRC sampling activities, and with CHPRC input stipulates to the Contract Laboratory the number and types of samples it should receive annually and analyses to perform. In addition, MSA ENFM provides projected yearly sampling requirements (e.g., numbers of samples and needed analyses) and data quality objectives (DQOs) for types of analyses as part of the laboratory contract. CHPRC participates in verification and validation of the laboratory analysis data and assists with correcting and/or explaining sample errors or anomalies identified.

MSA manages the number and kind of radiological analyses performed by Contract Laboratory in accordance with al statement of work which addresses sample media collected from stacks managed by CHPRC. Specific radionuclides to be analyzed are determined with the assistance of CHPRC environmental and facility or project technical authorities. MSA ENFM coordinates the transferring of laboratory analytical data into the Automatic Bar Coding of All Samples at Hanford (ABCASH) computerized system for retrieval by the MSA EI group and CHPRC environmental and facility management and support staff. The Contract Laboratory maintains a QA plan and analytical procedures that meet the requirements of Method 114..

2.2.1 Reporting of Airborne Releases

Radioactive air emissions data are used to support the reporting of releases of airborne radioactivity from the Hanford Site and the corresponding dose to the maximally exposed member of the public. This reporting is conducted annually in accordance with 40 Code of Federal Regulations (CFR) 61, [Subpart H](#) and Washington Administrative Code ([WAC](#)) [246-247](#), “Radiation Protection - Air Emissions”, as well as the DOE Order 458.1, *Radiation Protection of the Public and the Environment*. Collection, compilation, calculation, verification, and validation of radioactive air emissions data are the primary steps in a process by which samples are collected from selected stacks and ambient air locations, analyzed in a laboratory to detect amounts of specified radioactive materials, and the results validated and documented in the reports. Quantified data on releases from ongoing activities obtained through the use of structured data collection and trending are periodically provided to management via annual emission and environmental reports.

The MSA contractor has primary responsibility for preparing all reports of point-source radioactive air emissions data for submission to the U.S. Environmental Protection Agency (EPA), Washington State Department of Health (WDOH), and RL.

The activities specific to radioactive air emissions sample measurements and reporting include the following:

- Completion and recording of laboratory analyses performed to detect the presence of radioactive materials on particulate filter media, silver-zeolite cartridges, or other sampling media appropriate to the material to be sampled as well as compatible with analytical methods available at Contract Laboratory
- Calculation of releases and average concentrations of radioactivity based on the laboratory analysis data of sampled emissions, and the measured stack flow data or maximum stack flow rates (or in some cases as rated by exhauster manufacturers)
- Calculation of quantities of radionuclides released and average concentrations for a calendar year for a specific discharge point or the general ambient area of the Hanford Site
- Validation of acquired data
- Preparation and release of reports identified above.

2.2.2 MSA Contract Laboratory

The Contract Laboratory personnel perform radiochemical analyses, pursuant to a statement of work, on sample media collected from stacks managed by CHPRC as well as other site contractors. Specific radionuclides to be analyzed are determined by MSA EI with the assistance of ECOs and facility or project stack engineers. The Contract Laboratory maintains a QA plan and analytical procedures that meet the requirements of 40 CFR 61, Appendix B, Method 114.

2.2.3 Pacific Northwest National Laboratory

Pacific Northwest National Laboratory (PNNL) has been designated by RL to perform dose modeling for the Hanford Site, including compliance dose modeling for stacks operated by CHPRC. PNNL derives effective dose equivalents using an EPA approved dose model (e.g., CAP88 PC). Dose modeling results supplied by PNNL are included in the annual Radionuclide Air Emission Report for the Hanford Site (e.g., DOE/RL-2011-12-R0, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year (CY) 2010*) prepared for EPA, WDOH, and DOE, and in the annual Hanford Site Environmental Report prepared by PNNL for DOE (e.g., [PNNL-19455](#), *Hanford Site Environmental Surveillance Data Report for Calendar Year 2009*).

MSA and PNNL also maintain DOE/RL-2007-53, *Methods for Calculating Doses to Demonstrate Compliance with Air Pathway Radiation Dose Standards at the Hanford Site*, which describes the methods and procedures used annually for determining the Hanford Site maximally exposed individual (MEI) and assessing DOE Hanford Site dose standard compliance. It also serves somewhat as a history of the sources and development of Hanford Site methods.

E-3 Assessment and Oversight

In addition to the federal and state documents referenced above, this QAPjP also conforms to the requirements in the latest revisions of the QAP, and the EQAPP. Where appropriate, this QAPjP applies to monitoring and reporting of radioactive air emissions from licensed major and minor stacks managed by CHPRC, as well as fugitive and diffuse sources. The implementing procedures, plans, and instructions are appropriate for the control of radioactive air emissions data, as required by Method 114 and applicable DOE Orders.

Distribution and control of this QAPjP are in compliance with PRC-PRO-IRM-8310, *Document Control Processes*. This QAPjP is reviewed and updated annually or whenever significant changes are made to the program. A reduced set of quality actions has been imposed on licensed minor stacks — i.e., reduced compared to quality actions required for major stacks — via Section 4.0 of “The Department of Energy Hanford Site Radioactive Air Emissions License, #FF-01.” Those actions are intended to assure and confirm the quality of periodic measurements of emissions from minor point source emission units that use sample extraction as the approved form of periodic confirmatory measurement. Such measurements are required to confirm that emissions from such sources have remained low. Those reduced quality actions are summarized in the following:

- Implementation of quality checks supporting the periodic confirmatory measurements. These checks shall assure that the emissions measurements are sufficient to verify low emissions.
- Stack flow measurements shall be conducted annually.
- An annual calibration will be performed on the existing sample flow meter or an annual function check will be performed if the flow meter is replaced by either a rotameter or a magnahelic gauge.
- Effluent samples shall be collected on standard (i.e., very high efficiency particulate air) sample filters.
- Laboratory sample analysis will meet the requirements of 40 CFR 61, Appendix B, Method 114(3).
- The following items as documented in this National Emission Standards for Hazardous Air Pollutants (NESHAP) quality assurance project plan or other documents:
 - The sample collection and analysis procedures which refer to facility-specific procedures.
 - The quality control (QC) program for evaluating and tracking the quality of the periodic confirmatory measurement data against preset criteria (as identified in MSC-23333). The QC program includes, where applicable, a system of replicates, spiked samples, split samples, blanks and control charts. The number and frequency of such QC checks (as identified in MSC-23333 and in contractual documents.
 - A sample tracking system providing positive identification of samples and data through all phases of the sample collection, analysis, and reporting system (refer to Section E-3). Sample handling and preservation procedures maintain the integrity of the samples during collection, storage, and analysis (refer to Section E-3; PRC-PRO-EP-15334; MSC-PRO-15334, *Effluent and Environmental Monitoring*; and *Automated Bar Coding of All Samples at Hanford* (ABCASH as described in MSC-PRO-EI-0605.)).

CHPRC is responsible for collecting stack emission samples, associated sampling information, and stack flow rate measurements at facilities it manages. Stack samples are submitted to the Contract Laboratory for analysis, and the flow rate measurements are provided to MSA EI. CHPRC also is responsible for reviewing various information and reports cited in this QAPjP and retaining required records.

Table E-2. Responsibility for Quality Assurance Activities

Item	Task	Performed by MSA EI with Review/Concurrence by CHPRC	Performed by CHPRC
1	Provide analytical criteria and detection limits for radioanalysis	X	
2	Annual documenting of Contract Laboratory analytical services, which includes sampling and analytical requirements and sampling schedules	X	
3	Collect samples of radioactive air emissions from sample locations and record information on sample envelope data and/or into ABCASH via handheld barcode scanners		X
4	Transport samples from sampled stacks to the MSA receiving station utilizing chain of custody procedures.		X
5	Analyze samples at the Contract Laboratory	X	
6	Audit laboratory QA/QC	X	
7	Prepare radioactive air emissions sampling and monitoring data compilation and reporting procedures	X	
8	Verify measured stack flow data from V&B and transmit to MSA EI for annual reporting		X
9	Verify sample analyses	X	
10	Compile sampling results, flow data, and data on duration of operation into annual releases in curie quantities and annual average concentrations	X	
11	Prepare annual emissions and releases reports	X	
12	Compute annual effective dose equivalent to maximally exposed member of the public from Hanford Site radioactive emissions	X	
13	Conduct programmatic audits of emissions data handling	X	X
14	Conduct compliance assessments on radiological air sampling and monitoring systems		X
15	Conduct Tracking and Trending of Air Emissions Abatement System		X

E-3.1 NESHAP Quality Assurance Requirements

The QA sub-elements of 40 CFR 61, Appendix B, Method 114, §4.0 are listed below in bold face italicized text, followed in each case with a description of how they are addressed by the program:

- ***§4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communication for all activities related to the emissions monitoring program shall be identified and documented:*** refer to Section E-1 of this QAPjP. Additional Environmental Program and

Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220, *Environmental Program and Strategic Planning Roles, Responsibilities, and Functions*.

- §4.2 ***Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations:*** refer to Sections E-1.2, E-2, and E-4 of this QAPjP.
- §4.3 ***The sample collection and analysis procedures used in measuring the emissions shall be described:*** refer to the Attachments.
- §4.4 ***The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data including a description of the procedures used to assess these parameters:***
 - a. Specific to the laboratory analysis of samples, refer to Sections E-3 and E-4 of this QAPjP.
 - b. The quantitative QA parameters are precision, accuracy, and completeness (defined in 40 CFR 61, Appendix B, Method 114, 4.4). Accuracy is the degree of agreement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of valid data obtained compared to the amount expected under normal conditions.
 - c. Specific to the measurement of effluent flow, accurate measurements of the flow in stacks and ducts must be provided because the accuracy of any emissions estimate is directly related to the accuracy of flow measurements. The flow rate of air exhausted through each stack or duct is periodically measured and may be continuously monitored if there is a potential for significant variation in flow rate (i.e., >20% during a year, based upon guidance of ANSI/HPS N13.1-1999). If historical data are available, the 20% variability may be approximated by the standard deviation of the measurements. If the variability of flow rate is based on engineering judgment, such factors as fan maintenance, the opening of doors, and the variations in the number of fans shall be taken into account. For stacks and ducts that must be continuously monitored for effluent flow, flow calibration tolerances assure the flow measurement and recording system shall be capable of determining the mass flow rate of the effluent stream with an accuracy that is within $\pm 10\%$ of that measured with the Reference Method (per guidance of ANSI/HPS N13.1-1999). Where only annual measurements of flow rate are performed, these shall be performed following the applicable requirement of 40 CFR 60, Appendix A, Methods 1 or 2, or other alternative methods that have been approved as providing acceptable accuracy.

Taking into account the variables affecting stack flow, such as those discussed in the preceding paragraph, precision of the flow measurements is addressed by limited indirect data indicating reasonable precision of air effluent flow measurements is achieved. Flow measurements will have sufficient precision to ensure emissions limits for each stack are not exceeded. Calibration of continuous flow measurement devices per manufacturers or approved specifications provides adequate check for comparable readings. Use of comparative multiple traverses as part of the procedure for annual flow measurements, along with comparison with NIST-traceable standards, provides adequate indication of agreement among individual measurements (see also Section E-1.4 above). For stacks approved for use of maximum system flow capacity as an agency approved alternative method for stack emissions measurement, precision has been adequately addressed.

Within the context of the 40 CFR 61, Subpart H and referenced 40 CFR 61, Appendix B, Method 114, completeness of effluent flow measurement is addressed by utilizing a completeness criteria of no less than 80% operational coverage during periods of powered stack flow for continuous measurement devices. For the annual flow measurement methods, completeness is satisfied by a minimum of one measurement per calendar year by the approved method, with no greater than 18 months duration between any two measurements.

Applying the criteria above in combination with the quality parameters addressed during stack sample analytical measurements, validation and verification conducted as part of the development of the annual report of emissions, and the data quality activities and objectives described in the supporting document MSC-PRO-EI-0605, *Environmental Protection Monitoring and Reporting* provides adequate assurance of the precision, accuracy and completeness of the effluent flow measurements. The annual reported emissions calculations developed for compliance reporting purposes shall address the applicable uncertainty parameters for the emission measurement data, including the annual effluent flow and sample analysis data.

- **§4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include where applicable a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified:** The Contract Laboratory contractual documents and MSC-23333, *Environmental Quality Assurance Program Plan* establish the Quality Control Program DQOs. . Tracking and trending of indication devices at the emission unit is conducted per PRC-PRO-EP-15333, Section 5.14. Periodic independent assessments provide an additional review to evaluate and track the quality of emissions measurement data against preset criteria.
- **§4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and transport:** Refer to PRC-PRO-EP-15334, Section E-2 of this QAPjP, and ABCASH. Also see MSC-PRO-EI-0605, *Environmental Protection Monitoring and Reporting*. Sample tracking is also required by PRC-PRO-EP-15334, Section 5.6.
- **§4.7 Regular maintenance, calibration, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table 2 – Maintenance, Calibration and Field Check Requirements** (included herein as Table E-2-1): Maintenance, Calibration, and Field Check Requirements are addressed in Attachments E-1 through E-10. Other documents are listed in Section E-2 of this QAPjP, and facility-specific procedures.
- **§4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited:** refer to Section E-3 of this QAPjP and to PRC-PRO-QA-9662, *Independent Assessment Process*.
- **§4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective actions will be taken and who is responsible for taking the corrective action:** refer to Section E-3 of this QAPjP, and to PRC-PRO-QA-052, *Issues Management*.

- §4.10 *Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and description of corrective actions:* refer to Section E-3 of this QAPjP. Also, notification requirements are contained in PRC-PRO-15333, Section 5.56. A review of emissions measurement data quality is included as a line of inquiry for assessment of NESHAP major radioactive air emission sources managed by CHPRC.
- §4.11 *The QA program should be documented in a quality assurance project plan (QAPjP) that should address each of the above requirements:* refer to the purpose of this QAPjP.

E-3.2 Organizations Responsible for QA

QA oversight of the radioactive air emissions monitoring responsibilities carried out by CHPRC is performed by the CHPRC Environment Compliance & Quality Assurance (ECQA) organization. On a periodic basis, the CHPRC ECQA group conducts internal and external audits of the radioactive air emissions monitoring activities of the CHPRC program. Those assessments are performed in accordance with PRC-PRO-QA-9662, *Independent Assessment Process*.

The CHPRC ECQA group is responsible for the following CHPRC radioactive air emissions QA oversight activities:

- Scheduling and conducting QA surveillances of air emissions activities in accordance with PRC-PRO-QA-9769.
- Reviewing documents to assure data quality and QA objectives are met
- Verifying resolution of nonconforming items
- Reviewing sample system design, operation, sample collection, and sample chain-of-custody
- Verifying use of qualified analytical laboratories for sample analysis
- Serving as interpretative authority for environmental QA requirements
- Assessing and evaluating the effectiveness of implementation of this QAPjP
- Serving as the focal point for ECQA-related issues
- Approval of this QAPjP
- Generating other environmental documentation related to quality and environmental activities.

MSA is responsible for the following:

- Reviewing and approving sample analysis and data transfer deliverables as applied to the Contract laboratory while implementing contractual and regulatory QA requirements
- Reviewing and approving Contract Laboratory procedures specific to radioactive air emission sample chain-of-custody, sample analysis, and data and records management
- Scheduling and conducting QA or QC surveillances or inspections of Contract Laboratory analysis of air emissions samples, generally conducted internally by MSA QA personnel.

3.2.1 MSA, Environmental Integration

The MSA EI group manages the radioactive air emissions sample analysis and compliance reporting for facilities managed by CHPRC, and for other prime contractors. Responsibilities include managing radioactive air emissions data, advising on engineering and regulatory matters, and submitting required reports to EPA, WDOH, and DOE. EI is also responsible for ensuring the required quality assurance related to the sample analysis and reporting.

The EI group works with CHPRC points of contact to address any concerns over known or suspected elevated emissions from normal or unplanned operations. To ensure an appropriate and prompt response to such situations, the CHPRC projects, with assistance from CHPRC Environmental Protection, relies on their subject matter experts and following of internal procedures such as PRC-PRO-EP-15333 and PRC-PRO-EP-15334.

The CHPRC ECQA group is also responsible for independent assessments of the CHPRC radioactive air emissions monitoring program adherence to CHPRC-00189.

3.2.2 CHPRC Environmental Compliance Officers

ECOs or their delegates have responsibility for reviewing project environmental compliance, and technical and engineering aspects are delegated to project engineers. ECOs or their delegates review the stack flow data measurements. These are most often performed by V&B personnel. ECOs are responsible for monitoring stack emissions data for their facilities and assisting in evaluating concerns over elevated emissions, which might require notification (to management and regulators) as well as corrective actions. ECOs are also responsible for evaluating the performance of the facility abatement systems for indications of reduced efficiency over time. They also review the MSA internal statement of work issued annually by MSA EI that lists laboratory analytical services and sampling schedules. As changes in operating conditions and/or source terms at facilities occur, ECOs may, in consultation with and approval by CHPRC technical and project engineering, direct the addition or deletion of radionuclides identified for sampling and analysis.

E-4 Data Verification and Validation

MSA EI, in consultation with CHPRC ECOs and subject matter experts (SMEs), verifies and validates effluent and environmental data for reporting and decision-making. The data is verified by ensuring that the quantity and type of samples collected and analyses performed are adequate to meet regulatory, (e.g., sampling, and analytical) requirements. The data is also validated by ensuring that it is of the type and quality suitable for the intended use.

Verification and validation of effluent and environmental sampling and analysis data are important quality assurance objective (QAO) activities that are performed by qualified laboratory, facility, and environmental support personnel. When properly done, these two comprehensive QAO activities increase the probability of acquiring quality data having a high degree of accuracy (see WAC 246-247-075(13)). The following definitions of validation and verification are from [EPA 2001](#) (*EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5):

Validation: Confirmation by examination and provision of objective evidence that particular requirements for a specified use are fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs. To supplement this is another definition of data validation, from [EPA 2002](#), *Guidance on Environmental Data Verification and Data Validation*, (EPA QA/G-8): It is an analyte-specific and sample-specific process that extends the evaluation of data

beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

Verification: Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. In design and development, verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity. To supplement this is another definition of data verification, from EPA QA/G-8: It is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against method, procedural, and/or contractual requirements.

To varying degrees, all parties involved in the sampling, analysis, and reporting program perform verification and validation on samples, effluent flow measurements, and resulting analytical data, which are the central elements of the entire program. For example, field sample collectors follow procedures and sampling schedules to assure samples are properly handled, exchanged on time, and, if possible, are of nominal volume; technical support specialists measure effluent flow rates. MSA analytical laboratory personnel adhere to analytical procedures in accordance with national standards and the laboratory QAPP; and MSA EI personnel evaluate the sample data for completeness and for representativeness to expected as well as historical and regulatory values before approving them to be of adequate quality and sufficiently verified and validated for their intended use, which is usually to comply with federal and state reporting requirements. With regard to stack emissions data, for instance, the data evaluations include comparing those data against laboratory minimum detectable concentrations (MDCs) (e.g., $2.0\text{E}-15$ $\mu\text{Ci/L}$ for gross alpha and $1.9\text{E}-14$ $\mu\text{Ci/L}$ for gross beta), concentration guides (e.g., DOE Derived Concentration Guides [DCGs] and Table 2 Appendix E of 40 CFR 61), and multi-year concentration trends of each stack (typically in the range of $5.0\text{E}-14$ $\mu\text{Ci/L}$ to $5.1\text{E}-16$ $\mu\text{Ci/L}$ for gross alpha, and $8.3\text{E}-14$ $\mu\text{Ci/L}$ and $2.0\text{E}-16$ $\mu\text{Ci/L}$ for gross beta [these ranges vary within approximately a factor of 10 according to the facility source terms]). These evaluations help keep in view the relative position stack concentrations have to MDCs, DCGs, and Table 2 concentrations.

Those stack concentrations, and respective yearly releases, are also roughly projected to a potential annual radiological dose to an MEI member of the public, which is then compared with the MEI dose limit of 10 mrem/yr effective dose equivalent.

To borrow further from EPA QA/G-8: “Data verification is primarily an evaluation of performance against pre-determined (and often generic) requirements given in a document such as an analytical method procedure or a contract. Data validation, on the other hand, focuses on particular data needs for a project, as stated in a project-specific document such as a Quality Assurance (QA) Project Plan. Furthermore, data verification and data validation are typically sequential steps performed by different parties.” and “[d]ata validation begins with the outputs from data verification. The definitions and approaches described in this guidance are not intended to be prescriptive or necessarily to be applied rigidly across all programs, organizations, and circumstances.”

Laboratories analyze effluent and environmental samples; technical support and facility groups measure effluent flows, collect samples, and record operating and sampling information. These organizations supply MSI EI with all pertinent operating, sampling, and analytical data needed to perform effluent and environmental compliance calculations, evaluations, and reports.

The facility support personnel, laboratory personnel, and MSA EI generally follow these types of steps during the verification phase of data review:

- Confirming the equipment operates such that the quantity of sample meets requirements, which includes sampling periods, sample volume, and number of samples (i.e., completeness)

- Confirming an appropriate sampling medium was used to collect the sample
- Confirming the sample analyses performed meet requirements and are appropriate to the sample medium
- Confirming that chain-of-custody and physical integrity of the samples were acceptably maintained
- Confirming that sample data are handled properly and available within time constraints.

Contract Laboratory personnel and MSA EI personnel in consultation with CHPRC ECOs and environmental support SMEs generally follow as applicable some or all of these types of steps during the validation phase of data review:

- Identifying values acquired under significant deviations from standard operating procedures and possibly correcting or removing them
- Identifying and correcting mistakes and errors during data transfer
- Identifying periods during which baselines or calibrations deviated from tolerable limits, and then identifying, denoting, correcting, or removing data acquired during those periods
- Checking the internal consistency of simultaneous measurements, making corrections when possible, and denoting when corrections are not possible
- Checking outlying values to determine whether a measurement process error was responsible
- Checking consistency of measurements with expectations.

Once these verification and validation steps have been completed, the data may still exhibit indications of a statistically significant anomalous event or the appearance of a measurement error that has not been satisfactorily explained. At this point, the data evaluator traces the path of the measurement to establish whether a measurement error is involved. If that explanation is reasonably eliminated, the data may be used as indicative of a real event.

The data management activities further include ABCASH data downloading and effluent flow data entry into the MSA-managed Environmental Reporting System (ERS), release and flow calculations, and data formatting for reports. Most laboratory analytical data are formatted for direct electronic downloading from ABCASH into ERS, but some data, such as flow measurements, currently are not and must be loaded using separately created files. MSA EI staff who verify and validate effluent and environmental data are experienced with the mathematical methods described in this document and with commonly used units of measure.

The majority of the data calculations are performed within ABCASH and ERS. For instance, ABCASH calculates sample concentrations in $\mu\text{Ci}/\text{mL}$ by dividing the amount of radioactivity (in either μCi or pCi) per sample by the volume of sampled emissions. ERS performs calculations by multiplying laboratory analytical data (e.g., concentrations in $\mu\text{Ci}/\text{mL}$) by stack emission or liquid effluent volumes to yield total releases of analytes, usually in Ci. These calculations also render average concentrations of analytes, weighted over the selected time range of reporting. These data are presented in ERS generated release reports. Individual sample and flow data, including actual sampling periods, are presented in ERS generated trend reports. The resulting release and trend data are verified and validated through:

- Evaluation by cognizant MSA EI staff members and CHPRC ECOs and support SMEs who compare the data for reasonableness against historical data of generally the past five years, or more years if

indicated; this evaluation is an ongoing process throughout each calendar year as effluent data for that year accumulate in ABCASH and ERS

- Periodic evaluation throughout the calendar year by MSA EI and CHPRC ECOs and support SMEs and qualified representatives of facilities that generated the air emissions
- Further in-depth evaluation by MSA EI staff and qualified CHPRC facility representatives during the yearly review cycle required before annual reports of air emission and liquid effluent data are published
- An ERS anomaly program that identifies data lying outside preset control ranges based on compliance levels and degree of increase, or decrease, of release in relation to historical trends; if suspect data are identified, they and any identified underlying causes are investigated until determined to be genuine, erroneous, or perpetually suspect (i.e., no definitive explanation found). Suspect data are corrected to the fullest extent possible. For cases in which no complete resolution can be further developed, prudently applied scientific judgment is the only recourse for resolving as much as practicable any questionable data.

Dispositions of data may include the primary option of retaining and reporting the data as is, or keeping the data in the databases but not reporting them. Non-reporting of questionable data should be supported by adequate scientific reasoning, such as a “measured” radionuclide having too short a half-life to reasonably exist in measurable amounts in the emissions of a particular source term. The potential impact of questionable data to the dose standard for the Hanford Site is also considered when dispositioning questionable data. If, for instance, based upon historical measurements, the ostensible presence of a short-lived radionuclide in a sample result were not expected and its dose impact were inconsequential, the inclination would generally be to not report that value.

Sampling and analysis of radionuclide air emissions are performed in accordance with the schedule in the latest revision of the Contract Laboratory Statement of Work document. The resulting sampling and analytical data are available in ABCASH for the vast majority of stacks. MSA EI effluent scientists and engineers, and CHPRC scientists and health physicists evaluate those analytical results throughout each year. Normally this evaluation, a key part of the verification and validation process, is done in concert with cognizant CHPRC facility personnel who participate in the evaluation by reviewing periodic data packages compiled by MSA EI. The data are evaluated for consistency with historically expected concentrations for each emission source; sufficient sampling times and/or volumes; anomalies in timer, totalizer, rotameter, and/or vacuum gauge readings; and laboratory analytical uncertainties, being mindful of contractually stipulated MDCs. Eventually, after the data are validated within ABCASH, they are transferred to ERS, which has a built-in anomaly detection program. This program identifies potential statistical discrepancies in the data, usually involving sampling time overlaps and concentrations that may indicate a deviation two- to three-sigma higher than historical averages.

Essential to verifying and validating emissions data is reviewing basic and typical sampling parameter information associated with nearly every sample. That information is as follows:

Table E-3. Sampling Parameter Information

Date On	Date sample filter installed in record sampler (should match date off of previous sample collected)
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Table E-3. Sampling Parameter Information

Time On	Time sample filter installed in recorded sampler (typically should be within 30 minutes of the time off of the previous sample)
Date Off	Date sample filter collected
Time Off	Time sample filter removed from record sampler
Timer hours	Total hours sample collected (value taken from the timer may differ from actual elapsed sampling time, in which case, the timer value is normally less)
Vacuum On	Measure of suction pressure through stack sampling system with filter installed
Vacuum Off	Measure of suction pressure through stack sampling system just prior to filter removal
Rotameter On	Measure of flow rate through sampling line with filter installed; flow rate is typically at or near 2 cfm or as appropriate for the particular stack sampling system for near-isokinetic collection of stack particulate emission sample
Rotameter Off	Measure of flow rate through sampling line with filter removed

MSA EI and Contract Laboratory personnel, with input from CHPRC ECOs and SMEs, perform the following when anomalies are noted between the data received from Contract Laboratory and the sampling information:

- When dates or times are missing, contact the point-of-contact at the facility from which the emission sample originated and request documented information on the sample in question from the respective sample logbook or other source of reliable information. If the date on or time on are not available, enter the date off and time off of the immediately preceding sample if such an example exists. If date off or time off is missing, enter the date on and time on from the sample of the immediately succeeding week, if such an example exists.
- Document all corrections in ABCASH to maintain an audit trail.

Appendix E

Attachments

40 CFR 61, Appendix B, Method 114, Section 4 Compliance Demonstrations

The following is the list of major stacks managed by CHPRC, the General Permit Required monitoring locations and the Appendices describing the monitoring methods for them relative to requirements in Method 114 §4:

Attachment	Stack
E-1	105-KW Air Sparger*
E-2	291-A-1 (PUREX) Stack
E-3	291-T-1 (T Plant)
E-4	291-Z-1 (Plutonium Finishing Plant)*
E-5	296-B-1 (B Plant)
E-6	296-B-10 (Waste Encapsulation and Storage Facility)
E-7	296-H-212 (Canister Storage Building)
E-8	296-K-142 (Cold Vacuum Drying Facility)*
E-9	296-W-4 (Waste Receiving and Processing Facility)
E-10	General Permit Required Monitoring Locations

*Operating under CERCLA authority

Attachment E-1

105-KW Air Sparger

Compliance Document Contents:

1. 40 CFR 61 Subpart H (Revised as of July 1, 1998)
2. DOE/RL-98-02 (IDMS Accession #D198040486)
3. Letter AIR 98-307 (IDMS Accession #DA03908661)
4. Letter EPA 1998 (IDMS Accession #D8195755)
5. Letter RL 99-SFD-190 (IDMS Accession #D8100132)
6. Letter RL 00-SFO-076 (IDMS Accession #D8209343)
7. Letter FH-0005889 (IDMS Accession #D8467852)

Alternative Monitoring Method Per 40 CFR 61.93(b)(3)

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the Air Sparger at the 105-KW Basin with the radionuclide emission requirements defined in the alternative monitoring method that was submitted and approved by EPA per 40CFR61.93(b)(3) per the code date above which is applicable to this emission unit which transitioned into CERCLA per References 6 and 7 above and the QA Program elements described below. This stack has been assigned an Electronic Data Processing (EDP) code of Y249.

E-1-1.0 Purpose and Background

This section provides the following requirements associated with the alternative monitoring method:

- Stack sample collection methods appropriate for radionuclides
- Radiochemical methods that are used to determine the amounts of radionuclides collected by the stack sampling
- QA methods that are conducted in conjunction with these measurements.

The entire effluent stream from this stack passes through two 12 inch by 12 inch HEPA filters in series. The revised stack monitoring method includes a destructive test of downstream filter that is used for the characterization of emissions. This involves the coring of the HEPA filter and chemically digesting it for subsequent radiochemical analyses.

Many different types of facilities release radionuclides into air. These radionuclides differ in the chemical and physical forms, half-lives, and type of radiation emitted. The appropriate combination of sample extraction, collection, and analysis for an individual radionuclide is dependent upon many interrelated factors including the mixture of other radionuclides present. Because of this wide range of conditions, no single method for monitoring or sample collection and analysis of a radionuclide is applicable to all types of facilities. Therefore, a series of methods based on “principles of measurement” is described for monitoring and sample collection and analysis that are applicable to the measurement of radionuclides found in effluent streams at stationary sources. This approach provides the user with the flexibility to

choose the most appropriate combination of monitoring and sample collection and analysis methods that are applicable to the effluent stream to be measured.

E-1-2.0 Stack Monitoring and Sample Collection Methods

Monitoring and sample collection methods are described based on “principles of monitoring and sample collection” that are applicable to the measurement of radionuclides from effluent streams at stationary sources. Radionuclides of most elements will be in the particulate form in these effluent streams and can be readily collected using suitable filter media. Radionuclides of hydrogen, oxygen, carbon, nitrogen, the noble gases, and in some circumstances iodine, will be in the gaseous form. Radionuclides of these elements in a gaseous form are not required to be monitored at this stack.

E-1-2.1 Radionuclides as Particulates

Response: The entire effluent stream from the processes that either vent passively or actively through this stack passed through two HEPA filters in series to remove the particulates. The HEPA filter has a high efficiency for removal of sub-micron particles and is designed in accordance with ASME AG-1.

E-1-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in the contractual documents.

E-1-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative and are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-1-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Refer to §E-1 in the main body of this QAPjP. The Organization Chart is located on the CHPRC Environmental Protection website. Section E-1 documents most of the roles and responsibilities associated with these activities. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220,

E-1-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to §§E-1.2 and E-2 of this QAPjP. Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-1-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including where applicable:

E-1-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: The sample site is the second of two HEPA filters in series which filters 100% of the air being exhausted out the stack. The sample is assigned EDP code Y249.

E-1-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: The revised monitoring method involves the destructive analysis of a 12 inch by 12 inch HEPA filter that is removed from the system for characterization. Through it passes 100% of the air that is either passively or actively emitted from the system. This HEPA filter is the second HEPA filter of two in series used to filter the particulate emissions from this stack. From this HEPA filter, core samples are taken and then transferred to the WCSF where they will be chemically digested in preparation for radiochemical analysis.

E-1-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. Compliance is demonstrated by the continuous sampling of emissions (see next section).

E-1-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: The revised monitoring method involves the destructive analysis of a 12 inch by 12 inch HEPA filter that is removed from the system for characterization. Through it passes 100% of the air that is either passively or actively emitted from the system. This HEPA filter is the second HEPA filter of two in series used to filter the particulate emissions from this stack. From this HEPA filter, core samples are taken and then transferred to the WCSF where they will be chemically digested in preparation for radiochemical analysis. Removing the HEPA filter and characterizing it is done every three months in the event sparging is performed. In the case where sparging is not performed and the stack only acts as a passive vent to the system, the removal and characterization of the HEPA filter shall be done annually. The second stage HEPA filter is assigned EDP code Y249. There are no calibration requirements associated with this alternative monitoring method other than those associated with the radiochemical analyses conducted by the laboratory in accordance with the latest revision of Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program

E-1-4.3.5 A description of the Contract Laboratory analytical procedures used for each radionuclide measured, including frequency of analysis, calibration procedures and frequency of calibration.

Response: The radionuclides which are required to be measured and laboratory analysis procedures are included as requirements in contractual documents.

E-1-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: Per the revised method of monitoring that has been approved by EPA, sample flow measurements are not required.

E-1-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: Per the revised method of monitoring that has been approved by EPA, effluent flow rate measurements are not required.

E-1-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures

used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 QAPjP, and Contract Laboratory *Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program*.

E-1-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory *Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program*.

E-1-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to the main body of this QAPjP and PRC-PRO-EP-15334, and ABCASH.

E-1-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-1-1, Maintenance, Calibration, and Field Check Requirements.

Response: Per the revised method of monitoring that has been approved by EPA, the maintenance, calibrations, and field checks found in Method 114 Table 2 are not applicable.

E-1-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §§E-3 in the main body of this QAPjP and to PRC-PRO-QA-9662.

E-1-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-1-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§E-1.2, E-1.2.1, E-1.2., E-1.2.3 in the main body of this QAPjP.

Table E-1-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	N/A

Table E-1-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Inspect Pitot tubes for contaminant deposits	N/A
Inspect Pitot tube systems for leaks	N/A
Inspect sharp-edged nozzles for damage	N/A
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	N/A
Check transport lines of HEPA-filtered applications to determine if cleaning is required	N/A
Clean transport lines	N/A
Inspect or test the sample system for leaks	N/A
Check mass flow meters of sampling systems with a secondary or transfer standard	N/A
Check sampling flow rate through critical flow venturis	N/A
Inspect rotameters of sampling systems for presence of foreign matter	N/A
Check response of stack flow rate systems	N/A
Calibration of flow meters of sampling systems	N/A
Calibration of effluent flow measurement devices	N/A
Calibration of timing devices	N/A

E-2-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-2

291-A-1 (PUREX) Stack

Method 114 Comparison for 291-A-1 Stack

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 291-A-1 Stack at the Plutonium-Uranium Extraction (PUREX) Plant with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in *italics text* immediately following the requirements.

E-2-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 40 CFR 61 Subpart H §61.18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in ANSI/HPS N13.1-1999, Table D.1 to be from 99.7 to >99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-2-2.2 Radionuclides as Gases

The following sections provide guidance for radionuclides as gases.

E-2-2.2.1 Tritium (H-3)

Tritium in the form of water vapor is collected from the extracted effluent sample by sorption, condensation, or dissolution techniques. Appropriate collectors may include silica gel, molecular sieves, and ethylene glycol or water bubblers.

Tritium in the gaseous form may be measured directly in the sample stream using Method B-1, collected as a gas sample, or may be oxidized to tritiated water using a metal catalyst and collected as described above.

Response: Irradiated fuel has not been introduced into PUREX for many years. No dissolutions have been performed since late 1989. Gaseous sampling systems have shown that the levels of tritium have fallen to levels at or below analytical detection limits, which are also well below environmental release and monitoring limits. Consequently, sampling for tritium is no longer required or performed.

E-2-2.2.2 Iodine

Iodine is collected from an extracted sample by sorption or dissolution techniques. Appropriate collectors may include charcoal, impregnated charcoal, metal zeolite, and caustic solutions.

Response: Irradiated fuel has not been introduced into PUREX for many years. No dissolutions have been performed since late 1989. Iodine-131 has decayed to essentially zero, leaving only the longer-lived I-129. Despite the low activity and low dose potential of I-129, sampling and analysis for iodine (using silver-zeolite cartridges) continues, since I-129 emissions remain the largest contributor of actual

emissions doses from the 291-A-1 stack, and the results have value in tracking offsite radionuclides emitted from Hanford Site stacks. Iodine sampling at the 291-A-1 stack is not required by 40 CFR 61 or WAC 246-247.

E-2-2.2.3 Argon, Krypton, and Xenon

Radionuclides of these elements are either measured directly by an in-line or off-line monitor, or are collected from the extracted sample by low-temperature sorption techniques. Appropriate sorbers may include charcoal or metal zeolite.

Response: Irradiated fuel has not been introduced into PUREX for many years. No dissolutions have been performed since late 1989. Sampling for these gaseous radionuclides is no longer required or performed. The release of other radioactive gases decreased even more rapidly than for these nuclides. No 40 CFR 61 requirement or license requirement exists requiring sampling for these gaseous radionuclides.

E-2-2.2.4 Oxygen, Carbon, Nitrogen, and Radon

Radionuclides of these elements are measured directly using an in line or off line monitor. Radionuclides of carbon in the form of CO₂ may be collected by dissolution in caustic solutions.

Response: Irradiated fuel has not been introduced into PUREX for many years. No dissolutions have been performed since late 1989. Gaseous sampling systems have shown that the levels of 14C have fallen to levels at or below analytical detection limits, which are also well below environmental release and monitoring limits. Consequently, sampling for this radionuclide is no longer required or performed.

E-2-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-2-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative and are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-2-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Refer to §1.4 in the main body of this QAPjP. Section E-1 documents most of the roles and responsibilities associated with these activities. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220. Project specific roles and responsibilities are located in PRC-MP-MS-003, Integrated Safety Management System/Environmental Management System Description (ISMSD).

E-2-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: The facility is shut down and processing has ceased; therefore, unplanned operations resulting in increased emissions are unlikely. Administrative controls are in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-2-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including where applicable:

E-2-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: Only one sampling site is currently being used for obtaining samples from the PUREX 291-A-1 stack. The elevation of the active sampling site is 22.6 m (74 ft) above grade. The location was chosen to assure a well-mixed, fully developed flow, in compliance with the criteria of ANSI-N13.1-1969 (§4.2.1.2: “The sampling point should be a minimum of five diameters downstream from abrupt changes in flow direction or prominent transitions”) and of 40 CFR 60, Appendix A, Method 1 (§11.1.1: “Sampling and/or velocity measurements are performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance”).

The 291-A-1 stack is 2.1 m (7 ft) in diameter, based on the dimension of a steel liner inside the concrete stack. The last major disturbance in the air flow is at the connection of the underground effluent tunnel to the stack where the air is redirected up the stack. This transition is at grade level; therefore, the sampling site is more than 10 times the diameter downstream from the last major disturbance.

The 291-A-1 stack is 61 m (200 ft) high, or more than 28 times the diameter above grade. The active sampling site is therefore approximately 18 diameters from the top of the stack.

The continuous sampling involves particulate collection on a record filter (EDP code A006), and iodine gas collection on a silver-zeolite cartridge (EDP code A007). To ensure representative particulate sampling, the sample is withdrawn from the stack via a Kurz six-nozzle multipoint probe. The number and position of nozzles were designed to comply with ANSI N13.1-1969 to provide representative sampling of stack emissions.

E-2-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: To ensure representative particulate sampling, the sample probe is located, designed, and operated in accordance with ANSI N13.1-1969. The probe is located over five diameters downstream from abrupt changes in accordance with ANSI N13.1-1969, §4.2.1.2. The Kurz probe (identified as SSP-V18-2) has six nozzles, located at centers of equal annular areas, in accordance with ANSI N13.1-1969 Appendix A3. The sample is withdrawn continuously from the stack at near-isokinetic flow rate in accordance with ANSI N13.1-1969, §4.2.2.3. The probe and sample line are made entirely of stainless steel. The probe design and operation comply with the required standards for representative sampling of stack emissions.

E-2-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. Compliance is demonstrated by the continuous sampling of emissions (see next section).

E-2-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Sample air is withdrawn continuously from the stack effluent stream by the probe as described in §4.3.2 above.

The sample is collected in two stages. The first stage is a record filter (EDP code A006) for particulate collection. The second is a silver-zeolite cartridge (EDP code A007) for iodine gas collection. The particulate filter and silver zeolite cartridge are exchanged routinely and analyzed at the Contract Laboratory. The frequency of collection and the specific radionuclides analyzed are identified in the Air Monitoring Plan (AMP) of the Remedial Action Work Plan (RAWP). Sample collectors are not amenable to calibration; however, sample flow rate measurement instruments are calibrated as discussed in §E-2-4.3.6 below.

E-2-4.3.5 A description of the Contract Laboratory analytical procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: References to the laboratory analytical requirements are included in contractual documents.

E-2-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate measurement system consists of a rotameter and vacuum gauge. The sampling systems are inspected routinely and flow rate adjusted by a manual flow control valve to maintain a constant flow. Calibrations are performed annually in accordance with PRC-PRO-EP-15333, PRC-PRO-MN-490, and with Table E-2-1 below. Precision, accuracy and completeness are met for stack flow as described in Section E-3.1, Bullet 4.4.

E-2-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: The stack flow is relatively constant, so the emissions flow rate is measured annually by traverses with a standard Pitot tube in the rectangular duct upstream of the base of the stack using a variant of the Pitot traverse method described in 40 CFR 60 Appendix A Method 2. This variant Pitot traverse procedure was approved by EPA (EPA 9501426) because it was used in certifying the stack flow meter to 40 CFR 52 Appendix E). Flow measurement Pitot traverses are performed by V&B personnel. Calibration of V&B equipment is discussed in §1.5 of the main text. Precision, accuracy and completeness are met for stack flow as described in Section E-3.1, bullet 4.4.

E-2-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this document, and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-2-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program, which is updated yearly.

E-2-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to the main body and PRC-PRO-EP-15334, and ABCASH.

E-2-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-2-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-2-1 below, PRC-PRO-EP-15334, and to facility-specific procedures.

E-2-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §§E-3 in the main body of this QAPjP and to PRC-PRO-QA-9662.

E-2-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-2-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§E-2.2, E-2.2.1, E-2.2.2, E-2.2.3 in the main body of this QAPjP.

Table E-2-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	N/A – There is no thermal anemometer. This is not a component of the approved sampling system, therefore no cleaning is conducted.
Inspect Pitot tubes for contaminant deposits	N/A – There are no Pitot tubes. This is not a component of the approved sampling system, therefore no cleaning is conducted.
Inspect Pitot tube systems for leaks	N/A – There are no Pitot tubes. This is not a component of the approved sampling system, therefore no cleaning is conducted.
Inspect sharp-edged nozzles for damage	At least annually or after maintenance that could cause damage. See Section 4.3.4 of 2CP-SOP-ENV-54007.
Check nozzles for alignment, presence of deposits,	Annually. See procedure 2CP-SOP-ENV-54007,

Table E-2-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
or other potentially degrading factors	Section 4.3.3.
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually. See Section 4.4.3 of 2CP-SOP-ENV-54007.
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications. This is N/A as the check of the transport line has not shown any visible deposits.
Inspect or test the sample system for leaks	At least annually. See procedure 2CP-SOP-ENV-54001, Section 4.1.2.
Check mass flow meters of sampling systems with a secondary or transfer standard	N/A – There are no stack mass flow meters. This is not a component of the approved sampling system, therefore no check is conducted.
Inspect rotameters of sampling systems for presence of foreign matter	At the start of each sampling period. See procedure 2CP-SOP-ENV-54001, Section 4.1.2.
Check response of stack flow rate systems	N/A – There are no effluent flow measurement devices at PUREX. This is not a component of the approved sampling system. The Vent & Balance team, employed from a separate DOE contractor, measures the effluent flow annually.
Calibration of flow meters of sampling systems	N/A - There are no effluent flow measurement devices at PUREX. This is not a component of the approved sampling system. The Vent & Balance team, employed from a separate DOE contractor, measures the effluent flow annually.
Calibration of effluent flow measurement devices	N/A – An installed effluent flow measurement device is not a component of the approved sampling system. The Vent & Balance team, employed from a separate DOE contractor, measures the effluent flow annually using a calibrated pitot tube.
Calibration of timing devices	N/A Timing devices are not a component of the approved sampling system, therefore no calibration is conducted.

E-2-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-3

291-T-1 (T Plant)

Compliance Document Contents:

Letter AIR 12-312 (IDMS Accession #DA06434703)

Method 114 Comparison for Stack 291-T-1

E-3-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through filter media to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 10 CFR 61 Subpart H §18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in Table D.1 of ANSI/HPS N13.1-1999 to be from 99.7 to >99.99 percent efficient for particles in the range of 0.035 to 1 µm. The sample filter is exchanged biweekly for gross alpha and gross beta analysis and the filters composited quarterly for analysis of specified particulate radionuclides.

E-3-2.2 Radionuclides as Gases

Response: There is no requirement to perform gaseous radionuclide sampling because T Plant is no longer processing radioactive materials that might cause gaseous radionuclide emissions.

E-3-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-3-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, are of known precision and accuracy, and include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-3-4.1 The organizational structure functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Responsibilities for radioactive air emissions sampling activities are described in Section E-1 of this QAPjP. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220, The T Plant facility specific organization charts and roles and responsibilities policy are located on the Waste & Fuels Management Project website.

E-3-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to Sections E-1.2, E-2, and E-4 of this QAPjP. Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-3-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including, where applicable:

E-3-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: Refer to the “291-T-1 Stack Equivalency Demonstration to ANSI N13.1-1999” (HNF-29175)

E-3-4.3.2 A description of sampling probes and representativeness of the samples.

Response: Refer to “291-T-1 Stack Equivalency Demonstration to ANSI N13.1-1999” (HNF-29175) for a description of the sampling probes.

E-3-4.3.3 A description of any continuous monitoring systems used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. Compliance is demonstrated by the continuous sampling of emissions (see next section).

E-3-4.3.4 A description of the sample collection systems for each radionuclide measured including frequency of collection, calibration procedures, and frequency of calibration.

Response: Sample air is withdrawn continuously from the stack emissions stream by the probe as described in §4.3.2 above. [291-T-1 Stack Equivalency Demonstration to ANSI N13.1-1999” (HNF-29175)] This air flows through the sample line, and particulate radionuclides are collected on a sample filter. The sample filters are exchanged routinely and analyzed at the Contract Laboratory. The frequency of collection and the specific radionuclides analyzed are identified in the FF-01 license. Sample collectors are not amenable to calibration; however, sample flow rate measurement instruments are calibrated as discussed in §E-3-4.3.6 below.

Radionuclide particulate sampling is described in project specific Radiological Control procedures.

E-3-4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The laboratory analytical requirements are included in contractual documents.

E-3-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate measurement system consists of a flow meter that accounts for the total flow volume and instantaneous flow rate. The sampling systems are inspected routinely and flow rate adjusted by a manual flow control valve to maintain a constant flow. Calibrations are performed annually in accordance with PRC-PRO-EP-15333, PRC-PRO-MN-490, and Table B1 of §E-3-4.7 below. Precision, accuracy and completeness are met for sample flow as described in Section E-3.1, bullet 4.4.

E-3-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: An alternative method has been approved by EPA and WDOH (EPA Letter 0401888 and AIR 03-601). Precision, accuracy and completeness are met as described in Section E-3.1, bullet 4.4 for approved alternative methods.

E-3-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements at the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this QAPjP, and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program, which is updated yearly.

E-3-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-3-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to, PRC-PRO-EP-15334, and ABCASH.

E-3-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-3-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-3-1, PRC-PRO-EP-15334, and facility-specific procedures.

Table E-3-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	As required by application and performed as needed during calibration of mass flow element
Inspect Pitot tubes for contaminant deposits	At least annually and documented in a PM/S
Inspect Pitot tube systems for leaks	At least annually and documented in a PM/S
Inspect sharp-edged nozzles for damage	At least annually or after maintenance that could cause damage and documented in a PM/S
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Annually and documented in a PM/S
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually and documented in a PM/S

Table E-3-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications and documented in a PM/S (Cleaning performed only if deposits are found)
Inspect or test the sample system for leaks	At least annually and documented in a PM/S
Check mass flow meters of sampling systems with a secondary or transfer standard	At least quarterly and documented in a PM/S
Inspect rotameters of sampling systems for presence of foreign matter	N/A (Not a component of the approved sampling system, therefore no inspection is conducted)
Check response of stack flow rate systems	N/A (Alternate Method approved for effluent flow measurement) (Alternate Method request number 03-RCA-0163 dated 03/04/2003 and EPA Letter #0401888 dated 06/21/2004)
Calibration of flow meters of sampling systems	N/A Alternative Method did not include flow meters.
Calibration of effluent flow measurement devices	N/A (Alternative Method approved for effluent flow measurement) (Alternate Method request number 03-RCA-0163 dated 03/04/2003 and EPA Letter #0401888 dated 06/21/2004)
Calibration of timing devices	N/A (Not a component of the approved sampling system, therefore no calibration is conducted)

E-3-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §§E-3 of this QAPjP and to PRC-PRO-QA-9662.

E-3-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-3-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§ E-2.2, E-2.2.1, E-2.2.2, E-2.2.3 in the main body of this QAPjP.

E-3-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-4

291-Z-1 (Plutonium Finishing Plant)

Compliance Document Contents:

DOE/RL-2005-14 / AIR 09-1003

Method 114 Comparison for the 291-Z-1 Stack

The formerly licensed stack is undergoing closure under CERCLA authority. In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 291-Z-1 stack at PFP with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in *italics* text immediately following the requirements.

E-4-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through filter media to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 10 CFR 61 Subpart H §18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in Table D.1 of ANSI/HPS N13.1-1999 to be from 99.7 to greater than 99.99 percent efficient for particles in the range of 0.035 to 1 μm .

E-4-2.2 Radionuclides as Gases

Response: The 291-Z-1 stack does not exhaust radionuclides in gaseous form; therefore, this section is not applicable.

E-4-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-4-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This quality assurance program shall include the program elements that follow.

E-4-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Roles and responsibilities are discussed in Section E-1. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220. Organizational roles and responsibilities are also referred to in Section 5.1 of DOE/RL-2005-14.

E-4-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to DOE/RL-2005-14, Section 4.3.2.

E-4-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including, where applicable:

E-4-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: Refer to DOE/RL-2005-14, Section 4.3.1.3. A continuous effluent sample is extracted from the 291-Z-1 stack by a single probe located at the 15 m (50 ft) level of the stack. The stack diameter at this location is 4.8 m (15.75 ft). The nearest flow disturbances are at the inlet and outlet of the stack, approximately three stack diameters downstream and nine stack diameters upstream from the sampling location. The 15 m (50 foot) sampling location was selected after extensive studies were performed. The presence of an existing penetration in the stack at this level was an important factor in sampling site location since this supplied PNNL an access point through which instrumentation could be inserted to study the effluent characteristics. The site proved to be acceptable for sampling. Replacement of the sampling probe, from a multi-nozzle probe to a single shrouded probe, was approved in an EPA letter dated March 14, 2002, and WDOH letter AIR 02-308, dated March 25, 2002.

This sampling location meets the alternative site location requirements of 40 CFR 60 Appendix A Method 1.

E-4-4.3.2 A description of sampling probes and representativeness of the samples.

Response: The sampling probe consists of a single shrouded nozzle on 1-1/4-in. schedule 40 pipe, composed entirely of 300-series stainless steel. The collection probe assembly is installed such that the shrouded nozzle is located within the center one-third of the stack cross-sectional area. The pipe between the stack wall and the shrouded nozzle has a minimum bend radius of eight inches. Sampled emissions pass through the probe to a 300-series stainless steel flow splitter, which routes the sampled emission to both the record and CAM samples.

The velocity distribution at the sampling site was measured before sampler construction. But as stated in ANSI N13.1, “. . . as the flow becomes more turbulent, the velocity becomes more nearly uniform across the duct.” Therefore, velocity distribution is of lesser importance for the 291-Z-1 stack since the flow is highly turbulent (Reynolds number equals 2,000,000). The flow rate for the 291-Z-1 stack varies by only a few percent. The variation in 1988 was determined to be only three percent, and for 1991 a variation of 4.5 percent was observed. Results from additional testing in December 2001 were in agreement with and reconfirmed earlier data. Given these facts, the single shrouded sampling probe provides a representative sample.

E-4-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable because continuous monitoring is not used to demonstrate compliance for this emission unit. Compliance is demonstrated by the continuous sampling of emissions, subsequent analysis, and reporting of those sample data (see next section).

E-4-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: The sample collection probe extracts effluent from the stack at a flow rate of $1.9E-03 \text{ m}^3/\text{s}$ (4 cfm). The sampler probe uses six nozzles for sampling the stack flow. A sample transport line extends approximately 1 m (3.3 ft) horizontally from the stack surface connection flange to the monitoring instruments located within an adjacent, elevated sample shack. The sample transport line is heated by a baseboard heater immediately below the line within the building to inhibit condensation of moisture and resultant sample flow retardation by maintaining the temperature above the dew point. The sample transport line was selected and installed to minimize particle loss attributed to gravity settling and turbulent impaction. The transport line length and tube transition severity of the sample transport line were minimized. The bend radii are 1.25 times the inside diameter of the collection tube. The sample stream passes through a flow splitter and is divided into two equal parts: the record sample loop and the CAM loop.

Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven nylon fabric. The manufacturer rates the efficiency of this medium at not less than 91 percent for a 0.3- μm aerosol. In 1991, the manufacturer tested 24 samples with a 0.3- μm dioctyl phthalate aerosol. The measured average efficiency was 95.8 percent and the standard deviation was 1.6 percent, which supports the rated efficiency. The efficiency of this filter is rated in ANSI/HPS N13.1-1999 to be from 98.1 to greater than 99 percent. The record sampler system provides a representation of the amount and concentrations of radioactive particulates being discharged. The record samples provide the basis for reporting the amount and concentration of radionuclides released to the environment. The filter media are exchanged biweekly and evaluated by laboratory analysis for gross alpha and gross beta activities. The filter media are composited for quarterly analysis of specific radionuclide concentrations.

E-4-4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The laboratory analytical requirements are included in contractual documents.

E-4-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate is measured and regulated by instruments located downstream of the sample collection filter and CAM. The record sample loop passes in turn through an integrating flow meter (totalizer), a sight flow indicator (rotameter), a vacuum pressure indicator, a vacuum switch, a flow regulator, and a vacuum pump. The flow rate regulator is provided to maintain a constant flow rate through the collection filter assembly to compensate for filter loading effects. Audible and visible alarms signals indicating low vacuum pressure are provided remotely in the MICON Power Operations Station, room 714, which is staffed 24 hours per day. Components included in the annual calibration procedure(s) are the vacuum gauge, flow totalizer, rotameter, and vacuum switch.

One carbon vane vacuum pump is provided for the record sample system. Redundant vacuum systems are not furnished, but failure annunciation is provided and flow rates are checked periodically to demonstrate operability.

E-4-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: To comply with the 40 CFR 61 Subpart H standards, volumetric flow rate for the 291-Z-1 stack conservatively is assumed to be 137 m³/s (290,000 cfm). On May 11, 1995, the EPA granted approval to DOE RL for the use of this value in calculations involving this stack (EPA 1995).

On June 26, 1995, DOE/RL satisfied the only EPA approval condition by providing direction to use 137 m³/s (290,000 cfm—DOE RL 1995). Finally, in a memorandum dated September 18, 1995, EPA Region 10 declared the 291-Z-1 stack compliant with the requirements of 40 CFR 61 Subpart H (95 PCA 914). This approval was retained as part of the stack transition to CERCLA (09-EMD-0123)

E-4-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Site Methods and practices for licensed stacks will be utilized to the extent practicable to assure substantive requirements are met.

E-4-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Site Methods and practices for licensed stacks will be utilized to the extent practicable to assure substantive requirements are met.

E-4-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to, PRC-PRO-EP-15334, and ABCASH.

E-4-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-4-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table C1, PRC-PRO-EP-15334, and PFP-specific procedures.

E-4-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Site Methods and practices for licensed stacks will be utilized to the extent practicable to assure substantive requirements are met.

Table E-4-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	Not Applicable
Inspect Pitot tubes for contaminant deposits	Not Applicable

Table E-4-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Inspect Pitot tube systems for leaks	Not Applicable
Inspect sharp-edged nozzles for damage	Not Applicable
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Annually
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications
Inspect or test the sample system for leaks	At least annually
Check mass flow meters of sampling systems with a secondary or transfer standard	At least quarterly
Inspect rotameters of sampling systems for presence of foreign matter	At the start of each sampling period
Check response of stack flow rate systems	At least quarterly
Calibration of flow meters of sampling systems	At least annually
Calibration of effluent flow measurement devices	At least annually
Calibration of timing devices	At least annually

E-4-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-4-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and description of corrective actions.

Response: Site Methods and practices for licensed stacks will be utilized to the extent practicable to assure substantive requirements are met.

E-4-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Site Methods and practices for licensed stacks will be utilized to the extent practicable to assure substantive requirements are met.

Attachment E-5

291-B-1 (B Plant)

Compliance Document Contents:

Letter AIR 06-1010 (IDMS Accession #DA03877552)

Method 114 Comparison for the 296-B-1 Stack

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 296-B-1 stack at the B Plant complex with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in *italics* text immediately following the requirements.

The B Plant facility and the original stack 291-B-1 were built in the 1940s, and the stack was used to support two missions: (1) the bismuth-phosphate plutonium/uranium recovery mission, and (2) the recovery of cesium and strontium from the fission product waste stream. When the stack was taken out of service in 1997, it was isolated from B Plant, along with associated filters and fans. The stack has been deregistered with the regulators and will not be addressed further in point-by-point evaluations. A new 296-B-1 stack was built to replace the 291-B-1 stack and began operation in 1998 when the deactivation of the facility was completed and placed in surveillance and maintenance status. The replacement system has its own fans, two banks of dual-stage HEPA filters, and a stack sampling system.

E-5-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 10 CFR 61 Subpart H §18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in Table D.1 of ANSI/HPS N13.1-1999 to be from 99.7 to greater than 99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-5-2.2 Radionuclides as Gases

Response: There is no requirement to perform gaseous radionuclide sampling because the B Plant is no longer processing radioactive materials that might cause gaseous radionuclide emissions. Irradiated fuel is no longer being introduced into B Plant because its first primary mission was completed in the early 1950s. No dissolutions have been performed since late 1952, and the separation of cesium and strontium ended in 1984. Following the bismuth-phosphate and cesium-strontium missions, the facility was cleaned out and no processing performed. Consequently, there is no need for gaseous radionuclide sampling, and the 296-B-1 stack is not equipped for gaseous radionuclide sampling.

E-5-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-5-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-5-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Roles and responsibilities are discussed in E-1. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220,

E-5-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: The facility is shut down and processing has ceased; therefore, unplanned operations resulting in increased emissions are unlikely. Refer to Sections E-1.2, E-2, and E-4 of this QAPjP. Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-5-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including, where applicable:

E-5-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: The stack is cylindrical and approximately 27 m (88.5 ft) tall. The sampling location is at an elevation of 13.1 m (43 ft). The sampling nozzle inlet is about 7.4 m (24.4 ft) above the top of the duct, which enters the stack at a 45° upward angle. The internal diameter of the stack is 31.25 in. The nozzle of the sampling probe is about 9.4 stack diameters from the inlet duct. The sampling location qualification criteria are described in PNNL-12017, "Airborne Effluent Monitoring System Certification for New B-Plant Ventilation Exhaust Stack," (PNNL 1998). The sampling probe (an Anderson Model RF-2-111) has a single shrouded nozzle. The sampling probe, tubing, and filter holder are all stainless-steel. The sampling system meets the criteria of 40 CFR 61, Subpart H, and the requirements of HPS/ANSI N13.1-1999. The 296-B-1 stack sampling location is identified by EDP code B001.

E-5-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: Particles in emissions from the 296-B-1 stack are continuously withdrawn with a single-point shrouded probe at a location in the stack emission stream where contaminants are of a uniform distribution. The sampling equipment meets the ANSI/HPS N13.1-1999 standard. Sampling location criteria, sampling nozzle, and sampling tube are described in PNNL-12017. The EPA had approved the DOE alternative-method petition that allowed the use of a sampling probe with a single shrouded nozzle in applications that previously required a probe with several isokinetic nozzles. This single-point sampling-extraction approach is applicable when the potential contaminants in the emission stream are of uniform concentration at the sampling location (PNNL-12017).

E-5-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. Compliance is demonstrated by the continuous sampling of emissions (see §E-5-4.3.4 below).

E-5-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Sample air is withdrawn continuously from the stack emissions stream by the probe as described in §4.3.2 above. This air flows through the sample line, and particulate radionuclides are collected on a sample filter. The sample filters are exchanged routinely and analyzed at the Contract Laboratory. The frequency of collection and the specific radionuclides analyzed are identified in the FF-01 license. Sample collectors are not calibrated; however, sample flow rate measurement instruments are calibrated as discussed in §E-5-4.3.6 below.

E-5-4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The laboratory analytical requirements are included in contractual documents.

E-5-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate measurement system consists of a rotameter and vacuum gauge. The sampling systems are inspected routinely and the flow rate is adjusted by a manual flow control valve to maintain a constant flow. Calibrations are performed annually in accordance with PRC-PRO-EP-15333 and PRC-PRO-MN-490. Precision, accuracy and completeness are met for stack flow as described in Section E-3.1, bullet 4.4.

E-5-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: The stack flow is relatively constant, so the flow rate is measured annually in accordance with 40 CFR 61.93. The flow is measured by standard Pitot traverses in accordance with 40 CFR 60 Appendix A Method 2. The traverse ports are tangential and located on the horizontal 30-in. duct between the HEPA filters and the exhaust fans. Traverse points are located at centers of equal area annuli. Flow measurement Pitot traverses are performed by V&B personnel. Calibration of V&B equipment is discussed in §E-1.4 of the main text. Precision, accuracy and completeness are met for stack flow as described in Section E-3.1, bullet 4.4.

E-5-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this QAPjP, and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program, which is updated yearly.

E-5-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of

replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program, which is updated yearly.

E-5-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to PRC-PRO-EP-15334, and ABCASH.

E-5-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-5-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-5-1, PRC-PRO-EP-15334, and B Plant-specific procedures.

Table E-5-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	N/A - This is not a component of the approved sampling system, therefore no cleaning is conducted.
Inspect Pitot tubes for contaminant deposits	N/A - This is not a component of the approved sampling system, therefore no inspection is conducted.
Inspect Pitot tube systems for leaks	This is not a component of the approved sampling system, therefore no inspection is conducted.
Inspect sharp-edged nozzles for damage	At least annually or after maintenance that could cause damage. See 2CP-SOP-ENV-54007 Section 4.3.4
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Annually - See 2CP-SOP-ENV-54007 Section 4.3.3
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually - See 2CP-SOP-ENV-54007 Section 4.4.3
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications – N/A. The check of the transport line has not shown any visible deposits
Inspect or test the sample system for leaks	At least annually - See 2CP-SOP-ENV-54007 Section 4.7.
Check mass flow meters of sampling systems with a secondary or transfer standard	N/A - This is not a component of the approved sampling system, therefore no check is conducted.

Table E-5-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Inspect rotameters of sampling systems for presence of foreign matter	At the start of each sampling period - See 2CP-SOP-ENV-54003 Section 4.1.2
Check response of stack flow rate systems	There are no effluent flow measurement devices at B Plant. This is not a component of the approved sampling system. The Vent & Balance team, employed from a separate DOE contractor, measures the effluent flow annually.
Calibration of flow meters of sampling systems	At least annually
Calibration of effluent flow measurement devices	At least annually - Effluent flow measurement devices at B Plant are not an installed component of the approved sampling system. The Vent & Balance team, employed from a separate DOE contractor, measures the effluent flow annually using a calibrated pitot tube.
Calibration of timing devices	N/A – There are no timing devices at B Plant. This is not a component of the approved sampling system, therefore no calibration is conducted.

E-5-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §§E-3 of this QAPjP and to PRC-PRO-QA-9662.

E-5-4.9 A corrective action program shall be established, including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-5-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and description of corrective actions.

Response: Refer to §§E-2.2, E-2.2.1, E-2.2.2, E-2.2.3 in the main body of this QAPjP.

E-5-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-6

296-B-10 (Waste Encapsulation & Storage Facility)

Compliance Document Contents:

Letter AIR 06-1014 (IDMS Accession #DA03882573)

Method 114 Comparison for the 296-B-10 Stack

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 296-B-10 stack at WESF with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in italics text immediately following the requirements.

E-6-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 40 CFR 61 Subpart H §61.18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in Table D.1 of ANSI/HPS N13.1-1999 to be from 99.7 percent to greater than 99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-6-2.2 Radionuclides as Gases

Response: The 296-B-10 stack does not exhaust radionuclide gases; therefore, this section is not applicable.

E-6-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-6-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-6-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Roles and responsibilities are discussed in E-1 and Section 1.4 of this QAPjP. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220,

E-6-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to Sections E-1.2, E-2, and E-4 of this QAPjP Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-6-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including the following elements where applicable.

E-6-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: The 296-B-10 stack has an inside diameter of 1.1 m (42 in.) and the probe location is approximately 17.4 m (57 ft) from the base. There are five nozzles supplying the record sampler. ANSI N13.1-1969 §A3.2 recommends a minimum of five nozzles on a stack that has the diameter of the 296-B-10 stack.

The procedure in 40 CFR 60 Appendix A Method 1 requires sampling to be performed at least eight stack diameters downstream and two diameters upstream of any flow disturbances. Eight stack diameters correspond to 8.5 m (28 ft,) and two stack diameters correspond to 2.1m (7 ft). The 296-B-10 stack complies with this criterion.

E-6-4.3.2 A description of sampling probes and representativeness of the samples.

Response: The sampling probe consists of five nozzles. The five nozzle inlets are 0.38 in. in diameter. The stack flow is fully turbulent (Reynolds number approximately $7.4E+03$) and, as stated in §A.3.3.2 of ANSI N13.1-1969, “. . . as the flow becomes more turbulent, the velocity becomes more nearly uniform across the duct.”

E-6-4.3.3 A description of any continuous monitoring systems used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable because monitoring is not used to demonstrate compliance for this emission unit.

E-6-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven nylon fabric. The manufacturer rates the efficiency of this medium at not less than 91 percent for a 0.3- μ m aerosol. In 1991, the manufacturer tested 24 samples with a 0.3- μ m dioctyl phthalate aerosol. The measured average efficiency was 95.8 percent and the standard deviation was 1.6 percent, which supports the rated efficiency. The efficiency of this filter is rated in ANSI/HPS N13.1–1999 to be from 98.1 to greater than 99 percent.

This filter is a membrane filter that collects 0.3 μ m particles with a collection efficiency of 95.8 percent. The sampler runs continuously to ensure a representative sample, and record samples are exchanged at least monthly based on balancing of the need to maintain an adequate flow rate and meet detection limits.

E-6-4.3.5 A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The analytes of interest for the 296-B-10 stack are identified in the FF-01 license. The laboratory analytical requirements are included in contractual documents.

E-6-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: Two vacuum pumps draw air through the sample transport lines at $1.9E-03$ m³/s (4 cfm), while the record sampler operates at $9.4E-04$ m³/s (2.0 cfm). The sample transport line drops with almost a 90° bend from the 17.4 m (57 ft) level on the stack to the sample cabinet located at the base of the stack. The sample transport line is heat-traced and insulated to inhibit condensation. The sample transport lines were installed with a minimum number of bends.

The sample passes through a 47 mm-diameter Versapor 3000 filter paper in the record sampler. The filter paper is changed monthly and evaluated for gross alpha and gross beta activity. The samples are analyzed monthly to provide isotopic radionuclide concentrations. The record sampler results provide the basis for reporting the amount and concentrations of radionuclides released to the environment. These reports are forwarded to all appropriate organizations and agencies. Downstream of the filter, the sampled air passes through a flow meter, a flow totalizer, a flow regulator, and a vacuum pump. In the event of a low flow in the record sampler line, a local alarm and a remote alarm are activated. Precision, accuracy and completeness are met for sample flow as described in Section E-3.1, bullet 4.4.

E-6-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: Because of physical constraints of the K-1 system, the flow in the K-1 duct cannot be measured per 40 CFR 60 Appendix A Methods 1, 1A, 2, and 2C. The maximum exhaust flow capacity of 24,390 cfm is used instead. Precision, accuracy and completeness are met as described in Section E-3.1, bullet 4.4 for approved alternative methods

E-6-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this QAPjP, and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-6-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Refer to §E-3 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-6-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and

preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to, PRC-PRO-EP-15334, Section 5.6 and ABCASH.

E-6-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-6-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-6-1, PRC-PRO-EP-15334, and WESF-specific procedures.

Table E-6-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	N/A - This is not a component of the approved sampling system, therefore no cleaning is conducted.
Inspect Pitot tubes for contaminant deposits	N/A - WESF does not have a flow measurement pitot tube and transport line. This is not a component of the approved sampling system. Instead, an EPA approval is in place allowing for an alternative flow measurement method using the maximum exhaust fan capacity
Inspect Pitot tube systems for leaks	N/A - WESF does not have a flow measurement pitot tube and transport line. This is not a component of the approved sampling system, therefore no inspection is conducted. Instead, an EPA approval is in place allowing for alternative flow measurement using the maximum exhaust fan capacity.
Inspect sharp-edged nozzles for damage	At least annually or after maintenance that could cause damage. See procedure 2C24023, Step 4.1.1.
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Annually. See procedure 2C24023, Steps 4.2.22 and 4.2.27.
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually. See procedure 2C24023, Step 4.2.33.
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications. N/A – The check of the transport line has not shown any visible deposits.
Inspect or test the sample system for leaks	At least annually. See procedure 2C24023, Step 4.3
Check mass flow meters of sampling systems with a secondary or transfer standard	N/A - There are no mass flow meters in use at WESF. This is not a component of the approved sampling system. Instead, a rotameter is used.

Table E-6-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Inspect rotameters of sampling systems for presence of foreign matter	At the start of each sampling period
Check response of stack flow rate systems	N/A - WESF does not measure stack flow rate using any component installed in the stack. EPA has approved the use of maximum exhaust fan capacity as an alternative flow measurement method.
Calibration of flow meters of sampling systems	At least annually – See PRC-PRO-MN-22478, Step 4.2.
Calibration of effluent flow measurement devices	N/A- An effluent flow measurement device is not a component of the approved sampling system. The DOH permit allows use of the maximum effluent flow value provided from the fan curve.
Calibration of timing devices	At least annually.

E-6-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §E-3 of this QAPjP and to PRC-PRO-QA-9662.

E-6-4.9 A corrective action program shall be established, including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-6-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and description of corrective actions.

Response: Refer to §E-3 in the main body of this QAPjP.

E-6-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-7

296-H-212 (Canister Storage Building)

Compliance Document Contents:

Letter AIR 11-1104 (IDMS Accession #0901280267)

Method 114 Comparison for the 296-H-212

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 296-H-212 Stack at the Canister Storage Building (CSB) with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in italics text immediately following the requirements.

E-7-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 40 CFR 61 Subpart H §61.18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in Table D.1 of ANSI/HPS N13.1-1999, to be from 99.7 to greater than 99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-7-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-7-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative and are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-7-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Refer to §E-1 of this QAPjP. Section E-1 documents most of the roles and responsibilities associated with these activities. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220,

E-7-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Administrative controls are in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-7-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including where applicable:

E-7-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: Only one sampling site is currently being used for obtaining samples from the 296-H-212 stack. The 296-H-212 stack is 0.70 m (2.30 ft) in diameter and 22.86 m (75.00 ft) high. The exhaust fan inlet to the stack is at 2.4 m (7.38 ft) above grade. The elevation of the active sampling site is 7.85 m (25.75 ft) above grade. An alternative methodology for use of a shrouded probe at this location in the stack was approved by EPA in a letter, Mary D. Nichols (EPA) to Raymond F. Pelletier (U.S. DOE), dated November 21, 1994 (see Appendix E of the Radioactive Air Emissions Notice of Construction Canister Storage Building, Building 212-H, HNF-7880, Rev 0B).

E-7-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: The sampling probe consists of a shrouded probe. Per PNNL-12166, testing has shown the sample system to provide 91% penetration for a stack flowrate of 9300 cfm.

E-7-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable because monitoring is not used to demonstrate compliance for this emission unit.

E-7-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven nylon fabric. The manufacturer rates the efficiency of this medium at not less than 91 percent for a 0.3- μ m aerosol. In 1991, the manufacturer tested 24 samples with a 0.3- μ m dioctyl phthalate aerosol. The measured average efficiency was 95.8 percent and the standard deviation was 1.6 percent, which supports the rated efficiency. The efficiency of this filter is rated in ANSI/HPS N13.1-1999 to be from 98.1percent to greater than 99 percent.

This filter is a membrane filter that collects 0.3 μ m particles with a collection efficiency of 95.8 percent. The sampler runs continuously to ensure a representative sample, and record samples are exchanged monthly for analysis.

E-7-4.3.5 A description of the Contract Laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The analytes of interest for the 296-H-212 stack are identified in the FF-01 license and the laboratory analytical requirements are found in contractual documents.

E-7-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: Two vacuum pumps draw air through the sample transport line at $.95E 03 \text{ m}^3/\text{s}$ (2 cfm), while the record sampler operates at $4.7E-04 \text{ m}^3/\text{s}$ (1.0 cfm). The sample transport line drops with a 90° bend from the 14.0 m (46 ft) level on the stack to the sample cabinet located at the base of the stack. The sample transport lines were installed with a minimum number of bends.

The sample passes through a 47 mm-diameter Versapor 3000 filter paper in the record sampler. The filter paper is changed monthly and evaluated for gross alpha and gross beta activity. The samples are analyzed monthly to provide isotopic radionuclide concentrations. The record sampler results provide the basis for reporting the amount and concentrations of radionuclides released to the environment. These reports are forwarded to all appropriate organizations and agencies. Downstream of the filter, the sampled air passes through a flow meter, a flow totalizer, a flow regulator, and a vacuum pump. In the event of a low flow in the record sampler line, a local alarm and a remote alarm are activated.

E-7-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: The flow rate is measured continuously with the GEMS system. The flow meter is calibrated annually per procedure SP-10-002 "Stack Monitor Periodic Calibration".

E-7-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to §§E-3, E-4

E-7-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Refer to §E-3 and Laboratory requirements are presented in MSC-23333 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program, which is updated yearly...

E-7-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to PRC-PRO-EP-15334, Section 5.6

E-7-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-7-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table 1-7-1, PRC-PRO-EP-15334, and WESF-specific procedures.

Table E-7-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	N/A – This is not a component of the approved sampling system, therefore no cleaning is conducted at CSB.
Inspect Pitot tubes for contaminant deposits	At least annually
Inspect Pitot tube systems for leaks	At least annually
Inspect sharp-edged nozzles for damage	At least annually or after maintenance that could cause damage
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Annually
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications N/A – The check of the transport line has not shown any visible deposits.
Inspect or test the sample system for leaks	At least annually
Check mass flow meters of sampling systems with a secondary or transfer standard	At least quarterly
Inspect rotameters of sampling systems for presence of foreign matter	N/A – This is not a component of the approved sampling system, therefore no inspection is conducted.
Check response of stack flow rate systems	At least quarterly
Calibration of flow meters of sampling systems	At least annually
Calibration of effluent flow measurement devices	At least annually
Calibration of timing devices	At least annually

E-7-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §§E-3 of this QAPjP and to PRC-PRO-QA-9662.

E-7-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-7-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§E-3 in the main body of this QAPjP.

E-7-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-8

296-K-142 (Cold Vacuum Drying Facility)

Compliance Document Contents:

13-ESQ-0031

Method 114 Comparison for the 296-K-142 (Cold Vacuum Drying Facility)

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 296-K-142 Stack at the Cold Vacuum Drying Facility (CVDF) with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in italics text immediately following the requirements.

E-8-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 40 CFR 61 Subpart H §61.18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in ANSI/HPS N13.1-1999, Table D.1 to be from 99.7 percent to >99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-8-2.2 Radionuclides as Gases

The following sections provide guidance for radionuclides as gases.

E-8-2.2.1 Tritium (H-3)

Tritium in the form of water vapor is collected from the extracted effluent sample by sorption, condensation, or dissolution techniques. Appropriate collectors may include silica gel, molecular sieves, and ethylene glycol or water bubblers.

Tritium in the gaseous form may be measured directly in the sample stream using Method B-1, collected as a gas sample, or may be oxidized to tritiated water using a metal catalyst and collected as described above.

Response: Per the NOC, tritium does not contribute greater than 10% of the potential- to- emit.

E-8-2.2.2 Iodine

Iodine is collected from an extracted sample by sorption or dissolution techniques. Appropriate collectors may include charcoal, impregnated charcoal, metal zeolite, and caustic solutions.

Response: Per the NOC, iodine does not contribute greater than 10% of the potential- to- emit.

E-8-2.2.3 Argon, Krypton, and Xenon

Radionuclides of these elements are either measured directly by an in-line or off-line monitor, or are collected from the extracted sample by low-temperature sorption techniques. Appropriate sorbers may include charcoal or metal zeolite.

Response: Per the NOC, argon, krypton, and xenon do not contribute greater than 10% of the potential-to-emit.

E-8-2.2.4 Oxygen, Carbon, Nitrogen, and Radon

Radionuclides of these elements are measured directly using an in line or off line monitor. Radionuclides of carbon in the form of CO₂ may be collected by dissolution in caustic solutions.

Response: Per the NOC, radionuclides of oxygen, carbon, nitrogen, and radon do not contribute greater than 10% of the potential-to-emit.

E-8-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-8-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative and are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-8-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Refer to §E-1 in the main body of this QAPjP. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-40220.

E-8-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to §E-1.2 and E-2 of this QAPjP. Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-8-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including where applicable:

E-8-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: Only one sampling site is used for obtaining samples from the 296-K-142 stack. The layout of the CVDF stack is shown on drawing H-1-82211 and the elevation and orientation of the sampling site is shown on drawing H-1-82216, Sheets 1, 2, and 3.. The location was chosen to assure a well-mixed, fully

developed flow, in compliance with the criteria of ANSI-N13.1-1999 (§5.2). Field qualification testing of the sample location is documented in PNNL-13401, “Cold Vacuuming Drying Facility Stack Air Sampling System Qualification Tests”.

The 296-K-142 stack is 0.76 m (30 inches) in diameter and exhausts approximately 14.5 m (47.5 feet) above grade.

The continuous sampling involves particulate collection on a record filter (EDP code Y201). To ensure representative particulate sampling, the sample is withdrawn from the stack via a shrouded probe designed to comply with ANSI N13.1-1999 to provide representative sampling of stack emissions.

E-8-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: To ensure representative particulate sampling, the sample is withdrawn from the stack via a shrouded probe designed to comply with ANSI N13.1-1999 to provide representative sampling of stack emissions. Field qualification testing of the sample location is documented in PNNL-13401, “Cold Vacuuming Drying Facility Stack Air Sampling System Qualification Tests”.

E-8-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: There is no requirement for continuous on-line monitoring.

E-8-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Sample air is withdrawn continuously from the stack effluent stream by the probe as described in §4.3.2 above.

The sample is comprised of a record sample as described in §2.1 above and is assigned EDP code Y201. The frequency of collection and the specific radionuclides analyzed are identified in the AMP of the RAWP. Sample collectors are not amenable to calibration; however, sample flow rate measurement instruments are calibrated as discussed in §E-8-4.3.6 below.

E-8-4.3.5 A description of the MSA laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

The radionuclides which are required to be measured and laboratory analytical requirements are included in contractual documents.

E-8-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate measurement system makes use of mass flow controller to maintain a constant sample flow. It is calibrated both quarterly and annually per Table E-8-1 below.

E-8-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: The effluent flow rate measurement system makes use of an annubar in the stack. The stack flow measurement system was qualified per 40CFR52 Appendix E as described in PNNL-13401, “Cold Vacuuming Drying Facility Stack Air Sampling System Qualification Tests”. The corresponding procedures associated with its use and calibration which is performed in accordance with Table E-8-1.

E-8-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this QAPjP, and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-8-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-8-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to the main body and PRC-PRO-EP-15334, and ABCASH.

E-8-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-8-1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-8-1 below, PRC-PRO-EP-15334, and to facility-specific procedures.

E-8-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §§E-3 in the main body of this QAPjP and to PRC-PRO-QA-9662.

E-8-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-8-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§E-8.2, E-8.2.1, E-8.2.2, E-8.2.3 in the main body of this QAPjP.

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	As required by application
Inspect Pitot tubes for contaminant deposits	At least annually

Sampling system components	Frequency of activity
Inspect Pitot tube systems for leaks	At least annually
Inspect sharp-edged nozzles for damage	At least annually or after maintenance that could cause damage
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Annually
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Annually
Clean transport lines	Visible deposits for HEPA-filtered applications; surface density of 1 g/cm ² for other applications
Inspect or test the sample system for leaks	At least annually
Check mass flow meters of sampling systems with a secondary or transfer standard	At least quarterly
Check sampling flow rate through critical flow venturis	At the start of each sampling period
Inspect rotameters of sampling systems for presence of foreign matter	At the start of each sampling period
Check response of stack flow rate systems	At least quarterly
Calibration of flow meters of sampling systems	At least annually
Calibration of effluent flow measurement devices	At least annually
Calibration of timing devices	At least annually

E-8-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-9

296-W-4 (Waste Receiving and Packaging Facility)

Compliance Document Contents: WDOH Approval Letter, AIR 12-301, Dated AFebruary 2, 2012

Method 114 Comparison for the 296-W-4 (Waste Receiving and Packaging Facility)

In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the 296-W-4 Stack at the Waste Receiving and Packaging Facility with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in italicized text immediately following the requirements.

E-9-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 40 CFR 61 Subpart H §61.18).

Response: Particles from sampled stack emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric. This filter is rated in ANSI/HPS N13.1-1999, Table D.1 to be from 99.7 percent to >99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-9-2.2 Radionuclides as Gases

Response: The 296-W-4 stack does not exhaust radionuclide gases; therefore, this section is not applicable

E-9-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in contractual documents.

E-9-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative and are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-9-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Refer to §E-1 in the main body of this QAPjP. Section E-1 documents most of the roles and responsibilities associated with these activities. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-4022.,

E-9-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to §E-1, 1.2, E-2, and E-4 of this QAPjP. Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-9-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including where applicable:

E-9-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: The top of the 296-W-4 Stack is 46 ft above the base. The record sampling port is located at a height of 11.73 m, (38.5 ft) above the base. The sample port is approximately 6.4 diameters downstream of the last disturbance.

The site was chosen to provide representative sampling of the effluent and to comply with ANSI N13.1. The sample port was chosen to minimize the length of sample line in accordance with ANSI N13.1.

E-9-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: The sampling probe consists of five nozzles branching from a single delivery line and is made entirely of 304 stainless steel tubing. At the inlet, each port is tapered to a knife edge with a 15-degree angle. The probe nozzles have an inside diameter of 4.0 mm (0.156 in). Entrance into the manifold is at 45 deg. The use of a n isokenetic five-point probe located more than 6.4 duct diameters downstream of the last major flow disturbance is believed to achieve representative sampling (sample flow rates are checked daily to ensure near isokineises of +/- 20 %).

E-9-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. Compliance is demonstrated by the continuous sampling of emissions (see next section).

E-9-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Sample air is withdrawn continuously from the stack effluent stream by the probe as described in §4.3.2 above.

The sample is collected on a record filter (EDP code W-123) for particulate collection. The particulate filter is exchanged routinely (bi-weekly) and analyzed at the Contract Laboratory. The frequency of collection and the specific radionuclides analyzed are identified in the FF-01 license. Sample collectors are not amenable to calibration; however, sample flow rate measurement instruments are calibrated as discussed in §E-2-4.3.6 below.

E-9-4.3.5 A description of the Contract Laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The laboratory analytical requirements are included in contractual documents.

E-9-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate measurement system consists of a mass flow meter, flow regulator (flow control valve, a vacuum gauge, and a vacuum pump). The flow transmitter sends information through a data logger to the plant control system. The flow rate regulator is provided to maintain a constant flow rate through the sample collection. At least once a day, personnel ensure proper sample flow rates are near Isokinetic (+-20%). The audible and visible alarm signals that indicate low flow rates for the record sampler are provided remotely in the dispatch office. The data logger inputs data from the flow transmitter and outputs data to the facility Annunciator panel (including and flow alarms).

Calibration of the mass flow meters is performed off site on two identical mass flow meters in accordance with PRC-PRO-MN-490 and contract 2957. These flow meters are swapped out every six months on a rotating basis. Every quarter the operating mass flow meter is either checked against a secondary standard or checked and swapped out with the other transmitter.

Alternative vacuum pumps are provided for the system. Failure annunciation (low flow rate) is provided and checked periodically in the dispatcher's office to demonstrate operability.

Precision, accuracy and completeness are met for sample flow as described in Section E-3.1, bullet 4.4.

E-9-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: The 296-W-4 stack flow is relatively constant, so the emissions flow rate is measured annually by traverses with a standard Pitot tube using the test ports located 33'6" above the base of the stack using the Pitot traverse method described in 40 CFR 60 Appendix A Method 2. Flow measurement Pitot traverses are performed by Vent & Balance (V&B) personnel. Calibration of V&B equipment is discussed in §1.5 of the main text.

The 296-W-4 stack does have a stack flow probe and transmitter that is un-calibrated and is considered reference only. For information purposes the value from the stack transmitter is compared to the value obtained by the Pitot tube method described above but is not used for reporting values for emissions. There are no alarms associated with the stack flow value.

Precision, accuracy and completeness are met as described in Section E-3.1, bullet 4.4.

E-9-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this QAPjP, and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program.

E-9 -4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program, which is updated yearly..

E-9 -4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to the main body and PRC-PRO-EP-15334, and the Automated Bar Coding of All Samples at Hanford (ABCASH).

E-9 -4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table E-9 -1, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-2-1 below, PRC-PRO-EP-15334, and to facility-specific procedures.

E-9 -4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §E-3 in the main body of this QAPjP and to PRC-PRO-QA-9662.

E-9 -4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-9 -4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§E-2.2, E-2.2.1, E-2.2.2, E-2.2.3 in the main body of this QAPjP.

Table E-9 -1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	Performed as needed during annual stack inspection
Inspect Pitot tubes for contaminant deposits	N/A, Not Used
Inspect Pitot tube systems for leaks	N/A, Not Used
Inspect sharp-edged nozzles for damage	Performed during annual stack inspection
Check nozzles for alignment, presence of deposits, or other potentially degrading factors	Performed during annual stack inspection
Check transport lines of HEPA-filtered applications to determine if cleaning is required	Performed during annual stack inspection
Clean transport lines	Performed as needed during annual stack inspection
Inspect or test the sample system for leaks	Performed during annual stack inspection
Check mass flow meters of sampling systems with	Checked or checked and swapped with calibrated

Table E-9 -1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
a secondary or transfer standard	instrument quarterly
Inspect rotameters of sampling systems for presence of foreign matter	N/A, Not used
Check response of stack flow rate systems	N/A Per 40 CRF 61, Subpart H, 61.93.b.1.iii For relatively constant flow rates only periodic measurements are necessary. WRAP runs at a relatively constant flow and the period of the measurement is annually
Calibration of flow meters of sampling systems	Two instruments are calibrated annually and installed alternately every six months
Calibration of effluent flow measurement devices	The WRAP effluent flow meter is reference only. It is checked against the annual stack flow measurement performed by vent and balance personnel.
Calibration of timing devices	N/A, Not used.

E-9 -4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

Attachment E-10

General Permit Required Monitoring Locations

The quality assurance objectives for measurements applicable to General Permit Required monitoring locations are related primarily to the following:

- Defining the appropriate methods for sampling and analysis for the required analytes of interest.
- Defining quantitative limits and values for analytical precision and accuracy appropriate for the sampling locations.
- Defining data representativeness, completeness and comparability in terms applicable to the sampling locations.

The CHPRC responsibilities will generally be limited to sample collection and monitoring equipment maintenance and calibration. The analytical and data reduction responsibilities will be generally performed by a Contract Laboratory and MSA, respectively. In some cases, the monitoring, analysis and data reduction for a location will be performed by MSA as contracted work.

Air samples collected in support of the General Permit Required monitoring locations meet the quality assurance requirements of Method 114 used to report air emissions in accordance with 40 CFR 61, Subpart H, “National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities”. The sample collection frequency and analytes of interest are specified in the license requirements for each General Permit Required monitoring location. Sample collection procedures will generally be in the form of a radioactive work tasks or plans. The Chain of Custody process will comply with Method 114 requirements. The analytical method for the sample is prescribed in Method 114 (3) and is specified in the contract requirements for the Contract Laboratory. The contract requirements contain EPA established method and analyte specific quantitation limits and ranges for precision and accuracy. The Contract Laboratory will provide data packages to MSA that meet the requirements of SW-846, *Test Methods for Evaluating Solid Waste, Physical Chemical Methods*. MSA will validate and analyze the data as provided for in MSC-23333, *Environmental Quality Assurance Program Plan*. Preventive maintenance and calibration of field monitoring equipment will be performed in accordance with facility procedures.

Method 114 Comparison for General Permit Required Monitoring Locations

The 40 CFR 61 Appendix B Method 114 provides requirements for stack (point source) monitoring at stationary sources. The radioactive air licenses contained in the FF-01 license utilize select portions of Method 114 as compliance requirements for non-point source emissions. In this appendix, a requirement-by-requirement recitation and response is given, which describes the state of compliance of the General Permit Required Monitoring Locations for non-point source emissions monitoring with the radionuclide emission requirements defined in Method 114. Requirements from Method 114 are directly quoted by section number. Responses that detail the state of compliance appear in italicized text immediately following the requirements.

E-10-2.1 Radionuclides as Particulates

The extracted effluent stream is passed through a filter to remove the particulates. The filter must have a high efficiency for removal of sub-micron particles. The guidance in ANSI N13.1-1999 (§6.6.2 Filter media) shall be followed in using filter media to collect particulates (incorporated by reference—see 40 CFR 61 Subpart H §61.18).

Response: Particles from sampled emissions are collected on a 47 mm-diameter Versapor 3000 filter, an acrylic copolymer membrane supported by a non-woven polyester or nylon fabric or equal. This filter is rated in ANSI/HPS N13.1-1999, Table D.1 to be from 99.7 percent to >99.99 percent efficient for particles in the range of 0.035 to 1 μ m.

E-10-2.2 Radionuclides as Gases

Response: For General Permit Required monitoring locations, radionuclide gases are not considered analytes of interest; therefore, this section is not applicable

E-10-3.0 Radionuclide Analysis Methods

Response: The analysis methods have been evaluated by cognizant MSA personnel and are included in MSC-23333, Environmental Quality Assurance Program Plan and Contract Laboratory contractual documents.

E-10-4.0 Quality Assurance Methods

Each facility required to measure their radionuclide emissions shall conduct a QA program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative and are of known precision and accuracy, and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions, and reports. This QA program shall include the program elements that follow.

E-10-4.1 The organizational structure, functional responsibilities, levels of authority, and lines of communications for all activities related to the emissions measurement program shall be identified and documented.

Response: Refer to §E-1 in the main body of this QAPjP. Section E-1 documents most of the roles and responsibilities associated with these activities. Additional Environmental Program and Strategic Planning Roles, Responsibilities, and Functions are documented in PRC-MP-EP-4022.,

E-10-4.2 Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.

Response: Refer to §E-1, 1.2, E-2, and E-4 of this QAPjP. Administrative controls are also in place for trending emissions data in accordance with procedure PRC-PRO-EP-15333, §5.14, and notification in accordance with procedure PRC-PRO-EP-15333, §5.56.

E-10-4.3 The sample collection and analysis procedures used in measuring the emissions shall be described, including where applicable:

E-10-4.3.1 Identification of sampling sites and number of sampling points, including the rationale for site selections.

Response: The monitoring locations are dictated in the license conditions and generally consist of a single point low volume particulate sampler.

E-10-4.3.2 A description of the sampling probe and representativeness of the samples.

Response: This requirement is not applicable. These locations are not stacks or vents and the use of a sample probe to obtain a representative sample is not required.

E-10-4.3.3 A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. Compliance is demonstrated by the continuous sampling of emissions for historical monitoring (see next section).

E-10-4.3.4 A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures, and frequency of calibration.

Response: Sample air is withdrawn continuously from ambient atmosphere by a low volume sampler onto a filter for laboratory analysis.

The sample is collected on a record filter for particulate collection. The particulate filter is exchanged routinely (bi-weekly) and analyzed at the Contract Laboratory. The frequency of collection and the specific radionuclides analyzed are identified in the location specific license of the FF-01 license. Sample collectors are not amenable to calibration; however, sample flow rate measurement instruments are calibrated as discussed in §E-2-4.3.6 below.

E-10-4.3.5 A description of the Contract Laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures, and frequency of calibration.

Response: The laboratory analytical requirements are included in MSC-23333, Environmental Quality Assurance Program Plan and the Contract Laboratory scope of work.

E-10-4.3.6 A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.

Response: The sample flow rate measurement system consists of a mass flow meter, flow regulator (flow control valve, a vacuum gauge, and a vacuum pump). The flow rate regulator is provided to maintain a constant flow rate through the sample collection.

Calibration of the mass flow meters is performed in accordance with PRC-PRO-MN-490

Precision, accuracy and completeness are met for sample flow as described in Section E-3.1, bullet 4.4.

E-10-4.3.7 A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures, and frequency of calibration.

Response: This requirement is not applicable. The General Permit Required monitoring does not sample from duct confined emission points.

E-10-4.4 The objectives of the QA program shall be documented and shall state the required precision, accuracy, and completeness of the emission measurement data, including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of data obtained compared to the amount expected under normal conditions.

Response: Refer to Sections E-3 and E-4 of this QAPjP, and Contract Laboratory *Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program*.

E-10-4.5 A QC program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of such QC checks shall be identified.

Response: Laboratory requirements are presented in MSC-23333 and Contract Laboratory *Statement of Work for Services Provided for the Effluent and Environmental Monitoring Program*.

E-10-4.6 A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis, and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage, and analysis.

Response: Refer to the main body and PRC-PRO-EP-15334, and the *Automated Bar Coding of All Samples at Hanford (ABCASH)*.

E-10-4.7 Regular maintenance, calibrations, and field checks shall be performed for each sampling system in use by satisfying the requirements found in Table 2, Maintenance, Calibration, and Field Check Requirements.

Response: Refer to Table E-10-1 below, PRC-PRO-EP-15334, and to facility-specific procedures.

E-10-4.8 Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.

Response: Refer to §E-3 in the main body of this QAPjP and to PRC-PRO-QA-9662.

E-10-4.9 A corrective action program shall be established including criteria for when corrective action is needed, what corrective action will be taken, and who is responsible for taking the corrective action.

Response: Refer to PRC-PRO-QA-052.

E-10-4.10 Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits, and descriptions of corrective actions.

Response: Refer to §§E-2.2, E-2.2.1, E-2.2.2, E-2.2.3 in the main body of this QAPjP.

Table E-10-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
Cleaning of thermal anemometer	N/A, Not used
Inspect Pitot tubes for contaminant deposits	N/A, Not Used
Inspect Pitot tube systems for leaks	N/A, Not Used
Inspect sharp-edged nozzles for damage	N/A, Not used
Check nozzles for alignment, presence of deposits,	N/A, Not used

Table E-10-1. Maintenance, Calibration, and Field Check Requirements

Sampling system components	Frequency of activity
or other potentially degrading factors	
Check transport lines of HEPA-filtered applications to determine if cleaning is required	N/A, Not used
Clean transport lines	Performed as needed
Inspect or test the sample system for leaks	Performed during annual inspection
Check mass flow meters of sampling systems with a secondary or transfer standard	If present, checked or checked and swapped with calibrated instrument quarterly
Inspect rotameters of sampling systems for presence of foreign matter	If present, performed each time samples are collected
Check response of stack flow rate systems	N/A, Not used
Calibration of flow meters of sampling systems	Performed annually
Calibration of effluent flow measurement devices	N/A, Not used.
Calibration of timing devices	N/A, Not used.

E-10-4.11 The QA program should be documented in a QAPjP that should address each of the above requirements.

Response: Refer to this QAPjP as a whole.

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Appendix F
CHPRC
Environmental Management System
Assessment Program

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F1 Introduction

The Environmental Management System (EMS) is used to develop and implement the CH2M HILL Plateau Remediation Company (CHPRC) environmental policy and manage its environmental aspects (activities, products, or services that can interact with the environment). The EMS is a system that incorporates existing procedures and work practices in a formal structure to ensure that important environmental impacts are identified and addressed.

EMS is a systematic approach to work that is designed to:

- Ensure protection of human health and the environment while complying with environmental requirements
- Identify and focus on activities that could have an impact on the environment
- Ensure that employees working on such activities are properly trained
- Ensure that proper controls are developed and implemented to minimize environmental impacts
- Facilitate the monitoring of environmental performance over time

PRC-MP-EP-40182, *EMS Manual* provides an overview of EMS. The EMS was developed to satisfy the specifications of the CHPRC Plateau Remediation Contract (PRC) DE-AC06-08RL14788 which states the Integrated Safety Management System (ISMS) shall include an integrated EMS developed pursuant to Department of Energy (DOE) Order (O) 436.1, *Departmental Sustainability*, including supplemental requirements for spill prevention, reporting, and response (hereinafter referred to as CRD O 436.1). The issuance of the PRC, Section J.2 has been modified to include the Contractor Requirements Document (CRD) for DOE O 436.1.

The EMS as described in the EMS manual reflects the elements and framework of the *International Standard for Environmental Management Systems* (ISO 14001:2004) and incorporates the additional provisions of CRD O 436.1 for an EMS. The EMS follows the basic format of plan-do-check-act and includes the ISO 14001 requirements. The EMS has categorized the requirements into five Core Elements; 1) Environmental Policy, 2) Planning, 3) Implementation and Operation, 4) Checking and Corrective Action, and 5) Management Review, so that the alignment with the ISMS Core Functions and guiding principles can be easily identified.

The ISMS Guiding Principles establish the organizational culture for doing work safely. ISMS Core Functions and EMS Core Elements establish organizational processes to identify and control human and environmental hazards. When the culture and processes function together the outcome is a balance between compliance and operational excellence designed to protect the worker, public, and environment.

The EMS Manual describes the scope of the EMS and how it relates to the ISMS and existing systems. It is largely a referencing document pointing to existing CHPRC programs and procedures that demonstrate conformance to ISO 14001:2004.

A component of the EMS program is the Assessment Program which is described in this document.

F2 Purpose, Scope, and Applicability

F2.1 Purpose

The purpose of this document is to establish the requirements for the CHPRC EMS audit program, including the process, roles and responsibilities, and auditor qualifications. The purpose of the EMS audit program is to determine whether the CHPRC Environmental Management System conforms to ISO 14001:2004 and CRD O 436.1, as required by the contract, and has been properly implemented, maintained, and continually improved, where necessary.

F2.2 Scope and Applicability

This document applies to the CHPRC EMS and the activities/operations covered by the EMS.

Note 1: The term "assessment" is understood to be "independent assessments" which are used synonymously with audits in this document.

Note 2: Terms specific to this document are defined in ISO 14001 and ISO 19011.

The scope of each audit will be elements of ISO 14001, determined by the Environmental Compliance and Quality Assurance (ECQA) Manager at the beginning of each fiscal year.

F3 Implementation

This document is effective upon publication.

F4 Frequency of EMS Internal Audit

Internal EMS audits shall be scheduled on the basis of need as reflected by the importance of activities or the results of previous audits, but not less than tri-annually, in order to verify that the system is implemented and functioning as expected. An individual audit may be limited to a sampling of EMS elements or areas and can be both random and/or focused on certain activities based on their importance and/or results of previous audits. All elements of the EMS program will be audited every three years. The ECQA Manager will decide on the strategy to be pursued in the audit at the beginning of each fiscal year.

F5 Auditor Evaluation

F5.1 Auditors

The evaluation of auditors shall be in accordance with Table F-1 below and shall occur at the following different stages:

- The initial evaluation of persons who wish to become auditors;
- The evaluation of the auditors
- The continual evaluation of auditor performance to identify needs for maintenance and improvement of knowledge and skills.

In accordance with ISO 19011, Section 7.2, auditors shall demonstrate competence based on the following personal attributes:

- Ethical, i.e., fair, truthful, sincere, honest and discreet
- Open-minded, i.e., willing to consider alternative ideas or points of view

- Diplomatic, i.e., tactful in dealing with people
- Observant, i.e., actively aware of physical surroundings and activities
- Perceptive, i.e., instinctively aware of and able to understand situations
- Versatile, i.e., adjusts readily to different situations
- Tenacious, i.e., persistent, focused on achieving objectives
- Decisive, i.e., reaches timely conclusions based on logical reasoning and analysis
- Self-reliant, i.e., acts and functions independently while interacting effectively with others.

Section 7.3 of ISO 19011 states auditors should also have the ability to apply the knowledge and skills in the following areas:

- a. Audit principles, procedure and techniques. An auditor should be able to:
 - To apply audit principles, procedures and techniques,
 - To plan and organize the work effectively,
 - To conduct the audit within the agreed time schedule,
 - To prioritize and focus on matters of significance,
 - To collect information through effective interviewing, listening, observing and reviewing documents, records and data,
 - To understand the appropriateness and consequences of using sampling techniques for auditing,
 - To verify the accuracy of collected information,
 - To confirm the sufficiency and appropriateness of audit evidence to support audit findings and conclusions,
 - To assess those factors that can affect the reliability of the audit findings and conclusions,
 - To use work documents to record audit activities,
 - To prepare audit reports,
 - To maintain the confidentiality and security of information, and
 - To communicate effectively, either through personal linguistic skills or through an interpreter.
- b. Management system and reference documents: to enable the auditor to comprehend the scope of the audit and apply audit criteria. Knowledge and skills in this area should cover
 - The application of management systems to different organizations,
 - Interaction between the components of the management system,
 - Quality or environmental management system standards, applicable procedures or other management system documents used as audit criteria,
 - Recognizing differences between and priority of the reference documents,
 - Application of the reference documents to different audit situations, and
 - Information systems and technology for, authorization, security, distribution and control of documents, data and records
- c. Organizational situations: to enable the auditor to comprehend the organization's operational context. Knowledge and skills in this area should cover

- Organizational size, structure, functions and relationships,
 - General business processes and related terminology, and
 - Cultural and social customs of the auditee.
- d. Applicable laws, regulations and other requirements relevant to the discipline: to enable the auditor to work within, and be aware of, the requirements that applies to the organization being audited. Knowledge and skills in this area should cover
- Local, regional and national codes, laws and regulations,
 - Contracts and agreements,
 - International treaties and conventions, and
 - Other requirements to which the organization subscribes.

EMS auditors should have knowledge and skills in the following areas:

- a. Environmental management methods and techniques: to enable the auditor to examine environmental management systems and to generate appropriate audit findings and conclusions. Knowledge and skills in this area should cover
- Environmental terminology,
 - Environmental management principles and their application, and
 - Environmental management tools (such as environmental aspect/impact evaluation, life cycle assessment
 - Environmental performance evaluation, etc.).
- b. Environmental science and technology: to enable the auditor to comprehend the fundamental relationships between human activities and the environment. Knowledge and skills in this area should cover:
- The impact of human activities on the environment,
 - Interaction of ecosystems,
 - Environmental media (e.g. air, water, land)
 - Management of natural resources (e.g. fossil fuels, water, flora and fauna), and
 - General methods of environmental protection.
- c. Technical and environmental aspects of operations: to enable the auditor to comprehend the interaction of the auditee's activities, products, services and operations with the environment. Knowledge and skills in this area should cover:
- Sector-specific terminology,
 - Environmental aspects and impacts,
 - Methods for evaluating the significance of environmental aspects,
 - Critical characteristics of operational processes, products and services,
 - Monitoring and measurement techniques, and
 - Technologies for the prevention of pollution.

Auditors should have the education, work experience, auditor training and audit experience listed in Table F-1 below and their work experience should be in a technical, managerial or professional position involving the exercise of judgment, problem solving, and communication with other managerial or professional personnel, peers, customers and/or other interested parties.

Part of the work experience should be in a position where the activities undertaken contribute to the development of knowledge and skills in the environmental management field.

Note: A qualified RABQSA Environmental Lead Auditor with current certifications and objective evidence to support maintenance of their proficiency may be qualified to lead a CHPRC EMS audit based on concurrence by the ECQA Manager.

F5.2 Lead Auditors

Lead auditors should have the qualifications shown in Table F-1 and should have additional knowledge and skills in audit leadership to facilitate the efficient and effective conduct of the audit. A lead auditor should be able:

- To plan the audit and make effective use of resources during the audit,
- To represent the audit team in communications with the audit client and auditee,
- To organize and direct audit team members,
- To provide direction and guidance to auditors-in-training,
- To lead the audit team to reach the audit conclusions,
- To prevent and resolve conflicts, and
- To prepare and complete the audit report.

This additional experience should have been gained while acting in the role of lead auditor under the direction and guidance of another auditor who is competent as a lead auditor.

F5.3 Maintenance and Improvement of Competence Continual Professional Development

Continual professional development is concerned with the maintenance and improvement of knowledge, skills and personal attributes. This can be achieved through means such as additional work experience, training, private study, coaching, attendance at meetings, seminars and conferences or other relevant activities. Auditors should demonstrate their continual professional development. The continual professional development activities should take into account changes in the needs of the individual and the organization, the practice of auditing, standards and other requirements.

Auditors should maintain and demonstrate their auditing ability through regular participation in audits of quality and/or environmental management systems.

Table F-1. Auditor and Lead Auditor Qualification Criteria

Parameter	Auditor	Lead Auditor
Education	Bachelors Degree	Bachelors Degree
Total Work Experience	5 years	5 years
Work Experience in Quality or Environmental Management Field	2 years	2 years
Auditor Training	ISO 14001 EMS Lead Auditor	ISO 14001 EMS Lead Auditor

	Training	Training
Audit Experience	Four complete audits for a total of at least 20 days of audit experience as an auditor-in-training under the direction and guidance of an auditor competent as a lead auditor	Three complete audits for a total of at least 15 days of audit experience acting in the role of a lead auditor under the direction and guidance of an auditor competent as a lead auditor The audits should be completed within the last two consecutive years

F6 Roles and Responsibilities

F6.1 Lead Auditor

The Lead Auditor is responsible for all phases of the audit including but not limited to:

- Pre-Audit Planning which includes:
 - Select the audit team
 - Verify all team members are qualified (See section F4)
 - Obtain any background information necessary to achieve the audit objectives
 - Prepare the audit plan
- Conducting the Opening meeting
- Conducting the audit
- Communication during the audit with the audit team and the auditee
- Assigning work to the audit team
- Post Audit activities
 - Notify auditee when findings of critical nonconformities are discovered.
 - Report audit findings
 - Makes recommendations for improvements to the EMS

The lead auditor provides leadership to ensure that the audit is conducted efficiently and effectively in accordance with the audit scope and plan.

F6.2 Auditor

The auditor follows the directions of the lead auditor and supports the lead auditor. The auditor plans and carries out assigned responsibilities effectively and efficiently. The auditor complies with applicable audit requirements.

During the audit, the auditor identifies and documents nonconformities (audit findings)

The auditor assists the lead auditor in preparing the audit report.

F6.3 Auditee

The person or group audited is referred to as the auditee. It is the responsibility of the auditee to:

- Coordinate the date and visit logistics of the audit. This includes finding a conference room or office to meet in.
- Provide access to the facilities and documents requested by the auditors
- Cooperate with the auditors, to provide any information requested by the auditors
- Determine and initiate any corrective actions based on the audit findings.

F7 Audit/Assessment Process

EMS audits/assessments are planned and conducted to measure the effectiveness of the overall EMS, or to determine the conformity or nonconformity with defined criteria, the effectiveness of a process or compliance with regulatory requirements. This section of this document defines the process for CHPRC ECQA to perform an EMS audit/assessment on any organization, function, or person within CHPRC.

Actionee	Action
ECQA Manager	<p>Schedules the internal EMS audit. Although ISO 14001:2004 does not specify an audit frequency, the schedule is based on the environmental importance of the activity and the results of previous audits. At a minimum, each of the EMS elements will be audited internally every 3 years. Every three years, an external independent audit shall be conducted in accordance with the EMS Manual.</p> <p>The assessment schedules shall be reviewed periodically and modified as new information on the facility or organization is obtained that changes the estimated complexity or available resources. Some considerations in scheduling include:</p> <ul style="list-style-type: none"> • Previous assessment results and their dispositions • Independent information (e.g. experiences from other DOE contractors, peer organizations, and regulatory organizations) • Changes in responsibilities, resources, or management.
ECQA Manager	<p>Responsible for planning the EMS audits.</p> <p>The determination of criteria to be assessed and the degree to which ISMS/EMS core functions/core elements are demonstrated within each work level depends upon the consequence and likelihood of failure or risk of the work activity and or the scope of the specific assessment. Programs, systems, and processes that contribute a higher risk to quality, safety, and mission accomplishment are assessed with greater rigor or frequency. Assessment criteria are tailored during the planning phase of an assessment in order to embrace the vision set forth for each assessment and answer the question, "What do we want to accomplish?"</p>
Qualification of Auditor	
Prospective Lead Auditor	<p>Provide the following to the ECQA Manager:</p> <ul style="list-style-type: none"> • Certification records • Records of previous audit/assessment participation • Record of successfully completed ISO 14001 training • Resume.
ECQA Manager	<ul style="list-style-type: none"> • Verifies EMS Auditors and Lead auditors are qualified and impartial. • Reviews the prospective lead's training and experience, determines if any additional training is required and if not: • Completes form # A-6005-401 EMS Lead Auditor Qualification/Certification Record. This form documents the requirements for an EMS Lead Auditor and is shown in Attachment A. • Approves qualification/certification by signing and dating the EMS Lead Auditor Qualification/Certification form # A-6005-401 when complete.

Actionee	Action
	<ul style="list-style-type: none"> • Verifies this form has been completed, signed, dated and current. • Verifies this form is maintained as a record in accordance with PRC-PRO-IRM-10588, <i>Records Management Processes</i>. • Ensures all the EMS auditors are qualified in accordance with section 4.0 of this document and is impartial. • Approve all assessors and Lead assessors. This approval will be documented by signature on the Assessment Plan which includes the names of the audit team. • Verify other team members have a strong technical background in the elements they will be auditing. Note: To ensure impartiality, the lead auditor and audit team members shall not be responsible for developing or implementing the activity being audited. • Annually evaluates the EMS Lead Auditor's proficiency by verifying regular and active participation in the EMS assessment program that contribute to the development of their knowledge and skills described in Section F8 of this document
Lead Auditor	Prior to the audit, the lead auditor notifies the respective operations being assessed of the upcoming audit.
Lead Auditor	<p>Develops the EMS Audit/Assessment Plan which may include:</p> <ul style="list-style-type: none"> • Assessment Criteria – checklists or lines of inquiry; significant issues from previous occurrences, assessments or nonconformities; performance measures; and best management practices; Include Reference documents • Audit Scope including organization to be audited • Assessment Team - members and respective qualifications or technical expertise; • Assessment Strategy – e.g., interviews, document reviews, surveillances, verification testing; • Schedule - dates and coordination activities with affected staff (opening/closing meetings, debriefings, interview schedules) and dates when draft and final reports will be provided to the VP EP&SP and the ECQA Manager. <p>Note: If the audit is being used to verify the effectiveness of previous corrective/preventive actions, the audit plan should state this explicitly.</p> <p>Sends the audit plan to the organization being audited before the audit activities begin. Any objections by the auditee should be resolved and a revised audit plan written, if applicable, before continuing the audit.</p>
Conducting an EMS Assessment	
Lead Auditor	<ul style="list-style-type: none"> • Conduct an entrance meeting with the assessment team and appropriate management and staff of the assessed organization to discuss the assessment scope, determine the status of work to be assessed, and meet counterparts. • Document the assessment scope, individuals in attendance, and the meeting date.
Lead Auditor/Assessment Team	<p>Review documents related to the EMS and the elements/activities that are the subject of the audit before and during the assessment to gain an understanding of the organizations activities before the assessment.</p> <p>Examples of documents that can be reviewed include:</p> <ul style="list-style-type: none"> • previous EMS internal and external audit reports, • environmental policy, • significant environmental aspects list, • training records, • communication records, • operational procedures and records, • contractor documents that specify environmental requirements, • nonconformance and corrective and preventive action records, • effluent and emission monitoring records,

Actionee	Action
	<ul style="list-style-type: none"> • performance measure records and data; and • other EMS documents relevant to the elements that are within the scope of the audit, such as objectives and targets, management review documentation, etc.
Lead Auditor/Assessment Team	<p>Conduct the audit by performing the following tasks, as applicable:</p> <ul style="list-style-type: none"> • Evaluates procedures, EMS program implementation, previous EMS assessment results, and corrective and preventive actions taken; obtains objective evidence, including staff interviews, records, or direct observation of facility operations or functional processes. Includes titles of documents or records that provide objective evidence of conformance on audit checklist or in audit report; • Evaluates applicability and implementation for guests, visitors, or contractors who perform work for the organization, and tenants and concessionaires. <p>Immediately addresses any unacceptable conditions, including possible regulatory noncompliance issues, by notifying the ECQA Manager.</p> <p>Completes the assessment checklist.</p> <p>Analyzes data from the assessment to provide useful information for the organization's management. The Assessor shares data, objective evidence, and preliminary analyses and identifies the strengths and weaknesses associated with the element and activities being assessed. Findings shall be clear, accurate and actionable.</p> <p>The Assessor/Assessment Team concludes the assessment by briefing the EMS VP EP&SP and the ECQA Manager and other managers as appropriate, of the assessment findings. The results of the assessment will be included in the management review per Section 8.0, <i>Management Review of the Environmental Management System Manual</i>, PRC-MP-EP-40182.</p>
Lead Auditor	<ul style="list-style-type: none"> • Conducts periodic (daily recommended) meetings with the assessment team to discuss the progress of the assessment and any potentially adverse condition. • Conduct periodic (daily recommended) meetings with management of the assessed organization, as appropriate, to report the progress and status of the assessment, and to coordinate required interfaces involved in the assessment. • Conduct an exit meeting to present the results of the assessment to appropriate management of the assessed organization. • Document the exit meeting scope and date and provide to attendees for signature.
Lead Auditor	<p>Identifies audit findings and categorizes them as one of the following:</p> <p><u>Nonconformity</u>: Objective evidence exists that a requirement has not been addressed (intent), a practice differs from the defined system (implementation), or the system is not effective.</p> <p><u>Major nonconformity</u>: A system element is missing, or there is evidence that a system element is not implemented or not effective. Multiple minor nonconformities may be grouped together as a major if they are all examples of the same type of nonconformity.</p> <p><u>Minor nonconformity</u>: A single observed discrepancy in the system, with evidence that the overall system is defined, implemented, and effective.</p> <p><u>Observation</u>: Not a nonconformity, but something that could lead to a nonconformity if allowed to continue uncorrected, or an existing condition without adequate supporting evidence to verify that it constitutes a nonconformity.</p> <p><u>Opportunity for Improvement/Recommendation</u>: A suggested means of accomplishing an activity, fulfilling the intent of a procedural requirement, or improving the efficiency or effectiveness of the EMS. It is not a nonconformity or observation. A recommendation involves an element that meets the minimum ISO 14001 requirements, but could bring that element of the EMS to the next level, as part of continual improvement.</p> <p><u>Noteworthy Practice</u>: Performance that exceeds expectations in terms of efficiency and/or effectiveness and provides a model for others to follow.</p>

Actionee	Action
Preparing the EMS Audit Report	
Lead Auditor	<p>Prepares the draft assessment report including:</p> <ul style="list-style-type: none"> • Audit Objectives • Scope • Identification of lead auditor and members • Dates and Places where audit activities were conducted • Audit criteria • Audit findings including Major and Minor nonconformities, observations, opportunities for improvement and noteworthy practices and a statement of the effectiveness of the EMS Program elements which were evaluated. • Audit conclusions • Attachments to the report, if any, may include: <ul style="list-style-type: none"> – Identification of assessment team members – Areas reviewed – Personnel contacted during the assessment – Procedures and documents reviewed. <p>Forward the draft assessment report, for technical and factual accuracy review, as applicable, to the responsible assessed manager(s) of the assessed organization(s) and resolve any issues from this review.</p> <p>Enters the findings, nonconformities and opportunities for improvement into the Condition Report and Resolution System (CRRS) per PRC-PRO-QA-052, <i>Issues Management</i>.</p> <p>Prepare the transmittal letter and ensure distribution of the final assessment report the responsible managers and ^CHPRC IEP.</p> <p>Distribute approved report within 30 days of final report issuance.</p>
ECQA Manager	<p>Reviews and approves all audit/assessment reports. Retains the audit records, in accordance with PRC-MP-QA-599, <i>Quality Assurance Program (QAP)</i> and PRC-PRO-IRM-10588, <i>Records Management Processes</i>.</p> <p>Note: Completion and effectiveness of corrective action is verified as part of a subsequent audit. It is the responsibility of the ECQA Manager to assure this occurs.</p>

F8 Management Assessments

Management Assessments evaluate how well management processes are meeting organizational objectives and customer expectations and are normally performed at the program level to determine whether the overall organizational programs are properly established and effectively implemented. Management Assessments will be performed in accordance with PRC-PRO-QA-246, *Management Assessment*.

F9 Surveillances

Surveillances are similar to assessments but differ in the extent covered. Surveillances are conducted to verify conformance with specified requirements and to evaluate the adequacy and effectiveness of activities affecting the quality of work processes and products. Surveillances are performed by personnel who are technically knowledgeable about, and not directly responsible for, the work under surveillance. Surveillances will be performed in accordance with PRC-PRO-QA-9769, *Surveillance Process*.

F10 EMS Assessment Report

The EMS Assessment Report will be written in a timely manner upon completion of the assessment. The report will include major and minor nonconformities, opportunities for improvement and also document noteworthy practices. The report may also include the assessment scope, the executive summary, a statement of the effectiveness of the program elements which were evaluated, as applicable. The report will include the identification of the assessment team members, areas reviewed, personnel contacted and interviewed during the assessment and the documents reviewed.

The report must be reviewed and approved by the EMS ECQA Manager. Information on the results of audits is provided to management.

F11 Review

The EMS ECQA Manager is responsible for administering this document. This document will be reviewed, and updated as necessary, at a minimum of every three years.

F12 Required Records

All records are generated, processed, and maintained in accordance with PRC-PRO-IRM-10588, *Records Management Processes*.

F13 Applicable Standards and References

CHPRC EMS Program Description: PRC-MP-EP-40182, *Environmental Management System Manual*.

DOE O 436.1, *Departmental Sustainability*.

International Organization for Standardization (ISO) Standard 14001:2004 Revision, *Environmental Management Systems*.

ISO 19011:2002, *Guidelines for Quality and/or Environmental Management Systems Auditing*.

PRC-MP-QA-599, *Quality Assurance Program (QAP)*.

PRC-PRO-IRM-10588, *Records Management Processes*.

PRC-PRO-QA-052, *Issues Management*.

PRC-RD-EP-15332, *Environmental Protection Requirements*

Attachment A – EMS Lead Auditor Qualification/Certification Record

CHPRC EMS LEAD AUDITOR QUALIFICATION/CERTIFICATION RECORD			
Name:		Date:	
Employer:			
Education: Has Lead Auditor Candidate completed a level of education, work experience, auditor training and audit experience sufficient to acquire the following knowledge and skills?			
Document Education:			
YES	NO	EXPERIENCE	COMMENTS
<input type="checkbox"/>	<input type="checkbox"/>	a) Audit principles, procedure and techniques. A lead auditor should be able to: <ul style="list-style-type: none"> • apply audit principles, procedures and techniques, • plan and organize the work effectively, • conduct the audit within the agreed time schedule, • prioritize and focus on matters of significance, • collect information through effective interviewing, listening, observing and reviewing documents, records and data, • understand the appropriateness and consequences of using sampling techniques for auditing, • verify the accuracy of collected information, • confirm the sufficiency and appropriateness of audit evidence support audit findings and conclusions, • assess those factors that can affect the reliability of the audit findings and conclusions, • use work documents to record audit activities, • prepare audit reports, • maintain the confidentiality and security of information, and • communicate effectively, either through personal linguistic skills or through an interpreter. 	
<input type="checkbox"/>	<input type="checkbox"/>	b) Management system and reference documents: to enable the auditor to comprehend the scope of the audit and apply audit criteria. Knowledge and skills in this area should cover: <ul style="list-style-type: none"> • the application of management systems to different organizations, • interaction between the components of the management system, • quality or environmental management system standards, applicable procedures or other management system documents used as audit criteria, • recognizing differences between and priority of the reference documents, • application of the reference documents to different audit situations, and • information systems and technology for authorization, security, distribution and control of documents, data and records. 	
<input type="checkbox"/>	<input type="checkbox"/>	c) Organizational situations: to enable the auditor to comprehend the organization's operational context. Knowledge and skills in this area should cover: <ul style="list-style-type: none"> • organizational size, structure, functions and relationships, • general business processes and related terminology, and cultural and social customs of the auditee. 	
<input type="checkbox"/>	<input type="checkbox"/>	d) Applicable laws, regulations and other requirements relevant to the discipline: to enable the auditor to work within, and be aware of, the requirements that apply to the organization being audited. Knowledge and skills in this area should cover <ul style="list-style-type: none"> • local, regional and national codes, laws and regulations, • contracts and agreements, • international treaties and conventions, and • other requirements to which the organization subscribes. 	

CHPRC EMS LEAD AUDITOR QUALIFICATION/CERTIFICATION RECORD			
Name:		Date:	
EXPERIENCE: Audit experience should have been gained while acting in the role of an audit team leader under the direction and guidance of another auditor who is competent as an audit team leader.			
YES	NO	EXPERIENCE	COMMENTS
<input type="checkbox"/>	<input type="checkbox"/>	Does the candidate have five (5) years of work experience, two (2) of which are in quality or environmental management, that contributes to the development of the knowledge and skills described above?	
<input type="checkbox"/>	<input type="checkbox"/>	Is this work experience in a technical, managerial or professional position involving the exercise of judgment, problem solving, and communication with other managerial or professional personnel, peers, customers and/or other interested parties?	
<input type="checkbox"/>	<input type="checkbox"/>	Is part of the Candidate's work experience in a position where the activities undertaken contribute to the development of knowledge and skills in the environmental management field?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the Lead Auditor Candidate successfully completed 3 audits and at least 15 days of audit experience acting in the role of an audit team leader under the direction and guidance of an auditor competent as an audit team leader?	
AUDIT EXPERIENCE The audits should be completed within the last two consecutive years During the required 3 audits listed above, has the candidate performed the following?:			
YES	NO	EXPERIENCE	COMMENTS
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate informed the audit client of inadequate documentation, if found?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate prepared an audit plan?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate had experience communicating with the audit client and auditees, including the progress of the audit?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate organized, assigned audit responsibilities, and directed audit team members?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate chaired the opening and closing meetings?	
<input type="checkbox"/>	<input type="checkbox"/>	During the closing meeting, has the candidate advised the auditee of situations that may have decreased reliance on the audit conclusions, if any?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate provided direction and guidance to auditors in training?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate led an audit team to reach audit conclusions?	
<input type="checkbox"/>	<input type="checkbox"/>	During the closing meeting,	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate prevented or resolved any audit conflicts?	
<input type="checkbox"/>	<input type="checkbox"/>	Has the candidate prepared and completed an audit report?	
AUDITOR TRAINING			
<input type="checkbox"/>	<input type="checkbox"/>	Has the Lead Auditor Candidate successfully completed the ISO 14001:2004 EMS Lead Auditor Training? (A copy of that certification must be attached to this form).	
ATTRIBUTES			
Does the candidate possess the following personal attributes in order to enable them to act in accordance with the principles of auditing?			
YES	NO	ATTRIBUTES	COMMENTS
<input type="checkbox"/>	<input type="checkbox"/>	Ethical-(fair, truthful, sincere, honest and discreet)	
<input type="checkbox"/>	<input type="checkbox"/>	Open-minded-(willing to consider alternative ideas or points of view)	
<input type="checkbox"/>	<input type="checkbox"/>	Diplomatic-(tactful in dealing with people)	
<input type="checkbox"/>	<input type="checkbox"/>	Observant-(Actively aware of physical surroundings and activities)	

CHPRC EMS LEAD AUDITOR QUALIFICATION/CERTIFICATION RECORD			
Name:		Date:	
YES	NO	ATTRIBUTES	COMMENTS
<input type="checkbox"/>	<input type="checkbox"/>	Perceptive-(Instinctively aware of and able to understand situations)	
<input type="checkbox"/>	<input type="checkbox"/>	Versatile-(Adjusts readily to different situations)	
<input type="checkbox"/>	<input type="checkbox"/>	Tenacious-(Persistent, focused on achieving objectives)	
<input type="checkbox"/>	<input type="checkbox"/>	Decisive-(Reaches timely conclusions based on logical reasoning and analysis)	
<input type="checkbox"/>	<input type="checkbox"/>	Self-Reliant-(Acts and functions independently while interacting effectively with others)	
Communication Skills Evaluation			
Evaluate the written and verbal communication skills of the candidate:		Sat <input type="checkbox"/> UnSat <input type="checkbox"/> Justification:	
Qualification Expiration Date:			
ECQA Manager (print): _____		Signature _____	Date _____
Annual Proficiency Evaluation- ECQA Manager Initial and Date:			
Print Name	Signature	Date	

Appendix G

CHPRC

Quality Assurance Project Plan for Modeling

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Terms

CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)</i>
CHPRC	CH2M Hill Plateau Remediation Company
DOE	U.S. Department of Energy
EMDT	Environmental Modeling Data Transmittal
EMMA	Environmental Model Management Archive
EPA	U.S. Environmental Protection Agency
EP&SP	Environmental Programs and Strategic Planning (organization)
HSWET	Hanford Site Worker Eligibility Tool
IDMS	Integrated Document Management System
ITEM	Integrated Training Electronic Matrix
MKS Integrity™	Software configuration management system used at the Hanford Site (MKS Integrity is a trademark of MKS, Inc.)
QAPjP	Quality Assurance Project Plan
RCRA	<i>Resource Conservation and Recovery Act of 1976 (RCRA)</i>
SMP	Software Management Plan
STP	Software Test Plan

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1. Introduction

CHPRC-00189, *CH2M Hill Plateau Remediation Company Quality Assurance Program Plan*, requires that planning for modeling projects invoke the use of the EPA's guidance document for environmental modeling, EPA QA/G-5M, *EPA Guidance for Quality Assurance Project Plans for Modeling*. This Quality Assurance Project Plan (QAPjP) is developed following the guidance found in EPA QA/G-5M. All nine "Group A" elements presented in EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans* are relevant and important and are addressed in this QAPjP for modeling work.

This QAPjP also addresses model documentation requirements that provide for compliance with U.S. Department of Energy (DOE) management expectations listed in EM-QA-001 Rev 1, *EM Quality Assurance Program*, Attachment H – Model Development, Use, and Validation.

The guidance has been tailored under a graded approach to meet the ongoing need of the CH2M Hill Plateau Remediation Company (CHPRC) Modeling Team to provide timely model development and application to meet project needs in an environment where model development and application activities are not managed as a stand-alone project. The Modeling Team functions as a support organization, providing technical expertise and product delivery to support CHPRC projects and occasionally other Hanford Site Contractors as well. Thus, the guidance has been adapted to support quality model development and application as an ongoing service function that supports multiple model development and application efforts.

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2. Project/Task Organization

Modeling tasks performed by the Modeling Team are an ongoing effort in support of CHPRC projects. As such, multiple models are expected to be under concurrent development and use at any given time and must be managed to meet aggressive schedules. The roles and relations of the modeling team are identified in the organization chart shown in Figure 1.

The organizations involved and their responsibilities are summarized as follows:

- CHPRC Environmental Programs and Strategic Planning – line organization for the Modeling Team. Provide technical resources, coordinate modeling work, perform modeling work, and assure quality of the modeling work. Fund model development. Also the Environmental Quality Assurance group provides support in performing reviews of quality planning documents, software lifecycle documents, and in conducting surveillances.
- CHPRC Projects – define modeling work needed to support projects and review modeling work performed. Fund model application.

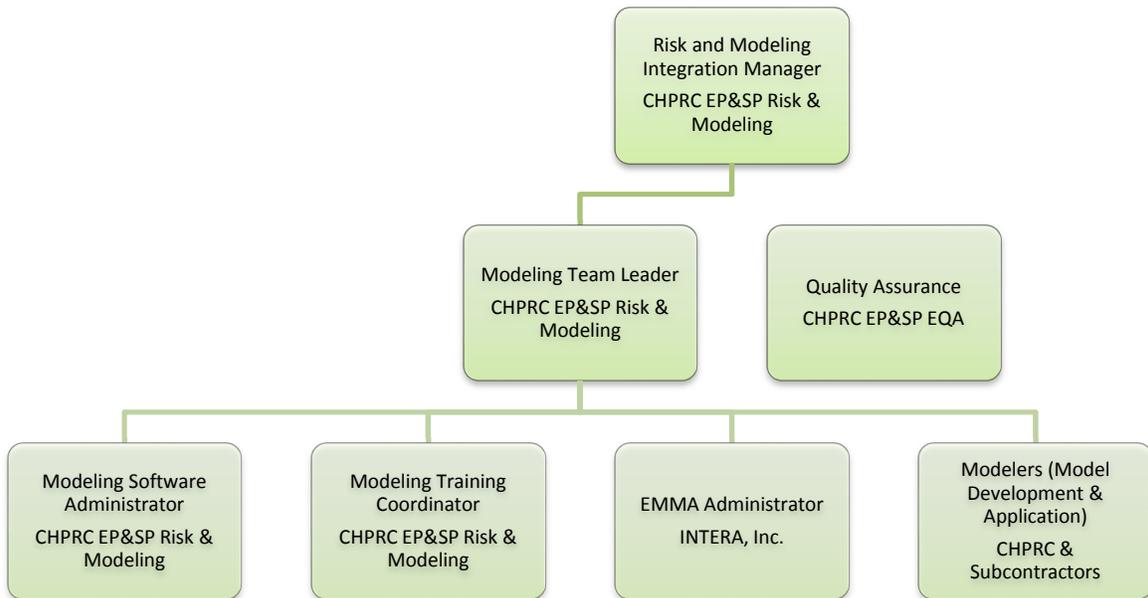


Figure 1 - Modeling Team Organization Chart

Responsibilities listed in Table 1 are assigned to staff in the CHPRC Environmental Program and Strategic Planning (EP&SP) organization’s Risk and Modeling Integration Group and as well as to staff members of CHPRC’s pre-selected modeling subcontractor INTERA.

Table 1 – Modeling Team Roles and Responsibilities

Role	Organization	Responsibilities
Risk and Modeling Integration Manager	CHPRC EP&SP	Responsible for performance of quality technical work, line management responsibility for modeling staff, assignment of responsibilities, final approval of modeling work products, and management assessments (roles & responsibilities are defined in PRC-MP-EP-40220 and PRC-PRO-EP-40253)
Modeling Team Leader	CHPRC EP&SP	Responsible for technical work definition and direction, and compliance by modeling staff with the requirements of this QAPjP
Modeling Training Coordinator	CHPRC EP&SP	Issue training assignments to modelers, track modeler training, ensure evidence of modeler training assignment completion is placed in records
Modeling Software Administrator	CHPRC EP&SP	Software owner for all modeling software (roles & responsibilities are defined in PRC-PRO-IRM-309)
EMMA Administrator	INTERA	Setup, maintenance, and access control to the Environmental Model Management Archive (EMMA)
Environmental Quality Assurance	CHPRC EP&SP	Review of this QAPjP and software lifecycle documents; plan and conduct surveillances and support assessments
Modelers	CHPRC and subcontractors	Perform model development and model application work consistent with the requirements of this QAPjP and relevant CHPRC procedures

3. Problem Definition/Background

Groundwater and vadose zone modeling is needed to support *Resource Conservation and Recovery Act of 1976* (RCRA) and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), document preparation, aid in design of remedies, prepare documents for compliance with DOE Order 435.1, *Radioactive Waste Management*, and to meet other environmental subsurface predictive needs. Such models are to be developed and applied following a graded approach that tailors the sophistication and quality assurance efforts to the quality demands driven by specific model needs.

Specific problems to be solved, or decisions to be made, or outcomes to be achieved through model development and application are not documented here. Rather, specification of modeling objectives is accomplished for each model development and/or application effort through communication between project personnel requiring modeling support and the Modeling Team. A *Modeling Support Work Plan Template* for documenting specific modeling objectives, schedule for work, assumptions, and concurrences is provided in Attachment 1 and shall be completed to define the work and approved before each modeling activity commences.

EPA guidance directs that modeling objectives should address the following:

- What is the specific problem? What are the goals and objectives of this project that will address this problem?
- Why should a modeling approach be used to address the problem? Is there a regulatory requirement for a modeling analysis?
- What specifically will this project produce to address this problem (e.g., a new predictive tool, modeling results for a new scenario)?
- What types of decisions regarding the problem may be made as a result of this project? Who will be responsible for making these decisions?
- Will any aspect of the problem not be addressed in this modeling work?
- What other types of problems may this modeling work address?

It is important to place the problem in historical perspective to give a sense of the purpose and position of this modeling work relative to other project and program phases and initiatives. Such information also indicates the importance of generating new information and suggests tools that may be available to do this. Therefore, sufficient background information may be provided where appropriate in the work plan or in the *Model Package Report* (see Section 7.5) to answer the following types of questions, as applicable:

- Why is this modeling work important, and how may it support proposed or existing research, programs, initiatives, regulations, or other legal directives?
- How may this project “fit in” with other on-going, broader efforts?
- What types of conflicts or uncertainties currently exist that will be resolved by this work?
- What information, previous work, or previous data may currently exist that this work can use?

- Given that the problem is best solved by a modeling approach, what models currently exist (if any) that can be used to achieve this project's goals and objectives? If multiple models exist, how is one determined to be better than the others for this application?

The completed modeling objectives statement in the Model Support Work Plan should be included in the Model Package Report when the full model is documented (see Section 7.5).

4. Project/Task Description and Schedule

Modeling work performed under this QAPjP is not managed as a distinct project, but rather as a support function for other projects. Thus, task and schedules for this work is developed cooperatively with Projects (ideally with input from the Modeling Team). The Model Support Work Plan (template found in Attachment 1) includes a section to plan a detailed work breakdown because model development and application is often not planned to sufficient detail in Field Estimate Schedules to allow for Modeling Team work planning. The detailed work planning shall map to the Field Estimate Schedule to permit reporting on status back to projects.

Examples of tasks that can be addressed in the detailed work planning include the following:

- how the conceptual model of the problem or site will be developed;
- how the structural model and data processing software will be obtained;
- how data may be acquired for model development, calibration, and testing;
- the criteria used to decide whether probabilistic model output or point estimates are needed, and;
- assessments relative to associated project-specific quality requirements.

This element of the Model Support Plan shall also list the products, deliverables, and milestones to be completed in the various stages of the project, along with a schedule of anticipated start and completion dates for the milestones and deliverables, and the persons responsible for them.

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5. Quality Objectives and Criteria for Model Inputs/Outputs

This element of the QAPjP for Modeling introduces the quality criteria that the expected components and outcomes of each specific modeling effort needs to achieve in order to meet the needs of the user of modeling results. These criteria are specified within *performance or acceptance criteria* that are developed in a *systematic planning process*. The systematic planning process invoked by the Modeling Team identifies the expected outcome of the modeling project, its technical goals, cost and schedule, and the criteria for determining whether the inputs and outputs of the various intermediate stages of the project, as well as the project's final product, are acceptable. This is usually an iterative process involving at least modelers and users of model results. The goal is to ensure that the project will produce the right type, quality, and quantity of data to meet the user's needs.

The systematic planning process can be applied to any type of data-generating project. The seven basic steps of the systematic planning process are illustrated in Figure 2. The first three steps can be considered preliminary aspects of scoping and defining the modeling effort, while the last four steps relate closely to the establishment of performance criteria or acceptance criteria that will help ensure the quality of the model outputs and conclusions. While both are measures of data quality, *performance criteria* are used to judge the adequacy of information that is newly-collected or generated on the project, while *acceptance criteria* are used to judge the adequacy of existing information that is drawn from sources that are outside of the current project. Generally, performance criteria are used when data quality is under the project's control, while acceptance criteria focus on whether data generated outside of the project are acceptable for their intended use on the project (e.g., as input to a model).

The systematic planning approach under this QAPjP is based on the intent of PRC-PRO-QA-259, *Graded Approach*. This means that the extent of systematic planning and the approach to be taken should match the general importance of the project and the intended use of the data. For example, when modeling is to be used on a project that generates data to be used either for decision making (i.e., hypothesis testing) or to determine compliance with a standard, EPA recommends that the systematic planning process take the form of the *Data Quality Objectives (DQO) Process* that is explained in detail within *Guidance for the Data Quality Objectives Process* (EPA QA/G-4). It is noted here that the DQO Process is undertaken by the project the Modeling Team supports, and is not commonly managed by the Modeling Team although its members often participate in that process.

The performance or acceptance criteria developed by the model planning team will address the following types of components for modeling projects:

- the particular type of task being addressed and the intended use of the output (e.g., predictions) of the modeling project to achieve this task;
- the type of output needed to address the specific regulatory decision (if relevant), including whether probabilistic or point estimates are needed;
- the statistical criteria (e.g., limits on decision error) to be used in the model-building process to identify those variables considered statistically important to the prediction process and included as input to the model;

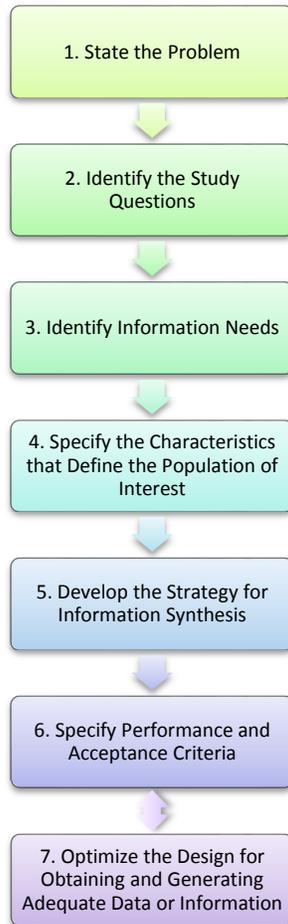


Figure 2 – Systematic Planning Process

- desired limits placed on the probability of making a certain type of decision error due to the uncertainty associated with the model output (if a decision is to be made) and/or criteria to demonstrate the model performs adequately (e.g., as well or better than a previously accepted model for a given situation);
- how the parameter, input, calibration, and test data necessary for this project are acquired and evaluated for use in model development and/or in producing output;
- requirements associated with the hardware/software configuration (e.g., run time or processing capabilities) for those studies involving software evaluation.

While DQOs state the user's data needs relative to a given decision, corresponding criteria need to be placed on the data to determine whether the data have satisfied these needs. For modeling projects, such quality criteria can be placed on outcomes such as software performance (e.g., run time or processing capabilities) and model prediction (e.g., acceptable level of uncertainty associated with model prediction, relative to decision error). For this QAPjP, no quality criteria are placed on run time or processing

capabilities. This is because the nature of the models involved always involve tradeoffs between resolution (e.g., temporal, spatial) and processing capability (e.g., model size, run time). The appropriate balance of resolution and processing capability is found iteratively for each modeling effort and cannot be stipulated in advance. Similarly, model prediction criteria are seldom established in advance due to the variable quality and sparseness of data to support modeling input parameters. Rather, sensitivity studies and uncertainty analyses are used to interpret model predictions in light of the limitations of available data used to develop the model. The level of rigor needed in sensitivity studies and uncertainty analyses will be determined using a graded approach based on modeling objectives.

PRC-PRO-EP-40253, *Risk Assessment and Modeling Integration*, establishes the requirements and processes to assure consistent, timely, and high quality risk assessments and modeling in support of Plateau Remediation Contract (PRC) projects and DOE's decision making process. The main objective of this procedure is to ensure that all risk assessments conducted for the Central Plateau:

- Are based on a common set of assumptions and datasets.
- Use comparable procedures, models, and analysis methods.
- Provide comparable results, and provide compatible conclusions that contribute to the overall mission of the Central Plateau cleanup and closure efforts and Hanford Site cleanup strategy.

PRC-PRO-EP-40253 identifies steps for sufficient planning, staffing, communication and coordination during implementation, review and quality assurance that shall be used for risk assessment and modeling activities conducted in support of CHPRC projects.

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6. Special Training Requirements/Certification

Modeling Team members are selected and hired specifically for their academic training and professional work experience that provides the expertise necessary to develop and apply numerical simulation models for subsurface flow and transport modeling. There are no specific certification requirements. Training requirements for Modelers are identified in the following subsection.

6.1 Indoctrination and Training Program for Modelers

The indoctrination program for modelers is established here and provides personnel performing environmental modeling work with an understanding of their job responsibilities and authority, general criteria including applicable codes and standards, regulatory commitments, CHPRC procedures, and quality assurance program requirements.

Modelers shall be trained and qualified to ensure they are capable of performing assigned work and shall have continuing training to ensure that job proficiency is maintained. This section describes the requirements and responsibilities established by the Risk & Modeling Integration Group to ensure that personnel performing modeling work are properly trained and qualified for their assigned tasks.

The Risk and Modeling Integration Group training and qualification program shall meet the requirements of PRC-MP-QA-599, *CHPRC Quality Assurance Program*, Section 2, "Personnel Training and Qualifications," and CHPRC-00189, *Environmental Quality Assurance Program Plan*, Section 3, and this training plan. A Training Coordinator is assigned by the Modeling Team Leader to assure that Modelers receive the required training and maintain their qualification. The Risk and Modeling Integration Group shall require personnel training and qualification in accordance with the procedures identified in PRC-MP-QA-599, Appendix B.

Required Reading

The following DOE and CHPRC level 1 or level 2 procedures are required reading for all Modelers:

1. PRC-MP-QA-599, *Quality Assurance Program*
2. CHPRC-00189, *CH2M Hill Plateau Remediation Company Quality Assurance Program Plan*
3. PRC-PRO-EP-40253, *Risk Assessment and Modeling Integration*
4. PRC-PRO-EP-40205, *CHPRC Environmental Calculation Preparation and Issue*
5. PRC-PRO-IRM-309, *Controlled Software Management*
6. PRC-PRO-IRM-10588, *Records Management Processes*
7. PRC-PRO-QA-052, *Issues Management*
8. PRC-PRO-QA-259, *Graded Approach*
9. DOE-0343, *Stop Work Responsibility*
10. PRC-PRO-EP-15333, *Environmental Protection Processes*
11. PRC-PRO-WKM-12115, *CHPRC Work Management*

The following software quality assurance documents are also required reading for all Modelers:

12. *Software Management Plans (SMPs) and Software Test Plans (STPs) (or equivalent) for each CHPRC controlled software element used by a Modeler to perform modeling work*

In addition to the above, the Modeling Team Leader is required to read the following procedure:

13. PRC-PRO-QA-40090, *Work Site Assessment*

The Modeling Training Coordinator is responsible for issuing and tracking training assignments to all Modelers performing work under the direction of the EP&SP organization and ensuring that evidence of training assignment completion is placed in records consistent with PRC-PRO-IRM-10588. The Responsible Manager retains responsibility for confirming that completed modeling work products meet all CHPRC requirements.

Training assignments for the above required reading list will be made and completion recorded as follows:

- For CHPRC Modelers, the Modeling Training Coordinator will request that the CHPRC Responsible Manager assign the documents listed above as required reading to the Modeler(s) using the ITEM (Integrated Training Electronic Matrix) Required Reading List or, when it replaces ITEM, the Hanford Site Worker Eligibility Tool (HSWET). One exception is for SMPs and STPs (#11 in list above): for these, the Modeling Training Coordinator will use Form A-6004-943, *Required Reading Acknowledgement Sheet*, to assign and record completion.
- For subcontractor employees working under the direction of the EP&SP organization, the Modeling Training Coordinator will use Form A-6004-943, *Required Reading Acknowledgement Sheet*, to assign and record completion of all of the documents listed as required reading above.

All completed *Required Reading Acknowledgement Sheets* will be placed in electronic records in the Integrated Document Management System (IDMS), consistent with requirements in PRC-PRO-IRM-10588, *Records Management Processes*.

The documents listed as required reading are subject to revision. To ensure training remains current, the Modeling Training Coordinator will register in *CHPRC Docs Online* to receive Email Notice of Updates of each procedure listed in this training plan. Upon receipt of notification of a revision of any of listed procedure, a new training assignment will be issued to all subcontractor Modelers to require reading the revised procedure. ITEM (or later, HSWET) will automatically issue reading assignments for updated procedure documents for CHPRC Modelers.

Computer Based Training

Modelers who hold a Hanford security badge are also required to complete the following Computer Based Training courses:

1. Courses #000001 & #000006 – Hanford General Employee Training (HGET)
2. Course #000030 - Official Use Only Training
3. Course #004108 – Beryllium Associate Worker Training

In addition to the above, the Modeling Software Administrator is required to complete the following Computer Based Training course:

4. Course 600006, PRC Controlled Software Management Training

Assignment of Computer Based Training is made by the responsible CHPRC manager.

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7. Documentation and Records

Preparing appropriate documentation for quality assurance purposes is important for all environmental data operations, but especially so for modeling projects. Information on how a model was selected, developed, evaluated, and applied (as relevant) on a given project needs to be documented so that sufficient information is available for model testing and assessment, peer review, and future model application. For the purposes of modeling work that is the subject of this QAPjP, an overview of what constitutes documentation and what constitutes a record is provided in Table 2. This table also identifies what needs to be preserved (whether it is a record or not) and where this information will be preserved. CHPRC's document approval and clearance process results in a cleared document being placed in IDMS, but this action does not in itself constitute a record; action must be taken to commit the document to electronic records space in IDMS. The Modeling Team Leader will ensure that final documents and related records are committed to electronic records space in IDMS following document clearance and release.

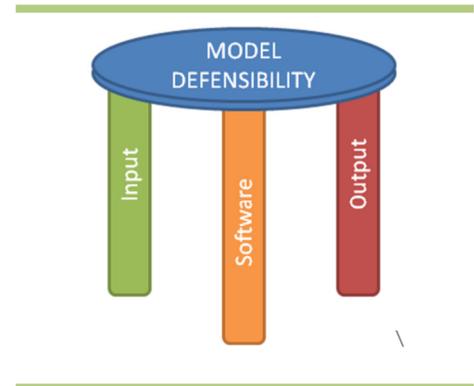
An *Environmental Model Management Archive (EMMA)* will provide the means to document all aspects of model development and application for the Modeling Team. The objective of using EMMA is to provide for the defensibility of environmental models developed and maintained for CHPRC. Model defensibility requires traceability and reproducibility which are achieved by change control and version preservation of three general model components; inputs, software, and outputs. All documents that are identified as CHPRC records will be submitted and managed through the IDMS as required by PRC-PRO-IRM-10588 *Records Management Processes*.

Traceability is achieved to the degree that a reviewer with sufficient training and access to supporting information is able to follow the flow of information in a model from source data through conceptualization, parameterization, code input, code calculations, and code output, and ultimately to the results reported in released documents.

Reproducibility is achieved when it is demonstrated that a model can be restored to any check point in time during the model maintenance period when it was used to produce reported results and can be rerun to obtain the reported results.

The development of a complex simulation model of a system such as a vadose zone or aquifer represents a substantial investment. Such models are only rarely "single-use" tools, but evolve as improvements are made over time to leverage the investment: source data are added from monitoring programs; computer simulation codes are improved; conceptual understanding of the system modeled improves; and refinements are made to address new problems. Strong configuration management of complex environmental models is necessary to provide a defensible tool that can support decision making.

EPA/QA/G-5M, *Guidance for Quality Assurance Project Plans for Modeling*, identifies the following three items as especially relevant to a modeling project:



“Model defensibility requires traceability and reproducibility which are achieved by change control and version preservation of three general model components; inputs, software, and outputs.”

Table 2 - Model Components, Documents, and Records Map

Model Component	Element	Preserve?	Document?	Record?
Training	Training evidence	Yes; IDMS Electronic Records	Required Reading Acknowledgement Sheet	Yes
Basis (inputs)	Electronic Data Transfers	Yes; EMMA	Electronic Data Transfer Package Cover Sheet	No
Model	Preliminary model development files	No	-	No
	Input files	Yes; EMMA	-	No
	Software files (executables, documentation,	Yes; MKS Integrity™	Per PRC-PRO-IRM-309	Per PRC-PRO-IRM-309
	Software installation and checkout record	Yes; IDMS Electronic Records	Software Installation and Checkout form	Yes
	Output files ^a	Yes ^a ; EMMA	-	
	Model documentation	Yes; IDMS Electronic Records with copy in EMMA	Model Package Report	As needed
Application	Application documentation	Yes; IDMS Electronic Records with copy in EMMA	Environmental Calculation File	Yes
	Input files	Yes	No	No
	Output files ^a	Yes*	No	No

^a Output files are preserved at the discretion of the modeler with consideration to the storage requirements and ease of replication from preserved input files and software.

- [Model] Calibration (B7): Documenting the process for calibrating the model that will perform the designated regulatory predictive task.
- Non-direct measurements (data acquisition requirements) (B9): Introducing the types and sources of existing data to be used in building and/or executing the model(s) to be considered, specifying how these data will be acquired, and documenting the quality associated with these data and their relevance in addressing project objectives.
- Data management and hardware/software configuration (B10): Documenting the data management process from data acquisition through transmission and processing, and to final use; documenting the components of the process to generate model outputs; and highlighting the QA procedures associated with the configuration of the hardware and software utilized by the model.

The Model Package Report (template in Attachment 2) will be used to document the model development and calibration process for major models that will be utilized to support multiple model applications. The graded approach will be applied to determine the need for a separate Model Package Report: if a model is relatively simple, has a narrow model objective (such as hypothesis testing or scoping evaluation), and/or will be used only once then the document requirements of the Model Package Report can be included in the ECF. The purpose of a separate Model Package Report is to document major models that support multiple calculations in a single location and thereby avoid duplication of model development and management information across multiple ECFs.

Non-direct measurements and data management will be documented using the *Electronic Model Data Transmittal* (EMDT) cover sheet (template in Attachment 3) to record the source of data used to derive input parameters, the date these data were obtained, and if a database query was used, a copy of the query used.

Software configuration management is based on PRC-PRO-IRM-309, *Controlled Software Management*. **Error! Reference source not found.** illustrates the relationship this procedure to the requirements it implements. The configuration management of software used for environmental models is adopted as a supporting activity for environmental model configuration management. That is, it is recognized that software used for environmental models is already well managed to meet the objectives of traceability and reproducibility in so far as the software itself is concerned. Thus, all that is required to uniquely link software to the model package is to fully identify the version of all managed software used. This will enable recovery of that version of the software, when needed, from the software configuration management system used by CHPRC (MKS Integrity^{TM1}).

A diagram illustrating how this QAPjP relates the most important CHPRC quality assurance procedures for modeling, document products, simulation software, and archive systems shown in Figure 4. Note from this illustration that EMMA serves to capture and retain numerical model parameter basis and information, simulation inputs, and simulation outputs while MKS IntegrityTM is the repository for software.

¹ MKS Integrity is a trademark of MKS, Inc.

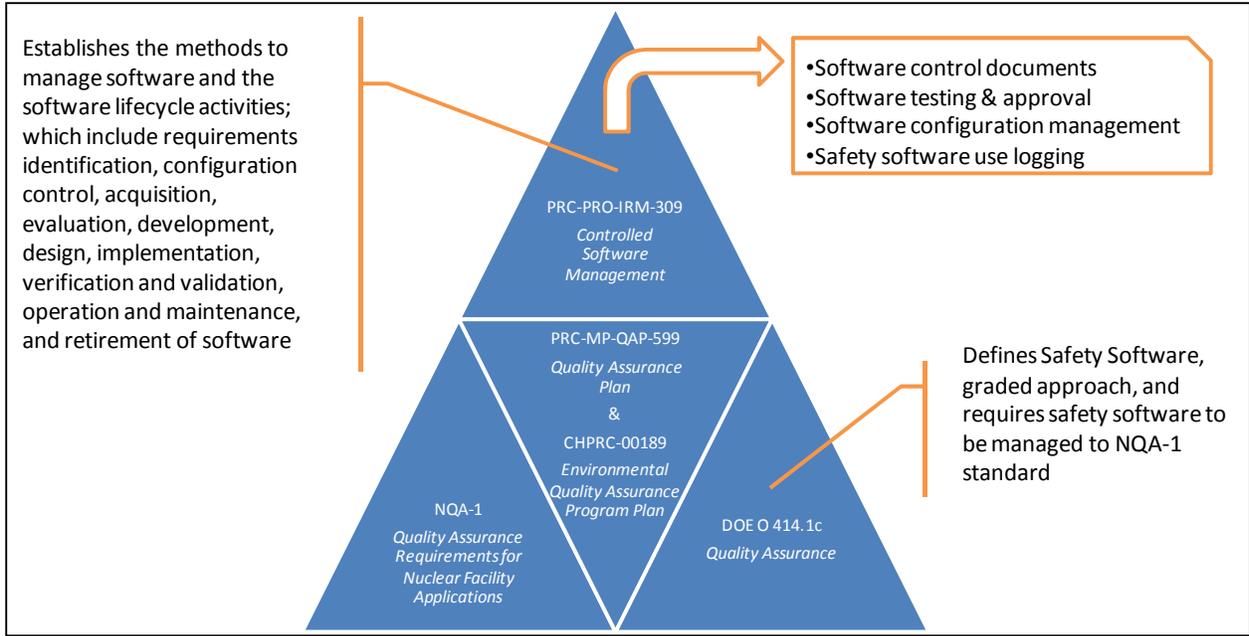


Figure 3 - CHPRC Software Quality Assurance Requirement, Procedure, and Documentation Relationships

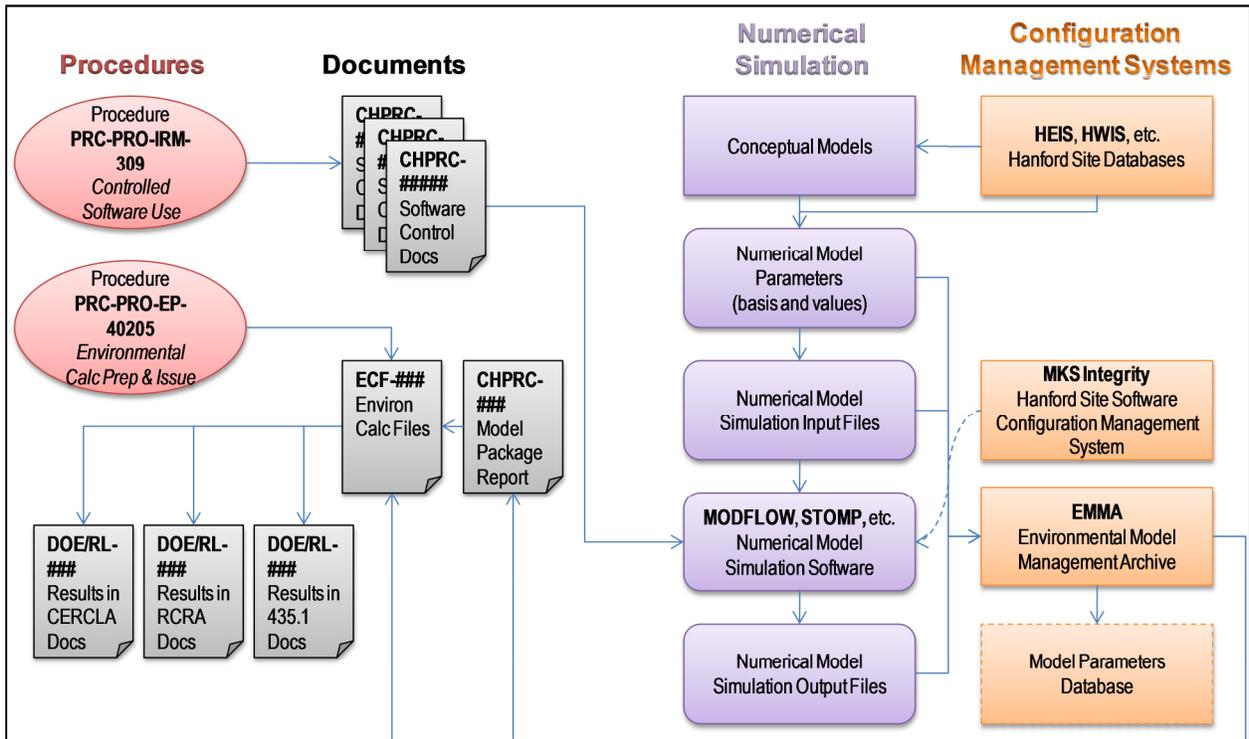


Figure 4 - Relationship of EMMA to CHPRC Quality Control Components for Modeling

7.1 Model Components Subject to Configuration Management

Configuration management of environmental models requires control of three components of a model: input parameters, simulation software, and output results. If these are not preserved in a retrievable, linked fashion, then modelers cannot reliably retrieve, reproduce, or trace model simulation results. It is important to note that the objective of this model configuration management system is not to create a “records” type database (e.g., IDMS) that is unalterable with strong focus on preventing changes to past versions; rather the objective is to create a means to store clearly identifiable and traceable versions of evolving computer simulation models to provide for reproducibility and transparency.

7.2 Inputs

Models use input parameters that are derived from data, but are not typically directly observed data. Parameterization of model inputs from observed data involves many considerations including but not limited to: data uncertainty, data quality, data spatial variability, data scalability, quality of observed data, and model objectives. Thus, the same collection of observed data may lead to different parameter values for different models.

To meet the objectives of traceability and reproducibility, model input parameters must be preserved, together with information that identifies sources used and decisions made to derive those parameters and evidence of input checking performed to ensure the intended inputs were correctly selected and input to the software. Due to the variety of software used, the means to accomplish this will vary. In some instances, it may be possible to include not only the input parameter values, but the source notes and checker validation certification directly in the input file (perhaps as comment fields) thus making the input file(s) fully self-contained in this respect. In other cases, this is not possible and separate documentation, such as text “readme” files that accompany the inputs, might be used to fulfill this purpose. Typically, more information than the mere numerical inputs used for a model must be preserved to document the complete basis for parameter input values. Collectively, all of this information constitutes the “basis” information that is the source of parameter values for a model or models. All such information must be archived to enable clear identification of the sources of information and decisions that result in the inputs used in a particular model. Only by preserving both the basis information and the inputs used in a given model and

A simple example of how differences in model objectives can lead to different parameterizations for the same data set:

Consider two models that are otherwise identical except for the model objectives: one is intended to provide a conservative, bounding estimate of arrival in the aquifer for a drinking water dose calculation for a sorbing contaminant; the other is to provide a conservative, bounding estimate of soil concentration of the same contaminant in the upper soil for a dust inhalation dose calculation. The modeler in each case will examine the available data on contaminant sorption, but one could select a high value of K_d to ensure that the upper soil contaminant level is overestimated (meeting the model objective for a dust inhalation dose) where the other modeler could select a lower value of K_d to bias the model to over predict the concentration in groundwater.

Thus, the very same data are used to arrive at different parameter values due solely to different model objectives.

model application is full traceability possible. The tool to be used for tracking sources of inputs is the EMDT cover sheet (Attachment 3), discussed in Section 8.2.

7.2.1 Software

The governing procedure at CHPRC for software configuration management is PRC-PRO-IRM-309, *Controlled Software Management*. The configuration management of software used for environmental models is adopted as a supporting activity for environmental model configuration management. That is, it is recognized that software used for environmental models is already well managed to meet the objectives of traceability and reproducibility as far as the software itself is concerned. Thus, what is required to link software uniquely to the model package is to identify the version (build) of all managed (HISI-listed) software used. This will enable recovery of that version of the software, when needed, from the software configuration management system used by CHPRC (MKS Integrity™).

7.2.2 Outputs

Preservation of model outputs is also necessary because it documents the results originally obtained and enables direct checking of documented results to model output files. However, judgment must be exercised in deciding how much needs to be archived and what does not because model output can be very voluminous. It is not necessary to save all information recorded during any given model simulation where doing so simply fills electronic media with information of little value. Therefore, modelers are expected to identify the minimum output necessary to preserve that will allow tracing results to particular applications and reported results and checking for reproducing simulations.

7.3 Environmental Model Management Archive (EMMA)

The key implementation feature for model configuration management is the establishment, administration, and use of a model file archive that is designed to meet the objectives of this model configuration management plan. The model file archive for this purpose will be identified as EMMA. The EMMA interface tool provides a means to denote linkages between basis information, models, and applications and visualize the archive, but all file storage is by design merely a disciplined file archive arrangement that does not depend on the EMMA application. As such, the EMMA interface tool is a low risk, standalone, desktop tool, and therefore does not need to meet the requirements of PRC-PRO-IRM-309 (see Section 1.2 Scope, parts 4 and 5.).

7.3.1 EMMA Organization

EMMA is organized in a logical manner to support access both through a simple configuration management system as well as through direct browsing of the directory structure. The top level of the archive will include three fundamental divisions: /models, /applications, and /basis:

- /basis – archival of the basis for input parameters used for model construction and application with associated Electronic Data Transfer Cover sheets
- /models – for files and Model Package Reports that archive all files that constitute a distinct version of a particular model and the output files obtained from runs of record (those used to report results)

- /applications – all input files necessary to repeat any given run that was used to report results using a given model, output files necessary to trace inputs to results (at minimum), and the associated Environmental Calculation File

Maintenance of the information in these three divisions of the archive will meet the goals of model reproducibility and transparency.

The /models division will be organized by model, then by model version. For example, a subdirectory named /CPGWM would contain the Central Plateau Groundwater Model, and be further subdivided into versions; /v1.0, /v2.0, etc. Within each version directory, a Model Package Report should be placed, as well as the input files needed to run this model. The Environmental Calculation File will identify the specific software used (software archival is handled separate from this model file archive).

The /applications division will be organized by Environmental Calculation File number (which is assigned in accordance with PRC-PRO-EP-40205, *CHPRC Environmental Calculation Preparation and Issue*). For example, the Environmental Calculation File for the first application of the S-SX Groundwater Submodel was ECF-200UP1-10-0056, so all inputs and a copy of the Environmental Calculation File itself is stored in the /ECF-200UP1-10-0056/rev.0 directory.

The /basis division will be organized primarily by the nature of the information that constitutes a basis for inputs used in models. Thus, artificial recharge data will be grouped separately from sorption values. The primary level of the /basis division then reflects the nature of the information, including /recharge-artificial, /recharge-natural, /sorption, /stratigraphy, etc. The next division is reserved to reflect the site or similar aspect. Thus, discharges from the Treated Effluent Disposal Facility (TEDF) would be stored in /basis/recharge-artificial/TEDF. It is recognized that flexibility must be retained for organizing information at this level because the nature of the data varies by basis type. The fourth level is reserved for revisions (/rev.0, /rev.1, etc.). An electronic data transfer cover sheet should be stored with each archival to document the source and transfer of basis information.

A partial depiction of how the archive structure appears is depicted in Figure 5 below.

7.3.2 EMMA Location

EMMA will be maintained on a server physically located and managed at the INTERA Richland Office. The model file archive will be configured to permit changes only from approved users in the INTERA office. Initially EMMA will only be accessible from the INTERA office, but limited access by internet or changes in hosting location may be provided under later revisions of this QAPjP.

7.3.3 EMMA Change Control

Three levels of access will be used for controlling the configuration of EMMA; administrator, read/write access, and read-only access. Read-only will be available to anyone in the INTERA office. Users with need to commit model, basis, or application products will be granted read/write access, which will be managed at the appropriate level of the archive. The EMMA administrator will be responsible for establishing the archive, granting and revoking access privileges at the direction of the Modeling Team Leader, and providing configuration management software to manage access to the archive. The EMMA administrator and Modeling Team Leader will collaborate to identify the level of control at which write privileges are granted to individual users (whether at the model level, calculation package level, revision level, etc.). EMMA users granted read/write access will be able to commit new files to the archive, but

will be trained and agree to abide by this model configuration management plan. Read-only access will be freely granted to those who need to browse and obtain copies of models, applications, and basis information without any need to commit new information.

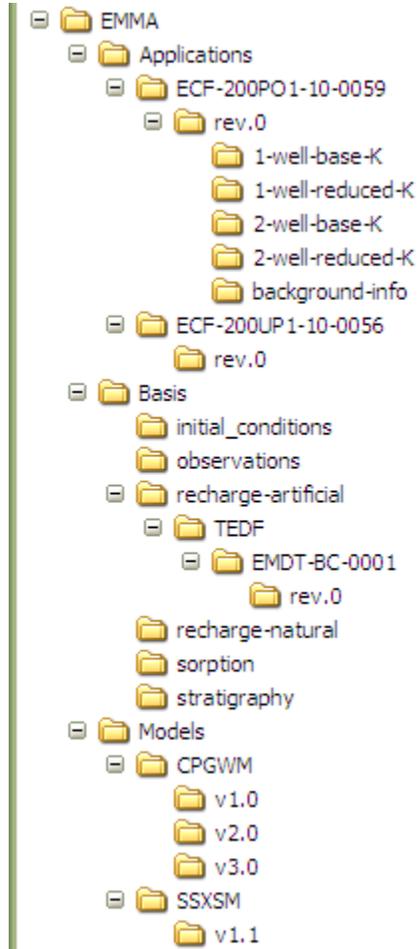


Figure 5 – EMMA Organization

7.4 Environmental Model Version Identification

For purposes of archival in EMMA, model version and simulation run numbers will be assigned to each distinct model and model version to enable complete identification and traceability.

The preferred convention for naming model versions and designating simulations will include six entries in the form:

Model Name, Version (N1), Simulation G(N2)_B(N3)_I(N4)_TC.CC_CN_iter

where:

<i>Model Name</i>	a descriptive character string to uniquely identify the model, e.g. “Central Plateau Groundwater Model”
N1:	Major version number (for readily identifiable distinct model); can have a decimal place (e.g., Version 1.1)
N2:	Model grid; entry is an index number
N3:	Flow boundary conditions; entry is an index number
N4:	Initial conditions; entry is an index number
TC:	Transport code (“p” for particle tracking or “c” for contaminant transport)
CC:	Constituent code (e.g., “H3” for tritium, “I129” for iodine-129, “Tc99” for technetium-99, etc.)
CN:	Computer Name (typically a DOE Property Tag number, e.g., “WD95463”)
iter:	Iteration; a sequential number to distinguish between multiple runs (note that it is not necessary to save and archive all successive iterations)

Examples:

- Central Plateau Groundwater Model, Version 1.0, Simulation G4_B2_I3_c_H3_WD95462_4 (major version 1, simulation with model grid 4, boundary condition set 2, initial condition set 3, contaminant transport of tritium, simulated on computer WD95642, iteration 4).
- S-SX Groundwater Submodel, Version 1.1, Simulation G1_B1_I1_p_flow_INTERA-0053_1 (major version 1.1, simulation with model grid 1, boundary condition set 1, initial condition set 1, particle tracking, flow only, run on computer INTERA-0053, iteration 1).

Sub-models (smaller models that are extracted from a large-scale model, refined, and use boundary conditions drawn from the larger scale model) receive major version numbers that reflect the version of the larger scale number and major versions of the submodel itself. For example, S-SX Groundwater Submodel Version 2.1 is version 1 of a submodel extracted from major version 2 of the Central Plateau Groundwater Model.

7.5 Model Package Reports

The Model Package Report is the instrument for documenting information regarding a complete configuration managed version of an environmental model. A general template is provided in Appendix A that specifies the overall organization and typical content for a Model Package Report. It is expected that a Model Package Report will be completed for each distinct major version of a model and a copy committed to EMMA with the associated model files. If appropriate, the Model Package Report may also be issued as a CHPRC document to provide a citable report.

Care must be taken not to make a Model Package Report and an Environmental Calculation File, which is required under procedure PRC-PRO-EP-40205, duplicative. The Model Package Report is intended to document the development of the model itself and should be written first. The Environmental Calculation File will be used to document the application of a specific model to perform a specific set of calculations. The Environmental Calculation File should cite and refer to the Model Package Report for information on

the development, domain, parameterization, calibration, and other essential information regarding the model itself.

In addition, the purpose of the Model Package Report is to meet the management expectations for model development, use, and validation specified in EM-QA-001 Rev. 1, Attachment H. Table 3 lists these required documentation elements for models and how these will be fulfilled under this QAPjP.

Table 3 – Fulfillment of DOE EM-QA-001 Documentation Requirements for Models

EM-QA-001 Rev. 1 Attachment H Required Documentation Element	Where Documented ^a
Model development and approaches to validation are planned, controlled, and documented. Planning for model validation identifies the validation methods and the validation criteria used. If model validation activities are completed after documentation of the model (i.e., using new confirmation test data gathered in the field or laboratory), these activities are described in the work-planning document.	MSWP
Definition of the objective (intended use) of the model	MPR Section 2, Model Objectives ECF Section 1, Purpose
Description of conceptual model and scientific basis, as well as alternatives for the selected conceptual model. Rationale for not selecting alternatives should also be included.	MPR Section 3, Model Conceptualization
Results of literature searches and other applicable background information.	MPR Section 1.2, Background
Identification of inputs and their sources.	MPR Section 4.3, Parameterization ECF Section 4, Assumptions and Inputs (specific applications)
Identification of, and rationale for, assumptions that are made to develop or apply the model, including model idealizations, as well as those assumptions that support the input to the model and impact model results.	MPR Section 3, Model Conceptualization ECF Section 4, Assumptions and Inputs (specific applications)
Discussion of mathematical and numerical methods that are used in the model, including governing equations, formulas, and algorithms, and their scientific and mathematical bases.	MPR Section 4, Model Implementation
Identification of any associated software used, computer calculations performed, and basis to permit traceability of inputs and outputs.	MPR Section 4.1, Software MPR Section 7, Model Configuration Management ECF Section 5, Software Applications (specific applications)

Table 3 – Fulfillment of DOE EM-QA-001 Documentation Requirements for Models

EM-QA-001 Rev. 1 Attachment H	
Required Documentation Element	Where Documented^a
Discussion of initial and/or boundary conditions	MPR Section 4.3, Parameterization ECF Section 4, Assumptions and Inputs (specific applications)
Discussion of model limitations (i.e., data available for model development, valid ranges of model application, spatial and temporal scaling).	MPR Section 6, Model Limitations
Discussion of model uncertainties (e.g., conceptual model, mathematical model, process model, abstraction model, system model, parameters) and how they affect the model.	MPR Section 5, Model Sensitivity and Uncertainty Analysis
Identification of the originator, reviewer, and approver.	ECF Cover Sheet (specific applications)
The intended use of the model and the importance of the model is used to determine the appropriate level of confidence for a model (i.e., models of system components most relied upon are validated with the highest levels of confidence to the extent practical).	MPR Section 2, Model Objectives ECF Section 1, Purpose (specific applications)

ECF = environmental calculation file

MPR = model package report (template in Attachment B)

MSWP = Modeling Support Work Plan (template in Attachment A)

7.6 EMMA Archival

Environmental Calculation Files are managed under PRC-PRO-EP-40205 and as part of that procedure will be issued and included in IDMS; these will also be placed in IDMS record space.

Model Package Reports will be issued as CHPRC reports as necessary where there is a need to cite information regarding model development.

EMMA itself is a working archive and does not constitute a record because it is a working archive.

A full copy of the EMMA archive will be transferred at least monthly to the CHPRC Environmental Data Management group for inclusion in CHPRC managed disk space.

7.7 Recommended Graphics Tag Convention for Model-Related Graphics

Graphics that portray model construction and the numerical results obtained with models that are included in regulatory documents, environmental calculation files, and other reports should include a unique alphanumeric graphics identification tag to ensure results are traceable to the specific model and version

used. This tag should be embedded directly in the graphic – usually in the bottom right corner – so that it is not separable from the graphic. It should also be used as the file name of the graphic file to enable rapid unique location of a specific graphic file.

To support use of the graphics tag as a file name, this alphanumeric string should not include characters that are not allowable in file naming conventions for common computer operating systems (e.g., “/” or “\” characters that denote directory levels in Linux² and Windows³ respectively). Use of spaces in the tag is also highly discouraged. Periods should be reserved for the file name extension only.

The variety of graphical presentations associated with presenting a model and results obtained with it preclude specifying a mandatory convention for assigning a unique alphanumeric identification tag. Instead, the following convention is provided as guidance to the graphic creator that should be adapted to specific graphic types.

It is recommended to construct the alphanumeric string to include the following elements with underscores to separate these elements:

- Model identification, e.g., CGWM
- Model version, e.g., 3-3
- Other codes as appropriate to distinguish unique attributes from other graphical results
- Creator’s initials, e.g., JQD for John Q. Doe
- Date the graphic was created in format yyyy-mm-dd, e.g., 2010-10-01 for October 1, 2010

Example graphics tags and descriptions are given in Table 4.

² Linux is a registered trademark of Linus Torvalds in the United States and other countries.

³ Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

Table 4 – Examples of Graphics ID Tags and Associated Descriptions

Graphic ID Tag	Description
CPGWM_3-3_Head_2025_JQD_2010-10-01	Hydraulic head contour map in year 2025 predicted with the Central Plateau Groundwater Model Version 3.3; graphic generated by John Q. Doe on October 1, 2010
SSXSM_0-2_Tc99_2075_JPD_2011-01-15	Technetium-99 concentration in year 2075 predicted with the S-SX Submodel Version 0.2; graphic generated by Jane P. Doe on January 15, 2011.
CPGWM_3-2_HSU1_JQD_2010-09-12	Hydrostratigraphic Unit distribution in Model Layer 1 of the Central Plateau Groundwater Model Version 3.2; graphic generated by John Q. Doe on September 12, 2010.
CPGWM_3-4_Head_Well-699-24-33_TDH_2010-11-11	Time history of hydraulic head in Well 699-24-33 predicted with the Central Plateau Groundwater Model Version 3.4; graphic generated by Tom D. Harry on Veteran's Day, 2010.

An example of the graphics tag convention use is shown in an example plot in Figure 6 that shows the time history of the aqueous phase concentration (C_l) of tritium (H₃) in two wells predicted using the Dust Suppression Well Model for Burial Ground 618-10 (DSWM61810) Version 1.0 (1-0) for the two-well configuration (2W) and hydraulic conductivity of 100 m/d (K100); this plot was generated by William E. Nichols (WEN) on March 16, 2010 (20100316).

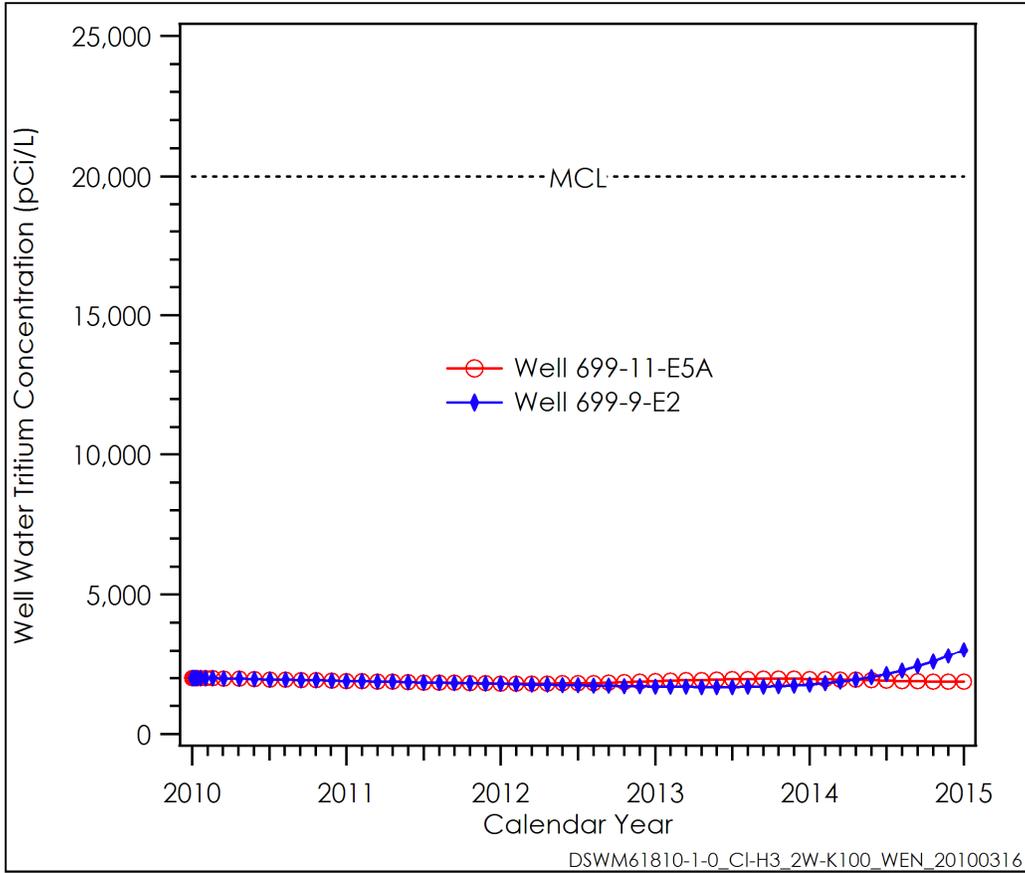


Figure 6 – Example Graphic ID Tag

8. Measurement and Data Acquisition

Input data for model development and application efforts are typically collected outside of the modeling effort or generated by other models or processing software. These data need to be properly assessed to verify that a model characterized by these data would yield predictions with an acceptable level of uncertainty. To this end, the “Group B” elements presented in *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5) address various aspects of data acquisition, the calibration of the model based on these data, management of the data, and the software/hardware configuration needed for data processing. Of the ten “Group B” elements presented in QA/R-5, the following three are especially relevant for a modeling project:

- *[Model] Calibration (B7)*: Documenting the process for calibrating the model that will perform the designated regulatory predictive task.
- *Non-direct measurements (data acquisition requirements) (B9)*: Introducing the types and sources of existing data to be used in building and/or executing the model(s) to be considered, specifying how these data will be acquired, and documenting the quality associated with these data and their relevance in addressing project objectives.
- *Data management and hardware/software configuration (B10)*: Documenting the data management process from data acquisition through transmission and processing, and to final use; documenting the components of the process to generate model outputs; and highlighting the QA procedures associated with the configuration of the hardware and software utilized by the model.

8.1 Model Calibration

All models, by definition, are a simplification of the environmental processes they are intended to represent. When formulating the mathematical representations of these processes one must define empirical relationships and parameters (e.g., the rate of formation or destruction of a chemical). The estimation of parameters involved in formulating these empirical relationships is called (*model calibration*), and it is most often performed once in the model development phase.

However, some model parameters may need to be estimated for every application of the model, using site-specific field data. Similar to an analytical instrument, models are calibrated by comparing the predictions (output) for a given set of assumed conditions to observed data for the same conditions. This comparison allows the modeler to evaluate whether the model and its parameters reasonably represent the environment of interest. Statistical methods typically applied when performing model calibrations include regression analyses and goodness-of-fit methods. The details of the model calibration process, including any statistical analyses that are involved, are documented in the Model Package Report Section 4.4 (see template in Attachment 2).

Most modeling work performed under this QAPjP will support regulatory decision making, so the level of detail on model calibration in the QA Project Plan should be sufficient to allow another modeler to duplicate the calibration method, if the modeler is given access to the model and to the actual data being used in the calibration process.

It is recognized that not every model managed under this QAPjP will be calibrated; some predictive models lack adequate data on which to base a calibration such as is often the case in vadose zone

modeling. In other cases, models may be constructed using parameters obtained from previous model calibrations applicable to the same hydrostratigraphic units and scales.

Where calibration is undertaken, the features of the model calibration effort that should be documented include:

- objectives of model calibration activities, including acceptance criteria;
- frequency of model calibration activities;
- details on the model calibration process;
- method of acquiring the input data;
- types of output generated by the model calibration;
- method of assessing the goodness-of-fit of the model calibration equation to calibration data;
- method of incorporating variability and uncertainty in the model calibration results;
- corrective actions taken if acceptance criteria were not met.

Each of these items to be documented is addressed in detail in the paragraphs that follow.

Objectives of Model Calibration Activities, Including Acceptance Criteria – Information related to objectives and acceptance criteria for calibration activities includes the following:

- *Objectives of the model calibration*, including what the calibration should accomplish and how the predictive quality of the model might be improved as a result of implementing the calibration process.
- *Acceptance criteria*: The specific limits, standards, goodness-of-fit, or other criteria on which a model will be judged as being properly calibrated (e.g., the percentage difference between reference data values from the field or laboratory and predicted results from the model). This includes a mention of the types of data and other information that will be necessary to acquire in order to determine that the model is properly calibrated (e.g., field data, laboratory data, and predictions from other accepted models).
- *Justifying the calibration approach and acceptance criteria*: Each time a model is calibrated, it is potentially altered. Therefore, it is important that the different calibrations, the approaches taken (e.g., qualitative versus quantitative), and their acceptance criteria are properly justified. This justification can refer to the overall quality of the standards being used as a reference or of the quality of the input data (e.g., whether data are sufficient for statistical tests to achieve desired levels of accuracy).

Frequency of Model Calibration Activities – Inputs to the model calibration process can highly influence the quality of information generated by the model. Therefore, the calibration process may need to be iterative in nature, repeated whenever some key aspect of the environment changes. Each iteration utilizes data that accurately portray the changing environment and, therefore, would provide further necessary refinements to the model leading to a new version of the maintained model. The need for additional iterations is determined based on model needs established in work planning, but identification of those data that are likely to be added in the future and would provide the basis from an improved calibration is helpful.

Details on the Model Calibration Process – Provide information such as the following:

- An overview of each model or model component requiring calibration should be given, along with the various components of the calibration process, some of which may coincide with the model's components. This could be specified in text format and/or in a graphic, flow diagram-type figure. This presentation can incorporate how schedule and other time-dependent factors interplay with the various stages of the calibration process.
- Details on specific methods to be used to perform the calibration, for each portion of the model and at each stage.
- Any modification to the calibration made to accommodate data acquired for calibration purposes (see below).
- The resources necessary to conduct the model calibration, along with the individual responsible for directing the model calibration efforts.
- Where calibration records are stored to ensure that the results can be traced to the appropriate version of the model.

Method of Acquiring the Input Data – Section 8.2 provides details on how existing data are acquired and documented for use as input to model calibration and application activities. This element can document some introductory information on these data, such as the following:

- The types of data necessary at each stage of the calibration process and for each model component (or each model), along with any need for the data to represent a specific environmental situation determined by location or some other unique characteristic;
- How the data were acquired (by reference to an EMDT);
- How the quality of the data for model calibration will be determined and verified throughout the calibration process. If previous investigations on these data provide information on the quality of the data, references documenting the level of data quality should be included in the QA Project Plan. Otherwise, any methods used to verify data quality in the context of this project should be documented.

Types of Output Generated by the Model Calibration – The important measures and outputs that are expected to be generated upon implementing the model calibration process and that will be used to assess whether the model is properly calibrated should be documented. In addition, statistical quality control techniques to be used to process the output data for comparison to reference values or other acceptance criteria should be described. The quality assurance aspects of these analyses should also be addressed.

Method of Assessing the Goodness-of-fit of the Model Calibration Equation to Calibration Data – Statistical methods and various regression diagnostic reviews (e.g., residual plots, tests for lack of fit) are generally used when comparing the distribution of model output data that results from calibrating the model to the distribution of data measured within the particular environment that the model output is to simulate. If such methods are used on the project, they should be referenced here along with the criteria to be used in judging the “goodness-of-fit” of the model-generated distribution with the reference distribution.

Method of Incorporating Variability and Uncertainty in the Model Calibration Results – For a given environmental condition, uncertainty in the representativeness of the model input data (e.g., incompleteness, variability, and unintentional bias) will affect uncertainty in the outcome of model calibration. Deviations to the input data (reflecting the data’s inherent uncertainty) or to the calibration methods and acceptance criteria can yield different model calibration outcomes.

Uncertainty in the outcome of model calibration and its potential impact on decisions being made from this outcome are addressed by documenting the following:

- The expected sources of uncertainty and variability in the model and their potential effect on the outcome of model calibration.
- The tools to be used to characterize uncertainty and variability in the outcome of model calibration (e.g., Monte Carlo techniques, sensitivity analysis).
- Acceptance criteria to be used to evaluate the level of uncertainty and variability, relative to whether the resulting uncertainty in the outcome of model calibration falls within acceptable limits.

Corrective Action Taken If Acceptance Criteria Were Not Met – document if corrective actions were taken to deal with situations such as:

- Limits, standards, or other criteria that identify whether the model is properly calibrated were not achieved.
- Sensitivity or uncertainty analysis implied that uncertainty in the model calibration outputs exceeded pre-specified criteria.

Situations in which the model calibration process may need to be repeated after any corrective action is taken should also be specified.

8.2 Non-direct Measurements (Data Acquisition Requirements)

“Non-direct” measurements refer to data and other information that have been previously collected or generated under some effort outside the specific project being addressed by the QA Project Plan. Examples include computer databases, literature files, and software processing.

Frequently, using existing data rather than generating new data is sufficient to meet the needs of some phases of a modeling project. Because the data have already been collected and therefore, the needs of the project cannot influence how the measurements were generated, these data need special consideration. Issues regarding how relevant non-direct measurements are identified, acquired, and used on the project are addressed within this QAPjP element. The following four issues regarding how non-direct measures are acquired and used for modeling work are addressed here:

- the need and intended use of each type of data or information to be acquired;
- how the data will be identified or acquired, and expected sources of these data;
- the method of determining the underlying quality of the data; and
- the criteria established for determining whether the level of quality for a given set of data is acceptable for use on the project.

Each of these items is addressed in detail below. The key tool to be used to manage these issues is the EMDT cover sheet. The template for this tool is found in Attachment 3. When non-direct measurement are gathered for use in modeling, these are to be documented using the EMDT cover sheet to identify the need and intended use of these data, to identify the source of these data, document review of the data quality for modeling purposes by a modeler, and acceptance for use. The nature and form of data used in environmental modeling is so varied that no *a priori* standard is established in this QAPjP for acceptance or rejection of data; rather, the quality of these data will be assessed and documented in the EMDT upon receipt for later use in evaluating the resultant uncertainty in model calculations.

Review of non-direct measurements for quality by a modeler should consider the following criteria:

- *Representativeness*: Were the data collected from a population sufficiently similar to the population of interest and the model-specified population boundaries? Were the sampling and analytical methods used to generate the collected data acceptable to this project? How will potentially confounding effects in the data (e.g., season, time of day, location, and scale incompatibilities) be addressed so that these effects do not unduly impact the model output?
- *Bias*: Would any characteristics of the data set directly impact the model output (e.g., unduly high or low process rates)? For example, has bias in analysis results been documented? Is there sufficient information to estimate and correct bias? If using data to develop probabilistic distributions, are there adequate data in the upper and lower extremes of the tails to allow for unbiased probabilistic estimates?
- *Precision*: How is the spread in the results estimated? Is the estimate of variability sufficiently small to meet the uncertainty objectives of the modeling project as stated in Section 5 (Quality Objectives and Criteria for Model Inputs/Outputs) (e.g., adequate to provide a frequency of distribution)?
- *Qualifiers*: Have the data been evaluated in a manner that permits logical decisions on the data's applicability to the current project? Is the system of qualifying or flagging data adequately documented to allow data from different sources to be used on the same project (e.g., distinguish actual measurements from estimated values, note differences in detection limits)?
- *Summarization*: Is the data summarization process clear and sufficiently consistent with the goals of this project (e.g., distinguish averages or statistically transformed values from unaltered measurement values)? Ideally, processing and transformation equations will be made available so that their underlying assumptions can be evaluated against the objectives of the current project.

8.3 Data Management and Hardware/Software Configuration

Data gathered to support modeling activities may support only one model, or multiple models. Additional data may be added over time. EMMA (Section 7.3) was designed to enable capture of linkages between model basis information (including versions reflecting changes in time), model versions, and applications of models. When new information is added to EMMA, the modeler committing the information will use the EMMA interface to provide the appropriate linkages between model basis, models, and applications. Model documentation (Model Package Reports) and application documentation (Environmental Calculation Files) will include reference to software used and specific versions to establish traceability to controlled software maintained in MKS Integrity™.

8.3.1 Data Management

Data (non-direct measurements; Section 8.2) gathered and maintained to support modeling work is to be stored in EMMA (refer to Section 7.3) under the “Basis” category.

In the pre-processing stage, the input parameters are prepared for use in the modeling stage by performing processes such as data formatting, reduction, transformations, conversions, and subsetting. These data reduction and processing steps may either be documented in full in the EMDT cover sheet (Attachment 3), or in electronic format in files referenced in the EMDT cover sheet.

In the model computational stage, the mathematical equations within the model are derived and applied to the data. While a purpose of the project may not be to develop the specific mathematical processes and equations that constitute the model computational stage, this element can still highlight the primary mathematical approaches that are expected to be applied and how these approaches will ensure that the model’s underlying scientific principles will be properly incorporated. This step is documented in the Model Package Report (Attachment 2).

In the post-processing stage, statistical methods are applied to analyze the model output, to generate data summaries and reports, and to characterize variability and uncertainty in the model output. This step is documented in an Environmental Calculation File (PRC-PRO-EP-40205).

“Control mechanisms” associated with data management for modeling work includes the following:

- Data transmittals are reviewed by a modeler before inclusion in EMMA;
- Model applications are checked by a verifier and reviewed by a senior reviewer before issue of an Environmental Calculation File;
- The use of EMMA provides an audit trail, including hash numbering to uniquely identify each basis, model, or application submittal.

8.3.2 Hardware/Software Configuration

Hardware used by the Modeling Team includes a variety of computing equipment and operating systems (e.g., Linux® and Windows®). No specific platform of operating system standard is enforced so long as each platform meets installation testing criteria for all controlled modeling software installed and used on that platform. Requirements for acceptance and installation testing are specified in the pertinent software test plans. Approved computer systems and users for controlled software are tracked in the software entries in the HISI. Each software test plan requires retesting when the configuration of the hardware (such as an operating system major upgrade) changes.

Software configuration management is managed for each controlled modeling software program through lifecycle management documents as required under PRC-PRO-IRM-309, *Controlled Software Management*. These documents usually include a Functional Requirements Document, Software Management Plan, Software Test Plan, Acceptance Test Report, and Requirements Traceability Matrix (although some of these document elements may be combined into integrated documents in some instances).

Security issues are addressed at the INTERA Richland office through the “INTERA Richland Information Security Plan.” At CHPRC offices, security is addressed through adherence to CHPRC computer security requirements.

Software installation of modeling software is performed per the relevant software management plan that implements PRC-PRO-IRM-309 requirements for each modeling software package.

Documentation requirements are addressed in Section 7.

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9. Assessment

This section identifies the types of assessments to be performed throughout the various stages of both model development and application. Findings and opportunities for improvement are reported to management for corrective action through the implementation of PRC-PRO-QA-052.

9.1 Management Assessment

The Responsible Manager for modeling activities shall periodically assess the modeling management processes. Management assessments will be conducted in accordance with PRC-PRO-QA-246, *Management Assessment*, and will focus on compliance with documented requirements and procedures.

9.2 Independent Surveillance and Assessment

Independent assessments will be conducted periodically by the Environmental Quality Assurance organization in accordance with PRC-PRO-QA-9662, *Independent Assessment Process*.

Surveillances will be conducted periodically by the Environmental Quality Assurance organization in accordance with PRC-PRO-QA-9769, *Surveillance Process*.

9.3 Work Site Assessment

Work site assessments are those conducted by the Modeling Team and will follow PRC-PRO-QA-40090, *Work Site Assessment*. These assessments are usually initiated or overseen by the Modeling Team Leader. Such assessments will address:

- reviews of the model theory, mathematical structure, parameters, and data to ensure the objectives of the new model or application of an existing model are being met;
- reviews of the model evaluation and hardware/software configuration testing conducted to assure the quality requirements for a new application of an existing model;
- reviews to assess the appropriateness of data being used or considered for use in a new application of a model.

Work site assessments include senior reviews performed as part of the process of producing an Environmental Calculation File in accordance with PRC-PRO-EP-40205, ongoing review of model development documented in a Model Package Report (Attachment 2), reviews by modelers of data receipts documented in EMDT cover sheets (Attachment 3), informal reviews conducted as part of regular (usually weekly) Modeling Team meetings, and other assessment opportunities.

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10. Reports to Management

Reports to management are a critical part of the communication process among all participants in model development or application work. Planned reports provide a structure for notifying management of the following:

- adherence to project schedule and budget;
- deviations from approved QA Project Plans, as determined from project assessment and oversight activities (discussed in the previous subsection);
- the impact of these deviations on model prediction, application quality, and uncertainty;
- the need for and results of response actions to correct the deviations;
- potential uncertainties in decisions based on model predictions and data; and
- Data Quality Assessment findings regarding model input data and model outputs (predictions).

Reports to management should provide an understanding of the potential effect that changes made in one segment of the model input data, the algorithms, or the development and application process may have on segments of the model algorithms, process, or predictions.

The following types of reports to management are relevant for a modeling work:

- final version of the QAPjP for Modeling Work (submitted by the Modeling Team Leader to the Risk and Modeling Integration Manger),
- weekly status updates for active modeling support work to project document managers (submitted by the Modeling Team Leader to the Risk and Modeling Integration Manger),
- quarterly risk and modeling software quality assurance status reports to Risk and Modeling Integration Manager (submitted by the Modeling Team Leader to the Risk and Modeling Integration Manager),
- final version of Model Package Reports (submitted by modeler tasked with model development to the Modeling Team Leader),
- final version of Environmental Calculation Files (submitted by modeler tasked with application of a model to prepare a calculation to the Modeling Team Leader),
- disposition of peer review comments (where peer review is used),
- assessment reports (surveillance, management assessments),
- corrective actions taken or planned in response to identified issues entered into the CHPRC Issues Management system (PRC-PRO-QA-052 *Issues Management*).

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11. Data Validation and Usability

This section describes the process to assess the usability of the model results (whether from the first application of a new or revised model or from application of an accepted model). Therefore, these elements refer to quality procedures that occur near or at the end of model development. This section deals with “Group D” elements that describe data review, verification, and validation processes (EPA QA/R-5). For modeling projects, this is analogous to confirming that the steps of the modeling process were followed correctly to produce the model outputs and that the results meet modeling objectives.

Data (or information) validation and usability activities for modeling projects are represented within the following three elements:

- *Departures from Validation Criteria (D1)*: This first element documents the criteria used to evaluate how deviating from the specifications given in the QA Project Plan may impact the quality and usability of final results and decisions that are made based on these results.
- *Validation Methods (D2)*: This second element describes the process and methods for determining whether deviations have occurred within the model components.
- *Reconciliation with User Requirements (D3)*: This element combines the information from the previous two elements to make a final assessment of the usability of the model results.

Each element is addressed in the following subsections.

11.1 Departures from Validation Criteria

Along with Validation Methods (Section 11.2), this element elaborates on the acceptance criteria mentioned in Section 5 (Quality Objectives and Criteria for Model Inputs/Outputs), which evaluate the model and its components based on its ability to produce results that can be used to achieve modeling objectives. For example, the acceptance criteria associated with the degree to which each model output item has met its quality specifications should be documented in the Model Package Report.

Examples of such acceptance criteria and details about how such criteria may be evaluated in the various stages of the modeling process are as follows, presented in the context of specific model applications:

- *Mathematical basis for the model*: evaluated to the degree that the model incorporates the Features, Events, and Processes selected for representation; addressed in the Model Package Report. List possible ways in which the criteria may not be met are specified, and the effects these conditions may have on the model output.
- *Numerical models*: confirmation that the numerical (coded) model accurately estimates the mathematical theory behind the model; achieved through code selection, in compliance with PRC-PRO-IRM-309, *Controlled Software Management* and typically documented in a Functional Requirements Document for the numerical code.
- *Code verification*: achieved through adherence to PRC-PRO-IRM-309, *Controlled Software Management* and typically documented through an Acceptance Test Report.
- *Model evaluations*: a model can be evaluated by comparing model predictions of current conditions with similar field or laboratory data not used in the model calibration process, or with

comparable predictions from accepted models or by other methods (uncertainty and sensitivity analyses); evaluations are documented in a Model Package Report.

- *Validation of input data:* For a first application of the model, where parameter values are specified and site-specific data are input into the model or subsequent applications, the input data may need to be validated for their requirements planned in Section 5 (Quality Objectives and Criteria for Model Inputs/Outputs). In addition how the criteria were established and the possible ways in which the criteria may not be met are specified, and the effects these conditions may have on the model output are discussed in a Model Package Report and/or an Environmental Calculation File.
- *Model output:* The criteria used to assess the usability of the model output include its regulatory task requirements, as specified in Section 5 (Quality Objectives and Criteria for Model Inputs/Outputs). For model applications in production mode, model outputs are similarly assessed against program uncertainty and variability requirements. Comments on the process of choosing these criteria and objectives should refer to Section 5 (Quality Objectives and Criteria for Model Inputs/Outputs).

Many of the assessment approaches used to evaluate these acceptance criteria may have already been provided in Section 9 (Assessment and Response Actions).

11.2 Validation Methods

The purpose of this element is to describe, in detail, the process for making a final assessment of whether model components and their outputs satisfy the user requirements specified throughout this QAPjP. The appropriate methods of evaluation are determined by the quality objectives discussed in Section 5 (Quality Objectives and Criteria for Model Inputs/Outputs). The individuals responsible for the evaluation of the various components of the model together with the lines of authority should be shown on the organizational chart presented in Section 2 (Project/Task Organization).

Final validation of a model is achieved through review and acceptance of a Model Package Report. The following criteria are to be considered to validate a model:

- *Mathematical basis for the models:* Senior review will be used to evaluate the models mathematical basis.
- *Numerical models:* software acceptance tests identified in the Software Test Plans for each modeling software package are explicitly designed to test the numerical model implementation against Hanford-specific test cases.
- *Code verification:* software installation tests identified in the Software Test Plans for each modeling software package are used to confirm correct code operation.
- *Model evaluation:* the process of specifying how and when model output will be compared with independent data to ensure that the modeling results meet project objectives will vary with each model implementation; the process used will be documented in a Model Package Report.
- *Validation of input data:* parameter values and site-specific data that are input into the model are validated through modeler review of EMDTs.

- *Model output*: the usability of the model output is assessed by comparing it against its modeling objectives; this comparison is documented in an Environmental Calculation File.

11.3 Reconciliation with User Requirements

Modeling products are to be provided to projects for review and subject to iterative improvement by the Modeling Team to ensure these products meet the needs of users of model output.

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12. References

Internal Plans and Procedures

CHPRC-00189, *CH2M Hill Plateau Remediation Company Quality Assurance Program Plan*, Rev. 9, CH2M HILL Plateau Remediation Company, Richland, Washington.

DOE-0343, 2009, *Stop Work Responsibility*, U.S. Department of Energy, Washington, D.C.

PRC-MP-QA-599, 2013, *Quality Assurance Program*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-MP-EP-40220, 2012, *Environmental Program and Strategic Planning Roles, Responsibilities, and Functions*, Rev. 4, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-EP-15333, 2012, *Environmental Protection Processes*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-EP-40205, 2010, *CHPRC Environmental Calculation Preparation and Issue*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-EP-40253, 2010, *Risk Assessment and Modeling Integration*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-IRM-10588, 2011, *Records Management Processes*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-IRM-309, 2012, *Controlled Software Management*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-QA-052, 2013, *Issues Management*, Rev. 5, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-QA-246, 2012, *Management Assessments*, Rev. 3, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-QA-40090, 2012, *Work Site Assessment*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-QA-259, 2010, *Graded Approach*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-QA-9669, 2013, *Independent Assessment Process*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-QA-9769, 2013, *Surveillance Process*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

PRC-PRO-WKM-12115, 2012, *CHPRC Work Management*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

External Laws, Guidance, and Direction

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.
DOE, 1999, *Radioactive Waste Management*, DOE O 435.1, U.S. Department of Energy, Washington, D.C.

EM-QA-001, “Implementation of Revision 1 to the Corporate Quality Assurance Program, EM-QA-001, and Department of Energy Order 414.1D, *Quality Assurance*,” Memorandum from Tracy P. Mustin, Principal Deputy Assistant Secretary for Environmental Management, U.S. Department of Energy, Washington, D.C.

EPA QA/G-4, 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, U.S. Environmental Protection Agency, Washington, D.C.

EPA QA/G-5M, 2002, *Guidance for Quality Assurance Project Plans for Modeling*, U.S. Environmental Protection Agency, Washington, D.C.

EPA QA/R-5, 2001, *EPA Requirements for Quality Assurance Project Plans*, U.S. Environmental Protection Agency, Washington, D.C.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

Attachment 1 – Modeling Support Work Plan Template

Modeling Support Work Plan for [Identify Project]

1. Modeling Objectives

Include a clear and concise statement of the objectives this work will support and the calculations required; address the following where appropriate:

- What is the specific problem? What are the goals and objectives of this project that will address this problem?
- Why should a modeling approach be used to address the problem? Is there a regulatory requirement for a modeling analysis?
- What specifically will this project produce to address this problem (e.g., a new predictive tool, modeling results for a new scenario)?
- What types of decisions regarding the problem may be made as a result of this project? Who will be responsible for making these decisions?
- Will any aspect of the problem not be addressed in this modeling work?
- What other types of problems may this modeling work address?

2. Model Development & Application Schedule

Activity ID	Work Element	Start	Finish	Status
1.	Task 1 description			
2.	Task 2 description			
3.				

3. Assumptions

Include a list of limiting assumptions regarding the work elements and schedule above:

1. Assumption 1
2. Assumption 2
3. ...
4. Assumption N

4. Anticipated Staff Responsibilities

Team Member	Responsibility

5. Communication

Detail how often, in what form, and to who the status of work will be reported.

6. Change Management

Project risks include exceeding authorized budgets or not maintaining the schedule. Proactive identification, communication, management, and documentation of change are critical to the success of a project. Project risks include exceeding authorized budgets, not maintaining the schedule, and performing work outside the scope of work. Each team member is responsible for reviewing and understanding the scope of work, and communicating any issues that may involve changes in scope, schedule or level of effort to the Project Manager or Technical Leader in a timely manner. Work outside the project scope of work should not be performed by any team member without prior authorization of the Project Manager. If you have questions about your work activities as they pertain to the scope of work, please contact the Project Manager or Technical Leader.

7. Concurrence

Risk / Modeling
Team Leader

Name, Title
CHPRC

Date

Risk and Modeling
Integration
Manager

Name, Title
CHPRC

Date

Project Lead

Name, Title
CHPRC

Date

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Model Package Report: [Model Name]

Version #.#

This template identifies the required structure and content for documenting an environmental fate and transport simulation model used for CHPRC work in support of remedial activities at the Hanford Site. This structure may be expanded (through addition of appropriate sub-sections) as necessary to describe more complex simulation models, but all content identified must be included using the basic structure provided to ensure consistent presentation of simulation models and support integration of modeling efforts at the Hanford Site. The objective of the model package is to concisely describe the modeling objectives, conceptualization, implementation, uncertainty and sensitivity, configuration control, and limitations of a specific model.

The model package documents the model itself, not a specific calculation. The use of the model to perform specific calculations is to be documented in an Environmental Calculation File as required by PRC-PRO-EP-40205, *Environmental Calculation Preparation and Issue*), including inputs and results. Control of all software used to implement the model is directed by the requirements of PRC-PRO-IRM-309, *Controlled Software Management*.

Title

Include document number (if released as a CHPRC-##### document) and model title, e.g., "Model Package Report: Central Plateau Groundwater Model, Version 1.1".

Executive Summary

Summarize the model purpose and objectives, system conceptualization, and numerical results. Identify how model is uniquely identified for model configuration management purposes.

1. Introduction

State the purpose of the model and decisions to be supported.

1.1 Need

Describe why modeling is necessary, regulatory context, and relevant prior modeling work.

1.2 Background

Summarize the physical setting, site infrastructure, and process and operational history of the model setting. Summarize previous modeling efforts that pertain to the domain included in this effort.

1.3 Document Organization

Describe the organization of this model package.

2. Model Objectives

Comprehensively identify the objectives of the model, including the results that must be provided (quantities, locations, times); how uncertainty (conceptual and parameter) must be addressed; and validation required. Reference any documents that identified objectives and metrics established for this model prior to the start of model development.

The intended use of the model and the importance of the model is used to determine the appropriate level of confidence for a model (i.e., models of system components most relied upon are validated with the highest levels of confidence to the extent practical).

3. Model Conceptualization

Introduce conceptual model development.

Provide a description of the conceptual model and scientific basis, as well as alternatives for the selected conceptual model. Rationale for not selecting alternatives should also be included.

Provide identification of, and rationale for, assumptions that are made to develop or apply the model, including model idealizations, as well as those assumptions that support the input to the model and impact model results.

3.1 Features, Events, and Processes (FEPs)

Introduce features, events, and processes (FEPs) included and excluded.

Identify relevant features, which may include but are not limited to: geologic setting; stratigraphic and structural controls; recharge; boundary controls, spatial variability. Identify uncertainties.

Identify relevant events, which may include but is not limited to: climate change and associated consequences; anthropogenic changes to boundary conditions (e.g., surface cover changes with associated recharge modification; changes in groundwater flow resulting from construction of a reservoir that influences the system), remediation actions (e.g., pump and treat systems). Identify uncertainties.

Identify relevant processes, which may include but is not limited to river/aquifer interaction and exchange flow (e.g., bank storage effects for near-river settings); fast path mechanisms (flow through unsealed boreholes); sorption; reactive transport; waste chemistry impacts on sorption.

Formulate and present conceptualization(s) of the system consistent with available data. [Note: this may include alternative conceptual models if more than one conceptual model can be proposed that is consistent with data and observations.] Identify dimensionality for model components consistent with included FEPs.

3.2 Nature and Extent of Contamination

Describe current understanding of the nature and extent of contamination in the system for contaminants of concern and/or contaminants of potential concern. Identify supporting data. Discuss potential contaminant migration into model domain from out-of-domain sources (e.g., vadose zone continuing sources for a groundwater model).

4. Model Implementation

Introduce model implementation.

Discuss the mathematical and numerical methods that are used in the model, including governing equations, formulas, and algorithms, and their scientific and mathematical bases.

4.1 Software

Describe basis for selection of numerical software used to implement the model. Map software features to included FEPs and note limitations in this regard.

Demonstrate compliance with PRC-PRO-IRM-309, *Controlled Software Management*, by citing CHPRC software control documents (e.g., Functional Requirements Document, Software Management Plan, Software Test Plan, Requirements Traceability Matrix, and Acceptance Test Report), user authorization and training, and Software Checkout and Installation record.

4.2 Discretization

Summarize spatial and temporal discretization, including historic and future model setup(s). Identify sensitivity studies performed to confirm validity of these discretizations and associated results.

4.3 Parameterization

Identify model parameters, values assigned, and how derived. Identify data sources, data quality, and traceability. Describe assignment of boundary and initial conditions. Identify temporal and spatial changes in parameters and boundary conditions.

4.4 Calibration

Summarize calibration process and results, if applicable (or reason if calibration is not applicable). Address the following:

- objectives of model calibration activities, including acceptance criteria;
- frequency of model calibration activities needed to maintain the model in future revisions;
- details on the model calibration process;
- method of acquiring the input data (reference Environmental Model Data Transfers);
- types of output generated by the model calibration;
- method of assessing the goodness-of-fit of the model calibration equation to calibration data;
- method of incorporating variability and uncertainty in the model calibration results;
- corrective actions taken if acceptance criteria were not met.

5. Model Sensitivity and Uncertainty Analyses

Discuss modeling assumptions and calibration results. Highlight their potential impacts on model results.

5.1 SENSITIVITY ANALYSIS

Describe method used and relevant software implementation (PEST, SENSAN, etc.), e.g., Monte Carlo, LHS, etc. Provide as many sub-sections as necessary to document the analysis. Provide recommendations/guidance for calibration improvement.

5.2 UNCERTAINTY ANALYSIS

Describe method(s) used and metrics chosen. Provide as many sub-sections as necessary to document the analysis. Provide recommendations for model improvement.

6. Model Limitations

Identify and discuss limitations of this model in terms of model objectives, implementation, and software limitations.

7. Model Configuration Management

Identify how this model is uniquely identifiable and where the inputs, software, and outputs are configuration managed to assure reproducibility.

8. Model Recommendations

Include any recommendations for further refinement, expansion, or improvement to this model and benefit that might be derived from each change.

9. References

List all cited publications.

Attachment 3 – Environmental Modeling Data Transmittal Cover Page Template

	<h2 style="margin: 0;">Environmental Modeling Data Transmittal Cover Page</h2>				
No.: EMDT- <i>[Request EMDT number from Modeling Team Leader]</i>	Revision No.:				
Title:	Date:				
Data Description					
Data Sources <i>List databases, documents, etc. – provide sufficient detail to enable data to be located by independent reviewer</i>					
Data Query Tools <i>For databases, identify query language used to obtain data from database (SQL, etc.), briefly describe the query description and attach copy</i>					
Data Package Review & Approval:					
Data Provider	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 80%;">NAME/POSITION</td> <td style="width: 20%;"></td> </tr> <tr> <td style="border-bottom: 1px solid black; width: 70%;">SIGNATURE</td> <td style="border-bottom: 1px solid black; width: 30%;">DATE</td> </tr> </table>	NAME/POSITION		SIGNATURE	DATE
NAME/POSITION					
SIGNATURE	DATE				
Data Reviewer	<i>Describe steps taken to verify that the data are appropriate for intended use (note limitations):</i> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 80%;">NAME/POSITION</td> <td style="width: 20%;"></td> </tr> <tr> <td style="border-bottom: 1px solid black; width: 70%;">SIGNATURE</td> <td style="border-bottom: 1px solid black; width: 30%;">DATE</td> </tr> </table>	NAME/POSITION		SIGNATURE	DATE
NAME/POSITION					
SIGNATURE	DATE				