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Tri-Party Agreement

Change Notice for Modifying Approved Documents/ Workplans In Accordance with the Tri-Party Agreement Action Plan, Section 9.0, *Documentation and Records*

Change Number	Document Submitted Under Tri-Party Agreement Milestone	Date:
TPA-CN-236		9/17/2008

Document Number and Title: HNF-6495 Rev. 2-B, Sampling and Analysis Plan for K Basins Debris

Date Document Last Issued: 11/15/2005

Originator: J. L. Westcott **Phone:** 373-9800

Description of Change:

T. K. Teynor (DOE) and Larry Gadbois (Lead Regulatory Agency) agree that the proposed change modifies an approved

The document HNF-6495 tables and text has been updated with radionuclide distributions that been decay corrected to this year.

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Note: Table 2-2 on page 2-9, page A-2, page A-3, Table A-1 on pages A-5 and A-6, Table A-2 on page A-7, and Table A-3 on page A-11 and A-12

Justification and Impacts of Change:

The document requires that the radionuclide distribution be decay corrected at least every three years. The updated radionuclide distribution will be used to calculate the waste radioactive content.

Approvals:

DOE Project Manager	9-23-08 Date	✓ Approved	__ Disapproved	
Larry Gadbois Lead Regulatory Project Manager	9-23-08 Date	✓ Approved	__ Disapproved	

Once all the above steps have been completed, the originator sends a copy of the signed change notice to the FH TPAI organization (H8-12), the Administrative Record (H6-08) (refer to TPA Action Plan, Section 9.3), lead regulatory agency, affected Hanford contractor, DOE Project Manager, project/contractor Document Custodian, and others as appropriate. Maintain the original Change Notice per approved Records Management procedures.

Table 2-2. Summary List of Radionuclide Contaminants of Concern and Ratios to ^{137}Cs for K Basin Waste.

Radionuclide Name	Radionuclide Symbol	Ratio for KE/KW Below Water Washed Metal Debris	Ratio for KE Below Water Unwashed or Non-Metal Debris (except KE NLOP)	Ratio for KE/KW Above Water Debris	Ratio for KW Below Water Unwashed or Non-Metal Debris	Ratio for KE Unwashed or Non-Metal Debris Removed From KE NLOP	Ratio for Washed Aluminum Canisters
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Tritium	H-3	0.20%	0.20%	0.069%	0.21%	0.21%	0.20%
Cobalt	Co-60	3.5%	0.12%	0.042%	0.031%	0.61%	0.09%
Nickel	Ni-63	0.041%	0.040%	0.39%	0.040%	0.040%	0.041%
Strontium	Sr-90	76%	94%	102%	176%	38%	95%
Antimony	Sb-125	0.53%	0.028%	0.034%	0.034%	0.034%	0.53%
Cesium	Cs/Ba-137m	100%	100%	100%	100%	100%	100%
Promethium	Pm-147	0.33%	0.34%	0.42%	0.42%	0.42%	0.33%
Samarium	Sm-151	1.58%	1.57%	1.6%	1.53%	1.53%	1.58%
Europium	Eu-152	0.0053%	0.0060%	0.012%	0.0088%	0.015%	0.0053%
Europium	Eu-154	1.64%	0.50%	1.02%	0.77%	1.31%	0.31%
Europium	Eu-155	0.68%	0.15%	0.47%	0.23%	0.27%	0.68%
Uranium	U-234	0.0089%	0.018%	0.03%	0.045%	0.040%	0.086%
Uranium	U-235	0.00032%	0.00060%	0.0056%	0.0014%	0.0015%	0.00032%
Uranium	U-238	0.0073%	0.014%	0.026%	0.032%	0.032%	0.073%
Plutonium	Pu-238	1.08%	1.26%	2.36%	2.64%	4.44%	0.086%
Plutonium	Pu-239	2.28%	5.5%	15.6%	11.0%	22.6%	1.86%
Plutonium	Pu-240	1.20%	3.0%	4.3%	6.03%	12.4%	2.46%
Plutonium	Pu-241	41%	101%	161%	201%	452%	40.9%
Americium	Am-241	10.4%	9.4%	22.7%	17.8%	36.6%	5.76%
Curium	Cm-244	0.011%	0.021%	0.024%	0.040%	0.083%	0.011%

Notes: All the values shown on this table have been decayed to January 1, 2008.
KE = K East.
KW = K West.
NLOP = north loadout pit.

2.2.4 Suspect TRU Waste

In addition to consideration of the gamma ratios, any waste for which the estimated total TRU radionuclide content is greater than 100 nCi/g will undergo further evaluation including, but not limited to, contingency/NDA sampling, package specific dose rate to curie modeling, etc., in order to obtain a more accurate quantification of the TRU content obtained, or alternatively be manage as TRU waste. If a more precise measurement of TRU content of the waste is obtained, the contingency/NDA sampling results will be used. If a more precise measurement of the waste is not obtained or does not confirm that the waste is potentially TRU, alternatives to disposal at ERDF will be explored.

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. Each basin, KW and KE, could have three sets of ratios that could be applied to the waste depending on the origin of the waste. These three sets of ratios are:

1. Ratios applicable to metallic waste that originated from below the water line of the basin and was washed before removing it from the water. The ratios used on this waste would be primarily fuel ratios (HNF-SD-SNF-TI-009, Volume 1, "Fuel") based on the data available and the conceptual model of how contamination occurred. Nondestructive assay (NDA) and laboratory results were also considered for this waste. Examples of this waste include fuel canisters, basin pipe racks, and any other pressure washed metal.

2. Ratios applicable to non-metallic or non-washed waste that originated from below the water line or the basin. The ratios used for this waste would be primarily those observed from measurement of basin floor and canister sludge (HNF-SD-SNF-TI-015).

3. Ratios applicable to waste that originates from above the water line of the basin. The ratios used for this waste are primarily an amalgamation of data from WHC-SD-NR-RPT-005 and data from air sampling ("Facility Source Term Report," [Huntley 1999).

Additional discussion regarding the selection of applicable radionuclide ratios is provided below. The information used to select the applicable radionuclide ratios is shown in Table A-1. All values shown in Table A-1 are decay corrected to January 1, 2005. The selected radionuclide ratios shown in Table A-2 are decay corrected to January 1, 2008

A.1.1 Below-Water Debris

The data reviewed and shown in Table A-1 indicated that washed metal items (e.g. pipe hangers and fuel canisters) more closely demonstrated the radionuclide ratios estimated for fuel (HNF-SD-SNF-TI-009, Volume 1, "Fuel"). If ratios of specific radionuclides to ^{137}Cs were available on samples applicable to a specific waste stream, the data were used. If no data were available, then ratios calculated from fuel (HNF-SD-SNF-TI-009, Volume 1, "Fuel") were used as appropriate. A decision was made to use KE below water washed metal debris ratios for both KE and KW below water washed metal debris (with the exception of washed aluminum canisters). This decision was based on KE fuel/canister transfers to KW basin and subsequent fuel cleaning activities. The previous KW washed metal ratios were based exclusively on KW fuel ratios which underestimated the TRU to ^{137}Cs ratios.

The ratios for below water washed aluminum canisters were derived from HNF-23774, *Contingency Sampling Work Plan for K Basins Aluminum Canisters*. Twelve aluminum canisters were washed using the routine canister cleaning system process and metal coupon samples were collected from each canister. The coupons were sent to the 222-S Laboratory for radiochemical analysis to determine the ratio of various isotopes, specifically comparing transuranic radionuclides to ^{137}Cs. The contingency sample results were supplemented with decay-corrected KE below-water washed metal ratios to develop the ratios in column 8, Table A-2.

For non-metal items or non-washed metal K East Basin items, the most appropriate source term was determined using the design basis ratio of 80/20 vol % basin floor/canister sludge as developed for Large Diameter Containers presented in Table 5-1 of HNF-SD-SNF-TI-015. Radionuclide ratios were calculated using the appropriate tables in HNF-SD-SNF-TI-015. If there were no sludge ratios available

from either sample data or published sources, then fuel ratios were selected as default. In Table A-1 the available ratios that were deemed appropriate are tabulated along with a column that provides the chosen ratios for application to the K Basin debris.

In KW Basin, the canister and internal sludge are essentially homogeneous due to the fuel washing process. Since the startup of fuel cleaning and transfer operations, sludge material from the KE and KW canisters has been introduced into the KW floor. Therefore, KW floor sludge will be treated as KE canister sludge. KE north loadout pit (NLOP) sludge has been sampled and analyzed and varies markedly from KE floor sludge; therefore, unwashed metal and non-metal debris removed from the KE NLOP will be treated as KE NLOP sludge. Table A-2 provides a summary of the final selected ratios.

A.1.2 Above-Water Debris

Significant differences from radionuclide ratios found in fuel and found in KE versus KW were noted in historical analyses of samples from above water portions of the KE and KW (WHC-SD-NR-RPT-005). Another source of data that was used was the air sampling data from 1998 (Huntley 1999). Upon closer examination it was determined that the air filter data does not accurately reflect the above water contamination. Subsequently, the data from WHC-SD-NR-RPT-005 were used to determine the COC ratios. Not all of the COC radionuclides were measured on the samples from either source. If there were no measured ratios, then KW fuel data radionuclide ratios (HNF-SD-SNF-TI-009, Volume 1, "Fuel") or sludge data radionuclide ratios (HNF-SD-SNF-TI-015, Volume 2, "Sludge") were selected. Table A-2 provides a summary of the final selected radionuclide ratios. ~~All ratios were decay corrected to January 1, 2005.~~

A decision was documented in meeting minutes (Hall 2005) to use KE above-water debris ratios for both KE and KW above-water debris. This decision was based on KE fuel/canister transfers to KW basin and subsequent fuel cleaning activities. The KE above-water debris ratios provide a worst-case bounding condition for both KE and KW above-water debris.

Table A-1. Ratios of Measured Radionuclides.[g]

Radionuclide Name	Radionuclide Symbol	KE Fuel COC Ratio % to ^{137}Cs[a]	Metal coupons from KE Pipes Ratio % to ^{137}Cs[b]	Pipe Smears from KE Ratio % to ^{137}Cs[c]	Canister NDA from KE Ratio % to ^{137}Cs[d]	Canister Smears from KE Ratio % to ^{137}Cs[d]	Ratio for KE/KW Below Water Washed Metal Debris	KE 80% Floor/20% Canister Sludge Ratio % to ^{137}Cs[e]	Ratio for KE Below Water Unwashed or Non-Metal Floor Debris	WHC Report KE Ratio % to ^{137}Cs[e,f]	Ratio for KE/KW Above Water Debris	KE Canister Sludge Ratio % to ^{137}Cs[e]	Ratio for KW Below Water Unwashed or Non-Metal Floor Debris	KE NLOP Sludge Ratio% to ^{137}Cs	Ratio for KE NLOP Below Water Unwashed or Non-Metal Floor Debris
Tritium	H-3	0.22%					**0.22%**	0.22%	0.22%	0.076%	**0.076%**	0.23%	**0.23%**	0.23%	**0.23%**
Cobalt	Co-60	0.013%	0.17%	0.67%	4.8%	0.88%	**4.8%**	0.16%	0.16%	0.058%	**0.058%**	0.043%	**0.043%**	0.84%	**0.84%**
Nickel	Ni-63	0.039%					**0.039%**	0.038%	0.038%	0.37%	**0.37%**	0.038%	**0.038%**	0.038%	**0.038%**
Strontium	Sr-90	76%					**76%**	94%	94%	102%	**102%**	177%	**177%**	38%	**38%**
Antimony	Sb-125	0.051%			1.05%		**1.05%**	0.056%	0.056%		**0.067%**	0.067%	**0.067%**	0.067%	**0.067%**
Cesium	Cs/Ba-137m	100%	100%	100%		100%	**100%**	100%	100%	100%	**100%**	100%	**100%**	100%	**100%**
Promethium	Pm-147	0.69%					**0.69%**	0.71%	0.71%		**0.86%**	0.86%	**0.86%**	0.86%	**0.86%**
Samarium	Sm-151	1.51%					**1.5%**	1.5%	1.5%		**1.5%**	1.46%	**1.46%**	1.46%	**1.46%**
Europium	Eu-152	0.0058%					**0.0058%**	0.0065%	0.0065%		**0.013%**	0.0096%	**0.0096%**	0.016%	**0.016%**
Europium	Eu-154	0.54%	0.28%	0.74%	1.95%	1.2%	**1.95%**	0.60%	0.60%		**1.21%**	0.92%	**0.92%**	1.56%	**1.56%**
Europium	Eu-155	0.070%	0.41%	0.28%	0.97%	0.40%	**0.97%**	0.21%	0.21%		**0.67%**	0.33%	**0.33%**	0.39%	**0.39%**
Uranium	U-234	0.0083%					**0.0083%**	0.017%	0.017%	0.03%	**0.030%**	0.042%	**0.042%**	0.037%	**0.037%**
Uranium	U-235	0.00030%					**0.00030%**	0.00056%	0.00056%	0.0052%	**0.0052%**	0.0013%	**0.0013%**	0.0014%	**0.0014%**
Uranium	U-238	0.0068%					**0.0068%**	0.013%	0.013%	0.024%	**0.024%**	0.030%	**0.030%**	0.030%	**0.030%**
Plutonium	Pu-238	1.03%	0.14%				**1.03%**	1.2%	1.2%	2.26%	**2.26%**	2.52%	**2.52%**	4.24%	**4.24%**
Plutonium	Pu-239	2.13%	0.8%				**2.13%**	5.1%	5.1%	**14.6%**	**14.6%**	10.3%	**10.3%**	21.1%	**21.1%**
Plutonium	Pu-240	1.12%					**1.12%**	2.8%	2.8%		**4.0%**	5.63%	**5.63%**	11.6%	**11.6%**
Plutonium	Pu-241	44%					**44%**	109%	109%	174%	**174%**	217%	**217%**	489%	**489%**
Americium	Am-241	9.53%	1.6%	5.4%		7.9%	**9.53%**	8.3%	8.3%	**20.5%**	**20.5%**	15.7%	**15.7%**	32.1%	**32.1%**
Curium	Cm-244	0.012%					**0.012%**	0.022%	0.022%		**0.025%**	0.042%	**0.042%**	0.087%	**0.087%**

Notes:

[a] 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.

[b] Metal coupons cut from three fuel storage hangers in KE. Data reference Memo from Jeff Huisingh to R. M. Jochen, "222-S Final Hanger Coupon Analysis and Rad Survey Reports".

[c] Data reports from the SNF Facility Operations Counting Facility. Gamma Energy Analysis dated 1/10/97.

[d] "Characterization of Empty Fuel Storage Canisters in 105 KE Basin", WHC-SD-SNF-TI-019, author Jeremy B. Crystal.

[e] "Spent Nuclear Fuel Project Databook, Volume 2, Sludge", HNF-SD-SNF-TI-015, Rev. 12.

[f] "Characterization of Radioactive Waste at 100 Area", WHC-SD-NR-RPT-005, Rev. 0, author John DeVanney.

[g] All values shown on this table are decay corrected to January 1, 2005.

COC = contaminant of concern.

KE = K East.

KW = K West.

NDA = nondestructive assay.

NLOP = north loadout pit.

WHC = Westinghouse Hanford Company.

Table A-2. Summary List of Radionuclide Contaminants of Concern and Ratios to ^{137}Cs for K Basin Waste.

Radionuclide Name	Radionuclide Symbol	Ratio for KE/KW Below Water Washed Metal Debris	Ratio for KE Below Water Unwashed or Non-Metal Debris (except KE NLOP)	Ratio for KE/KW Above Water Debris	Ratio for KW Below Water Unwashed or Non-Metal Debris	Ratio for KE Unwashed or Non-Metal Debris Removed From KE NLOP	Ratio for Washed Aluminum Canisters
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Tritium	H-3	0.20%	0.20%	0.069%	0.21%	0.21%	0.20%
Cobalt	Co-60	3.5%	0.12%	0.042%	0.031%	0.61%	0.09%
Nickel	Ni-63	0.041%	0.040%	0.39%	0.040%	0.040%	0.041%
Strontium	Sr-90	76%	94%	102%	176%	38%	95%
Antimony	Sb-125	0.53%	0.028%	0.034%	0.034%	0.034%	0.53%
Cesium	Cs/Ba-137m	100%	100%	100%	100%	100%	100%
Promethium	Pm-147	0.33%	0.34%	0.42%	0.42%	0.42%	0.33%
Samarium	Sm-151	1.58%	1.57%	1.6%	1.53%	1.53%	1.58%
Europium	Eu-152	0.0053%	0.0060%	0.012%	0.0088%	0.015%	0.0053%
Europium	Eu-154	1.64%	0.50%	1.02%	0.77%	1.31%	0.31%
Europium	Eu-155	0.68%	0.15%	0.47%	0.23%	0.27%	0.68%
Uranium	U-234	0.0089%	0.018%	0.03%	0.045%	0.040%	0.086%
Uranium	U-235	0.00032%	0.00060%	0.0056%	0.0014%	0.0015%	0.00032%
Uranium	U-238	0.0073%	0.014%	0.026%	0.032%	0.032%	0.073%
Plutonium	Pu-238	1.08%	1.26%	2.36%	2.64%	4.44%	0.086%
Plutonium	Pu-239	2.28%	5.5%	15.6%	11.0%	22.6%	1.86%
Plutonium	Pu-240	1.20%	3.0%	4.3%	6.03%	12.4%	2.46%
Plutonium	Pu-241	41%	101%	161%	201%	452%	40.9%
Americium	Am-241	10.4%	9.4%	22.7%	17.8%	36.6%	5.76%
Curium	Cm-244	0.011%	0.021%	0.024%	0.040%	0.083%	0.011%

Notes: All the values shown on this table have been decayed three years to January 1, 2008 from the values shown on Table A-1.

KE = K East.
KW = K West.
NLOP = north loadout pit.

Table A-3. Comparison of Ion Exchange Module Water Ratios and Historical Ratios and Final Recommended Ratios.[d]

Radionuclide Name	Radionuclide Symbol	Fuel[a] KE Ratio % to ^{137}Cs	Water[b] 2004 Ave KE Ratio % of ^{137}Cs	Proposed 2004 Water Ratios for KE IXM Charac. % of ^{137}Cs	Proposed 2007 Water Ratios for KE IXM Charac. % of ^{137}Cs	Fuel[c] KW Ratio % to ^{137}Cs	Water 2004 Ave KW Ratio % of ^{137}Cs	Proposed 2004 Water Ratios for KW IXM Charac. % of ^{137}Cs	Proposed 2007 Water Ratios for KW IXM Charac. % of ^{137}Cs
Tritium	H-3	0.22%	130%	130%	118%	0.22%	213%	213%	193%
Cobalt	Co-60	0.01%	0.06%	0.06%	0.04%	0.02%		0.02%	0.01%
Nickel	Ni-63	0.04%		0.04%	0.04%	0.04%		0.04%	0.04%
Strontium	Sr-90	76%	23%	23%	23%	76%	200%	200%	199%
Antimony	Sb-125	0.05%		0.05%	0.26%	0.05%		0.05%	0.03%
Cesium	Cs/Ba-137m	100%	100%	100%	100%	100%	100%	100%	100%
Promethium	Pm-147	0.69%		0.69%	0.33%	0.60%		0.60%	0.29%
Samarium	Sm-151	1.51%		1.51%	1.58%	1.40%		1.40%	1.47%
Europium	Eu-152	0.01%		0.01%	0.01%	0.01%		0.01%	0.01%
Europium	Eu-154	0.54%		0.54%	0.45%	0.54%		0.54%	0.45%
Europium	Eu-155	0.07%		0.07%	0.05%	0.07%		0.07%	0.05%
Uranium	U-234	0.01%	0.01%	0.01%	0.01%	0.01%	0.05%	0.05%	0.05%
Uranium	U-235	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%
Uranium	U-238	0.01%	0.00%	0.00%	0.00%	0.01%	0.02%	0.02%	0.02%
Plutonium	Pu-238	1.03%	0.06%	0.06%	0.06%	0.85%	0.04%	0.04%	0.04%
Plutonium	Pu-239/240	3.25%	0.43%	0.43%	0.46%	2.78%	0.33%	0.33%	0.35%
Plutonium	Pu-239	2.13%		0.29%	0.31%	1.80%		0.22%	0.24%
Plutonium	Pu-240	1.12%		0.14%	0.15%	0.98%		0.11%	0.12%
Plutonium	Pu-241	44%		5.80%	5.38%	41%		4.90%	4.54%
Americium	Am-241	9.53%	0.44%	0.44%	0.50%	3.20%	0.27%	0.27%	0.31%
Curium	Cm-244	0.01%		0.01%	0.01%	0.01%		0.01%	0.01%

Notes:

[a]Data from HNF-SD-SNF-TI-009, Volume 1, "Fuel," Table 3.6.

[b]Average of 2004 Routine Monthly water samples, Jan-Dec.

[c]Data from HNF-SD-SNF-TI-009, Volume 1, "Fuel," Table 3.7.

[d]The proposed radionuclide ratios are decayed corrected to July 1 for KE and October 1 for KW of the year stated in the column heading.

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

IXM = ion exchanges module.

KE = K East.

KW = K West.