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ENGINEERING CHANGE NOTICE

Page 1 of 3

1. ECN 669821

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	D. J. Watson, SNF Envir. Protection/X3-79/373-3250	☐ Yes ☒ No	11/14/01
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12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	N/A	N/A [signature] 12-4-01 Design Authority/Cog. Engineer Signature & Date	Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ☐ Yes ☒ No

- The executive summary has been modified to encompass the materials at K West. The most significant difference between the two sites is that the concrete pad at K West is not painted. Because the potential for contamination at K West is considered to be significantly lower than at K East, K East samples will providing a bounding condition for contamination at K West.
- Section 1.1, which includes the background and history of activities at the two facilities, describes activities and wastes found at K East that provide a basis for using contamination at that site as a bounding condition for K West. This section includes a discussion of spills at each site.
- Section 1.1.1, Paint Analysis applicable to Monorails and Concrete Supporting the Monorails, describes the analysis of paint samples that were collected from inside the buildings housing the basins. The original SAP had considered paint from the overhead trolley as representative what would be found on the monorails. This conclusion was determined to be inappropriate. This section describes the basis for this change; paint data in Appendix C has also been changed to support the new approach.
- Section 1.1.2, Monorails and Painted Concrete supporting the Monorails, has been modified so that the COPC discussion reflects the new Appendix C data.
- Section 1.2.4, Boundaries, has been modified to include the materials that will be generated at K West.

See Continuation Page

14a. Justification (mark one)	14b. Justification Details
Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const. ☒ Const. Error/Omission ☐ Design Error/Omission ☐	(1) expanding the scope of the Sampling and Analysis Plan to include demolition debris from the site preparation activities for the 105 K West Basin Fuel Transfer Annex; (2) adding information to be used in characterizing paint for waste designation purposes; and (3) expanding the contingency sampling/analysis protocols to include non-radiological analytes of interests.5 K West Basin Fuel Transfer Annex; (2) adding information to be used in characterizing paint for waste designation purposes; and (3) expanding the contingency sampling/analysis protocols to include non-radiological analytes of interests.

15. Distribution (include name, MSIN, and no. of copies)
See Distribution Sheet

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1. ECN (use no. from pg. 1): 669821

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
☐ Yes	Additional ☐ $ -	Additional ☐ $ -	Improvement ☐
☒ No	Savings ☐ $ -	Savings ☐ $ -	Delay ☐

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
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OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	EQM Mitzi Miller	11-14-01	PE		
Cog. Mgr.		12-12-04	QA		
QA	RP Luth	12/4/01	Safety		
Safety			Design		
Environ.	D. J. Watson	11-14-01	Environ.		
Other	WM Program JH Zimmerman	11-14-01	Other		
Proj Ops Center					

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

DOE-RL Letter 02-SFO-021 — 12-3-01

ADDITIONAL

13a. Description of Change (continued)

- Section 2.4, Contingency Analyses. Language has been added to clarify that samples may be collected at locations where unusual conditions or potential contamination are encountered. The original document focused on contingency samples to verify radionuclide ratios; this section has been expanded to address TC metals and organics, as applicable.

- Section 3.1, Overview and Objectives. Language has been added to address the inclusion of activities at K West.

- The discussion and tables in Appendix A have been modified to include radionuclide ratios at K West.

Appendix C. It was determined that the paint on the trolley crane inside the basin structures is not representative of the paint that is present on the monorails. Appendix C, which formerly provided analysis of paint from the crane, has been replaced with data from analyses of paint samples believed to be more representative of the paints that will be found on this debris.th data from analyses of paint samples believed to be more representative of the paints that will be found on this debris.

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A-6000-135 (10/97)

HNF-8918
Revision 1

Sampling and Analysis Plan for Removal of Structures External to the 100 K Storage Basin

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 Hanford
P.O. Box 1000
Richland, Washington

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Revision 1
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Document Type: ENV Division: SNF

M. Miller
Environmental Quality Management for Fluor Hanford

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Assistant Secretary for Environmental Management

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Revision 1

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Page 1

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EXECUTIVE SUMMARY

This Sampling and Analysis Plan (SAP) presents the rationale for waste characterization and the strategy for sampling and analysis activities to support removal of structures and soil external to the K East and K West Fuel Transfer System Buildings in the K East and K West Areas on the Hanford Site. This project is focused on characterization to support waste designation for disposal of the resulting waste at the appropriate disposal facility. This interim remedial action is conducted under the 100 Area Remaining Sites ROD which identifies the Environmental Restoration Disposal Facility (ERDF) as the preferred disposal facility.

The waste that is the subject of this SAP includes:

- Concrete from pads previously used to store filters from the K Basins;
- Soil underlying the concrete pads and soil on the north side of the pads, down to a depth of between a few inches to 4.5 ft;
- Sections of the carbon steel monorail and associated concrete supports;
- Asphalt road on the east side of the pads; and
- Transite siding (external wall).

The structures and soil addressed by this SAP are either known to be contaminated with radioactivity or are in areas where contamination is possible. Therefore, all materials removed from the buildings and associated structures are presumed to be radioactively contaminated. All debris and soil will be managed as low-level radioactive waste.

Debris that contains *Resource Conservation and Recovery Act of 1976* (RCRA)/Washington State dangerous constituents above regulated levels will be designated as mixed waste. These constituents may be present at levels that require treatment to comply with Land Disposal Restrictions (LDR). Debris composed primarily of pieces greater than 60 mm, that requires treatment for compliance with the LDR, will be treated through an approved alternative treatment technology for debris under 40 *Code of Federal Regulations* 268.45. Debris less than or equal to 60 mm will be byproducts from and commingled with larger debris items and will be

managed with the related waste stream per RCRA. Only a small amount of debris less than or equal to 60 mm is anticipated.

The sampling design for the debris uses facility or historical radiological sample data to establish the radionuclide distribution of radiological constituents of concern. The radionuclide distributions are established for each waste stream and subsequently used to estimate the content of constituents of concern, indexed to cesium-137 (Cs-137). The Cs-137 content of the waste debris will be estimated using the weight-to-curie relationships previously developed for K Basin above water waste (HNF 2001a). Laboratory analysis of the soil underlying and around the filter wash pads will be used to determine the Cs-137 content and the concentration of hazardous constituents. Section 2.3 discusses the details of this approach and utilizes existing sampling and analysis procedures.

Based on operational history, the contamination source term for the concrete, steel, and soil addressed in this SAP is assumed to be the same as the K Basin above water waste (basin water and sludge). Thus, the radionuclide distribution used to estimate the concentration of radionuclides in the waste will be the same as that previously developed for above water debris from K East and K West (HNF 2001a).

In cases where assumptions used to establish historical radionuclide ratios are shown not to be applicable, contingency sampling and analysis may be required. Section 2.4 presents methods to obtain contingency laboratory analysis of the debris to measure specific isotopes to revise the radionuclide ratios for a waste stream. Section 2.4 also includes use of nondestructive assay as a contingency analytical approach. It must be emphasized that Section 2.4 is for contingency analysis and not routine use. Fluor Hanford is responsible for contingency sampling.

The concrete pad at K East is painted with different paintthan is found on the monorail and concrete monorail supports. The material safety data sheets (M SDSs) (Appendix B) for the paint on the pad will be used instead of characterization to develop the waste profile for the pad. No polychlorinated biphenyls are present in this paint. To determine if the concrete debris from the pad designates as RCRA hazardous waste, the concentratons of RCRA constituents in the debris

will be based on the concentration of hazardous constituents in the paint being evaluated as a portion of the mass of the debris. Waste smaller than 60 mm will be managed based on a determination of hazardous constituents. The concrete pad at K West has not been painted.

The carbon steel monorails and the concrete foundations and supports were painted with the same paint discussed in the Debris SAP (HNF 2001a), and a previous ERDF profile exists for debris painted with this paint. The same information used for the previous ERDF profile for debris from K Basin will be used to assess the characteristics of the waste in the monorail debris.

Because there is no basis to believe the asphalt has been contaminated, the asphalt roadway material is excluded from designation per Washington Administrative Code 173-303-071(3)(e) and no characterization will be done for disposal.

The soil at K East will be sampled to confirm the radionuclide distribution and the concentrations of characteristic metals and organics and additional organics required by ERDF. The details of the sampling are discussed in Section 3.0 of this document. Because the operational history of the two facilities indicates that contamination levels at K East are higher than what would be expected at K West, sampling results from K East will provide the basis for designation of waste materials generated from activities at K West.

Personal protective equipment (PPE) associated with these removal activities will be discarded using the same procedures as PPE currently generated during routine K Basins operations. As such, the PPE is covered by other waste profiles currently in place for K Basin PPE. As a result, this SAP does not discuss PPE.

This SAP is based on the results of implementing the Data Quality Objectives (DQO) Process as documented in the *Data Quality Objectives Process in Support of the Characterization of Debris and Soil from Removal of Structures External to the 100 K Storage Basins* (HNF 2001b). The following topics are summarized in Section 1.0:

- historical data,
- rationale for data collection, including radiation surveys and sampling, and
- results of the DQO Process.

Section 2.0 includes the quality assurance project plan that includes details of the radiation survey, analytical methods, detection limits, accuracy, and precision criteria.

Section 3.0 includes the sampling plan that summarizes information needed by those collecting and shipping samples to the laboratory or those performing the radiation surveys.

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ACRONYMS

AA	alternative action
AJHA	automated job hazards analysis
ALARA	as low as reasonably achievable
BHI	Bechtel Hanford, Inc.
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
CMP	Chemical Management Program
COC	constituent of concern
COPC	constituent of potential concern
DOE	U.S. Department of Energy
DQO	data quality objectives
DS	decision statement
DW	dangerous waste
EHW	extremely hazardous waste
EPA	U.S. Environmental Protection Agency
ERC	environmental restoration contractor
ERDF	Environmental Restoration Disposal Facility
FH	Fluor Hanford, Inc.
GEA	gamma energy analysis
HASP	Health and Safety Plan
HASQARD	*Hanford Analytical Quality Assurance Requirements Documents*
HSRCM	*Hanford Site Radiological Control Manual*
ICP	inductively coupled plasma (emission spectroscopy)
LDR	Land Disposal Restrictions
LLW	low-level waste
MSDS	material safety data sheet
NDA	nondestructive assay
PCB	polychlorinated biphenyl
PHMC	Project Hanford Management Contract
PPE	personal protective equipment
PQL	practical quantitation limit
PSQ	principal study question
QA	quality assurance
QC	quality control
RCRA	*Resource Conservation and Recovery Act of 1976*
ROD	Record of Decision
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SNF	spent nuclear fuel
SFL	standard fixed laboratory
SOP	standard operating procedure
TBD	to be determined
TC	toxicity characteristic

TCLP	Toxicity Characteristic Leaching Procedure
TRU	transuranic
TSCA	*Toxic Substances Control Act of 1976*
VOC	volatile organic compound
WAC	waste acceptance criteria

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) is currently removing spent nuclear fuel (SNF), sludge, and debris from the K East and K West Areas, located in the 100 K Area of the Hanford Site. In order to facilitate the transfer of SNF, the SNF project is constructing an annex on the north side of both the 105 K East and K West Basins. This will involve modifying some of the staging areas external to the Basin buildings. These modifications require the removal and disposal of some structures and soil that are potentially contaminated with radionuclide and non-radiological constituents. This Sampling and Analysis Plan (SAP) is focused on removal and characterization of the following materials at both K East and K West for waste designation and disposal:

- a portion of the filter wash pads,
- the painted and unpainted sections of the carbon steel monorails,
- the painted concrete supports for the monorails,
- the underlying soil,
- the soil that is not covered by any structure on the north side of the pads,
- the asphalt road on the east side of the pads and soil area, and
- the Transite siding (external walls).

All areas are external to the Fuel Transfer System building located at each facility.

This work is governed by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) 100 Areas Remaining Sites Record of Decision (ROD) (EPA 1999). The ROD describes disposal of contaminated materials at the Environmental Restoration Disposal Facility (ERDF) as the selected remedy, if the materials meet that facility's waste acceptance criteria (WAC). The purpose of this plan is to obtain characterization data that allow for proper disposal of the waste, whether at ERDF or another appropriately permitted facility. This document identifies the waste streams, as well as radiation survey and sampling approaches to be used to characterize the debris and soil. Throughout the text, this interim remedial action is referred to as a removal action or activity.

The personal protective equipment (PPE) is covered by other existing disposal documents and profiles and is not part of this SAP.

1.1 BACKGROUND

The K Basin Reactors and their associated fuel storage basin were constructed in the early 1950s. The basins are located in the Hanford 100 K Area within 1,380 ft of the Columbia River. The fuel basins are large, open-topped concrete pools, containing approximately 1.3 million gallons of demineralized water each. The basins were originally used to store SNF from the K Reactors until the early 1970s, when the reactors were removed from service and the fuel removed from the basins. The basins subsequently were used to store SNF from the Hanford N Reactor. Prior to removal of SNF from the basins, the K East fuel basin held approximately 1,200 metric tons of N Reactor SNF; approximately 900 metric tons of N Reactor fuel were stored at K West. The spent fuel elements are contained in canisters placed in storage racks under 16 ft of water for cooling and radiation shielding.

Process knowledge indicates that the fuel stored in the K East Basin experienced significantly more corrosion than the materials stored at K West. This resulted in a higher release rate of isotopic materials and toxic metal constituents in the sludge found at K East than at K West. Water from either basin would be expected to contain some level of contamination from the associated sludge, K East more so than K West. The Department of Ecology and the United States Environmental Protection Agency (EPA) have agreed in the past that the history of the two basins is sufficiently similar that characterization of sludge from K East can be used to designate the sludge from K West. Because the primary source of contamination at the filter pads is believed to be from basin water, the same logic that was used for the sludge will be applied for these activities. Characterization of soil and debris at K East will be used to designate the waste streams generated from similar activities at K West. For the reasons described above, and the process history for the pads described below, this is believed to provide a conservative approach for the K West materials.

In the absence of a definition for debris in the 100 Area Remaining Sites ROD (EPA 1999), the definition given in the ERDF WAC (Bechtel 1998) will be used for this project. This definition is based on the *Resource Conservation and Recovery Act of 1976* (RCRA) definition of debris provided in 40 *Code of Federal Regulations* (CFR) 268.2(g). For purposes of establishing disposal requirements, RCRA defines debris as a solid material exceeding a 60-mm particle size. The project does not anticipate that a significant quantity of material less than 60 mm will be generated. These items will generally be byproducts from and commingled with larger debris items and will be managed with the related waste stream.

Debris and soil management will depend upon the waste designation. All materials are anticipated to be low-level waste (LLW). This project is not expected to generate any transuranic (TRU) waste. Debris and soil might designate as hazardous or mixed waste, and may or may not contain polychlorinated biphenyls (PCBs).

The radiological historical data discussed in Section 1.1.1 apply to the concrete pads and soil. Filters containing residual water from the basins were previously stored on the pads, and thus may have contaminated the concrete surface with basin water. Although some filters were likely stored on the pad at K West, that facility made greater use of ion-exchange columns, reducing the potential for contamination. In addition, anecdotal descriptions indicate that basin water from K East may have flowed to the soil outside the building before the pad was built. There is no history of basin water flushing over the comparable area at K West.

The last paragraph of Section 1.1.1 explains the previous paint analyses that apply to the paint on the monorails and the painted portion of the concrete supports on the monorails. Note that the paint on the K East concrete filter wash pad is a new and different paint than that used on the monorail and associated monorail support concrete. The material safety data sheets (MSDSs) for the paint on the concrete filter pad are presented in Appendix B. The pad at K West has not been painted.

1.1.1 Previous Investigations

Summaries of historical data applicable to this project are provided below:

Mixed Waste Debris for the K Basins Project. An estimate of the Cs-137 content of debris was performed for past shipments using established dose-to-curie relationships (WHC 1996a, WHC 1996b). Radionuclides considered reportable in previous waste shipments included strontium-90, Cs-137, plutonium-239/240, americium-241, and plutonium-241. The results of these Cs-137 estimates and the weights of the associated waste packages were used to develop a weight-to-curie relationship that will be applied to this waste (HNF 2001a).

Above – Water Waste. Radiochemical analyses for gross alpha, gross beta, cobalt-60, Cs-137, and americium-241 were performed on 20 105-KE smears. Nondestructive assay (NDA) of 20 compacted drums and NDA of four boxes of waste was performed. Radionuclides in the resulting waste profiles included strontium-90, Cs-137, europium-152, plutonium-238, plutonium-239, plutonium-240, americium-241, plutonium-241, and curium-244. The radiological data were used along with other information to develop an estimate of the radionuclide mix for above water waste in the K Basins (HNF 2000a, HNF 2001a).

Fuel Basin Water. Because the basin water may have infiltrated the soil under and around the K East pad, and the residual water from the filters from the basins may have leaked on the concrete pads, the basin water characterization data are discussed here. Waters from the K East and K West Basins were analyzed for PCBs. PCBs were not detected in the water using a minimum detection limit of 0.5 ug/mL. Inductively coupled plasma (ICP) analysis for total metals was performed on water samples from both basins and on sludge from the K East Basin only. Although zinc, silicon, copper, and boron were detected in water samples, no toxicity characteristic (TC) metals were found above the TC levels, so the water is not a characteristic waste. Metals have been found in K East Basin sludge at concentrations that exceed the total concentration screening level. Only limited Toxicity Characteristic Leaching Procedure (TCLP) analyses were performed on the sludge. There are no data for mercury or organics. In addition, these existing TCLP data for the sludge cannot be correlated to the constituents in the water that may have accumulated in the soil.

Based on this information, the soil at K East must be analyzed to assess whether characteristic metals are present. Because the water from K East is considered to be more contaminated than water from K West, and there is reason to believe that less water would have been introduced to the soil at K West, the results from sample analyses at K East will be used to designate soil from K West. Because the water does not contain PCBs above the *Toxic Substances Control Act of 1976* (TSCA) levels of 50 ppm, and is not TSCA, the soil should not be a TSCA waste.

Paint Analysis Applicable to Monorails and Concrete Supporting the Monorails. Analysis for total metals by ICP according to SW-846 Method 6010A [*Test Methods for Evaluating Solid, Waste Physical/Chemical Methods*, EPA 1997] were performed on nine paint chip samples, as well as multiple chip samples from an overhead crane. The nine samples were from a grey paint that was applied to various surfaces on the mezzanine, I-beams, load out pit and other areas in K East and K West. The overhead trolley crane was painted with a red paint. Because the

monorail and support pads are coated with a grey paint, the results from the nine samples are considered to be more representative of the constituents in monorail paint. Toxic metals (silver, arsenic, barium, cadmium, chromium, and lead) were confirmed in paint chips based on total metals analysis using ICP. The SAP for K Basin debris (HNF 2001a) discussed these data and the data were evaluated in a previous ERDF waste profile (#KBASIN001, Rev 01, 7/19/2001). The total metals concentrations were divided by 20 to approximate TC concentrations in the paint and results applied to the total mass of the debris disposed. Based on the resulting concentration, the debris does not designate as characteristic waste. The data from the nine paint samples are presented in Appendix C. Because a previous profile at ERDF exists for painted debris, the previous data supporting ERDF disposal (Profile #KBASIN001, Rev 01, 7/19/2000) will be used. No further analysis or evaluation of this waste stream is performed in this SAP.

1.1.2 Constituents of Potential Concern

Constituents of potential concern (COPCs) include RCRA hazardous constituents (i.e., the TC metals and organics as listed in Table 2-3), applicable RCRA underlying hazardous constituents if the waste designates as characteristic, and PCBs as Aroclors. In addition, the ERDF WAC includes limits for additional organics and for radiological content.

The Data Quality Objectives (DQO) documentation for this project presents the rationale for exclusion of COPCs (HNF 2001b). Table 1-6 in the DQO document (HNF 2001b) provides the final list of constituents of concern (COCs) remaining for each waste stream with the rationale for inclusion and exclusion. The logic for selection of the radioisotopes is presented in HNF 2001a and HNF 2001b. The radiological COCs are the same as those presented in the previous K Basin SAP (HNF 2001a) for waste disposal at ERDF, and are listed in Table 2-2 of this document. The radiological COCs are based on the "above water" logic presented in HNF 2001a (Appendix A). The logic is that water might have splashed and dried on the debris and soil, and thus represent the same source of radionuclides. The soil underlying and surrounding the filter wash pad at K East will be analyzed for the COCs listed in Table 2-3.

The debris waste streams (concrete and steel debris) will be evaluated based upon a previously employed weight-to-curie approach (HNF 2001a) and will use the current ERDF Profile (#KBASIN001, Rev 01, 7/19/2001) for K-Basin debris.

For designation of the debris, the following approach has been used to identify the non-radiological COCs:

Concrete Filter Pads - Only a portion of the concrete pad at K East is painted. The MSDSs for the paint are provided in Appendix B. The pad is relatively new, the paint is not the older paint previously used in the 100 Area, and the MSDSs do not list PCBs or metals as constituents. Therefore, PCBs are not a COC for the concrete. No characteristic metals or organics are listed on the MSDSs; therefore, no characteristic COCs apply. Although the components of the epoxy paint used on the pad at K East contained ingredients that might have been regulated, after the catalyst and resin were mixed, any chlorines would have been significantly reduced by the reaction (Lee & Neville 1967). The resulting concentration (~0.5%) of chlorine would be further

reduced by application of the agreed-upon conversion factor of 0.05%, based on the waste matrix. The pad at K West is not painted.

Soil - No data exist for evaluation of the hazardous constituents in this soil; therefore, the soil will be analyzed for the TC constituent list and the additional organics required by the ERDF WAC.

Monorails and Painted Concrete Supporting the Monorails - The paint used for these areas was the same paint previously evaluated for similar paint used at the K Basins (HNF 2001a). The data (Appendix C) used to evaluate the paint indicated that it would not designate for TC metals. The metals and organics data supporting the previous profile for debris from K Basins will be used to generate this profile.

Transite Siding – This asbestos siding is to be removed from an external wall at each location. It may or may not have been painted. If paint is present, the time period to which the paint belongs has not been identified. Therefore, the waste stream will be evaluated for both old and new paints, based upon the previous evaluation for old paint (HNF 2001a) and the MSDSs in Appendix B.

Asphalt Paving – Because there is no reason to believe that the asphalt contains any COPCs other than PAH, the asphalt is excluded by Washington Administrative Code 173-303-071 (3)(e) from analysis for disposal; therefore, no analyses will be requested for the asphalt and it is not given further consideration.

1.2 DATA QUALITY OBJECTIVES

The DQO process was employed to develop this SAP and determine the approach for characterizing the waste streams for disposal.

The scope of the DQO process (HNF 2001b) included characterization of the five waste streams at each location anticipated to result from this removal activity: (1) concrete pad debris and associated new paint; (2) underlying and surrounding soil; (3) asphalt from a road; (4) painted carbon steel monorail and concrete supports; (5) Transite siding from an external wall. The resulting information and data will allow the SNF Project to designate the waste streams for disposal. The DQO process was structured to provide the strategy for characterizing these waste streams in support of designation to determine the appropriate disposal facility and/or treatment required.

As noted above, decisions documented through the DQO process may be modified due to subsequent changes in project direction or based on discussions documented through the comment/response process. Any changes will be documented in project files. Refer to the DQO documentation (HNF 2001b) for details about the process or resulting DQO.

1.2.1 Step 1: State the Problem

In the absence of a definition for debris in the 100 Area Remaining Sites ROD (EPA 1999), the definition given in the ERDF WAC (Bechtel 1998) will be used for this project. This definition is based on the RCRA definition of debris provided in 40 CFR 268.2(g). Debris generated by remediation activities must be characterized and designated to allow disposal at ERDF, or be segregated for an alternate disposal pathway, as appropriate. All materials removed from these project areas are assumed to be radioactively contaminated. Most debris will designate as LLW, although some may designate as mixed waste (i.e., radioactive and hazardous). For the radiological constituents in the concrete pads, the curie-to-weight method used in the debris SAP (HNF 2001a) will be used for the characterization for disposal.

Because no current data exist for the soil, soil underlying and outside the concrete structures will be excavated and data must be obtained to support designation for disposal. Because the process history for the two basins indicates that contamination should be at higher concentrations at K East, samples will be analyzed from soil at K East only and the results will be applied to designate materials at K West.

1.2.2 Step 2: Identify the Decision

Step 2 presents the logic pathway that is used to resolve the problem. Tables 2-1 through 2-3 in the DQO document (HNF 2001b) that supports this SAP present the Principal Study Questions (PSQs), Alternative Actions (AAs), and Decision Statements (DSs) to resolve the problem that was presented above. Figures 1-1 and 1-2 in this SAP present the decision logic, based on Step 2, which will be used to assess if the waste may be disposed at ERDF or other permitted disposal facility. This logic is the same logic previously used for waste designation for debris (HNF 2001a).

1.2.3 Step 3: Identify Inputs to the Decisions

Step 3 identified the data needed to resolve each of the DSs identified in Step 2, as well as the analytical performance requirements (e.g., practical quantitation limits, precision, and accuracy) to support the data. The logic behind the selection of inputs, field techniques, and analytical methods and the tables, which present these information needs, may be found in the DQO document (HNF 2001b). Because the MSDSs and existing debris profile for the paint will be used to designate debris waste streams for TC metals and PCBs, no sampling and analysis will be conducted to support decisions related to these COCs. However, sampling and analysis will be performed to provide data to characterize the soil waste stream in support of waste designation. Table 2-2 in this SAP presents a list of the radiological COCs and the radionuclide ratios that will be used to estimate the radionuclide content of the waste. Table 2-3 presents the list of radiological and non-radiological COCs and associated analyses to be used for the soil. Appendix A presents the final list of radionuclides to be addressed for the debris and soil waste streams. Appendix B presents the MSDSs for designation of the painted concrete pad.

Table 1-1 lists the DS, the waste stream, and the associated data needed to support each decision. For each set of decision, waste stream, and information needs, one or more existing documents are listed that allow a designation decision to be made. For soil, there are no data and, therefore, sampling is required. The table also provides general rationale and information with respect to waste characterization to support designation.

Table 1-1. Evaluation of Existing Data for Waste Designation (3 pages)

DS#	Waste Stream	Information Needed	Available Data	Is information sufficient?	Rationale
1,2, 3	Monorails, concrete supports to rails, concrete pads, Transite siding	Radiological composition (Curie/weight) and radionuclide ratios	Above water radionuclide ratios from HNF 2001a	Y	Radionuclides source terms are expected to be the same as K East and K West above water debris
1,2,3	soil	Radiological composition, radionuclide ratios	radionuclide ratios from above water (HNF 2001a), no data available to confirm ratios	Ratios – Y Data to confirm ratios – N	Radionuclides source terms are expected to be the same as K East and K West above water debris. Analyses will be performed for gamma emitters and, if necessary, then for other radionuclides.
4	Monorails, concrete supports to rails, concrete pads, Transite siding	Listed dangerous waste	No documentation of listed waste sources.	Y	No evidence exists to believe there were listed wastes (F, K, P, or U) used in association with the waste streams. EPA policy is to apply listed waste codes only when process knowledge indicates a listed waste source.
4	Monorails, concrete supports to rails, concrete pads, Transite siding	Characteristic waste	NHC-96-101, "Analytical Report for K Basin Paint – FT-6112," 9/11/96. ERDF Profile #KBASIN001, Rev. 01, 7/19/01. Process knowledge.	Y	These materials are solids, which are not ignitable, do not support a corrosive solid (WA state) designation, are not explosive, and do not contain reactive sulfides or cyanides. There are two types of paint present on these materials; an older paint on the monorails, supports, and transite and a newer paint applied to the concrete pad. Six toxic metals (silver, arsenic, barium, cadmium, chromium, and lead) were confirmed to be present in older paint chips at concentrations greater than screening limits for TC criteria. However, it is assumed that the paint remaining on the surfaces is less than 0.05% of the waste

Table 1-1. Evaluation of Existing Data for Waste Designation (3 pages)

DS#	Waste Stream	Information Needed	Available Data	Is information sufficient?	Rationale
					streams; therefore, the waste streams will not designate for toxic metals. Because pesticides/ herbicides are not in the paint formulations and the paint is dry (i.e., no volatile organics are present), none of the remaining characteristic codes will apply to these waste streams. The TC volatile organics were previously removed from consideration based on: Paint was applied over 30 years ago and, due to low vapor pressure, volatiles organics are no longer present. MSDS for the newer paint indicates no basis for designating these materials for any characteristic constituents.
4	Monorails, concrete supports to rails, concrete pads, Transite siding	Toxic dangerous waste	ERDF Profile #KBASIN001, Rev. 01, 7/19/01. Process knowledge	Y	Toxic waste constituents are not suspected in these waste streams of steel, concrete, and asbestos materials. However, if toxic constituents are present in the paint and it is assumed that the paint remaining on the surfaces is less than 0.05% of the waste streams, the waste streams will not designate as toxic dangerous waste.
4	Monorails, concrete supports to rails, concrete pads, Transite siding	Persistent dangerous waste	ERDF Profile #KBASIN001, Rev. 01, 7/19/01. Process knowledge	Y	Halogenated organic compounds and polycyclic aromatic hydrocarbons are not suspected in the waste streams at concentrations that would cause the waste to designate as persistent dangerous waste. The MSDS for the newer paints used on the concrete pad indicate that there should be no persistent waste issues associated with that material.

Table 1-1. Evaluation of Existing Data for Waste Designation (3 pages)

DS#	Waste Stream	Information Needed	Available Data	Is information sufficient?	Rationale
4	Painted monorails, concrete supports to rails, Transite siding (old paint)	PCB concentrations	Process knowledge	Y	PCBs are not a constituent of the steel, concrete, or Transite, although some of the surfaces retain paint. PCBs have been found, associated with old paint, elsewhere on the Hanford Site at levels above 50 ppm but below 500 ppm.
4	Concrete pad with (new) paint	PCB concentrations	MSDSs; see Appendix B	Y	MSDSs for new paint used in the 100 K East Area do not identify PCBs as an ingredient.
4	Painted monorails, concrete supports to rails, concrete pads, soil	Asbestos	Process knowledge	Y	These materials are solids which do not contain asbestos.
4	Transite siding	Asbestos	Process knowledge	Y	This building material is known to contain asbestos.
5	Monorails, concrete supports to rails, concrete pads, Transite siding	Land disposal restricted waste	Process knowledge	Y	Because the waste streams are not expected to designate, federal land disposal restrictions (LDR) are not applicable. Also, the material is not liquid, a solid acid waste, or organic/ carbonaceous and is not believed to be extremely hazardous waste; therefore the state LDR do not apply.
4	Soil	Listed dangerous waste	No documentation of listed waste sources.	Y	No evidence exists to believe there were listed wastes (F, K, P, or U) used/generated in the 100 K Area. EPA policy is to apply listed waste codes only when process knowledge indicates a listed waste source.
4,5	Soil	Characteristic waste, toxic dangerous waste, LDR waste, PCBs	no data	N	Analyses will be performed. Designation will be based on the analyses.
4	Soil	Persistent dangerous waste	no data	N	Designation will be performed based on data from analyses by Methods 8260 and 8270.

The EPA policy regarding the application of a listed waste designation is that the listed waste codes should be applied only when the source of the waste is known and it can be concluded to require the application of the listed code. Even when analysis indicates the presence of a

constituent that could carry a listed waste code, unless process knowledge indicates that the constituent was used for a listed purpose, the code should not be applied. There is no available information that indicates a listed waste code should be applied to the K Basin waste streams; therefore, no listed waste codes will be applied.

A radiological survey of the filter wash pad was performed on 7/28/00 (SNF Project Radiological Survey Report (K000511)). Although the data were not gathered to support waste characterization, it provides information as to the potential contamination levels that will be encountered during this project. The debris SAP (HNF 2001a) provides a calculation that supports use of the weight-to-curie conversion factor currently used for K Basin debris.

1.2.4 Step 4: Define the Boundaries of the Study

Step 4 identifies the geographic (spatial) and temporal boundaries of the area under investigation, as well as practical constraints that must be considered in the sampling design. No temporal boundaries have been identified. Table 4-1 in the DQO document (HNF 2001b) defines the attributes that make up each population of interest. It is expected that approximately 40 yd^3 of concrete, 260 yd^3 of soil, 20 yd^3 of asphalt, and 270 ft^2 of Transite siding will be removed and require disposal from K East; similar quantities of concrete, soil, and asphalt will be generated at K West, while approximately 300 ft^2 of Transite are expected from that facility.

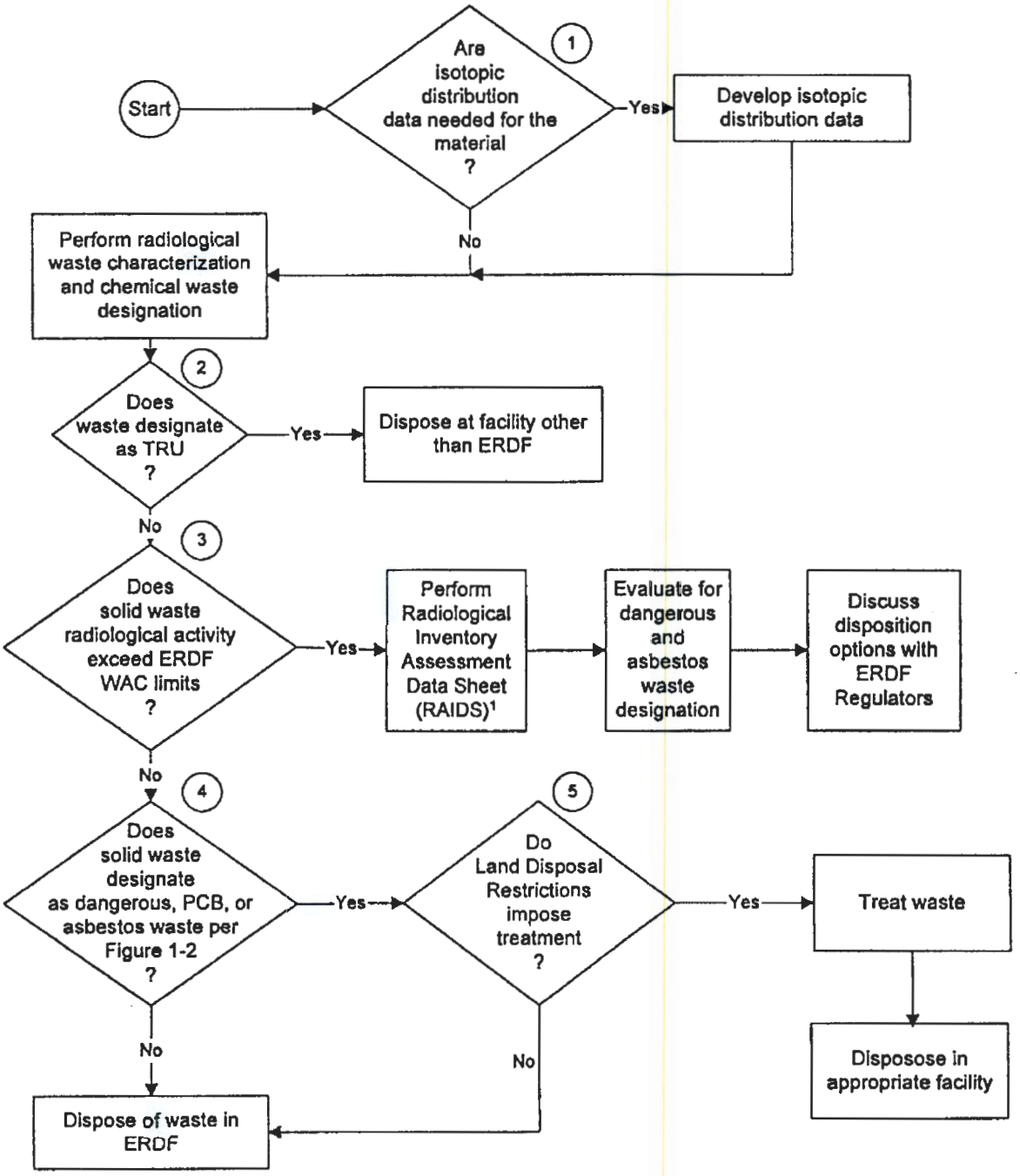
The geographic area of investigation at K East includes the portion of the filter wash pad that is not currently marked as a radiation control area, and the underlying soil to a depth of at least 4.5 ft, external to the north side of the Fuel Transfer System building. Decisions on the disposition of concrete pad or soil (i.e., the scale of the decision) will be made for the entire area being investigated. The pad to be removed at K West has the same configuration as that at K East, but is not delineated based on contamination; removal will be based on project requirements to support the site changes.

The decisions identified in the DQO process apply to the removal of all debris or soil covered by this removal action. These decisions may or may not be appropriate for later debris or soil removal activities external to the K East and K West buildings. The difficulty associated with collecting representative samples from debris waste streams supports use of the weight-to-curie conversion rather than sampling and laboratory-based analysis of radionuclides.

1.2.5 Step 5: Develop a Decision Rule

Step 5 combines information developed in DQO Steps 1 through 4 with a statistical parameter of interest (such as mean, median, or percentile) and an action level to provide a concise description of what action will be taken based on the results of the data collected. Table 5-2 in the DQO document (HNF 2001b) lists the final action level for each DS and COC. This information is incorporated into the analytical performance requirements presented later in this SAP.

Figure 1-1. K East Area Debris and Soil Disposition Decision Logic



[1]SNF staff will provide the necessary inputs for the ERDF to perform calculations. It is not anticipated that the proposed waste will present any problems for the ERDF inventory.

Figure 1-2. Chemical Waste Designation Decision Logic

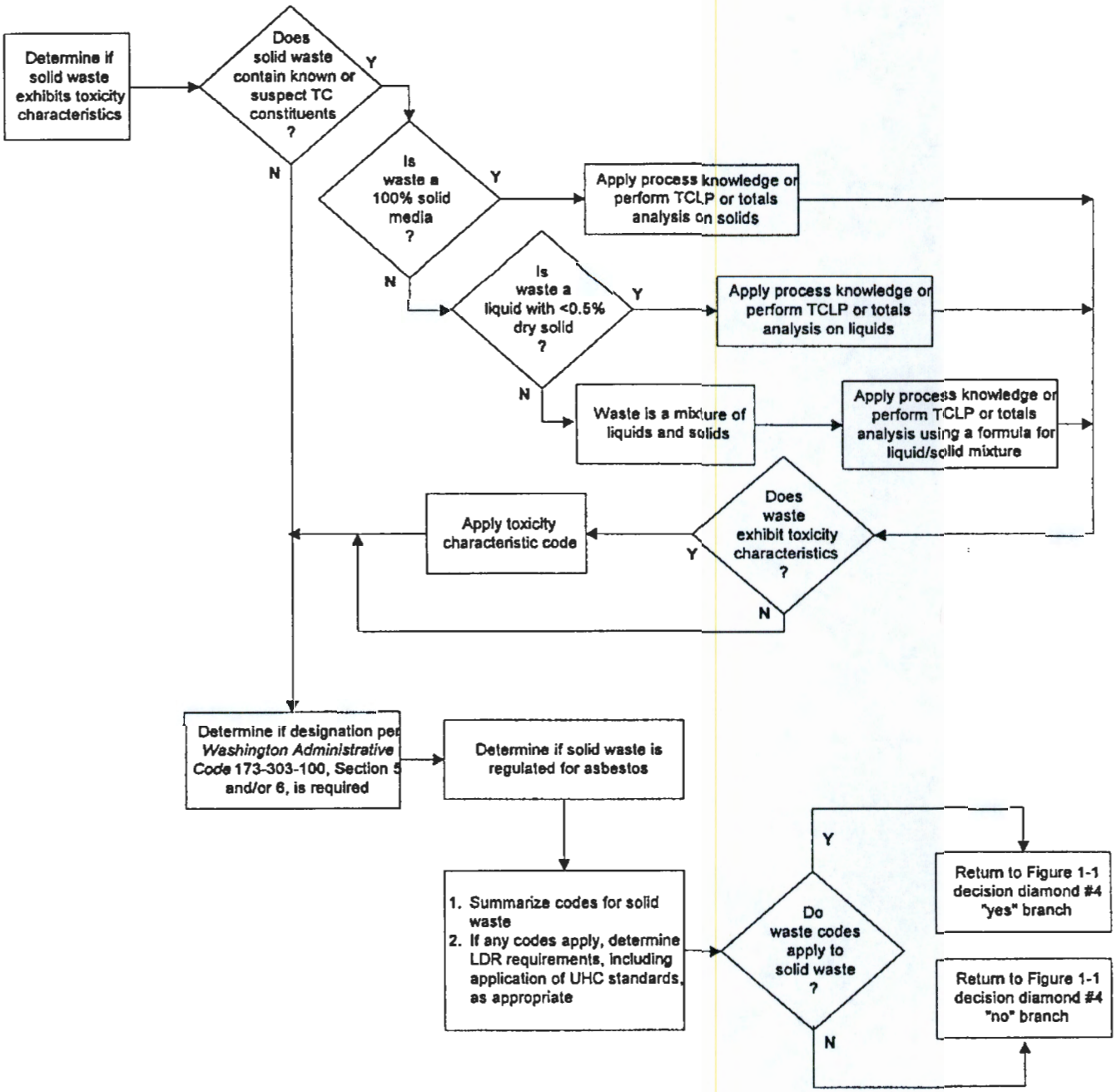


Table 1-2, below, (Table 5-3 in the DQO document (HNF 2001b)) combines the parameter of interest, scale for decision making, action levels, and alternative actions into separate "IF...THEN..." Decision Rules. These decision rules are the output from the DQO process and describe actions that will be taken based upon the results of data analysis.

Table 1-2. Decision Rules

DS#	Decision Rule
1, 2, 3	If the radionuclide COCs in the waste do not exceed the radionuclide ERDF WAC (BHI 1998) (Ci/m^3), then the waste will be evaluated by Decision Rules # 4a, 4b, and 5. If the radionuclide COCs in the waste exceed the radionuclide ERDF WAC (BHI 1998) (Ci/m^3), then the waste will be evaluated on a case-by-case basis for possible ERDF disposal, but may not be sent to ERDF. The waste will be evaluated by Decision Rules # 4a, 4b, and 5.
4a	If process knowledge or concentrations of the detected analytes indicate that the waste does not designate as listed, TC, toxic dangerous (i.e., state dangerous waste (DW)), persistent dangerous (i.e., state dangerous extremely hazardous waste (EHW)), PCBs, or asbestos, then the waste will be evaluated for disposal at ERDF or another permitted facility. If process knowledge or concentrations of the detected analytes indicate that the waste designates as listed, TC, toxic dangerous (i.e., state DW), persistent dangerous (i.e., state dangerous EHW), PCBs, or asbestos, then the waste will be evaluated for disposal at ERDF or another permitted facility.
4b	If process knowledge or concentrations of the detected analytes do not exceed the ERDF WAC limits, the waste will be disposed at ERDF. If process knowledge or concentrations of the detected analytes do exceed the ERDF WAC limits, then discuss with regulators the options of treating the waste and/or sending the waste to another permitted facility
5	If process knowledge or any detected analyte dictates LDR-required treatment and disposal, the waste will be treated and disposed at ERDF or another permitted facility. If no process knowledge and none of the detected analytes dictate LDR-required treatment and disposal, the waste will be disposed in ERDF or another permitted facility without treatment.

*Radionuclide content is estimated from weight to Cs-137 curie conversions for debris, followed by application of the radionuclide ratios in Table 2-2. For soil, the Cs-137 and other gamma emitters will be obtained from laboratory data, followed by application of the radionuclide ratios in Table 2-2.

1.2.6 Step 6: Specify Limits on Decision Error

This section of a DQO generally is used to establish the parameters for a statistically-based sampling design. This SAP does not describe a statistically-based sampling approach for debris. Debris will be evaluated through weighing of all materials followed by use of the curie/weight ratio and application of the above water radionuclide ratios in Table 2-2, as discussed in HNF 2001a.

Soil will be evaluated for non-radiological COCs by random sampling designed to establish a mean estimated concentration for all soil to be removed. Radiological COCs for the soil will be estimated using a judgmental sampling of areas of maximum dose rate. Refer to Step 6 in the DQO document (HNF 2001b) for additional details.

Contingency sampling will be performed only if anomalous waste is generated. Contingency sampling is discussed in Section 2.4.

1.2.6.1 Radioactive Debris Waste

Each waste container of debris will be weighed. An estimated COC inventory for waste containers of debris will be derived from weight-to-Cs-137 curie data coupled with radionuclide ratios from the previous K Basin SAP (HNF 2001a).

1.2.6.2 Painted Debris

Designation for characteristic waste of the painted waste streams (concrete and metal debris from the monorails and concrete pads) will be based on the contribution of the hazardous constituents in the paint layer to the mass of debris being disposed.

For painted monorails and concrete supports, the PCB concentration in the paint alone will be used to designate with respect to PCB concentration.

1.2.6.3 Soil

Sampling and analysis of the soil underlying and adjacent to the concrete at K East is planned to characterize the soil waste stream from both sites for designation. There are three options discussed for the timing of soil sampling: (1) sample before digging, (2) sample during the soil removal, and (3) sample from the bags after removal. The timing of sampling is important because the project must remove soil before fixed laboratory data will be completed and thus before a profile and ERDF roll-off (or other approved facility transportation boxes) will be obtained. The project will store soil in large plastic disposal bags until the soil is disposed at ERDF or other approved facility.

Option 1. This option will be used if samples are collected before digging. Triangular grids will be placed on the soil surface after removal of the pad. The grids will cover the soil under the pad and area adjacent to the pad that will be removed. For radionuclides, the surface soil will be surveyed, the three highest dose rate areas located, and subsequent samples in those three areas collected down to depth of excavation predicted for that area (4.5 ft to a few inches). Each sample will be a composite from the surface to a maximum depth of 4.5 ft. The depth is to be equivalent to the planned depth of excavation. This is a biased sampling design and will result in a conservative estimate of radionuclide concentration.

For the non-radiological parameters, there is no demonstrated association between (1) metals and organics and (2) the radionuclides. Therefore, three samples from randomly selected grid nodes will be collected. Each sample will be collected and composited from the surface to a maximum depth of 4.5 ft at each location. The depth of sampling is to be equivalent to the planned depth of excavation. The samplers will discuss with the construction engineers the depth of planned excavation before sampling.

Analysis for all options. For all options for rad analysis of soil, the approach described below will be followed. Initially, gamma energy analysis (GEA) of the samples for gamma emitters will be performed by the fixed laboratory. The ratios of individual gamma emitters to Cs-137 will be compared to the values in Table 2-2. If the ratios are less than or equal to those in Table 2-2, no additional analyses will be performed, and the ratios based on Table 2-2 will be used to estimate radionuclides other than Cs-137. If the gamma analysis indicates that the ratios are not consistent with the values in Table 2-2, then radionuclides in Table 2-3 may be analyzed and the actual concentrations used for all measured isotopes.

For all options for analysis of non-rad, the analytes, methods and practical quantitation limits (PQLs) in Table 2-3 will be obtained.

Option 2: This option will be used if sampling is performed during soil removal. In this case, it is assumed that the bulldozer or backhoe will be used both for excavation of the soil and for digging in areas to allow sample collection. Triangular grids will be placed on the soil surface after removal of the pad. The grids will cover the soil under the pad and area adjacent to the pad that will be removed. For radionuclides, the surface soil will be surveyed using the same grids previously discussed. The three highest dose rate areas will be located and marked with flags. As excavation proceeds, samples in those three areas will be collected down to depth of excavation predicted for that area (4.5 ft to a few inches). Each sample will be a composite from the surface to a maximum depth of 4.5 ft. The depth is to be equivalent to the planned depth of excavation. This is a biased sampling design and will result in a conservative estimate of radionuclide concentration. The radionuclide and non-radionuclide analyses will be the same as previously discussed.

For the non-radiological parameters, the same grids will be used. Three random locations will be selected and flagged before digging begins. Three samples from randomly selected grid nodes will be collected as the excavation proceeds. Each sample will be a composite from the surface to a maximum depth of 4.5 ft at each location. The depth of sampling is to be equivalent to the planned depth of excavation. The samplers will discuss with the construction engineers the depth of planned excavation before sampling.

Option 3. This option will be used if the samplers cannot be present during digging and the soil must be bagged before sampling. Triangular grids will be placed on the soil surface after removal of the pad. The grids will cover the soil under the pad and area outside the pad that will be removed. For radionuclides, the surface soil will be surveyed using same grids previously discussed. The three highest dose rate areas will be located and marked with flags. As excavation proceeds, for radionuclides, the soil from the three highest surface survey areas will be placed in one or more bags and will be marked for radionuclide sampling. A sample from each of three bags containing the high survey data surface soil will be obtained. Each bag contains about 9.5 yd^3 and has a large opening to allow for obtaining the samples.

Workers removing the soil will keep a map and log identifying the location and depth from which each bag of soil is collected. Each bag will be randomly numbered; three random numbers will be selected for sampling the non-radionuclide analytes. A clean, small shovel, trowel, or small hand coring device will be used to get samples from various soil portions within each bag. A sample will be collected from each of the three randomly numbered bags chosen for sampling.

The following tables show, under a variety of assumptions of what the sample standard deviation might be, what sample sizes would achieve the desirable error rates ($\alpha = 0.10$, $\beta = 0.20$). For each table, the regulatory limit of an inorganic analyte is taken as the Action Limit. The sample standard deviation(s) is varied to show the impact on sample size of the variability in the concentrations.

No analytical data exist for the concentration of any parameter to be measured in the soil underlying or adjacent to the concrete pad. Of the eight TC metals, arsenic, chromium, lead, and silver (As, Cr, Pb, and Ag) have same TC action limit of 100 ppm (based on total analysis) and all have the same published variance; therefore, Pb will be used as the target analyte to represent these metals. Pb is the logical choice because there are at least two possible sources of contamination. Vehicles which used leaded gasoline have driven on the soil, and Pb is a known contaminant from vehicle exhaust. In addition, Pb shielding was used in this area and is known to shed Pb particles. Barium (Ba) has one of the higher limits and was selected for this reason. This leaves mercury, selenium, and cadmium (Hg, Se, and Cd) which have various action limits. There is no reason, given the volatility of Hg and Se and the mobility of Hg, to suspect that these would remain in the soil. In addition, Cd and the organic compounds are not expected to be present. Because it is more likely that Pb and Ba may be present in the soil, these metals were used to estimate the number of samples.

The following discussion shows, under a variety of assumptions of what the sample standard deviation might be, what sample sizes would achieve the desirable error rates ($\alpha = 0.10$, $\beta = 0.20$). In each table, the regulatory limit of an inorganic analyte is taken as the Action Limit. The sample standard deviation is varied to show the impact on sample size of the variability in the concentration.

For Pb:

Action Limit = 100 mg/kg for the TC based on total analysis
Δ = width of gray region (area of greater uncertainty and inability to determine with sufficient confidence that the site concentration is truly below the Action Limit)

Sample Size Determination for Lead Under Varying Assumptions

($\alpha = 0.10$, $\beta = 0.20$	$s = 5$	$s = 10$	$s = 20$	$s = 30$	
$\Delta = 20$ (20% of Action Limit)	2	6	11		s = 13.9* 3
$\Delta = 10$ (10% of Action Limit)	2	6	19	42	s = 6.9* 3

*Greatest standard deviation for which three samples meet the desired error rates.

For Ba:

Action Limit = 2000 mg/kg for the TC based on total analysis
Δ = width of gray region (area of greater uncertainty and inability to determine with sufficient confidence that the site concentration is truly below the Action Limit)

Sample Size Determination for Barium Under Varying Assumptions

($\alpha = 0.10$, $\beta = 0.20$	$s = 50$	$s = 100$	$s = 150$	$s = 300$	
$\Delta = 400$ (20% of Action Limit)	2	2	2	4	s = 278* 3
$\Delta = 200$ (10% of Action Limit)	2	2	4	11	s = 139* 3

*Greatest standard deviation for which three samples meet the desired error rates.

The sample sizes under these two examples imply that, if we are comfortable with $\alpha = 0.10$ and $\beta = 0.20$ and with a gray region equal to 20% of the Action Limit, then three samples are sufficient to meet the error tolerances under assumptions that the standard deviation for Pb will be 13.9 mg/kg or less, and that for Ba will be no larger than 278 mg/kg. These standard deviations are greater than the expected analytical variation based on current precision estimates. The added variation allows for heterogeneity of the soil. These seem like reasonable assumptions for the expected concentrations, implying that three samples is a reasonable sample size to propose. In order to achieve low standard deviations in analytical data, it is recommended that sample handling and preparation carefully follow approved standard operating procedures, and that blending of the composited segment of the core sample be done as thoroughly as possible. (However, note that the samples taken for analysis of volatile organics will not be blended or homogenized. Blending or homogenization would cause loss of volatile analytes.)

1.2.6.4 Transite Siding

Transite siding is known to be made of asbestos and may have both old and new paint. It will be evaluated by process knowledge.

2.0 QUALITY ASSURANCE PROJECT PLAN

2.1 PROJECT MANAGEMENT

The following section identifies the individuals or organizations participating in the project and discusses specific roles and responsibilities. This section also discusses quality objectives for measurement data and discusses special training requirements for staff performing the work.

2.1.1 Project and Task Organization

Figure 2-1 presents the organization chart for sampling/analysis and waste management interfaces to ERDF.

2.1.2 Roles and Responsibilities

This section identifies the responsibilities of various organizations supporting these remedial activities which collect, analyze, survey, or assess results of data for waste disposal.

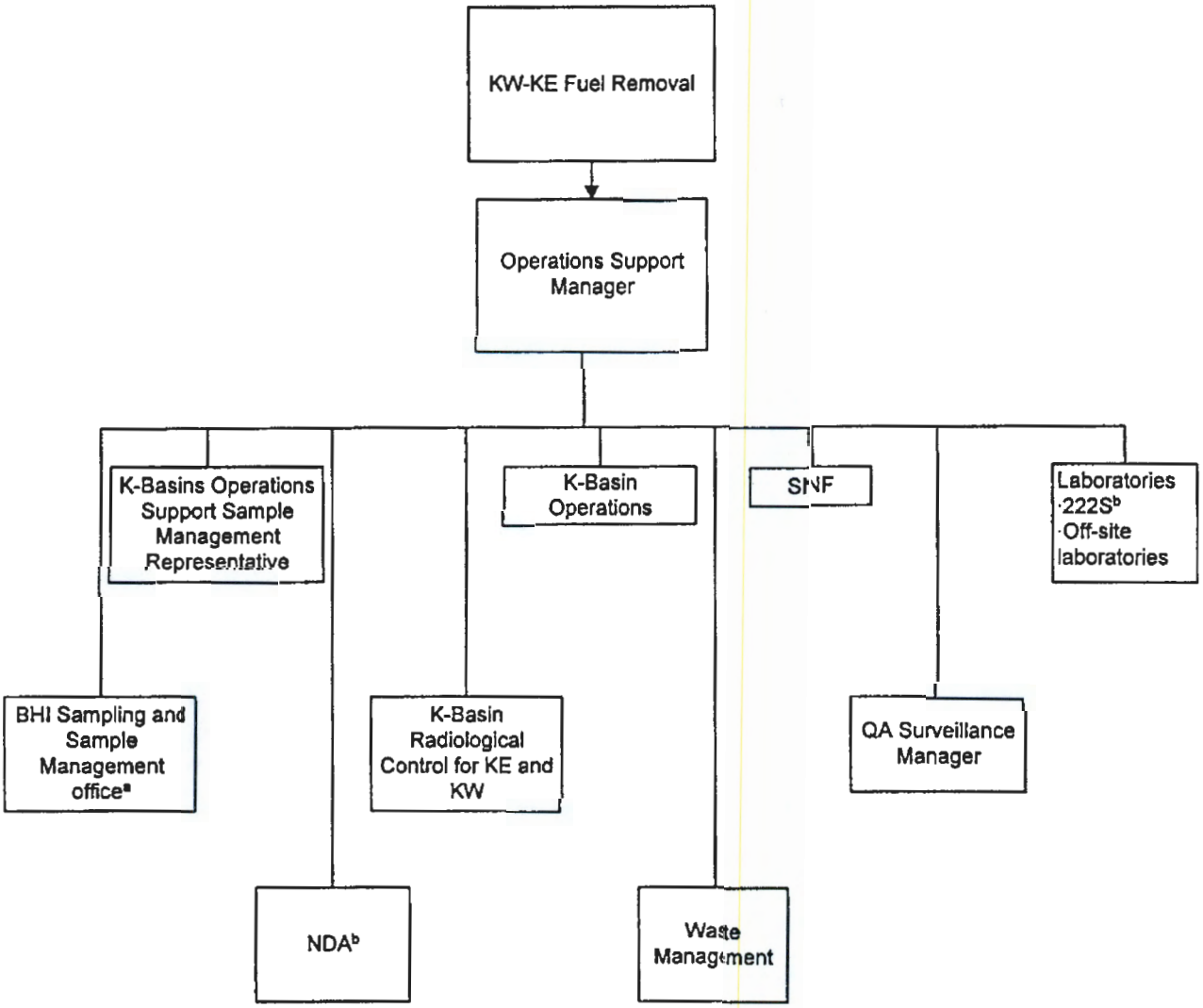
K Basin Operations Support Sample Management Representative (contingency only)

- Used for contingency sample management only
- Maintain operating procedures as custodian, and revise procedures (if necessary) to perform sampling that include collection, chain of custody, packaging, and shipping procedure
- Maintain sample analysis records in a 2-hour-rated fire resistant file cabinet
- Receive data packages
- Perform or contract data review
- Maintain copies of radiological survey records and assemble into files to support waste characterization and designation

Fluor Hanford, Inc. (FH) Nuclear Process Operators (Duties apply to Contingency Sampling only; do not apply to soil)

- Perform sampling for contingency sampling only
- Document sampling activities in a controlled logbook
- Initiate chain-of-custody documentation
- Package and ship samples to the specified laboratory

Figure 2-1. Sampling/Analysis and Waste Management Organization Chart



a BHI will collect, ship, and manage sample analysis other than contingency analysis
b Used for contingency analysis only

Specified Analytical Laboratory

- Adhere to and use procedures that are equivalent to those listed in Table 2-3, Sections 2.3, 2.6, 3.8, and 3.9
- Adhere to the latest revision of the *Hanford Analytical Quality Assurance Requirements Documents* (HASQARD)
- Receive samples and initiate internal chain-of-custody documentation
- Provide specified radiological or non-radiological analyses
- Provide specified data package to the Operations Support Sample Management Representative

K Basin Operations Support Manager (or designee) (contingency samples only)

- Oversees sample management program
- Authorizes new radionuclide ratios to be applied to waste, as needed
- Obtain additional analytical services such as NDA, if needed

FH Radiological Control Organization

- Conduct specified surveys and/or NDA
- Provide dose rate data for sample collection, packaging, and transportation or shipment to the laboratory used for contingency analysis discussed in Section 2.4
- Provide the Radiological Work Permit

Waste Management FH

- Review characterization data used to designate waste
- Provide shipping documentation to ERDF

ERDF Waste Management (Bechtel Hanford, Inc.[BHI])

- Designate waste based on survey/laboratory results and calculated radionuclide content
- Supply shipping containers for waste going to ERDF
- Dispose of waste that meets ERDF WAC in ERDF

Quality Assurance Organization

- FH quality assurance (QA) and BHI QA have the option to conduct random surveillances to verify compliance with requirements of this plan

Environmental Restoration Contractor (ERC) Analytical and Field Services

- CH2M Hill Hanford/BHI will collect only the soil samples
- Manage the logistics of obtaining soil analyses from offsite laboratories
- BHI will not perform contingency sampling or analyses

2.1.3 Special Training Requirements/Certification

Hazards associated with radiation and radiological contamination are well known and documented for the K East and K West Areas. The *Hanford Site Radiological Control Manual* (HSRCM) (DOE-RL 1996) addresses worker training requirements, visitor training and escort requirements, dosimetry, monitoring, posting, and required radiological surveillance. The specific training required by 29 CFR 1910.120 is implemented by the HSRCM. Training requirements for this project are discussed in Section 7 of the *K-Basins Interim Remedial Action Health and Safety Plan* (HASP) (HNF 2000b). Project-specific training requirements and references are discussed below.

In the event that a worker may have a reasonable possibility of exposure to hazardous chemicals while performing a specific remediation task in the K East or K West Area, the worker's supervisor will ensure that the worker has the appropriate level of training, in accordance with 29 CFR 1910.120, before the work is performed.

SNF Project Administrative Procedure RP-14-004, "Radiological Area Access Control," defines training requirements for various circumstances applicable to entry into K Basins. Training requirements in this procedure apply to all individuals who are required to have access to the K Basins.

Job-specific training requirements for SNF Project personnel are outlined in Procedure TN 8-001-08, "General Training Administration." This procedure covers facility orientation training, Hanford General Employee Training, facility emergency plan, SNF Project orientation, initial and continuing training, on-the-job training, required reading and drills. The training requirements for each employee are determined using a graded-approach and are documented in the appropriate Training Matrix.

All visitors, general employees, or members of the public, will have training or instruction before entry to the K Basins according to the requirements of SNF RP-14-004.

2.1.4 Quality Objectives and Criteria for Measurement Data

The QA objective of this plan is to develop implementation requirements that will provide data of known and appropriate quality. Data quality is typically assessed by representativeness, comparability, accuracy, precision, and completeness. These parameters are described below. The applicable quality control (QC), 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 analytical method. A summary of COCs for each waste stream is provided in Table 1-6 of the DQO document (HNF 2001b). The analytical methods and laboratory detection limits for soil samples that will be measured are presented in Table 2-3; sample size and holding times are provided in Table 3-4. Table 2-4 provides the same information for radionuclide contingency samples. The COCs that are not listed in these tables will be estimated based on radionuclide ratios in the waste as discussed in Section 2.2. QC parameters of accuracy and precision that will be applied to soil or

contingency characterization samples are presented in Table 2-3. The nomenclature used to describe quality parameters is discussed below.

Representativeness is a measure of how closely measured results reflect the concentration of constituents distributed in the sample matrix. Sampling plan design, sampling techniques, and sample handling protocols (e.g., storage, preservation, and transportation/shipping) have been developed and are discussed in later sections of this document. Documentation will establish that protocols have been followed and sample identification and integrity are ensured.

Comparability expresses the confidence with which one data set can be compared to or used with another data set. Data comparability will be maintained by using standard documented procedures, consistent methods, and data reporting units. Analytical methods and target detection limits are listed in Table 2-3. Actual detection limits will depend on the sample matrix, constituent, and test portion and will be reported as defined for the specific samples. Detection limits are functions of the analytical method utilized to provide the data and the test portion analyzed. For the soil analyses and contingency sampling, sufficient amounts of sample material are expected to be available. In addition, for radiological analyses, sufficient radionuclide activity to perform the analyses also is expected.

Accuracy is an assessment of the closeness of the measured value to the true value. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. A matrix spike is the addition to a sample of known amounts of a standard compound similar to the compounds being measured. Radionuclide measurements that require chemical separations often use this technique to measure method performance. For radionuclide measurements that are analyzed by gamma spectroscopy, laboratories typically compare results of Laboratory Control Samples against known standards to establish accuracy. Usually, only a few target analytes are selected for QC analysis for gamma spectroscopy (e.g., Cs-137, cobalt-60). Calibrations are evaluated by comparing results from measurements of check standards to known values and/or by generation of in-house statistical limits. Table 2-3 lists the accuracy targets for laboratory analyses for the project.

Precision is a measure of the data spread when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements or as the relative standard deviation for other multiples. Precision targets for laboratory analyses are listed in Table 2-3.

Completeness is a comparison of the valid data required to the amount of valid data obtained from the analytical measurement process and the complete implementation of defined field procedures. The completeness objective for this SAP is 100%. Completeness will be assessed by waste stream on an analyte-specific basis. If the completeness objective is not met, additional samples will be collected and analyzed.

2.1.5 Documentation and Records

Field logbooks contain area and task-specific information. Field logbooks that are used during collection of samples for waste characterization will be identified as a quality record and will be maintained as such.

Maintenance of field documents will be in accordance with the HASQARD (DOE-RL 1998) Volume II, "Sampling Technical Requirements," Section 4.1.2, "Field Logbook," or equivalent.

2.2 SURVEY/DATA ACQUISITION

The following sections present the logic and requirements for radiological survey. The radiological dose rate survey data will be used to guide selection of sample points in the underlying soil after removal of the concrete pad.

Waste generated by this removal activity and deemed appropriate for shipment to ERDF will be processed to comply with ERDF WAC (BHI 1998) and packaged according to Procedure OP-46-006 ("Processing Contaminated Waste for ERDF Disposal").

Packaged waste will be surveyed according to appropriate instrument procedures to assure that the outside of the waste debris /soil package meets surface contamination limits. The survey will be documented per HNF-PRO-1892 ("Documentation of Radiological Surveys"), and shipped to ERDF where it will be weighed. The weight of the waste package will be used to estimate the Cs-137 curie content of the debris waste streams as discussed below. Soil will be analyzed for Cs-137 curie content as discussed in Section 2.3. Utilizing the ratios of the COCs to Cs-137 as discussed in Section 2.2.1, the radionuclide content of both debris and soil will be estimated.

If the waste is determined to be anomalous (as defined in Section 2.2.3), it will be set aside and may be subjected to sampling and analysis. The approach for contingency sampling is discussed in Section 2.4 of this SAP. The sections below address requirements for instrument calibration and maintenance, and data management.

2.2.1 Debris Weight-to-Cs-137 Curie Conversion

The weight-to-curie relationship that will be utilized for K Basin waste is based on the dose-to-curie relationships found in methods discussed in WHC-SD-WM-PROC-020 ("Procedure for Categorizing and Inventorying Waste in Standard Containers" [WHC 1996e]). The technical basis for this procedure is presented in WHC-SD-WM-RPT-267, "Basis for Dose Rate to Curie Assay Method" (WHC 1996a). Briefly, the method utilizes a family of curves that relate the measured dose rate (R/hr) to the Cs-137 curie content of the waste. Although the technical basis document (WHC 1996a) was prepared for tank waste, the basic premise of the document is that the major contributor to the measured dose rate is Cs-137. That same premise is appropriate for the K Basin debris. Although other gamma emitters do exist in the K Basin debris, the most common (cobalt-60, europium-152, europium-154, and europium-155) generally are less than 10% of the Cs-137 content. By using the conservative assumption that all measured dose rate is from Cs-137, other gamma-emitting radionuclides, if present, would be led to an overestimation

of the Cs-137 content of the waste. All other radionuclides will be estimated based on use of specific ratios of COC radionuclides to Cs-137 for the waste in question. Thus, the final estimated radionuclide content would likely be overestimated if gamma-emitting radionuclides were present in greater abundance than anticipated.

A review of the past K Basin waste disposal records was performed to develop a correlation between Cs-137 concentrations and the weights of the various waste streams, "Documentation of K Basin Waste Determination Based on Cs-137 Concentration in Ci/Kg" (SNF 2001). This relationship was then utilized with the scaling factors from the SAP to determine the radionuclide concentrations.

The review consisted of looking at waste data from 1996 through early 2000 and comparing Cs-137 concentrations from each of the waste streams from K East and K West.

In late 1999, a change in the nuclide determination methodology was made and the dose-to-curie models were updated. This resulted in three orders of magnitude increase in waste Cs-137 concentration. In reviewing the data, the higher Cs-137 information was used to make the comparison.

The basis for the Cs-137 concentrations applied to the waste determinations prior to mid-1999 came from the report, "Characterization of Radioactive Waste at 100-N," (WHC 1990). The methodology utilized after mid-1999 is identified in WHC-SD-WM-RPT-267, "Basis for Dose to Curie Assay Method," (WHC 1996a). This later method is recommended in the "Sampling and Analysis Plan for K-Basins' Debris" (HNF 2000e).

The waste containers chosen to make the Cs-137 Ci/kg relationship were those that the Cs-137 concentrations in the waste were developed after mid-1999.

A Cs-137 waste concentration was developed by performing the following steps:

- Waste information was obtained from the Solid Waste Information Tracking System and placed on an Excel spreadsheet. The data was then sorted to just provide Cs-137 waste concentration. The data was then further sorted into three waste streams, K East Above Water, K East Below Water and K West Above Water.

- The K East and K West Above Water Waste was then sorted into those containers classified before September 1999 and those classified after September 1999. This allowed a statistical review of the data.

- The mean standard deviation for Cs-137 and container weight of each set of data was determined. A 95% confidence level of the data was used to identify an upper limit for the waste. The Cs-137 concentration was determined to be the mean Cs-137 concentration of the waste plus 1.96 standard deviation of the Cs-137 concentration. The Cs-137 concentrations are presented in Table 2-1.

- The Cs-137 concentration was then used to determine the COCs radionuclides using scaling factors identified in the "Sampling and Analysis Plan for K-Basin's Debris" (HNF 2001a). These radionuclides were then compared against the ERDF WAC.

Table 2-1. Cs-137 Concentration in K Basin Waste Streams

Waste Stream	Cs-137 Concentration (Ci/Kg)
K East Above Water	1.12 E-5
K West Above Water	8.51 E-6

2.2.2 Cs-137 Curie-to-Radionuclide Content Estimate for Waste

In previous work (HNF 2001a), a final list of COCs was generated for waste disposal from K East and K West. The logic and approach for selecting the final list of COCs are discussed in Appendix A of the Debris External to the Basins Removal DQO (HNF 2001b) and Appendix A of this document. The COCs appropriate for these removal actions at K East and K West would be the same as those estimated for the above water waste from the basins. As discussed in the previous documents (HNF 2000e, HNF 2001a), the source of radionuclides in the above water waste in the K Basin is ultimately N Reactor fuel rods. The mechanism for deposition of contamination on above water waste is also discussed and is mainly dried Fuel Basin water and incidental sludge particles that might adhere to equipment and filters that are removed from the basin.

As discussed in the DQO for this project, the source of radionuclides on, around, and under the pads is basically the same as for the K East and K West above water debris, and the same list of COCs will be used. For debris waste streams, the Cs-137 content will be estimated through weight-to-curie conversions that are discussed above. The ratios of various COCs to Cs-137 have been estimated based on review of available analytical data and computer calculations of estimated content of fuel and sludge from the basins (HNF 2001a). Table 2-2 lists the calculated ratios. The same ratios are assumed to apply to this project. The following sections discuss the use of estimated ratios to characterize waste.

2.2.3 Anomalous Waste

Two anomalies may result. One is based on visual examination of the debris and the other is based on the concentrations radiological and non-radiological contaminants that result after applying the methodologies (e.g., weight-to-curie estimates) or analytical data results to the waste.

A visual examination of the debris will be performed. If anything other than concrete debris including rebar, steel debris, Transite siding debris, soil, or asphalt is included, it will be set aside and the survey and sampling approach will be revisited. An alteration in the waste profile may be needed.

The radiological and non-radiological data obtained on the soil will be evaluated. For radiological data, if the ratios of individual gamma emitters (Co-60, Sb-125,Eu-152, Eu-154, Eu-155, Am-241) to Cs-137 exceed the percentages listed in Table 2-2, the soil samples will be

analyzed for the remaining radionuclides listed in Table 2-3. In addition, the waste may be considered anomalous. The percentages listed in Table 2-2 represent the highest percentage of ratio from available data that was applicable to the basins above water debris, thus all of the current waste should fall within that profile. The anomalous waste will be segregated until the additional radionuclide data are available. Alternative survey/sampling and profiling will be performed as needed.

It should be noted that professional judgment will be used to evaluate the GEA data with regard to detection limits and analytical error. If it is determined that the observed exceedance of ratios in Table 2-2 is likely due to random statistical fluctuations as a result of low levels of radionuclide in the waste, no additional analyses or revision of ratios will be performed.

Table 2-2. Summary List of Radionuclide Contaminants of Concern and Ratios to Cs-137 for K East and K West Debris and Soil

Radionuclide Name	Radionuclide Symbol	Chosen Ratio for K West Debris and Soil	Chosen Ratio for K East Debris and Soil
Tritium	H-3	7.1%	0.090%
Cobalt	Co-60	3.2%	1.0%
Nickel	Ni-63	0.26%	0.34%
Strontium	Sr-90	10%	103%
Antimony	Sb-125	0.16%	0.16%
Cesium	Cs-137	100%	100%
Promethium	Pm-147	2.0%	2.3%
Samarium	Sm-151	1.3%	1.4%
Europium	Eu-152	0.0068%	0.062%
Europium	Eu-154	0.72%	1.4%
Europium	Eu-155	0.13%	0.45%
Uranium	U-234	0.0075%	0.027%
Uranium	U-235	0.0010%	0.0046%
Uranium	U-238	0.0062%	0.021%
Plutonium	Pu-238	0.11%	2.1%
Plutonium	Pu-239	0.90%	13%
Plutonium	Pu-240	0.87%	5.1%
Plutonium	Pu-241	7.7%	197%
Americium	Am-241	0.77%	17%
Curium	Cm-244	0.0084%	0.013%

In addition to the gamma ratios, any waste for which the estimated radionuclide content is greater than 100 nCi/g total TRU or greater than Class C limits (10 CFR 61.55) will be set aside for possible sampling and analysis. The methodologies for estimating the individual radionuclides (weight-to-curie and soil analysis) are considered sufficiently conservative such

that the decision level will be 100 nCi/g total TRU radionuclides. If sampling is required, the path forward must be developed because this contingency is not within the scope of the DQO process for this removal project. The path forward will have input from EPA, DOE, FH, and ERDF representatives. If a more precise measurement of the waste is not obtained, or if measurements confirm that the waste is potentially TRU, the waste cannot be disposed at ERDF and an alternate disposition pathway must be identified.

2.2.4 Radiological Survey Methods/QC Requirements

Surveys of the surface of the waste packages will be performed (as appropriate) to the criteria discussed in Procedure OP-46-006 to determine if waste packages can be removed from the initial staging area and placed in a bulk waste container. Radiological protection technicians will perform surveys and obtain smears from the surfaces of waste packages (typically wrapped or bagged in plastic) to assess compliance with the criteria in Procedure OP-46-006. It is anticipated that due to contamination levels on the waste and the general background in the bagging area, smears of waste package surfaces may be required before removal from the staging area. Appropriate scan speeds, survey techniques, and smear counting procedures are referenced in the instrument specific procedures that will be used (see Section 2.2.4.1).

2.2.4.1 Radiological Surveys

Radiological surveys of the outside of waste packages for radiological control purposes and to comply with ERDF waste surface contamination acceptance criteria will be performed as appropriate and reported according to the following procedures:

- OP-46-006
- HNF-PRO-1892

The instruments used will be as required by the procedures:

- Beta/gamma survey meter, "GM Portable Survey Instrument," HNF-PRO-632
- Dose rate meter, "Eberline RO-3B (CP)," HNF-PRO-648
- Alpha survey meter, "Portable Alpha Meter," HNF-PRO-633

2.2.4.2 QC Requirements for Radiological Surveys

QA is necessarily built into each phase of the characterization as field instrument operational checks that monitor field instrumentation performance.

Alpha, beta/gamma surveys, and dose rate measurements may be used. Instruments will be calibrated against known standards representative of the instrument response to the identified analyte. The instrument will be within the calibration period specified by the instrument procedure.

QC measures taken to support field operations performance, including daily calibration checks, will be performed and documented on each instrument used to survey or characterize waste. These checks will be performed as defined in the appropriate instrument procedure.

2.2.4.3 Instrument Testing, Inspection, and Maintenance Requirements

Measurement and testing equipment used in the field will be subject to acceptance testing and preventative maintenance measures to ensure minimization of measurement system downtime. Maintenance requirements, such as parts lists and instructions, and documentation of routine maintenance, will be performed according to the general program procedure ("Radiation Protection Instrument Program," HNF-PRO-436), as well as any additional measures that are specified in the specific instrument procedure referenced in Section 2.2.4.1.

2.2.4.4 Instrument Calibration and Frequency

Instruments used for surveys and screening for off-site sample shipment will be calibrated in accordance with HNF-PRO-436. The results from all instrument calibration activities shall be recorded as defined in the program procedure. Control documents must specify when the instrument was last calibrated, the results of that calibration, and the due date for new calibration.

2.2.4.5 Inspection/Acceptance Requirements for Supplies and Consumables

Procurement activities related to radiological survey will be limited to performing acceptance testing for all instruments and standards used as described in the program procedure (HNF-PRO-436) and specific instrument procedures.

2.2.4.6 Field Survey Documentation

Field documentation will be kept in accordance with HNF-PRO-1892.

2.2.5 Waste Handling and Custody Requirements

All waste handling, shipping, and custody requirements will be met in accordance with Procedure OP-46-006, "Processing Contaminated Waste for ERDF Disposal."

In addition, radioactive waste will be surveyed for shipment in accordance with HNF-PRO-1892. Radiological survey tags will be attached to individual bags of waste until they are placed in a larger container, such as a drum or box. The survey tags from bags that go into a larger container will be retained in order to provide a record of the surveys and associated estimate of curie content of the waste.

2.2.6 Waste and Sample Packaging for Shipping/Transportation

Waste and contingency sample packaging for shipping/transportation will be performed in accordance with procedure OP-46-006, "Processing Contaminated Waste for ERDF Disposal." The contingency samples or waste will be shipped/transported according to the procedure HNF-PRO-157, "Radioactive Material/Waste Shipments."

The following applies only to contingency samples discussed in Section 2.4. The current process is that for samples transported to onsite laboratories, unused samples are sent back to the generator. For samples shipped offsite, unused samples are not returned. The contracts with offsite laboratories specify that the laboratory disposes of any remaining sample and the waste associated with analysis.

Section 3.0 discusses BHI procedures for shipping samples that apply to soil.

2.3 K BASIN SOIL SAMPLING FOR WASTE DESIGNATION

2.3.1 Sampling Approach for Radiological Analyses

Soil sampling will occur after removal of the concrete pad. Since anecdotal information indicates that the K East pad was placed on soil that contained low-level radiological contamination, the approach is biased to sample the areas of highest radiological contamination. Initially a dose rate or other applicable survey of the surface soil will be performed. The survey will use the same grid that is established for non-radiological sampling. Survey results will be reported on a standard SNF Project Radiological Survey Report Form (BD-6002-600).

At each of three locations at K East containing the highest instrument reading (e.g., mR/hr), a sample will be collected to be analyzed as discussed in Section 3.1. The details of sample collection are discussed in Section 3.0. Because soil from the surface to a maximum 4.5 ft depth will be removed for disposal, either a shovel, hand auger, backhoe, or bulldozer will be used for sample collection through the entire interval for Options 1 and 2, and a clean shovel used for each of three samples for Option 3, followed by homogenizing the soil and bottling for shipment to the standard fixed laboratory (SFL). This approach will be repeated for each sampling location.

2.3.2 Sampling Approach for Non-radiological Analyses for Soil Samples

The details of sample collection are discussed in Section 3.0 For all three options, all non-rad analyses will be the same and will be those analytes, methods, and PQLs listed in Table 2-3.

For the samples for the non-radiological analytes (i.e., metals, volatile organic compounds (VOCs), semi-volatile organic compounds, pesticides, and herbicides), a triangular grid will be drawn and random samples collected (Options 1 and 2) or one sample will be collected from each of three randomly numbered bags (Option 3). Past data from soil in the 100 Area have indicated no correlation between radiological and non-radiological contaminants; therefore, a random sampling will be representative of the waste.

For samples for all analytes except VOCs, the following approach will be used at each sampling point for options 1 and 2. Because soil from the surface to a maximum 4.5 ft depth will be removed for disposal, either a shovel or hand auger will be used for sample collection, followed by homogenizing the soil from the surface to a depth of 4.5 ft or homogenizing subsamples from a given bag and bottling for shipment to the SFL.

For samples for VOCs, from each shovel or hand auger, small portions of soil from throughout the interval to be excavated (i.e., surface to 4.5 ft) or small portions from the bag will be placed in the jar for volatile organic analyses. No homogenizing will be performed.

2.3.3 Soil Sample Handling and Custody Requirements

Sample handling, shipping and chain-of-custody requirements are discussed in Section 3.0.

2.3.4 Soil Sample Preservation, Containers and Holding Times

Preservatives, containers, and holding times are discussed in Section 3.0.

2.3.5 Soil Sample Shipping

Requirements are described in Section 3.0.

2.3.6 Soil Survey Radionuclide Survey Measurements

Requirements are described in Section 3.4

2.3.7 Standard Fixed Laboratory Measurements for Soil Samples

The laboratory shall adhere to HASQARD and shall adhere to Chapter 1 of SW-846 and the QC described in the SW-846 methods. Exceptions to the two cited documents shall be pre-approved by FH and by ERDF before analyses shall begin.

Parameters for soil analysis are listed in Table 2-3. Laboratory-specific standard operating procedures (SOPs) for analytical methods are in place. Laboratory SOPs and QA Plans to be used include Analytical Procedures and QA Plans that have previously been reviewed and approved by BHI contracts with off-site analytical laboratories. Changes or additional methods identified during future engineering or planning will be presented in page changes, addenda, or revisions to this SAP as appropriate. Detection limits achievable by the laboratory will be dependent on sample quantity available and also may be affected by the matrix and radionuclide activity levels of the sample. Two of the radionuclide COCs (Pm-147 and Sm-151) are not listed in Table 2-3 because there are no established analytical procedures to analyze them. These radionuclide COCs will be estimated based on the established COC ratios to Cs-137.

For all organic laboratory analyses, actual standards of each compound or Aroclor will be used to calibrate the equipment. The number of standards of varied concentrations used in the

calibration curve will be that required by SW-846 method cited in Table 2-3. Tentatively Identified Compounds analysis cannot be substituted for the use of the actual calibration standards required by the organic method specified in Table 2-3.

Table 2-3. Analytical Performance Requirements (3 pages)

Waste Stream	Constituent of Concern	Action Level		Action Level for total analysis	Analytical Method[1]/ Technique	Requirements		
						PQL	Accuracy as Spike Recovery (%)	Precision as RPD (%)
		mg/Kg		*mg/Kg*		*mg/Kg*		
Soil	PCBs[2]	500		500	8082	0.0165	70 - 130	± 30
	HOCs (halogenated organic compounds)[3]	<1000		<1000	NA	NA	NA	NA
	Radionuclides[4]	*pCi/g[4]*				*pCi/g*		
Soil	H-3 (tritium)	NL		NA	LSC	400	70 - 130	± 30
	Co-60	NL		NA	GEA	0.05	NA	± 30
	Ni-63	4.38E+08		NA	Sep/LSC	30	70 - 130	± 30
	Sr-90	4.38E+09		NA	GPC	1	70 - 130	± 30
	Sb-125	NL		NA	GEA	0.3	70 - 130	± 30
	Cs-137	2.00E+07		NA	GEA	0.1	70 - 130	± 30
	Eu-152	1.31E+13		NA	GEA	0.1	NA	± 30
	Eu-154	NL		NA	GEA	0.1	NA	± 30
	Eu-155	NL		NA	GEA	0.1	NA	± 30
	U-234	4.64E+04		NA	AEA	1	70 - 130	± 30
	U-235	1.69E+03		NA	AEA	1	70 - 130	± 30
	U-238	7.50E+03		NA	AEA	1	70 - 130	± 30
	Pu-238	1.00E+05		NA	AEA	1	70 - 130	± 30
	Pu-239	1.81E+04		NA	AEA	1	70 - 130	± 30
	Pu-240	1.81E+04		NA	AEA	1	70 - 130	± 30
	Pu-241	3.88E+06		NA	LSC	15	75 - 125	± 30
	Am-241	3.12E+04		NA	AEA	1	70 - 130	± 30
	Cm-244	1.00E+05		NA	AEA	1	70 - 130	± 30
	TC metals[5]	*TC*	*LDR*					
		mg/L TCLP		*mg/Kg[5,6]*		*mg/Kg*		
Soil	As	5.0	5.0	100	6010	10	70 - 130	± 25
	Ba	100.0	21.0	420	6010	20	70 - 130	± 25
	Cd	1.0	0.11	2.2	6010	0.5	70 - 130	± 25
	Cr	5.0	0.6	12	6010	1	70 - 130	± 25
	Pb	5.0	0.75	15	6010	10	70 - 130	± 25
	Hg	0.2	0.025	0.5	7471	0.2	70 - 130	± 25
	Se	1.0	5.7	20	6010	10	70 - 130	± 25
	Ag	5.0	0.14	2.8	6010	2	70 - 130	± 25

Table 2-3. Analytical Performance Requirements (3 pages)

Waste Stream	Constituent of Concern	Action Level		Action Level for total analysis	Analytical Method[1]/ Technique	Requirements		
						PQL	Accuracy as Spike Recovery (%)	Precision as RPD (%)
		TC	*LDR*					
	TC organics[5]	*mg/L TCLP*	*mg/Kg*	*mg/Kg*[5,6]		*mg/Kg*		
Soil	Endrin	0.02	0.13	0.13	8081	0.0033	70 - 130	± 30
	Lindane	0.4	0.066	0.066	8081	0.00165	70 - 130	± 30
	Methoxychlor	10	0.18	0.18	8081	0.0165	70 - 130	± 30
	Toxaphene	0.5	2.6	2.6	8081	0.165	70 - 130	± 30
	2,4-D (2,4-Dichlorophenoxy-acetic acid)	10	10	10	8151	0.4	70 - 130	± 30
	2,4,5-TP (Silvex)	1	7.9	7.9	8151	0.02	70 - 130	± 30
	Benzene	0.5	10	10	8260	0.005	70 - 130	± 30
	Carbon tetrachloride	0.5	6	6	8260	0.005	70 - 130	± 30
	Chlordane	0.03	0.26	0.26	8081	0.0165	70 - 130	± 30
	Chlorobenzene	100	6	6	8260	0.010	70 - 130	± 30
	Chloroform	6	6	6	8260	0.05	70 - 130	± 30
	o-Cresol	200	5.6	5.6	8260	0.33	70 - 130	± 30
	m-Cresol	200	5.6	5.6	8260	0.33	70 - 130	± 30
	p-Cresol	200	5.6	5.6	8260	0.33	70 - 130	± 30
	Cresol (total)	200	na	11.2[7]	8260	NA	70 - 130	± 30
	1,4-Dichlorobenzene	7.5	6	6	8260	0.33	70 - 130	± 30
	1,2-Dichloroethane	0.5	6	6	8260	0.005	70 - 130	± 30
	1,1-Dichloroethylene	0.7	6	6	8260	0.01	70 - 130	± 30
	2,4-Dinitrotoluene	0.13	140	2.6	8270	0.33	70 - 130	± 30
	Heptachlor (and epoxide)	0.008	0.066	0.066	8081	0.00165	70 - 130	± 30
	Hexachlorobenzene	0.13	10	2.6	8270	0.33	70 - 130	± 30
	Hexachloro-1,3-butadiene	0.5	5.6	5.6	8270	0.33	70 - 130	± 30
	Hexachloroethane	3	30	30	8270	0.33	70 - 130	± 30
	Methyl ethyl ketone	200	36	36	8260	0.01	70 - 130	± 30
	Nitrobenzene	2	14	14	8270	0.33	70 - 130	± 30
	Pentachlorophenol	100	7.4	7.4	8270	0.33	70 - 130	± 30
	Pyridine	5	16	16	8270	0.66	70 - 130	± 30
	Tetrachloroethylene	0.7	6	6	8260	0.005	70 - 130	± 30
	Trichloroethylene	0.5	6	6	8260	0.005	70 - 130	± 30

Table 2-3. Analytical Performance Requirements (3 pages)

Waste Stream	Constituent of Concern	Action Level		Action Level for total analysis	Analytical Method/ Technique	Requirements		
						PQL	Accuracy as Spike Recovery (%)	Precision as RPD (%)
	2,4,5-Trichlorophenol	400	7.4	7.4	8270	0.33	70 - 130	± 30
	2,4,6-Trichlorophenol	2	7.4	7.4	8270	0.33	70 - 130	± 30
	Vinyl chloride	0.2	6	4	8260	0.01	70 – 130	± 30

1 Analytical methods are from SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," (EPA 1997, as amended).

2 The TSCA action limit is 50 ppm total Aroclors for soils. However, ERDF may accept higher PCB concentrations for solid materials.

3 The total halogenated organic carbon action level is from the ERDF WAC. This is calculated from the halogenated organics measured by SW-846 Methods 8260 and 8270.

4 The individual radionuclide limits are from Table 3 of the ERDF WAC. They have been converted from Ci/m^3 to pCi/g by assuming that the bulk density of the waste is 1.6 g/cm^3. Where there are two or more radionuclides present in the waste, the "sum of fractions" method (10 CFR 61.55) shall be used to determine acceptability. This will ensure that the integrated inventory is below TRU and class C limits.

5 Total metals and organics will be determined. This is allowed by the regulations (see Method 1311) and will facilitate a rapid turnaround time for analysis. The resulting totals (in mg/Kg) can be compared to the "Action Level for total analysis" in this table or, if applicable, the total can be divided by 20 and compared to the Action Level in the TCLP extract (in mg/L). The factor of 20 is derived from the leachate to sample ratio in the TCLP Method 1311.

6 These values represent either the TC action level or the LDR action level, whichever is the lowest concentration.

7. ERDF WAC (BHI 1998) for total cresol.

2.3.8 Radiological Field Survey QC

Daily calibration checks will be performed and documented on each survey instrument. Instrument response checks will be made with a known standard in accordance with FH procedures.

2.3.9 Field and Laboratory QC Requirements for Soil Samples

Definitions of QC requirements are presented in HASQARD (DOE-RL 1998) and Chapter 1 of SW-846 (EPA 1997). Control samples for field work may include:

- Field equipment blanks will be collected to assess the cleanliness of the sampling equipment and only apply if equipment is reused between events. Therefore, if applicable, equipment blanks will be collected in the field using clean silica sand passed through decontaminated sampling equipment prior to reuse of the equipment. The blank will be analyzed for the same radionuclides and chemical analytes as actual samples collected during the use of the equipment. At least one equipment blank will be collected during sampling for each type of equipment.

- Field duplicates are two samples of the same matrix being sampled. Field duplicates are analyzed independently and provide information concerning the homogeneity of the matrix. At least one field duplicate for each analysis will be submitted.

Control measures taken to monitor laboratory performance are:

- One laboratory method blank for every 20 samples (5% of samples), analytical batch or sample delivery group (whichever is most frequent) 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 (LCS) or blank spike will be performed for every batch of samples for each analytical method criteria to monitor the effectiveness of the sample preparation process. The LCS will be carried through the preparation and analysis procedure. Since soil is the matrix of interest, clean sand or water may be used for the LCS. The results from the analyses are used to assess laboratory performance.

- A matrix spike sample will be prepared and analyzed for every 20 samples (as applicable to method) of the same matrix or sample preparation batch, whichever is most frequent. The matrix spike results are used to document the bias of an analytical process in a given matrix.

- Laboratory duplicates or matrix spike duplicates will be used to assess precision and will be analyzed at the same frequency as the matrix spikes. These will be carried through preparation and analysis.

2.3.10 Instrument/Equipment Testing, Inspection, and Maintenance

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventative maintenance measures that ensure minimization of measurement system downtime and avoids inconsistencies in instrument performance.

Laboratories and onsite measurement organizations must maintain their equipment. Instrument preventative maintenance consists of routine inspections, instrument maintenance, and corrective actions. Preventative maintenance is performed in accordance with a schedule based on manufacturer's recommendations, instrument performance history, and usage. Each instrument has a logbook to record maintenance events with date and name of person performing the maintenance. The logbook includes routine inspections, significant corrective actions, instrument maintenance, and repairs.

Spare parts inventories help ensure minimal loss of analytical capability. Spare parts include day-to-day consumables and manufacturers recommended spare parts.

2.3.11 Instrument Calibration and Frequency

Laboratory measurement systems are subject to calibration and/or calibration verification before use for sample analyses. For all organic laboratory analyses, actual standards of each compound or Aroclor will be used to calibrate the equipment. The number of concentrations of the standards used in the calibration curve will be that required by the relevant SW 846 method cited in Table 2-3. Tentatively Identified Compounds analysis cannot be substituted for the use of the actual calibration standards required by the organic method specified in Table 2-3. Calibrations are conducted in accordance with the specific analytical methods performed and in the applicable laboratory QA Plan.

Instruments that fail acceptance criteria shall be investigated and re-calibrated. Instruments are not allowed to be used for sample analysis until they meet acceptance criteria. The responsible chemist or manager is required to take corrective action when measurement systems fail calibration QC criteria.

2.3.12 Inspection/Acceptance Requirements for Supplies and Consumables

FH's procurement activities will be limited to providing BHI Procurement with requisitions to provide sampling and analysis. All subject activities will meet the requirements of BHI Procurement procedures found in BHI-PR-01, "ERC Procurement Procedures."

The lot number from the manufacturer-certified, pre-cleaned sample containers is recorded in the sampler's logbook.

2.4 CONTINGENCY ANALYSES

The primary purpose of contingency sampling and analysis is to verify radionuclide ratios. The purpose of verifying the radionuclide ratios may be to demonstrate that a waste is or is not anomalous. Contingency sampling and analysis will be performed and managed by FH. Determination of anomalous waste is discussed in Section 2.2.3. In addition, samples may be collected and analyzed from locations where conditions suggest unusual conditions exist; for example, if staining is present or anomalous materials are found as discussed in Section 2.2.3. These samples should be analyzed for the constituents listed in Table 2-3.

2.4.1 When Contingency Analyses May Be Required

Contingency analyses may be required if the measured gamma ratios fall outside the target range of Table 2-2 and/or the waste is determined to be anomalous as discussed in Section 2.2.3. Contingency analyses also could occur if the waste is designated as potential TRU waste utilizing the weight-to-curie conversion factors previously discussed. Before conducting contingency sampling, K Basin project staff will determine if there are cost-effective alternatives. If contingency sampling and analyses are chosen, a path forward will be developed by EPA, DOE, FH, and ERDF representatives. Sections 2.4.2 through 2.4.9 discuss the anticipated approach to contingency sampling and analyses. The details of the approach may vary depending on the selected vendor and specific waste to be sampled. If conducting a

contingency sampling effort, involvement of representatives from ERDF will ensure that the proposed process will provide acceptable data for waste designation.

2.4.2 Contingency Sample Locations, Handling, and Custody Requirements

Waste that has been determined to require sampling will be staged in a controlled area while the path forward is developed. If required, contingency sampling will occur on a representative sample of the waste in the package that is being sampled. The purpose of the contingency sampling is to determine the appropriate representative radionuclide ratios to Cs-137 through radiochemical analysis or the presence of contaminants that were not anticipated.. It is recommended that beta/gamma and/or alpha survey instruments be used to select a piece of the waste that exhibits a relatively high count rate. This will ensure that adequate contamination is available so the analyses will not be reported as "less-than values."

K Basin operators will be responsible for contingency sample collection, packaging and shipment of samples to the selected laboratory. Any sampling will be conducted in accordance with the guidance presented in HASQARD, Volume II, Section 4.0 and will address the following activities:

- Sample Identification
- Chain of Custody
- Sample Packaging
- Sample Shipment
- Field Logbooks

2.4.3 Contingency Sample Preservation, Containers, Size, and Holding Times

For radionuclide contingency sampling, preservation is not applicable to the debris or soil samples. Certified clean plastic or glass containers are not necessary for sample collection. Any clean container may be used. It is recommended that at least 500 g of sample be collected in two or more bottles. This will provide a backup sample if needed. The laboratory requires that the waste be cut into pieces of 1 to 2 in^2 each or less. It is recommended that final sample weight is discussed with the laboratory before obtaining the samples. Holding times for radionuclide analyses are 180 days. Non-radiological samples should be handled according to the protocols described in Section 3.9.

2.4.4 Contingency Sample Shipping

All sample containers will undergo field radiological screening to determine proper shipping and handling requirements. On-site transfers over nonpublic thoroughfares shall be performed in accordance with written procedures. The procedure includes requirements for proper monitoring and control of the radioactive samples and should be reviewed and approved by the Radiological Control Organization. Shipments of waste samples are performed per HNF-PRO-156, "Non-radioactive Hazardous Material/Hazardous Waste Shipments (HM/HW)," if the samples are known or suspected to be mixed waste, and HNF-PRO-157 if the samples are radioactive waste.

2.4.5 Analytical Methods Requirements for Contingency Samples

Parameters and methods for contingency samples are listed in Table 2-2 and 2-3. Laboratory-specific SOPs for analytical methods are in place. Laboratory SOPs and QA plans to be used include analytical procedures and QA plans from WSCF or the 222-S Laboratory. Other laboratories may be used subject to review and approval of their QA program. Changes or additional methods identified during future engineering or planning for contingency sampling should be presented in page changes, addenda, or revisions, as appropriate. Detection limits achievable by the laboratory will be dependent on sample quantity available and also may be affected by the matrix and radionuclide activity levels of the sample.

2.4.6 QC Requirements for Contingency Samples

This characterization effort relies on direct measurements to locate areas of higher beta/gamma contamination for sub-sampling. QA is necessarily built into each phase of the characterization both as QC samples, which monitor sampling and laboratory performance, and field instrument operational checks that monitor field instrumentation performance.

QC measures taken to support field operations performance are described in Section 2.2.6.

For contingency samples collected for laboratory analyses, the following QC samples will be collected during sampling and sent to the laboratory.

- Equipment blanks will be collected on contingency samples to assess the potential for gross cross contamination of the sampling equipment, the effectiveness of the sample decontamination process, and potential sampling environment contaminant contribution. These will be used if equipment is not pre-cleaned or if equipment is reused between sampling events.

Table 2-4. Contingency Sample Measurement Methods, Detection Limits, and Sample Volumes for Selected Radionuclide COCs (2 pages)

Contaminant of Concern (COC)	Analytical Callout	Analytical Technique	Method Reference[1]	Detection Limits[2]	Mass Requirements[3]
				Solid (pCi/g)	Solid (g)
Radionuclides					
H-3 (tritium)	LSC	Liquid Scintillation Beta Analysis	LA-218-114	400	TBD
Pu-238, Pu-239/240	Pu Isotopic	Alpha Energy Analysis	LA-953-104	1	TBD
Cm-244	Cm Isotopic	Alpha Energy Analysis	LA-953-104	1	TBD
Am-241	Am Isotopic	Alpha Energy Analysis	LA-953-104	1	TBD

Table 2-4. Contingency Sample Measurement Methods, Detection Limits, and Sample Volumes for Selected Radionuclide COCs (2 pages)

Contaminant of Concern (COC)	Analytical Callout	Analytical Technique	Method Reference[1]	Detection Limits[2]	Mass Requirements[3]
				Solid (pCi/g)	Solid (g)
Co-60	GEA	Gamma Energy Analysis	LA-548-121	0.05	TBD
Sb-125	GEA	Gamma Energy Analysis	LA-548-121	0.5	TBD
Cs-137	GEA	Gamma Energy Analysis	LA-548-121	1	TBD
Eu-152	GEA	Gamma Energy Analysis	LA-548-121	0.1	TBD
Eu-154	GEA	Gamma Energy Analysis	LA-548-121	0.1	TBD
Eu-155	GEA	Gamma Energy Analysis	LA-548-121	0.1	TBD
Sr-90	Total Radioactive Sr	Beta Counting	LA-220-103	1	TBD
Ni-63	Sep/LSC	Chemical Separation and Liquid Scintillation Counting	TBD	30	TBD
U-234, U-235, U-238	ICP/MS	ICP/MS	LA-506-101	1 µg/g	TBD
Pu-238, Pu-239/240	ICP/MS	ICP/MS	LA-506-101	1 µg/g	TBD

1 An equivalent method may be used dependent on the laboratory performing the analysis.
2 Target detection limits are listed for soil or concrete. The detection limit for actual samples or other materials may be higher.
3 Sample matrix may include 1 to 2 in. sections of metal coupons. The estimated mass for these sections is approximately 80g. Other samples (e.g., concrete, soil) may require different sample sizes and the size of sample collected should be coordinated with the laboratory that will provide the analyses.

Control measures taken to monitor laboratory performance are:

- One laboratory method blank for every 20 samples (5% of samples), analytical batch or sample delivery group (whichever is most frequent) 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 blank spike will be performed for every batch of samples for each analytical method criteria to monitor the effectiveness of the sample preparation process. The results from the analyses are used to assess laboratory performance.

- A matrix spike sample will be prepared and analyzed for every 20 samples (as applicable to method) of the same matrix or sample preparation batch, whichever is most frequent. The

matrix spike results are used to document the bias of an analytical process in a given matrix. It is assumed the matrix spike will be added after digestion.

- Laboratory duplicates or matrix spike duplicates will be used to assess precision and will be analyzed at the same frequency as the matrix spikes. Replicate analysis of the etching solution (digestate) of pipe coupons will be used to monitor precision where appropriate.

2.4.7 Instrument/Equipment Testing, Inspection, and Maintenance

See Section 2.3.7 for applicable criteria.

2.4.8 Instrument Calibration and Frequency

See Section 2.3.8 for applicable criteria.

2.4.9 Inspection/Acceptance Requirements for Supplies and Consumables

See Section 2.3.9 for applicable criteria.

2.5 SURVEY SAMPLING AND ANALYSIS ASSESSMENT/OVERSIGHT

QA oversight requirements are described below.

2.5.1 Assessments and Response Actions

Project QA related to FH radiological surveys may conduct random surveillances and assessments in accordance with QA-11-006-02, "Quality Assurance Surveillances," to verify compliance with requirements outlined in this SAP, associated project work packages, procedures, and/or regulatory requirements.

Deficiencies identified during the assessment will be reported in accordance with QA-11-006-02. When necessary, corrective actions will be taken by the Operations Support Manager.

BHI Compliance and Quality Programs group may conduct random surveillance and assessments in accordance with BHI-MA-02, "ERC Project Procedures," and Procedure 2.9, "Surveillances," to verify compliance with the requirements outlined in this SAP, project work packages, the BHI Quality Management Plan, BHI procedures, and regulatory requirements.

Deficiencies identified by one of the assessments shall be reported in accordance with BHI-MS-02, Procedure 5.3, "Self-Assessments." When appropriate, corrective actions will be taken by the project engineer in accordance with HASQARD, Volume 1, Section 4.0 (DOE-RL 1996a) to minimize recurrence.

2.5.2 Reports to Management

Management Assessments for FH are performed in accordance with MS-1-036-02, "Management Assessments." Management Assessment results are reviewed and analyzed by management to identify and implement appropriate actions. Management Assessment results are distributed to affected managers and deficiencies and are managed as required by HNF-PRO-052, "Corrective Action Management."

BHI management shall be made aware of all deficiencies identified by the self-assessments. All deficiencies shall be reported in accordance with BHI-MA-02, Procedure 5.3.

2.6 DATA REVIEW, VALIDATION AND USABILITY

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

2.6.1 Data Review and Verification Requirements

Data verification will be performed on analytical data to assure that sampling and chain-of-custody documentation is complete, sample numbers can be related to the specific sampling location, samples were analyzed within the required holding times, and analyses meet the data quality requirements specified in the SAP.

Analytical personnel and the project team will review the data. Laboratory personnel will perform a peer review of all analytical data. Peer review will be conducted by a person trained to the particular analytical method being reviewed. HASQARD, Volume 4 (DOE-RL 1998) describes the data review that will be performed by the laboratory. The laboratory will use its own data review procedures that meet the HASQARD criteria to review data before it is sent to the project.

Project personnel or designees will review the data and the summary QC with respect to the criteria in this SAP.

Survey measurement systems will be verified by a review of 5% of the documentation to ensure that calibration checks are performed as required by the methods, dates of survey, and analysis locations are properly documented. The review should be performed by program personnel.

2.6.2 Data Validation

Analytical and survey data will not undergo data validation.

2.6.3 Definition of QC Calculations

Following review, the laboratory data will be assessed by the project team against the criteria in Table 2-3. Assessment will include review of quantitative DQO (i.e., accuracy, precision, completeness, and detection limits). These quantitative DQO are defined below.

Precision

If calculated from duplicate measurements:

$$RPD = \frac{(C_1 - C_2)100}{(C_1 + C_2)/2} \quad (1)$$

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 replicates, use RSD rather than RPD:

$$RSD = \left(s/\bar{y}\right) 100 \quad (2)$$

where:

RSD = relative standard deviation (in units of %)
s = standard deviation
$\bar{y}$ = mean of replicate analyses.

Standard deviation, s, is defined as follows:

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

where:

s = standard deviation
y_I = measured value of the ith replicate
$\bar{y}$ = mean of replicate measurements
n = number of replicates.

Accuracy

For measurements where matrix spikes are used:

$$\%R = 100\left[\frac{S-U}{C_{sa}}\right] \quad (4)$$

where:

%R	=	percent recovery
S	=	measured concentration in spiked aliquot
U	=	measured concentration in unspiked aliquot
C_{sa}	=	actual concentration of spike added.

For situations where a standard reference material (SRM) is used instead of or in addition to matrix spikes:

$$\%R = 100\left[\frac{C_m}{C_{srm}}\right] \tag{5}$$

where:

%R	=	percent recovery
C_m	=	measured concentration of SRM
C_{srm}	=	actual concentration of SRM.

Completeness

Defined as follows for all measurements:

$$\%C = 100\left[\frac{V}{T}\right] \tag{6}$$

where:

%C	=	percent completeness
V	=	number of measurements judged valid
T	=	total number of measurements.

Detection Limit

Defined as follows for metals measurements:

$$MDL = t_{(n-1,1-\alpha=0.99)}S \tag{7}$$

where:

MDL	=	method detection limit
S	=	standard deviation of the replicate analyses
$t_{(n-1,\,1-\alpha=0.99)}$	=	students' t-value appropriate to a 99% confidence level and a standard deviation estimate with n-1 degree of freedom

2.7 DATA QUALITY ASSESSMENT

Data quality assessment is performed by the project (or project designee) after review of the radiation survey and laboratory data as described in Section 2.6. The review by the project (or project designee) includes evaluation of the method accuracy, precision, detection limits, and completeness as required in Sections 2.2.5, 2.3.8, 2.3.9, 2.4.5, 2.4.6, 3.3 and 3.9.

The data reported must be reviewed with respect to the DQO. This includes the conceptual model and any assumptions that are included in the data collection design. The estimated concentrations of COCs will be compared by the project to the applicable ERDF WAC requirements (BHI 1998) for designation.

2.8 ANALYTICAL DATA REPORTS

The data report required by this SAP is a summary report with QC summary. This report includes a case narrative and analytical QC, such as percent recovery on LCSs, matrix spikes, RPDs on duplicate or matrix spike/matrix spike duplicates, and method blank results and sample result and reporting limits.

3.0 FIELD SURVEY AND SAMPLING OBJECTIVES

3.1 OVERVIEW AND OBJECTIVES

The objective is to characterize the concrete debris, soil, carbon steel debris, and Transite siding debris waste streams to obtain data for designation and disposal. ERDF is the preferred disposal location.

FH will perform the radiological surveys of the packages containing concrete debris, and carbon steel debris and of the Transite walls before demolition. FH will perform the surface soil surveys after the concrete pad is removed. BHI will perform the soil sampling and will submit the soil samples for laboratory analyses. BHI will request routine turn around times for the analyses.

The following summaries provide an overview of the characterization strategy for the similar waste streams at K East and K West. As noted elsewhere in this SAP, characterization data from K East will be used to designate the corresponding materials from K West when data are not available from K West. No sample collection is planned at K West, although radiological surveys will be performed.

- Concrete pad: The pad will be packaged and the weight-to-curie ratio described in Section 2.2.1, and Tables 2-1 and 2-2 will be used to provide the radionuclide concentration. Note that the paint used to fix radionuclide contamination on the surface of the concrete will be evaluated for characteristics via the MSDSs in Appendix B. No characteristic metals or organics are listed in the MSDSs.

- Carbon steel monorail and concrete supports: The same approach discussed for the concrete pad will be used for determining the radionuclide content in the steel and the supports. The previous SAP (HNF 2001a) and the profile generated based on the previous SAP (ERDF Profile #KBASIN001, Rev 01, 7/19/2001) listed metals in the paint that are on the TC list. The concentration of the metals will be calculated based on the total weight of the debris. The PCB concentration in the paint will be based on the previous ERDF painted debris profile (#KBASIN001, Rev 01, 7/19/2001), unless additional data become available.

- Transite wall: The Transite siding is known to contain asbestos and will be managed as such. If the paint appears to be the same older paint used in the monorail, it will be managed in the same manner; otherwise, if the paint is newer the Appendix B MSDSs will be used to profile the waste stream.

- Soil under and around/in front of the pad: Because the basin water may have contaminated the soil, the radionuclide ratios in Table 2-2 will be verified by analyses, and if verified will be used. Samples for radionuclide analysis will be collected from three hot spots determined by dose rate surveys. There are three options discussed for the timing of soil sampling: (1) sample before digging, (2) sample during the soil removal, and (3) sample from the bags after removal. The timing of sampling is important because the project must remove soil before fixed laboratory data will be completed and thus before a profile and ERDF roll-off

(or other approved facility transportation boxes) will be obtained. The project will store soil in large plastic disposal bags until the soil is disposed at ERDF or other approved facility.

For Options 1 and 2 for rad, one sample from each of three locations at K East with higher survey data will be composited from the surface to a maximum of 4.5 ft. The maximum sampling depth will be dependent on the planned depth of excavation, which will be provided by FH Project Management. For Option 3, the high rad survey areas will be bagged separately and three samples from these 'higher rad survey soil' will be collected.

For all options for rad analysis, the following will be done. Initially GEA of the samples for gamma emitters will be performed by the fixed laboratory. The ratios of individual gamma emitters to Cs-137 will be compared to the values in Table 2-2. If the ratios are the less than or equal to those in Table 2-2, no additional analyses will be performed and the ratios based on Table 2-2 will be used to estimate radionuclides other than Cs-137. If the gamma analysis indicates that the ratios are not consistent with the values in Table 2-2, then radionuclides in Table 2-3 may be analyzed and the actual concentrations used for all measured isotopes.

For Options 1 and 2, for the non-radiological analytes, a triangular grid covering the entire area will be used. One sample from each of three random locations will be composited from the surface to a maximum depth of 4.5 ft will be collected. The maximum sampling depth will be dependent on the planned depth of excavation, which will be provided by FH Project Management.

For all three options, all non-rad analyses will be the same and will be those analytes, methods, and PQLs listed in Table 2-3.

Option 3 will be used if the samplers cannot be present during digging and the soil must be bagged before sampling. Triangular grids will be placed on the soil surface after removal of the pad. The grids will cover the soil under the pad and area outside the pad that will be removed. For radionuclides, the surface soil will be surveyed using same grids previously discussed. The three highest dose rate areas will be located and marked with flags. As excavation proceeds, for radionuclides, the soil from the three highest surface survey areas will be placed in one or more bags and will be marked for radionuclide sampling. Three samples will be obtained from the bags containing the soil with high survey data.

For non-rad, the same bags will be randomly numbered, and one sample from each of three randomly chosen bags will be obtained and analyzed as previously discussed.

Workers removing the soil (at K East) will keep a map and log identifying the location and depth from which each bag of soil is collected. Each bag will be randomly numbered, three random numbers will be selected for sampling the non-radionuclide analytes. A clean, small shovel, trowel, or small hand coring device will be used to get samples from various soil portions within each bag. A sample will be collected from each of the three randomly numbered bags.

3.2 RADIOLOGICAL SURVEY OBJECTIVES

This section builds on the DQO Process developed previously (HNF 2001b) and summarized in Section 1.0. The sections below summarize the radiological survey and sample design discussed in previous sections.

Radiological measurements will be utilized to ensure that exposure to radiation and/or radioactive contamination is as low as reasonably achievable (ALARA). Surveys will ensure that the radiation dose rates and contamination levels are acceptable to the ERDF criteria as specified in the ERDF WAC.

Radiological measurements can be utilized for those wastes that are determined to be anomalous. Those wastes where it is not appropriate to utilize the weight-to-curie relationships due to the density of the waste being outside the range of 0.2 to 8 g/cm^3. Table 3-1 provides a list of some potential survey methodologies.

Radiological measurements will also be utilized to determine locations for soil sampling.

If modeling or direct assay is utilized to make the radionuclide determinations, the modeling methodology or assay results will be provided with the waste package when offered to ERDF personnel for disposal.

3.3 SURVEY LOCATIONS AND FREQUENCY FOR SOIL

The soil under the concrete pad will be surveyed using a dose meter. The surveys will be conducted in accordance with procedures listed in Section 2.2.

3.4 RADIOLOGICAL SURVEY QC

Radiological survey QC will consist of initial calibrations and operational checks in accordance with the applicable procedures discussed in Section 2.2.4

3.5 RADIOLOGICAL SAMPLING OBJECTIVES AND REQUIREMENTS

The objective of the soil sampling, as discussed in Section 2.3, is to provide data for use in characterizing the soil for designation and disposal.

The objective of radiological contingency sampling for this project is to provide data to confirm (or establish appropriate) radionuclide ratios for anomalous waste as discussed in Section 2.2.3, Anomalous Waste. Contingency sampling also may be employed to more accurately characterize suspect TRU waste as discussed in Section 2.4.1.

After performing the surveys, the survey reports/maps and locations will be provided to BHI from FH. The radiological control technicians will flag the highest survey locations so that BHI will know where to collect the radiological samples.

3.6 SOIL SAMPLE COLLECTION

After the concrete pad is removed and the radiological surveys are performed, soil sampling will be performed. Samples will either be collected before soil removal (Option 1), during soil removal (Option 2) or from bags after removal of the soil (Option 3). Two designs are presented: one for radionuclides and another for non-radionuclides.

The sample locations of the three highest rad-surveys will be flagged by rad control technician staff and will be used to sample for SFL analyses for radionuclides. The rad surveys will utilize the same grid established for non-radiological sampling. For Options 1 and 2, either a hand auger, shovels, backhoe, or bulldozer will be used to collect the sample. A backhoe or bulldozer is allowed because the rock content is not known under the concrete pad and the depth is lower than most hand operated equipment can attain. At each of the three locations, a sample from the surface to 4.5 ft maximum depth will be collected. The sampling crew will be told by the FH Project Manager the depth of excavation in each location. This is done because the depth will vary from a few inches to 4.5 ft, depending on the location. For Option 3, the highest rad survey soil will be placed in separate bags and marked as such. Three soil samples will be collected from these 'higher' level bags. Each soil sample for radionuclides at each location will be homogenized in a stainless steel container and will be bottled and shipped to the SFL.

For Options 1 and 2, for the non-radioactive analytes, a triangular grid covering the removal area will be generated, each grid node will be numbered and one sample will be collected from each of the three nodes, as identified by the three random numbers. At each of the sample locations, a sample which represents the interval from the surface to depth of excavation (i.e., a few inches to 4.5 ft as provided by FH Project Management) will be taken. Each sample will be composited from the surface to the depth of excavation.

For Option 3, bags will be randomly numbered and a sample will be collected from each of three randomly numbered bags. For all options, analysis will be performed as presented in Section 3.1.

For all options, samples for volatile organic analyses will be collected before homogenizing. Each soil sample for metals and all non-volatile organic analyses will be homogenized in a stainless steel container and will be bottled and shipped to the offsite laboratory by the ERC sampling personnel.

Table 3-1. Radiological Survey Instrumentation QC Requirements (2 pages)

Data Type	Survey Method and Purpose	Analyte	Typical Instrument	Preliminary Action Level	Requirements		
					Detection Limit	Accuracy (% of True Value) [a]	Precision (RSD as %) [b]
Dose Rate	Dose rate Measurement for R/hr to Curie Cs-137 conversion and for determination of restricted and nonrestricted waste classification.	Gamma-emitting radionuclides [c]	Eberline RO-3B, Ionization Chamber	50 mR/hr @ 30 cm from surface: 75 mR/hr at surface	0.5 mR/hr	Within Limits printed on source check assembly.	20%
Alpha Activity	Alpha Scintillation for determination restricted and non restricted waste	Alpha-emitting radionuclides	Bicron Surveyor X with a Scintillation Detector	Fixed Activity: 80,000 dpm/100 cm^2 Smears: 400 dpm/100 cm^2	Fixed Activity: <80,000 dpm/100 cm^2 Smears: <400 dpm/100 cm^2	Within Limits printed on source check assembly.	20%
Beta/gamma activity	Beta/gamma pancake Geiger-Mueller (GM) for determination restricted and non restricted waste	Beta-emitting radionuclides [d]	Bicron Surveyor X, or Eberline E-140 Series with a pancake GM detector.	Fixed Activity 80,000 dpm/100 cm^2 Smears: 100,000 dpm/100 cm^2	Fixed Activity <80,000 dpm/100 cm^2 Smears: <100,000 dpm/100 cm^2	Within Limits printed on source check assembly.	20%
Gamma activity	NDA Gamma analysis for determination of radionuclide content of waste.	Gamma-emitting radionuclides	Collimated Gamma Detector, multi-channel analyzer.	45 nCi/g Cs-137 [e]	< 45 nCi/g Cs-137	80-120	20%

Table 3-1. Radiological Survey Instrumentation QC Requirements (2 pages)

Data Type	Survey Method and Purpose	Analyte	Typical Instrument	Preliminary Action Level	Requirements		
					Detection Limit	Accuracy (% of True Value) [a]	Precision (RSD as %) [b]
Neutron activity	NDA Thermal Neutron analysis for determination of TRU radionuclides.	TRU Radionuclides	Collimated neutron detector	100 nC/g TRU	TBD [f]	80-120	20%

[a] Source check must be within these limits per applicable procedure.

[b] Multiple source checks must within 20% of each other.

[c] Although the instrument is capable of measuring the dose from a wide variety of gamma and beta emitting radionuclides, for purposes of this SAP, the measurements will be made with the window closed and all of the dose will be ascribed to Cs-137.

[d] Although the instrument is capable of measuring gamma emitters with a very low efficiency the response of the instrument will be assumed to be entirely from beta emitting radionuclides.

[e] If the waste is such that the radionuclide ratios for K East Basin above water waste are applied, the estimated TRU content of the waste is about 0.4 times the measured Cs-137 activity. Thus, if the method can detect 45 nCi/g Cs-137, then the estimated TRU content would be about 20 nCi/g.

[f] Acceptable detection limit for neutrons will be such that the detection limit of TRU in waste is equivalent to <50 nCi/g TRU based on estimated TRU content of K East sludge or fuel as appropriate to the waste being measured.

The samplers log book should document the following:

- the grid design as applicable,
- the number of any bags and which bags contained the 'higher rad survey soil,'
- location of samples collected and corresponding sample numbers,
- radiological survey results related to the sample locations,
- description of the field conditions and observations.

The soil samples will be obtained with stainless-steel hand augers, shovels, backhoes, or bulldozers as tools. Plastic cannot be used for sampling due to the organics being analyzed. It is understood that due to the plastic bags used for storage, phthalates may be present from the storage bags.

3.7 SOIL SAMPLE COLLECTION PROCEDURES

The following procedures found in BHI-EE-01 are used during sample collection:

- Procedure 1.5, "Field Logbooks"
- Procedure 2.0, "Sample Event Coordination"
- Procedure 2.1, "Sampling Documentation Processing"
- Procedure 3.0, "Chain of Custody"
- Procedure 3.1, "Sample Packaging and Shipping"
- Procedure 3.2, "Field Decontamination of Sampling Equipment"
- Procedure 4.0, "Soil and Sediment Sampling"
- Procedure 4.2, "Sample Storage and Shipping Facility"
- Procedure 4.5, "Sample Compositing"

3.8 FIELD AND LABORATORY QC FOR SOIL SAMPLING

Field QC sampling requirements are summarized in Table 3-2. Table 3-3 summarizes the laboratory analytical QC sampling requirements. The definitions of the field and laboratory QC sample are found in Section 2.3.9 of this SAP.

Table 3-2. Field QC Samples and Frequencies, Analytical Methods and Analytes

Analytes and Methods	Field Duplicates	Equipment Blanks
See Table 2-3	Minimum of one. (Normal frequency is 1 per 20 samples, however only 3 samples are specified.)	Minimum of one. (If disposable or single-use equipment is used, no equipment blanks are needed.)

Table 3-3. Laboratory QC Sampling Requirements Summary

QC Sample Type	Purpose	Frequency Reference
Method blank	Assess laboratory contamination	One per 20 samples of same matrix prepared in one batch.
Laboratory Control Sample	Assess laboratory accuracy	One per 20 samples of same matrix prepared in one batch.
Matrix Spike	Assess accuracy of method on soil matrix	One per 20 samples of same matrix prepared in one batch.
Matrix spike duplicate or duplicate	Assess precision	One per 20 samples of same matrix prepared in one batch.

3.9 SAMPLE MANAGEMENT

3.9.1 Sample Custody

3.9.1.1 Field Custody

All samples obtained during the project will be controlled from the point of origin to the analytical laboratory, as required by BHI-EE-01, Procedure 3.0, "Chain of Custody."

3.9.1.2 Laboratory Custody Procedures

Sample custody during laboratory analysis will be addressed in the applicable laboratory SOPs. Laboratory custody procedures will ensure that sample integrity and identification are maintained through out the analytical process.

3.9.2 Sample Preservation, Containers, and Holding Times for Soils

Soils are preserved via cold storage to slow the chemical reaction rates. Sample preservation and container details will be addressed on the sample authorization form in accordance with BHI-EE-01, Procedure 2.0, "Sample Event Coordination."

3.9.3 Sample Packaging and Shipping

Sample packaging and shipping will be performed in accordance with BHI-EE-01, Procedure 3.1, "Sample Packaging and Shipping." Samples submitted for SFL analysis will be screened for radioactivity at the Radiological Counting Facility before shipment offsite.

Table 3-4. Soil Sample Preservation, Minimum Weight, Containers, Storage and Holding Times

Method/Parameter Group	Minimum Collection Weight**	Container P=plastic G=glass	Storage	Holding Time from Collection to Preparation and/or analysis*
6010/metals except Hg	200 g	P or G	Room temperature	6 months from collection to analysis
7471 (Hg)		P or G	4 +/- 2°C	28 days from collection to analysis
8260 Volatiles	20 g	G w/Teflon lid	4 +/- 2°C	14 days from collection to analysis
8270 Semivolatiles, 8151 herbicides, 8081 pesticides 8082 PCBs	500 g	G w/Teflon lid	4 +/- 2°C	14 days from collection to analysis; analyze within 40 days from extraction
GEA	1000g	P or G	Room Temperature	6 months from collection to analysis
AEA/LSC	125 g	P or G	Room Temperature	6 months from collection to analysis

*Turnaround time (TAT) is 45 days for non-radiochemical parameters, and for radiochemical parameters this will be agreed upon by FH and BHI staff.

**The volumes may be altered based on BHI detailed procedures.

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4.0 HEALTH AND SAFETY

4.1 GENERAL SAFETY AND HEALTH REQUIREMENTS

All field operations required by this SAP will be conducted in accordance with the HASP (HNF 2000b). Field operation performed by BHI will meet both the FH requirements and the BHI requirements.

4.2 FH SNF REQUIREMETNS

The HASP identifies the primary hazards associated with debris management activities. Some of the hazards included 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 HASP references documents which provide the necessary direction to mitigate and control these hazards. To assist in the development of sub-tier or task-/subproject-specific implementation of the HASP, the Project Hanford Management Contract (PHMC) Automated Job Hazards Analysis (AJHA) will be used in accordance with HNF-PRO-079, "Job Hazard Analysis". The AJHA is a computer-based application to help planners identify the potential hazards associated with a job task, and to implement the proper controls based on the hazards identified. Proper use of the AJHA in conjunction with the project HASP (HNF 2000b), plus specifics associated with the task, will constitute acceptable sub-tier or task-/subproject-specific implementation of the HASP. In accordance with 29 CFR 1910.120(6)(1)(v) (OSHA99A), the HASP (HNF 2000b) shall be made available to PHMC employees and any contractor/subcontractor involved with hazardous waste operations.

The PHMC has a well-developed radiation protection program. This program is described in the HSRCM (DOE-RL 1996). The HSRCM fully implements 10 CFR 835, *Occupational Radiation Protection*, as currently amended. The planning of work involving radiation and radioactive materials hazards is further described in HNF-PRO-1623, "Radiological Work Planning Process." Implementation of radiological work and radiation protection activities is detailed in procedures. Procedures address 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 and entry requirements), self-assessments, and use of specific radiation monitoring devices and meters.

The PHMC Chemical Management Program (CMP), as described in HNF-PRO-2258 ("Chemical Management"), in conjunction with implementation of the PHMC AJHA in accordance with HNF-PRO-079, will be relied upon to protect the worker, general public, and the environment from specific chemical substances and their associated hazards. The CMP provides direction for the acquisition, storage, transportation, use, final disposition, and record keeping for chemicals at the Hanford Site, as well as management review of the CMP program performance.

4.3 BHI SAFETY REQUIREMENTS

All field operations will be performed in accordance with BHI Health and Safety requirements outline in BHI-SH-01, "ERC Safety and Health Program" and BHI-RC-01, "Radiation Protection Program Manual."

The sampling procedures and associated activities will take into consideration exposure reduction and contamination control techniques that will minimize the radiation exposure to the sampling team as required by BHI-RC-01 and BHI-QA-01, ERC Quality Program.

5.0 REFERENCES

10 CFR 61.55, "Waste Classification," *Code of Federal Regulations*, as amended.

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

29 CFR 1910.120, 1991, "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*, as amended.

40 CFR 268.48, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

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5.1 SPENT NUCLEAR FUELS PROCEDURES

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OP-02-025, "Basin Water Quality Control," Spent Nuclear Fuels Operations Project Technical Procedure.

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5.2 PROJECT HANFORD MANAGEMENT SYSTEM PROCEDURES

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HNF-PRO-079, "Job Hazard Analysis," Rev. 5, Effective Date: May 5, 2000.

HNF-PRO-156, "Non-radioactive Hazardous Materials/Hazardous Waste (HM/HW) Shipments," Rev. 1, Effective Date: April 15, 2000.

HNF-PRO-157, "Radioactive Material/Waste Shipments," Rev. 1, Effective Date: April 15, 2000.

HNF-PRO-338, "Asbestos Control—Construction Industry," Rev. 1, Effective Date: May 23, 2000.

HNF-PRO-408, "Asbestos—Facility Management/General Industry," Rev. 1, Effective Date: May 18, 2000.

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HNF-PRO-632, "GM Portable Survey Instrument," Rev. 1, Effective Date: March 29, 2000.

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HNF-PRO-2258, Rev. 0, "Chemical Management," Effective Date August 31, 1998.

5.3 WASTE MANGEMENT LABORATORY ANALYTICAL PROCEDURES

LA-220-103, Rev. F-7, "^{90}Strontium in Leachates of Soil, Vegetation, Air Filters and Other Solid Samples," Release Date: November 8, 1999.

LA-220-104, Rev. E-7, "^{90}Strontium in Water by Carbonate Precipitation," Release Date: November 8, 1999.

LA-506-101, Rev. A-3, "Determination of Trace Elements and Radionuclides by Inductively Coupled Plasma-Mass Spectrometry using TJA Poems," Release Date: November 10, 1999.

LA-548-121, Rev. F-2, "Preparation of Sample Mounts for Gamma Energy Analysis," Release Date: November 15, 1999.

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5.4 ERC PROCEDURES

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BHI-MA-02, *ERC Project Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-PR-01, *ERC Procurement Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-01, *ERC Quality Program*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-01, *Radiation Protection Program Manual*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-01, *Hanford ERC Environmental, Safety, and Health Program*, Bechtel Hanford, Inc., Richland, Washington.

APPENDIX A
INFORMATION SUPPORTING DEVELOPMENT OF RADIONUCLIDE RATIOS FOR CHARACTERIZATION OF K EAST AND K WEST DEBRIS AND SOIL

INFORMATION SUPPORTING DEVELOPMENT OF RADIONUCLIDE RATIOS FOR CHARACTERIZATION OF K EAST AND K WEST DEBRIS AND SOIL

The source-term for all radionuclides that could reasonably be expected in the 100 K Basins are from N Reactor fuel and associated activation products. The selection of constituents of concern (COCs) was discussed in Appendix A of the *Sampling and Analysis Plan for K Basin's Debris, HNF-6495, Rev. 1* (HNF 2001) and Appendix B of *the Data Quality Objectives Process for Designation of K-Basin Debris*, Rev 0 (HNF 2000a). The selection was performed by listing all radionuclides that have been reported as present in the fuel or measured during historical characterization of the K East, K West, N, or 105-C fuel storage basins. Several selection criteria were applied to define the Environmental Restoration Disposal Facility (ERDF) Waste Acceptance Criteria (WAC) (BHI 1998) that all "Radioactive waste constituents shall be adequately characterized to permit proper segregation, treatment, storage, and/or disposal. This characterization shall ensure that the major radionuclide content of the waste is known and recorded during the waste management process..." (ERDF WAC, Section 3.2.1.1). As a result of that effort, twenty radionuclide COCs were selected. The sections below discuss the application of radionuclide ratios to estimate the radionuclide content of K Basin debris for those radionuclides that are not measured from radionuclides that are measured. As discussed in the body of this report, it is assumed that the source terms for potential soil or debris contamination outside of the K Basins structures would be the same as the above water debris inside the basin structures (basin water and incidental sludge). Thus although the discussion below pertains directly to above water debris inside the K Basins buildings, it is assumed that the soil and debris will be adequately characterized using the same radionuclide ratios for soil and concrete outside the K Basins buildings.

A.1 RADIONUCLIDE RATIOS FOR CHARACTERIZATION OF K BASIN DEBRIS

Two documents formed a key part of the basis for the selection of radionuclide ratios for the purpose of estimating the radionuclide content of above water waste from the K Basins. These documents were entitled:

1. HNF-SD-SNF-TI-009, Rev 3, *105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project Facilities*, Volume 1, "Fuel" (HNF 2000b) and

2. HNF-SD-SNF-TI-009, Rev 3, *105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project Facilities*, Volume 1, "Sludge" (HNF 2000c).

A WHC report (WHC 1990) contained extensive analyses of samples from the K East and K West Basin areas above the water line. These data provided valuable estimates of several radionuclides that had not been estimated from other sources (e.g., nickel-59, chromium-51, and manganese-54). In order to put all radionuclides from the various sources on a normalized basis, all final estimates of radionuclide content of the fuel (HNF 2000b, HNF 2000c) or samples from K West and K East Basins, were converted to a percent of the estimated Cs-137 concentration. For instance, if the reference indicated that the fuel would contain 500 Ci of strontium-90 and 1,000 Ci of Cs-137, the percentage entered into Table A-1 would be 50%. Only the information related to this K East and K West removal project is included in the remainder of this appendix.

In addition to the reports mentioned above there were several sampling efforts that had been conducted on various waste streams. The data from these various sampling efforts were tabulated and reviewed and ratios of each radionuclide measured are presented in Table A-1. Based on a review of the data from the various sources and the conceptual model for the waste stream it was determined that the following logic would be used to select the applicable ratio for each waste stream. The K East basin could have different sets of ratios that could be applied to the waste depending on the origin of the waste. The ratio applicable to waste that originates from above the water line of the basin was considered applicable to this removal action. The above water waste around the K-Basin was contaminated mainly by water removed from the basins and incidental sludge particles that might have adhered to equipment being moved in and out of the basins. Filters from the basin were placed on the K East Filter Wash Pad that is being removed. Basin water and some sludge particles would likely be the source of contamination on the wash pad and surrounding soil. There is no indication of a similar practice at K West; however, contamination of concrete and soil outside of the building would likely have been from basin water and incidental sludge particles. Data that measured the airborne contamination radionuclide ratios were also used in developing the K East and K West Basins above water radionuclide ratios, thus the ratios are also applicable to incidental contamination that may be found on the Monorail Foundations/Supports and Rails. The ratios used for this waste are primarily an amalgamation of data from WHC (1990) and data from recent air sampling data (Slotemaker 1999).

Additional discussion regarding the selection of applicable radionuclide ratios is provided below.

A.1.1 Above-Water Waste

Significant differences from radionuclide ratios found in fuel and found in K East versus K West sample data were noted in historical analyses of samples from above water portions of the K East and K West (WHC 1990). Another source of data that was used was the air sampling data from 1998 (Slotemaker 1999). It was reasoned that the data obtained from collecting high volume air samples would provide a reasonable estimate of the radionuclide mix that might be encountered from continued operations around the fuel basins. In selecting the final ratios to use, generally the highest ratio from either the WHC (1990) report or the air data were used if available for a specific radionuclide. Not all of the COC radionuclides were measured on the samples from either source. If there were no measured ratios, then K East or K West fuel data radionuclide ratios (HNF 2001) were selected. Table A-2 provides a summary of the final selected radionuclide ratios.

A.1.2 Estimate of Gamma Survey Ratios to Define Anomalous Waste

The purpose of estimating a ratio of all COC gamma emitters to Cs-137 is to alert project staff to the presence of waste that is outside of the anticipated ratios that were discussed above. It is assumed that if the measured contamination levels of the six major anticipated gamma emitters (including Cs-137) to the measured Cs-137 activity (dpm/package) is within a certain range, then the waste is presumed to contain contamination that can be adequately estimated using the listed ratios in Table A-2. If the gamma data ratio is outside of the estimated range, then the waste is considered anomalous and may be subjected to additional NDA measurements and/or sampling.

Table A-1. Comprehensive List of Radionuclide Contaminants Concern and Ratios to Cs-137 for K Basin Debris and Soil.

Radionuclide		Fuel K East Ratio % to Cs-137[2]	WHC Report K East Ratio % to Cs-137[1]	K East Air Data Ratio % to Cs-137[5]	Chosen Ratio for K East Above Water Debris	Fuel K West Ratio % to Cs-137[2]	WHC Report K West Ratio % to Cs-137[1]	K West Air Data Ratio % to Cs-137[5]	Chosen Ratio for K West Above Water Debris
Name	Symbol								
Tritium	H-3	0.26	0.09		0.090	0.26	7.10		7.1
Cobalt	Co-60	0.023	0.96		1.0	0.025	3.18		3.2
Nickel	Ni-63	0.036	0.34		0.34	0.034	0.26		0.26
Strontium	Sr-90	76	103	51.4	103	77.7	1.11	10.3	10
Antimony	Sb-125	0.16			0.16	0.16			0.16
Cesium	Cs-137	100	100	100	100	100	100	100	100
Promethium	Pm-147	2.3			2.3	2.02			2.0
Samarium	Sm-151	1.4			1.4	1.35			1.3
Europium	Eu-152	0.062			0.062	0.007			0.0068
Europium	Eu-154	0.72			1.4[4]	0.72			0.72
Europium	Eu-155	0.13			0.45	0.13			0.13
Uranium	U-234	0.0074	0.027		0.027	0.0064	0.007		0.0075
Uranium	U-235	0.0003	0.0046		0.0046	0.0003	0.00001		0.0010
Uranium	U-238	0.0061	0.02		0.021	0.0050	0.006		0.0062
Plutonium	Pu-238	0.95	2.07	2.0	2.1	0.79	0.11	0.09	0.11
Plutonium	Pu-239	1.9	13.20	11.6	13	1.59	0.90	0.34	0.90
Plutonium	Pu-240				5.1[3]	0.87			0.87
Plutonium	Pu-241	50	197		197	47	7.66		7.7
Americium	Am-241	8.2	16.7	6.88	17	2.66	0.66	0.77	0.77
Curium	Cm-244	0.013			0.013	0.008			0.0084

(1) WHC-SD-NR-RPT-005, Rev 0. "Characterization of Radioactive Waste at 100 Area", Nov. 1990. Written by John DeVanney (WHC 1990)

(2) Data from Table 3.6, "105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project Facilities, Volume 1, Fuel," HNF-SD-SNF-TI-009, Volume 1, Rev. 3 (HNF 2000b)

(3) Because the air data for the measured Pu isotopes showed an increased % relative to Cs-137, a ratio that was measured in K East Basin sludge was applied in this case (Table A-1, HNF 2001).

(4) A ratio that was measured in K East Basin sludge was applied in this case (Table A-1, HNF 2001).

(5) Slotemaker, C.J., Facility Source Term Report, 99-SNF/CJS-024, March 1999.

Table A-2. Summary List of Radionuclide Contaminants of Concern and Ratios to Cs-137 for K East and K-West Debris and Soil.

Radionuclide Name	Radionuclide Symbol	Chosen Ratio for K West Debris and Soil	Chosen Ratio for K East Debris and Soil
Tritium	H-3	7.1%	0.090%
Cobalt	Co-60	3.2%	1.0%
Nickel	Ni-63	0.26%	0.34%
Strontium	Sr-90	10%	103%
Antimony	Sb-125	0.16%	0.16%
Cesium	Cs-137	100%	100%
Promethium	Pm-147	2.0%	2.3%
Samarium	Sm-151	1.3%	1.4%
Europium	Eu-152	0.0068%	0.062%
Europium	Eu-154	0.72%	1.4%
Europium	Eu-155	0.13%	0.45%
Uranium	U-234	0.0075%	0.027%
Uranium	U-235	0.0010%	0.0046%
Uranium	U-238	0.0062%	0.021%
Plutonium	Pu-238	0.11%	2.1%
Plutonium	Pu-239	0.90%	13%
Plutonium	Pu-240	0.87%	5.1%
Plutonium	Pu-241	7.7%	197%
Americium	Am-241	0.77%	17%
Curium	Cm-244	0.0084%	0.013%

A.3 REFERENCES

BHI, 1998, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev. 3, Bechtel Hanford, Inc., Richland, Washington.

HNF, 1998, *Hanford Site Solid Waste Acceptance Criteria*, HNF-EP-0063-4, Rev. 5, Fluor Hanford, Richland, Washington.

HNF, 2000a, *Data Quality Objectives Process for Designation of K-Basin Debris*, HNF-6273, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF, 2000b, *105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project Facilities*, HNF-SD-SNF-TI-009, Rev. 3,Volume 1, "Fuel," Fluor Hanford, Richland, Washington.

HNF, 2000c, *105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project Facilities*, HNF-SD-SNF-TI-009, Rev. 3,Volume 2, "Sludge," Fluor Hanford, Richland, Washington.

HNF, 2001, *Sampling and Analysis Plan for K Basin's Debris*, HNF-6495, Rev. 1, Fluor Hanford, Richland, Washington.

Slotemaker, 1999, "Facility Source Term Report," 99-SNF/CJS-024, Interoffice Correspondence from P.G. Huntley to C. J. Slotemaker, dated March 29, 1999.

WHC, 1990, *Characterization of Radioactive Waste at 100 Area*, WHC-SD-NR-RPT-005, Rev. 0, Westinghouse Hanford Company, Richland, Washington. Written by John DeVanney.

APPENDIX B
GFMSDSs FOR PAINT ON CONCRETE PAD

MSDS # 057948

MATERIAL SAFETY DATA SHEET

COATINGS AND RESINS GROUP

PPG Industries, Inc.

SECTION 1 - CHEMICAL, PRODUCT, AND COMPANY INFORMATION

PRODUCT CODE/IDENTITY: 97-948

REVISION DATE: 04/13/00 (000) 0814

CUSTOMER PART #/NAME: Not applicable

PRODUCT TRADE NAME: PITT-GUARD ALL WEATHER DTR GRAY COA

CHEMICAL FAMILY: Epoxy

EMERGENCY MEDICAL/SPILL INFO: (304) 843-1300 (U.S.) 91-800-00-214 (MEXICO)

TECHNICAL INFORMATION: 1-800-441-9695

PRODUCT SAFETY/MSDS INFORMATION: 4325 ROSANNA DRIVE, P.O. BOX 9 ALLISON PARK, PA 15101 (412) 492-5555

DATE OF MSDS PREPARATION: 07/31/00

PRIMARY HAZARD WARNING

Flammable. Keep away from heat, sparks, flames, and other sources of ignition. Do not smoke. Extinguish all flames and pilot lights. Turn off stoves, heaters, electrical motors, and other sources of ignition during use and until all vapors/odors are gone. Harmful if swallowed. May cause slight skin irritation. Causes eye irritation. Prolonged or repeated contact may cause an allergic skin reaction. Vapor and/or spray mist may be harmful if inhaled. Vapor irritates eyes, nose, and throat. Sanding and grinding dusts may be harmful if inhaled.

THIS MATERIAL SAFETY DATA SHEET HAS BEEN PREPARED IN ACCORDANCE WITH THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200), THE SUPPLIER NOTIFICATION REQUIREMENTS OF SARA TITLE III, SECTION 313, AND OTHER APPLICABLE RIGHT-TO-KNOW REGULATIONS.

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

REF	HAZARDOUS INGREDIENTS	PERCENT	CAS NUMBER	CARCINOGEN*
01	ETHYL BENZENE	1 - <5	100-41-4	
02	TOLUENE	5 - <10	108-88-3	
03	XYLENES	5 - <10	1330-20-7	
04	CARBON BLACK	0.1- <1	1333-86-4	I
05	TITANIUM DIOXIDE	5 - <10	13463-67-7	
06	QUARTZ	20- <30	14808-60-7	I N O
07	EPOXY RESIN	40- <50	25068-38-6	
08	SILICA	1 - <5	7631-86-9	

* Carcinogens: O=OSHA; A=ACGIH; N=NTP; I=IARC

SARA TITLE III & CERCLA CLASSIFICATIONS

REF	SARA 102 RQ (LBS)	SARA 302 TPQ (LBS)	SARA 313	SARA 311/312 AC	CH	FL	PR	RE
01	1000	NOT ESTAB	Y	Y	Y	Y	N	N
02	1000	NOT ESTAB	Y	Y	N	Y	N	N
03	100	NOT ESTAB	Y	Y	N	Y	N	N
04	NOT ESTAB	NOT ESTAB	N	N	Y	N	N	N
05	NOT ESTAB	NOT ESTAB	N	N	N	N	N	N
06	NOT ESTAB	NOT ESTAB	N	N	Y	N	N	N
07	NOT ESTAB	NOT ESTAB	N	Y	N	N	N	N
08	NOT ESTAB	NOT ESTAB	N	N	N	N	N	N

SARA 311/312 CATEGORIES FOR THIS PRODUCT: ACUTE= Y, CHRONIC= Y, FLAMMABILITY= Y, PRESSURE= N, REACTIVITY= N

OCCUPATIONAL EXPOSURE LIMITS HAVE BEEN ESTABLISHED FOR THE FOLLOWING MATERIALS:

REF	ACGIH TLV-TWA	ACGIH TLV-STEL	U.S. OSHA PEL-TWA	U.S. OSHA PEL-STEL
01	100 ppm	125 ppm	100 ppm	125 ppm
02	S- 50 ppm	NOT ESTAB.	100 ppm	150 ppm
03	100 ppm	150 ppm	100 ppm	150 ppm
04	3.5 mg/m3	NOT ESTAB.	3.5 mg/m3	NOT ESTAB.
05	10 mg/m3	NOT ESTAB.	10 mg/m3	NOT ESTAB.
06	R- 0.1 mg/m3	NOT ESTAB.	R- 0.1 mg/m3	NOT ESTAB.
07	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.
08	10 mg/m3	NOT ESTAB.	6 mg/m3	NOT ESTAB.

[C- Ceiling Limit; S- Potential Skin Absorption; R- Respirable Dust] [NOT ESTAB. = NOT ESTABLISHED = NOT APPLICABLE]

PRODUCT STATUS RELATIVE TO THE U.S. EPA TOXIC SUBSTANCES CONTROL ACT

All chemical substances in this product are listed on the U.S. TSCA Inventory or are otherwise exempt from TSCA Inventory reporting requirements.

SECTION 3 - HAZARDS IDENTIFICATION

EFFECTS OF OVEREXPOSURE FROM:

INGESTION: Harmful if swallowed.

EYE CONTACT: Causes eye irritation.

SKIN CONTACT: May cause slight skin irritation. Prolonged or repeated contact may cause an allergic skin reaction.

INHALATION: Vapor and/or spray mist may be harmful if inhaled. Vapor irritates eyes, nose, and throat. Sanding and grinding dusts may be harmful if inhaled. Repeated exposure to high vapor concentrations may cause irritation of the respiratory system and permanent brain and nervous system damage.

CHRONIC OVEREXPOSURE: Avoid long-term and repeated contact. This product contains crystalline silica which has been classified as a human carcinogen by IARC. Long-term exposures may also lead to a disabling lung condition known as silicosis. The risk depends on the duration and level of exposure to dust from

sanding surfaces or mist from spray applications. Use of appropriate personal protective equipment and/or engineering controls should be employed whenever these types of operations are being performed. This product contains titanium dioxide. Animals inhaling massive quantities of titanium dioxide dust in a long-term study developed lung tumors. Studies with humans involved in manufacture of this pigment indicate no increased risk of cancer from exposure. Potential for inhalation of titanium dioxide dusts from coatings is very limited. Since overexposures are not expected, there is no significant hazard for man. This product contains toluene. Toluene inhalation in animals (greater than 1500 ppm) and intentional inhalation of toluene-containing products by humans (e.g. glue) has caused adverse fetal development effects. This product contains carbon black which has been rated an IARC 2B carcinogen due to animal data. Ethylbenzene has been reported by NTP to cause cancer in laboratory animals following a chronic (2 year) inhalation exposure. Dose levels of 75, 250 and 750 ppm were used, with evidence of carcinogenicity found in the kidneys of rats and the lung and liver of mice at 750 ppm. The No Observed Effect Level (NOEL) was 75 ppm. The relevance of these findings to humans is uncertain, but appropriate safeguards should be employed to reduce or eliminate inhalation exposure to ethylbenzene. High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo and fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Eye watering, headaches, nausea, dizziness, and loss of coordination are indications that solvent levels are too high. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. Redness, itching, burning sensation and visual disturbances may indicate excessive eye contact. Dryness, itching, cracking, burning, redness, and swelling are conditions associated with excessive skin contact.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Not applicable.

WARNING: This product contains a chemical(s) known to the State of California to cause cancer and birth defects or other reproductive harm.

SECTION 4 - FIRST AID MEASURES

INGESTION: If swallowed, do not induce vomiting. Gently wipe out inside mouth to remove any residual material.

EYE CONTACT: In case of eye contact, remove contact lenses and flush eyes immediately with a gentle stream of luke warm water for at least 15 minutes.

SKIN CONTACT: In case of skin contact, flush immediately with plenty of water for at least 15 minutes followed by washing with soap and water.

INHALATION: If affected by inhalation of vapor or spray mist, remove to fresh air. Apply artificial respiration and other support measures as required.

OTHER: If ingestion, any type of overexposure or symptoms of overexposure occur during or following the use of this product, contact a poison control center, emergency room or physician immediately; have Material Safety Data Sheet information available.

SECTION 5 - FIRE FIGHTING MEASURES

FLASHPOINT: 70 Degrees F (21 Degrees C) (PENSKY-MARTENS CLOSED CUP)

FLAMMABLE LIMITS: Lower explosion limit (LEL): 1.2

Upper explosion limit (UEL): Not available

EXTINGUISHING MEDIA: Use National Fire Protection Association (NFPA) Class B extinguishers (carbon dioxide, dry chemical, or universal aqueous film forming foam) designed to extinguish NFPA Class IB flammable liquid fires.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Keep this product away from heat, sparks, flame, and other sources of ignition (i.e., pilot lights, electric motors, static electricity). Invisible vapors can travel to a source of ignition and flash back. Do not smoke while using this product. Keep containers tightly closed when not in use. Closed containers may explode when overheated. Do not apply to hot surfaces. Toxic gases may form when this product comes in contact with extreme heat.

SPECIAL FIRE FIGHTING PROCEDURES: Water spray may be ineffective. Water spray may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat. If water is used, fog nozzles are preferable. Fire-fighters should wear self-contained breathing apparatus and full protective clothing.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Provide maximum ventilation. Only personnel equipped with proper respiratory, skin, and eye protection should be permitted in the area. Remove all sources of ignition. Take up spilled material with sand, vermiculite, or other noncombustible absorbent material and place in clean, empty containers for disposal. Only the spilled material and the absorbant should be placed in this container.

WASTE DISPOSAL METHOD: Waste material must be disposed of in accordance with federal, state, provincial, and local environmental control regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

SECTION 7 - HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS: Do not store above 120 degrees F.(48 degrees C.). Store large quantities in buildings designed and protected for storage of NFPA Class IB flammable liquids.

OTHER PRECAUTIONS: Vapors may collect in low areas. If this material is part of a multiple component system, read the Material Safety Data Sheet(s) for the other component or components before blending as the resulting mixture may have the hazards of all of its parts. Containers should be grounded when pouring. Avoid free fall of liquids in excess of a few inches.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT FOR:

EYE PROTECTION: Wear chemical-type splash goggles when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapors.

gloves should be constructed of: nitrile rubber. No specific permeation/degradation testing have been done on protective clothing for this product. Recommendations for skin protection are based on infrequent contact with this product. For frequent contact or total immersion, contact a manufacturer of protective clothing for appropriate chemical impervious equipment.

RESPIRATORY PROTECTION: Overexposure to vapors may be prevented by ensuring proper ventilation controls, vapor exhaust or fresh air entry. A NIOSH- approved air purifying respirator with the appropriate chemical cartridges or a positive-pressure, air-supplied respirator may also reduce exposure. Read the respirator manufacturer's instructions and literature carefully to determine the type of airborne contaminants against which the respirator is effective, its limitations, and how it is to be properly fitted and used.

OTHER EQUIPMENT: Clean contaminated clothing and shoes.

VENTILATION REQUIREMENTS: Provide general dilution or local exhaust ventilation in volume and pattern to keep the concentration of ingredients listed in Section 2 below the lowest suggested exposure limits, the LEL below the stated limit, and to remove decomposition products during welding or flame cutting.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

[FORMULA VALUES, NOT SALES SPECIFICATIONS]

BOILING RANGE: 230- 293Degrees F

SOLUBILITY IN WATER: .0 %

VAPOR PRESSURE: 13.0 mmHg

WEIGHT/GALLON (LBS): 11.64 (U.S.)

VAPOR DENSITY: Heavier than air

pH: Not applicable

% VOLATILE/VOLUME: 24.630

% SOLIDS BY WEIGHT: 84.73

SPECIFIC GRAVITY: 1.397

EVAPORATION RATE(BuOAc=100): 141

ODOR/APPEARANCE: Viscous liquid with an odor characteristic of the solvents listed in Section 2.

SECTION 10 - STABILITY AND REACTIVITY

This product is normally stable and will not undergo hazardous reactions.

INCOMPATIBILITY (MATERIALS AND CONDITIONS TO AVOID): Avoid contact with strong alkalies, strong mineral acids, or strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: May produce the following hazardous

decomposition products when exposed to extreme heat: carbon monoxide ; carbon dioxide ; lower molecular weight polymer fractions; Extreme heat includes, but is not limited to, flame cutting, brazing, and welding.

Hazardous Materials Identification System (HMIS) and National Fire Protection Association (NFPA) Ratings:

HMIS Rating		NFPA Rating	
HEALTH	2*	HEALTH	2
FLAMMABILITY	3	FLAMMABILITY	3
REACTIVITY	0	INSTABILITY	0

Rating System: 0=Minimal, 1=Slight, 2=Moderate, 3=Serious, 4=Severe, *=Chronic Effects.

Safe handling of this product requires that all of the information on the MSDS be evaluated for specific work environments and conditions of use.

THIS IS THE END OF THE MSDS FOR: 97-948 (00172120.00197-948)

Manufactured and Supplied by:

PPG INDUSTRIES, EAST POINT

1377 OAKLEIGH DRIVE

EAST POINT, GA 30344

MSDS # 057949

MATERIAL SAFETY DATA SHEET

COATINGS AND RESINS GROUP

PPG Industries, Inc.

SECTION 1 - CHEMICAL, PRODUCT, AND COMPANY INFORMATION

PRODUCT CODE/IDENTITY: 95-249

REVISION DATE: 08/21/98 (000) 0814

CUSTOMER PART #/NAME: Not applicable

PRODUCT TRADE NAME: EPOXY MASTIC CATALYST COMP B

CHEMICAL FAMILY: Epoxy

EMERGENCY MEDICAL/SPILL INFO: (304) 843-1300 (U.S.) 91-800-00-214 (MEXICO)

TECHNICAL INFORMATION: 1-800-441-9695

PRODUCT SAFETY/MSDS INFORMATION: 4325 ROSANNA DRIVE, P.O. BOX 9 ALLISON PARK, PA 15101 (412) 492-5555

DATE OF MSDS PREPARATION: 10/14/99

PRIMARY HAZARD WARNING

Flammable. Keep away from heat, sparks, flames, and other sources of ignition. Do not smoke. Extinguish all flames and pilot lights. Turn off stoves, heaters, electrical motors, and other sources of ignition during use and until all vapors/odors are gone. Harmful if swallowed. May cause moderate skin irritation. Causes eye irritation. May be absorbed through the skin. Prolonged or repeated contact may cause an allergic skin reaction. Vapor and/or spray mist may be harmful if inhaled. May cause irritation and/or allergic respiratory reaction in lungs. Vapor irritates eyes, nose, and throat.

THIS MATERIAL SAFETY DATA SHEET HAS BEEN PREPARED IN ACCORDANCE WITH THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200), THE SUPPLIER NOTIFICATION REQUIREMENTS OF SARA TITLE III, SECTION 313, AND OTHER APPLICABLE RIGHT-TO-KNOW REGULATIONS.

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

REF	HAZARDOUS INGREDIENTS	PERCENT	CAS NUMBER	CARCINOGEN*
01	ETHYL BENZENE	0.1- <1	100-41-4	
02	PROPYLENE GLYCOL MONOMETHYL ETHER	5 - <10	107-98-2	
03	ALKYL GLYCIDYL ETHER	5 - <10	120547-52-6	
04	XYLENES	1 - <5	1330-20-7	
05	SODIUM ALUMINUM SILICATE	20- <30	1344-00-9	
06	TALC	20- <30	14807-96-6	
07	EPOXY RESIN	30- <40	25068-38-6	
08	NITROETHANE	1 - <5	79-24-3	

* Carcinogens: O=OSHA; A=ACGIH; N=NTP; I=IARC

SARA TITLE III & CERCLA CLASSIFICATIONS

REF	SARA 102 RQ (LBS)	SARA 302 TPQ (LBS)	SARA 313	SARA 311/312 AC	CH	FL	PR	RE
01	1000	NOT ESTAB	Y	Y	Y	Y	N	N
02	NOT ESTAB	NOT ESTAB	N	Y	N	Y	N	N
03	NOT ESTAB	NOT ESTAB	N	Y	Y	N	N	N
04	100	NOT ESTAB	Y	Y	N	Y	N	N
05	NOT ESTAB	NOT ESTAB	N	Y	N	N	N	N
06	NOT ESTAB	NOT ESTAB	N	N	N	N	N	N
07	NOT ESTAB	NOT ESTAB	N	Y	N	N	N	N
08	NOT ESTAB	NOT ESTAB	N	Y	N	Y	N	N

SARA 311/312 CATEGORIES FOR THIS PRODUCT: ACUTE= Y, CHRONIC= Y, FLAMMABILITY= Y, PRESSURE= N, REACTIVITY= N

OCCUPATIONAL EXPOSURE LIMITS HAVE BEEN ESTABLISHED FOR THE FOLLOWING MATERIALS:

REF	ACGIH TLV-TWA	ACGIH TLV-STEL	U.S. OSHA PEL-TWA	U.S. OSHA PEL-STEL
01	100 ppm	125 ppm	100 ppm	125 ppm
02	100 ppm	150 ppm	100 ppm	150 ppm
03	NOT ESTAB	NOT ESTAB	NOT ESTAB	NOT ESTAB
04	100 ppm	150 ppm	100 ppm	150 ppm
05	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.
06	R- 2 mg/m3	NOT ESTAB.	R- 2 mg/m3	NOT ESTAB.
07	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.
08	100 ppm	NOT ESTAB.	100 ppm	NOT ESTAB.

[C- Ceiling Limit; S- Potential Skin Absorption; R- Respirable Dust] [NOT ESTAB. = NOT ESTABLISHED = NOT APPLICABLE]

PRODUCT STATUS RELATIVE TO THE U.S. EPA TOXIC SUBSTANCES CONTROL ACT

All chemical substances in this product are listed on the U.S. TSCA Inventory or are otherwise exempt from TSCA Inventory reporting requirements.

SECTION 3 - HAZARDS IDENTIFICATION

EFFECTS OF OVEREXPOSURE FROM:

INGESTION: Harmful if swallowed.

EYE CONTACT: Causes eye irritation.

SKIN CONTACT: May cause moderate skin irritation. May be absorbed through the skin. Prolonged or repeated contact may cause an allergic skin reaction.

INHALATION: Vapor and/or spray mist may be harmful if inhaled. May cause irritation and/or allergic respiratory reaction in lungs. Vapor irritates eyes, nose, and throat. Repeated exposure to high vapor concentrations may cause irritation of the respiratory system and permanent brain and nervous system damage.

CHRONIC OVEREXPOSURE: Avoid long-term and repeated contact. This product contains nitroethane. Studies with laboratory animals have shown that ingestion

or inhalation of high levels of nitroethane causes kidney and liver damage and central nervous system effects. This product contains talc. In a lifetime inhalation study female rats exposed to an elevated respirable concentration (9 times the Permissible Exposure Limit) of cosmetic grade talc developed lung cancer. To date, no U.S. regulatory agency has classified talc as a carcinogen based on this data. Ethylbenzene has been reported by NTP to cause cancer in laboratory animals following a chronic (2 year) inhalation exposure. Dose levels of 75, 250 and 750 ppm were used, with evidence of carcinogenicity found in the kidneys of rats and the lung and liver of mice at 750 ppm. The No Observed Effect Level (NOEL) was 75 ppm. The relevance of these findings to humans is uncertain, but appropriate safeguards should be employed to reduce or eliminate inhalation exposure to ethylbenzene. High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo and fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Eye watering, headaches, nausea, dizziness, and loss of coordination are indications that solvent levels are too high. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. Redness, itching, burning sensation and visual disturbances may indicate excessive eye contact. Dryness, itching, cracking, burning, redness, and swelling are conditions associated with excessive skin contact.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Not applicable.

SECTION 4 - FIRST AID MEASURES

INGESTION: If swallowed, do not induce vomiting. Gently wipe out inside mouth to remove any residual material.

EYE CONTACT: In case of eye contact, remove contact lenses and flush eyes immediately with a gentle stream of luke warm water for at least 15 minutes.

SKIN CONTACT: In case of skin contact, flush immediately with plenty of water for at least 15 minutes followed by washing with soap and water.

INHALATION: If affected by inhalation of vapor or spray mist, remove to fresh air. Apply artificial respiration and other support measures as required.

OTHER: If ingestion, any type of overexposure or symptoms of overexposure occur during or following the use of this product, contact a poison control center, emergency room or physician immediately; have Material Safety Data Sheet information available.

SECTION 5 - FIRE FIGHTING MEASURES

FLASHPOINT: 80 Degrees F (26 Degrees C) (PENSKY-MARTENS CLOSED CUP)

FLAMMABLE LIMITS: Lower explosion limit (LEL): 2.1

Upper explosion limit (UEL): Not available

EXTINGUISHING MEDIA: Use National Fire Protection Association (NFPA) Class B extinguishers (carbon dioxide, dry chemical, or universal aqueous film forming foam) designed to extinguish NFPA Class IC flammable liquid fires.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Keep this product away from heat, sparks,

flame, and other sources of ignition (i.e., pilot lights, electric motors, static electricity). Invisible vapors can travel to a source of ignition and flash back. Do not smoke while using this product. Keep containers tightly closed when not in use. Closed containers may explode when overheated. Do not apply to hot surfaces. Toxic gases may form when this product comes in contact with extreme heat.

SPECIAL FIRE FIGHTING PROCEDURES: Water spray may be ineffective. Water spray may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat. If water is used, fog nozzles are preferable. Fire-fighters should wear self-contained breathing apparatus and full protective clothing.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Provide maximum ventilation. Only personnel equipped with proper respiratory, skin, and eye protection should be permitted in the area. Remove all sources of ignition. Take up spilled material with sand, vermiculite, or other noncombustible absorbent material and place in clean, empty containers for disposal. Only the spilled material and the absorbant should be placed in this container.

WASTE DISPOSAL METHOD: Waste material must be disposed of in accordance with federal, state, provincial, and local environmental control regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

SECTION 7 - HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS: Do not store above 120 degrees F.(48 degrees C.). Store large quantities in buildings designed and protected for storage of NFPA Class IC flammable liquids.

OTHER PRECAUTIONS: Vapors may collect in low areas. If this material is part of a multiple component system, read the Material Safety Data Sheet(s) for the other component or components before blending as the resulting mixture may have the hazards of all of its parts. Containers should be grounded when pouring. Avoid free fall of liquids in excess of a few inches.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT FOR:

EYE PROTECTION: Wear chemical-type splash goggles when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapors.

SKIN PROTECTION: Wear protective clothing to prevent skin contact. Apron and gloves should be constructed of: impermeable material. No specific permeation/degradation testing have been done on protective clothing for this product. Recommendations for skin protection are based on infrequent contact with this product. For frequent contact or total immersion, contact a manufacturer of protective clothing for appropriate chemical impervious equipment.

RESPIRATORY PROTECTION: Overexposure to vapors may be prevented by ensuring proper ventilation controls, vapor exhaust or fresh air entry. A NIOSH- approved air purifying respirator with the appropriate chemical cartridges or a

positive-pressure, air-supplied respirator may also reduce exposure. Read the respirator manufacturer's instructions and literature carefully to determine the type of airborne contaminants against which the respirator is effective, its limitations, and how it is to be properly fitted and used.

OTHER EQUIPMENT: Clean contaminated clothing and shoes.

VENTILATION REQUIREMENTS: Provide general dilution or local exhaust ventilation in volume and pattern to keep the concentration of ingredients listed in Section 2 below the lowest suggested exposure limits, the LEL below the stated limit, and to remove decomposition products during welding or flame cutting.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

[FORMULA VALUES, NOT SALES SPECIFICATIONS]

BOILING RANGE: 248- 396Degrees F

SOLUBILITY IN WATER: 8.8 %

VAPOR PRESSURE: 9.2 mmHg

WEIGHT/GALLON (LBS): 12.64 (U.S.)

VAPOR DENSITY: Heavier than air

pH: Not applicable

% VOLATILE/VOLUME: 21.280

% SOLIDS BY WEIGHT: 86.95

SPECIFIC GRAVITY: 1.517

EVAPORATION RATE(BuOAc=100): 56

ODOR/APPEARANCE: Viscous liquid with an odor characteristic of the solvents listed in Section 2.

SECTION 10 - STABILITY AND REACTIVITY

This product is normally stable and will not undergo hazardous reactions.

INCOMPATIBILITY (MATERIALS AND CONDITIONS TO AVOID): Avoid contact with strong alkalies, strong mineral acids, or strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: May produce the following hazardous decomposition products when exposed to extreme heat: carbon monoxide ; carbon dioxide ; lower molecular weight polymer fractions; Extreme heat includes, but is not limited to, flame cutting, brazing, and welding.

Hazardous Materials Identification System (HMIS) and National Fire Protection Association (NFPA) Ratings:

HMIS Rating		NFPA Rating	
HEALTH	3*	HEALTH	3
FLAMMABILITY	3	FLAMMABILITY	3

REACTIVITY 0 INSTABILITY 0

Rating System:0=Minimal, 1=Slight, 2=Moderate, 3=Serious, 4=Severe, *=Chronic Effects.

Safe handling of this product requires that all of the information on the MSDS be evaluated for specific work environments and conditions of use.

THIS IS THE END OF THE MSDS FOR: 95-249 (00125847.00195-249)

Manufactured and Supplied by:

PPG INDUSTRIES, EAST POINT

1377 OAKLEIGH DRIVE

EAST POINT, GA 30344

g_

MSDS # 057950

MATERIAL SAFETY DATA SHEET

COATINGS AND RESINS GROUP

PPG Industries, Inc.

SECTION 1 - CHEMICAL, PRODUCT, AND COMPANY INFORMATION

PRODUCT CODE/IDENTITY: 99-2402

REVISION DATE: 09/29/98 (000) 0814

CUSTOMER PART #/NAME: Not applicable

PRODUCT TRADE NAME: PITT-GUARD RAPID CURE YELLOW BASE

CHEMICAL FAMILY: Polyamide

EMERGENCY MEDICAL/SPILL INFO: (304) 843-1300 (U.S.) 91-800-00-214 (MEXICO)

TECHNICAL INFORMATION: 1-800-441-9695

PRODUCT SAFETY/MSDS INFORMATION: 4325 ROSANNA DRIVE, P.O. BOX 9 ALLISON PARK, PA 15101 (412) 492-5555

DATE OF MSDS PREPARATION: 10/14/99

PRIMARY HAZARD WARNING

Flammable. Keep away from heat, sparks, flames, and other sources of ignition. Do not smoke. Extinguish all flames and pilot lights. Turn off stoves, heaters, electrical motors, and other sources of ignition during use and until all vapors/odors are gone. Harmful if swallowed. May cause skin burns. This product contains a material which causes irreversible eye damage. May be absorbed through the skin. Prolonged or repeated contact may cause an allergic skin reaction. Vapor and/or spray mist harmful if inhaled. Vapor irritates eyes, nose, and throat.

THIS MATERIAL SAFETY DATA SHEET HAS BEEN PREPARED IN ACCORDANCE WITH THE OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200), THE SUPPLIER NOTIFICATION REQUIREMENTS OF SARA TITLE III, SECTION 313, AND OTHER APPLICABLE RIGHT-TO-KNOW REGULATIONS.

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

REF	HAZARDOUS INGREDIENTS	PERCENT	CAS NUMBER	CARCINOGEN*
01	ETHYL BENZENE	1 - <5	100-41-4	
02	BENZYL ALCOHOL	5 - <10	100-51-6	
03	XYLENES	5 - <10	1330-20-7	
04	SODIUM ALUMINUM SILICATE	10- <20	1344-00-9	
05	TALC	5 - <10	14807-96-6	
06	ISOPROPYL ALCOHOL	10- <20	67-63-0	
07	POLYAMIDE RESIN	40- <50	68410-23-1	
08	SUBSTITUTED AMIDE	1 - <5	82199-12-0	
09	2,4,6 TRIS (DIMETHYLAMINOMETHYL) PHENOL	1 - <5	90-72-2	

* Carcinogens: O=OSHA; A=ACGIH; N=NTP; I=IARC

SARA TITLE III & CERCLA CLASSIFICATIONS

REF	SARA 102 RQ (LBS)	SARA 302 TPQ (LBS)	SARA 313	SARA 311/312 AC	CH	FL	PR	RE
01	1000	NOT ESTAB	Y	Y	Y	Y	N	N
02	NOT ESTAB	NOT ESTAB	N	Y	N	Y	N	N
03	100	NOT ESTAB	Y	Y	N	Y	N	N
04	NOT ESTAB	NOT ESTAB	N	Y	N	N	N	N
05	NOT ESTAB	NOT ESTAB	N	N	N	N	N	N
06	NOT ESTAB	NOT ESTAB	N	Y	N	Y	N	N
07	NOT ESTAB	NOT ESTAB	N	Y	N	N	N	N
08	N.E.	N.E.	N	N	N	N	N	N
09	NOT ESTAB	NOT ESTAB	N	Y	Y	N	N	N

SARA 311/312 CATEGORIES FOR THIS PRODUCT: ACUTE= Y, CHRONIC= Y, FLAMMABILITY= Y, PRESSURE= N, REACTIVITY= N

OCCUPATIONAL EXPOSURE LIMITS HAVE BEEN ESTABLISHED FOR THE FOLLOWING MATERIALS:

REF	ACGIH TLV-TWA	ACGIH TLV-STEL	U.S. OSHA PEL-TWA	U.S. OSHA PEL-STEL
01	100 ppm	125 ppm	100 ppm	125 ppm
02	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.
03	100 ppm	150 ppm	100 ppm	150 ppm
04	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.
05	R- 2 mg/m3	NOT ESTAB.	R- 2 mg/m3	NOT ESTAB.
06	400 ppm	500 ppm	400 ppm	500 ppm
07	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.
08	R- 2 MG/M3	NOT ESTAB	2 MG/M3	NOT ESTAB
09	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.	NOT ESTAB.

[C- Ceiling Limit; S- Potential Skin Absorption; R- Respirable Dust] [NOT ESTAB. = NOT ESTABLISHED = NOT APPLICABLE]

PRODUCT STATUS RELATIVE TO THE U.S. EPA TOXIC SUBSTANCES CONTROL ACT

All chemical substances in this product are listed on the U.S. TSCA Inventory or are otherwise exempt from TSCA Inventory reporting requirements.

SECTION 3 - HAZARDS IDENTIFICATION

EFFECTS OF OVEREXPOSURE FROM:

INGESTION: Harmful if swallowed.

EYE CONTACT: This product contains a material which causes irreversible eye damage.

SKIN CONTACT: May cause skin burns. May be absorbed through the skin. Prolonged or repeated contact may cause an allergic skin reaction.

INHALATION: Vapor and/or spray mist harmful if inhaled. Vapor irritates eyes, nose, and throat. Repeated exposure to high vapor concentrations may cause irritation of the respiratory system and permanent brain and nervous system damage.

CHRONIC OVEREXPOSURE: Avoid long-term and repeated contact. Prolonged inhalation of an ingredient(s) in this product may cause edema of the lungs and/or lung damage. This product contains talc. In a lifetime inhalation study female rats exposed to an elevated respirable concentration (9 times the Permissible Exposure Limit) of cosmetic grade talc developed lung cancer. To date, no U.S. regulatory agency has classified talc as a carcinogen based on this data. Ethylbenzene has been reported by NTP to cause cancer in laboratory animals following a chronic (2 year) inhalation exposure. Dose levels of 75, 250 and 750 ppm were used, with evidence of carcinogenicity found in the kidneys of rats and the lung and liver of mice at 750 ppm. The No Observed Effect Level (NOEL) was 75 ppm. The relevance of these findings to humans is uncertain, but appropriate safeguards should be employed to reduce or eliminate inhalation exposure to ethylbenzene. High exposures to xylenes in some animal studies have been reported to cause health effects on the developing embryo and fetus. These effects were often at levels toxic to the mother. The significance of these findings to humans has not been determined.

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Eye watering, headaches, nausea, dizziness, and loss of coordination are indications that solvent levels are too high. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. Redness, itching, burning sensation and visual disturbances may indicate excessive eye contact. Dryness, itching, cracking, burning, redness, and swelling are conditions associated with excessive skin contact.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Not applicable.

SECTION 4 - FIRST AID MEASURES

INGESTION: If swallowed, give one to two eight ounce glasses of water, but do not induce vomiting. Gently wipe out inside mouth to remove any residual material.

EYE CONTACT: In case of eye contact, remove contact lenses, flush eye immediately with a gentle stream of warm water for at least 30 minutes.

SKIN CONTACT: In case of skin contact, flush immediately with plenty of water for at least 15 minutes followed by washing with soap and water.

INHALATION: If affected by inhalation of vapor or spray mist, remove to fresh air. Apply artificial respiration and other support measures as required.

OTHER: If ingestion, any type of overexposure or symptoms of overexposure occur during or following the use of this product, contact a poison control center, emergency room or physician immediately; have Material Safety Data Sheet information available.

SECTION 5 - FIRE FIGHTING MEASURES

FLASHPOINT: 62 Degrees F (17 Degrees C) (PENSKY-MARTENS CLOSED CUP)

FLAMMABLE LIMITS: Lower explosion limit (LEL): 1.8

Upper explosion limit (UEL): Not available

EXTINGUISHING MEDIA: Use National Fire Protection Association (NFPA) Class B extinguishers (carbon dioxide, dry chemical, or universal aqueous film forming

foam) designed to extinguish NFPA Class IB flammable liquid fires.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Keep this product away from heat, sparks, flame, and other sources of ignition (i.e., pilot lights, electric motors, static electricity). Invisible vapors can travel to a source of ignition and flash back. Do not smoke while using this product. Keep containers tightly closed when not in use. Closed containers may explode when overheated. Do not apply to hot surfaces. Toxic gases may form when this product comes in contact with extreme heat.

SPECIAL FIRE FIGHTING PROCEDURES: Water spray may be ineffective. Water spray may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat. If water is used, fog nozzles are preferable. Fire-fighters should wear self-contained breathing apparatus and full protective clothing.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Provide maximum ventilation. Only personnel equipped with proper respiratory, skin, and eye protection should be permitted in the area. Remove all sources of ignition. Take up spilled material with sand, vermiculite, or other noncombustible absorbent material and place in clean, empty containers for disposal. Only the spilled material and the absorbant should be placed in this container.

WASTE DISPOSAL METHOD: Waste material must be disposed of in accordance with federal, state, provincial, and local environmental control regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

SECTION 7 - HANDLING AND STORAGE

HANDLING AND STORAGE PRECAUTIONS: Do not store above 120 degrees F.(48 degrees C.). Store large quantities in buildings designed and protected for storage of NFPA Class IB flammable liquids.

OTHER PRECAUTIONS: Vapors may collect in low areas. If this material is part of a multiple component system, read the Material Safety Data Sheet(s) for the other component or components before blending as the resulting mixture may have the hazards of all of its parts. Containers should be grounded when pouring. Avoid free fall of liquids in excess of a few inches.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT FOR:

EYE PROTECTION: Wear chemical-type splash goggles or full face shield when possibility exists for eye contact due to splashing or spraying liquid, airborne particles, or vapors.

SKIN PROTECTION: Wear protective clothing to prevent skin contact. Apron and gloves should be constructed of: butyl rubber. No specific permeation/degradation testing have been done on protective clothing for this product. Recommendations for skin protection are based on infrequent contact with this product. For frequent contact or total immersion, contact a manufacturer of protective clothing for appropriate chemical impervious equipment.

RESPIRATORY PROTECTION: Overexposure to vapors may be prevented by ensuring proper ventilation controls, vapor exhaust or fresh air entry. A NIOSH- approved air purifying respirator with the appropriate chemical cartridges or a positive-pressure, air-supplied respirator may also reduce exposure. Read the respirator manufacturer's instructions and literature carefully to determine the type of airborne contaminants against which the respirator is effective, its limitations, and how it is to be properly fitted and used.

OTHER EQUIPMENT: Clean contaminated clothing and shoes.

VENTILATION REQUIREMENTS: Provide general dilution or local exhaust ventilation in volume and pattern to keep the concentration of ingredients listed in Section 2 below the lowest suggested exposure limits, the LEL below the stated limit, and to remove decomposition products during welding or flame cutting.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

[FORMULA VALUES, NOT SALES SPECIFICATIONS]

BOILING RANGE: 180- 400Degrees F

SOLUBILITY IN WATER: 15.8 %

VAPOR PRESSURE: 19.7 mmHg

WEIGHT/GALLON (LBS): 8.82 (U.S.)

VAPOR DENSITY: Heavier than air

pH: Not applicable

% VOLATILE/VOLUME: 37.830

% SOLIDS BY WEIGHT: 69.25

SPECIFIC GRAVITY: 1.058

EVAPORATION RATE(BuOAc=100): 147

ODOR/APPEARANCE: Viscous liquid with an odor characteristic of the solvents listed in Section 2.

SECTION 10 - STABILITY AND REACTIVITY

This product is normally stable and will not undergo hazardous reactions.

INCOMPATIBILITY (MATERIALS AND CONDITIONS TO AVOID): Avoid contact with strong alkalies, strong mineral acids, or strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: May produce the following hazardous decomposition products when exposed to extreme heat: carbon monoxide ; carbon dioxide ; lower molecular weight polymer fractions; oxides of nitrogen ; Extreme heat includes, but is not limited to, flame cutting, brazing, and welding.

Hazardous Materials Identification System (HMIS) and National Fire Protection Association (NFPA) Ratings:

MSDS # 057950

HMIS Rating		NFPA Rating	
HEALTH	3*	HEALTH	3
FLAMMABILITY	3	FLAMMABILITY	3
REACTIVITY	0	INSTABILITY	0

Rating System:0=Minimal, 1=Slight, 2=Moderate, 3=Serious, 4=Severe, *=Chronic Effects.

Safe handling of this product requires that all of the information on the MSDS be evaluated for specific work environments and conditions of use.

THIS IS THE END OF THE MSDS FOR: 95-2402 (00125842.00195-2402)

Manufactured and Supplied by:

PPG INDUSTRIES, EAST POINT

1377 OAKLEIGH DRIVE

EAST POINT, GA 30344

U_

APPENDIX C
ANALYSIS OF PAINT FROM K BASINS USED TO SUPPORT MONORAIL, CONCRETE SUPPORT DESIGNATION

10/17/01 09:57 FAX 509 373 9195 001

SPENT NUCLEAR

FUEL PROJECT

FAX COVERSHEET

Date: 10-17-01 No. Pages: 15

To: mitzi miller FAX: 946-4595

Company: EQM Phone: 946-4985

From: Jim Zimmerman FAX: 373-9195

Company: FH Phone: 373-3288

Message: mitzi

Attached is analytical Report (FT 6112)

Highest hit is 196,800 mg/kg for Lead - which comes out

Non Regulated @ .05%. In fact all metals are non Reg.

Sorry for the confusion. Thanks Jim Z

NUMATEC HANFORD CORPORATION

Author	Addressee	Letter No.
L. L. Lockrem 373-4771	D. H. Rehn, DESH	NHC-96-010

Subject: ANALYTICAL REPORT FOR K-BASIN PAINT - FT6112

DISTRIBUTION

Correspondence Control	Z3-01
D. J. Smith	S3-90
J. Y. Smith	S3-90
FAST File	S3-90
Letterbook	S3-90
DE&S Hanford, Inc.	
R. M. Jochen	X3-67
K. M. Jones	X3-85

NHC
Numatec Hanford Corporation
An SGN/Cogema, Inc. Company

September 11, 1996

NHC-96-010

David L. Rehn
President
DE&S Hanford, Inc.
Post Office Box 350
MSIN H5-30
Richland, Washington 99352

Dear Mr. Rehn

ANALYTICAL REPORT FOR K-BASIN - FT6112

Attached is the analytical report for K-Basin - FT6112 in support of this project.

If you have any questions regarding analysis, please contact either Mr. Don Smith at 373-2482 or Ms. Joy Smith at 373-9171.

Sincerely,

for L. L. Lockrem
Manager

llm

Attachment

NUMATEC HANFORD CORPORATION

Author	Addressee	Letter No.
L. L. Lockrem 373-4771	D. H. Rehn, DESH	NHC-96-010

Subject: ANALYTICAL REPORT FOR K-BASIN PAINT - FT6112

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Letterbook	S3-90
DE&S Hanford, Inc.	
R. M. Jochen	X3-67
K. M. Jones	X3-85

Attachment

ANALYTICAL REPORT

for

FAST PROJECT FT6112
K-Basin Paint

Consisting of
11 pages

ANALYTICAL REPORT

for

FAST PROJECT FT6112
K-Basin Paint

prepared for

Duke Engineering Services Hanford
Richland, Washington 99352

October 10, 1996

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Project Sampling and Analysis Case Narrative

INTRODUCTION

On August 28, 1996, Field Assessment Services Team (FAST) personnel collected paint samples from the K East and West Basins. The samples were collected into vendor certified clean containers and transported on chain of custody to the 622R facility for analysis.

ANALYSES REQUESTED

FAST Sample ID	Date Sampled	Analysis Requested	Procedure WHC-IP-1128
FT6112-01	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-02	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-03	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-04	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-05	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-06	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-07	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-08	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55
FT6112-09	8/28/96	ICP Metals (Ag,As,Ba,Cd,Cr,Pb,Se)	3.50, 3.55

ANALYSIS

The samples were microwave digested, filtered and analyzed for lead and chrome by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES).

QUALITY CONTROL

All quality control results were within acceptable limits with the exception of the matrix spike recoveries for silver and arsenic which were low. In the case of silver, this low bias is possibly the result of the relative insolubility of silver at high concentrations. Therefore, the silver results should be considered to be estimates and biased low. The low recovery for arsenic is probably due to the relatively low spiking level relative to the sample concentration. Again, these results should be considered to be estimates and biased low.

REFERENCES

EPA July 1992, Test Methods for Evaluating Solid Waste (SW-846), Third Edition; U.S. Environmental Protection Agency, Washington, D.C.

WHC-IP-1128, Special Analytical Studies Procedure Manual.

Project FT6112 - K Basin Paint Results

ple ID		FT6112-01	FT6112-02	FT6112-03	FT6112-04	FT6112-05	FT6112-06	FT6112-07	FT6112-08	FT6112-09
Sampled		8/28/96	8/28/96	8/28/96	8/28/96	8/28/96	8/28/96	8/28/96	8/28/96	8/28/96
Sampled		1330	1340	1355	1420	1445	1510	1530	1545	1610
ix		Paint	Paint	Paint	Paint	Paint	Paint	Paint	Paint	Paint
ction Method		Microwave	Microwave	Microwave	Microwave	Microwave	Microwave	Microwave	Microwave	Microwave
Analyzed		10/7/96	10/7/96	10/7/96	10/7/96	10/7/96	10/7/96	10/7/96	10/7/96	10/7/96
Metals	**Units**									
silver)	mg/kg	208.0	232.2	1.29	117.7	154.0	108.7	40.25	38.87	42.96
rsenic)	mg/kg	41.22	79.03	31.12	6.78	<2.7	9.42	<2.7	2.84	<2.7
arium)	mg/kg	722.7	1040	33.50	6855	2496	6556	26.43	26.38	25.16
cadmium)	mg/kg	17.21	2.84	<0.45	10.79	8.24	4.30	23.95	20.98	20.63
hromium)	mg/kg	19610	41990	15160	1337	128.9	2110	2.10	1.26	1.24
ead)	mg/kg	72000	196800	51720	28990	15260	4987	12.79	14.15	14.63
elenium)	mg/kg	<20	<20	<20	<20	<20	<20	<20	<20	<20

Reviewed by: JH
Date: 10/11/96

Printed on: 10/17/96

QC SUMMARY

Quality Control Sum(ry - FT6112

ration Verification (ICV/CCV)												
ent	Units	Actual Value	ICV	%Recovery	CCV1	%Recovery	CCV2	%Recovery	CCV3	%Recovery	CCV4	%Recovery
ilver)	mg/L	0.100	0.096	96.30	0.093	92.50	0.092	92.40	0.103	103.10	0.109	109.30
rsenic)	mg/L	4.000	3.903	97.58	3.705	92.63	3.878	96.95	3.983	99.58	4.116	102.90
arium)	mg/L	4.000	3.932	98.30	3.698	92.45	3.852	96.30	3.941	98.53	4.038	100.95
admium)	mg/L	0.100	0.098	98.10	0.093	93.40	0.096	95.60	0.102	102.40	0.104	104.40
hromium)	mg/L	0.400	0.395	98.70	0.376	94.10	0.384	96.10	0.402	100.53	0.418	104.43
ead)	mg/L	1.000	1.002	100.20	0.935	93.47	0.983	98.28	0.979	97.90	1.017	101.70
elenium)	mg/L	4.000	3.836	95.90	3.625	90.63	3.806	95.15	3.987	99.68	4.057	101.43

ent	Units	Actual Value	ICV	%Recovery	CCV1	%Recovery
elenium)	mg/L	4.000	3.866	96.65	3.866	96.65

ratory Control Sample (LCS)				
ent	Units	Actual Value	Found	% Recovery
ilver)	mg/L	0.125	0.118	94.40
rsenic)	mg/L	5.000	5.13	102.60
arium)	mg/L	5.000	5.062	101.24
admium)	mg/L	0.125	0.123	98.4
hromium)	mg/L	0.500	0.499	99.8
ead)	mg/L	1.250	1.264	101.12
elenium)	mg/L	5.000	4.96	99.2

ix Spike (MS)							
ent	Units	Spiked Sample ID	Original Sample Conc.	Spiked Sample	Spiking Level	% Recovery	SW-846 Limit
ilver)	mg/Kg	FT6112-09	42.96	54.12	20.00	55.80	75-125%
rsenic)	mg/Kg	FT6112-09	0.00	301.8	400.00	75.45	75-125%
arium)	mg/Kg	FT6112-09	25.16	426.9	400.00	100.44	75-125%
admium)	mg/Kg	FT6112-09	20.63	37.70	20.00	85.35	75-125%
hromium)	mg/Kg	FT6112-09	1.237	41.09	40.00	99.63	75-125%
ead)	mg/Kg	FT6112-09	14.63	113.6	100.00	98.97	75-125%
elenium)	mg/Kg	FT6112-09	0.00	375.0	400.00	93.75	75-125%

Reviewed by: EH
Date: 10/17/01

Printed on: 10/17/96

Quality Control Sun(.ry - FT6112

ix Spike (MS)												
ent	Units	Spiked Sample ID	Original Sample Conc.	Spiked Sample	Spiking Level	% Recovery	SW-846 Limit					
ilver)	mg/Kg	FT6112-09	42.96	55.25	20.00	61.45	75-125%					
rsenic)	mg/Kg	FT6112-09	0	285.7	400.00	71.43	75-125%					
arium)	mg/Kg	FT6112-09	25.16	422.6	400.00	99.36	75-125%					
admium)	mg/Kg	FT6112-09	20.63	39.53	20.00	94.50	75-125%					
hromium)	mg/Kg	FT6112-09	1.237	40.77	40.00	98.83	75-125%					
ead)	mg/Kg	FT6112-09	14.63	115.2	100.00	100.57	75-125%					
elenium)	mg/Kg	FT6112-09	0	362.1	400.00	90.53	75-125%					

ks												
ent	Units	Cal Blank-1	Cal Blank-2	Cal Blank-3	Cal Blank-	Prep Blank						
ilver)	mg/L	-0.0029	-0.0019	-0.0063	-0.0037	-0.1728						
rsenic)	mg/L	0.0226	-0.0017	0.0136	-0.0409	0.1364						
arium)	mg/L	-0.003	0.0028	0.0048	0.0037	-0.2057						
admium)	mg/L	-0.0024	-0.0024	-0.0051	-0.0017	-0.1109						
hromium)	mg/L	-0.0002	0.0006	-0.0002	-0.0004	0.0061						
ead)	mg/L	-0.0136	0.0032	0.0069	-0.0009	-0.0529						
elenium)	mg/L	0.0161	0.0549	-0.0115	0.011	2.522						

ix Spike Duplicates												
ent	Units	FT6-09MS	T6-09MSDu	% RPD								
ilver)	mg/Kg	54.12	55.25	2.07								
rsenic)	mg/Kg	301.8	285.7	5.48								
arium)	mg/Kg	426.9	422.6	1.01								
admium)	mg/Kg	37.70	39.53	4.74								
hromium)	mg/Kg	41.09	40.77	0.78								
ead)	mg/Kg	113.6	115.2	1.40								
elenium)	mg/Kg	375.0	362.1	3.50								

Reviewed by: [illegible]
Date: 10-1-96

Printed on: 10/17/96

CHAIN-OF-CUSTODY INFORMATION

Field Assessment Services Team
Special Analytical Services
Hanford Technical Services
Richland, WA. 99352
(509) 373-3798 FAX (509) 373-3193

Chain-of-Custody/ Sample Analysis Request

SAS # _____

Date 8/28/96

Page 1 of 1

Project FT6112 Job No. _____

Client Rod Tuhesi Telephone No. _____

Project Location K-West

Sampler L.D. Lockard Telephone No. 3-5544

Testing Parameters: 8260 Metals by ICP, Cr+Pb

Turnaround Time
- ☐ Standard
- ☐ Accelerated
- ☐ Other _____

Hold Time _____

FAST ID	Date	Time	*	No. of Containers	8260	Metals by ICP	Cr+Pb								Observations/Comments	Customer ID
FT6112-01	8-28-96	1330	O	1	X											
FT6112-02	↑	↑	↑	↑	X											
FT6112-03					X											
FT6112-04					X											
FT6112-05					X											
FT6112-06					X											
FT6112-07					X											
FT6112-08	↓	↓	↓	↓	X											
FT6112-09	8-28-96	1610	O	1												

Special Shipment/Handling or Storage Requirements

Possible Sample Hazards/ Remarks

☐ Rad Screening
☐ Field Analysis

Relinquished By	Date/Time	Received By	Date/Time
L.D. Lockard	8/28/96 1615	Jay Smith	8/28/96 1615

* Matrix

S = Soil	DS = Drum Solids
SE = Sediment	DL = Drum Liquids
SO = Solid	T = Tissue
SL = Sludge	WI = Wipe
W = Water	L = Liquid
O = Oil	V = Vegetation
A = Air	X = Other

Final Sample Disposition	Disposal Method	Disposed By	Date/Time

Westinghouse Hanford Company

10/17/01 10:02 FAX 509 373 9195 015

APPENDIX D
RADIOLOGICAL SURVEY K000511, "INVESTIGATIVE SURVEY OF OLD RAD PAD"

Originally, it was reported by K Basin staff that all of the hot spots currently identified by survey on the K East Filter Wash Pad would not be part of this removal action. Subsequent meetings determined that some of the spots would be left behind but others would be removed. The survey data were evaluated to assess whether disposal of higher contaminated areas would allow the use of the current curie-to-weight ratios. The evaluation assessed whether current ratios would underestimate to the Cs-137 content.

The discussion below illustrates that even if all of the highest contaminated concrete squares scheduled to be removed are placed in one waste box, the weight to curie conversion factor currently used by K East Basin for above water waste will be conservative. Using the factor will not underestimate the Cs-137 in the waste from this action.

The figure attached to the survey provides 3'x3' square grids that are uniquely numbered. The numbers in this paragraph are grid numbers. The area of the Filter Wash Pad that is being removed is divided from the area being left by a north south line between squares 315 and 316 on the north and squares 15 and 16 on the south on the map in the attached survey report K000511. Squares 66,67,68,69,91 are in the area to be removed and they are all >1,000,000 dpm/100cm2. Three other squares (40,65,90) are immediately adjacent to the line and are all listed as >1,000,000 dpm per 100 cm2 but are not scheduled for removal.

It was assumed that all five of the highest contaminated squares of concrete from the area to be removed were placed in a 4x4x8 ft wood box. The 4x4x8 ft wooden box has a dose to Cs-137 curie conversion factor published in WHC documents (WHC 1996a, 1996b). If the five squares of concrete are placed in the box, the maximum dose rate on the outside of the box (ignoring shielding by the box or self shielding by the concrete) is assumed to be a simple addition of the field dose rate survey (≥30 cm from slab) with the dose rate meter window closed.

The closed window reading at 30 cm was selected because it is the dose rate of gamma emitters on the concrete. All gamma emitters are assumed to be Cs-137 for this exercise. The data from the survey sheet for the five squares that are in the area to be removed (squares 66, 67, 68, 69, 91) indicate dose rates of 2.7,0.7, <0.5, <0.5 mR/hr. If the results are summed the in-situ survey dose on the five portions of the slabs equal 4.4 mR/hr.

After placing the contaminated concrete in a waste box, the average dose rate on the waste box could be measured. A rough estimate of how the dose rates from the contaminated concrete would be reduced by the shielding of the other concrete and the wood box was made. It was estimated that the dose rate outside of a wood box full of rubble would be that less than 10% of the dose rate measured when the survey reading is taken 30 cm away from the in-situ concrete without shielding. Applying a 10% factor for shielding and geometry, one could estimate an average measured dose rate outside of the hypothetical box of waste (averaged over all sides of the box) of 0.44 mR/hr (4.4E-4 R/hr). The dose rate conversion for the wood box is 13.8 Ci Cs-137 per R/hr. Thus, if the five contaminated concrete squares were placed in a 4x4x8 wooden box, and an average reading of 0.44 mR/hr was obtained, it is estimated that the five contaminated squares contain about 6.1E-3 Ci of Cs-137.

Using the current K East weight to curie methodology, the concentration of Cs-137 in the waste that is assumed for all of K East above water waste is 1.12E-5 Ci/kg. According to the current K Basin SAP in use (HNF 2001), an ERDF roll-off box can be loaded with 7,980 kg. Applying the current factor to this maximum load, a Cs-137 amount of approximately 9E-2 Ci of Cs-137 would be within the profile. If one estimates the number of curies in the five contaminated sections (6.1E-3 Ci) and divides by the maximum weight of waste that can be placed in the ERDF box, the Cs-137 content of the waste container is nearly a factor of 15 below the maximum allowed in the current profile. Even if the boxes were sent to ERDF only half full, the waste would not exceed the profile.

The calculations and assumptions presented above are conservative in that it is not expected that all of the highest contaminated portions of the pad will end up in one ERDF roll-off box. The highly contaminated section of the pad is less than 4% of the total of the surface area of the pad. It is also known that the dose to Cs-137 curie conversion factors (WHC 1999a, WHC 1999b) are conservative, so it is likely that the 10% factor that was used to convert the dose measured in the survey to a dose that would be measured if the waste were put in a 4x4x8 wood box, would actually be less. That would translate into a lower number of Curies of Cs-137 being placed in the ERDF roll-off box and provide an even larger safety margin.

Map/Sketch

SEE PAGE 16 FOR SURVEY MAP

COPY

SNF PROJECT RADIOLOGICAL SURVEY REPORT

Date (MM/DD/YY)	Time (Start/Stop)	Survey Report No.
07/28/00	0930/1600	K000511

RWP	Area/Bldg./Room/Location	Facility Code
K-026	100K/105KE/OUTSIDE	K

Description: Investigative survey of old Bad Pad

Purpose of Survey
- ☐ Job Coverage
- ☐ Material Release
- ☐ Routine No. ____
- ☐ Work Package No. ____
- ☐ HRA/VHRA
- ☐ RM Transfer/Shipment
- ☐ RSR No. ____
- ☐ RPR No. ____

Incident
- ☐ Skin Contamination
- ☐ Clothing Contamination
- ☐ CAM
- ☐ ARM
- ☐ PSD
- ☐ Spill
- ☐ Exposure
- ☒ Other Investigative

Check appropriate box(es) above

AIR SAMPLE MEASUREMENTS (µCi/ml)

	BZ	GA	Initial	Decay	Sample No.
α1					
βγ1			N		
α2				A	
βγ2					

All dose rates are in mrem/hr, unless otherwise noted.

Instrument	RO-20	GM	PAM	GM	GM
Probe		Probe	Probe	Probe	Probe
Serial No.	1362	0025	NA	0010	0064
				0022	0062
Efficiency	NA	10%	↓	10%	10%

LEGEND
- (#) Smear
- [#] Large Area Wipe
- # Deep Dose Field, CF=1
- ■ Support beam
- △# Air Sample
- * Contact Reading
- ⬡# Neutron
- --- Radiological Area Boundary

BD-6002-600 (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
1	Grid 1	NA	NA	NA	NA	NA	NA	NA	NA	500	NA	800	NA	<1000	NA	3000	NA
2	Grid 2									1000		1000		<1000		<D	
3	Grid 3									1000		1000		<1000		<D	
4	Grid 4									1000		1200		<1000		8000	
5	Grid 5									700		700		<1000		<D	
6	Grid 6									1000		1000		<1000		<D	
7	Grid 7									1000		800		<1000		15,000	
8	Grid 8									600		700		<1000		3,000	
9	Grid 9									800		900		<1000		3,000	
10	Grid 10									900		1000		<1000		4,000	
11	Grid 11									1500		2000		<1000		15,000	
12	Grid 12									2000		2500		<1000		15,000	
13	Grid 13									2000		2000		<1000		<D	
14	Grid 14									2000		2000		<1000		<D	
15	Grid 15	NA	NA	NA	NA	NA	NA	NA	NA	2500	NA	3000	NA	<1000	NA	15,000	NA

Comments: Investigative survey of old rad pad. Each grid measures 3'x3'. Gross direct cpm/PA = maximum probe area per grid. Total dpm/100cm² = Sum of six adjacent probe areas. <D = 75% of grid at 6 inches/sec. No audible counts above background detected. Pad needs painting due to cracking and chipping. Background ranges from 300 - >1,000,000 cpm and measured while facing south at each grid. Western most row of grids measure 1½' x 3'. Perimeter of fence 3' out surveyed for total contamination. LAW taken on all grids. Areas reading >1,000,000 total dpm/100cm² measured with dose rate meter. Area inside fence posted 'RA' and pad is posted 'FCA'. Survey peformed 07/28/00-08/01/00 and documented 8/1/00

RCT Name (Print)	Date	Payroll	Signature	Reviewer Name (Print)	Date	Payroll	Signature
Sheila Godfrey	08/01/00	81497 22324	Sheila Godfrey	Thomas Bratrold	8/1/00	84075	

HNF-8918, Rev. 1

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SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm^2		Total dpm/100 cm^2	
										βγ	α	βγ	α	βγ	α	βγ	α
16	Grid 16	NA	NA	NA	NA	NA	NA	NA	NA	1500	NA	2500	NA	<1000	NA	25,000	NA
17	Grid 17									1500		2000		<1000		15,000	
18	Grid 18									1500		2000		<1000		5,000	
19	Grid 19									800		800		<1000		<D	
20	Grid 20									500		500		<1000		<D	
21	Grid 21									500		500		<1000		<D	
22	Grid 22									500		500		<1000		<D	
23	Grid 23									600		600		<1000		<D	
24	Grid 24									800		800		<1000		<D	
25	Grid 25									800		800		<1000		<D	
26	Grid 26									1000		1000		<1000		<D	
27	Grid 27									1000		1000		<1000		<D	
28	Grid 28									1000		1000		<1000		<D	
29	Grid 29									1000		1000		<1000		<D	
30	Grid 30									1000		1000		<1000		<D	
31	Grid 31									1000		1500		<1000		10,000	
32	Grid 32									1500		2000		<1000		30,000	
33	Grid 33									1000		1000		<1000		<D	
34	Grid 34									1000		1000		<1000		<D	
35	Grid 35									1000		1000		<1000		<D	
36	Grid 36									1500		1500		<1000		<D	
37	Grid 37									1500		1500		<1000		<D	
38	Grid 38									1500		2000		<1000		15,000	
39	Grid 39	NA	NA	NA	NA	NA		NA	NA	4000		5000		<1000		40,000	
40	Grid 40	C / F	19 / NA	0.3 / 1.2	6 / NA	5 / 1	NA	113 / NA	1.2	150000	NA	>1,000,000	NA	<1000	NA	>1,000,000	NA

COPY!

BD-6002-601R (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								1° CONTAMINATION MEASUREMENTS							
		Dist.[1] Note cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
41	Grid 41	NA	NA	NA	NA	NA	NA	NA	NA	3000	NA	4000	NA	<1000	NA	20,000	NA
42	Grid 42									1500		3000		<1000		35,000	
43	Grid 43									1000		1000		<1000		<D	
44	Grid 44									600		600		<1000		<D	
45	Grid 45									600		600		<1000		<D	
46	Grid 46									500		500		<1000		<D	
47	Grid 47									600		600		<1000		<D	
48	Grid 48									700		700		<1000		<D	
49	Grid 49									700		700		<1000		<D	
50	Grid 50									700 1500		700 3500		<1000		<D 75,000	
51	Grid 51									1500		3500		<1000		75,000	
52	Grid 52									1000		1000		<1000		<D	
53	Grid 53									1000		1000		<1000		<D	
54	Grid 54									1000		1000		<1000		<D	
55	Grid 55	NA	NA	NA	NA	NA		NA	NA	1000		1000		<1000		<D	
56	Grid 56 >3" disc	C/F	20/NA	1.2/<0.5	6/NA	5/1		118.8/NA	6/<0.5	2000		>1,000,000		<1000		>1,000,000	
57	Grid 57 >3" disc	C/F	20/NA	<0.5/<0.5	6/NA	5/1		120/NA	120/<0.5	4000		>1,000,000		<1000		>1,000,000	
58	Grid 58	NA	NA	NA	NA	NA		NA	NA	2000		2000		<1000		<D	
59	Grid 59 >3" disc	C/F	13/NA	<0.5/<0.5	6/NA	5/1		78/NA	<0.5/<0.5	1500		>1,000,000		<1000		>1,000,000	
60	Grid 60	NA	NA	NA	NA	NA		NA	NA	1500		5,500		<1000		55,000	
61	Grid 61									1500		6,500		<1000		65,000	
62	Grid 62									1500		2,000		<1000		15,000	
63	Grid 63									2000		2500		<1000		10,000	
64	Grid 64	NA	NA	NA	NA	NA	NA	NA	NA	5500		20,000		<1000		155,000	
65	Grid 65 >3" disc	C/F	100/NA	1/.7	6/NA	5/1	NA	579/NA	5/.7	50000	NA	>1,000,000	NA	<1000	NA	>1,000,000	NA

COPY

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist.[1] Note cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable[2] dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
66	Grid 66 >3" disc	C/F	250/NA	13/2.7	6/NA	5/1	NA	1487/NA	65/2.7	>1,000,000	NA	>1,000,000	NA	<1000	NA	>1,000,000	NA
67	Grid 67 >3" disc	C/F	15/NA	1/.7	6/NA	5/1		89/NA	5/.7	10,000		>1,000,000		<1000		>1,000,000	
68	Grid 68 >3" disc	C/F	10/NA	<0.5/<0.5	6/NA	5/1		60/NA	<0.5/<0.5	2500		80,000		<1000		>1,000,000	
69	Grid 69 >3" disc	C/F	20/NA	<0.5/<0.5	6/NA	5/1		120/NA	<0.5/<0.5	2500		>1,000,000		<1000		>1,000,000	
70	Grid 70	NA	NA	NA	NA	NA		NA	NA	1000		1000		<1000		<D	
71	Grid 71									700		700		<1000		<D	
72	Grid 72									700		700		<1000		<D	
73	Grid 73									700		700		<1000		<D	
74	Grid 74									800		800		<1000		<D	
75	Grid 75	NA	NA	NA	NA	NA		NA	NA	700		700		<1000		<D	
76	Grid 76 >3" disc	C/F	190/NA	1/.5	6/NA	5/1		139/NA	5/.5	1500		>1,000,000		<1000		>1,000,000	
77	Grid 77	NA	NA	NA	NA	NA		NA	NA	1000		1500		<1000		10,000	
78	Grid 78	NA	NA	NA	NA	NA		NA	NA	1000		3500		<1000		80,000	
79	Grid 79	NA	NA	NA	NA	NA		NA	NA	1000		1500		<1000		30,000	
80	Grid 80 >3" disc	C/F	38/NA	.4/.4	6/NA	5/1		227.6/NA	2/.4	1000		>1,000,000		<1000		>1,000,000	
81	Grid 81 >3" disc	C/F	22/NA	.4/.4	6/NA	5/1		131.6/NA	2/.4	1500		>1,000,000		<1000		>1,000,000	
82	Grid 82 >3" disc	C/F	23/NA	.4/.4	6/NA	5/1		137.6/NA	2/.4	2000		>1,000,000		<1000		>1,000,000	
83	Grid 83	NA	NA	NA	NA	NA		NA	NA	1000		1000		<1000		<D	
84	Grid 84									1000		1000		<1000		<D	
85	Grid 85									1000		2000		<1000		45000	
86	Grid 86									1000		1500		<1000		30,000	
87	Grid 87									1000		2000		<1000		60,000	
88	Grid 88									1500		3000		<1000		90,000	
89	Grid 89	NA	NA	NA	NA	NA		NA	NA	2500/6000		4000		<1000		45000	
90	Grid 90 >3" disc	C/F	800/NA	.8/.6	6/NA	5/1	NA	4797.2/NA	8.4/.6	20,000	NA	>1,000,000	NA	<1000	NA	>1,000,000	NA

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BD-6002-601R (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
91	Grid 91	C / F	15 / NA	1.3 / .9	6 / NA	5 / 1	NA	88.7 / NA	45.6 / .9	20,000	NA	70000	NA	<1000	NA	>1,000,000	NA
92	Grid 92	NA	NA	NA	NA	NA		NA	NA	3500		3500		<1000		<D	
93	Grid 93									3000		4000		<1000		60,000	
94	Grid 94									2000		2000		<1000		<D	
95	Grid 95									1000		2000		<1000		30,000	
96	Grid 96									1000		1000		<1000		<D	
97	Grid 97									600		600		<1000		<D	
98	Grid 98									550		550		<1000		<D	
99	Grid 99									700		700		<1000		<D	
100	Grid 100									700		700		<1000		<D	
101	Grid 101									3000		20,000		<1000		420,000	
102	Grid 102									1500		1500		<1000		<D	
103	Grid 103									1000		2000		<1000		15,000	
104	Grid 104									1000		2500		<1000		50,000	
105	Grid 105									1000		4500		<1000		700,000	
106	Grid 106									1000		2000		<1000		30,000	
107	Grid 107									1000		1500		<1000		15,000	
108	Grid 108									1000		1500		<1000		15,000	
109	Grid 109									1000		1500		<1000		15,000	
110	Grid 110									600		6000		<1000		324,000	
111	Grid 111									700		7000		<1000		378,000	
112	Grid 112									700		7000		<1000		378,000	
113	Grid 113									1500		3000		<1000		90,000	
114	Grid 114									1000		1500		<1000		10,000	
115	Grid 115	NA	NA	NA	NA	NA	NA	NA	NA	1500	NA	2500	NA	<1000	NA	45,000	NA

COPY

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist., Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
116	Grid 116	NA	NA	NA	NA	NA	NA	NA	NA	3000	NA	4000	NA	<1000	NA	30,000	NA
117	Grid 117									2000		3000		<1000		30,000	
118	Grid 118									2000		2000		<1000		<D	
119	Grid 119									1000		1000		<1000		<D	
120	Grid 120									800		800		<1000		<D	
121	Grid 121									600		600		<1000		<D	
122	Grid 122									500		500		<1000		<D	
123	Grid 123									400		400		<1000		<D	
124	Grid 124									500		500		<1000		<D	
125	Grid 125									500		500		<1000		<D	
126	Grid 126									550		550		<1000		<D	
127	Grid 127									550		550		<1000		<D	
128	Grid 128									600		600		<1000		<D	
129	Grid 129									700		700		<1000		<D	
130	Grid 130									650		650		<1000		<D	
131	Grid 131									700		800		<1000		6,000	
132	Grid 132									900		20,000		<1000		646,000	
133	Grid 133									800		3000		<1000		52,000	
134	Grid 134									500		500		<1000		<D	
135	Grid 135									500		500		<1000		<D	
136	Grid 136									500		500		<1000		<D	
137	Grid 137									600		700		<1000		6,000	
138	Grid 138									1000		1000		<1000		<D	
139	Grid 139									1000		1000		<1000		<D	
140	Grid 140	NA	NA	NA	NA	NA	NA	NA	NA	1000	NA	1000	NA	<1000	NA	<D	NA

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BD-6002-601R (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								1" CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_T	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
141	Grid 141	NA	NA	NA	NA	NA	NA	NA	NA	1500	NA	1500	NA	<1000	NA	<D	<D
142	Grid 142									1000		1000		<1000		<D	<D
143	Grid 143									750		750		<1000		<D	<D
144	Grid 144									450		450		<1000		<D	<D
145	Grid 145									400		400		<1000		<D	<D
146	Grid 146									350		350		<1000		<D	<D
147	Grid 147									350		350		<1000		<D	<D
148	Grid 148									400		400		<1000		<D	<D
149	Grid 149									400		400		<1000		<D	<D
150	Grid 150									400		400		<1000		<D	<D
151	Grid 151									600		600		<1000		<D	<D
152	Grid 152									400		400		<1000		<D	<D
153	Grid 153									450		450		<1000		<D	<D
154	Grid 154									450		450		<1000		<D	<D
155	Grid 155									450		450		<1000		<D	<D
156	Grid 156									500		500		<1000		<D	<D
157	Grid 157									600		2000		<1000		84,000	
158	Grid 158									700		700		<1000		<D	
159	Grid 159	NA	NA	NA	NA	NA		NA	NA	750		750		<1000		<D	
160	Grid 160 >3" disc	C/F	8/NA	<0.5/<0.5	6/NA	5/1		48/NA	<0.5/<0.5	600		50,000		<1000		>1,000,000	
161	Grid 161	NA	NA	NA	NA	NA		NA	NA	600		600		<1000		<D	
162	Grid 162	NA	NA	NA	NA	NA		NA	NA	650		550		<1000		<D	
163	Grid 163 >3" disc	C/F	3.6/NA	<0.5/<0.5	6/NA	5/1		21.6/NA	<0.5/<0.5	650		35,000		<1000		>1,000,000	
164	Grid 164 >3" disc	C/F	8/NA	.7/<0.5	6/NA	5/1		47.3/NA	3.5/<0.5	850		50,000		<1000		>1,000,000	
165	Grid 165	NA	NA	NA	NA	NA	NA	NA	NA	900	NA	1000	NA	<1000	NA	6,000	

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SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
166	Grid 166	NA	NA	NA	NA	NA	NA	NA	NA	700	NA	700	NA	<1000	NA	<D	NA
167	Grid 167									500		500		<1000		<D	
168	Grid 168									500		500		<1000		<D	
169	Grid 169									600		600		<1000		<D	
170	Grid 170									500		500		<1000		<D	
171	Grid 171									450		450		<1000		<D	
172	Grid 172									350		350		<1000		<D	
173	Grid 173									300		300		<1000		<D	
174	Grid 174									300		300		<1000		<D	
175	Grid 175									300		300		<1000		<D	
176	Grid 176									400		400		<1000		<D	
177	Grid 177									400		400		<1000		<D	
178	Grid 178									400		400		<1000		<D	
179	Grid 179									400		400		<1000		<D	
180	Grid 180									400		400		<1000		<D	
181	Grid 181									400		400		<1000		<D	
182	Grid 182									500		500		<1000		<D	
183	Grid 183									500		500		<1000		<D	
184	Grid 184									550		550		<1000		<D	
185	Grid 185									500		500		<1000		<D	
186	Grid 186									400		400		<1000		<D	
187	Grid 187									300		300		<1000		<D	
188	Grid 188	NA	NA	NA	NA	NA		NA	NA	1500		2000		<1000		15,000	
189	Grid 189 >3" disc	C / F	4 / NA	.6 / <0.5	6 / NA	5 / 1		23.4 / NA	3 / <0.5	3000		25,000		<1000		>1,000,000	
190	Grid 190	NA	NA	NA	NA	NA	NA	NA	NA	1000	NA	1000	NA	<1000	NA	<D	NA

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BD-5002-601R (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
191	Grid 191	NA	NA	NA	NA	NA	NA	NA	NA	450	NA	450	NA	<1000	NA	<D	NA
192	Grid 192									350		350		<1000		<D	
193	Grid 193									400		400		<1000		<D	
194	Grid 194									400		400		<1000		<D	
195	Grid 195									350		350		<1000		<D	
196	Grid 196									300		300		<1000		<D	
197	Grid 197									300		300		<1000		<D	
198	Grid 198									300		300		<1000		<D	
199	Grid 199									300		300		<1000		<D	
200	Grid 200									300		300		<1000		<D	
201	Grid 201									300		300		<1000		<D	
202	Grid 202									300		300		<1000		<D	
203	Grid 203									300		300		<1000		<D	
204	Grid 204									300		300		<1000		<D	
205	Grid 205									300		300		<1000		<D	
206	Grid 206									300		300		<1000		<D	
207	Grid 207									300		300		<1000		<D	
208	Grid 208									300		300		<1000		<D	
209	Grid 209									300		300		<1000		<D	
210	Grid 210									300	300	300		<1000		<D	
211	Grid 211									300	300	300		<1000		<D	
212	Grid 212									300	500	1000		<1000		30,000	
213	Grid 213									650	650	NA		<1000		NA	
214	Grid 214									1500	1500	5000		<1000		210,000	
215	Grid 215	NA	NA	NA	NA	NA	NA	NA	NA	1000	1000	1000	NA	<1000	NA	<D	NA

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SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

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No.	Description	DOSE RATE MEASUREMENTS Note 1 F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note 1 cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
216	Grid 216	NA	NA	NA	NA	NA	NA	NA	NA	300	NA	300	NA	<1000	NA	<D	NA
217	Grid 217									300		300		<1000		<D	
218	Grid 218									300		300		<1000		<D	
219	Grid 219									300		300		<1000		<D	
220	Grid 220									300		300		<1000		<D	
221	Grid 221									300		300		<1000		<D	
222	Grid 222									300		300		<1000		<D	
223	Grid 223									300		300		<1000		<D	
224	Grid 224									300		300		<1000		<D	
225	Grid 225									300		300		<1000		<D	
226	Grid 226									500		500		<1000		<D	
227	Grid 227									500		500		<1000		<D	
228	Grid 228									500		500		<1000		<D	
229	Grid 229									500		500		<1000		<D	
230	Grid 230									500		500		<1000		<D	
231	Grid 231									500		500		<1000		<D	
232	Grid 232									500		500		<1000		<D	
233	Grid 233									500		500		<1000		<D	
234	Grid 234									500		500		<1000		<D	
235	Grid 235									500		500		<1000		<D	
236	Grid 236									500		800		<1000		18,000	
237	Grid 237									500		500		<1000		<D	
238	Grid 238									500		2000		<1000		90,000	
239	Grid 239									300		1500		<1000		72,000	
240	Grid 240	NA	NA	NA	NA	NA	NA	NA	NA	300	NA	300	NA	<1000	NA	<D	NA

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BD-6002-601R (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								1' CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
241	Grid 241	NA	NA	NA	NA	NA	NA	NA	NA	300	NA	300	NA	<1000	NA	<D	NA
242	Grid 242									300		300		<1000		<D	
243	Grid 243									300		300		<1000		<D	
244	Grid 244									300		300		<1000		<D	
245	Grid 245									300		300		<1000		<D	
246	Grid 246									300		300		<1000		<D	
247	Grid 247									300		300		<1000		<D	
248	Grid 248									300		300		<1000		<D	
249	Grid 249									300		300		<1000		<D	
250	Grid 250									300		300		<1000		<D	
251	Grid 251									300		300		<1000		<D	
252	Grid 252									300		300		<1000		<D	
253	Grid 253									300		300		<1000		<D	
254	Grid 254									300		300		<1000		<D	
255	Grid ~~254~~ 255									300		300		<1000		<D	
256	Grid 256									300		300		<1000		<D	
257	Grid 257									300		300		<1000		<D	
258	Grid 258									300		300		<1000		<D	
259	Grid 259									300		300		<1000		<D	
260	Grid 260									300		300		<1000		<D	
261	Grid 261									300		600		<1000		18,000	
262	Grid 262									300		700		<1000		24,000	
263	Grid 263									500		1000		<1000		30,000	
264	Grid 264									500		500		<1000		<D	
265	Grid 265	NA	NA	NA	NA	NA	NA	NA	NA	500	NA	500	NA	<1000	NA	<D	NA

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SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
266	Grid 266	NA	NA	NA	NA	NA	NA	NA	NA	500	NA	300	NA	<1000	NA	<D	NA
267	Grid 267									500		300		<1000		<D	
268	Grid 268									300		300		<1000		<D	
269	Grid 269									300		300		<1000		<D	
270	Grid 270									300		300		<1000		<D	
271	Grid 271									300		300		<1000		<D	
272	Grid 272									300		300		<1000		<D	
273	Grid 273									300		300		<1000		<D	
274	Grid 274									300		300		<1000		<D	
275	Grid 275									300		300		<1000		<D	
276	Grid 276									300		300		<1000		<D	
277	Grid 277									300		300		<1000		<D	
278	Grid 278									300		300		<1000		<D	
279	Grid 279									300		300		<1000		<D	
280	Grid 280									300		300		<1000		<D	
281	Grid 281									300		300		<1000		<D	
282	Grid 282									300		300		<1000		<D	
283	Grid 283									300		300		<1000		<D	
284	Grid 284									300		300		<1000		<D	
285	Grid 285									250		250		<1000		<D	
286	Grid 286									250		250		<1000		<D	
287	Grid 287									250		~~250~~ 400		<1000		33,000	
288	Grid 288									250		~~250~~ 1000		<1000		45,000	
289	Grid 289									250		250		<1000		<D	
290	Grid 290	NA	NA	NA	NA	NA	NA	NA	NA	250	NA	250	NA	<1000	NA	<D	NA

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BD-6007-601R (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Data

Survey Report No. K000511

No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist.[1] Note cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
291	Grid 291	NA	NA	NA	NA	NA	NA	NA	NA	300	NA	300	NA	<1000	NA	<D	NA
292	Grid 292									250		250		<1000		<D	
293	Grid 293									250		250		<1000		<D	
294	Grid 294									250		250		<1000		<D	
295	Grid 295									250		250		<1000		<D	
296	Grid 296									250		250		<1000		<D	
297	Grid 297									250		250		<1000		<D	
298	Grid 298									250		250		<1000		<D	
299	Grid 299									300		300		<1000		<D	
300	Grid 300									250		250		<1000		<D	
301	Grid 301									300		300		<1000		<D	
302	Grid 302									300		300		<1000		<D	
303	Grid 303									300		300		<1000		<D	
304	Grid 304									300		300		<1000		<D	
305	Grid 305									300		300		<1000		<D	
306	Grid 306									300		300		<1000		<D	
307	Grid 307									300		300		<1000		<D	
308	Grid 308									300		300		<1000		<D	
309	Grid 309									300		300		<1000		<D	
310	Grid 310									300		300		<1000		<D	
311	Grid 311									300		300		<1000		<D	
312	Grid 312									300		300		<1000		<D	
313	Grid 313									250		250		<1000		<D	
314	Grid 314									250		250		<1000		<D	
315	Grid 315	NA	NA	NA	NA	NA	NA	NA	NA	250	NA	250	NA	<1000	NA	<D	NA

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DD-6002-601 (12/98)

SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Map/Sketch

Survey Report No. K000511

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No.	Description	DOSE RATE MEASUREMENTS Note[1] F = Field (≥ 30 cm) C = Contact (≤ 1 cm)								CONTAMINATION MEASUREMENTS							
		Dist. Note[1] cm	WO mR/hr	WC mR/hr	CF_β	CF_γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	Bkg cpm		Gross Direct cpm/PA		Removable dpm/100 cm²		Total dpm/100 cm²	
										βγ	α	βγ	α	βγ	α	βγ	α
316	Grid 316	NA	NA	NA	NA	NA	NA	NA	NA	250	NA	250	NA	<1000	NA	<D	NA
317	Grid 317									250		250		<1000		<D	
318	Grid 318									250		250		<1000		<D	
319	Grid 319									250		250		<1000		<D	
320	Grid 320									250		250		<1000		<D	
321	Grid 321									250		250		<1000		<D	
322	Grid 322									250		250		<1000		<D	
323	Grid 323									250		250		<1000		<D	
324	Grid 324									250		250		<1000		<D	
325	Grid 325									250		250		<1000		<D	
NA	3' Perimeter Around Rad Pad									250		250		<1000		<D	
	NA									NA		NA		NA		NA	
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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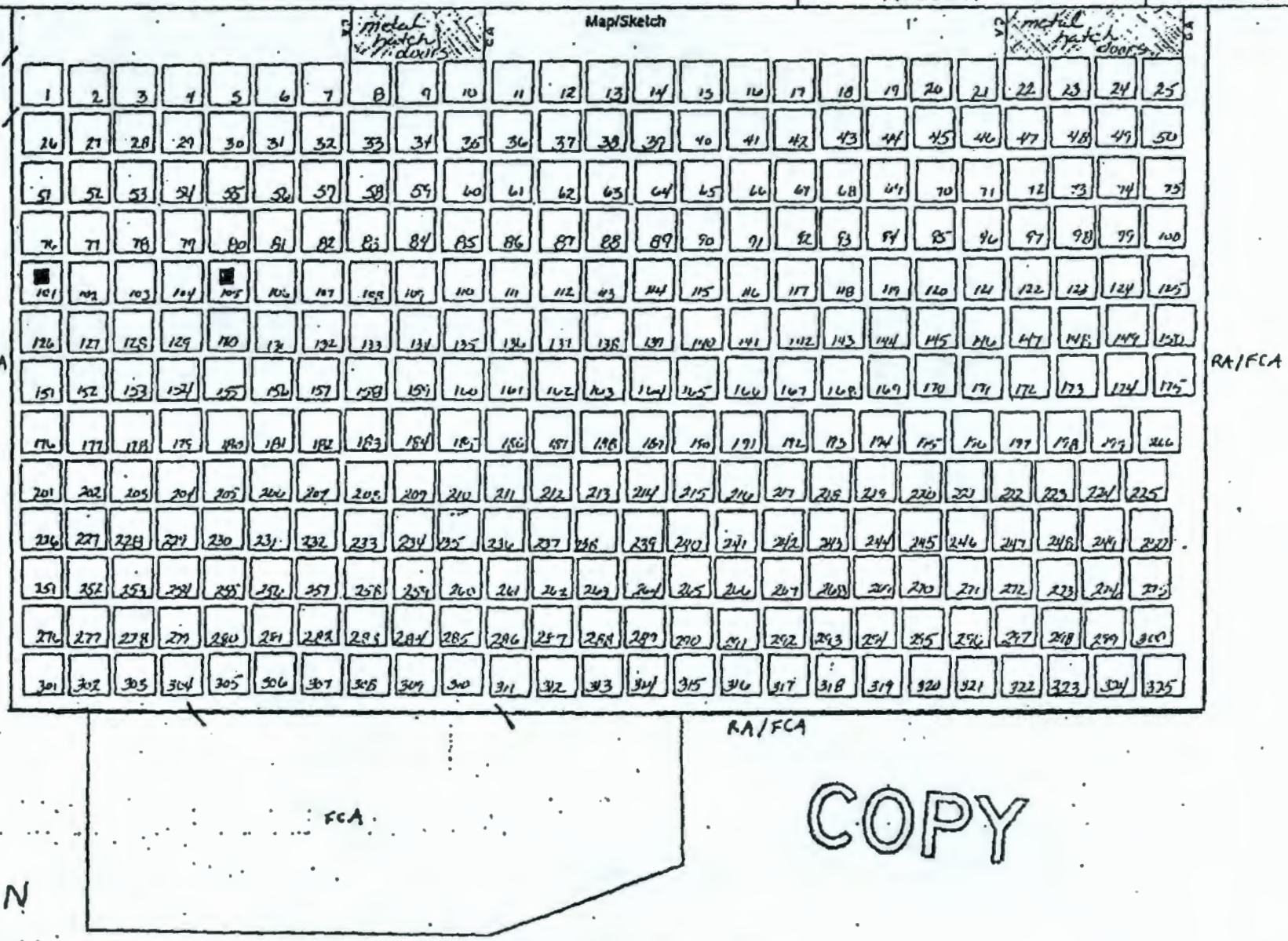
SNF PROJECT RADIOLOGICAL SURVEY REPORT - Continuation Sheet - Map/Sketch

Survey Report No. K000511

Map/Sketch



All dose rates are in mrem/hr, unless otherwise noted.

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