KBC-24706
Revision D

Sampling and Analysis Plan for 105-K East Basin Sand Filter Monolith

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

KBC-24706
Revision D

Sampling and Analysis Plan for 105-K East Basin Sand Filter Monolith

Document Type: RPT   Program/Project: KBC

J. L. Westcott
Fluor Hanford, Inc.

Date Published
June 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

J.E. Bratton   6/21/06
Release Approval   Date

Approved for Public Release;
Further Dissemination Unlimited

KBC-24706
Revision D

TRADEMARK DISCLAIMER

39 total Pages

CONTENTS

APPENDIX

FIGURES

TABLES

ACRONYMS

AJHA	Automated Job Hazards Analysis
ALARA	as low as reasonably achievable
BTP	Branch Technical Position
D&D	decontamination and decommissioning
DQO	data quality objective
DR	decision rule
DS	decision statement
DFS	Duratek Federal Services
ERDF	Environmental Restoration Disposal Facility
FH	Fluor Hanford, Inc.
KBC	K Basins Closure
KE	K East
NLOP	North Loadout Pit
PCB	polychlorinated biphenyl
QA	quality assurance
QAP	quality assurance program
SAP	sampling and analysis plan
SWOC	Solid Waste Operations Complex
TSD	treatment, storage, and disposal
WAC	*Washington Administrative Code*
WCH	Washington Closure Hanford, LLC
WSD	Waste Stabilization and Disposition

1.0 INTRODUCTION

The 105 K East (KE) Basin sand filter and the surrounding vault are to be removed as necessary components in implementing *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 2003) milestone M-034-32 (Complete Removal of the K East Basin Structure).

The sand will be removed from the sand filter to the extent practicable; disposition of the sand removed from the sand filter is outside the scope of this document. Grout will be added to the sand filter and in the space between the sand filter and the surrounding vault to absorb free liquid, immobilize the contaminants, provide self-shielding, minimize void space, and provide a structurally stable waste form. The waste to be offered for disposal is the encapsulated monolith defined by the exterior surfaces of the vault and the lower surface of the underlying slab.

The sand filter monolith must be characterized to facilitate disposal. The sand filter monolith will be disposed of at the Environmental Restoration Disposal Facility (ERDF) or other facility approved by U.S. Environmental Protection Agency (EPA) consistent with the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (also known as the "100 Area Remaining Sites ROD")* (EPA 1999) for the K Basins interim remedial action. Characterization data will be evaluated relative to BHI-00139, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, or other applicable requirements. If the sand filter monolith does not comply with BHI-00139, then the waste will be disposed at another waste management facility, such as the Hanford low-level burial ground, as approved by the EPA. The purpose of this document is to specify the data, data quality control, and data management necessary to dispose of the sand filter monolith as low-level waste at the ERDF, or if not ERDF compliant, then another facility approved by EPA.

1.1 BACKGROUND

The KE Basin is located in the 100 K Area on the Hanford Site. The KE Basin is a 4.9 million L (1.3 million gal) open-topped concrete pool constructed in the early 1950s to store spent nuclear fuel from the KE Reactor, which was removed from service in the early 1970s. Spent nuclear fuel, primarily from the N Reactor, was stored in the KE Basin beginning in 1975 (DOE/EIS-0245, *Environmental Impact Statement—Management of Spent Nuclear Fuel from the K Basins at the Hanford Site*). Fuel was stored in canisters arranged in metal racks on the floor of the basin with a water cover to a depth of approximately 6.1 m (20 ft). Fuel stored in the basin has fractured or corroded, releasing soluble materials, particulates, and fuel pieces, which, combined with dust and other debris, accumulate as sludge on the basin floor.

In 1978, the water cleaning system for the KE Basin was upgraded by adding a sand filter and ion-exchange modules. Basin water containing finely divided solids is collected by three surface skimmers and pumped through the sand filter. Filtrate from the sand filter is further treated in the ion-exchange modules. The suspended solids accumulate in the sand until the pressure drop across the filter reaches established operating limits, at which time the sand filter is backwashed. The backwash is collected in the KE Basin North Loadout Pit (NLOP), where the solids are allowed to settle as sludge.

1.2 DATA QUALITY OBJECTIVES (DQO)

The DQOs applicable to this waste were developed in accordance with EPA QA/G-4, *Guidance for the Data Objectives Process* (EPA QA/G-4 2000). KBC-24705, *Data Quality Objective Summary Report for Disposition of the 105 K East Basin Sand Filter Monolith*, documents the DQO process for the sand filter monolith.

1.2.1 Statement of Problem

Table 1-1 shows the planning team assembled to contribute to the DQO process and this sampling and analysis plan (SAP) for the sand filter monolith based on the recommendations of the project lead and decision makers. Table 1-2 shows the key decision makers.

The following is problem statement specific to the sand filter monolith:

> "The sand filter monolith must be characterized to determine compliant disposal at ERDF or other U.S. Environmental Protection Agency (EPA) authorized facility."

The disposal of the sand filter monolith requires collecting information on the physical characteristics of the waste to demonstrate its compliance with BHI-00139. Figure 1-1 shows the sand filter as depicted on Drawing No. 950-011, *Filter System HRB-78 w/Single Lever*, with notations made during sand depth measurements.

Table 1-1. Data Quality Objective Planning Team for the Sand Filter Monolith.

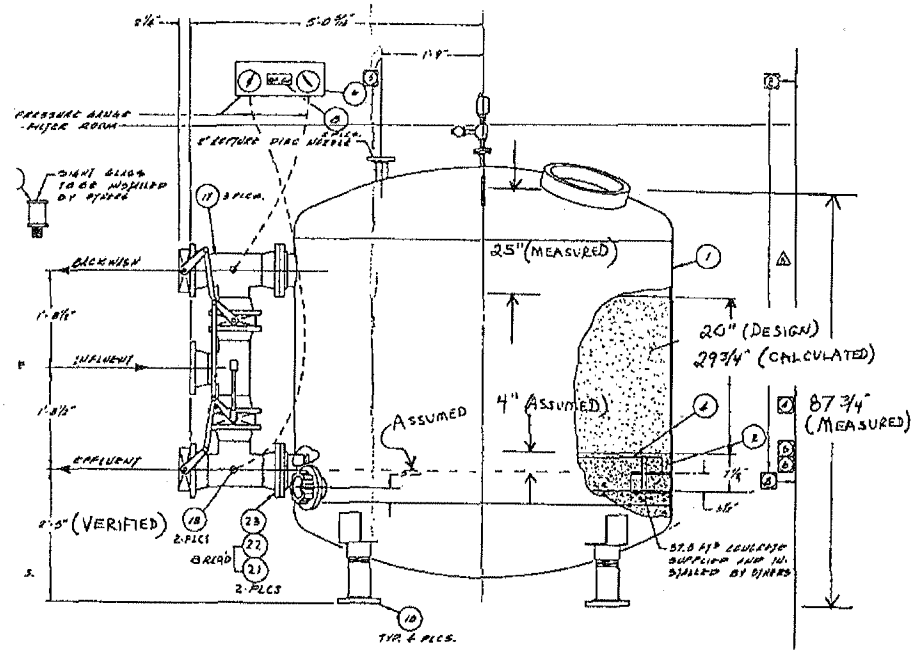
Name	Company/organization	Position or area of expertise
Rod Jochen	FH/100K Facility Operations	Operation Administration/Sample Management
Mary Ann Green	FH/KBC D&D Work Management	D&D Technical Point of Contact
Rich Lipinski	WCH/Waste Management	Waste Management
George Mata	FH/SNF Quality Assurance	Quality Assurance
Dan Moder	FH/Closure Projects	Waste Management
Tom Orgill	FH/KBC	D&D Project Manager
Tino Romano	FH/Transportation Safety Operations	Transportation Specialist
Jim Sailer	Xron Associates, Inc.	Consultant
Larry Stuhl	DFS/Project Engineering	DQO/Sampling and Analysis Plan Author
Glen Triner	FH/WSD	Waste Management
Mike Waters	FH/Closure Project	Project Lead
Dave Watson	FH/Nuclear Material Disposition	Regulatory Support
Jeff Westcott	FH/WSD	Waste Management
Terry Winward	FH/Nuclear Material Disposition	Environmental

WCH Washington Closure Hanford, LLC
D&D decontamination and decommissioning
DFS Duratek Federal Services
DQO data quality objective
FH Fluor Hanford, Inc.
KBC K Basins Closure
SNF Special Nuclear Fuel
WSD Waste Stabilization and Disposition

Table 1-2. Key Decision Makers for the Sand Filter Monolith Data Quality Objectives.

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

Figure 1-1. Sand-Depth Measurements for the Sand Filter.



93LDAMJL.002, 1993, *105KE Sand Filter Sand Depth Calculation* (internal memo from Safety Technical Support and K Basins Engineering to G. L. Bennett, November 18), Westinghouse Hanford Company, Richland, Washington.

Table 1-3 shows the contaminants of concern for the sand filter monolith determined by the DQO process.

Table 1-3. Final List of Contaminants of Concern for the Sand Filter Monolith.

Radionuclides	^{3}H, ^{14}C, ^{55}Fe, ^{60}Co, ^{59}Ni, ^{63}Ni, ^{79}Se, ^{90}Sr, ^{93}Zr, ^{93}Mo, ^{99}Tc, ^{113m}Cd, ^{126}Sn, ^{125}Sb, ^{134}Cs, ^{135}Cs, ^{137}Cs, ^{147}Pm, ^{151}Sm, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{232}Th, ^{231}Pa, ^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, ^{242m}Am, ^{243}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm
Metals	Mercury, selenium, arsenic, barium, cadmium, chromium, lead, silver
Organics	Polychlorinated biphenyl
Physical characteristics	Free liquid, void space

1.2.2 Identify the Decisions

After the alternative actions were examined, the principal study question and the alternative actions are combined into a decision statement expressing a choice among alternatives. Table 1-4 shows decision statements relevant to the disposition of the waste.

Table 1-4. Decision Statements for Sand Filter Monolith Designation.

No.	Decision statement
1	Determine if the waste • **is** a listed dangerous waste and will be evaluated for treatment and disposal at a candidate facility (e.g., ERDF or other facility approved by EPA), **OR** • **is not** a listed dangerous waste and will be evaluated for disposal at a candidate facility (e.g., ERDF or other facility approved by EPA).
2	Determine if the waste • **is** a characteristic dangerous waste and will be evaluated for treatment and disposal at a candidate facility (e.g., ERDF or other facility approved by EPA), **OR** • **is not** a characteristic dangerous waste and will be evaluated for disposal at a candidate facility (e.g., ERDF or other facility approved by EPA).
3	Determine if the waste • **is** a toxic dangerous waste and will be evaluated for treatment and disposal at a candidate facility (e.g., ERDF or other facility approved by EPA), **OR** • **is not** a toxic dangerous waste and will be evaluated for disposal at ERDF or other facility approved by EPA.
4	Determine if the waste • **is** a persistent dangerous waste and will be evaluated for treatment and disposal at a candidate facility (e.g., ERDF or other facility approved by EPA), **OR** • **is not** a persistent dangerous waste and will be evaluated for disposal at a candidate facility (e.g., ERDF or other facility approved by EPA).
5	Determine if the waste • **is** a PCB waste and will be evaluated for disposal at a candidate facility (e.g., ERDF or other facility approved by EPA), **OR** • **is not** a PCB waste and will be evaluated for disposal at a candidate facility (e.g., ERDF or other facility approved by EPA).
6	Determine if the waste • **does** comply with the radiological criteria and can be disposed at ERDF, **OR** • **does not** comply with the radiological criteria and must be disposed at another facility approved by EPA.
7	Determine if the waste • **does** complies with the physical form requirements and can be disposed at ERDF, **OR** • **does not** comply with physical form requirements and must be disposed at another facility approved by EPA.
8	Determine if the waste • **is** land disposal restricted and requires treatment prior to disposal, **OR** • **is not** land disposal restricted and may be disposed without treatment in ERDF or another facility approved by EPA.

ERDF Environmental Restoration Disposal Facility
PCB polychlorinated biphenyl

1.2.3 Identify Inputs to the Decisions

Sampling and analysis are not necessary to characterize the sand filter monolith. Based on past sampling and analysis, some contaminants are known to remain in the sand filter following backwash. The type and concentration of contaminants in the sand remaining in the sand filter are well represented by the contaminants of NLOP sludge, as NLOP sludge is primarily residue from the sand filter backwash. The NLOP sludge (and therefore the sand in the sand filter) has been determined to not be regulated as a dangerous waste under WAC 173-303 (Correspondence

No. 0101943). Grout application to the sand filter and the resulting immobilization of contaminants is not performed for compliance with 40 CFR 268, "Land Disposal Restrictions," but would satisfy the requirements if it were applicable.

The sand filter is polychlorinated biphenyl (PCB) remediation waste due to basin sludge contamination. However analysis for PCB content is not planned as ERDF and the Hanford lined trench can accept solid PCB remediation waste. The maximum PCB concentration reported for K East Basin sludge will be assigned to sand contaminating a monolith.

Data collection is necessary to support radioactivity characterization and physical form. The new data collection necessary to support decision-making consists of the following:

- Determine the quantity of residual sand remaining in the sand filter
- Determine the mass and volume of the sand filter monolith
- Manage free liquid by grouting to incorporate nonhazardous free liquid inside the monolith
- Design the monolith to minimize void space.

1.2.4 Define the Study Boundaries

The target population for the DQO is the 105-KE Basin sand filter monolith consisting of the KE sand filter vessel emptied to the extent practicable of sand, sand filter ancillary piping and instruments and the vault surrounding the sand filter vessel, which have been grouted in preparation for disposal at the ERDF or other facility approved by EPA. Characterization must be sufficient to resolve the decision statements identified in Table 1-4.

Figure 1-1 shows the sand filter and contents. The sand filter monolith will include the filter vessel, the filter vessel vault, internal piping, external piping within the limits of the surrounding vault, residual sand (minimal, but in no case more than 30 % of the sand currently within the sand filter), and grout in the sand filter and in the annulus between the filter and the vault. Figure 5-2 that is based on Drawing H 1-34596, *Structural Plans and Sections*, shows the sand filter vault; the boundaries of the monolith are the exterior surfaces of the vault and the underlying 15 cm (6-in.) slab.

It is anticipated that the sand filter will be removed from service and grouted in 2006 and the monolith removed as operational readiness allows. The amount of residual sand remaining in the empty filter shall be determined when the sand is removed from the filter, based on measurements collected. The grout will be added to the filter vessel to minimize void space and stabilize any free liquid during the curing process. The volume and mass of the sand filter monolith and the concentration of contaminants will be calculated based on a material inventory. Disposition of the sand removed from the sand filter is outside the scope of this document.

The empty filter vessel is expected to exhibit a substantial radiation dose rate, so personnel exposure will limit the work activities. Measurements should be made in a manner consistent with as low as reasonably achievable (ALARA) principles.

1.2.5 Decision Rules

The information developed in the previous steps of the DQO process (KBC-24705) are combined with the parameter of interest and an action level to provide a concise description of what action will be taken based on the results of data collected. Table 1-5 lists the decision rules that apply to the designation of the KE basin sand filter encapsulated in grout.

1.2.6 Limits on Decision Error

The parameters to be determined to support decision making are quantity of sand media contaminating the empty filter vessel and the total mass and volume of the monolith. The measurements collected are not statistically based; therefore, quantitative error tolerances are not set. Instead, a qualitative decision error regarding the quantity of sand remaining in the filter vessel is set to ensure acceptable confidence in the decision.

The qualitative decision error tolerance from sand removal from the filter is that no more than 30% of the filter sand bed remains in the filter vessel after completion of sand removal. If 30% of the sand remains in the filter vessel, the calculated radionuclide concentrations in the monolith approaches 90 % of the 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," 61.55, "Waste classification," Table 1 Class C limits. If more than 30 % of the sand remains in the filter vessel, the consequences are potentially severe as the ERDF or other facility waste acceptance criteria could be exceeded.

The monolith will not contain listed or characteristic dangerous wastes. Although the monolith may contain toxic metals below regulatory thresholds, the waste will be encapsulated. The monolith will not contain persistent waste constituents. The monolith might contain small quantities of PCB; however, the ERDF is authorized to accept PCB waste in solid form and the Hanford lined trenches, in specific cases with EPA approval, may accept PCB remediation waste in solid form. The consequences of incorrect decisions in regard to chemical contamination are anticipated to be minimal because the macroencapsulated sand filter monolith would satisfy the requirements in 40 CFR 268.45, "Treatment Standards for Hazardous Debris," for treating debris.

The monolith will contain free liquids due to the remaining sand; however, the liquid will be stabilized with grout. As the waste will be encapsulated the consequence of an incorrect decision is anticipated to be minimal.

The monolith is expected to exhibit minimal void space as grout will be added to fill the available space.

Table 1-5. Decision Rules for the Sand Filter Monolith.

DS No.	DR No.	Decision rule
1	1	1. If the waste **is** a listed dangerous waste, treat and dispose at the ERDF or another facility approved by EPA in accordance with WAC 173-303 and the facility waste acceptance criteria. 2. If the material **is not** a listed dangerous waste, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA.
2	2	1. If the waste **is** a characteristic dangerous waste, treat and dispose at the ERDF or another facility approved by EPA in accordance with WAC 173-303 and the facility waste acceptance criteria. 2. If the waste **is not** a characteristic dangerous waste, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA.
3	3	1. If the waste **is** a toxic dangerous waste, treat and dispose at the ERDF or another facility approved by EPA in accordance with WAC 173-303 and the facility waste acceptance criteria. 2. If the waste **is not** a toxic dangerous waste, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA.
4	4	1. If the waste **is** a persistent dangerous waste, treat and dispose at the ERDF or another facility approved by EPA in accordance with WAC 173-303 and the facility waste acceptance criteria. 2. If the waste **is not** a persistent dangerous waste, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA.
5	5	1. If the waste **is** a PCB waste, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA. 2. If the waste **is not** a PCB waste, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA.
6	6	1. If the waste complies with BHI-00139 radiological criteria or can be treated to comply, dispose at the ERDF. 2. If the waste **does not** comply with BHI-00139 radiological criteria, **do not** dispose at the ERDF, but at another facility approved by EPA .
7	7	1. If the waste complies with BHI-00139 physical form requirements or can be treated to comply, dispose at the ERDF. 2. If the waste **does not** comply with BHI-00139 physical form requirements, **do not** dispose at the ERDF, but at another facility approved by EPA.
8	8	1. If the waste **is** land disposal restricted and requires treatment prior to ERDF or other facility approved by EPA disposal, treat waste prior to disposal. 2. If the waste **is not** land disposal restricted, dispose at the ERDF in accordance with BHI-00139 or at another facility approved by EPA.

BHI-00139, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.
WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

DR decision rule
DS decision statement
ERDF Environmental Restoration Disposal Facility
PCB polychlorinated biphenyl

1.2.7 Optimize the Design for Obtaining Data

Information collection is limited to (1) measurement of the quantity of sand media either remaining in the filter or removed from the filter and (2) the configuration of the monolith including the formulation, volume, and density of grout added to the monolith. The measurement of sand, either remaining in the filter or removed from the filter, may use a measuring rod, measuring tapes, or weigh scale.

Data collection is straightforward and on one unit that constitutes the entire waste stream. Data collection alternatives are not necessary. A statistical method is not being used. Residual sand contaminating the empty filter vessel will be calculated based on simple physical measurements. The method of measurement will be dictated by the conditions under which the work will be accomplished.

2.0 MEASUREMENT RATIONALE AND DESIGN

Existing radionuclide analytical data and process knowledge are adequate to establish contaminants of concern concentrations in the sand filter media. Sand will be removed from the sand filter to the extent practicable. Sand media remaining in the filter is expected to exhibit free liquid prior to stabilization using grout.

As described in Section 1.2.3 of this SAP, new information required to adequately characterize the sand filter monolith is as follows:

- Determine the quantity of residual sand remaining in the sand filter
- Determine the mass and volume of the sand filter monolith
- Manage free liquid by grouting to incorporate free liquid inside the monolith
- Design the monolith to minimize void space.

2.1.1 Physical Waste Form

KBC-24705, Appendix A, describes the physical form of the sand filter monolith waste.

The sand filter monolith is expected to have no free liquids and minimal void space. Wet sands within the filter will be removed to the maximum extent practicable. Inlet and outlet pipes will be drained. Grout will be pumped into the pipes and filter, displacing any remaining free liquid and void space. Residual sand will be mixed to the extent practicable with the grout using a lance to force grout into pockets of sand or other equivalent method, which will chemically incorporate water as part of the curing process.

An inventory of the contents of the sand filter monolith will be maintained, including at a minimum the filter vessel, grout added, sand media remaining, structural concrete, and piping and instruments. The inventory will support determinations of monolith mass and volume.

Table 2-1. Calculation of Sand Filter Monolith Mass for Concentration Averaging.

	Volume	Density	Mass
Residual sand	[a]	1,922 kg/m^3 (120 lb/ft^3)	[a]
Vessel/vault[b]	-	-	16,318 kg (35,975 lb)
Grout in vessel[c]	[c]	[c]	Calculate
Grout in vault[b,c]	3.34 m^3 (118 ft^3)	[c]	Calculate
Monolith[b]	13.9 m^3 (490 ft^3)	-	Sum

[a]Residual sand volume and mass are determined as described in Section 3.2.
[b]Only the underlying slab, the lower vault walls, and grout in the vault annulus (below the midpoint of the vessel 1.22 m [48 in.] above the top of the floor slab) are used for purposes of concentration averaging.
[c]Grout volume and density to be provided by vendor performing the work.

2.1.2 PCB Waste Characterization

The sand filter monolith might contain small quantities of PCBs; however, the ERDF is authorized to accept PCB waste in solid form and the Hanford lined trench, in specific cases with EPA approval, can accept PCB remediation waste in solid form. The waste will be an encapsulated solid; therefore, sampling is not necessary. PCB content shall be specified as the residual sand containing the maximum PCB concentration in the KE Basin sludge.

2.1.3 Dangerous Waste Constituents

The components of the monolith (sludge, sand, filter, structural concrete and grout) are not dangerous waste. The K Basin sludge, which contains a bounding-case source term for contaminants in the sand filter monolith, does not designate as a dangerous waste (Correspondence No. 0101943). Therefore, the monolith is not regulated as a dangerous waste under WAC 173-303.

As such, the immobilization (grouting) of contaminants that is planned is not intended for compliance with the requirements of 40 CFR 268.

2.1.4 Radionuclide Characterization of Encapsulating Monoliths

Characterization of the radionuclide content of the monolith is required for purposes of determining that the waste meets the requirements of BHI-00139. The radionuclide inventory of the monolith is calculated by multiplying the quantity of sand remaining by the radionuclide concentrations shown in the column labeled "Estimated sand conc." of Table D-1 of KBC-24705. The radioactive waste class calculation should be based on the material masses for concentration averaging shown or calculated in Table 2-1. These values represent the amount of waste that can be considered to properly determine the radioactive waste class and does not represent the entire monolith mass or volume.

The Nuclear Regulatory Commission Branch Technical Position (BTP) papers provide guidance describing situations where the masses of both the encapsulating agent, such as grout, and waste may be used in waste class determinations. A grouted sand filter vessel corresponds to the situation described in BTP guidance as Encapsulation of Solid Material where it is permissible to consider grout and waste masses together in making classification determinations. As the contaminating sand media will primarily remain in the bottom of the filter vessel an evaluation based on the BTP determined grout is necessary to provide shielding around the exterior of the bottom half of the vessel and fix contamination on the inside of the filter vessel. Therefore, the mass and volume for radioactive waste classification purposes will be the filter vessel including piping and instruments, grout inside the filter vessel, and exterior to the filter vessel, grout and concrete structure including the filter vault wall and floor up to the midpoint of the sand filter vessel. To comply with the BTP guidance, the grout will be formulated to bear the expected overburden, and the radionuclide loading will be limited to ensure less than 0.0002 mSv/h (0.02 mrem/h) external package dose rate after 500 years of decay.

The mass and volume of the sand filter monolith are needed to calculate contaminant concentrations in the monolith. As described in KBC-24705, Section 2.1, the mass and volume of the sand filter monolith are calculated as 58,390 kg (128,730 lb) and 23.8 m^3 (840 ft^3). For purposes of radioactive waste classification, concentration averaging is employed. The waste radioactivity concentrations are averaged over the filter vessel including piping and instruments, grout inside the filter vessel, and, exterior to the filter vessel, grout and concrete structure including the filter vault wall and floor up to the midpoint of the sand filter vessel. The monolith for radioactive waste classification purposes is calculated as 34,430 kg (75,900 lb) and 13.9 m^3 (490 ft^3).

3.0 SAMPLE LOCATION AND FREQUENCY

3.1 SAMPLING

Sample collection and testing is not being conducted per this activity so these attributes do not apply in this document.

3.2 MEASUREMENTS

The quantity of residual sand is needed to calculate the inventory of contaminants remaining in the sand filter monolith. Two methods are used to determine the quantity of residual sand:
1. After the sand media is removed, measure the depth using a tape or rod from the lip of the opening at the top of the sand filter to the top of the residual sand. This measurement is comparable to the '25" (measured)' notation in Figure 1-1. Subtract the measured depth from the 1.58 m (62.25-in.) depth to the bottom of the sand media (as measured from the lip of the opening) to obtain the residual depth. Multiply the residual depth by the 2.96 m^2 (31.9-ft^2) filter bed cross sectional area to determine sand volume remaining in the filter vessel.
2. First measure the amount of sand in the filter as described in method 1 except that visual observation is not required. Then measure the quantity of sand transferred from the filter vessel to other containers by subtracting the tare weights of the containers from the filled weights, or determine the volume of sand in the filled containers to determine the volume of sand removed. Use a wet sand density of 1,922 kg/m^3 (120 lb/ft^3), as necessary. The quantity of residual sand remaining in the sand filter monolith may be determined by any suitable method consistent with the conditions under which the work will be accomplished. Multiple measurements are not necessary or advisable due to ALARA concerns; however, if multiple measurements are made, average values should be used.

If method 1 is used, the measurement will be visually observed to ensure that it is measuring the nominal sand level in the filter vessel. Visual observation may be accomplished using mirrors or using remote methods such as a camera.

4.0 SAMPLE HANDLING AND ANALYSIS

4.1 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

4.1.1 Sample Preservation, Containers, and Holding Times

Activity is not applicable as no sample management activities are required.

4.1.2 Sample Shipping

Activity is not applicable as no sample shipping is required.

4.2 SAMPLE ANALYSIS

Activity is not applicable as no sample analysis is required.

5.0 QUALITY ASSURANCE PROJECT PLAN

This quality assurance project plan describes the specific quality assurance (QA) procedures and quality control activities associated with data acquisition for the disposition of the KE sand filter monolith.

This document has been prepared consistent with EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans*, as supplemented by EPA QA/G-5, *Guidance for Quality Assurance Project Plans*. The quality assurance project plan includes the following four elements:

- Project management
- Data generation and acquisition
- Assessment and oversight
- Data validation and usability.

This document considered application of SW-846, *Test Methods for Evaluating Solid, Waste Physical/Chemical Methods* (EPA 1997). However as SW-846 applies to sample collection and analysis for chemical constituents (activities not being performed to accomplish this action) it does not apply to this SAP.

5.1 PROJECT MANAGEMENT

5.1.1 Project/Task Description

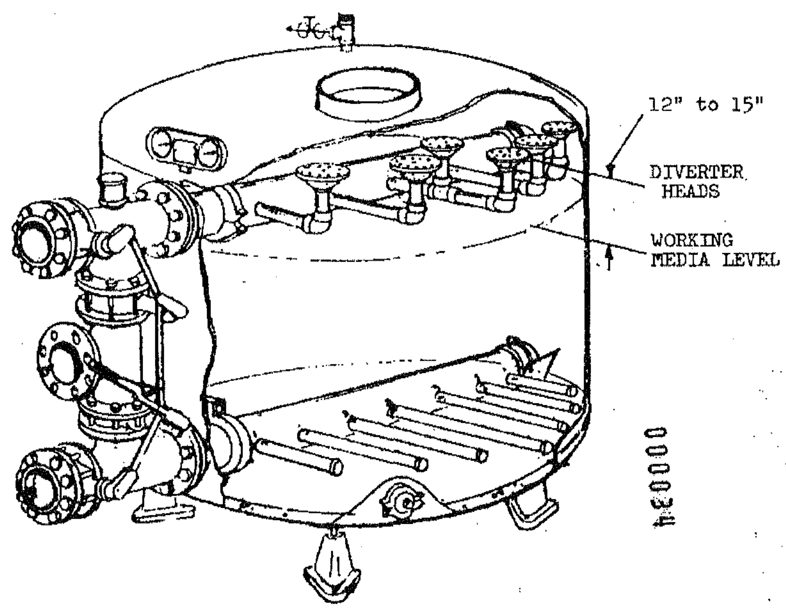
Following a final backwash, the sand filter will be disconnected from the KE Basin water treatment system. The port on top of the sand filter will be removed. Sand level readings will be performed before and after removing the sand to ensure that a minimum of 70% of the sand is removed from the filter housing. The sand in the filter will be sluiced or vacuumed and transferred out of the filter to the maximum extent practicable; at least 70 % of the sand will be removed from the filter. The sand in the filter housing will be maintained in a slurry with additional water added as needed. Water will be supplied to an eductor pump (as the motive force). The eductor will then suck up the sand and transfer it with the water (as slurry) to a container or alternate location. Disposition of the sand removed from the filter is outside the scope of this document. Figure 5-1 shows a cutaway view of the sand filter and its internal components, including the approximate level of the working media. Figure 5-2 shows a plan view of the vault as depicted in WHC-SD-WM-TI-625, *Non-Destructive Evaluation of the 105-KE Sandfilter*.

The quantity of residual sand in the sand filter monolith may be determined by any suitable method consistent with the conditions under which the work will be accomplished. Multiple measurements are not necessary or advisable due to ALARA concerns. Section 3.2 describes two methods that may be used to determine the quantity of residual sand.

After the sand is removed, grout will be pumped into the pipes, vessel, and the annulus between the vessel and walls of the surrounding vault. The vendor supplying the grout must report the volume and density of grout pumped into the monolith. Approximately 8,500 kg (19,000 lbs) of grout will be added inside the filter vessel and 20,000 kg (45,000 lbs) added in the space exterior to the filter vessel, but inside the vault wall. The estimated total mass of the sand filter monolith is about 58,000 kg (129,000 lbs).

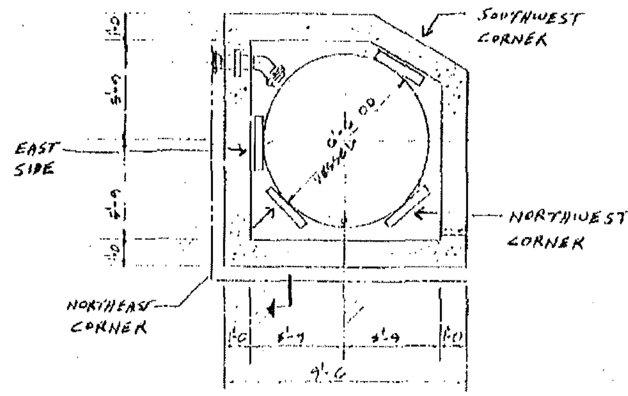
After curing, the monolith will be removed from the facility by a method still to be determined. The monolith will be transferred to an onsite facility for disposal.

Figure 5-1. Cutaway View of the Sand Filter.



Baker, 1978, *Installation, Operation & Maintenance Manual Baker Model 2 HRB-78*, Manual 157, Issue 1, Baker Filtration Company, Huntington Beach, California.

Figure 5-2. Plan View of Sand Filter Vault and Assay Locations.



WHC-SD-WM-TI-625, 1994, *Non-Destructive Evaluation of the 105-KE Sandfilter*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

This activity is proposed to occur in 2006, depending on funding and operational readiness.

As documented in KBC-24705, existing analytical data from quarterly sampling of the sand filter media will be used in conjunction with analytical data from the KE Basin NLOP. In addition, KBC-24705 compiles material quantities associated with the sand filter vessel and surrounding vault. The data will be used to calculate material quantities and the concentration of contaminants. Contaminant concentrations will be used to verify the waste meets BHI-00139 requirements.

5.1.2 Project Organization

Table 1-1 shows major participants in the SAP process. Table 1-2 shows the principal decision makers. The primary data users are K Basins Closure (KBC) project personnel, who will calculate contaminant concentrations in the sand filter monolith. Data will be used for purposes of verifying compliance with BHI-00139 for ERDF disposal or the acceptance criteria of another facility approved by EPA, both by KBC staff and personnel at the receiving facility.

Figure 5-3 shows the organization chart for measurement collection and waste management interfaces to the receiving facility.

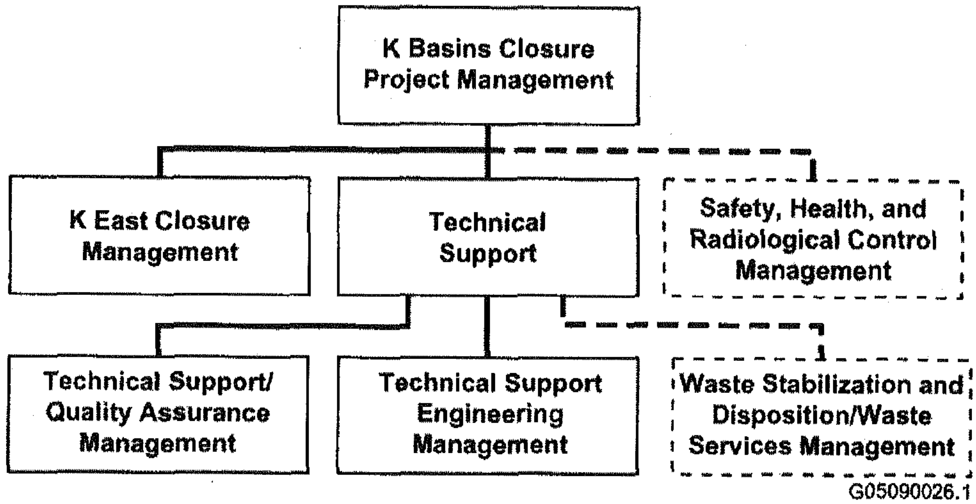


Figure 5-3. Measurement Collection and Waste Management Organization Chart.

The organization responsible for maintaining this quality assurance project plan is Waste Stabilization and Disposal.

5.1.3 Roles and Responsibilities

Roles and responsibilities for the sand filter monolith project are as follows.

K Basins Closure Project
The K Basins Closure Project has the following responsibilities:

- Integrate activities of the project to accomplish removal and disposal of K East Basin sand filter
- Manage corrective actions associated with work performed by organization
- Maintain qualifications of personnel performing work in accordance with this document.

K East Basin Closure Project
The K East Basin Closure Project has the following responsibilities:

- Manage and integrate K East Basin sand filter removal activities
- Procure equipment necessary to perform K East Basin sand filter removal operations
- Grout the sand filter and cut from building for removal
- Excavate around the sand filter to gain access to the sand filter and load monolith for transport to disposal

- Execute K East Basin sand filter grout and removal activities
- Collect information necessary to maintain an inventory of the monolith
- Manage corrective actions associated with work performed by organization
- Maintain qualifications of personnel performing work in accordance with this document.

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

- Determine and maintain calculation of monolith weight and volume
- Manage corrective actions associated with work performed by organization
- Maintain qualifications of personnel performing work in accordance with this document.

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

- Support the K East Basin sand filter removal activities and monolith transportation to disposal
- Manage corrective actions associated with work performed by organization
- Maintain qualifications of personnel performing work in accordance with this document.

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

- Maintain an inventory of the contents of the monolith
- Perform data review and validation, then prepare a report of measurements performed
- Perform waste designation and radioactive waste classification determinations
- Prepare disposal facility waste profile and shipping papers
- Manage corrective actions associated with work performed by organization
- Maintain qualifications of personnel performing work in accordance with this document.

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

- Conduct surveillance to verify compliance with the implementation of this SAP
- 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

No activities associated with this SAP require task-specific training. Measurement activities may be controlled through special work permits to minimize worker exposure. Subcontractors perform work to training requirements established in the specific contract for the work activity being performed.

5.1.5 QA Objectives and Criteria for Measurement Data

The QA objective of this SAP is to obtain data of known and appropriate quality to calculate the quantity of residual sand remaining in the sand filter monolith. The determination of the quantity of residual sand remaining in the sand filter may involve length and/or weight measurements. Table 5-1 shows the performance requirements of length and weight measurement instruments.

Table 5-1. Field Instrument Performance Requirements for the Sand Filter Monolith.

Measurement	Measurement method	Action level/ detection limit	Accuracy	Precision
Length	Tapes, rods	Lower 5% of scale range	plus or minus 2.54 cm (1 inch)	plus or minus 2.54 cm (1 inch)
Weight	Weight scale	Lower 5% of scale range	plus or minus 1 kg (2.2 pounds)	plus or minus 1 kg (2.2 pounds)

Existing analytical data documented and referenced in KBC-24705 were evaluated along with analysis of standard, blank, and duplicate samples. Analytical values cited in KBC-24705 are expected to be conservative.

Data quality typically is assessed by representativeness, comparability, accuracy, precision, and completeness. These parameters are described in the following paragraphs. The applicable quality control guidelines, quantitative target limits, and levels of effort for assessing data quality are dictated by the intended use of the data and the nature of the measurement method.

Representativeness. Representativeness is a measure of how closely field measurements reflect the actual condition in the field. The attribute applies to weight and length measurements but not to visual inspection or material inventory. The data collection documentation will establish that protocols have been followed and measurement identification and integrity are ensured.

Comparability. Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained by using standardized and consistent methods and units. The attribute applies to weight or volume measurements of removed sand only as it is the only multiple measurement. The attribute does not apply to length measurement, visual observation, and material inventory.

Accuracy. Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of physical measurements is assessed by calibration of the weight measuring tools. The attribute does not apply to visual observation and material inventory. The attribute is satisfied for length measurement if the rod or tape can be read to within one inch on the scale. Table 5-1 shows the accuracy targets for the sand filter monolith project.

Precision. Precision is a measure of the data spread when more than one measurement has been taken on the same population. Precision of physical measurements is assessed by calibration of the weight measuring tools. The attribute does not apply to visual observation and material inventory. The attribute is satisfied for length measurement if the rod or tape can be read to within one inch on the scale. Table 5-1 shows the precision targets for the sand filter monolith project.

Completeness. Completeness is a comparison of the amount of valid data obtained to the valid data required from the measurement process. A measurement is collected of either the sand remaining in or the sand removed from the filter vessel. The determination of sand remaining in the filter requires measurement of either: 1) the sand after removal or 2) the sand before removal and amount of sand removed from the filter vessel. A material inventory of the sand filter monolith is required. The completeness objective for free liquid removal or absorption and void space is that the grout has been applied to stabilize free liquid and minimize void space. If the completeness objective is not met, additional measurements will be taken as applicable.

5.1.6 Documentation and Records

Field measurement documentation and calculations will be kept in accordance with quality processes and work instructions that satisfy the fundamentals of the quality criteria expressed in the Fluor Hanford quality assurance program. Field measurements include weight and length measurements and visual observations using cameras or eyesight.

5.2 DATA GENERATION AND ACQUISITION

The field data collected in accordance with this SAP includes visual inspection and weighing or dimensional measurements. Measurements will provide information about the entire quantity of residual sand. No samples are collected for analysis. Because samples are not collected, this document will not discuss activities specific to sampling and laboratory analysis including sample process design, sampling methods, sample handling and custody, and laboratory analytical methods. Activities appropriate for field instrumentation measurements are discussed where appropriate.

5.2.1 Quality Control Requirements

Measurements consist of field measurements of length and weight, plus visual observation as necessary. The quality control requirements that are applicable to these measurements are equipment calibration as appropriate and ensuring the measurement is greater than or equal to 5% of scale.

Contaminant concentrations shall be calculated consistent with the methodology detailed in KBC-24705, Appendix D.

All requirements and corrective actions for a nonconformance must be established and implemented through the Fluor Hanford quality assurance program.

5.2.2 Instrument Testing, Inspection, and Maintenance

Field instruments including cameras, weigh scale, tapes, and rods will be tested, inspected and maintained in accordance with quality processes and work instructions that satisfy the fundamentals of the quality criteria expressed in the Fluor Hanford quality assurance program,

Correction of nonconformances shall be in accordance with quality processes and work instructions that satisfy the fundamentals of the quality criteria expressed in the Fluor Hanford quality assurance program.

5.2.3 Instrument Calibration and Calibration Frequency

Field instruments including cameras and weigh scales will be calibrated in accordance with quality processes and work instructions that satisfy the fundamentals of the quality criteria expressed in the Fluor Hanford quality assurance program. Calibration does not apply to tapes and rods used for length measurement unless required by the manufacturer.

Correction of nonconformances shall be in accordance with requirements established and implemented through a QAP that meets the criteria of the Fluor Hanford quality assurance program.

5.2.4 Inspection/Acceptance Requirements for Supplies

Supplies obtained to support field instruments including cameras will be obtained in accordance with quality processes and work instructions that satisfy the fundamentals of the quality criteria expressed in the Fluor Hanford quality assurance program.

Correction of nonconformances shall be in accordance with requirements established and implemented through a QAP that meets the criteria of the Fluor Hanford quality assurance program.

5.2.5 Nondirect Measurement

KBC-24705 documents existing contaminant concentrations and material quantity data used to support disposition of the sand filter monolith. All radionuclide inventories are calculated using concentrations established from existing data, which is documented in KBC-24705, Appendix D.

A measurement of free liquid content of the sand remaining in the filter vessel is not planned. It is expected that the sand media will exhibit free liquid until grout is placed in the filter vessel.

Void space is not measured but is minimized with the placement of grout inside and outside of the filter vessel.

5.2.6 Data Management

Sampling and measurements generated during this project will be managed according to the processes described in Section 5.1.6 of this SAP, Documents and Records. Data will be generated during measurements of length and weight and in developing information concerning monolith size and weights. Specific records and a summary of their content are identified in Section 3 of this SAP.

5.3 ASSESSMENT/OVERSIGHT FOR MEASUREMENTS

5.3.1 Assessments and Response Actions

FH Quality Assurance may conduct random surveillances and assessments. Assessments and surveillances are performed to verify compliance with requirements outlined in this SAP, procedures, and regulatory requirements. Deficiencies identified during surveillances are addressed in accordance with quality improvement processes that satisfy the basic fundamentals from the quality criteria expressed in the Fluor Hanford quality assurance program.

Assessments may include surveillance, management systems reviews, readiness reviews, technical systems audits, performance evaluations, and audits of data quality. Assessment may evaluate the following criteria:

- Data meet basic project specifications and are appropriately relevant and suitable for their targeted use;
- The quality of data meets the acceptance criteria specified and that a sufficient quantity of existing data is available to allow the project to meet criteria on data quality;
- Sufficient quality control information is obtained on the data; and,
- The QA techniques documented in this quality assurance project plan are followed.

A graded approach is used to determine the overall scope and level of detail in which the assessments are performed. Assessments performed shall document the following:

- The role that these assessments play in the project's total set of assessments
- The schedule of assessments
- The organizations and individuals expected to participate in the assessments
- Information expected from the assessment
- Documentation needed for the assessment
- Types of corrective action and levels of authority that would determine corrective action.

5.3.2 Reports to Management

Reports on the results of performance evaluations and system audits, of periodic data quality assessments, and significant QA problems and recommended solutions are distributed to affected managers as appropriate. Nonconformances and corrective action status are reported to FH management in accordance with internal work processes. The project status is maintained and presented to FH management using a summary report written for the sand filter monolith that is evaluated for ERDF or other facility approved by EPA waste acceptance. A summary report will be published on an as-needed basis but, as a minimum, before shipment of waste to disposal.

5.4 DATA REVIEW, VALIDATION, AND USABILITY

KBC personnel shall review, verify, and validate data prior to use. The reported data is compared to the established data quality requirements. Waste Stabilization and Disposition (WSD) personnel then review the data against acceptance criteria for transportation and disposal.

5.4.1 Data Review and Validation Requirements

The data collected will be assessed against the criteria in Section 5.1.5. Data assessment will include review of data quality indicators (e.g., accuracy, precision) as appropriate to the measurement and preparation of a summary report. The report will include an evaluation of the overall adequacy of the total measurement system with regard to the DQO of the data generated.

Data will not undergo a third-party validation as the data quality is adequate without it.

5.4.2 Validation Methods

Data validation is the comparison of reported data and data quality measures to data quality requirements as per data acceptance criteria specified in Section 5.4.1 of this document. The waste monolith will be evaluated with the results of the evaluation being recorded on a form provided in Appendix A for weight and length measurements. Records shall be maintained per Section 5.1.6 of this SAP.

The data collected will not undergo a third-party validation as the data quality is adequate without it.

5.4.3 Reconciliation With User Requirements

Once a data measurement has been reviewed and verified, the data are provided to Waste Management personnel to determine if the requirements of the SAP/DQOs are met. Any outstanding issues shall be resolved in consultation with WSD, Transportation Safety Operations, or the KBC Project as appropriate. Reconciliation of data is performed to ensure the following:

- Requirements of this SAP are met
- Radioactive waste classification is established
- The status of the waste is determined under the *Washington Administrative Code*173-303, "Dangerous Waste Regulations"
- Waste meets BHI-00139 requirements for ERDF disposal or other facility waste acceptance criteria and conforms to the waste profile.

A statistical data quality assessment will not be performed for data collected because random sampling will not be conducted.

The estimated concentrations of radionuclides with the waste weight, grout content, and void space will be compared by the KBC project to BHI-00139 for acceptance at the ERDF or other facility approved by EPA. A summary report evaluating the overall adequacy of the total measurement system with regard to the DQO of the data generated and comparison to BHI-00139 will be sent to Waste Services and K Basins Closure Management. The report will be published on an as-needed basis but before shipment of waste to disposal.

6.0 HEALTH AND SAFETY

All field operations at Fluor Hanford-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 Fluor Hanford employees and any contractor or subcontractor involved with hazardous waste operations.

Fluor Hanford has a robust and mature radiation protection program, which fully implements 10 CFR 835, "Occupational Radiation Protection." Implementation of radiological work and radiation protection activities include defining 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 and access and entry requirements), self-assessments, and use of specific radiation monitoring devices and meters.

The Fluor Hanford Chemical Management Program, in conjunction with implementation of the AJHA, will be relied on to protect the workers, the general 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 management review of program performance for chemicals at the Hanford Site.

7.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

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

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, as amended.

93LDAMJL.002, 1993, *105KE Sand Filter Sand Depth Calculation* (internal memo from Safety Technical Support and K Basins Engineering to G. L. Bennett, November 18, Westinghouse Hanford Company, Richland, Washington.

950-011 (drawing), 1978, *Filter System HRB-78 w/Single Lever*, Baker Filtration Company, Huntington Beach, California.

Baker, 1978, *Installation, Operation & Maintenance Manual Baker Model 2 HRB-78*, Manual 157, Issue 1, Baker Filtration Company, Huntington Beach, California.

BHI-00139, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 4, Bechtel Hanford, Inc., Richland, Washington.

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

DOE/EIS-0245, *Environmental Impact Statement—Management of Spent Nuclear Fuel from the K Basins at the Hanford Site*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-36, 2003, *Hanford Sitewide Transportation Safety Document*, Rev. 0-A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 2003, *Hanford Federal Facility Agreement and Consent Order*, 89-10, Rev. 6, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA QA/G-5, 2002, *Guidance for Quality Assurance Project Plans*, EPA/240/R-02/009, U.S. Environmental Protection Agency, Washington, D.C.

EPA QA/R-5, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA/240/B-01/003, U.S. Environmental Protection Agency, Washington, D.C.EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (also known as the "100 Area Remaining Sites ROD")*, U.S. Environmental Protection Agency, Washington, D.C.

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

H-1-34596 (drawing), 1986, *Structural Plans and Sections*, Rev. 4, U.S. Energy Research and Development Administration, Richland, Washington.

KBC-24705, 2006, *Data Quality Objective Summary Report for Disposition of the 105 K East Basin Sand Filter Monolith*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

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

SW-846, 1997, *Test Methods for Evaluating Solid, Waste Physical/Chemical Methods*, 3rd Edition, as amended by Updates, U.S. Environmental Protection Agency, Washington, D.C.

Toxic Substances Control Act of 1976, 15 USC 2601 *et seq.*

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

WHC-SD-WM-TI-625, 1994, *Non-Destructive Evaluation of the 105-KE Sandfilter*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

DATA VALIDATION FORMS

APPENDIX A

DATA VALIDATION FORMS

Weight/Volume Data Validation Checklist

Identification:

Data Quality Attribute	Attribute Criteria	Decision
The measurements are representative of the waste.	The material being measured is clearly identified.	☐yes ☐no
The waste measurements are comparable.	The measurements are collected in compliance with procedures, work plans, or within skill of the craft.	☐yes ☐no
The measurement accuracy is within acceptable limits.	Instrument is calibrated at the time measurement is obtained.	☐yes ☐no
The measurement precision is within acceptable limits	Instrument is calibrated at the time measurement is obtained.	☐yes ☐no
The measurement data is complete.	A measurement is required for all of the sand removed from the filter.	☐yes ☐no
The measurement detection limit is acceptable	Measurement result is equal to or more than 5% of the instrument scale.	☐yes ☐no
Data for Monolith meet quality requirements and are valid for use in decision making.		☐yes ☐no

Assessor Comments and Notes:

Assessor Certification
Print Name, sign, and date:

Length Data Validation Checklist		
Identification:		
Data Quality Attribute	**Attribute Criteria**	**Decision**
The measurements are representative of the waste.	The material being measured is clearly identified.	☐yes ☐no
The waste measurements are comparable.	Not applicable	☐yes ☐no
The measurement accuracy is within acceptable limits.	Instrument can be read to within plus or minus one inch.	☐yes ☐no
The measurement precision is within acceptable limits	Instrument can be read to within plus or minus one inch.	☐yes ☐no
The measurement data is complete.	Measurement has been collected.	☐yes ☐no
The measurement detection limit is acceptable	Measurement result is equal to or more than 5% of the instrument scale.	☐yes ☐no
Data for Monolith meet quality requirements and are valid for use in decision making.		☐yes ☐no
Assessor Comments and Notes:		
Assessor Certification Print Name, sign, and date:		