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F Tank Farm

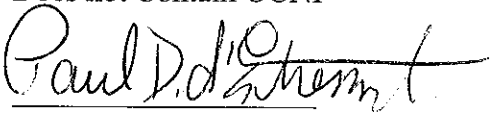
**CHARACTERIZATION OF RADIONUCLIDES
IN PUREX WASTE SLUDGES
FROM F-AREA HIGH LEVEL WASTE TANKS (U)**

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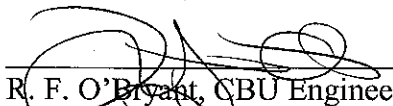
R. F. O'Bryant and J. K. W. Dunaway

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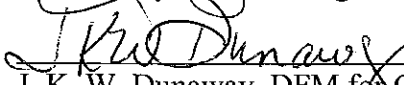

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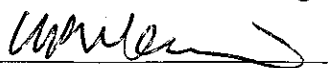
APPROVALS


R. F. O'Bryant, CBU Engineering, Co-Author

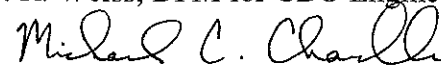
Date: 1/30/03


J. K. W. Dunaway, DFM for CBU Engineering, Co-Author

Date: 1/30/03


W. R. Weiss, DFM for CBU Engineering, Technical Reviewer

Date: 1/30/03


M. C. Chandler, CBU Engineering

Date: 2/04/03

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Revision Description

This revision to this document includes the following substantive changes to the Revision 0 document:

- Revalidate F-Area high level waste streams.
- Revise the consolidation of the waste from F-Area high level waste tanks from three waste streams (FTK-00002-1, -17, and -19) in Revision 0 to two waste streams (FTK-00002-1 and -19) in Revision 1.
- Update the distribution of radionuclides in each waste stream based on current high level waste tank contents and revised SRS Waste Acceptance Criteria (WAC) 2.02 and 3.17 requirements.

1.0 Background

Characterization of High Level Waste Sludge by the Concentration Storage and Transfer (CST) Department is outlined in WSRC-TR-94-0579, *High Level Waste Sludge Characterization in Support of Low Level Waste Certification* (Reference 1). The sludge characterization is based on a series of scaling factors for 31 of 34 known sludge-containing waste tanks. Scaling Factors were previously compiled and compared with available sample data in WSRC-TR-94-0562, *Characterization of Radionuclides in HLW Sludge Based on Isotopic Distribution in Irradiated Assemblies* (Reference 2). Quantification of sludge-contaminated waste and application of the scaling factors has been performed on a case-by-case basis since approval of the methodology by the Waste Characterization Board in 1994.

The Waste Characterization System (WCS) was established in 1996 to consolidate waste characterization information. Inventories and compositions of major sludge constituents are based on tank fill histories. Minor constituent inventories are based on compositions developed during DWPF design. Fill histories for each tank are also contained in the WCS (Reference 3). Subsequent analytical data is incorporated into this database as deemed appropriate. Pu-238 and Am-241 inventories for tanks containing Purex Low Activity Waste (LAW) were adjusted in 1999 (Reference 4).

Further examination of historical tank use data contained in Reference 3, tank contents (i.e. high heat or low heat fractions of either Purex or H-Modified waste) and waste age (both in Reference 2) allowed consolidation of sludge in waste tanks to be considered.

WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 2.02, *Low Level, Hazardous, Mixed and PCB Waste Characterization Requirements*, Revision 7 (Reference 5), allows for consolidation of waste streams when the following two criteria are met:

1. Performance Assessment (PA) radionuclide scaling factors do not vary from the proposed data set scaling factor by more than a factor of 10, and
2. The fractional activity of the predominant radionuclides (predominant radionuclides being those that make up 10% or greater of the activity) in each data set does not vary by more than a factor of 2 from the fractional activity of the same radionuclide in the proposed data set.

This document contains the characterization methodology for sludge-contaminated waste generated from the F-Area Tank Farm, based on process knowledge and available analytical data. In addition, this document contains an evaluation for consolidation of sludge-contaminated waste from multiple HLW tanks in the F-Area Tank Farm. The scaling factors developed in this document supercede those presented in References 1 and 2, and any other previously-developed radionuclide characterizations for F-Area Tank Farm sludge-contaminated waste.

2.0 Introduction

Sludge-contaminated waste consists of waste contaminated with both insoluble species (the sludge fraction) and entrained supernate. The WCS is based on the assumption that approximately 70% of the weight of what is commonly referred to as sludge is interstitial supernate; the remaining approximately 30% consists of the insoluble species (Reference 1).

Development of a method for characterization of sludge-contaminated waste must consider both fractions. Separate waste cuts may contain sludge and supernate fractions in varying proportions due to the nature of the job generating the waste and the variability in waste handling techniques. Development of a distribution representative of all sludge-contaminated waste cuts must allow for varying fractions of sludge and supernate contamination.

This document will develop a radionuclide distribution for the sludge fraction of sludge-contaminated waste stored in the F-Area Tank Farm in accordance with the methodology outlined in WSRC 1S SRS Waste

Acceptance Criteria Manual, Procedure 2.02, Revision 7. This distribution was based on the assumption that sludge-contaminated waste from F-Area High Level Waste Tanks could be co-mingled, and the actual contamination present on waste in a series of containers from these tanks will be representative of the mean radionuclide distribution. The original characterization was based primarily on process knowledge and fill histories. A single, comprehensive characterization for supernate has been developed previously (Reference 6).

This document also describes the methodology for application of radionuclide distributions representative of the sludge and supernate fractions of sludge-contaminated waste to individual waste packages.

Most of the waste contaminated with sludge from the F-Area Tank Farm will be categorized as Low Level Waste (LLW) and disposed of in the E-area Vaults (EAV). The waste does, however, have the potential to be categorized as TRU and/or mixed waste. Quantification of hazardous constituents and determination of whether the waste is classified as mixed is dependent on the amount of sludge present on the waste matrix and the nature of the waste matrix, and will be performed on a case-by-case basis. Quantification of radionuclides present in each waste package will be performed as described in Section 5.0.

The radionuclide distribution developed for LLW contaminated with sludge from the F-Area Tank Farm can also be applied to waste classified as transuranic. [Neither WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 3.06, *E-Area TRU Pads Transuranic Waste Acceptance Criteria*, Revision 5, nor Appendix A:34, *TRU Waste Container Characterization Form (OSR 29-90) Instruction* specifies a methodology for determination of the isotopic distribution in TRU Waste; simply that the methodology be documented.]

3.0 Development of a Radionuclide Distribution for Sludge Fraction of Sludge-Contaminated Waste

The development of the radionuclide distribution in this section is performed per guidance outlined in WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 2.02, Revision 7 (Reference 5).

3.1 Determining the Initial List of Radionuclides

WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 2.02, Revision 7, stipulates that the characterization of each package of waste having a total activity greater than 2 nanocuries/gram must consider the potential presence of any radionuclide that meets any one of three criteria:

1. The radionuclide is identified in WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 3.17, *Low Level Waste Acceptance Criteria*, Revision 7 (Reference 7), as being a Performance Assessment (PA) or Safety Authorization (SA) Basis radionuclide for a specific Treatment, Storage or Disposal (TSD) facility. For purposes of this distribution, we will use those PA and SA radionuclides for the EAV.
2. The radionuclide could be present in the waste with a relative activity greater than 1.0% of the total waste stream activity at the time of the characterization.
3. The radionuclide is a detectable transuranic or a fissile radionuclide.

The above criteria are hereafter referred to as "inclusion criteria."

Based on the three inclusion criteria and available process knowledge, the following list of 36 radionuclides (Table 3.1) will be considered when developing the radionuclide distribution of waste packages contaminated with sludge from the F-Area Tank Farm.

Table 3.1. Radionuclides Important to Characterization of the Sludge Fraction of Sludge-Contaminated Waste				
Radionuclide	Inclusion Criteria			
	PA Limiting	SA Limiting	Potentially Present At >1% Total Activity	Detectable Fissile or TRU Radionuclide
H-3		SA		
C-14	PA			
Ni-59			X	
Co-60			X	
Se-79			X	
Sr-90			X	
Y-90			Daughter of Sr-90	
Tc-99	PA			
Ru-106			X	
Rh-106			Daughter of Ru-106	
Sb-125			X	
Sn-126			X	
I-129	PA			
Cs-134			X	
Cs-135			X	
Cs-137			X	
Ba-137m			Daughter of Cs-137	
Ce-144			X	
Pr-144			Daughter of Ce-144	
Pr-144m			Daughter of Ce-144	
Pm-147			X	
Eu-154			X	
U-233				Detectable Fissile
U-234	PA			
U-235				Detectable Fissile
U-238	PA			
Np-237				Detectable TRU
Pu-238				Detectable TRU
Pu-239				Detectable Fissile, TRU
Pu-240				Detectable TRU
Pu-241				Detectable Fissile
Pu-242				Detectable TRU
Am-241				Detectable TRU
Am-242m				Detectable Fissile, TRU
Cm-244			X	
Cm-245				Detectable Fissile, TRU

Scaling factors for radionuclides known to be present in HLW tanks in the F-Area Tank Farms were calculated from decay-corrected concentration data tables in the WCS (Attachments 1, 2, and 3; Reference 8). Consolidated waste stream averages for radionuclide concentration data and resultant scaling factors are conservatively calculated to include only those tanks in the consolidation that contained the particular radionuclide; i.e., zero concentrations were not included in the averages.

3.2 Consolidating Sludge from F-Area Tank Farm

WSRC IS SRS Waste Acceptance Criteria Manual, Procedure 2.02, Revision 7, allows for consolidation of waste streams when the following two criteria are met:

1. Performance Assessment radionuclide scaling factors do not vary from the proposed data set scaling factor by more than a factor of 10, and
2. The fractional activity of the predominant radionuclides (predominant radionuclides being those that make up 10% or greater of the activity) in each data set does not vary by more than a factor of 2 from the fractional activity of the same radionuclide in the proposed data set.

Historical data for tanks under consideration for consolidation are summarized in Table 3.2.

Table 3.2. F-Area Tank Farm Sludge Tanks Historical Data					
Tank No.	% Purex HHW	% Purex LHW	Avg. Age, PHHW	Avg. Age, PLHW	Tank Use/Notes
1	61	39	41	39	Waste Removal
2	50	50	46	46	Waste Removal
3	50	50	43	43	Waste Removal
4	97	3	31	31	Waste Removal
5	66	34	39	39	Waste Removal
6	100		33		Waste Removal
7		100		37	Waste Removal
8	22	78	35	25	Waste Removal
18		100		30	Waste Removal
19		100		27	Heel; contains zeolite
26		100		15	Evaporator Feed
33	100		16		F Waste Receipt
34	100		17		Storage
47		100		18	Waste Removal

The tanks contain exclusively Purex Waste with varying proportions of Purex High Heat Waste (PHHW) and Purex Low Heat Waste (PLHW) of varying age (15-47 years), and are all utilized for either waste removal, concentrate receipt, or evaporator feed.

Waste Tanks 17 and 20 were formerly used for waste removal and, accordingly, were included in characterization documentation for F-Area Tank Farm sludge-contaminated waste. Tanks 17 and 20 have subsequently been closed and grouted and will, therefore, no longer be used for management of wastes.

The scaling factors for PA radionuclides for each waste stream were then compared to determine what tanks could be consolidated based on whether they were within an order of magnitude from the mean set of scaling factors for those tanks. This comparison results in the following proposed waste streams for the F-Area Tank Farms:

Table 3.3. F-Area HLW Tank Farm Waste Streams	
HLW Tanks	Waste Stream Number
All active FTF Tanks except 19 (1-8, 18, 26, 33, 34, 47)	FTK-00002-1
19	FTK-00002-19

The grouping of waste tanks per table 3.3 was made based on the following factors:

- All but one F-Area waste tank were grouped together in waste stream FTK-00002-1. The exception to this grouping includes Tank 19. Tank 19 contains spent zeolite resin, which, by virtue of its high concentration of Cs-137, skews the radionuclide distribution for the sludge/zeolite layer. Tank 19 sludge is therefore characterized separately as waste stream FTK-00002-19. Zeolite resin in Tank 19 contains significantly higher Cs-137:Sr-90 ratios than sludge solids.
- Fractional activities were within consolidation criteria set forth in WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 2.02, Revision 7. Two exceptions to this exist in waste stream FTK-00002-1, however. C-14 and U-234, PA radionuclides, are present in some tanks in this grouping, while not in others. In addition, some tanks contain up to 3 orders of magnitude less C-14 than the fractional activity in the average stream. The WAC 2.02, Revision 7, indicates that "these [consolidation] factors can be exceeded if it can be shown that the distribution used will be conservative, i.e., the reported activity will be greater than if the factors were within the guidelines." In the case of C-14 and U-234 in this waste stream, the scaling factors will be based upon an average of scaling factors for the tanks containing the radionuclides, and applied to waste generated from all the tanks in this grouping.

Specific issues related to quantification of sludge-contaminated waste generated from these tanks are contained in Section 5. Analysis of combined waste streams FTK-00002-1 and FTK-00002-19 are documented in Attachment 2. The presence of each PA radionuclide, expressed as a fraction of the mean scaling factor for each tank was calculated. In order to meet the first consolidation criteria, the PA radionuclides must be present within an order of magnitude from the mean, or within a range of 0.1 to 10 times the mean scaling factor. All PA radionuclides in combined waste stream FTK-00002-1 meet this criteria with the exception of C-14 in Tanks 1, 2, 3, 4, 5, 7, and 8, and U-238 in Tank 2, which are each below this range. Since WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 2.02, Revision 7, allows for exception to the consolidation criteria where it can be shown "that the...reported activity will be greater..." as outlined in the first bullet above, the affected tanks can be grouped into this waste stream. By virtue of being made up of waste from only one waste tank, all PA radionuclides in waste stream FTK-00002-19 meet the first consolidation criterion.

The second consolidation criterion applies to predominant radionuclides only. There are two predominant radionuclides in these waste stream distributions, Sr-90 and its daughter Y-90. For waste stream FTK-00002-1, the fractional activities of Sr-90 and Y-90 vary only slightly within the distribution of sludge; the maximum variation from the proposed data set (the mean distribution) is well within a factor of 2, the second criteria for consolidation. Again, by virtue of being made up of waste from only one waste tank, the predominant radionuclides in waste stream FTK-00002-19 meet the second consolidation criterion.

The mean set of scaling factors and comparison of both scaling factors and predominant radionuclides is presented in Attachment 4. Based on the results of this comparison, both consolidation criteria are met for these two combined waste streams, and the sludge fraction of sludge-contaminated waste from tanks in Table 3.3 may be consolidated into two waste streams, FTK-00002-1 and -19; the mean values will include all tanks that contain the specific radionuclide.

3.3 Excluding Radionuclides from Consideration

Under WAC 2.02, Revision 7, radionuclides that meet one of the inclusion criteria outlined in section 3.1 may be excluded from further consideration for a waste stream if one or more of the following conditions exist:

1. There is no reason to expect the radionuclide to be present in the waste stream.
2. For non-SA or -PA radionuclides, or non-detectable fissile or TRU radionuclides, the individual activity contribution is less than 1% of the total radionuclide activity.

The above criteria are hereafter referred to as "exclusion criteria;" exclusion results are presented in Table 3.4.

(Note: WSRC IS SRS Waste Acceptance Criteria Manual, Procedure WAC 2.02, Revision 7, also allows for exclusion from the waste stream distribution of radionuclides whose activities are below specific analytical laboratory Maximum Allowable Lower Limits of Detection [MALLDs]. This exclusion criterion will not be used for this process-knowledge-based characterization of sludge waste streams FTK-00002-1 and -19).

Of the 36 radionuclides listed in Table 3.1, one SA radionuclide (H-3) is excluded because it is not expected to be present in either waste stream; also, one PA radionuclide (U-234), one fissile radionuclide (U-233), one TRU radionuclide (Np-237), and one fissile/TRU radionuclide (Am-242m) are excluded from FTK-00002-19 because they are not expected to be present (Table 3.4). Of the radionuclides included because they were expected to be present at more than 1% of total activity, an additional 14 are determined to be present at less than 1% of the total activity in both waste streams. Three additional radionuclides (Sr-90, Y-90, and Pm-147) are present at <1% in waste stream FTK-00002-19. Four of these radionuclides, however, are retained in one or the other of the distributions (Co-60, Sb-125, and Eu-154 in FTK-00002-1 and Sr-90 and Y-90 in FTK-00002-19) since they are near 1% of total activity. Calculations supporting this determination are summarized in Attachment 5.

Table 3.4. Radionuclides Excluded from Consideration, Sludge Fraction				
Radionuclide	Exclusion Criteria			
	Not Expected		Present at <1% (a)	
	FTK-00002-		FTK-00002-	
	1	19	1	19
H-3	X	X		
C-14				
Ni-59			X	X
Co-60			X(b)	X
Se-79			X	X
Sr-90				X(b)
Y-90				X(b)
Tc-99				
Ru-106			X	X
Rh-106			X	X
Sb-125			X(b)	X
Sn-126			X	X
I-129				
Cs-134			X	X
Cs-135			X	X
Cs-137				
Ba-137m				
Ce-144			X	X
Pr-144			X	X
Pr-144m			X	X
Pm-147				X
Eu-154			X(b)	X
U-233		X		
U-234		X		
U-235				
U-238				
Np-237		X		
Pu-238				
Pu-239				
Pu-240				
Pu-241				
Pu-242				
Am-241				
Am-242m		X		
Cm-244			X	X
Cm-245				

(a) For those radionuclides included only because they were expected to be present at >1%

(b) Retained in distribution since they are close to 1% total activity

NOTE: Bold = PA/SA radionuclides

3.4 Development of the Sludge Fraction Distribution

Thirty-six radionuclides were determined to be important to characterization of the sludge in F-Tank Farm. A number of these have been excluded per discussion in Section 3.3, leaving 24 and 16 radionuclides to be quantified for waste streams FTK-00002-1 and -19, respectively. Current tank contents were used to update the scaling factors to create an isotopic distribution for the two consolidated waste streams.

The radionuclides, their concentrations per gallon of sludge, corresponding mean scaling factors (to Sr-90), and mean activity distribution in the waste streams are summarized in Table 3.5.

Table 3.5. Radionuclide Scaling Factors and Distribution for F-Area Tank Farm Sludge						
Radio-nuclide	Mean Activity (Ci/gal)		Mean Scaling Factors (Ci/Ci Sr-90)		Mean Distribution, Normalized (%)	
	FTK-00002-		FTK-00002-		FTK-00002-	
	1	19	1	19	1	19
C-14	1.54E-06	2.74E-07	1.10E-06	3.98E-06	4.88E-05	1.03E-06
Co-60	2.46E-01	1.29E-04	2.50E-03		1.11E-01	
Sr-90	6.84E+01	6.88E-02	1.00E+00	1.00E+00	4.44E+01	2.59E-01
Y-90	6.84E+01	6.88E-02	1.00E+00	1.00E+00	4.44E+01	2.59E-01
Tc-99	2.32E-02	2.31E-05	3.81E-04	3.36E-04	1.69E-02	8.71E-05
Sb-125	3.17E-01	4.27E-05	2.88E-03		1.28E-01	
I-129	1.11E-07	1.10E-10	1.82E-09	1.59E-09	8.06E-08	4.13E-10
Cs-137	4.73E+00	1.35E+01	6.97E-02	1.97E+02	3.09E+00	5.10E+01
Ba-137m	4.48E+00	1.28E+01	6.59E-02	1.86E+02	2.93E+00	4.83E+01
Pm-147	5.71E+00	6.81E-04	5.17E-02		2.30E+00	
Eu-154	3.36E-01	2.72E-04	3.91E-03		1.73E-01	
U-233	9.60E-12		6.91E-14		3.07E-12	
U-234	8.01E-08		5.76E-10		2.56E-08	
U-235	1.69E-06	2.67E-08	7.94E-08	3.88E-07	3.53E-06	1.01E-07
U-238	1.04E-04	2.44E-06	4.68E-06	3.55E-05	2.08E-04	9.20E-06
Np-237	9.98E-05		1.76E-06		7.82E-05	
Pu-238	5.36E-02	1.00E-02	2.95E-02	1.46E-01	1.31E+00	3.78E-02
Pu-239	2.62E-02	1.43E-03	3.71E-03	2.08E-02	1.65E-01	5.40E-03
Pu-240	5.44E-03	3.20E-04	8.67E-04	4.65E-03	3.85E-02	1.21E-03
Pu-241	1.21E-01	4.15E-02	1.80E-02	6.03E-01	7.98E-01	1.57E-01
Pu-242	1.56E-06	6.58E-07	5.23E-07	9.56E-06	2.32E-05	2.48E-06
Am-241	2.34E-01	4.02E-03	4.23E-03	5.83E-02	1.88E-01	1.51E-02
Am-242m	3.01E-04		3.91E-06		1.74E-04	
Cm-245	3.81E-11	3.82E-14	6.27E-13	5.55E-13	2.78E-11	1.44E-13
Total	1.53E+02	2.65E+01	2.25E+00	3.85E+02	1.00E+02	1.00E+02
Total TRU	3.20E-01	1.58E-02				

3.5 Other WAC Criteria

3.5.1 Comparison to Package Guidelines

Most sludge-contaminated waste will be disposed of in the E-Area Vaults (EAV). Administrative Waste Package Radiological Concentration Guidelines apply to waste disposed of in the EAV. The guidelines applicable to the Low Activity Waste Vault (LAWV), that portion of the EAV reserved for low activity waste, will be used for comparison since they are the most restrictive of the EAV facilities. Low activity waste is defined as waste that will produce less than or equal to 200 mR/hr at 5 cm from an unshielded final disposal container. The average concentration of each PA radionuclide in the F-Area Tank Farm Sludge Waste Streams (Attachment 3) and their corresponding LAWV limits (Reference 5) are summarized in Table 3.6. Calculations supporting this comparison are in Attachment 6. LAWV limits are expressed in Ci/ft³ waste and Ci/90 ft³ B-25 container.

Table 3.6. Comparison of Sludge Fraction of Sludge-Contaminated Waste to LAWV Limits						
	Sludge (Ci/gal)		LAWV Limit		Gallons of sludge in B-25 to reach LAWV limit	
Radio-nuclide	Stream FTK-00002-01	Stream FTK-00002-19	Ci/ft ³	Ci/B-25	Stream FTK-00002-01	Stream FTK-00002-19
	A ₁	A ₂	B	C=B*90ft ³	D ₁ =C/A ₁	D ₂ =C/A ₂
C-14	1.54E-06	2.74E-07	2.50E-05	2.25E-03	1.46E+03	8.21E+03
Tc-99	2.32E-02	2.31E-05	5.60E-05	5.04E-03	2.17E-01	2.18E+02
I-129	1.11E-07	1.10E-10	1.10E-08	9.90E-07	8.92E+00	9.00E+03
U-234	8.01E-08		1.10E-03	9.90E-02	1.24E+06	
U-238	1.04E-04	2.44E-06	1.20E-03	1.08E-01	1.04E+03	4.43E+04

From the container limits, the maximum volume of sludge that could be present in a B-25 container while still meeting the LAWV limits can be calculated. The most limiting isotope in waste stream FTK-00002-1 is Tc-99, for which more than 0.2 gallons of sludge in a B-25 would cause the waste to exceed the LAWV limit. The most limiting isotope in waste stream FTK-00002-19 is also Tc-99, for which more than 218 gallons of sludge in a B-25 would cause the waste to exceed the LAWV limit. Sludge in the F-Area Tank Farm contains exclusively Purex sludge with an average total radionuclide and total TRU activity, respectively, for waste stream FTK-00002-1 of 153 and 0.3 Ci/gallon and for FTK-00002-19 of 26.5 and 0.02 Ci/gal (Table 3.7; Attachment 6). Accordingly, 0.2 gallons of FTK-00002-1 sludge to meet the LAWV for Tc-99 would be equivalent to 33 total Ci in a B-25, 0.07 Ci of which are transuranics; similarly, 218 gallons of FTK-00002-19 sludge would be equivalent to 33,400 total Ci in a B-25, 70 Ci of which are transuranics. Per Table 3.7, for waste stream FTK-00002-1, a box with less than 1,531lb. of waste and 0.2 gallons or more of sludge will fail TRU limits. For waste stream FTK-00002-19, the limiting amount of sludge would be equivalent to an amount that would exceed the TRU limit and would not be disposed of in the LAWV. In practice, very few waste boxes fail TRU limits. Any such box will, upon entry into WITS, be flagged as TRU and not be sent to the LAWV.

Table 3.7. Comparison of Maximum Amount of Sludge Present to Meet LAWV limits to TRU Criteria					
	Max gals sludge / B-25 to meet LAWV criteria	Average total Ci / gallon sludge	Average total Ci / B-25 at LAWV limit	Average total TRU Ci / gallon sludge	Average total TRU Ci / B-25 at LAWV limit
FTK-00002-	A	B	C=A*B	D	E=(D/B)*C
1	2.17E-01	1.53E+02	3.32E+01	3.20E-01	6.95E-02
19	2.18E+02	2.65E+01	3.34E+04	1.58E-02	6.98E+01

	TRU nCi/g at maximum waste weight (5000 lb) in a B-25 at LAWV limit	Minimum waste weight in a B-25 at LAWV limit to not be TRU waste (lb)
FTK-00002-	$=(E*1E+09nCi/Ci) / (5000 \text{ lb} * 454 \text{ g/lb})$	$=(E*1E+09nCi/Ci) / (454 \text{ g/lb} * 100 \text{ nCi/g})$
1	3.06E+01	1.53E+03
19	3.08E+04	1.54E+06

3.5.2 Sum of Fractions Calculation

For acceptance of waste packages sent to the LAWV, the radiological content of the waste package must be compared to the administrative guidelines and shown to satisfy the sum-of-fractions criteria where:

$$\begin{aligned} & \text{activity concentration of isotope A/limit of isotope A} \\ & + \text{activity concentration of isotope B/limit of isotope B} \dots\dots \\ & + \text{activity concentration of isotope N/limit of isotope N} \\ & \leq 1 \end{aligned}$$

Table 3.8 calculates the maximum concentration of sludge on sludge-contaminated waste in order for the sum-of-the-fractions criteria to be met. Calculations supporting this comparison are in Attachment 6.

Table 3.8. Sum-of-Fractions for Sludge Fraction of Sludge-Contaminated Waste											
Radio-nuclide	Ci/gal sludge		Ci/ft ³ sludge		ft ³ sludge / ft ³ waste		Ci/ft ³ waste		LAWV Limit (Ci/ft ³)	Fraction	
	A		B=A*7.48		C		D=B*C		E	=D/E	
	FTK-00002-1	FTK-00002-19	FTK-00002-1	FTK-00002-19	FTK-00002-1	FTK-00002-19	FTK-00002-1	FTK-00002-19		FTK-00002-1	FTK-00002-19
H-3									1.10E+01		
C-14	1.54E-06	2.74E-07	1.15E-05	2.05E-06	3.15E-04	3.07E-01	3.63E-09	6.29E-07	2.50E-05	1.45E-04	2.52E-02
Tc-99	2.32E-02	2.31E-05	1.74E-01	1.73E-04	3.15E-04	3.07E-01	5.46E-05	5.30E-05	5.60E-05	9.75E-01	9.47E-01
I-129	1.11E-07	1.10E-10	8.30E-07	8.23E-10	3.15E-04	3.07E-01	2.61E-10	2.52E-10	1.10E-08	2.38E-02	2.30E-02
U-234	8.01E-08		5.99E-07		3.15E-04	3.07E-01	1.89E-10		1.10E-03	1.71E-07	
U-238	1.04E-04	2.44E-06	7.78E-04	1.83E-05	3.15E-04	3.07E-01	2.45E-07	5.60E-06	1.20E-03	2.04E-04	4.67E-03
									Sum-of-Fractions		9.99E-01

Tc-99 dominates the sum-of-the-fractions criteria for both waste streams FTK-00002-1 and -19. Primarily based on this dominance, the criteria are met for waste streams FTK-00002-1 and FTK-00002-19, respectively, for a maximum of 3.15E-04 ft³ and 3.07E-01 ft³ of sludge for each 1ft³ of waste, which equate to 0.2 gallon of sludge (2.83E-02 ft³) for FTK-00002-1 and 207 gallon of sludge (2.76E+01 ft³) for FTK-00002-19 per each 90 ft³ volume B-25 container (Attachment 6 and Table 3.9). This is equivalent to 3.24E+01 total Ci and 6.78E-02 Ci of transuranic isotopes of sludge in a B-25 for waste stream FTK-00002-1 and 5.47E+03 total Ci of sludge and 3.26E+00 Ci of transuranics of sludge in a B-25 for FTK-00002-19 (Table 3.9).

For waste stream FTK-00002-1, any B-25 waste container containing 6.78E-02 Ci (or 6.78E+07 nCi) of transuranics must contain 6.78E+05 g (or 1,493 lbs) or more of waste (compared to the 5000 lb maximum waste weight per B-25 container) in order to be within the TRU limit of 100 nCi/g total transuranics (Table 3.9; Attachment 6). For waste stream FTK-00002-19, the limiting amount of sludge would be equivalent to an amount that would exceed the TRU limit and would not be disposed of in the LAWV. In practice, very few waste boxes fail TRU limits. Any such box will, upon entry into WITS, be flagged as TRU and not be sent to the LAWV.

Table 3.9. Comparison of Maximum Amount of Sludge Present to Meet LAWV Sum-of-Fractions Limits to TRU Criteria						
Waste Stream FTK-	Maximum ft ³ sludge per ft ³ waste to meet sum-of-fractions criteria	Maximum gallons of sludge in a single B-25 to meet sum of fractions criteria	Average total TRU Ci / gallon sludge	Maximum total TRU Ci of a single B-25 to meet sum-of-fractions criteria	Minimum lb waste weight of a single B-25 to meet TRU limit of 100 nCi/g	TRU nCi/g in B-25 to meet sum-of-fractions criteria at 5000 lb maximum waste weight of a B-25
	A	$B = A * 90 \text{ ft}^3 / \text{B-25} * 7.48 \text{ gal/ft}^3$	C	$D = B * C$	$= (D * 1 \text{E} + 09 \text{ nCi/Ci}) / (100 \text{ nCi/g} * 454 \text{ g/lb})$	$= (D * 1 \text{E} + 09 \text{ nCi/Ci}) / (5000 \text{ lb} * 454 \text{ g/lb})$
0002-1	3.15E-04	2.12E-01	3.20E-01	6.78E-02	1.49E+03	2.99E+01
0002-19	3.07E-01	2.07E+02	1.58E-02	3.26E+00	7.18E+04	1.44E+03

3.5.3 Nuclear Criticality Safety Criteria

Sludge-contaminated LLW from F-Area Tank Farm Waste Streams contains an insignificant quantity of fissionable material to impact nuclear criticality criteria. Calculations supporting this comparison are in Attachment 6. Table 3.10 shows the maximum quantity of sludge that could be placed in a B-25 prior to exceeding the 50 g FGE U-235. This is equivalent to 33.9 and 978 gallons of sludge in a B-25 for waste streams FTK-00002-1 and -19, respectively, significantly exceeding TRU criteria for a waste box. Any such box will not be sent to the LAWV for disposal, therefore protecting this requirement.

Table 3.10. Calculation of FGE Equivalent for Sludge Fraction of Sludge-Contaminated Waste							
Radio-nuclide	Activity in blended sludge (Ci/gal)	Maximum gallons of sludge in a B-25 to meet FGE equivalent	Maximum Curies sludge in a B-25	Specific activity (Ci/g)	Maximum mass (grams) in a B-25	Equivalence factor	FGE U-235 (g)
	A	B	$C = A * B$	D	$E = C / D$	F	$G = E * F$
Waste Stream FTK-00001							
U-233	9.60E-12	33.9	3.25E-10	9.648E-03	3.37E-08	1.4	4.72E-08
U-235	1.69E-06	33.9	5.73E-05	2.16E-06	2.65E+01	1.0	2.65E+01
Pu-239	2.62E-02	33.9	8.88E-01	6.132E-02	1.45E+01	1.6	2.32E+01
Pu-241	1.21E-01	33.9	4.10E+00	1.034E+02	3.97E-02	3.5	1.39E-01
Am-242m	3.01E-04	33.9	1.02E-02	9.717E+00	1.05E-03	54.0	5.67E-02
Cm-245	3.81E-11	33.9	1.29E-09	1.716E-01	7.53E-09	24.0	1.81E-07
Waste Stream FTK-000019							
U-235	2.67E-08	978	2.61E-05	2.16E-06	1.21E+01	1.0	1.21E+01
Pu-239	1.43E-03	978	1.40E+00	6.20E-02	2.28E+01	1.6	3.65E+01
Pu-241	4.15E-02	978	4.06E+01	1.034E+02	3.92E-01	3.5	1.37E+00
Cm-245	3.82E-14	978	3.74E-11	1.716E-01	2.18E-10	24.0	5.22E-09

3.6 Documentation of the Sludge Fraction Distribution

Low level waste stream forms for F-Area Tank Farm Waste Streams, FTK-00002-1 and FTK-00002-19, included as Attachment 7, document the distribution from F-Area Tank Farms Waste Streams. For those packages determined to contain sufficient sludge to be determined mixed and/or transuranic, appropriate waste stream forms will be provided for each package.

4.0 Supernate Fraction of Sludge-Contaminated Waste

4.1 Radionuclide Distribution

The radionuclide distribution for the supernate fraction of sludge-contaminated waste has been previously determined and documented. "HLW Supernate Radionuclide Characterization," WSRC-TR-94-0290, Revision 3, April 19, 1999 (Reference 9), identifies 14 radionuclides present in supernate waste. This waste stream represents a single, comprehensive and conservative characterization/certification for all supernate in both F- and H-Areas. The waste stream consists primarily of Cs-137 and its daughter Ba-137m, which together comprise 97% of the total activity in supernate. The fourteen isotopes determined to be present in supernate waste, their relative activity and scaling factors (to Cs-137) for this waste stream are reproduced in Table 4.1.

Table 4.1. Validated Radionuclide Distribution and Scaling Factors for HLW Supernate		
Radionuclide	Normalized Distribution (%)	Scaling Factors (Ci/Ci Cs-137)
H-3	2.01E-01	4.00E-03
Co-60	1.71E+00	3.40E-02
Sr-90	4.73E-02	9.30E-04
Tc-99	9.15E-03	1.80E-04
I-129	1.11E-05	2.10E-07
Cs-137	5.03E+01	1.00E+00
Ba-137m	4.73E+01	9.40E-01
U-233	2.62E-04	5.20E-06
U-234	7.14E-05	1.40E-06
Pu-238	2.51E-01	5.00E-03
Pu-239	2.92E-03	5.90E-05
Pu-240	1.31E-03	2.60E-05
Pu-241	1.91E-01	3.80E-03
Am-241	1.81E-02	3.50E-04
Total	1.00E+02	

4.2 Other WAC Criteria

Comparison of supernate waste to other WAC requirements has been performed previously (Reference 9). The following determinations were made for supernate waste:

- A B-25 container 90% full (81 ft³ waste) can contain up to 0.36 gallons of supernate (1.8 Ci Cs-137), approximately 50-200 times the estimate of supernate expected in a typical B-25 before it is expected to exceed the LAWV Administrative Waste Package Radiological Concentration Guidelines
- Supernate waste passes the sum of fractions calculation

- Supernate waste contains an insignificant quantity of fissionable material to impact nuclear criticality criteria

4.3 Documentation of Supernate Fraction Distribution

Low Level waste stream form FHW-00001, previously submitted for approval to the Solid Waste Division, and included in Attachment 8 for information, will be used to document the supernate fraction distribution of sludge waste.

5.0 Quantification

5.1 Quantification of Sludge and Supernate Fractions

Quantification of radionuclides in sludge-contaminated waste requires quantification of both the supernate and sludge fractions in each waste cut. Independent quantification of Sr-90, indicative of the sludge fraction, and Cs-137, indicative of the supernate fraction, is key to accurate characterization of sludge-contaminated waste. Both the sludge and supernate fractions and their scaling ratios to Sr-90 and Cs-137, respectively, are reproduced in Attachment 9.

Scaling factors for the sludge fraction are tied to Sr-90. Although Sr-90 is present in the supernate fraction, it comprises less than 1% of total activity in the supernate fraction. For this reason, all Sr-90 identified in the sludge-contaminated waste will be attributed to the sludge fraction. Scaling ratios developed for the sludge fraction will be applied to the Sr-90 identified in sludge-contaminated waste.

Scaling factors for the supernate fraction are tied to Cs-137. Although Cs-137 is present in the sludge fraction, it typically comprises less than 5% of total activity in the sludge fraction (as is the case for waste stream FTK-00002-1). Waste stream FTK-00002-19 is a distinctly separate case, in that 99% of the activity in the sludge fraction is from Cs-137 and its daughter Ba-137m. Similarly, 98% of the activity in the supernate is from Cs-137 and its daughter Ba-137m. Application of the radionuclide distributions of waste streams FTK-00002-1 and -19 to quantification of waste from individual waste tanks will be performed on a case-by-case basis, based on available activity data and process knowledge.

The two fractions of sludge-contaminated waste will be manifested separately. The dose of Cs-137 and Sr-90 will be entered into two separate waste streams in WITS, representing the sludge and supernate fractions, respectively, which will calculate curies attributed to each radionuclide identified in the respective distributions. The two waste streams will be combined in WITS to create a single manifest.

5.2 Quantification of Job Control Waste and other Compactable Sludge-Contaminated Waste

The relative ease with which gamma radiation from Cs-137 is detected makes estimation of the curie content of the supernate fraction of waste straightforward. Dose-to-curie methodologies for quantification of Cs-137 on waste containers have been developed and are currently in use (References 9 and 10).

Sr-90, a low-energy beta emitter, is not easily measured. Although a Beta Screening Tool (BST) has been developed as an improved alternative method for providing a dose associated with Sr-90 (Reference 11), the BST methodology has not yet been implemented for waste quantification purposes. Until such time as the BST is field implemented, the actual quantity of Sr-90 present in the sludge fraction must be estimated by some other means.

The most conservative approach in quantification of a waste cut is to assume that all measured Cs-137 is attributed to both supernate and sludge fractions. For the sludge fraction, the known Sr-90 to Cs-137 ratio is utilized to estimate the maximum Sr-90 that could be present on the waste cut. This approach results in double-manifesting of the Cs-137, over-manifesting of virtually all of the remaining radionuclides, and significantly over-estimating the sludge fraction.

It is preferable, therefore, to determine an appropriate split of the measured Cs-137 that can be attributed to the supernate and sludge fractions. In determining the appropriate split between these fractions, one must consider the effects of overestimating one fraction or the other. Over-estimating the sludge fraction will result in

- under-manifesting of radionuclides attributed to supernate only (in this waste stream, the only radionuclide fitting this description is tritium, a PA radionuclide, present at 0.2% of total supernate activity), and
- over-manifesting of transuranics (a higher level of transuranics are present in sludge).

Over-estimating the supernate fraction will result in under-manifesting of radionuclides present in the sludge fraction only.

Determination of the split of Cs-137 contributed from the sludge and supernate fractions will be performed on a case-by-case basis for F-Area high level waste packages.

5.3 Quantification of Non-Compactable Sludge-Contaminated Waste

Estimation of the quantity of Cs-137 present on non-compactable waste, such as equipment or HEPA filters, is performed on a case-by-case basis. This is done by individual Dose-to-Curie runs, which take into account the specific geometry of the waste (Reference 12). Solid Waste Management Department personnel perform these runs.

Application of BST methodology to non-compactable waste to determine the amount of Sr-90 present is not appropriate since the waste itself shields beta radiation and would result in unrealistically low measured values. Estimation of Sr-90 present in cuts of non-compactable waste will be performed by estimation of the amount of Cs-137 attributed to the sludge fraction in combination with the known relationship between Sr-90 and Cs-137. This will be performed on a case-by-case basis.

6.0 Periodic Validation

Provisions of Procedure WAC 2.02, Revision 7 (Reference 5), require generators of routine wastes, including sludge-contaminated waste, to review and confirm the certification of each waste stream at least every two years. Since samples of supernate are routinely pulled and analyzed, validation of the supernate fraction is performed on this frequency.

Sludge sampling has been conducted on a very limited basis during development of DWPF design bases. Additional sludge samples have not been collected to date due to high cost and personnel exposure. For this reason, future validation performed of the sludge fraction will utilize process knowledge and analytical data as available.

7.0 References

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- 2 Georgetown, G. K. and J. R. Hester. "Characterization of Radionuclides in HLW Sludge Based on Isotopic Distribution in Irradiated Assemblies (U)," WSRC-TR-94-0562, Revision 1., January 27, 1995.
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- 4 Hester, J. R., "Correction of Am-241 Inventories and Adjustment of PUREX Low Heat Waste Pu-238 Inventories in the Waste Characterization System (WCS)," HLW-STE-99-0207, June 3, 1999.
- 5 Procedure WAC 2.02, Low Level Waste Characterization Requirements, WSRC 1S Savannah River Site Waste Acceptance Criteria Manual, Revision 7, Savannah River Site, November 1, 2002.
- 6 O'Bryant, R. F. and J. K. W. Dunaway, "Characterization of Radionuclides in Purex Waste Sludges from F-Area High Level Waste Tanks (U), WSRC-TR-2000-00215, June 2000.
- 7 Procedure WAC 3.17, Low Level Waste Acceptance Criteria, WSRC 1S Savannah River Site Waste Acceptance Manual, Revision 7, Savannah River Site, September 16, 2002.
- 8 M:\Waste\Hlcats\WCTables\TankData.xls, September 11, 2002.
M:\Waste\Hlcats\WCTables\SldgInv.xls, September 11, 2002.
- 9 Ketusky, E. T. and R. F. O'Bryant, "HLW Supernate Radionuclide Characterization," WSRC-TR-94-0290, Revision 3, April 19, 1999.
- 10 M. E. Jamison, "Characterization of Non-Routine Low-Level Waste from High Level Waste Activities (U)," WSRC-TR-95-0069, March 13, 1995.
- 11 P. D. Hunt, "Dose-to-Curie Calculations," ESH-HPT-99-0019, Revision 1, March 2, 1999.
- 12 Ross, R. H., Ketusky, E. T., and Petras, R. "HLW Characterization in Support of Low Level Waste Certification: HLW Sludge Beta Screening Tool," WSRC-TR-97-0555, Revision 1, October 8, 1998.
- 13 SRS-DTCTM 3.1, WMG Inc., 16 Bank Street, Peekskill, NY 10556.

Attachment 1

WCS Tank Data
Reference Date: September 11, 2002

Tank	Date	Total Waste Volume (gal)	Sludge Volume (kg)	Sludge Density (kg/gal)	Estimated Dry Sludge Weight (kg)	Sludge Interstitial Fraction (Vol. Frae.)	Salt Volume (gal)	Dry Salt Bulk Sp.G.	Estimated Salt Dry Wt. (kg)	Salt Interstitial Fraction (Vol. Frae.)	Free Supernate Vol. (gal)	Interstitial Sludge Supernate Vol. (gal)	Interstitial Salt Supernate Vol. (gal)	Total Supernate Vol. (gal)	Supernate Sp.G.	Precipitate Volume (gal)	Dry Precipitate Bulk Sp.G.	Estimated Dry Precipitate Weight (kg)	Precipitate Interstitial Fraction (Vol. Frae.)	Organic Resin Volume (gal)	Organic Resin Sp.G.	Organic Resin Weight (kg)	Zeolite Volume (gal)	Zeolite Sp.G.	Estimated Zeolite Weight (kg)	Sand Weight (kg)	Coal Weight (kg)	Gross Volume (gal)	Level (in)	Sludge Depth (in)	Salt Depth (in)	Free Supernate Depth (in)	Total Supernate Depth (in)	Supernate Concentration (Cytag)	Solids Concentration (Cytag)	Free Liquid in Tank?	Is Tank Filled to AB Limit for H2 Calculations?	Organic Tank?	Tank Farm Tank?	Total Vapor Space for Empty Tank (gal)	Current Vapor Space (in)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
1	2/3/2001	50567.1	7000	0.884	6198	0.70	480000	1.45	2634569	0.22	18857	4900	105800	120457	1.53	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	0	187	3	177	7	48	39.58	220.84	0	Y	Y	795740	250783																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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5	12/04/02	60704	28132	0.884	24886	0.58	0	1.45	0	0	0.22	332552	15765	0	48317	1.28	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	22	10	12	18	3.51	219.44	Y	Y	Y	795740	736036																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
6	12/04/02	306230	25005	0.884	221700	0.70	0	1.45	0	0	0.22	281220	17500	0	298730	1.12	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	113	9	104	10	0.07	282.55	Y	Y	Y	795740	48510																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
7	12/04/02	403627	20800	0.884	184756	0.70	0	1.45	0	0	0.22	194627	146300	0	340927	1.35	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	149	77	0	126	0.08	37.63	Y	Y	Y	795740	48510																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
8	12/04/02	31352	6448	0.884	5700	0.70	0	1.45	0	0	0.22	304904	4514	0	305418	1.41	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	115	2	113	114	0.11	41.03	Y	Y	Y	795740	363113																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
9	3/3/2001	545362	4000	0.884	3536	0.70	538000	1.45	2932913	0.22	1626	2800	118360	127786	1.41	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	0	101	1	109	1	45	14.03	56.74	0	Y	Y	795740	485388																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
10	10/3/01	182410	14000	0.884	3536	0.70	213000	1.45	1163080	0.22	0	2800	46880	49860	1.31	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	0	71	1	79	0	18	2.45	63.4	0	Y	Y	795740	253114																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
11	11/2/02	279190	14000	0.884	123760	0.84	0	1.45	0	0	0.22	139130	95000	0	237130	1.46	0.90	0.761	0	0	0	0.761							0	103	52	0	51	86	23.4	86.27	Y	Y	Y	795740	517610																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
12	12/2/02	279190	14000	0.884	123760	0.84	0	1.45	0	0	0.22	139130	95000	0	237130	1.46	0.90	0.761	0	0	0	0.761							0	103	52	0	51	86	23.4	86.27	Y	Y	Y	795740	517610																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
13	12/3/02	163569	173711	0.884	153561	0.63	92067	1.45	555226	0.22	0	0	0	792630	1.41	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	0	246	54	0	182	226	25.3	97.15	Y	Y	Y	1134000	274750																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
14	12/10/02	85250	223000	0.884	197132	0.70	0	1.45	0	0	0.22	18960	34200	53220	1440	1.10	0.90	0.761	0	0	0.761	0	0	0	0	0	0	0	0	50	8	0	15	32.51	45.46	0	Y	Y	1134000	900550																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
15	3/3/2001	173850	27000	0.884	23868	0.70	158000	1.45	856235	0.22	0	0	0	792630	1.41	0.90	0.761	0	0	0	0.761	0	0	0	0	0	0	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61

Attachment 2

**WCS Sludge Inventory
Reference Date: September 11, 2002**

Attachment 2

WCS Sludge Inventory

Reference Date: 9/11/02

M:\WASTEBH\cats\WCS\System\WCS\System\WCS\SludgeInv

Tank	H-3 (C)	C-14 (C)	N-59 (C)	Co-60 (C)	Ni-63 (C)	Se-79 (C)	Si-90 (C)	Y-90 (C)	Nb-94 (C)	To-99 (C)	Ru-106 (C)	Rh-106 (C)	Sb-125 (C)	Sr-126 (C)	I-129 (C)	Cs-134 (C)	Cs-135 (C)	Cs-137 (C)	Ba-137m (C)	Ce-144 (C)	Pr-144 (C)
1	1.278E-02	2.337E-02	2.337E-02	2.337E-02	2.337E-02	1.626E-01	6.039E-05	6.039E-05	6.039E-05	2.813E-02	3.048E-05	3.048E-05	2.521E-01	3.025E-01	1.340E-03	2.948E-02	1.883E-01	4.261E-04	4.261E-04	4.261E-04	4.261E-04
2	2.862E-03	3.371E-03	3.371E-03	3.371E-03	3.371E-03	2.307E-01	7.579E-04	7.579E-04	7.579E-04	3.914E-01	1.857E-08	1.857E-08	6.521E-01	4.291E-01	1.901E-04	3.889E-04	2.671E-02	5.387E-02	5.387E-02	5.387E-02	5.387E-02
3	2.478E-03	2.919E-03	2.919E-03	2.919E-03	2.919E-03	1.967E-01	6.874E-04	6.874E-04	6.874E-04	3.455E-01	1.244E-07	1.244E-07	1.007E-01	3.716E-01	1.646E-04	7.581E-04	2.313E-02	4.873E-03	4.873E-03	4.873E-03	4.873E-03
4	3.330E-03	1.184E-02	6.857E-03	6.857E-03	6.857E-03	8.468E-01	3.353E-06	3.353E-06	3.353E-06	1.464E-03	1.457E-04	1.457E-04	1.575E-02	6.971E-03	1.178E-01	9.805E-01	2.753E-05	2.804E-05	2.804E-05	2.804E-05	2.804E-05
5	4.447E-02	1.010E-02	1.976E-03	1.976E-03	1.976E-03	7.057E-01	2.842E-06	2.842E-06	2.842E-06	1.222E-03	1.319E-03	1.319E-03	2.551E-02	1.314E-02	5.824E-03	3.973E-01	8.183E-01	1.389E-05	1.389E-05	1.389E-05	1.389E-05
6	1.047E-02	3.251E-03	3.251E-03	3.251E-03	3.251E-03	7.452E-01	3.289E-06	3.289E-06	3.289E-06	1.289E-03	9.459E-03	9.459E-03	5.817E-02	1.386E-02	6.141E-03	1.114E-01	8.628E-01	2.300E-05	2.300E-05	2.300E-05	2.300E-05
7	8.618E-01	1.872E-02	1.509E-03	1.509E-03	1.509E-03	1.019E-02	3.642E-06	3.642E-06	3.642E-06	1.769E-03	1.262E-04	1.262E-04	1.117E-02	1.395E-02	8.369E-03	1.268E-01	1.180E-01	2.376E-05	2.376E-05	2.376E-05	2.376E-05
8	1.149E-02	4.322E-03	1.550E-02	1.550E-02	1.550E-02	2.666E-01	1.210E-06	1.210E-06	1.210E-06	4.613E-01	5.457E-03	5.457E-03	4.242E-01	4.960E-01	2.197E-04	1.172E-01	3.087E-02	8.446E-03	8.446E-03	8.446E-03	8.446E-03
9	3.087E-03	3.638E-03	2.073E-01	2.073E-01	2.073E-01	2.488E-01	8.171E-04	8.171E-04	8.171E-04	4.305E-01	1.568E-08	1.568E-08	6.991E-01	4.829E-01	2.051E-04	4.196E-04	2.882E-02	5.807E-03	5.807E-03	5.807E-03	5.807E-03
10	3.283E-04	3.811E-01	2.457E-04	2.457E-04	2.457E-04	2.593E-01	8.728E-03	8.728E-03	8.728E-03	4.884E-01	3.806E-09	3.806E-09	8.816E-02	4.783E-01	2.128E-05	7.316E-05	3.065E-03	6.163E-02	6.163E-02	6.163E-02	6.163E-02
11	1.586E-01	1.837E-02	1.326E-04	1.326E-04	1.326E-04	9.049E-01	3.422E-06	3.422E-06	3.422E-06	1.533E-03	1.407E-01	1.407E-01	7.884E-02	8.287E-01	5.390E-03	4.523E-01	1.023E-01	2.973E-05	2.973E-05	2.973E-05	2.973E-05
12	2.534E-02	2.802E-02	3.665E-06	3.665E-06	3.665E-06	1.578E-02	8.365E-06	8.365E-06	8.365E-06	2.681E-03	6.312E-03	6.312E-03	4.562E-02	1.691E-02	9.681E-03	1.728E-01	1.792E-01	4.174E-05	4.174E-05	4.174E-05	4.174E-05
13	2.912E-01	2.777E-02	7.462E-03	7.462E-03	7.462E-03	1.717E-02	7.690E-06	7.690E-06	7.690E-06	2.934E-03	3.170E-03	3.170E-03	2.494E-02	2.253E-02	1.178E-02	8.080E-02	1.962E-01	4.352E-05	4.352E-05	4.352E-05	4.352E-05
14	1.597E-03	7.719E-05	8.361E-01	8.361E-01	8.361E-01	5.284E-01	1.961E-05	1.961E-05	1.961E-05	9.080E-01	4.328E-07	4.328E-07	2.880E-02	8.822E-01	4.092E-04	1.028E-02	6.063E-02	1.317E-04	1.317E-04	1.317E-04	1.317E-04
15	2.338E-01	2.801E-02	1.012E-04	1.012E-04	1.012E-04	1.493E-02	7.504E-06	7.504E-06	7.504E-06	2.437E-03	1.011E-02	1.011E-02	3.006E-02	1.316E-02	8.431E-03	1.050E-01	1.623E-02	4.152E-05	4.152E-05	4.152E-05	4.152E-05
16	3.417E-03	2.016E-01	1.167E-05	1.167E-05	1.167E-05	1.663E-02	7.890E-02	7.890E-02	7.890E-02	2.888E-01	4.074E-05	4.074E-05	3.543E-01	3.091E-02	1.367E-06	9.802E-04	1.927E-04	5.497E-01	5.497E-01	5.497E-01	5.497E-01
17	4.009E-02	2.397E-01	1.256E-01	1.256E-01	1.256E-01	1.950E-01	9.081E-03	9.081E-03	9.081E-03	3.384E-05	4.391E-04	4.391E-04	3.832E-01	3.694E-01	1.606E-05	1.063E-02	2.297E-03	6.280E-02	6.280E-02	6.280E-02	6.280E-02
18	6.956E-04	4.092E-02	3.281E-01	3.281E-01	3.281E-01	3.384E-03	1.750E-02	1.750E-02	1.750E-02	5.872E-02	8.553E-06	8.553E-06	1.085E-01	6.284E-03	2.768E-07	2.978E-04	3.320E-05	3.440E-04	3.440E-04	3.440E-04	3.440E-04
19	8.957E-05	1.030E-05	1.894E-02	1.894E-02	1.894E-02	7.816E-01	5.372E-04	5.372E-04	5.372E-04	1.322E-01	1.225E-02	1.225E-02	2.477E-01	7.140E-01	4.579E-05	1.956E-05	8.837E-03	2.817E-03	2.817E-03	2.817E-03	2.817E-03
20	2.133E-02	3.698E-02	5.284E-01	5.284E-01	5.284E-01	1.654E-04	1.134E-05	1.134E-05	1.134E-05	2.800E-01	1.477E-02	1.477E-02	4.304E-01	1.513E-01	9.687E-05	3.136E-02	1.871E-02	6.167E-03	6.167E-03	6.167E-03	6.167E-03
21	5.877E-01	3.453E-01	1.371E-03	1.371E-03	1.371E-03	2.855E-01	1.967E-05	1.967E-05	1.967E-05	4.954E-01	7.823E-01	7.823E-01	2.221E-03	5.306E-04	2.350E-04	1.853E-01	3.307E-02	1.342E-04	1.342E-04	1.342E-04	1.342E-04
22	7.804E-04	4.559E-01	4.520E-02	4.520E-02	4.520E-02	4.709E-01	4.063E-04	4.063E-04	4.063E-04	7.979E-05	1.154E-04	1.154E-04	1.216E-02	4.306E-01	2.760E-05	1.760E-05	5.334E-03	2.168E-03	2.168E-03	2.168E-03	2.168E-03
23	2.453E-01	2.708E-02	4.977E-04	4.977E-04	4.977E-04	1.492E-02	1.020E-07	1.020E-07	1.020E-07	2.523E-03	7.304E-01	7.304E-01	8.187E-03	1.365E-02	8.747E-03	1.043E-03	1.690E-05	5.551E-05	5.551E-05	5.551E-05	5.551E-05
24	1.108E-01	5.418E-06	5.418E-06	5.418E-06	5.418E-06	7.954E-01	5.418E-06	5.418E-06	5.418E-06	1.375E-03	1.073E-03	1.073E-03	5.018E-04	1.474E-02	6.542E-03	3.803E-02	9.208E-01	3.988E-05	3.988E-05	3.988E-05	3.988E-05
25	1.227E-02	8.148E-06	8.148E-06	8.148E-06	8.148E-06	1.227E-02	8.148E-06	8.148E-06	8.148E-06	2.123E-03	1.621E-03	1.621E-03	6.875E-04	2.283E-02	1.011E-02	5.303E-02	1.421E-05	5.588E-05	5.588E-05	5.588E-05	5.588E-05
26	2.088E-01	2.702E-02	5.861E-04	5.861E-04	5.861E-04	1.249E-02	9.314E-06	9.314E-06	9.314E-06	2.116E-03	1.143E-02	1.143E-02	7.321E-03	1.283E-03	1.283E-03	1.283E-03	1.415E-05	5.053E-05	5.053E-05	5.053E-05	5.053E-05
27	2.332E-04	2.567E-01	4.841E-01	4.841E-01	4.841E-01	1.472E-01	1.007E-04	1.007E-04	1.007E-04	2.363E-05	1.889E-03	1.889E-03	4.965E-05	1.282E-01	8.280E-06	3.795E-01	1.600E-03	5.480E-02	5.480E-02	5.480E-02	5.480E-02
28	1.806E-01	1.981E-02	8.458E-04	8.458E-04	8.458E-04	1.080E-02	9.001E-06	9.001E-06	9.001E-06	1.847E-03	2.061E-02	2.061E-02	1.965E-04	9.977E-01	6.390E-03	2.667E-03	1.235E-05	4.859E-05	4.859E-05	4.859E-05	4.859E-05
29	6.141E-01	1.432E-02	5.051E-03	5.051E-03	5.051E-03	7.901E-01	3.660E-06	3.660E-06	3.660E-06	1.364E-03	1.732E-01	1.732E-01	1.235E-03	1.411E-02	6.345E-03	8.121E-03	9.131E-01	2.505E-05	2.505E-05	2.505E-05	2.505E-05
30	2.203E-01	1.328E-04	1.328E-04	1.328E-04	1.328E-04	1.714E-01	1.328E-04	1.328E-04	1.328E-04	2.909E-05	1.972E-02	1.972E-02	1.411E-01	1.567E-01	1.004E-05	1.413E-01	1.938E-03	7.163E-02	7.163E-02	7.163E-02	7.163E-02
31	2.574E-02	1.146E-01	4.322E-03	4.322E-03	4.322E-03	5.972E-01	3.171E-05	3.171E-05	3.171E-05	1.024E-02	6.326E-03	6.326E-03	2.465E-01	5.542E-01	3.505E-04	1.346E-01	6.679E-02	1.757E-04	1.757E-04	1.757E-04	1.757E-04
32	1.193E-01	8.014E-03	8.014E-03	8.014E-03	8.014E-03	1.893E-02	8.352E-01	8.352E-01	8.352E-01	1.893E-02	8.352E-01	8.352E-01	1.023E-01	1.023E-01	6.580E-04	4.709E-02	1.265E-01	5.093E-04	5.093E-04	5.093E-04	5.093E-04
33	3.227E-01	4.776E-01	4.182E-01	4.182E-01	4.182E-01	6.193E-04	2.856E-05	2.856E-05	2.856E-05	1.373E-01	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
34	4.547E-01	2.757E-03	3.320E-05	3.320E-05	3.320E-05	1.622E-03	9.176E-07	9.176E-07	9.176E-07	2.767E-04	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
35	3.227E-01	4.776E-01	4.182E-01	4.182E-01	4.182E-01	6.193E-04	2.856E-05	2.856E-05	2.856E-05	1.373E-01	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
36	4.547E-01	2.757E-03	3.320E-05	3.320E-05	3.320E-05	1.622E-03	9.176E-07	9.176E-07	9.176E-07	2.767E-04	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
37	3.227E-01	4.776E-01	4.182E-01	4.182E-01	4.182E-01	6.193E-04	2.856E-05	2.856E-05	2.856E-05	1.373E-01	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
38	4.547E-01	2.757E-03	3.320E-05	3.320E-05	3.320E-05	1.622E-03	9.176E-07	9.176E-07	9.176E-07	2.767E-04	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
39	3.227E-01	4.776E-01	4.182E-01	4.182E-01	4.182E-01	6.193E-04	2.856E-05	2.856E-05	2.856E-05	1.373E-01	3.259E-03	3.259E-03	1.705E-05	2.175E-03	1.918E-01	6.528E-03	1.903E-01	5.594E-06	5.594E-06	5.594E-06	5.594E-06
40	4.547E-01	2.757E-03	3.320E-05	3.320E-05	3																

Attachment 2

WCS Sludge Inventory

Reference Date: 9/11/02

'M:\WASTE8\Hleats\WCS\System\WCS\SldInv'

Tank	Pn-147 (Ci)	Eu-154 (Ci)	Th-232 (Ci)	U-232 (Ci)	U-233 (Ci)	U-234 (Ci)	U-235 (Ci)	U-236 (Ci)	U-238 (Ci)	Np-237 (Ci)	Pu-238 (Ci)	Pu-239 (Ci)	Pu-240 (Ci)	Pu-241 (Ci)	Pu-242 (Ci)	Ingrown Am-241 (Ci)	Am-241 (Ci)	Am-242m (Ci)	Cm-244 (Ci)	Cm-245 (Ci)
1	3.6048E+02	1.1818E+03	1.2709E-02	1.7650E-02	4.3927E-01	6.4083E-01	5.1937E-02	1.3289E-02	2.8723E-01	1.8529E-02	6.1152E-03	4.0566E-01	2.1108E+03	2.6629E+00	4.2481E-01	4.6188E-07	2.9632E+02	3.6871E-01	4.9450E-02	6.5532E-08
2	8.5707E+00	1.0850E+02	1.7297E-03	8.1193E-04	2.0247E-02	2.1175E-01	1.3925E-02	1.9755E-01	4.4154E+00	2.1040E-01	9.0842E-04	6.0179E+00	2.9632E+02	3.6871E-01	4.9450E-02	6.5532E-08	2.9632E+02	3.6871E-01	4.9450E-02	6.5532E-08
3	1.3617E+01	1.0991E+02	1.5250E-03	2.0282E-03	5.0578E-02	3.7804E-01	1.6843E-02	2.3775E-01	5.3142E+00	3.0483E-01	1.0833E-03	7.3042E+00	2.5748E+02	3.2198E-01	4.6101E-02	5.6733E-06	2.5748E+02	3.2198E-01	4.6101E-02	5.6733E-06
4	5.2280E+04	1.4057E+04	7.1620E-02	7.7690E-02	3.3431E+00	2.9945E+00	6.0537E-02	5.9775E-02	1.3380E-02	1.2824E+03	2.7487E-02	1.7490E+02	1.1190E+04	1.4499E-01	2.0920E+00	2.0070E-06	9.2283E+03	1.1758E-01	2.0920E+00	2.0070E-06
5	3.7756E+03	6.6374E+03	5.6892E-02	1.4070E-01	2.4801E+00	4.1889E+00	2.8887E-03	4.8206E-02	1.1517E+02	8.7522E-02	3.3972E-02	1.7316E+02	1.1758E-01	1.2697E-04	1.5938E+01	2.5048E+00	9.2283E+03	1.1758E-01	2.0920E+00	2.0070E-06
6	8.9356E+03	9.2822E+03	6.1842E-02	6.6479E-02	2.4801E+00	4.1889E+00	2.8887E-03	4.8206E-02	1.1517E+02	8.7522E-02	3.3972E-02	1.7316E+02	1.1758E-01	1.2697E-04	1.5938E+01	2.5048E+00	9.2283E+03	1.1758E-01	2.0920E+00	2.0070E-06
7	1.3514E+03	6.5294E+03	8.5885E-02	3.7937E-01	9.1577E+00	8.3986E+00	2.4285E-04	3.6651E-03	8.7522E-02	7.1181E+03	2.8240E-01	1.2903E+03	1.2697E-04	1.5938E+01	2.5048E+00	2.8958E-06	9.2283E+03	1.1758E-01	2.0920E+00	2.0070E-06
8	6.9952E+00	3.8128E+02	2.3535E-03	5.4268E-03	2.4971E-01	1.1339E-01	1.5427E-02	7.1295E-01	1.6778E-01	1.8136E-02	2.1167E-02	1.7153E-01	3.4453E-02	4.4070E-01	5.9879E-02	7.5743E-08	3.4453E-02	4.4070E-01	5.9879E-02	7.5743E-08
9	1.1832E+00	1.1682E-02	1.8653E-03	1.1790E-03	2.9402E-02	2.0104E-01	4.3654E-01	6.2382E-00	1.3939E+00	6.5716E+00	2.8677E-04	1.8824E+00	3.1984E-02	3.9768E-01	5.3292E-02	7.0888E-07	3.1984E-02	3.9768E-01	5.3292E-02	7.0888E-07
10	1.7786E+00	1.3826E-01	1.9227E-04	2.2830E-04	5.5931E-03	4.3541E-02	2.2110E-01	3.1585E+00	7.0598E-01	3.5649E+00	1.4525E-04	9.7175E-01	3.3162E-01	4.1270E-02	7.2190E-03	2.9769E-07	3.3162E-01	4.1270E-02	7.2190E-03	2.9769E-07
11	2.0550E+04	5.9937E+04	1.4315E-02	1.6831E-04	2.0418E+00	1.8759E-00	3.1618E-02	2.5904E-01	5.9643E-02	1.0665E+00	1.5298E+00	1.4883E-03	9.3397E-02	6.0761E-04	1.9889E+00	4.5916E+03	7.1014E+03	8.4568E+00	4.8739E-01	5.4395E-03
12	1.1245E+04	7.1824E+04	1.3605E-00	6.7447E-02	2.8408E-01	6.7924E-01	7.9381E+00	1.4101E+05	2.3162E-03	3.6891E-04	1.8495E+00	4.4582E+03	1.3363E+04	1.5935E-01	6.8648E-01	8.3752E-03	1.3363E+04	1.5935E-01	6.8648E-01	8.3752E-03
13	5.7940E-03	4.7114E+04	1.9815E-01	5.5434E-02	4.0600E+01	5.7287E+00	1.5664E-01	5.9066E-01	1.8312E+00	1.4731E+01	5.5578E+04	1.4578E-03	6.0307E-02	1.2061E-04	4.0007E-01	2.2286E+03	1.6515E+04	2.0555E-01	4.5472E-01	5.9810E-05
14	4.2988E-03	5.3103E+02	1.0594E-02	4.1468E-03	7.9708E-02	5.4780E-01	2.3049E+02	6.0446E-02	1.9518E-01	1.2105E-02	3.5796E-03	2.4336E+04	6.2785E+02	7.7952E-01	4.6032E-05	6.1062E-05	6.2785E+02	7.7952E-01	4.6032E-05	6.1062E-05
15	7.4062E+03	6.0844E+04	1.1349E-00	1.3870E-01	3.7925E+00	6.1173E-02	3.5881E-01	1.4033E-03	5.5532E+00	5.8175E+04	4.4498E-01	2.5489E+03	1.1233E+04	1.3156E-01	6.2315E-01	8.6449E-03	1.1233E+04	1.3156E-01	6.2315E-01	8.6449E-03
16																				
17	5.6405E+00	2.6933E+00	4.8849E-05	3.2871E-04	2.0428E-02	5.8307E-01	1.1972E-01	3.1684E+00	4.4467E-01	4.5535E-03	4.7984E+00	7.2737E+00	4.5605E-01	5.5088E-02	5.2153E-01	4.8919E-05	4.5605E-01	5.5088E-02	5.2153E-01	4.8919E-05
18	6.0597E+01	2.9521E+01	5.6639E-04	4.2980E-03	2.3133E-01	9.8518E-02	1.4074E-02	3.5956E-01	6.5756E-02	4.6079E-02	7.1227E-01	1.0208E+01	9.4003E+01	1.1368E-01	1.0964E+00	9.9353E-05	9.4003E+01	1.1368E-01	1.0964E+00	9.9353E-05
19	1.7295E+00	6.5086E-01	1.0302E-05	6.7959E-05	6.2087E-03	2.5477E-01	6.3395E-00	8.1346E-01	1.0560E-02	1.6736E-03										
20																				
21	6.7348E-02	8.0391E+02	5.6851E-06	1.7320E-01	1.7005E-01	1.5979E-03	3.4997E-02	1.5979E-03	1.0518E-01	9.5015E-02	1.0944E+00	2.3605E-01	5.3286E-04				4.5605E-01	5.5088E-02	5.2153E-01	4.8919E-05
22	1.1594E+03	1.6484E+03		1.0746E+00	3.8633E-01	5.9073E-03	6.3592E-02	8.5944E-03	2.3475E-01	1.6231E+03										
23																				
24																				
25																				
26	4.0634E-04	1.4992E+03		9.7325E-03		2.2130E-02		2.0218E+00	1.6755E+04	2.3396E-03	5.3497E+02	1.3235E+04	1.1006E-01							
27																				
28																				
29																				
30	3.5776E-03	9.5190E-02		1.8278E-02	3.2457E-04	3.3742E-03	1.2036E-05	8.2473E-03	3.5965E-03	3.0626E-01	2.1989E+01	2.3596E-02					3.8206E-01	4.7591E-02	4.4935E-01	2.8300E-05
31																				
32	2.3528E-05	1.5511E+05		2.7737E+00	3.9681E-02	6.2245E-01	1.8639E-02	1.1474E-00	4.1092E+05	3.3318E+03	2.6218E+03	2.0413E+05	5.5267E+00	1.4234E+04			1.1895E-04	1.4394E+01	9.9770E-01	8.9697E-03
33	9.0691E+05	3.9978E+04		1.6820E-01	7.4778E-02	2.4681E-01	9.5864E-00	2.2809E+01	6.9088E-03	1.2573E+03	3.9482E-04	6.4458E-02	2.7516E+02	2.4571E+04	1.4656E-01	2.2583E-06	1.0787E+04	1.4656E-01	5.3771E+00	2.2583E-06
34	1.2433E+06	5.7389E+04		1.1402E-01		8.0521E-00	6.2191E-00	1.3008E-03	2.9068E-02	6.8273E-03	6.0298E-02	2.8806E+02	1.6621E+04	2.2508E-01	7.9775E+00	3.4861E-06	1.6621E+04	2.2508E-01	7.9775E+00	3.4861E-06
35	2.9355E+05	1.6589E+05		2.1779E+00	4.7292E-02	8.0344E-01	2.7877E-02	9.8283E-01	4.1559E+05	3.2924E+03	2.2121E+05	5.6559E+00	1.3889E+04	1.0086E+04	1.2279E-01	9.4765E-01	1.0086E+04	1.2279E-01	9.4765E-01	7.5071E-03
36	1.3548E+02	1.5894E+02		7.2583E-03	1.4068E-04	2.5622E-03	4.6000E-05	2.0301E-03	6.4268E+02	4.9007E+00	2.8968E-02	8.4221E-03					1.1319E-01	1.3778E-02	9.9664E-02	8.4900E-06
37																				
38																				
39	5.7241E+05	1.9860E+05		9.5785E-00	5.6415E-02	8.9394E-01	4.8574E-03	4.0132E+00	7.0202E+05	5.7688E-03	3.9505E+03	4.1280E-05	1.3099E-01	1.7988E+04			8.8987E+03	1.5394E-01	2.2054E+05	1.7551E-01
40	2.0297E+04	1.4422E+04		6.6455E-01	1.9903E-01	1.0473E-01	8.3627E+00	3.4718E+00	2.3324E+04	2.3770E+02	8.5438E+03	8.8445E-01		9.1209E+02			9.6525E+03	1.2423E-01	5.8360E+00	3.7013E-04
41	3.9592E-02	2.5104E+02		1.2346E-02	1.4281E-04	3.5424E-06	3.6864E-02	2.0593E-02									9.8149E+00	1.2048E-02	1.3738E-01	1.0290E-05
42	6.2405E+02	2.7261E+03		2.2594E-01	5.3279E-03	3.0202E-02	9.3495E-02	1.8587E-01	3.0822E+03	1.0489E+02	3.7553E+01	7.3015E+02	3.4399E-02	1.2073E-02			4.5288E+02	5.3120E-01	2.8413E+00	3.5409E-04
43	8.8375E-04	2.2265E-04		4.4015E-00	4.4377E-02	6.7092E-01	6.2338E-03	3.8378E-00	1.1981E+05	3.7304E+02	2.4666E-02	1.9300E+04	4.6300E+00	4.1040E-02			6.4453E+02	7.9676E-01	1.0356E-01	6.7175E-04
44																				
45																				
46																				
47	1.6128E+04	9.5209E+02					1.8647E-02		1.5844E+04	2.2634E+03	5.0599E+02	1.1167E-04	1.0408E-01							
48																				
49																				
50																				

Attachment 3

Calculation of Scaling Factors from WCS Concentration Data

Attachment 3, F-Area Tank Farms

Calculation of Sludge Scaling Factors from WCS Concentration Data

WCS Reference Date: 9/11/02

Tank	H-3	C-14	Ni-59	Co-60	Se-79	Sr-90	Y-90	Tc-99	Ru-106	Rh-106	Sb-125	Sn-126	I-129	Cs-134	Cs-135	Cs-137	Ba-137m	Ce-144	Pr-144	Pm-147
Concentration (C/gal)																				
1	1.83E-06	3.34E-03	4.23E-02	2.32E-03	8.63E-01	8.63E-01	4.02E-02	4.34E-09	4.34E-09	3.61E-03	4.32E-03	1.91E-07	4.21E-06	2.69E-05	6.09E+00	5.76E+00	7.80E-12	7.80E-12	5.15E-02	5.15E-02
2	7.16E-07	8.43E-04	4.81E-03	5.77E-04	1.89E+01	1.89E+01	9.98E-01	4.63E-12	4.63E-12	1.33E-04	1.07E-03	1.07E-03	9.67E-08	6.68E-06	1.33E+00	1.27E+00	1.13E-15	1.13E-15	2.14E-03	2.14E-03
3	6.20E-07	7.30E-04	4.99E-04	5.47E-03	1.72E+01	1.72E+01	8.64E-03	3.11E-11	3.11E-11	2.52E-04	9.29E-04	4.12E-08	1.89E-07	5.78E-06	1.22E+00	1.15E+00	1.87E-14	1.87E-14	3.40E-03	3.40E-03
4	2.63E-08	9.33E-04	5.40E-02	6.87E-04	3.11E+01	3.11E+01	1.15E-02	1.15E-05	1.15E-05	2.49E-02	1.24E-03	5.50E-08	9.28E-05	7.72E-06	2.17E+00	2.05E+00	3.60E-07	3.60E-07	4.12E-01	4.12E-01
5	1.58E-06	3.59E-03	7.02E-02	2.51E-03	1.01E+02	1.01E+02	4.34E-02	4.69E-08	4.69E-08	9.06E-03	4.67E-03	2.07E-07	1.41E-05	2.91E-05	7.09E+00	6.71E+00	1.59E-10	1.59E-10	1.34E-01	1.34E-01
6	4.16E-03	1.30E-01	2.98E-03	1.32E+02	1.32E+02	1.32E+02	5.16E-02	3.78E-07	3.78E-07	2.33E-02	5.54E-03	4.40E-07	4.40E-05	3.45E-05	9.20E+00	8.70E+00	2.38E-09	2.38E-09	5.53E-01	5.53E-01
7	4.12E-06	8.96E-04	7.22E-03	4.88E-04	1.74E+01	1.74E+01	8.44E-01	6.04E-10	6.04E-10	5.34E-04	9.07E-04	4.02E-08	5.92E-07	5.65E-06	1.23E+00	1.17E+00	1.17E-12	1.17E-12	7.57E-03	7.57E-03
8	1.78E-06	6.70E-04	2.40E-02	4.14E-04	1.88E+01	1.88E+01	7.15E-03	8.48E-07	8.48E-07	6.88E-03	7.69E-04	3.41E-08	1.79E-05	4.79E-06	1.31E+00	1.24E+00	2.48E-08	2.48E-08	1.04E-01	1.04E-01
18	8.53E-07	5.02E-05	2.67E-04	4.15E-06	1.92E-01	1.92E-01	7.20E-05	9.77E-09	9.77E-09	8.09E-05	7.71E-06	3.42E-10	2.26E-07	4.81E-08	1.34E-02	1.26E-02	1.74E-10	1.74E-10	1.29E-03	1.29E-03
26	2.09E-06	1.23E-04	4.88E-03	1.02E-05	7.00E-01	7.00E-01	1.76E-04	2.79E-04	2.79E-04	7.90E-03	1.89E-05	8.37E-10	6.62E-05	1.18E-07	4.78E-02	4.52E-02	8.50E-05	8.50E-05	1.45E-01	1.45E-01
33	2.85E-03	8.97E-01	2.04E-03	1.39E+02	1.39E+02	1.39E+02	3.53E-02	2.75E-02	2.75E-02	1.29E+00	3.79E-03	1.68E-07	9.75E-03	2.36E-05	9.48E+00	8.97E+00	7.35E-03	7.35E-03	2.32E-01	2.32E-01
34	6.86E-03	1.95E+00	4.91E-03	3.26E+02	3.26E+02	3.26E+02	8.49E-02	6.49E-02	6.49E-02	2.75E+00	9.13E-03	4.05E-07	2.12E-02	5.69E-05	2.23E+01	2.11E+01	1.57E-02	1.57E-02	4.97E+01	4.97E+01
47	1.76E-06	1.03E-04	3.12E-03	8.56E-06	5.63E-01	5.63E-01	1.48E-04	2.86E-05	2.86E-05	3.66E-03	1.59E-05	7.04E-10	2.39E-05	9.91E-08	3.85E-02	3.64E-02	3.50E-06	3.50E-06	6.50E-02	6.50E-02
Average	1.54E-06	1.93E-03	2.46E-01	1.34E-03	6.84E+01	6.84E+01	2.32E-02	7.13E-03	7.13E-03	3.17E-01	2.49E-03	1.11E-07	2.40E-03	1.55E-05	4.73E+00	4.48E+00	1.78E-03	1.78E-03	5.71E+00	5.71E+00

19	2.74E-07	1.61E-05	1.29E-04	1.33E-06	6.88E-02	6.88E-02	2.31E-05	3.36E-09	3.36E-09	4.27E-05	1.24E-06	1.10E-10	1.17E-07	1.54E-08	1.35E+01	1.28E+01	4.03E-11	4.03E-11	6.81E-04	6.81E-04
Average	2.74E-07	1.61E-05	1.29E-04	1.33E-06	6.88E-02	6.88E-02	2.31E-05	3.36E-09	3.36E-09	4.27E-05	1.24E-06	1.10E-10	1.17E-07	1.54E-08	1.35E+01	1.28E+01	4.03E-11	4.03E-11	6.81E-04	6.81E-04

Scaling Factors (C/Gi Sr-90)

1	2.12E-08	3.87E-05	4.90E-04	2.89E-05	1.00E+00	1.00E+00	1.00E+00	4.66E-04	5.03E-11	5.03E-11	4.18E-05	5.01E-05	2.22E-09	4.88E-08	3.12E-07	7.06E-02	6.68E-02	9.05E-14	9.05E-14	5.97E-04
2	3.78E-08	4.45E-05	2.54E-04	3.04E-05	1.00E+00	1.00E+00	5.27E-04	2.44E-13	2.44E-13	8.61E-06	5.66E-05	2.51E-09	5.10E-09	3.52E-07	7.11E-02	6.72E-02	5.96E-17	5.96E-17	1.13E-04	
3	3.61E-08	4.25E-05	3.18E-04	2.91E-05	1.00E+00	1.00E+00	5.03E-04	1.81E-12	1.81E-12	1.47E-05	5.40E-05	2.39E-09	1.10E-08	3.36E-07	7.09E-02	6.71E-02	1.09E-15	1.09E-15	1.98E-04	
4	8.44E-10	3.00E-05	1.73E-03	2.14E-05	1.00E+00	1.00E+00	3.70E-04	3.68E-07	3.68E-07	8.01E-04	3.98E-05	1.77E-09	2.98E-06	2.48E-07	6.96E-02	6.59E-02	1.15E-08	1.15E-08	1.32E-03	
5	1.56E-08	3.55E-05	6.95E-04	2.49E-05	1.00E+00	1.00E+00	4.30E-04	4.64E-10	4.64E-10	8.98E-05	4.63E-05	2.05E-09	1.40E-07	2.88E-07	7.03E-02	6.65E-02	1.58E-12	1.58E-12	1.33E-03	
6	3.16E-05	9.88E-04	2.27E-05	1.00E+00	1.00E+00	1.00E+00	3.92E-04	2.87E-09	2.87E-09	1.77E-04	4.21E-05	1.87E-09	3.39E-07	2.62E-07	6.99E-02	6.61E-02	1.81E-11	1.81E-11	2.69E-03	
7	2.37E-07	5.14E-05	4.14E-04	2.80E-05	1.00E+00	1.00E+00	4.84E-04	3.47E-11	3.47E-11	3.07E-05	5.20E-05	2.31E-09	3.40E-08	3.24E-07	7.07E-02	6.69E-02	6.71E-14	6.71E-14	4.34E-04	
8	9.50E-08	3.57E-05	1.28E-03	2.20E-05	1.00E+00	1.00E+00	3.81E-04	4.51E-08	4.51E-08	3.50E-04	4.10E-05	1.82E-09	9.19E-07	2.55E-07	6.98E-02	6.60E-02	1.32E-09	1.32E-09	5.53E-03	
18	4.45E-06	2.62E-04	1.39E-03	2.17E-05	1.00E+00	1.00E+00	3.76E-04	5.10E-08	5.10E-08	4.22E-04	4.02E-05	1.78E-09	1.18E-06	2.51E-07	6.97E-02	6.60E-02	9.10E-10	9.10E-10	6.73E-03	
26	2.99E-06	1.76E-04	6.97E-03	1.45E-05	1.00E+00	1.00E+00	2.52E-04	3.98E-04	3.98E-04	1.13E-02	2.70E-05	1.19E-09	9.45E-05	1.68E-07	6.82E-02	6.45E-02	1.21E-04	1.21E-04	2.07E-01	
33	2.05E-05	6.46E-03	1.47E-05	1.00E+00	1.00E+00	1.00E+00	2.54E-04	1.98E-04	1.98E-04	9.26E-03	2.73E-05	1.21E-09	7.02E-05	1.70E-07	6.83E-02	6.46E-02	5.29E-05	5.29E-05	1.67E-01	
34	2.10E-05	5.99E-03	1.51E-05	1.00E+00	1.00E+00	1.00E+00	2.61E-04	1.99E-04	1.99E-04	8.44E-03	2.80E-05	1.24E-09	6.51E-05	1.74E-07	6.83E-02	6.47E-02	4.81E-05	4.81E-05	1.53E-01	
47	3.13E-06	1.84E-04	5.53E-03	1.52E-05	1.00E+00	1.00E+00	2.64E-04	5.08E-05	5.08E-05	6.50E-03	2.82E-05	1.25E-09	4.25E-05	1.76E-07	6.84E-02	6.47E-02	6.21E-06	6.21E-06	1.15E-01	
Average	1.10E-06	7.48E-05	2.50E-03	2.20E-05	1.00E+00	1.00E+00	3.81E-04	6.51E-05	6.51E-05	2.88E-03	4.10E-05	1.82E-09	2.14E-05	2.55E-07	6.97E-02	6.59E-02	1.76E-05	1.76E-05	5.17E-02	

19	3.98E-06	2.34E-04	1.88E-03	1.93E-05	1.00E+00	1.00E+00	3.36E-04	4.89E-08	4.89E-08	6.20E-04	3.59E-05	1.59E-09	1.70E-06	2.24E-07	1.97E+02	1.86E+02	5.85E-10	5.85E-10	9.89E-03	9.89E-03
Average	3.98E-06	2.34E-04	1.88E-03	1.93E-05	1.00E+00	1.00E+00	3.36E-04	4.89E-08	4.89E-08	6.20E-04	3.59E-05	1.59E-09	1.70E-06	2.24E-07	1.97E+02	1.86E+02	5.85E-10	5.85E-10	9.89E-03	9.89E-03

Attachment 3, F-Area Tank Farms

Calculation of Sludge Scaling Factors from WCS Concentration Data

WCS Reference Date: 9/11/02

Tank	Eu-154	U-233	U-234	U-235	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	Ingrown Am-241	Am-241	Am-242m	Cm-244	Cm-245	Total	TRU
Concentration (C/kgal)																		
1	1.69E-01				2.52E-06	6.28E-05	9.15E-05	7.42E-02	1.90E-02	4.25E-03	2.65E-02	8.74E-07	5.80E-03	3.02E-01	3.80E-04	6.07E-05	6.60E-11	1.85E+02
2	2.71E-02				2.03E-07	5.06E-06	5.29E-05	3.46E-02	4.94E-03	1.10E-03	5.26E-03	2.27E-07	1.50E-03	7.41E-02	9.22E-05	1.24E-05	1.64E-11	4.07E+01
3	2.75E-02				5.07E-07	1.26E-05	9.45E-05	4.16E-02	5.94E-03	1.33E-03	7.62E-03	2.73E-07	1.83E-03	6.44E-02	8.05E-05	1.15E-05	1.42E-11	3.69E+01
4	1.11E-01				6.12E-07	2.63E-05	2.35E-05	4.77E-03	4.71E-03	1.05E-03	1.01E-02	2.18E-07	1.38E-03	8.81E-02	1.14E-04	2.52E-05	1.89E-11	6.72E+01
5	2.36E-01				3.72E-06	8.81E-05	1.49E-04	1.03E-01	1.71E-02	4.09E-03	3.11E-02	1.21E-06	6.09E-03	3.28E-01	4.18E-04	7.43E-05	7.13E-11	2.17E+02
6	3.72E-01				2.66E-06	9.94E-05	3.45E-05	1.02E-02	3.54E-03	4.51E-02	6.95E-06	6.93E-03	3.93E-01	5.06E-04	1.02E-04	8.46E-11	2.82E+02	
7	3.12E-02				1.82E-06	4.38E-05	4.02E-05	1.16E-01	1.75E-02	4.19E-03	3.41E-02	1.35E-06	6.17E-03	6.07E-02	7.62E-05	1.20E-05	1.39E-11	3.76E+01
8	5.91E-02				8.42E-07	3.87E-05	1.76E-05	7.05E-02	1.11E-02	2.60E-03	2.81E-02	3.28E-06	2.66E-03	5.34E-02	6.90E-05	1.49E-05	1.17E-11	4.05E+01
18	6.28E-04				9.14E-08	4.92E-06		2.10E-02	2.99E-03	7.65E-04	1.40E-02	9.80E-07	1.52E-03			1.52E-07	1.19E-13	4.52E-01
26	5.34E-03				7.88E-08	7.19E-06		5.96E-02	8.52E-03	1.90E-03	4.71E-02	3.92E-07	1.86E-03			6.93E-07	2.92E-13	1.78E+00
33	1.03E+00	9.60E-12	8.01E-08		4.31E-06	6.33E-04	2.46E-04	5.85E-04	1.77E-01	3.22E-02	1.01E+00	1.65E-06	7.06E-03	2.77E-01	3.76E-04	1.38E-04	5.79E-11	3.24E+02
34	2.30E+00				4.56E-06	3.22E-04	2.49E-04		5.20E-02	1.16E-02	2.73E-01	2.41E-06	1.15E-02	6.65E-01	9.00E-04	3.19E-04	1.39E-10	7.53E+02
47	3.84E-03				7.52E-08	5.95E-06		6.39E-02	9.13E-03	2.04E-03	4.50E-02	4.20E-07	2.11E-03			5.43E-07	2.46E-13	1.40E+00
Average	3.36E-01	9.60E-12	8.01E-08	1.69E-06	1.04E-04	9.98E-05	5.36E-02	2.82E-02	5.44E-03	1.21E-01	1.56E-06	4.34E-03	2.30E-01	3.07E-04	5.93E-05	3.81E-11	1.53E+02	3.20E-01

19	2.72E-04				2.67E-08	2.44E-06		1.00E-02	1.43E-03	3.20E-04	4.15E-02	6.58E-07	4.02E-03			5.77E-08	3.82E-14	2.66E+01
Average	2.72E-04				2.67E-08	2.44E-06		1.00E-02	1.43E-03	3.20E-04	4.15E-02	6.58E-07	4.02E-03			5.77E-08	3.82E-14	2.66E+01

Scaling Factors (Ci/Ci Sr-90)																		
1	1.96E-03				2.92E-08	7.27E-07	1.06E-06	8.60E-04	2.20E-04	4.92E-05	3.07E-04	1.01E-08	6.72E-05	3.50E-03	4.41E-06	7.03E-07	7.65E-13	
2	1.43E-03				1.07E-08	2.67E-07	2.79E-06	1.82E-03	2.61E-04	5.83E-05	2.78E-04	1.20E-08	7.94E-05	3.91E-03	4.86E-06	6.82E-07	8.65E-13	
3	1.60E-03				2.95E-08	7.36E-07	5.50E-06	2.42E-03	3.46E-04	7.73E-05	4.43E-04	1.59E-08	1.06E-04	3.75E-03	4.68E-06	6.71E-07	8.25E-13	
4	3.56E-03				1.96E-08	8.46E-07	7.55E-07	1.53E-04	1.51E-04	3.38E-05	3.24E-04	6.95E-09	4.42E-05	2.83E-03	3.67E-06	8.11E-07	6.08E-13	
5	2.34E-03				3.68E-08	8.73E-07	1.47E-06	1.02E-03	1.70E-04	4.05E-05	3.08E-04	1.20E-08	6.04E-05	3.25E-03	4.14E-06	7.36E-07	7.06E-13	
6	2.82E-03				2.02E-08	7.56E-07	2.62E-07	7.74E-05	2.69E-05	3.43E-04	5.23E-08	5.26E-05	2.98E-03	3.85E-06	7.75E-07	7.75E-07	6.43E-13	
7	1.79E-03				1.04E-07	2.51E-06	2.31E-06	6.67E-03	1.01E-03	2.40E-04	1.95E-03	7.75E-08	3.54E-04	3.49E-03	4.37E-06	6.88E-07	7.95E-13	
8	3.15E-03				4.48E-08	2.06E-06	9.36E-07	3.75E-03	5.89E-04	1.39E-04	1.50E-03	1.75E-07	1.42E-04	2.85E-03	3.68E-06	7.92E-07	6.26E-13	
18	3.28E-03				4.77E-07	2.57E-05		1.09E-01	1.56E-02	3.99E-03	7.30E-02	5.12E-06	7.91E-03			7.93E-07	6.21E-13	
26	7.62E-03				1.12E-07	1.03E-05		8.52E-02	1.22E-02	2.72E-03	6.73E-02	5.59E-07	2.64E-03			9.90E-07	4.16E-13	
33	7.38E-03	6.91E-14	5.76E-10		5.76E-10	4.55E-06	1.77E-06	4.21E-06	1.27E-03	2.32E-04	7.28E-03	1.19E-08	5.08E-05	1.99E-03	2.70E-06	9.92E-07	4.17E-13	
34	7.04E-03				1.40E-08	9.88E-07	7.63E-07		1.60E-04	3.57E-05	8.38E-04	7.40E-09	3.54E-05	2.04E-03	2.76E-06	9.79E-07	4.28E-13	
47	6.82E-03				1.33E-07	1.06E-05		1.13E-01	1.62E-02	3.62E-03	7.99E-02	7.45E-07	3.74E-03			9.64E-07	4.36E-13	
Average	3.91E-03	6.91E-14	5.76E-10	7.94E-08	4.68E-06	1.76E-06	2.95E-02	3.71E-03	8.67E-04	1.80E-02	5.23E-07	1.18E-03	3.06E-03	3.91E-06	8.11E-07	6.27E-13	2.25E+00	3.83E-02

19	3.95E-03				3.88E-07	3.55E-05		1.48E-01	2.08E-02	4.65E-03	6.03E-01	9.56E-06	5.83E-02			8.38E-07	5.55E-13	
Average	3.95E-03				3.88E-07	3.55E-05		1.48E-01	2.08E-02	4.65E-03	6.03E-01	9.56E-06	5.83E-02			8.38E-07	5.55E-13	2.29E-01

Attachment 4

Comparison of F-Area Tank Farm Sludge Scaling Factors for Consolidation

Isotope	Fractional activity													Mean
	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6	Tank 7	Tank 8	Tank 18	Tank 25	Tank 33	Tank 34	Tank 47	
SI-90	4.69E-01	4.66E-01	4.66E-01	4.63E-01	4.68E-01	4.66E-01	4.64E-01	4.64E-01	4.24E-01	3.94E-01	4.28E-01	4.33E-01	4.02E-01	4.48E-01
Y-90	4.66E-01	4.66E-01	4.68E-01	4.68E-01	4.68E-01	4.68E-01	4.64E-01	4.64E-01	4.24E-01	3.94E-01	4.28E-01	4.33E-01	4.02E-01	4.48E-01

Predominant radionuclides, variation from mean fractional activity (allowable variation = 100%)													
	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6	Tank 7	Tank 8	Tank 18	Tank 26	Tank 33	Tank 34	Tank 47
	4.4%	4.4%	4.3%	3.8%	4.4%	4.4%	4.0%	3.9%	-5.0%	-11.7%	-4.0%	-3.0%	-9.8%
	4.4%	4.4%	4.3%	3.8%	4.4%	4.4%	4.0%	4.0%	-5.0%	-11.7%	-4.0%	-3.0%	-9.8%
	4.4%	4.4%	4.3%	3.8%	4.4%	4.4%	4.0%	4.0%	-5.0%	-11.7%	-4.0%	-3.0%	-9.8%

Isotope	Fractional Activity		Pred. rads. variation from mean fract. act. (allowable varn. = 100%)
	Tank 19	Mean	
Sr-90	2.59E-03	2.59E-03	0.0%
Y-90	2.59E-03	2.59E-03	0.0%

Attachment 5

F-Area Tank Farm Sludge Waste Streams Exclusion Criteria

**Attachment 5. F-Area Tank Farm Sludge Waste Streams
Exclusion Criteria**

					Distribution		
Isotope	Mean Ci/Ci Sr-90)	Mean Distribution (%)	<1% of dist?(a)	Not Expected	RADs remaining after excl criteria	Mean distribution (percent)	Re-normalized distribution
Waste Stream FTK-00002-1							
H-3				x			
C-14	1.10E-06	4.88E-05			C-14	4.88E-05	4.88E-05
Ni-59	7.48E-05	3.32E-03	yes				
Co-60	2.50E-03	1.11E-01	yes(b)		Co-60	1.11E-01	1.11E-01
Se-79	2.20E-05	9.78E-04	yes				
Sr-90	1.00E+00	4.44E+01	no		Sr-90	4.44E+01	4.44E+01
Y-90	1.00E+00	4.44E+01	no		Y-90	4.44E+01	4.44E+01
Tc-99	3.81E-04	1.69E-02			Tc-99	1.69E-02	1.69E-02
Ru-106	6.51E-05	2.89E-03	yes				
Rh-106	6.51E-05	2.89E-03	yes				
Sb-125	2.88E-03	1.28E-01	yes(b)		Sb-125	1.28E-01	1.28E-01
Sn-126	4.10E-05	1.82E-03	yes				
I-129	1.82E-09	8.06E-08			I-129	8.06E-08	8.06E-08
Cs-134	2.14E-05	9.49E-04	yes				
Cs-135	2.55E-07	1.13E-05	yes				
Cs-137	6.97E-02	3.09E+00	no		Cs-137	3.09E+00	3.09E+00
Ba-137m	6.59E-02	2.92E+00	no		Ba-137m	2.92E+00	2.93E+00
Ce-144	1.76E-05	7.80E-04	yes				
Pr-144	1.76E-05	7.80E-04	yes				
Pr-144m	1.76E-05	7.80E-04	yes				
Pm-147	5.17E-02	2.30E+00	no		Pm-147	2.30E+00	2.30E+00
Eu-154	3.91E-03	1.73E-01	yes(b)		Eu-154	1.73E-01	1.73E-01
U-233	6.91E-14	3.07E-12			U-233	3.07E-12	3.07E-12
U-234	5.76E-10	2.56E-08			U-234	2.56E-08	2.56E-08
U-235	7.94E-08	3.53E-06			U-235	3.53E-06	3.53E-06
U-238	4.68E-06	2.08E-04			U-238	2.08E-04	2.08E-04
Np-237	1.76E-06	7.82E-05			Np-237	7.82E-05	7.82E-05
Pu-238	2.95E-02	1.31E+00			Pu-238	1.31E+00	1.31E+00
Pu-239	3.71E-03	1.65E-01			Pu-239	1.65E-01	1.65E-01
Pu-240	8.67E-04	3.84E-02			Pu-240	3.84E-02	3.85E-02
Pu-241	1.80E-02	7.98E-01			Pu-241	7.98E-01	7.98E-01
Pu-242	5.23E-07	2.32E-05			Pu-242	2.32E-05	2.32E-05
Am-241	4.23E-03	1.88E-01			Am-241	1.88E-01	1.88E-01
Am-242m	3.91E-06	1.74E-04			Am-242m	1.74E-04	1.74E-04
Cm-244	8.11E-07	3.60E-05	yes				
Cm-245	6.27E-13	2.78E-11			Cm-245	2.78E-11	2.78E-11
Total	2.25E+00	1.00E+02			Total	1.00E+02	1.00E+02
Waste Stream FTK-00002-19							
H-3				x			
C-14	3.98E-06	1.03E-06			C-14	1.03E-06	1.03E-06
Co-60	1.88E-03	4.87E-04	yes				
Ni-59	2.34E-04	6.07E-05	yes				
Se-79	1.93E-05	5.02E-06	yes				
Sr-90	1.00E+00	2.59E-01	yes(b)		Sr-90	2.59E-01	2.59E-01
Y-90	1.00E+00	2.59E-01	yes(b)		Y-90	2.59E-01	2.59E-01
Tc-99	3.36E-04	8.71E-05			Tc-99	8.71E-05	8.71E-05
Ru-106	4.89E-08	1.27E-08	yes				
Rh-106	4.89E-08	1.27E-08	yes				
Sb-125	6.20E-04	1.61E-04	yes				
Sn-126	3.59E-05	9.32E-06	yes				
I-129	1.59E-09	4.13E-10			I-129	4.13E-10	4.13E-10
Cs-134	1.70E-06	4.41E-07	yes				
Cs-135	2.24E-07	5.81E-08	yes				
Cs-137	1.97E+02	5.10E+01	no		Cs-137	5.10E+01	5.10E+01
Ba-137m	1.86E+02	4.83E+01	no		Ba-137m	4.83E+01	4.83E+01
Ce-144	5.85E-10	1.52E-10	yes				
Pr-144	5.85E-10	1.52E-10	yes				
Pr-144m	5.85E-10	1.52E-10	yes				
Pm-147	9.89E-03	2.56E-03	yes				
Eu-154	3.95E-03	1.02E-03	yes				
U-233				x			
U-234				x			
U-235	3.88E-07	1.01E-07			U-235	1.01E-07	1.01E-07
U-238	3.55E-05	9.20E-06			U-238	9.20E-06	9.20E-06
Np-237				x			
Pu-238	1.46E-01	3.78E-02			Pu-238	3.78E-02	3.78E-02
Pu-239	2.08E-02	5.40E-03			Pu-239	5.40E-03	5.40E-03
Pu-240	4.65E-03	1.21E-03			Pu-240	1.21E-03	1.21E-03
Pu-241	6.03E-01	1.57E-01			Pu-241	1.57E-01	1.57E-01
Pu-242	9.56E-06	2.48E-06			Pu-242	2.48E-06	2.48E-06
Am-241	5.83E-02	1.51E-02			Am-241	1.51E-02	1.51E-02
Am-242m				x			
Cm-244	8.38E-07	2.17E-07	yes				
Cm-245	5.55E-13	1.44E-13			Cm-245	1.44E-13	1.44E-13
Total	3.85E+02	1.00E+02			Total	1.00E+02	1.00E+02

Bold = PA
radionuclides

(a) radionuclides
included only
because they were
expected to be
present >1%

(b) retained in
distribution since
they are close to 1%
of total activity

Attachment 6

Comparison of F-Area Sludge Waste Against WAC 3.17, Rev. 7, Requirements

Attachment 6
Comparison of F-Area Sludge Waste Against WAC 3.17, Rev. 7, Requirements

Comparison Against WAC 3.17, Rev. 7, Requirements - Waste Stream FTK-00002-1

Comparison to Package Guidelines (Section 3.5.1)

Isotope	Isotope Average Ci/gal	LAWV limit ci/ft3	LAWV limit Ci for B-25	Amt isotope in B-25 to reach LAWV Limit (gal) = LAWV limit in B-25/sludge activity	Total Curies in B-25	TRU Curies	for 5000 lb nCi/g	min waste wt to not be TRU
H-3		1.10E+01	9.90E+02					
C-14	1.54E-06	2.50E-05	2.25E-03	1.46E+03				
Tc-99	2.32E-02	5.60E-05	5.04E-03	2.17E-01	3.32E+01	6.95E-02	30.62265	1531.132
I-129	1.11E-07	1.10E-08	9.90E-07	8.92E+00				
U-234	8.01E-08	1.10E-03	9.90E-02	1.24E+06				
U-238	1.04E-04	1.20E-03	1.08E-01	1.04E+03				

Sum of Fractions Calculation (Section 3.5.2)

				Activity, blended waste		1.53E+02 Ci/gal		
Isotope	Isotope Average Ci/gal	Ci/ft3 sludge	Ci/ft3 waste	LAWV limit ci/ft3	Fraction	TRU Curies/Total Curies = 2.09E-03		
H-3				1.10E+01		Total TRU = 3.20E-01 Ci/gal		
C-14	1.54E-06	1.15E-05	3.63E-09	2.50E-05	1.45E-04	Np-237 9.98E-05		
Tc-99	2.32E-02	1.74E-01	5.46E-05	5.60E-05	9.75E-01	Pu-238 5.36E-02		
I-129	1.11E-07	8.30E-07	2.61E-10	1.10E-08	2.38E-02	Pu-239 2.62E-02		
U-234	8.01E-08	5.99E-07	1.89E-10	1.10E-03	1.71E-07	Pu-240 5.44E-03		
U-238	1.04E-04	7.78E-04	2.45E-07	1.20E-03	2.04E-04	Pu-242 1.56E-06		
						Am-241 2.34E-01		
						Am-242m 3.01E-04		
						Cm-245 3.81E-11		
	ft3 sludge/ft3 waste	3.15E-04		Total	9.99E-01			
	ft3 sludge/B-25	2.83E-02						
	Gal sludge/B-25	2.12E-01						
	Equivalent Curies	3.24E+01						
			max amount of sludge in a B-25 to meet Sum of Fractions Limit					
			TRU curies	6.78E-02		min lb wt to be TRU		
			nCi/g at max wt	2.99E+01		1493.176116		

Nuclear Criticality Safety Criteria (Section 3.5.3)

	Specific Activity Ci/g	Activity in Sludge Ci/gal sludge	Ci	Mass (g)	Equiv Factor	FGE
U-233	9.648E-03	9.60E-12	3.25E-10	3.37E-08	1.4	4.72E-08
U-235	2.160E-06	1.69E-06	5.73E-05	2.65E+01	1.0	2.65E+01
Pu-239	6.132E-02	2.62E-02	8.88E-01	1.45E+01	1.6	2.32E+01
Pu-241	1.034E+02	1.21E-01	4.10E+00	3.97E-02	3.5	1.39E-01
Am-242m	9.717E+00	3.01E-04	1.02E-02	1.05E-03	54.0	5.67E-02
Cm-245	1.716E-01	3.81E-11	1.29E-09	7.53E-09	24.0	1.81E-07
Gal Sludge		33.9			Total	4.99E+01
Equiv Curies		5.19E+03				

Comparison Against WAC 3.17, Rev. 7, Requirements - Waste Stream FTK-00002-19

Comparison to Package Guidelines (Section 3.5.1)

Isotope	Isotope Average Ci/gal	LAWV limit ci/ft3	LAWV limit Ci for B-25	Amt isotope in B-25 to reach LAWV Limit (gal) = LAWV limit in B-25/sludge activity	Total Curies in B-25	TRU Curies	for 5000 lb nCi/g	min waste wt to not be TRU
H-3		1.10E+01	9.90E+02					
C-14	2.74E-07	2.50E-05	2.25E-03	8.21E+03				
Tc-99	2.31E-05	5.60E-05	5.04E-03	2.18E+02	3.34E+04	6.98E+01	30755.21	1537761
I-129	1.10E-10	1.10E-08	9.90E-07	9.00E+03				
U-234		1.10E-03	9.90E-02					
U-238	2.44E-06	1.20E-03	1.08E-01	4.43E+04				

Sum of Fractions Calculation (Section 3.5.2)

				Activity, blended waste		2.65E+01 Ci/gal		
Isotope	Isotope Average Ci/gal	Ci/ft3 sludge	Ci/ft3 waste	LAWV limit ci/ft3	Fraction	TRU Curies/Total Curies = 5.95E-04		
H-3				1.10E+01		Total TRU = 1.58E-02 Ci/gal		
C-14	2.74E-07	2.05E-06	6.29E-07	2.50E-05	2.52E-02	Np-237		
Tc-99	2.31E-05	1.73E-04	5.30E-05	5.60E-05	9.47E-01	Pu-238 1.00E-02		
I-129	1.10E-10	8.23E-10	2.52E-10	1.10E-08	2.30E-02	Pu-239 1.43E-03		
U-234				1.10E-03		Pu-240 3.20E-04		
U-238	2.44E-06	1.83E-05	5.60E-06	1.20E-03	4.67E-03	Pu-242 6.58E-07		
						Am-241 4.02E-03		
						Am-242m		
						Cm-245 3.82E-14		
	ft3 sludge/ft3 waste	3.07E-01		Total	9.99E-01			
	ft3 sludge/B-25	2.76E+01						
	Gal sludge/B-25	2.07E+02						
	Equivalent Curies	5.47E+03						
			max amount of sludge in a B-25 to meet Sum of Fractions Limit					
			TRU curies	3.26E+00		min lb wt to be TRU		
			nCi/g at max wt	1.44E+03		71752.31016		


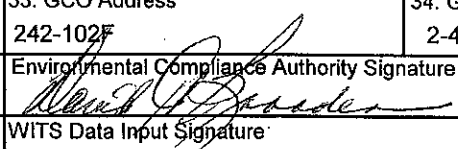
Nuclear Criticality Safety Criteria (Section 3.5.3)

	Specific Activity Ci/g	Activity in Sludge Ci/gal sludge	Ci	Mass (g)	Equiv Factor	FGE
U-233	9.648E-03				1.4	
U-235	2.160E-06	2.67E-08	2.61E-05	1.21E+01	1.0	1.21E+01
Pu-239	6.132E-02	1.43E-03	1.40E+00	2.28E+01	1.6	3.65E+01
Pu-241	1.034E+02	4.15E-02	4.06E+01	3.92E-01	3.5	1.37E+00
Am-242m	9.717E+00				54.0	
Cm-245	1.716E-01	3.82E-14	3.74E-11	2.18E-10	24.0	5.22E-09
Gal Sludge		977.9			Total	4.99E+01
Equiv Curies		2.59E+04				

Attachment 7

**Waste Characterization Forms for Sludge Fraction,
FTK-00002-1 and FTK-00002-19**

EAV Low Level Waste Stream Characterization

1. Waste Stream ID FTK-00002-1		2. Generating Facility FTF		3. Waste Organization F-Area Tank Farm		4. Building Name 241-F		5. Effective Date 6/30/2002	
6. WITS Stream Description Sludge contaminated waste from HLW tks 1-8, 18, 26, 33, 34, and 47				7. Reason for Submittal Re-characterize Stream		8. WSCF No.			9. Rev 2
10. Activity Generating Waste F Tank Farm Operations				11. Physical Form Combustible		12. TSD Facility/Location EAV - Low Vault - 1			
13. Valid Calculation Method for Waste <input type="checkbox"/> Dose-to-Curie <input type="checkbox"/> Smear to Curie <input type="checkbox"/> Char by Pack <input checked="" type="checkbox"/> Curies or RAD Weight				14. STC Constant N/A		15. STC Min Value N/A		16. DTC Waste Form N/A	
17. Assigned Container Types		18. DTC Containers		19. Waste Description			Vol %		
B-12 (14)		N/A		Contaminated Equipment			50		
B-25 (Yellow)-Light (6)				Job Control Waste			50		
B-25 (Yellow) 625# (733)									
55-gal Drum (A,7A) (15)									
Riser Plug Box (945)									
Any approved container (WITS) 2/4/03									
20. WITS ID FTK000021-LLW		21. Tech Baseline WSRC-2000-00215, Rev.1		22. Container Document No. N/A		23. Deviation Document No. N/A		24. CERCLA <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
								25. Waste < 2 nCi/g <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
26. Source(s) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		27. PCB Category <input type="checkbox"/> PCB Leachable <input type="checkbox"/> PCB Bulk <input checked="" type="checkbox"/> N/A <input type="checkbox"/> PCB Remediation <input type="checkbox"/> PCB Laboratory <input type="checkbox"/> PCB Article <input type="checkbox"/> PCB Decontamination							
28. Comments									
29. Meas Tech <input type="checkbox"/> Sample and Analysis <input checked="" type="checkbox"/> Process Knowledge				30. Waste Incidental to Reprocessing (WIR) — Evaluation Document No. _____ <input type="checkbox"/> NA					
31. Currently Assigned Isotopes									
Isotope	Ci %	Basis for Exclusion (PA isotopes only)		Isotope	Ci %	Basis for Exclusion*			
C-14	4.88E-05			Am-242m	1.74E-04				
Co-60	1.11E-01			Cm-245	2.78E-11				
Sr-90	4.44E+01								
Y-90	4.44E+01			H-3		Not present			
Tc-99	1.69E-02								
Sb-125	1.28E-01								
I-129	8.06E-08								
Cs-137	3.09E+00								
Ba-137m	2.93E+00								
Pm-147	2.30E+00								
Eu-154	1.73E-01								
U-233	3.07E-12								
U-234	2.56E-08								
U-235	3.53E-06								
U-238	2.08E-04								
Np-237	7.82E-05								
Pu-238	1.31E+00								
Pu-239	1.65E-01								
Pu-240	3.85E-02								
Pu-241	7.98E-01								
Pu-242	2.35E-05								
Am-241	1.88E-01								
<div style="text-align: right;">Total <u>100.60</u> 78.550 % PSC 2/4/03</div>									
32. GCO Name P. J. Riley				33. GCO Address 242-102F			34. GCO Phone 2-4425		
35. GCO Signature** 				Date 2/4/03		Environmental Compliance Authority Signature 			Date 2/4/03
Solid Waste Generator Service Approval				Date		WITS Data Input Signature			Date
**Generator Certification Statement: "I certify that to the best of my knowledge, the data submitted provides a true and accurate description of the waste."									

EAV Low Level Waste Stream Characterization

[illegible]

Attachment 8

Waste Characterization Form for Supernate Fraction, FHW-00001

19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 850. 851. 852. 853.

****Generator Certification Statement: "I certify that to the best of my knowledge, the data submitted provides a true and accurate description of the waste."**

EAV/CIF Low Level Waste Stream Characterization

Waste Stream ID
FWW00001

WCF No.

Rev

WITS ID

FHW00001LLW

CIF Section

36. Major Waste Components

[illegible]

38. Properties

| Heat Value (BTU/lb) | | Ash Content (Weight %) | | | Total Halogens (Weight %) | |
|-------------------------------|--------------------|------------------------|--------------|-------------------|---------------------------|-------------------------|
| No. of Liquid Layers in Waste | | | | Water (Weight%) | | |
| Liquid Layer Description | Vol % Liquid Layer | pH | Spec Gravity | Est Viscosity(CP) | Total Susp Solids (Wt%) | Total Diss Solids (Wt%) |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Attachment 9

F-Area Tank Farm Sludge Waste Streams, Sludge and Supernate Fractions Activity Distributions

Attachment 9. F-Area Tank Farm Sludge Waste Streams
Sludge and Supernate Fractions Activity Distributions

| SLUDGE FRACTION | | |
|-----------------|-----------------------------|--------------------------------|
| Radionuclide | Normalized Distribution (%) | Scaling Factors
Ci/Ci Sr-90 |
| FTK-00002-1 | | |
| H-3 | | |
| C-14 | 4.88E-05 | 1.10E-06 |
| Co-60 | 1.11E-01 | 2.50E-03 |
| Sr-90 | 4.44E+01 | 1.00E+00 |
| Y-90 | 4.44E+01 | 1.00E+00 |
| Tc-99 | 1.69E-02 | 3.81E-04 |
| Sb-125 | 1.28E-01 | 2.88E-03 |
| I-129 | 8.06E-08 | 1.82E-09 |
| Cs-137 | 3.09E+00 | 6.97E-02 |
| Ba-137m | 2.93E+00 | 6.59E-02 |
| Pm-147 | 2.30E+00 | 5.17E-02 |
| Eu-154 | 1.73E-01 | 3.91E-03 |
| U-233 | 3.07E-12 | 6.91E-14 |
| U-234 | 2.56E-08 | 5.76E-10 |
| U-235 | 3.53E-06 | 7.94E-08 |
| U-238 | 2.08E-04 | 4.68E-06 |
| Np-237 | 7.82E-05 | 1.76E-06 |
| Pu-238 | 1.31E+00 | 2.95E-02 |
| Pu-239 | 1.65E-01 | 3.71E-03 |
| Pu-240 | 3.85E-02 | 8.67E-04 |
| Pu-241 | 7.98E-01 | 1.80E-02 |
| Pu-242 | 2.32E-05 | 5.23E-07 |
| Am-241 | 1.88E-01 | 4.23E-03 |
| Am-242m | 1.74E-04 | 3.91E-06 |
| Cm-245 | 2.78E-11 | 6.27E-13 |
| Total | 1.00E+02 | |
| FTK-00002-19 | | |
| H-3 | | |
| C-14 | 1.03E-06 | 3.98E-06 |
| Ni-59 | | |
| Co-60 | | |
| Sr-90 | 2.59E-01 | 1.00E+00 |
| Y-90 | 2.59E-01 | 1.00E+00 |
| Tc-99 | 8.71E-05 | 3.36E-04 |
| Sb-125 | | |
| I-129 | 4.13E-10 | 1.59E-09 |
| Cs-137 | 5.10E+01 | 1.97E+02 |
| Ba-137m | 4.83E+01 | 1.86E+02 |
| Pm-147 | | |
| Eu-154 | | |
| U-233 | | |
| U-234 | | |
| U-235 | 1.01E-07 | 3.88E-07 |
| U-238 | 9.20E-06 | 3.55E-05 |
| Np-237 | | |
| Pu-238 | 3.78E-02 | 1.46E-01 |
| Pu-239 | 5.40E-03 | 2.08E-02 |
| Pu-240 | 1.21E-03 | 4.65E-03 |
| Pu-241 | 1.57E-01 | 6.03E-01 |
| Pu-242 | 2.48E-06 | 9.56E-06 |
| Am-241 | 1.51E-02 | 5.83E-02 |
| Am-242m | | |
| Cm-245 | 1.44E-13 | 5.55E-13 |
| Total | 1.00E+02 | |

| SUPERNATE FRACTION | | |
|--------------------|-----------------------------|---------------------------------|
| Activity Fraction | Normalized Distribution (%) | Scaling Factors
Ci/Ci Cs-137 |
| FHW-00001 | | |
| 2.00E-01 | 2.01E-01 | 4.00E-03 |
| 1.70E+00 | 1.71E+00 | 3.40E-02 |
| 4.70E-02 | 4.73E-02 | 9.30E-04 |
| 9.10E-03 | 9.15E-03 | 1.80E-04 |
| 1.10E-05 | 1.11E-05 | 2.10E-07 |
| 5.00E+01 | 5.03E+01 | 1.00E+00 |
| 4.70E+01 | 4.73E+01 | 9.40E-01 |
| 2.60E-04 | 2.62E-04 | 5.20E-06 |
| 7.10E-05 | 7.14E-05 | 1.40E-06 |
| 2.50E-01 | 2.51E-01 | 5.00E-03 |
| 2.90E-03 | 2.92E-03 | 5.90E-05 |
| 1.30E-03 | 1.31E-03 | 2.60E-05 |
| 1.90E-01 | 1.91E-01 | 3.80E-03 |
| 1.80E-02 | 1.81E-02 | 3.50E-04 |
| 9.94E+01 | 1.00E+02 | |