Keywords: Sludge,
Waste Characterization,
F Tank Farm

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

Retention: Permanent

Revised By

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

Classification: U
Does not Contain UCNI

Paul D. d'Entremont
ADC/RO

Issued: January 2003

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

TABLE OF CONTENTS

ATTACHMENTS

LIST OF TABLES

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 1S 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 1S 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/ft^3 waste and $Ci/90\ ft^3$ 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 excced 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 excced 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 lb*454 g/lb)	=(E*1E+09nCi/Ci) / (454 g/lb*100 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:

activity concentration of isotope A/limit of isotope A
+ activity concentration of isotope B/limit of isotope B.....
+ activity concentration of isotope N/limit of isotope N
≤ 1

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*90ft^3/B-25*7.48 gal/ft^3	C	D=B*C	=(D*1E+09 nCi/Ci) / (100 nCi/g *454 g/lb)	=(D*1E+09 nCi/Ci) / (5000lb*454 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 sludgee (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 ft^3 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

1 D'Entremont, P. D. "HLW Sludge Characterization in Support of Low Level Waste Certification (U)," WSRC-TR-94-0579, Revision 1., December 15, 1994.

2 Georgeton, 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.

3 Hester, J. R., "High Level Waste Characterization System (WCS)," WSRC-TR-96-0264, Revision 0, December 1996.

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-DTC™ 3.1, WMG Inc., 16 Bank Street, Peekskill, NY 10556.

Attachment 1

WCS Tank Data
Reference Date: September 11, 2002

Attachment 1
WCS Tank Data
Reference Date: 9/11/02
'M:\WASTE6\Hlcats\WCSystem\[WCSystem.xls]TankData'

Tank	Date	Total Waste Volume (gal)	Sludge Volume (gal)	Dry Sludge Density (kg/gal)	Estimated Dry Sludge Weight (kg)	Sludge Interstitial Fraction (vol. frac.)	Salt Volume (gal)	Dry Salt Bulk Sp.G.	Estimated Salt Dry Wt. (kg)	Salt Interstitial Fraction (vol. frac.)	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. frac.)	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)	Grout Volume (gal)	Level (in)	Sludge Depth (in)	Salt Depth (in)	Free Supernate Depth (in)	Total Supernate Depth (in)	Supernate Concentration (Ci/gal)	Solids Concentration (Ci/gal)	Free Liquid in Tank?	Dry Tank? Filled To AB Limit For H2 Calculations?	Organic Tank?	Tank Farm Tank?	Total Vapor Space for Empty Tank (gal)	Current Vapor Space (gal)
1	03/05/01	505957	7000	0.884	6188	0.70	480000	1.45	2634569	0.22	18957	4900	105600	129457	1.53	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	187	3	177	7	48	38.58	220.64	0			Y	796740	290783
2	03/05/01	540374	4000	0.884	3536	0.70	536000	1.45	2941935	0.22	374	2800	117920	121094	1.52	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	199	1	198	0	45	14.31	53.85	0			Y	796740	256366
3	03/05/01	540645	4000	0.884	3536	0.70	536000	1.45	2941935	0.22	645	2800	117920	121365	1.53	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	200	1	198	0	45	14.31	50.08	0			Y	796740	256095
4	12/04/02	484006	127000	0.884	112268	0.70	34000	1.45	186615	0.22	323006	88900	7480	419386	1.32	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	179	47	13	119	155	17.12	82.96	Y			Y	796740	312734
5	12/04/02	60704	28152	0.884	24886	0.56	0	1.45	0	0.22	32552	15765	0	48317	1.28	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	22	10	0	12	18	3.51	219.44	Y			Y	796740	736036
6	12/04/02	306230	25000	0.884	22100	0.70	0	1.45	0	0.22	281230	17500	0	298730	1.12	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	113	9	0	104	110	0.07	282.56	Y			Y	796740	490510
7	12/04/02	403627	209000	0.884	184756	0.70	0	1.45	0	0.22	194627	146300	0	340927	1.36	0	1.10	0	0.90	0	0.761	0	0	0.761	0	4545	3178	0	149	77	0	72	126	0.08	37.63	Y			Y	796740	393113
8	12/04/02	311352	6448	0.884	5700	0.70	0	1.45	0	0.22	304904	4514	0	309418	1.11	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	115	2	0	113	114	0.61	41.03	Y			Y	796740	485388
9	03/05/01	543626	4000	0.884	3536	0.70	536000	1.45	2952913	0.22	1626	2800	118360	122786	1.41	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	201	1	199	1	45	14.03	56.74	0			Y	796740	253114
10	03/05/01	192410	4000	0.884	3536	0.70	213000	1.45	1169090	0.22	0	2800	46880	49680	1.31	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	71	1	79	0	18	2.45	6.94	0			Y	796740	604330
11	12/04/02	279130	140000	0.884	123760	0.70	0	1.45	0	0.22	139130	98000	0	237130	1.46	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	103	52	0	51	88	2.54	86.27	Y			Y	796740	517610
12	06/08/99	173711	173711	0.884	153561	0.53	92067	1.45	505326	0.22	0	0	0	0	1.53	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	64	64	34	0	0	0.00	103.32	0	Y		Y	796740	623029
13	12/04/02	859250	223000	0.884	197132	0.70	0	1.45	0	0.22	636250	156100	0	792350	1.41	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	246	64	0	182	226	25.43	97.15	Y			Y	1134000	274750
14	03/05/01	173950	27000	0.884	23868	0.70	156000	1.45	856235	0.22	0	16900	34320	53220	1.40	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	50	8	45	0	15	32.51	45.46	0			Y	1134000	960050
15	02/26/98	213500	213500	0.884	188734	0.48	102480	1.45	562480	0.22	0	0	0	0	1.27	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	61	61	29	0	0	0.00	74.88	0	Y		Y	1134000	920500
16	08/12/80	0	0	0.884	0	0.70	0	1.45	0	0.22	0	0	0	0	0.00	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	0	0	0	0	0	0.00	0.00	0	Y		Y	1134000	1134000
17	07/01/97	0	0	0.884	0	0.70	0	1.45	0	0.22	0	0	0	0	0.00	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	1300000	0	0	0	0	0	0.00	0.00	0	Y			Y	1693640	1693640
18	12/04/02	318600	47000	0.884	41548	0.70	0	1.45	0	0.22	271600	32900	0	304500	1.18	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	90	13	0	77	86	0.04	0.49	Y		Y	Y	1693640	1375040
19	12/04/02	10974	2542	0.884	2247	0.70	0	1.45	0	0.22	8432	1779	0	10211	1.18	0	1.10	0	0.90	0	0.761	0	12440	0.761	35835	0	0	0	3	1	0	2	3	0.04	0.24	Y			Y	1693640	1682666
20	05/08/97	0	0	0.884	0	0.70	0	1.45	0	0.022	0	0	0	0	0.00	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	1300000	0	0	0	0	0	0.00	0.00	0	Y			Y	1693640	1693640
21	12/04/02	885354	14000	0.884	12376	0.70	0	1.45	0	0.22	871354	9800	0	881154	1.04	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	250	4	0	246	249	0.01	8.29	Y		Y	Y	1693640	808286
22	12/04/02	730656	21000	0.884	18564	0.70	0	1.45	0	0.22	709656	14700	0	724356	1.04	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	205	5	0	200	205	0.00	11.53	Y		Y	Y	1693640	962984
23	12/04/02	1269869	43000	0.884	38012	0.70	0	1.45	0	0.22	1226869	30100	0	1256969	1.02	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	359	12	0	347	355	0.00	0.02	Y		Y	Y	1693640	423771
24	12/04/02	1229973	0	0.884	0	0.70	0	1.45	0	0.22	1229973	0	0	1229973	1.04	0	1.10	0	0.90	0	0.761	0	4000	0.761	11522	0	0	0	347	0	0	347	347	0.00	0.00	Y			Y	1693640	463667
25	12/04/02	1284204	0	0.884	0	0.70	1108000	1.45	6081463	0.22	176204	0	243760	419964	1.41	0	1.10	0	0.90	0	0.761	0	1050	0.761	3025	0	0	0	366	0	316	50	120	6.89	6.34	Y			Y	1389960	105756
26	12/04/02	1212249	281000	0.884	248404	0.70	0	1.45	0	0.22	931249	196700	0	1127949	1.36	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	345	80	0	265	321	8.45	9.55	Y		Y	Y	1389960	177711
27	12/04/02	1283976	0	0.884	0	0.70	463000	1.45	2541261	0.22	820976	0	101860	922836	1.48	0	1.10	0	0.90	0	0.761	0	4980	0.761	14374	0	0	0	366	0	132	234	263	7.94	7.30	Y			Y	1389960	105984
28	12/04/02	1224393	0	0.884	0	0.70	1032000	1.45	5664323	0.22	192393	0	227040	419433	1.46	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	349	0	294	55	119	8.71	8.01	Y			Y	1389960	165567
29	12/04/02	1080273	0	0.884	0	0.70	1000000	1.45	5488685	0.22	80273	0	220000	300273	1.21	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	308	0	285	23	86	9.93	9.13	Y			Y	1389960	309687
30	12/04/02	1145910	500	0.884	442	0.70	65988	1.45	362187	0.22	1079422	350	14517	1094289	1.47	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	326	0	19	308	312	20.32	212.78	Y		Y	Y	1389960	244050
31	12/04/02	1259704	0	0.884	0	0.70	1014000	1.45	5565527	0.22	245704	0	223080	468784	1.47	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	359	0	289	70	134	22.10	20.33	Y			Y	1389960	130256
32	12/09/02	729518	182871	0.884	161658	0.70	0	1.45	0	0.22	546647	128010	0	674657	1.51	0	1.10	0	0.90	0	0.761	0	6700	0.761	19300	0	0	0	208	52	0	156	192	18.32	140.37	Y			Y	1389960	660442
33	12/04/02	513338	39000	0.884	34476	0.70	227000	1.45	1245931	0.22	247338	27300	49940	324578	1.17	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	146	11	65	70	92	1.03	325.35	Y			Y	1389960	876523
34	12/04/02	1256791	25000	0.884	22100	0.70	212000	1.45	1163601	0.22	1019791	17500	46640	1083931	1.17	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	358	7	60	291	309	7.72	760.35	Y			Y	1389960	133169
35	12/04/02	1107545	64584	0.884	57092	0.70	0	1.45	0	0.22	1042961	45209	0	1088170	1.30	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	316	18	0	297	310	15.07	336.12	Y			Y	1389960	282415
36	12/04/02	1255703	150	0.884	133	0.70	1094000	1.45	6004821	0.22	161553	105	240680	402338	1.47	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	358	0	312	46	115	40.69	187.71	Y			Y	1389960	134258
37	12/04/02	807300	0	0.884	0	0.70	973000	1.45	5340491	0.22	0	0	214060	214060	1.43	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	230	0	277	0	61	26.73	24.59	Y			Y	1389960	582660
38	12/04/02	1140785	0	0.884	0	0.70	886275	1.45	4864484	0.22	254510	0	194981	449491	1.49	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	325	0	253	73	128	1.89	1.74	Y		Y	Y	1389960	249175
39	12/04/02	657879	92664	0.884	81915	0.70	0	1.45	0	0.22	565215	64865	0	630080	1.34	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	187	26	0	161	180	8.92	235.31	Y			Y	1389960	732081
40	12/04/02	506493	506493	0.749	379611	0.70	0	1.45	0	0.22	0	354545	0	354545	1.04	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	144	144	0	0	101	0.12	15.73	Y			Y	1389960	883467
41	12/04/02	1222533	0	0.884	0	0.70	1222533	1.45	6710099	0.22	0	0	268957	268957	1.38	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	348	0	348	0	77	3.05	2.80	Y			Y	1389960	167427
42	12/04/02	1263951	13575	0.884	12000	0.80	0	1.45	0	0.22	1250376	10860	0	1261236	1.31	0	1.10	0	0.90	0	0.761	0	765	0.761	2204	0	0	0	360	4	0	356	359	1.88	51.79	Y			Y	1389960	126009
43	12/04/02	1208072	58756	0.884	51940	0.70	123084	1.45	675569	0.22	1026232	41129	27078	1094439	1.12	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	344	17	35	292	312	0.79	39.17	Y		Y	Y	1389960	181888
44	12/04/02	1277956	0	0.884	0	0.70	989000	1.45	5428309	0.22	288956	0	217580	506536	1.52	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	364	0	282	82	144	10.32	9.50	Y			Y	1389960	112004
45	12/04/02	1279149	0	0.884	0	0.70	1130000	1.45	6202214	0.22	149149	0	248600	397749	1.49	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	364	0	322	42	113	9.76	8.98	Y			Y	1389960	110811
46	12/04/02	1028430	0	0.884	0	0.70	667813	1.45	3665413	0.22	360617	0	146919	507536	1.50	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	283	0	190	103	145	9.90	9.11	Y		Y	Y	1389960	361530
47	12/04/02	1194418	248000	0.884	219232	0.70	868000	1.45	4764179	0.22	78418	173600	190960	442978	1.32	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	340	71	247	22	126	3.17	4.32	Y			Y	1389960	195542
48	12/04/02	236223	0	0.884	0	0.70	0	1.45	0	0.22	236223	0	0	236223	1.15	24570	1.10	102305	0.90	0	0.761	0	0	0.761	0	0	0	0	67	0	0	67	67	0.12	31.99	Y			Y	1389960	1153737
49	12/04/02	842751	0	0.884	0	0.70	0	1.45	0	0.22	842751	0	0	842751	1.16	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	240	0	0	240	240	20.20	18.58	Y			Y	1389960	547209
50	12/04/02	47385	0	0.884	0	0.70	0	1.45	0	0.22	47385	0	0	47385	1.06	0	1.10	0	0.90	0	0.761	0	0	0.761	0	0	0	0	14	0	0	14	14	0.00	0.00	Y			Y	1389960	1342575
51	12/04/02	357669	357669	0.158	56388	0.80	0	1.45	0	0.22	0	286135	0	286135	1.01	0	1.10	0	0.90	0	0.761	0	4335	0.761	12487	0	0	0	102	102	0	0	82	0.10	0.10	Y			Y	1389960	1032291

Attachment 2

WCS Sludge Inventory
Reference Date: September 11, 2002

Attachment 2
WCS Sludge Inventory
Reference Date: 9/11/02
'M:\WASTE8\HIcats\WCSystem\[WCSystem.xls]SldgInv'

Tank	H-3 (Ci)	C-14 (Ci)	Ni-59 (Ci)	Co-60 (Ci)	Ni-63 (Ci)	Se-79 (Ci)	Sr-90 (Ci)	Y-90 (Ci)	Nb-94 (Ci)	Tc-99 (Ci)	Ru-106 (Ci)	Rh-106 (Ci)	Sb-125 (Ci)	Sn-126 (Ci)	I-129 (Ci)	Cs-134 (Ci)	Cs-135 (Ci)	Cs-137 (Ci)	Ba-137m (Ci)	Ce-144 (Ci)	Pr-144 (Ci)
1		1.2782E-02	2.3378E+01	2.9616E+02		1.6263E+01	6.0392E+05	6.0392E+05		2.8132E+02	3.0348E-05	3.0348E-05	2.5251E+01	3.0250E+01	1.3404E-03	2.9481E-02	1.8831E-01	4.2619E+04	4.0318E+04	5.4625E-08	5.4625E-08
2		2.8622E-03	3.3715E+00	1.9227E+01		2.3074E+00	7.5799E+04	7.5799E+04		3.9914E+01	1.8517E-08	1.8517E-08	6.5231E-01	4.2918E+00	1.9018E-04	3.8682E-04	2.6719E-02	5.3872E+03	5.0963E+03	4.5149E-12	4.5149E-12
3		2.4785E-03	2.9189E+00	2.1873E+01		1.9976E+00	6.8749E+04	6.8749E+04		3.4555E+01	1.2446E-07	1.2446E-07	1.0076E+00	3.7156E+00	1.6464E-04	7.5641E-04	2.3131E-02	4.8734E+03	4.6102E+03	7.4889E-11	7.4889E-11
4		3.3380E-03	1.1844E+02	6.8567E+03		8.4687E+01	3.9538E+06	3.9538E+06		1.4648E+03	1.4567E+00	1.4567E+00	3.1667E+03	1.5751E+02	6.9791E-03	1.1787E+01	9.8050E-01	2.7534E+05	2.6047E+05	4.5660E-02	4.5660E-02
5		4.4477E-02	1.0101E+02	1.9765E+03		7.0674E+01	2.8420E+06	2.8420E+06		1.2225E+03	1.3190E-03	1.3190E-03	2.5518E+02	1.3145E+02	5.8246E-03	3.9732E-01	8.1831E-01	1.9969E+05	1.8890E+05	4.4836E-06	4.4836E-06
6			1.0407E+02	3.2515E+03		7.4523E+01	3.2899E+06	3.2899E+06		1.2890E+03	9.4536E-03	9.4536E-03	5.8176E+02	1.3861E+02	6.1416E-03	1.1148E+00	8.6284E-01	2.3000E+05	2.1758E+05	5.9514E-05	5.9514E-05
7		8.6183E-01	1.8723E+02	1.5093E+03		1.0191E+02	3.6429E+06	3.6429E+06		1.7630E+03	1.2632E-04	1.2632E-04	1.1170E+02	1.8955E+02	8.3992E-03	1.2368E-01	1.1801E+00	2.5764E+05	2.4373E+05	2.4458E-07	2.4458E-07
8		1.1498E-02	4.3226E+00	1.5507E+02		2.6668E+00	1.2106E+05	1.2106E+05		4.6130E+01	5.4557E-03	5.4557E-03	4.2429E+01	4.9601E+00	2.1977E-04	1.1129E-01	3.0877E-02	8.4469E+03	7.9907E+03	1.6009E-04	1.6009E-04
9		3.0874E-03	3.6368E+00	2.0673E+01		2.4889E+00	8.1715E+04	8.1715E+04		4.3054E+01	1.9588E-08	1.9588E-08	6.9913E-01	4.6294E+00	2.0514E-04	4.1363E-04	2.8821E-02	5.8079E+03	5.4942E+03	4.7406E-12	4.7406E-12
10		3.2383E-04	3.8101E-01	2.4575E+00		2.5963E-01	8.7264E+03	8.7264E+03		4.4894E+00	3.8065E-09	3.8065E-09	8.8163E-02	4.7835E-01	2.1284E-05	7.3168E-05	3.0052E-03	6.1638E+02	5.8309E+02	1.3644E-12	1.3644E-12
11		1.5868E-01	1.6377E+02	1.3261E+04		9.0493E+01	5.4228E+06	5.4228E+06		1.5335E+03	1.4076E-01	1.4076E-01	7.8845E+02	8.2877E+01	5.3060E-03	4.5237E+01	1.0251E+00	2.9773E+05	2.8165E+05	2.1852E-02	2.1852E-02
12		2.5340E-01	2.8025E+02	1.3207E+04		1.5782E+02	8.3655E+06	8.3655E+06		2.6811E+03	6.3132E-03	6.3132E-03	4.5625E+02	1.6191E+02	9.6916E-03	1.7226E+01	1.7926E+00	4.7124E+05	4.4579E+05	1.9512E-04	1.9512E-04
13		2.9212E-01	2.7772E+02	7.4622E+03		1.7171E+02	7.6960E+06	7.6960E+06		2.9347E+03	3.1705E-03	3.1705E-03	2.4843E+02	2.2535E+02	1.1784E-02	8.0807E+00	1.9628E+00	4.6352E+05	4.3849E+05	1.1019E-04	1.1019E-04
14		1.5057E-03	7.7159E+00	8.3951E+01		5.2584E+00	1.9612E+05	1.9612E+05		9.0600E+01	4.3326E-07	4.3326E-07	2.8803E+00	8.8226E+00	4.0927E-04	1.0283E-02	6.0633E-02	1.3178E+04	1.2466E+04	1.3888E-09	1.3888E-09
15		2.3383E-01	2.6013E+02	1.0127E+04		1.4383E+02	7.5049E+06	7.5049E+06		2.4374E+03	1.0111E-02	1.0111E-02	3.0065E+02	1.3163E+02	8.4312E-03	1.1050E+01	1.6294E+00	4.1520E+05	3.9278E+05	1.3402E-03	1.3402E-03
16																					
17		3.4177E-03	2.0116E-01	1.1679E+00		1.6636E-02	7.8904E+02	7.8904E+02		2.8864E-01	4.0745E-05	4.0745E-05	3.5436E-01	3.0912E-02	1.3697E-06	9.8028E-04	1.9271E-04	5.4937E+01	5.1971E+01	7.2038E-07	7.2038E-07
18		4.0069E-02	2.3587E+00	1.2562E+01		1.9507E-01	9.0081E+03	9.0081E+03		3.3845E+00	4.5919E-04	4.5919E-04	3.8032E+00	3.6246E-01	1.6061E-05	1.0630E-02	2.2597E-03	6.2803E+02	5.9411E+02	8.1966E-06	8.1966E-06
19		6.9567E-04	4.0928E-02	3.2817E-01		3.3848E-03	1.7500E+02	1.7500E+02		5.8725E-02	8.5531E-06	8.5531E-06	1.0854E-01	6.2894E-03	2.7868E-07	2.9780E-04	3.9208E-05	3.4408E+04	3.2550E+04	1.0240E-07	1.0240E-07
20																					
21		8.9571E-05	1.0360E+00	1.8948E+02		7.8169E-01	5.3729E+04	5.3729E+04		1.3226E+01	1.2256E-02	1.2256E-02	2.4773E+01	7.1480E-01	4.5799E-05	1.9556E+00	8.8370E-03	2.9176E+03	2.7601E+03	1.9681E-03	1.9681E-03
22			2.1332E+00	3.6969E+02		1.6554E+00	1.1354E+05	1.1354E+05		2.8006E+01	1.4770E-02	1.4770E-02	4.3047E+01	1.5137E+00	9.6987E-05	3.1362E+00	1.8712E-02	6.1667E+03	5.8337E+03	2.0719E-03	2.0719E-03
23				5.2644E-01												2.7131E-02		4.4947E+02	4.2520E+02		
24																					
25																					
26		5.8770E-01	3.4531E+01	1.3717E+03		2.8558E+00	1.9675E+05	1.9675E+05		4.9543E+01	7.8283E+01	7.8283E+01	2.2211E+03	5.3062E+00	2.3509E-04	1.8591E+01	3.3076E-02	1.3422E+04	1.2697E+04	2.3872E+01	2.3872E+01
27																					
28																					
29																					
30		7.8049E-04	8.5587E-01	4.5207E+02		4.7092E-01	4.0631E+04	4.0631E+04		7.9796E+00	1.1542E+00	1.1542E+00	1.2167E+02	4.3095E-01	2.7600E-05	1.7605E+01	5.3341E-03	2.1868E+03	2.0687E+03	6.9815E-01	6.9815E-01
31																					
32		2.4530E-01	2.7068E+02	4.9770E+04		1.4924E+02	1.0203E+07	1.0203E+07		2.5291E+03	7.3041E+01	7.3041E+01	8.1874E+03	1.3658E+02	8.7479E-03	1.0430E+03	1.6906E+00	5.5601E+05	5.2599E+05	5.1560E+01	5.1560E+01
33			1.1108E+02	3.4993E+04		7.9545E+01	5.4185E+06	5.4185E+06		1.3757E+03	1.0730E+03	1.0730E+03	5.0184E+04	1.4794E+02	6.5542E-03	3.8036E+02	9.2081E-01	3.6985E+05	3.4987E+05	2.8662E+02	2.8662E+02
34			1.7147E+02	4.8776E+04		1.2279E+02	8.1483E+06	8.1483E+06		2.1236E+03	1.6213E+03	1.6213E+03	6.8759E+04	2.2837E+02	1.0118E-02	5.3033E+02	1.4214E+00	5.5693E+05	5.2685E+05	3.9170E+02	3.9170E+02
35		2.0689E-01	2.2702E+02	5.8831E+04		1.2491E+02	9.3146E+06	9.3146E+06		2.1167E+03	1.1430E+02	1.1430E+02	1.0233E+04	1.1431E+02	7.3214E-03	1.2830E+03	1.4150E+00	5.0532E+05	4.7803E+05	1.1116E+02	1.1116E+02
36		2.3392E-04	2.5674E-01	4.8415E+01		1.4126E-01	1.0075E+04	1.0075E+04		2.3938E+00	1.6891E-03	1.6891E-03	4.9955E+00	1.2928E-01	8.2800E-06	3.7951E-01	1.6002E-03	5.4800E+02	5.1841E+02	1.9865E-04	1.9865E-04
37																					
38																					
39		1.8066E-01	1.9815E+02	8.4562E+04		1.0903E+02	9.0081E+06	9.0081E+06		1.8474E+03	2.0613E+02	2.0613E+02	1.9657E+04	9.9773E+01	6.3900E-03	2.6673E+03	1.2350E+00	4.8597E+05	4.5973E+05	2.1277E+02	2.1277E+02
40		6.1413E-01	1.4324E+02	5.0513E+03		7.9001E+01	3.6680E+06	3.6680E+06		1.3644E+03	1.7321E-01	1.7321E-01	1.2355E+03	1.4114E+02	6.3645E-03	8.1217E+00	9.1311E-01	2.5056E+05	2.3703E+05	7.7547E-03	7.7547E-03
41			2.2095E-01	7.1868E+01		1.7146E-01	1.3281E+04	1.3281E+04		2.9006E+00	1.9726E-02	1.9726E-02	1.4117E+01	1.5678E-01	1.0045E-05	1.4137E+00	1.9380E-03	7.1653E+02	6.7784E+02	4.6784E-03	4.6784E-03
42		2.5749E-02	1.1463E+01	4.8282E+02		5.9728E+00	3.1719E+05	3.1719E+05		1.0124E+02	6.3266E-03	6.3266E-03	2.4653E+01	5.5428E+00	3.5205E-04	1.3461E+00	6.7679E-02	1.7576E+04	1.6627E+04	9.7829E-04	9.7829E-04
43			1.4425E+01	8.0147E+03		1.1195E+01	9.4900E+05	9.4900E+05		1.8937E+02	8.3522E+01	8.3522E+01	2.9085E+03	1.0236E+01	6.5580E-04	4.7098E+02	1.2652E-01	5.0939E+04	4.8189E+04	1.2474E+02	1.2474E+02
44																					
45																					
46																					
47		4.3667E-01	2.5662E+01	7.7288E+02		2.1223E+00	1.3968E+05	1.3968E+05		3.6819E+01	7.0961E+00	7.0961E+00	9.0799E+02	3.9434E+00	1.7471E-04	5.9363E+00	2.4581E-02	9.5537E+03	9.0378E+03	8.6804E-01	8.6804E-01
48																					
49																					
50																					
51		3.2273E-01	4.7769E+00	4.1821E+01	2.3715E+00	6.1939E+00	2.8567E+05	2.8567E+05		1.3732E+01				2.4761E+00	7.9618E-02		5.3687E-01	9.4642E+02	8.9532E+02		
Total		4.5473E+00	2.7579E+03	3.5206E+05	2.3715E+00	1.6232E+03	9.1764E+07	9.1764E+07		2.7672E+04	3.2597E+03	3.2597E+03	1.7051E+05	2.1750E+03	1.9185E-01	6.5287E+03	1.9037E+01	5.5564E+06	5.2564E+06	1.2041E+03	1.2041E+03

Attachment 2
WCS Sludge Inventory
Reference Date: 9/11/02
'M:\WASTE8\Hlcats\WCSystem\[WCSystem.xls]Sldginv'

Tank	Pm-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	1.1819E+03		1.2709E-02			1.7650E-02		4.3927E-01	6.4083E-01	5.1937E+02	1.3299E+02	2.9723E+01	1.8529E+02	6.1152E-03	4.0566E+01	2.1108E+03	2.6629E+00	4.2481E-01	4.6186E-07
2	8.5707E+00	1.0850E+02		1.7297E-03			8.1193E-04		2.0247E-02	2.1175E-01	1.3828E+02	1.9755E+01	4.4154E+00	2.1040E+01	9.0842E-04	6.0179E+00	2.9652E+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	1.6643E+02	2.3776E+01	5.3142E+00	3.0483E+01	1.0933E-03	7.3042E+00	2.5748E+02	3.2196E-01	4.6101E-02	5.6733E-08
4	5.2280E+04	1.4057E+04		7.1620E-02			7.7690E-02		3.3431E+00	2.9845E+00	6.0537E+02	5.9775E+02	1.3360E+02	1.2824E+03	2.7487E-02	1.7490E+02	1.1190E+04	1.4499E+01	3.2065E+00	2.4047E-06
5	3.7756E+03	6.6374E+03		5.6892E-02			1.0470E-01		2.4801E+00	4.1889E+00	2.8887E+03	4.8206E+02	1.1517E+02	8.7522E+02	3.3972E-02	1.7158E+02	9.2283E+03	1.1756E+01	2.0920E+00	2.0070E-06
6	8.8356E+03	9.2882E+03		6.1842E-02			6.6479E-02		2.4860E+00	8.6277E-01		2.5458E+02	8.8448E+01	1.1270E+03	1.7408E-01	1.7316E+02	9.8221E+03	1.2658E+01	2.5487E+00	2.1161E-06
7	1.5814E+03	6.5294E+03		8.5869E-02			3.7937E-01		9.1577E+00	8.3986E+00	2.4285E+04	3.6661E+03	8.7562E+02	7.1181E+03	2.8240E-01	1.2903E+03	1.2697E+04	1.5936E+01	2.5046E+00	2.8954E-06
8	6.6965E+02	3.8126E+02		2.3535E-03			5.4268E-03		2.4971E-01	1.1336E-01	4.5427E+02	7.1295E+01	1.6778E+01	1.8136E+02	2.1167E-02	1.7153E+01	3.4453E+02	4.4507E-01	9.5879E-02	7.5743E-08
9	9.1832E+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	7.0688E-08
10	1.1786E+00	1.3826E+01		1.9227E-04			2.2830E-04		5.6931E-03	4.3541E-02	2.2110E+01	3.1586E+00	7.0598E-01	3.5649E+00	1.4525E-04	9.7175E-01	3.3152E+01	4.1270E-02	7.2190E-03	2.9769E-07
11	2.0550E+04	5.9937E+04	1.4315E-02	1.6631E-04	2.0418E+00	1.6759E+00	3.1618E-02	2.5904E-01	5.8643E-02	1.1066E+00	1.5299E+05	1.4883E+03	9.3397E+02	6.0761E+04	1.9899E+00	5.9616E+03	7.1014E+03	8.4565E+00	4.8739E+01	5.4350E-03
12	1.1246E+04	7.1824E+04	1.3605E+00	1.4052E-02	3.8285E+01	3.5849E+00	6.7447E-02	2.8408E-01	6.7924E-01	7.9381E+00	1.4101E+05	2.3162E+03	1.2802E+03	3.6891E+04	1.8495E+00	4.4582E+03	1.3363E+04	1.5935E+01	6.6848E+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	2.2296E+03	1.6515E+04	2.0055E+01	4.5472E+01	5.9810E-03
14	4.2988E+01	5.3103E+02	1.0584E-02	3.2207E-03	3.7354E-01	5.1289E-02	4.1488E-03	4.4106E-03	7.9106E-02	5.4780E-01	2.5049E+02	6.0446E+01	1.9516E+01	1.1210E+02	3.5736E-03	2.4336E+01	6.2785E+02	7.7952E-01	4.6323E-01	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	3.5532E+00	5.8175E+04	1.2176E+03	5.8978E+02	1.3899E+04	4.4496E-01	2.5489E+03	1.1233E+04	1.3156E+01	6.2315E+01	8.6449E-03
16																				
17	5.6400E+00	2.6933E+00		4.8849E-05			3.2871E-04		2.0426E-02		8.3807E+01	1.1972E+01	3.1664E+00	4.4467E+01	4.5535E-03	4.7984E+00			6.3350E-04	4.7739E-10
18	6.0597E+01	2.9521E+01		5.6639E-04			4.2980E-03		2.3133E-01		9.8516E+02	1.4074E+02	3.5956E+01	6.5756E+02	4.6079E-02	7.1227E+01			7.1398E-03	5.5978E-09
19	1.7299E+00	6.9086E-01		1.0302E-05			6.7959E-05		6.2087E-03		2.5477E+01	3.6395E+00	8.1346E-01	1.0560E+02	1.6736E-03	1.0208E+01			1.4669E-04	9.7128E-11
20																				
21	6.7348E+02	8.0391E+02	5.6651E-06		1.7320E-01	1.7108E-01	2.3576E-03	3.4997E-02	1.5973E-03	1.0513E-01	9.5015E+02	1.0944E+00	6.3401E-01	2.3605E+01	5.3286E-04	2.7237E+00	4.5605E+01	5.5086E-02	5.2153E-01	4.6919E-05
22	1.1584E+03	1.6484E+03			1.0746E+00	3.8633E-01	5.9073E-03	6.3592E-02	8.5994E-03	2.3475E-01	1.6251E+03						9.4003E+01	1.1368E-01	1.0964E+00	9.9353E-05
23																				
24																				
25																				
26	4.0634E+04	1.4992E+03		9.7325E-03			2.2130E-02		2.0218E+00		1.6755E+04	2.3936E+03	5.3497E+02	1.3235E+04	1.1006E-01	5.1873E+02			1.9484E-01	8.1937E-08
27																				
28																				
29																				
30	3.5776E+03	9.8190E+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	2.5696E+03	5.2626E-02	9.9573E+01	3.8206E+01	4.7591E-02	4.4835E-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	3.5316E+03	2.6218E+03	2.0413E+05	5.5267E+00	1.4234E+04	1.1895E+04	1.4394E+01	9.9170E+01	8.9697E-03
33	9.0631E+05	3.9978E+04		7.8393E-02	3.7431E-07	3.1230E-03	1.6820E-01	7.4778E-02	2.4681E+01	9.5864E+00	2.2809E+01	6.9086E+03	1.2573E+03	3.9482E+04	6.4456E-02	2.7516E+02	1.0787E+04	1.4656E+01	5.3771E+00	2.2583E-06
34	1.2433E+06	5.7389E+04		1.1972E-01			1.1402E-01		8.0521E+00	6.2191E+00		1.3006E+03	2.9069E+02	6.8273E+03	6.0298E-02	2.8806E+02	1.6621E+04	2.2508E+01	7.9775E+00	3.4861E-06
35	2.9356E+05	1.6589E+05				2.7179E+00	4.7222E-02	8.0244E-01	2.7877E-02	9.8283E-01	4.1559E+05	3.2924E+03	2.5186E+03	2.2212E+05	5.6559E+00	1.3689E+04	1.0036E+04	1.2279E+01	9.4765E+01	7.5071E-03
36	1.3548E+02	1.5894E+02				7.2583E-03	1.4058E-04	2.5622E-03	4.6000E-05	2.0301E-03	6.4269E+02	4.9007E+00	3.8971E+00	2.8968E+02	8.4221E-03	2.0786E+01	1.1319E+01	1.3776E-02	9.9664E-02	8.4900E-06
37																				
38																				
39	5.7241E+05	1.9880E+05				9.5795E+00	5.6415E-02	8.9294E-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	2.9041E-02	6.7237E-02	1.8388E+00	6.6455E-01	1.8909E-01	1.0473E-01	8.3627E+00	3.4716E+00	2.3324E+04	2.9710E+03	7.2667E+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				1.2348E-02	1.4281E-04	3.5424E-03	9.7754E-06	3.6864E-02	2.0593E+02						9.8149E+00	1.2048E-02	1.3738E-01	1.0290E-05
42	6.2409E+02	2.7261E+03	4.3597E-02	2.3486E-04	6.1403E-01	2.2594E-01	5.3279E-03	3.0202E-02	9.3495E-02	1.8581E-01	3.0822E+03	1.0468E+02	3.7553E+01	7.3015E+02	3.4393E-02	1.2073E+02	4.5288E+02	5.3120E-01	2.6413E+00	3.5409E-04
43	8.6375E+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	2.4668E+02	1.9300E+04	4.6300E+00	4.1040E+02	6.4453E+02	7.9976E-01	1.0356E+01	6.7179E-04
44																				
45																				
46																				
47	1.6126E+04	9.5209E+02		7.1052E-03			1.8647E-02		1.4782E+00		1.5844E+04	2.2634E+03	5.0589E+02	1.1167E+04	1.0408E-01	5.2255E+02			1.3459E-01	6.0894E-08
48																				
49																				
50																				
51		6.5722E+02			3.1847E+00	2.1182E+00	2.0525E-02	5.3906E-02	4.7186E-01	9.4226E-01	7.0850E+03		1.2997E+02	1.7761E+03	2.7172E-01		4.8324E+02		2.8536E+02	
Total	3.5335E+06	9.4225E+05	2.7911E+00	6.5252E-01	1.0205E+02	3.7913E+01	1.7158E+00	4.8574E+00	6.6396E+01	7.6674E+01	2.1597E+06	4.0898E+04	1.7585E+04	1.0784E+06	3.5791E+01	6.6275E+04	1.6481E+05	2.1070E+02	2.2129E+05	1.7597E+01

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 (Ci/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
2		7.16E-07	8.43E-04	4.81E-03	5.77E-04	1.89E+01	1.89E+01	9.98E-03	4.63E-12	4.63E-12	1.63E-04	1.07E-03	4.75E-08	9.67E-08	6.68E-06	1.35E+00	1.27E+00	1.13E-15	1.13E-15	2.14E-03
3		6.20E-07	7.30E-04	5.47E-03	4.99E-04	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
4		2.63E-08	9.33E-04	5.40E-02	6.67E-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
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
6			4.16E-03	1.30E-01	2.98E-03	1.32E+02	1.32E+02	5.16E-02	3.78E-07	3.78E-07	2.33E-02	5.54E-03	2.46E-07	4.46E-05	3.45E-05	9.20E+00	8.70E+00	2.38E-09	2.38E-09	3.53E-01
7		4.12E-06	8.96E-04	7.22E-03	4.88E-04	1.74E+01	1.74E+01	8.44E-03	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
8		1.78E-06	6.70E-04	2.40E-02	4.14E-04	1.88E+01	1.88E+01	7.15E-03	8.46E-07	8.46E-07	6.58E-03	7.69E-04	3.41E-08	1.73E-05	4.79E-06	1.31E+00	1.24E+00	2.48E-08	2.48E-08	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
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
33			2.85E-03	8.97E-01	2.04E-03	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
34			6.86E-03	1.95E+00	4.91E-03	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
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
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
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	2.47E-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
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	2.47E-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
Scaling Factors (Ci/Ci Sr-90)																				
1		2.12E-08	3.87E-05	4.90E-04	2.69E-05	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-02
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	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	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	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
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

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 (Ci/gal)																			
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	2.16E-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	6.96E-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	1.85E-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	2.62E-02	5.44E-03	1.21E-01	1.56E-06	4.34E-03	2.30E-01	3.01E-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	2.65E+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	2.65E+01	1.58E-02
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	6.52E-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	5.29E-08	5.26E-05	2.99E-03	3.85E-06	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	7.29E-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		1.46E-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		1.46E-01	2.08E-02	4.65E-03	6.03E-01	9.56E-06	5.83E-02			8.38E-07	5.55E-13	3.85E+02	2.29E-01

Attachment 4

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

Attachment 4

Comparison of F-Tank Farm Sludge Scaling Factors for Consolidation

Sludge scaling factors (Ci/Ci Sr-90)														
Isotope	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	Mean Ci/ Ci Sr-90
H-3														
C-14	2.12E-08	3.78E-08	3.61E-08	8.44E-10	1.56E-08		2.37E-07	9.50E-08	4.45E-06	2.99E-06			3.13E-06	1.10E-06
Tc-99	4.66E-04	5.27E-04	5.03E-04	3.70E-04	4.30E-04	3.92E-04	4.84E-04	3.81E-04	3.76E-04	2.52E-04	2.54E-04	2.61E-04	2.64E-04	3.81E-04
I-129	2.22E-09	2.51E-09	2.39E-09	1.77E-09	2.05E-09	1.87E-09	2.31E-09	1.82E-09	1.78E-09	1.19E-09	1.21E-09	1.24E-09	1.25E-09	1.82E-09
U-234											5.76E-10			5.76E-10
U-238	7.27E-07	2.67E-07	7.36E-07	8.46E-07	8.73E-07	7.56E-07	2.51E-06	2.06E-06	2.57E-05	1.03E-05	4.55E-06	9.88E-07	1.06E-05	4.68E-06

PA radionuclides, fraction of mean scaling factor (allowable fraction = 0.1-10.0)													
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
0.02	0.03	0.03	0.0008	0.014		0.21	0.09	4.04	2.71			2.84
1.22	1.38	1.32	0.97	1.13	1.03	1.27	1.00	0.99	0.66	0.67	0.68	0.69
1.22	1.38	1.32	0.97	1.13	1.03	1.27	1.00	0.98	0.66	0.67	0.68	0.69
										1.00		
0.16	0.06	0.16	0.18	0.19	0.16	0.54	0.44	5.49	2.20	0.97	0.21	2.26

Fractional activity														
Isotope	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	Mean
Sr-90	4.66E-01	4.66E-01	4.66E-01	4.63E-01	4.66E-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	4.46E-01
Y-90	4.66E-01	4.66E-01	4.66E-01	4.63E-01	4.66E-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	4.46E-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%	3.9%	-5.0%	-11.7%	-4.0%	-3.0%	-9.8%

	Sludge scaling factors (Ci/Ci Sr-90)		PA rads, fraction of mean scaling factor (allowable frctn. = 0.1-10.0)
Isotope	Tank 19	Mean Ci/ Ci Sr-90	Tank 19
H-3			
C-14	3.98E-06	3.98E-06	1.00
Tc-99	3.36E-04	3.36E-04	1.00
I-129	1.59E-09	1.59E-09	1.00
U-234			
U-238	3.55E-05	3.55E-05	1.00

	Fractional Activity		Pred. rads, variation from mean fract. act. (allowable vrtn. = 100%)
Isotope	Tank 19	Mean	Tank 19
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

Isotope	Mean Ci/Ci Sr-90)	Mean Distribution (%)	<1% of dist?(a)	Not Expected	Distribution: RADs remaining after excl criteria	Distribution: Mean distribution (percent)	Distribution: 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-240	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

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

TRU Curies/Total Curies = 2.09E-03

Total TRU = 3.20E-01 Ci/gal

Isotope	Isotope Average Ci/gal	Ci/ft3 sludge	Ci/ft3 waste	LAWV limit ci/ft3	Fraction
H-3				1.10E+01	
C-14	1.54E-06	1.15E-05	3.63E-09	2.50E-05	1.45E-04
Tc-99	2.32E-02	1.74E-01	5.46E-05	5.60E-05	9.75E-01
I-129	1.11E-07	8.30E-07	2.61E-10	1.10E-08	2.38E-02
U-234	8.01E-08	5.99E-07	1.89E-10	1.10E-03	1.71E-07
U-238	1.04E-04	7.78E-04	2.45E-07	1.20E-03	2.04E-04
	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	max amount of sludge in a B-25 to meet Sum of Fractions Limit		
	Equivalent Curies	3.24E+01	TRU curies	6.78E-02	min lb wt to be TRU
			nCi/g at max wt	2.99E+01	1493.176116

Isotope	Fraction
Np-237	9.98E-05
Pu-238	5.36E-02
Pu-239	2.62E-02
Pu-240	5.44E-03
Pu-242	1.56E-06
Am-241	2.34E-01
Am-242m	3.01E-04
Cm-245	3.81E-11

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

TRU Curies/Total Curies = 5.95E-04

Total TRU = 1.58E-02 Ci/gal

Isotope	Isotope Average Ci/gal	Ci/ft3 sludge	Ci/ft3 waste	LAWV limit ci/ft3	Fraction
H-3				1.10E+01	
C-14	2.74E-07	2.05E-06	6.29E-07	2.50E-05	2.52E-02
Tc-99	2.31E-05	1.73E-04	5.30E-05	5.60E-05	9.47E-01
I-129	1.10E-10	8.23E-10	2.52E-10	1.10E-08	2.30E-02
U-234				1.10E-03	
U-238	2.44E-06	1.83E-05	5.60E-06	1.20E-03	4.67E-03
	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	max amount of sludge in a B-25 to meet Sum of Fractions Limit		
	Equivalent Curies	5.47E+03	TRU curies	3.26E+00	min lb wt to be TRU
			nCi/g at max wt	1.44E+03	71752.31016

Isotope	Fraction
Np-237	
Pu-238	1.00E-02
Pu-239	1.43E-03
Pu-240	3.20E-04
Pu-242	6.58E-07
Am-241	4.02E-03
Am-242m	
Cm-245	3.82E-14

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**

OSR 29-82# (Rev 1-14-2003)

Ref. 1S Manual, Appendix A-17 Instructions

EAV Low Level Waste Stream Characterization

1. Waste Stream ID	2. Generating Facility	3. Waste Organization	4. Building Name	5. Effective Date
FTK-00002-1	FTF	F-Area Tank Farm	241-F	6/30/2002

6. WITS Stream Description	7. Reason for Submittal	8. WSCF No.	9. Rev
Sludge contaminated waste from HLW tks 1-8, 18, 26, 33, 34, and 47	Re-characterize Stream		2

10. Activity Generating Waste	11. Physical Form	12. TSD Facility/Location
F Tank Farm Operations	Combustible	EAV - Law Vault - 1

13. Valid Calculation Method for Waste	14. STC Constant	15. STC Min Value	16. DTC Waste Form
☐ Char by Pack ☐ Dose-to-Curie ☐ Smear to Curie ☒ Curies or RAD Weight	N/A	N/A	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	21. Tech Baseline	22. Container Document No.	23. Deviation Document No.	24. CERCLA	25. Waste < 2 nCi/g
FTK000021-LLW	WSRC-2000-00215, Rev.1	N/A	N/A	☐ Yes ☒ No	☐ Yes ☒ No

26. Source(s)	27. PCB Category				
☐ Yes ☒ No	☐ PCB Leachable	☐ PCB Bulk	☒ N/A	☐ PCB Article	
		☐ PCB Remediation	☐ PCB Laboratory	☐ PCB Decontamination	

28. Comments

29. Meas Tech	30. Waste Incidental to Reprocessing (WIR) — Evaluation Document No.
☐ Sample and Analysis ☒ Process Knowledge	_____ ☐ 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				

Total 100.00 ~~78.558~~ % PSR 2/4/03

32. GCO Name	33. GCO Address	34. GCO Phone
P. J. Riley	242-102F	2-4425

35. GCO Signature**	Date	Environmental Compliance Authority Signature	Date
	2/4/03		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."

OSR 29-82# (Rev 1-14-2003)

Ref. 1S Manual, Appendix A-17 Instructions

EAV Low Level Waste Stream Characterization

1. Waste Stream ID	2. Generating Facility	3. Waste Organization	4. Building Name	5. Effective Date
FTK-00002-19	FTF	F-Area Tank Farm	241-F	6/30/2002

6. WITS Stream Description	7. Reason for Submittal	8. WSCF No.	9. Rev
Sludge Contaminated HLW Tk 19	Re-characterize Stream		

10. Activity Generating Waste	11. Physical Form	12. TSD Facility/Location
F Tank Farm Operations	Combustible	EAV - Law Vault - 1

13. Valid Calculation Method for Waste	14. STC Constant	15. STC Min Value	16. DTC Waste Form
☐ Dose-to-Curie ☐ Smear to Curie ☐ Char by Pack ☒ Curies or RAD Weight	N/A	N/A	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) per 2/4/03

20. WITS ID	21. Tech Baseline	22. Container Document No.	23. Deviation Document No.	24. CERCLA	25. Waste < 2 nCi/g
FTK0000219-LLW	WSRC-2000-00215, Rev.1	N/A	N/A	☐ Yes ☒ No	☐ Yes ☒ No

26. Source(s)	27. PCB Category				
☐ Yes ☒ No	☐ PCB Leachable	☐ PCB Bulk	☐ PCB Remediation	☒ N/A	☐ PCB Laboratory	☐ PCB Article	☐ PCB Decontamination

28. Comments

29. Meas Tech	30. Waste Incidental to Reprocessing (WIR) — Evaluation Document No.
☐ Sample and Analysis ☒ Process Knowledge	☐ NA

31. Currently Assigned Isotopes

Isotope	Ci %	Basis for Exclusion (PA isotopes only)	Isotope	Ci %	Basis for Exclusion*
C-14	1.03E-06		H-3		Not present
Sr-90	2.59E-01		U-234		Not present
Y-90	2.59E-01				
Tc-99	8.71E-05				
I-129	4.13E-10				
Cs-137	5.10E+01				
Ba-137m	4.83E+01				
U-235	1.01E-07				
U-238	9.02E-06				
Pu-238	3.78E-02				
Pu-239	5.40E-03				
Pu-240	1.21E-03				
Pu-242	1.57E-01				
Am-241	1.51E-02				
Cm-245	1.44E-13				

Total 100.00 ~~53.9262~~ %

32. GCO Name	33. GCO Address	34. GCO Phone
P. J. Riley	242-102F	2-4425

35. GCO Signature**	Date	Environmental Compliance Authority Signature	Date
	2/4/03		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."

Attachment 8

Waste Characterization Form for Supernate Fraction, FHW-00001

EAV/CIF Low Level Waste Stream Characterization

1. Waste Stream ID	2. Generating Facility	3. Waste Organization	4. Building Name	5. Effective Date
FHW00001	FTF, HTF-E, HTF-W	FTF, HTF-E, HTF-W	241-F, 241-H, 241-197H	4/1 2001

6. WITS Stream Description	7. Reason for Submittal	8. WCF No.	9. Rev
Supernate-Ct'd Waste from FTF, HTF-E, HTF-W	New Waste Stream		

10. Activity Generating Waste	11. Physical Form	12. TSD Facility/Location
FTF & HTF operations, ITP/ESP Operations	Combustible	EAV

13. Valid Calculation Method for Waste			14. STC Constant	15. STC Min Value	16. DTC Waste Form
Dose-to-Curie	Smear to Curie	Char by Pack Curies or RAD Weight	N/A	N/A	N/A

17. Assigned Container Types	18. DTC Containers	19. Waste Description	Vol %
B-12 (14)	All B-12s	Job Control Waste	60
B-25 (Yellow)-Light (6)	All B-25s	Contaminated Equipment	36
55-gal Drum (A,7A) (15)	All 55-gal Drums	Soil	4
Recondition 55 Gal Drum (43)	Skid Pan		
Skid Pan (183)			
ITP Slurry Pump Box - 15K			

20. WITS ID	21. Tech Baseline	22. Container Document No.	23. Deviation Document No.
FHW00001LLW	WSRC-TR-94-0290, Rev. 3, 4/99	N/A	N/A

24. GCO Name	25. GCO Address	26. GCO Phone	27. CERCLA	28. Waste < 2 nCi/g
R. J. Petras	703-H	208-1410	☐ Yes ☑ No	☐ Yes ☐ No

29. Source(s)	30. PCB Category			
☐ Yes ☑ No	☐ PCB Leachable	☐ PCB Bulk	☑ N/A	☐ PCB Article
		☐ PCB Remediation	☐ PCB Laboratory	☐ PCB Decontamination

31. Comments

32. Meas Tech	33. Waste Incidental to Reprocessing (WIR) — Evaluation Document No.
☐ Sample and Analysis ☑ Process Knowledge	N/A

34. Currently Assigned Isotopes

Isotope	Ci %	Basis for Exclusion (PA isotopes only)	Isotope	Ci %	Basis for Exclusion*
H-3	2.01 E-01		C-14	0.00	Present at below MALLD
Co-60	1.71 E+00		U-238	0.00	Present at below MALLD
Sr-90	4.73 -02				
Tc-99	9.15 E-03				
I-129	1.11 E-05				
Cs-137	5.03 E+01				
Ba-137m	4.73 E+01				
U-233	2.62 E-04				
U-234	7.14 E-05				
Pu-238	2.51 E-01				
Pu-239	2.92 E-03				
Pu-240	1.31 E-03				
Pu-241	1.91 E-01				
Am-241	1.81 E-02				

Total 100.00 %

35. GCO Signature**	Date	Environmental Compliance Authority Signature	Date
Robert J Petras	4/16/01	Stuart Stinson	4/16/01
Solid Waste 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/CIF Low Level Waste Stream Characterization

Waste Stream ID	WCF No.	Rev	WITS ID
FHW00001			FHW00001LLW

CIF Section

36. Major Waste Components

Description	Concentration Wt%	Description	Concentration Wt%

37. Chemicals/Organics/Metals	Concentration, PPM	Chemicals/Organics/Metals	Concentration, PPM

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	Normaljzed 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	