KBC-27149
Revision B

Sampling and Analysis Plan for 105-K East and West Basins Wastewater

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

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

FLUOR®
P.O. Box 1000
Richland, Washington

Approved for Public Release;
Further Dissemination Unlimited

KBC-27149
Revision B
EDC #: HNF-EDC-06-29466

Sampling and Analysis Plan for 105-K East and West Basins Wastewater

Project No: KBC Document Type: RPT

J. B. Bolles
Fluor Hanford, Inc.

Date Published
April 2006

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

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

FLUOR®
P.O. Box 1000
Richland, Washington

APR 1 0 2006
DATE:
STA: 15
HANFORD RELEASE
ID: 20

J. D. Aardal 4/10/06
Release Approval Date Release Stamp

Approved for Public Release;
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Total Pages: 59

RECORD OF REVISION

(1) Document Number: KBC-27149

Page 1

(2) Title

Sampling and Analysis Plan for 105-K East and West Basins Wastewater

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) DA/TA Date
A	Issued on 02/08/2006, per HNF-EDC-27630.	J.B. Bolles 2/8/06
B RS	Complete revision, per HNF-EDC-06-29466.	J.B. Bolles 4/10/06 JB 4/10/06

CONTENTS

APPENDICES

FIGURES

TABLES

This page intentionally left blank.

TERMS

AEA	alpha energy analysis
ALARA	as low as reasonably achievable
COC	constituents of concern
COPC	constituents of potential concern
D&D	deactivation and decommissioning
DQO	data quality objective
DR	decision rule
DS	decision statement
EPA	U.S. Environmental Protection Agency
ETF	Effluent Treatment Facility
FH	Fluor Hanford, Inc.
GEA	gamma energy analysis
KBC	K Basins Closure Project
LERF	Liquid Effluent Retention Facility
MDA	minimum detectable activity
MDL	method detection limit (for water matrix)
ppm	parts per million
PCB	polychlorinated biphenyl
PQL	practical quantitation limit
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
SNF	spent nuclear fuel
WAC	*Washington Administrative Code*
WS	waste stream
WSCF	Waste Sampling and Characterization Facility

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	Millimeters	0.039	inches
inches	2.54	centimeters	Centimeters	0.394	inches
feet	0.305	Meters	Meters	3.281	feet
yards	0.914	Meters	Meters	1.094	yards
miles	1.609	kilometers	Kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	Hectares	Hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	Grams	Grams	0.035	ounces
pounds	0.454	kilograms	Kilograms	2.205	pounds
Ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	Milliliters	0.033	fluid ounces
tablespoons	15	milliliters	Liters	2.1	pints
fluid ounces	30	milliliters	Liters	1.057	quarts
cups	0.24	Liters	Liters	0.264	gallons
pints	0.47	Liters	cubic meters	35.315	cubic feet
quarts	0.95	Liters	cubic meters	1.308	cubic yards
gallons	3.8	Liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
Picocuries	37	millibecquerel	Millibecquerel	0.027	picocuries

1.0 INTRODUCTION

This sampling and analysis plan (SAP) presents the rationale and strategy for sampling and analysis activities to support wastewater (hereafter referred to as water) transfer from the 105-K West and 105-K East Basins via tanker truck to the Liquid Effluent Retention Facility (LERF)/Effluent Treatment Facility (ETF). Water transfer to LERF/ETF and K Basins water removal are completed under *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* authority as an interim remedial action in accordance with 61 FR 10736, "Record of Decision: Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington." The SAP is required in accordance with DOE/RL-99-89, *Remedial Design Report and Remedial Action Work Plan for K Basins Interim Remedial Action.*

The LERF/ETF has been receiving K Basins water since 2002 under HNF-11208, *Sampling and Analysis Plan for Characterization of 105-K West Basin Wastewater*, and HNF-11967, *Sampling and Analysis Plan for Characterization of 105-K East Basin Wastewater.* This SAP is a combined revision of HNF-11208 and HNF-11967 and has been prepared and updated to address new activities at the K Basins. HNF-11208 and HNF-11967 are cancelled and replaced with this SAP.

This SAP is applicable for routine K Basins water sampling and analysis associated with maintenance operations and to facilitate future hose-in-hose[1] and K Basins deactivation and decommissioning (D&D) closure activities. The SAP ensures that adequate information is obtained to meet applicable LERF/ETF waste stream acceptance requirements. Characterization will be based on process knowledge and analytical data. Final constituents of concern (COC) will be sampled and analyzed as outlined in this SAP.

1.1 BACKGROUND INFORMATION

The 100-K Area is one of six reactor areas located in the Hanford Site 100 Area. It consists of the K West Reactor, K East Reactor, and associated support facilities. The K West and East Reactors were constructed in the early 1950s and are located about 420 m (1,400 ft) from the Columbia River. Each reactor building contains a spent nuclear fuel (SNF) storage basin that originally served as a collection, storage, and transfer facility for the fuel elements discharged from the reactor. The basins are covered, unlined concrete water pools, each with a capacity of about 4.9 million L (1.3 million gallons) of demineralized water[2]. Both basins are divided into three main zones: the SNF discharge chute, a storage area (main basin floor), and the transfer areas (north loadout and south loadout).

---

[1]Hose-in-hose is the name used for the method to transfer sludge from the K East Basin to the K West Basin for storage. The transfer is accomplished by pumping containerized K East Basin sludge via hose to a container in the K West Basin.

[2] In 2004 and 2005, grouting of the K East Basin Discharge Chute and the K West Basin Discharge Chute resulted in the displacement and removal of approximately 108,000 gallons of water from each basin.

The K West and K East Reactors operated from the mid-1950s until 1970 and 1971, respectively. The SNF discharged from the reactors was stored in the K Basins until it was transferred to the Hanford Site 200 Areas for reprocessing. K Basins water provided worker radiation shielding and cooling to remove decay heat until the SNF was transferred. Most of the SNF discharged from the K West and K East Reactors was removed from the basins when the reactors were shut down. Beginning in 1981 for K West and 1975 for K East, the basins have been used to store N Reactor SNF and small quantities of single-pass reactor SNF (DOE/RL-99-89). Over the years that N Reactor SNF was stored in the K Basins, the fuel condition degraded, and sludge accumulated in the basins. Sludge consists of SNF corrosion products (including metallic uranium, uranium hydrides and oxides, plutonium, fission and activation products, and aluminum and zirconium compounds from the cladding), metal oxides from corrosion of basin equipment, ion exchange media from the water treatment system, concrete grit from basin walls and floors, sand, and dust. Removal of K East Basin SNF with subsequent drying and shipment to the 200 East Area for storage began in 2000 (Gephart 2003).

A waste designation has been completed for the K Basins sludge. The results demonstrated that the sludge is not a dangerous waste in accordance with *Washington Administrative Code* (WAC) 173-303, "Dangerous Waste Regulations." The rationale for this designation is documented in Letter 01-SFO-051, "Completion of Waste Designation for K Basin Sludge Waste Streams." Because the fuel and sludge are not regulated as dangerous waste, K Basins water also is not considered a dangerous waste.

1.2 CONSTITUENTS OF CONCERN

A list of COCs is developed by initially listing the constituents of potential concern (COPC) based on historical process operations. Radionuclides with short half-lives, constituents that are not environmentally regulated, and constituents that have sufficient process knowledge and analytical data that confirm them to be of insignificant concentration are excluded, leaving the final list of COCs.

1.2.1 Constituents of Potential Concern

Table 1-1 identifies the COPCs for K Basins water. The waste stream is numbered for tracking purposes. This waste stream number does not represent a waste code number.

Table 1-1. Constituents of Potential Concern for K Basins Water.

Waste Stream		Known or Suspected Source of Contamination	Type of Contamination (General)	Constituents of Potential Concern (Specific)
No.	Title			
1	K Basins water	Spent fuel in K Basins with activated metal	Radionuclides, metals	Radionuclides[a,b]
		K Basins sludge	PCBs-Aroclors, metals, anions, radionuclides (spent fuel is original nuclide source)	Radionuclides,[a,b] Al, As, Ag, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Si, Se, Ti, Tl, V, Zn, Br, Cl, F, NO_3, NO_2, PO_4, SO_4, and PCBs-Aroclors (1016/1242, 1221, 1232, 1248, 1254, and 1260)
		K Basins concrete wall and/or floor	Radionuclides, concrete, and carbonates	Radionuclides,[a,b] pH, and composition of concrete
		Maintenance and closure activities	Flocculent and algaecides	Sodium fluorescein, H_2O_2, NaOCl, $Ca(OCl)_2$,[c] and Optimer 7194 Plus flocculent[d]
		Equipment and debris located in the basins	Hydraulic fluid, debris types of material, and equipment	Polyalkanes, As, Ag, Ba, Be, Cd, Cr, Hg, Ni, Pb, Sb, Se, and Tl
		Grout	Fly ash and Portland cement	pH and composition of concrete

Aroclor is an expired trademark.
Optimer is a registered trademark of Nalco Company, Naperville, Illinois.
PCB = polychlorinated biphenyl.

[a]Radionuclides are listed in Table 3.5 of HNF-SD-SNF-TI-009, *Spent Nuclear Fuel Project Technical Data Book*, Vol. 1, "Fuel," Rev. 3.
[b]Activated metal radionuclides are listed in HNF-SD-SNF-TI-009.
[c]WHC-EP-0877, *K Basin Corrosion Program Report*.
[d]Nalco, 2004, *Optimer 7194 Plus Flocculent Material Safety Data Sheet*, Rev. 2.2.

1.2.2 Constituents of Potential Concern Exclusions

Table 1-2 lists the COPCs that were excluded from the investigation. These exclusions typically are based on physical laws, process knowledge, or other mitigating factors, as explained in Section 1.2.

Table 1-2. Constituents of Potential Concern Exclusions. (2 Pages)

WS No.	Excluded Constituents of Potential Concern	Rationale for Exclusion
1	C-14, Fe-55, Ni-59, Ni-63, Se-79, Kr-85, Y-90, Y-91, Zr-93, Nb-93m, Nb-95, Nb-95m, Zr-95, Tc-99, Ru-106, Pd-107, Ag-110, Ag-110m, Cd-113m, In-113m, Sn-113, Sn-119m, Sn-121m, Sn-123, Te-123m, Sb-124, Te-125m, Sb-126, Sb-126m, Sn-126, Te-127, Te-127m, I-129, Cs-135, Ba-137m, Ce-144, Pr-144, Pr-144m, Pm-147, Sm-151, Gd-153, Tb-160, U-236, Np-237, Pu-241, Pu-242, Am-242, Am-242m, Am-243, Cm-242, and Cm-244	Concentrations are sufficiently low, based on process knowledge and analytical laboratory analysis.[a] Radionuclides[b] are not a concern for waste acceptance at LERF/ETF.
	Al, As, Ag, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Si, Se, Ti, Tl, V, Zn, Br, Cl, F, NO_3, NO_2, PO_4, and SO_4	K East and K West Basin waters were sampled as part of the LERF/ETF waste acceptance process. Characterization results showed that the metals and anion concentrations met LERF/ETF waste acceptance criteria and were excluded from further sampling.[a]
	PCBs-Aroclors (1016/1242, 1221, 1232, 1248, 1254, and 1260)	K East and K West Basin waters were sampled as part of the LERF/ETF waste acceptance process and confirmed to be sufficiently low for waste acceptance at LERF/ETF.[a]
	Sodium fluorescein and Optimer 7194 Plus flocculent	The chemicals are not regulated as a dangerous waste.[c,d,e] Concentrations are sufficiently low, based on process knowledge, for waste acceptance at LERF/ETF.
	H_2O_2, NaOCl, and $Ca(OCl)_2$	Small quantities (10 ppm basin concentration) used for local applications. Hypochlorites would have to be >1% to be Washington State toxic, which is not credible. Hydrogen peroxide would have to be >0.01% to be Washington State toxic, which is not credible. Also, hypochlorites and peroxide chemicals react with the environment to decompose.[e]
	Composition of structural concrete	Analysis of concrete at the Hanford Site shows it is not regulated under WAC 173-303.[f] Characterization results showed that the anion concentrations met LERF/ETF waste acceptance criteria and were excluded from further sampling.[a]
	pH	The chemistry of aged concrete removes the characteristic of high pH by hydrolysis of lime.[f] Characterization results showed that the pH concentrations met LERF/ETF waste acceptance criteria and were excluded from further sampling.[a]
	Hydraulic fluid and polyalkanes	A 15-gal one-time spill in K East Basin. The material would float and be removed by the water treatment system. Concentrations are sufficiently low, based on process knowledge, for waste acceptance at LERF/ETF.[a]

Aroclor is an expired trademark.
Optimer is a registered trademark of Nalco Company, Naperville, Illinois.

Table 1-2. Constituents of Potential Concern Exclusions. (2 Pages)

WS No.	Excluded Constituents of Potential Concern	Rationale for Exclusion

LERF/ETF = Liquid Effluent Retention Facility/Effluent Treatment Facility.
ppm = parts per million.
PCB = polychlorinated biphenyl.
WAC = *Washington Administrative Code.*
WS = waste stream.

[a]200 Area Liquid Effluent Facility Regulatory File, Fluor Hanford, Inc., Richland, Washington.
[b]Radionuclides are listed in Table 3.5 of HNF-SD-SNF-TI-009, *Spent Nuclear Fuel Project Technical Data Book*, Vol. 1, "Fuel," Rev. 3.
[c]*TOMES Plus Database, Registry of Toxic Effects of Chemical Substances*, available on the Internet at the Hanford Technical Library Website (http://library.pnl.gov/databases.asp).
[d]Nalco, 2004, *Optimer 7194 Plus Flocculent Material Safety Data Sheet*, Rev. 2.2.
[e]CCN 0101943, "Contract No. DE-AC06-96RL13200 – Completion of Waste Designation for K Basin Sludge Waste Streams."
[f]Lea, 1970, *The Chemistry of Cement and Concrete*, 3rd Edition.

WAC 173-303, "Dangerous Waste Regulations."

1.2.3 List of Constituents of Concern

Table 1-3 lists the final COCs for K Basins water after the COPCs exclusion evaluation.

Table 1-3. Final List of Constituents of Concern.

Waste Stream No.	Constituents of Concern
1	H-3, Co-60, Sr-90, Sb-125, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239, Pu-240, and Am-241

1.3 DATA QUALITY OBJECTIVES AND CRITERIA

The data quality objectives (DQO) for the waste were developed in general accordance with EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process*, QA/G-4. Extensive information on the source and nature of K Basins water already exists.

These information sources include process knowledge, radiological data from routine process sampling, radiological data from periodic sampling performed on K Basins water, and sludge.

1.3.1 Statement of the Problem

Determine the data collection and collection quality requirements necessary to properly manage, designate, and prepare K Basins water for waste stream acceptance at LERF/ETF.

A team was assembled to evaluate the DQOs and prepare this SAP. Tables 1-4 and 1-5 identify the team members and key decision makers.

Table 1-4. Sampling and Analysis Plan Team Members.

Name	Company/Organization	Position or Area of Expertise
Justin Bolles	FH/Waste Management	Waste Management Support
Mark Bowman	FH LERF/ETF	LERF/ETF Waste Acceptance
Steven Burke	FH/K Basins Closure Project	100K Facility Management
Harry Fox	FH/K Basins Closure Project	D&D Project
Mary Ann Green	FH/K Basins Closure Project	D&D Project
Rod Jochen	FH/K Basins Closure Project	100K Facility Management/Sample Management
Kristi Lueck	FH LERF/ETF	LERF/ETF Waste Acceptance
John Trechter	FH WSCF	Analytical Laboratory Services
Glen Triner	FH/Waste Management	Waste Management
Dave Watson	FH/K Basins Closure Project	Regulatory Support
Jeff Westcott	FH/Waste Management	Waste Management
R. Terry Winward	FH/K Basins Closure Project	Regulatory Support

D&D = deactivation and decommissioning.
FH = Fluor Hanford, Inc.
LERF/ETF = Liquid Effluent Retention Facility/Effluent Treatment Facility.
WSCF = Waste Sampling and Characterization Facility.

Table 1-5. Key Decision Makers.

Name	Organization
Sen Moy	U.S. Department of Energy, Richland Operations Office
Larry Gadbois	U.S. Environmental Protection Agency

1.3.2 Identify the Decision

The decision statement (DS) shown in Table 1-6 was identified from the DQO review and requires data collection to support resolution. The data identified during the DQO process, and as directed by this SAP, will be used to prepare the waste for LERF/ETF acceptance.

Table 1-6. Decision Statement for K Basins Water.

DS #1 – Determine if the water complies with the LERF/ETF waste acceptance criteria and can be treated and disposed at LERF/ETF, OR if the water does not comply with the LERF/ETF waste acceptance criteria, determine if water can be treated and disposed at another Hanford Site facility.

DS = decision statement.
LERF/ETF = Liquid Effluent Retention Facility/Effluent Treatment Facility.

1.3.3 Identify Inputs to the Decisions

The data inputs needed to resolve the DS were identified during the DQO process. Table 1-7 provides a listing of source documents that were used to arrive at the data assessment conclusions. Table 1-8 provides the data assessment results.

Table 1-7. Source Document List. (2 Pages)

Reference (see Chapter 8.0 for Complete Citation)	Summary
01-SFO-051, 2001, "Completion of Waste Designation for K Basin Sludge Waste Streams."	Presents the Hanford Site waste designation for the K West and K East Basins sludge waste streams. The document includes process knowledge and test data from sludge and SNF sampling and analysis. The information shows that the K Basins sludge waste streams are nonregulated in accordance with WAC 173-303.
HNF-SD-SNF-TI-009, 1999, *Spent Nuclear Fuel Project Technical Data Book*, Vol. 1, "Fuel," Rev. 3.	Provides background information about SNF stored in the K West and K East Basins. Table 3.5 provides the radionuclide inventory of the combined K Basins.
HNF-SP-1201, 1997, *Analysis of Sludge from Hanford K East Basin Canisters*, Rev. 0.	Presents the analysis of sludge from K East Basin canisters.
HNF-6495, 2005 *Sampling and Analysis Plan for K Basin's Debris*, Rev. 2.	Presents the rationale and strategy for sampling and analysis activities to support removal of debris from the K West and K East Basins.
HNF-11208, 2002, *Sampling and Analysis Plan for Characterization of 105-K West Basin Wastewater*, Rev. 0.	Presents the rationale and strategy for sampling and analysis activities to support transfer of water from the K West Basin to LERF/ETF. The document details additional steps needed to ensure that adequate information is obtained to meet applicable LERF/ETF waste stream acceptance requirements. It provides sampling protocol and water collection strategies for the development of baseline data and process knowledge confirmation.
HNF-11967, 2002, *Sampling and Analysis Plan for Characterization of 105-K East Basin Wastewater*, Rev. 0.	Presents the rationale and strategy for sampling and analysis activities to support transfer of water from the K East Basin to LERF/ETF. The document details additional steps needed to ensure that adequate information is obtained to meet applicable LERF/ETF waste stream acceptance requirements. It provides sampling protocol and water collection strategies for the development of baseline data and process knowledge confirmation.
Lea, 1970, *The Chemistry of Cement and Concrete*, 3rd Edition.	Provides information to show that the chemistry of aged concrete removes the characteristic of high pH by hydrolysis of lime.
Nalco, 2004, *Optimer 7194 Plus Flocculent Material Safety Data Sheet*, Rev. 2.2.	Provides information to show that Optimer 7194 Flocculent is nonregulated in accordance with WAC 173-303.
200 Area Liquid Effluent Facility Regulatory File.	Presents a detailed historical record of K Basins water analyses, LERF/ETF waste acceptance activities, and other correspondence with K Basins Closure Project.

Table 1-7. Source Document List. (2 Pages)

Reference (see Chapter 8.0 for Complete Citation)	Summary
TOMES Plus Database, Registry of Toxic Effects of Chemical Substances, Hanford Technical Library website (http://library.pnl.gov/databases.asp).	Provides information to show that sodium fluorescein is nonregulated in accordance with WAC 173-303.

Optimer is a registered trademark of Nalco Company, Naperville, Illinois.

LERF/ETF = Liquid Effluent Retention Facility/Effluent Treatment Facility.
SNF = spent nuclear fuel.

WAC 173-303, "Dangerous Waste Regulations."

Table 1-8. Data Assessment Results.

Required Data	Survey/Sampling/Data Collection Methods	Additional Information Required? (Y/N)
Data to determine how the waste meets the LERF/ETF waste acceptance criteria.	Process knowledge, radiological surveys, and/or water sampling and analysis.	Y Radionuclide constituents of concern and monitoring parameters of gross alpha, gross beta, and conductivity

LERF/ETF = Liquid Effluent Retention Facility/Effluent Treatment Facility.

1.3.4 Define the Study Boundaries

The study boundaries identify the spatial and temporal boundaries of the sampling and analysis action, as well as practicable constraints that must be taken into consideration. The spatial boundary for this SAP is the water in the K West and K East Basins.[3] Activity temporal boundaries extend from SAP approval to the time that basin water is removed from both basins. Practical constraints that may impact sampling and analysis activities include physical barriers within the K Basins, operations and maintenance scheduling, sampling equipment malfunction, and LERF/ETF-requested water-screening parameter adjustments caused by D&D closure activities (e.g., introduction of fixatives). Other potential triggers include chemical spills and temperature changes. Additionally, laboratory-specific issues could arise, preventing timely turn-around of analyses.

[3] K Basins water also may be temporarily stored in a modular tank or other holding container to facilitate D&D activities.

1.3.5 Decision Rules

The decision rules (DR) provide the criteria for taking actions. The DRs state what action is to be taken when prescribed conditions are met. Table 1-9 presents the DRs that correspond to the DS identified in Table 1-6.

Table 1-9. Decision Rules.

DS No.	DR No.	Decision Rules
1	1	1. If the water complies with the LERF/ETF waste acceptance criteria, treat and release water to the environment at LERF/ETF. 2. If the water does not comply with the LERF/ETF waste acceptance criteria, treat and dispose water at another EPA approved Hanford Site facility.

DR = decision rule.
DS = decision statement.
LERF/ETF = Liquid Effluent Retention Facility/Effluent Treatment Facility.

1.3.6 Limits on Decision Error

This section generally is used to establish the error tolerance parameters for a statistically based sample design. Because a judgmental sampling approach is being used (not a probability-based sample design), a statement of decision error is not applicable. Each LERF/ETF water transfer is evaluated based on the most recent analyses.

1.3.7 Optimize the Design for Obtaining Data

A statistically based sample design has not been established for this SAP. Collected samples are routine water samples used to monitor K Basins water conditions. Because sample collection and analysis are also driven by other considerations, sample design optimization is not applicable.

This page intentionally left blank.

2.0 SAMPLING PROCESS DESIGN

The sampling strategy will influence several project decisions, including, but not limited to, sample locations, type of samples, sampling frequency, and sampling and analytical protocols. Sampling strategies also may be influenced by such factors as physical constraints, safety, and cost.

Up to the time of this SAP preparation, basin water transferred to LERF/ETF via tanker truck has been subjected to ion exchange and filtration. However, if the compliance samples can be shown to meet the LERF/ETF waste acceptance criteria, it is not necessary to perform ion exchange treatment on transferred water. Ion exchange operations will continue as part of the normal K Basins closed loop water circulation system. This ion exchange treatment and recirculation is necessary to keep worker dose as low as reasonably achievable (ALARA), maintain on-going water quality and basin temperatures, and for environmental protection. The LERF/ETF waste acceptance criteria require that water be filtered through a 5 μm filter to avoid solids accumulation in the tanker truck and LERF Basins. To ensure K Basins water meets this acceptance criterion, it will be passed through a 5 μm filter before tanker truck loading. Sampling and analysis for total suspended solids and PCB will not be required as particulate will be removed through filtering.

A judgmental sample design was and has been used to establish sample collection to evaluate K Basins water, because there is extensive and reliable historical, radiological, and chemical knowledge about water conditions. Because the water is relatively homogeneous and concentrations have been stable, only a small number of samples are needed for ongoing characterization of basin water. Additionally, K West and K East Basin physical constraints and maintaining worker dose ALARA discourage the ready use of a probability-based sampling approach.

Previous Water Sample and Analysis Activities

A series of water sampling and analysis campaigns were performed on K Basins water between June and December 2002 under previous basin water SAPs, HNF-11208 and HNF-11967, to establish a baseline and confirm process knowledge. Three campaigns were conducted at the K West Basin and two campaigns were conducted at the K East Basin. A discussion of the sampling campaign objectives is presented in HNF-11208 and HNF-11967. The analytical laboratory test results of the 2002 sampling campaigns were used to establish reduced sampling activities to monitor basin water conditions. Conductivity, gross alpha, and gross beta were added as monitoring parameters to the COCs listed on Table 1-3 to arrive at the analyses presented on Table 2-1.

The basin water has been monitored since 2002 by collecting and analyzing monthly water samples. The sample analyses performed to monitor basin water conditions are embodied in Table 2-1. Up to the time of this SAP preparation, the analysis results have consistently shown the water to be acceptable for receipt and treatment at LERF/ETF.

Future Water Sample and Analysis Activities

The basin water will continue to be monitored for adverse changes in water conditions using the analyses previously established and shown on Table 2-1. Samples are collected at locations that represent basin water. If adverse changes are detected, or operation or process changes occur that deviate from the 2002 baseline conditions, then the frequency and list of analyses will be evaluated as discussed in contingency sampling.

During the course of D&D closure activities, areas of basin water may be isolated when the potential for adverse changes in water conditions exist. When these situations arise, water samples of the isolated local area will be collected for analysis prior to transfer of water from that area to LERF/ETF for treatment. The sample frequency, or number and analyses the sample will be subjected to, will be determined as discussed in contingency sampling.

Contingency Sampling and Analysis

The LERF/ETF *Resource Conservation and Recovery Act of 1976* permit requires reevaluation of K Basins water if (1) LERF/ETF has been notified, or has reason to believe, the process generating the waste has changed or (2) LERF/ETF notes an increase in waste constituent concentrations beyond levels specified in the existing waste profile. As part of this reevaluation, LERF/ETF may require the generator to update its characterization through process knowledge or additional sampling. Additional sample analysis will be selected from the methods listed on Table A-1.

Contingency sampling and analysis also may be necessary if monitoring sample results reveal an adverse trend, or if activities associated with D&D closure activities, such as chemical treating or grouting, are believed to cause an adverse change in basin or isolated local area water quality. The change or potential change in water conditions will be evaluated to identify potential LERF/ETF issues with receipt and treatment. These issues will be used to identify the number or frequency of sample collection and the analyses the samples are subjected to from Table A-1 to be added to the list of Table 2-1. Appendix A, Table A-1 provides sampling and analysis methods that could be used to characterize water conditions as the need arises.

Table 2-1. Sampling and Analysis Requirements.

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method
Radionuclides						
H-3	Glass (1x250 mL)	--	180 days	400 pCi/L	--	Liquid Scintillation
Co-60	Plastic (1x500 mL square)	HNO_3; pH <2	180 days	50 pCi/L	--	GEA
Sr-90	Plastic (1x1 L)			2 pCi/L	--	Beta Counting
Sb-125	Plastic (1x500 mL square)			25 pCi/L	--	GEA
Cs-134				50 pCi/L	--	GEA
Cs-137				50 pCi/L	--	GEA
Eu-152				30 pCi/L	--	GEA
Eu-154				50 pCi/L	--	GEA
Eu-155				50 pCi/L	--	GEA
U-234	Plastic (1x1 L)			2 pCi/L	--	AEA
U-235				2 pCi/L	--	AEA
Pu-238				2 pCi/L	--	AEA
U-238	Plastic (2x1 L)			2 pCi/L	--	AEA
Pu-239/240				2 pCi/L	--	AEA
Am-241	Plastic (1x1 L)			0.18 pCi/L	--	AEA
General Chemistry						
Specific Conduc-tivity	Glass (1x100 mL)	--	--	--	10	EPA 120.1[b]
Gross Alpha	Glass (1x500 mL)	HNO_3; pH < 2	180 days	3 pCi/L	--	Proportional Counter
Gross Beta	Glass (1x500 mL)	HNO_3; pH < 2	180 days	4 pCi/L	--	Proportional Counter

[a]The amount of sample needed to perform the specified analyses is a full container. The container and sample quantity may be changed at the discretion of the fixed laboratory.

- Another method may be substituted, with sampling coordinator concurrence, if the PQL still can be met.
- Method modifications are documented and approved by the Washington State Department of Ecology or EPA.
- Analytical limits are based on the K Basins water quality. Limits can be changed, with prior approval by the sampling coordinator. Reported detection limits will be indicated on the final report.
- MDL values are based on a clean sample (water matrix). Conditions other than a clean sample (water matrix) may increase the MDL.

[b]EPA Method 120.1 in EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes* (conductance, specific conductance).

AEA = alpha energy analysis.
GEA = gamma energy analysis.
MDL = method detection limit.
EPA = U.S. Environmental Protection Agency.
MDA = minimum detectable activity.
PQL = practical quantification limit.

This page intentionally left blank.

3.0 SAMPLE LOCATION AND FREQUENCY

Sampling is the selection of a portion of a larger target population, universe, or body, with the characteristics of that sample being inferred to represent the target population. In this case, the target population is the K Basins water. The aim of the sampling is to obtain data that are representative of the K Basins water so appropriate LERF/ETF waste acceptance decisions can be made.

3.1 SAMPLE COLLECTION AND LOCATION

Discrete and composite sampling techniques will be used to collect K Basins water. A discrete (grab) sample is representative of a specific water location at a given point in time. The entire sample is collected at once and at a particular K Basins water location. Composite samples are composed of two or more grab samples collected at various sampling locations and/or different points of time. Composite sample analysis produces an average testing result value and can be used, in certain circumstances, as an alternative to averaging the testing results of multiple grab samples. Composite or grab samples may be collected using the methods listed for liquids in Table 9-7 of SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A* or a pump type system.

Basin Water Samples

Basin water samples will be collected in a manner representative of the water being shipped to LERF/ETF. Basin water circulation provides mixing of water throughout each basin, therefore grab or composite samples may be collected anywhere in the basins.

Isolated Local Area

Water samples will be collected in a manner representative of the isolated local area of the basin. The samples will be grab or composite samples.

3.2 SAMPLING FREQUENCY

A sample representing the basin water shall be collected at least once a month from each basin. Isolated basin areas with local water conditions shall be sampled at least once prior to water transfer to LERF/ETF. An increase in the sample frequency of basin water or isolated basin areas will be determined as described per contingency sampling and analysis of section 2.0 of this SAP.

This page intentionally left blank.

4.0 SAMPLE HANDLING AND ANALYSIS

4.1 SAMPLE HANDLING AND CUSTODY

The information presented in this chapter enables maintenance of sample integrity from the time of sample collection through transportation and storage.

Sample handling, shipping, and chain-of-custody activities will be performed in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the Fluor Hanford, Inc. (FH) quality assurance program and SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*.

4.1.1 Chain-of-Custody and Custody Seal

Chain-of-custody is a protocol developed to provide a legal record of the persons having contact with a sample from the moment of collection to final disposal. Chain-of-custody procedures provide a clear record of sample collection, transfer of samples between personnel, sample shipping, and laboratory receipt. If the analytical results performed in a project become subject to litigation, FH may be required to provide documentation and witnesses to prove that a chain-of-custody protocol was followed.

In addition to the chain-of-custody, there also is a custody seal. The custody seal is an adhesive seal placed so that if a sealed container is opened, the seal would be broken. The custody seal ensures that no sample tampering occurred between the field and laboratory analysis.

The chain-of-custody and custody seals will be prepared for the samples in accordance with K Basins water-sampling procedures or work instructions and maintained in accordance with Section 5.1.6. The sample collection organization will be responsible for initiating and maintaining the chain-of-custody from the time of sampling.

4.1.2 Sample Labels and Numbering

Sample labels are required for proper identification. Sample label information generally includes the sample location, sample number, sampler's name (with signature or initials), collection date and time, and type of sample (e.g., grab or composite). K Basins water samples must be properly labeled with the label affixed to the container before laboratory transport. Sample labels will be prepared in accordance with K Basins water-sampling procedures or work instructions.

A sample numbering system shall be used to identify each sample collected and submitted for laboratory analysis. The purpose of the numbering system is to assist in the tracking of samples and to facilitate retrieval of analytical results. The sample identification numbers for each sampling activity should be used on sample labels, sample tracking forms, chain-of-custody forms, field logbooks, and other applicable documentation. Each sample collected shall be assigned a unique sample number. Sample numbers should not change because different analyses are requested.

4.1.3 Sample Preservation, Containers, and Holding Times

Most analytical methods developed by the U.S. Environmental Protection Agency (EPA) and other organizations specify required sample preservation, containers, and holding times. These requirements are in place to preserve sample integrity against biological, chemical, and physical reactions affecting the analyte(s) of concern. Sample preservation, containers, and holding times are specified in Tables 2-1 and A-1.

4.1.4 Sample Storage

KBC and the fixed laboratory will store collected samples in a secure, contamination-free, and dry area. The samples also will be protected against radioactive and chemical intrusion.

4.1.5 Sample Shipping

Onsite transfers over nonpublic thoroughfares will be performed in accordance with processes and work instructions developed to ensure compliance with U.S. Department of Transportation regulations, Title 49, *Code of Federal Regulations*, "Transportation," Parts 100 to 185, or U.S. Department of Energy equivalent and other requirements identified in this document.

4.2 SAMPLE ANALYSIS

K Basins water samples will be submitted to a fixed laboratory for analysis. An analysis request specifying the analytes to be tested will be provided to the laboratory with the sample(s). The requested analytes will consist of those shown on Table 2-1 plus analytes selected from Table A-1, as necessary. The laboratory will determine the analytical procedure, for each analyte requested, that will provide data that meets the performance requirements (e.g., MDL/MDA, accuracy, precision) specified in this document. The actual detection limit determined by the laboratory is dependent upon the analytical procedure used, sample matrix, sample constituents, and the sample quantity. The MDL and PQL are listed in order for the laboratory to plan and execute the work.

The analytical laboratory shall provide a data report to the KBC that, at a minimum, contains the following information:

- Sample chain-of-custody
- A narrative describing the analyses, analytical results limitations, and quality assurance (QA) issues associated with the results
- A report of the analytical results with QA/quality control (QC) measurement results

- Laboratory sample number index with KBC-assigned sample numbers.

Documentation of sample analyses performed by a fixed laboratory will be maintained in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the laboratory quality assurance program and Section 5.1.6.

This page intentionally left blank.

5.0 QUALITY ASSURANCE PROJECT PLAN

Activities involving the collection, generation, acquisition, and use of environmental data identified in the Tri-Party Agreement shall meet the requirements of the EPA's quality assurance requirements. This SAP is written in general accordance with the applicable requirements of EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans*, QA/R-5 and SW-846.

5.1 PROJECT MANAGEMENT

The following section identifies the organizations participating in K Basins water sampling and analysis and discusses specific roles and responsibilities. This section also describes measurement DQOs, special training requirements, and document and record management.

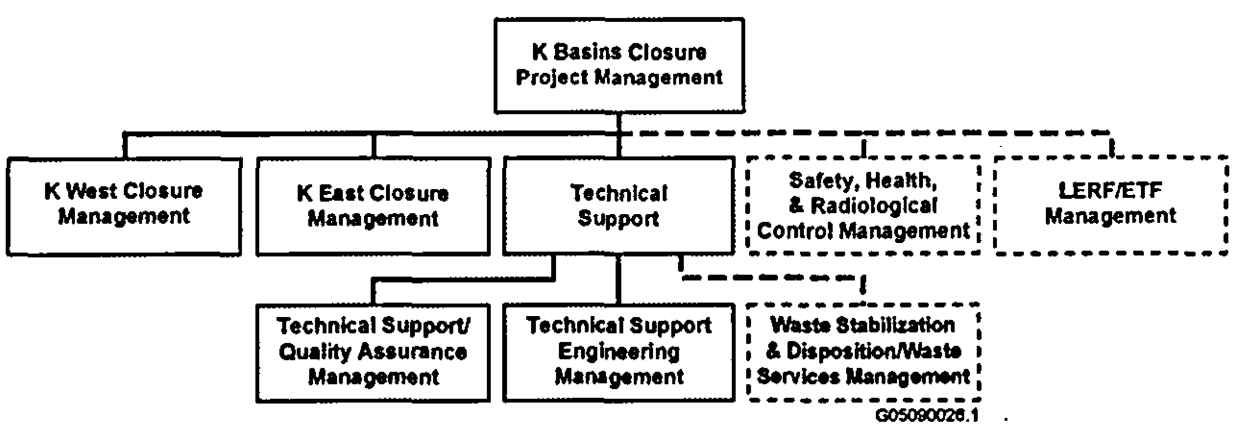
5.1.1 Project/Task Description

Collect water samples to monitor K Basins water quality and ensure that water meets LERF/ETF waste acceptance criteria. Transfer K Basins water to LERF/ETF for treatment and discharge to the environment.

5.1.2 Project Organization

Figure 5-1 is an organization chart showing project relationships and lines of communication.

Figure 5-1. Waste Management Organization Chart.



5.1.3 Roles and Responsibilities

FH is the current contractor responsible for SAP work scope. The SAP will not be revised if names, performing organizations, or contractors change. The new contractor or organization will assume the responsibilities and requirements described in this SAP.

K Basins Closure Project

KBC has the following responsibilities.

- Integrate project activities to accomplish K Basins water removal and transfer to LERF/ETF.
- Manage corrective actions associated with work performed by organization.
- Maintain qualifications of personnel performing work in accordance with this SAP.

K East and West Basins Closure Projects

The K Basins Decontamination and Decommissioning Project has the following responsibilities.

- Determine water sample locations.
- Collect water samples and ship samples to a laboratory for analysis.
- Execute K Basins water removal and transfer activities.
- Manage and integrate K Basins water removal and transfer activities.
- Procure equipment necessary to perform water removal and transfer.
- Initiate and manage fixed laboratory work.
- Manage corrective actions associated with work performed by organization.
- Maintain qualifications of personnel performing work in accordance with this SAP.

Safety, Health, and Radiological Control

The K Basins Safety, Health, and Radiological Control organization has the following responsibilities.

- Support K Basins water sample collection, removal, and transfer.
- Ensure project activities are conducted in a manner that is compliant with federal, state, and local regulations.
- Interface with U.S. Department of Energy, Richland Operations Office and regulatory agencies.
- Manage corrective actions associated with work performed by organization.
- Maintain qualifications of personnel performing work in accordance with this SAP.

K Basin Technical Support/Waste Stabilization and Disposition/Waste Services

The Waste Stabilization and Disposition/Waste Services organization has the following responsibilities.

- Ensure that adequate information is obtained to meet LERF/ETF waste acceptance requirements.
- Prepare and maintain K Basins water waste profile.
- Perform data verification and review and prepare a report of verification activities performed.
- Perform waste designation and radioactive waste classification determinations.
- Prepare shipping papers.
- Initiate reevaluation of water-testing requirements when conditions change.
- Manage corrective actions associated with work performed by organization.
- Maintain qualifications of personnel performing work in accordance with this SAP.

Liquid Effluent Retention Facility/Effluent Treatment Facility

The LERF/ETF has the following responsibilities.

- Provide interpretive authority for LERF/ETF waste acceptance criteria.
- Review analytical data to determine if K Basins water is acceptable for receipt and treatment at LERF/ETF.
- Participate in reevaluation of K Basins water-testing requirements if processing conditions or constituent concentrations increase significantly.
- Receive K Basins water for treatment.

K Basin Technical Support/Quality Assurance

The K Basin Technical Support/Quality Assurance Organization has the following responsibilities:

- Conduct assessments of compliance with this SAP.
- Manage corrective actions associated with work performed by organization.
- Maintain qualifications of personnel performing work in accordance with this document.

K Basin Technical Support/Engineering

The K Basin Technical Support/Engineering organization has the following responsibilities:

- Provide technical support to manage basin water conditions.
- Manage corrective actions associated with work performed by organization.
- Maintain qualifications of personnel performing work in accordance with this document.

5.1.4 Special Training Requirements and Certification

The activities performed in accordance with this SAP are routine and do not require special training. Personnel training is performed and maintained in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

5.1.5 Quality Assurance Objectives

The QA objective is to develop implementation guidance that will provide data of known and appropriate quality. Data quality typically is assessed by representativeness, comparability, accuracy, precision, and completeness. These parameters are described in the following paragraphs. The target accuracy and precision of laboratory analysis methods are provided in Table 5-1.

Table 5-1. Target Accuracy and Precision of Laboratory Analysis Methods.

Matrix	Accuracy[a] for Radionuclides and Chemicals (Percent of Standard)[b]	Precision[a] for Radionuclides and Chemicals (Relative Percent Difference)[c]
Water	70 – 130[d]	0 – 30%[d]

[a]Accuracy and precision are based on published analytical methods for waste analyses.
[b]Percent of standard = (measurement of standard/standard) x 100.
[c]Relative percent difference = ([result 1 – result 2]/average result) x 100.
[d]These limits are subject to change in accordance with the Waste Sampling and Characterization Facility quality assurance project plan.

Representativeness. Representativeness measures how close analytical results reflect the actual quantity in the waste matrix. Samples that are not properly collected or preserved or are analyzed beyond acceptable holding times are activities that affect representativeness. Sampling plan design, sampling techniques, and sample-handling protocols (e.g., storage, preservation, transportation) have been developed and are discussed in this SAP.

Comparability. Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained by using standard documented work processes and instructions, consistent methods, and consistent units. Fixed laboratory analytical methods and target detection limits are listed in Tables 2-1 and A-1. The actual sample MDL and PQL depend on the sample matrix, constituents, and available sample quantity. Detection limits are functions of the analytical method used to provide the data and the sample quantity available for analysis.

Accuracy. Accuracy evaluates the closeness of the measured value to the true value (e.g., theoretical or reference value, or population mean). Accuracy includes a combination of random and systematic error components that result from sampling and analytical operations. Laboratory result accuracy is expressed as relative percent recovery and is assessed by measuring known instrument standards, laboratory control samples, or spikes.

Precision. Precision measures the data spread when more than one measurement has been taken on the sample or standard. Laboratory result precision is expressed as relative percent difference (or relative standard deviation) and is assessed by measuring a sample and sample duplicate (or matrix spike/matrix spike duplicate) or standard multiple times.

Completeness. Completeness measures the amount of valid data obtained from a measurement system relative to the amount that was expected to be obtained. The desired level of completeness is dependent on project-specific DQOs. Planning and communication among involved parties is crucial in order to achieve high completeness percentages. Laboratory analyses completeness is critical to demonstrate compliance with the LERF/ETF waste acceptance criteria. The completeness rate for this project is set between 80 and 100 percent.

5.1.6 Documentation and Records

Fixed laboratory and project documentation will be maintained in accordance with quality process and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program or equivalent.

5.2 DATA GENERATION AND ACQUISITION

This section describes QC requirements; instrument testing, inspection, and maintenance requirements; calibration; and acceptance inspection requirements.

5.2.1 Quality Control Requirements

No field QC samples will be collected or submitted to the laboratory. Control measures taken to monitor fixed laboratory performance for water samples are as follows.

- One laboratory method blank for each analytical batch of 20 samples or less will be carried through the complete sample preparation and analytical procedure. The method blank will be used to document contamination resulting from the analytical process.
- One laboratory control sample or standard will be performed for each analytical batch of 20 samples or less to monitor the effectiveness of the sample preparation process. The results from the analyses will be used to assess laboratory performance.
- Sample or matrix spike duplicates or standards will be used to assess precision and will be analyzed at the same frequency as the laboratory control samples.
- Applicable radiological QC will be performed for each analytical batch of 20 samples or less to measure the effectiveness of the laboratory equipment.
- Gamma energy analysis does not have QC performed because it is a nondestructive test not requiring chemical or physical sample alteration. Gamma counter performance is established each day using standard sources.

5.2.2 Instrument/Equipment Testing, Inspection, and Maintenance

Equipment will be tested, inspected, and maintained in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

Fixed laboratory instruments will be tested, inspected, and maintained in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the laboratory quality assurance program.

Nonconformance corrections shall be in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the governing quality assurance program.

5.2.3 Instrument/Equipment Calibration and Frequency

Equipment will be calibrated in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

Fixed laboratory instruments will be calibrated in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the laboratory quality assurance program.

Nonconformance corrections shall be in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the governing quality assurance program.

5.2.4 Inspection/Acceptance of Supplies and Consumables

Supplies obtained to support sampling activities will be obtained in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

Fixed laboratory instrument supplies will be inspected and accepted in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the laboratory quality assurance program.

Nonconformance corrections shall be in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the governing quality assurance program.

5.2.5 Non-Direct Measurements

Non-direct measurements will not be used to fulfill COC quantification requirements.

5.2.6 Data Management

Data will be generated during sample collection and laboratory sample analysis. Sample and analysis data will be managed according to the processes described in Section 5.1.6.

The organization responsible for generating the measurement data shall be responsible for ensuring that the data are managed in accordance with Section 5.1.6.

5.3 ASSESSMENT AND OVERSIGHT

5.3.1 Assessments and Response Actions

The FH QA organization may conduct random surveillances and assessments in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

Nonconformance corrections shall be in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

5.3.2 Reports to Management

Project QA personnel will report surveillance and assessment results to KBC management.

Nonconformance corrections shall be in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the FH quality assurance program.

5.4 DATA VERIFICATION REVIEW AND USABILITY

Requirements for review and evaluation of data usability are described in the following sections.

5.4.1 Data Verification Review

The data collected will be assessed against the criteria in Section 5.1.5. Data assessment will include review of qualitative DQOs (e.g., representativeness, comparability, and completeness) and quantitative DQOs (e.g., accuracy and precision). The quantitative DQOs are defined as follows.

Precision

If calculated from duplicate or replicate fixed laboratory measurements (Equation 1):

$$\%RPD = \left| \frac{C_1 - C_2}{\left(\frac{C_1 + C_2}{2}\right)} \right| \times 100 \qquad (1)$$

where

%RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values.

If calculated from three or more fixed laboratory replicates, use the relative standard deviation rather than the relative percent difference (Equation 2):

$$\%RSD = \frac{s}{\bar{y}} \times 100 \tag{2}$$

where

%RSD	=	percent relative standard deviation
s	=	standard deviation
$\bar{y}$	=	mean of replicate analyses.

Standard deviation, s, is defined as follows (Equation 3):

$$s = \sqrt{\sum_{i=1}^{n} \frac{(y_i - \bar{y})^2}{n-1}} \tag{3}$$

where

s	=	standard deviation
y_i	=	measured value of the i^{th} replicate
$\bar{y}$	=	mean of replicate measurements
n	=	number of replicates.

Alternately, the student t may be employed.

Accuracy

For fixed laboratory measurements where reference activities are used (Equation 4):

$$\%R = \frac{M}{M_0} \times 100 \tag{4}$$

where

%R	=	percent of standard
M	=	measured activity
M_0	=	reference activity.

Method Detection Limit

The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The MDL is determined from analysis of a sample in a given matrix containing the analyte that has been processed through the preparative procedure.

The determination of fixed laboratory MDL will be performed in accordance with quality processes and work instructions that satisfy the quality criteria fundamentals expressed in the laboratory quality assurance program.

5.4.2 Verification and Validation Methods

The fixed laboratory will verify the analytical laboratory test results data package provided to KBC. The verification process will involve assessing the laboratory performance to the QC requirements of Section 5.2.1 and other method-specific performance criterion of Tables 5-1, 2-1, and A-1. Records shall be maintained in accordance with Section 5.1.6.

Data validation is the process for evaluating analytical test results verified by the laboratory and field activities for compliance with QA requirements of Section 5.1.5. Analytical laboratory test results of water samples collected of isolated local basin areas before LERF/ETF tanker truck transfer will be validated. The evaluation results will be recorded on the laboratory data validation checklist form, or equivalent, provided in Appendix B. Routine basin water samples collected monthly to monitor K Basins water quality will not be formally validated using the process shown on the data validation checklist. The data collected will not undergo a third-party validation.

5.4.3 Reconciliation with User Requirements

Data are reviewed to ensure DQO/SAP requirements have been met and the waste transfer complies with LERF/ETF waste acceptance criteria. A summary report will be prepared to document data verification results, whether DQO/SAP requirements have been met, and if water meets LERF/ETF waste acceptance criteria. The report will be provided to KBC management before LERF/ETF water transfer.

6.0 HEALTH AND SAFETY

Field operations at FH-operated facilities required by this SAP will be conducted in accordance with the principles of an integrated environmental, safety, and health management program.

The integrated environmental, safety, and health management program identifies processes and procedures where the primary hazards associated with waste management activities are managed. Some of these hazards are direct radiation exposure, potential personnel contamination, potential inhalation of airborne concentrations of radioactive materials, and exposures to hazardous substances. Rather than list the requirements to mitigate and control radiological and hazardous chemical exposures, the management plan references documents that provide the necessary direction to mitigate and control these hazards. The program incorporates the requirements of Title 29, *Code of Federal Regulations*, Part 1910, "Occupational Safety and Health Standards" (29 CFR 1910) Subpart 120(6)(1)(v). The management plan shall be made available to FH employees and contractors or subcontractors involved with hazardous waste operations.

FH has a robust and mature radiation protection program fully implementing Title 10, *Code of Federal Regulations*, Part 835, "Occupational Radiation Protection" (10 CFR 835). Implementation of radiological work and radiation protection activities is achieved through the Integrated Safety Management Systems process. The radiation protection program addresses roles and responsibilities, qualifications, training, implementation of the ALARA philosophy, external and internal dosimetry, monitoring and surveillance, work control mechanisms (e.g., radiation work permits, access entry requirements), self-assessments, and use of specific radiation monitoring devices and meters.

The FH Chemical Management Program, in conjunction with implementation of the integrated environmental, safety, and health management program, will be relied upon to protect the workers, the public, and the environment from specific chemical substances and their associated hazards. The Chemical Management Program provides direction for the acquisition, storage, transportation, use, final disposition, record keeping, and program performance management review for chemicals at the Hanford Site.

This page intentionally left blank.

7.0 REFERENCES

01-SFO-051, 2001, "Completion of Waste Designation for K Basin Sludge Waste Streams," (letter to D. R. Sherwood, U.S. Environmental Protection Agency, and M. A. Wilson, Washington State Department of Ecology), U.S. Department of Energy, Richland Operations Office, Richland, Washington, March 27.

10 CFR 830, "Nuclear Safety Management," Title 10, *Code of Federal Regulations*, Part 830, as amended.

10 CFR 835, "Occupational Radiation Protection," Title 10, *Code of Federal Regulations*, Part 835, as amended.

29 CFR 1910, "Occupational Safety and Health Standards," Title 29, *Code of Federal Regulations*, Part 1910, as amended.

49 CFR, "Transportation," Parts 100-185, Title 49, *Code of Federal Regulations*, as amended.

61 FR 10736, "Record of Decision: Management of Spent Nuclear Fuel from the K Basins at the Hanford Site, Richland, Washington," *Federal Register*, Vol. 61, No. 52, p. 10736, March 15, 1996.

200 Area Liquid Effluent Facility Regulatory File, Fluor Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et. seq.

CCN 0101943, 2001, "Contract No. DE-AC06-96RL13200 – Completion of Waste Designation for K Basin Sludge Waste Streams," (letter to D. R. Sherwood, U.S. Environmental Protection Agency, and M. A. Wilson, Washington State Department of Ecology, from P. G. Loscoe), U.S. Department of Energy, Richland Operations Office, Richland, Washington, March 27.

DOE/RL-99-89, 2001, *Remedial Design Report and Remedial Action Work Plan for K Basins Interim Remedial Action*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/R-96/055, 2000, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/4-79/020, 1983, *Methods of Chemical Analysis of Water and Wastes*, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Gephart, R. E., 2003, *Hanford – A Conversation About Nuclear Waste and Cleanup*, Battelle Press, Richland, Washington.

HNF-6495, 2005, *Sampling and Analysis Plan for K Basin's Debris*, Rev. 2, Fluor Hanford, Inc., Richland, Washington.

HNF-11208, 2002, *Sampling and Analysis Plan for Characterization of 105-K West Basin Wastewater*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-11967, 2002, *Sampling and Analysis Plan for Characterization of 105-K East Basin Wastewater*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-SD-SNF-TI-009, 1999, *Spent Nuclear Fuel Project Technical Data Book*, Vol. 1, "Fuel," Rev. 3, Fluor Hanford, Inc., Richland, Washington.

HNF-SP-1201, 1997, *Analysis of Sludge from Hanford K East Basin Canisters*, Rev. 0, DE&S Hanford, Inc., Richland, Washington.

Lea, F. M., 1970, *The Chemistry of Cement and Concrete*, 3rd Edition, Chemical Publishing Co., New York, New York.

Nalco, 2004, *Optimer 7194 Plus Flocculent Material Safety Data Sheet*, Rev. 2.2, Nalco Energy Services, L.P., Sugar Land, Texas.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

SW-846, 1999, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

TOMES Plus Database, Registry of Toxic Effects of Chemical Substances, available on the Internet at the Hanford Technical Library website (http://library.pnl.gov/databases.asp), Pacific Northwest National Laboratory, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WHC-EP-0877, 1995, *K Basin Corrosion Program Report*, Rev. 0, Westinghouse Hanford Co., Richland, Washington.

APPENDIX A

CONTINGENCY SAMPLING AND ANALYSIS REQUIREMENTS

This page intentionally left blank.

APPENDIX A

CONTINGENCY SAMPLING AND ANALYSIS REQUIREMENTS

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method
Radionuclides						
H-3	Glass (1x250 mL)	--	180 days	400 pCi/L	--	Liquid Scintillation
Tc-99	Glass (1x1 L)			5 pCi/L	--	Liquid Scintillation
C-14	Glass (1x2 L)	--	180 days	4 pCi/L	--	Liquid Scintillation
I-129	Glass (1x1 L)			25 pCi/L	--	GEA
Co-60	Plastic (1x500 mL square)	HNO_3; pH <2	180 days	50 pCi/L	--	GEA
Sr-90	Plastic (1x1L)			2 pCi/L	--	Beta Counting
Nb-94	Plastic (1x500 mL square)			50 pCi/L	--	GEA
Ru-103				50 pCi/L	--	GEA
Ru-106				140 pCi/L	--	GEA
Sn-113				50 pCi/L	--	GEA
Sb-125				25 pCi/L	--	GEA
Cs-134				50 pCi/L	--	GEA
Cs-137				50 pCi/L	--	GEA
Ce-144				200 pCi/L	--	GEA
Eu-152				30 pCi/L	--	GEA
Eu-154				50 pCi/L	--	GEA
Eu-155				50 pCi/L	--	GEA
Ra-226	Plastic (2x1 L)	HNO_3; pH <2	180 days	3 pCi/L	--	AEA

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method
U-234	Plastic (1x1 L)			2 pCi/L	--	AEA
U-235				2 pCi/L	--	AEA
Np-237				2 pCi/L	--	AEA
Pu-238				2 pCi/L	--	AEA
U-238	Plastic (2x1 L)			2 pCi/L	--	AEA
Pu-239/240				2 pCi/L	--	AEA
Pu-241				20 pCi/L	--	Calculated from Pu-239
Am-241	Plastic (1x1 L)			0.18 pCi/L	--	AEA
Cm-244				0.17 pCi/L	--	AEA
Metals						
Aluminum	Glass or plastic (500 mL)	HNO_3; pH < 2	180 days; Mercury, 28 days	28 µg/L	280 µg/L	6010[b]
Antimony				0.5 µg/L	5 µg/L	6010,[b] 200.8[c]
Arsenic				1 µg/L	10 µg/L	6010,[b] 200.8[c]
Barium				4.4 µg/L	44 µg/L	6010[b]
Beryllium				0.5 µg/L	5 µg/L	6010[b]
Cadmium				0.1 µg/L	1 µg/L	6010,[b] 200.8[c]
Calcium				23 µg/L	230 µg/L	6010[b]
Chromium				0.7 µg/L	7 µg/L	6010,[b] 200.8[c]
Copper				4.4 µg/L	44 µg/L	6010[b]
Iron				21 µg/L	210 µg/L	6010[b]
Lead				1.2 µg/L	12 µg/L	6010,[b] 200.8[c]
Magnesium				61µg/L	610 µg/L	6010[b]
Manganese				4.4 µg/L	44 µg/L	6010[b]
Mercury				0.1 µg/L	1 µg/L	6010,[b] 200.8[c]
Nickel				11 µg/L	111 µg/L	6010[b]
Potassium				655 µg/L	6,550 µg/L	6010[b]
Selenium				0.4 µg/L	4 µg/L	6010,[b] 200.8[c]
Silicon				22 µg/L	220 µg/L	6010[b]

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method
Silver				4.4 µg/L	44 µg/L	6010[b]
Sodium				200 µg/L	2,000 µg/L	6010[b]
Thallium				27 µg/L	270 µg/L	6010[b]
Uranium				0.1 µg/L	1 µg/L	6010,[b] 200.8[c]
Vanadium				5.6 µg/L	56 µg/L	6010[b]
Zinc				4.4 µg/L	44 µg/L	6010[b]
Volatile Organic Compounds						
Acetone	Amber glass (3x40 mL with septum)	HCL; pH <2, Cool to 4 °C.	14 days	4 µg/L	40 µg/L	8260[d]
Benzene				0.5 µg/L	5 µg/L	8260[d]
1-Butyl alcohol (1-Butanol)				50 µg/L	500 µg/L	8260[d]
Carbon Tetrachloride				0.5 µg/L	5 µg/L	8260[d]
Chlorobenzene				0.5 µg/L	5 µg/L	8260[d]
Chloroform				0.5 µg/L	5 µg/L	8260[d]
1,2-Dichloroethane				0.5 µg/L	5 µg/L	8260[d]
1,2-Dichloroethene				0.5 µg/L	5 µg/L	8260[d]
1,1-Dichloroethylene				0.5 µg/L	5 µg/L	8260[d]
2-Hexanone				5 µg/L	50 µg/L	8260[d]
Methylene Chloride				0.5 µg/L	5 µg/L	8260[d]
Methyl ethyl ketone (2-Butanone)				10 µg/L	100 µg/L	8260[d]
Methyl isobutyl ketone (Hexone, 4-Methyl-2-pentanone)				5 µg/L	50 µg/L	8260[d]
2-Pentanone				1 µg/L	10 µg/L	8260[d]
Tetrachloroethylene				0.5 µg/L	5 µg/L	8260[d]
Tetrahydrofuran				10 µg/L	100 µg/L	8260[d]
Toluene				0.5 µg/L	5 µg/L	8260[d]
1,1,1-Trichloroethane				0.5 µg/L	5 µg/L	8260[d]

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method
1,1,2-Trichloroethane				0.5 µg/L	5 µg/L	8260[d]
Trichloroethylene				0.5 µg/L	5 µg/L	8260[d]
Xylene				0.5 µg/L	5 µg/L	8260[d]
Vinyl Chloride				1 µg/L	10 µg/L	8260[d]
Semivolatile Organic Compounds						
Acetophenone	Amber glass (4x1-liter)	Cool to 4 °C.	7 days to extract/40 days after extraction	1 µg/L	10 µg/L	8270[e]
Benzyl alcohol				2 µg/L	20 µg/L	8270[e]
2-Butoxyethanol				100 µg/L	1,000 µg/L	8270[e]
Cresol (o,p,m)				1 µg/L	10 µg/L	8270[e]
1,4-Dichlorobenzene				1 µg/L	10 µg/L	8270[e]
Dimethylnitrosamine				1 µg/L	10 µg/L	8270[e]
2,4-Dinitrotoluene				1 µg/L	10 µg/L	8270[e]
Di-n-octyl phthalate				1 µg/L	10 µg/L	8270[e]
Hexachloroethane				1 µg/L	10 µg/L	8270[e]
Naphthalene				1 µg/L	10 µg/L	8270[e]
Tributyl phosphate				10 µg/L	100 µg/L	8270[e]
PCBs						
PCBs	Amber glass (3x1L)	Cool to 4 °C.	7 days to extract/40 days after extraction	–	–	–
Aroclor-1016				–	0.2 µg/L	8082[f]
Aroclor-1221				–	0.4 µg/L	8082[f]
Aroclor-1232				–	0.2 µg/L	8082[f]
Aroclor-1242				–	0.2 µg/L	8082[f]
Aroclor-1248				–	0.2 µg/L	8082[f]
Aroclor-1254				–	0.2 µg/L	8082[f]
Aroclor-1260				–	0.2 µg/L	8082[f]

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method
General Chemistry						
Bromide	Glass or plastic (1x60 mL)	Cool to 4 °C.	48 hours to 28 days	200 µg/L	2,000 µg/L	300.0[g]
Chloride				100 µg/L	1,000 µg/L	300.0[g]
Fluoride				50 µg/L	500 µg/L	300.0[g]
Formate				125 µg/L	1,250 µg/L	300.0[g]
Nitrate				10 µg/L	100 µg/L	300.0[g]
Nitrite				10 µg/L	100 µg/L	300.0[g]
Sulfate				1,000 µg/L	10,000 µg/L	300.0[g]
Phosphate				150 µg/L	1,500 µg/L	300.0[g]
Ammonia	Glass or plastic (1x50 mL)	H_2SO_4; pH <2, Cool to 4 °C.		4 µg/L	40 µg/L	350.1/350.3[h]
Total Kjeldahl nitrogen	Glass or plastic (1x250 mL)	--	28 days	60 µg/L	600 µg/L	EPA 351.2[i]
Cyanide	Glass or plastic (1x250 mL)	6M NaOH; pH >12, Cool to 4 °C.	14 days	10 µg/L	100 µg/L	EPA 335.3[j]
Total Dissolved Solids	Glass (1x1L)	Cool to 4°C.	7 days	--	10,000 µg/L	EPA 160.1[k]
Total Suspended Solids	Glass (1x1L)	Cool to 4°C.	7 days	--	1 mg/L	EPA 160.2[l]
Specific conductivity	Glass or plastic (1x100 mL)	--	--	--	10	EPA 120.1[m]
pH	Glass or plastic (1x25 mL)	--	As soon as practical	--	--	EPA 150.1[n]
Total Organic Carbon[o]	Amber glass (1x250 mL)	H_2SO_4, Cool to 4 °C.	28 days	--	0.3 mg/L	9060[p]
Gross Alpha	Glass or plastic (1x500 mL)	HNO_3; pH < 2	180 days	3 pCi/L	--	Proportional Counter
Gross Beta	Glass or plastic (1x500 mL)	HNO_3; pH < 2	180 days	4 pCi/L	--	Proportional Counter

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method

Aroclor is an expired trademark.

[a]The amount of sample needed to perform the specified analyses is a full container. The container and sample quantity may be changed at the discretion of the fixed laboratory.

[b]SW-846 Method 6010, *Inductively Coupled Plasma-Atomic Emission Spectrometry.*

[c]EPA Method 200.8, *Trace Elements in Water & Wastes – ICP/MS.*

[d]SW-846 Method 8260, *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).*

[e]SW-846 Method 8270, *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).*

[f]SW-846 Method 8082, *Polychlorinated Biphenyls (PCBs) by Gas Chromatography.*

[g]EPA Method 300.0, *Single Element Anion Sets.*

[h]EPA Methods 350.1, *Ammonia (as Nitrogen) – Colorimetric/Ammonia (as N) Semi-Automated Colorimetry,* and 350.3, *Ammonia (as N) – Potentiometric.*

[i]EPA Method 351.2, *Nitrogen, Kjeldahl, Total – Colorimetric/Total Kjeldahl Nitrogen – Semi-Automated Colorimetric.*

[j]EPA Method 335.3, *Cyanide, Total - Colorimetric, Automated UV.*

[k]EPA Method 160.1, *Residue, Filterable.*

[l]EPA Methods 160.2, *Residue, Non-Filterable & Total Suspended Solids,* and 150.1, *pH – Electrometric.*

[m]EPA Method 120.1, *Conductance – Specific Conductance, at 25 C.*

[n]EPA Method 150.1, *pH – Electrometric.*

[o]This method is considered a general chemistry method.

[p]SW-846 Method 9060, *Total Organic Carbon.*

For EPA Method 200.8, see EPA/600/R-94/111.
For EPA Methods 350.1 and 351.2, see EPA/600/4-79/020 and EPA/600/R-93/100.
For EPA Methods 120.1, 150.1, 160.1, 160.2, 300.0, 335.3, and 350.3, see EPA/600/4-79/020.

EPA/600/R-93/100, *Methods for the Determination of Inorganic Substances in Environmental Samples.*
EPA/600/R-94/111, *Methods for the Determination of Metals in Environmental Samples, Supplement I.*
EPA/600/4-79/020, *Methods of Chemical Analysis of Water and Wastes.*
SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A.*

Another method may be substituted, with sampling coordinator concurrence, if the PQL still can be met.
Method modifications are documented and approved by the Washington State Department of Ecology or EPA.
Analytical limits are based on the K Basins water quality. Limits can be changed, with prior approval by the sampling coordinator. Reported detection limits will be indicated on the final report.
PCBs will be reported down to the MDL. Values on the analytical report for PCBs falling between the MDL and PQL will be J-flagged.
MDL values are based on a clean sample (water matrix). Conditions other than a clean sample (water matrix) may increase the MDL.

AEA = alpha energy analysis.
EPA = U.S. Environmental Protection Agency.
GEA = gamma energy analysis.

Table A-1. Contingency Sampling and Analysis Requirements. (7 Pages)

Compound	Container[a]	Preservative	Maximum Holding Time	MDL/MDA	PQL	Method

MDA = minimum detectable activity.
MDL = method detection limit.
mL = milliliter.
PCB = polychlorinated biphenyl.
PQL = practical quantification limit.

REFERENCES

EPA/600/R-93/100, 1993, *Methods for the Determination of Inorganic Substances in Environmental Samples,* Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

EPA/600/R-94/111, 1994, *Methods for the Determination of Metals in Environmental Samples, Supplement 1,* U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/4-79/020, 1983, *Methods of Chemical Analysis of Water and Wastes,* Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

SW-846, 1999, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A,* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

APPENDIX B

EXAMPLE LABORATORY DATA VALIDATION CHECKLIST

This page intentionally left blank.

APPENDIX B

EXAMPLE LABORATORY DATA VALIDATION CHECKLIST

Laboratory Data Validation Checklist

Sample Number(s):

Data Quality Attribute	Attribute Criteria	Decision
The samples are representative of the waste.	• Samples were collected using methods and locations specified in SAP. • The number and quantity of sample(s) were collected in accordance with the SAP. • The sample hold time and preservation are as specified in accordance with the SAP. • The sample security and chain-of-custody are applied in compliance with the SAP.	O Yes O No
The sample analyses are comparable.	• The measurements were performed in accordance with SAP-specified methods. • The measurement results with QA data are reported as specified in the SAP.	O Yes O No
The analysis accuracy is within acceptable limits.	• The results comply with the QA requirements as specified in the SAP (e.g., blanks, percent difference from standard).	O Yes O No
The analysis precision is within acceptable limits.	• The results comply with the QA requirements as specified in the SAP (duplicate results are within specifications).	O Yes O No
The analysis data are complete.	• The results reported comply with the requirements listed above and meet the SAP-specified rate for data being valid for decision making.	O Yes O No
Analysis data meet quality requirements and may be used for decision making.		O Yes O No

Assessor Comments and Notes:

Assessor Certification
Print Name, Sign, and Date:

This page intentionally left blank.

DISTRIBUTION

Onsite

1	U.S. Department of Energy Richland Operations Office	
	DOE Public Reading Room	H2-53
1	Pacific Northwest National Laboratory	
	Hanford Technical Library	P8-55
1	Lockheed Martin Information Technology	
	Document Clearance	H6-08

This page intentionally left blank.