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HIGH LEVEL WASTE TANK FARMS CHARACTERIZATION OF SEALAND CONTAINERS WITH ROUTINE LOW-ACTIVITY WASTE (U)

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Revision Description

Revision	Date	Description
0	6/2003	Initial development of Low Activity Waste (LAW) stream
1	7/2005	Revalidation of LAW stream & update of radionuclide distribution based on current high level waste tank contents and revised SRS Waste Acceptance Criteria (WAC) 2.02 and 3.17 requirements. Roll-offs were added to the applicable LAW containers.

1.0 Background

High level radioactive waste is contained in underground storage tanks in the F- and H-Area Tank Farms at the Savannah River Site (SRS). Routine and non-routine activities associated with the operation of these facilities result in the generation of waste contaminated with the contents of these tanks. Characterization of solid waste contaminated with material from these tanks has been performed and is outlined in a series of documents (Ref. 1-4).

The bulk of waste generated at the tank farms is comprised of plastic, paper, tape, personal protective equipment, and miscellaneous equipment containing low levels of contamination. This waste is packaged in containers and transferred to SRS Solid Waste Division (SWD) facilities (e.g., E-Area Vaults, Engineered Trench, Slit Trench, or Components-in-Grout, based on form and radiological content) for long-term management.

In an effort to minimize costs associated with managing low-activity waste, the Sealand and Roll-Off containers have been identified as a suitable cost-effective alternative to B-12 or B-25 containers for waste shipment, storage, and disposal.

2.0 Introduction

High level waste at the SRS F- and H-Area Tank Farms consists of both sludge and supernate fractions. Supernate contains soluble species. Sludge contains both insoluble species and entrained supernate. The nature and extent of contamination present on waste generated during operation of the F- and H-Area Tank Farms is a function of the tank, the nature of the job generating the waste, variability in waste handling techniques, and other factors.

Historically, supernate-contaminated waste had been segregated and manifested as supernate waste. A single, comprehensive characterization for supernate has been developed previously (Reference 4). Sludge-contaminated waste has been manifested by combining sludge and supernate waste streams to account for entrained supernate present in sludge. Separate sludge waste stream characterizations have been developed for each of the F- and H-Area Tank Farms (Ref. 1 and 2).

Low-activity waste (LAW) consists of both sludge and supernate fractions. Routine LAW is waste that has a maximum dose rate of 50mrem/hr at 5cm for Sealands and 35mrem/hr at 5 cm for Roll-Offs. However, it is intended that routine, low-activity waste not be segregated; therefore, individual low-activity waste cuts may consist of items contaminated with either supernate or sludge in the same container. Historical waste generation rates of the two waste streams will be used to develop a single waste stream distribution representative of low-activity waste. The single distribution is based on the assumption that the actual contamination present on waste in a series of containers from these tanks will be representative of the average supernate/sludge radionuclide distribution.

This document develops a characterization for low-activity waste consisting of both radioactive and hazardous constituents. The characterization includes quantification of the average Sealand and Roll-Off containers of routine, low-activity waste. This characterization will apply only to low-level waste that has a whole body (30 cm) dose rate less than or equal to 5 mrem/hr from an individual waste bag or item and has a radionuclide distribution that is represented by the existing high level supernate and sludge waste streams (FHW-00001 and HTK-00002).

This document specifically refers to the issues of waste management related to the F- and H-Area Tank Farms. However, the characterization presented in this document of low-activity waste managed in Sealand and Roll-Off containers applies to any SRS facilities that process the supernate or sludge waste streams that are presently stored in the F- and H-Area Tank Farms.

3.0 Characterization of Low-Activity Waste

3.1 Low-Activity Waste at SRS

In 2003, a program was initiated to more efficiently manage low-activity waste generated within SRS Liquid Waste Disposition Facilities (Ref. 5). Historical data from January 2000 through October 2002, extracted from the Waste Inventory Tracking System (WITS; Ref. 6) for low-activity waste generated within Liquid Waste Disposition Facilities, is summarized in Appendix I and Table 3.1. Although approximately 85% of the volume of low-activity waste is supernate-contaminated, supernate accounts for only 55% of the curies.

Table 3.1. Historical Waste Generation Rates of LAW

Waste Type	Number of B-12 Containers / Total Ci	Number of B-25 Containers / Total Ci	Number of 55-Gal Drums / Total Ci	Total Volume (ft^3)	Total Ci	% of Low-Activity Waste by Volume	% of Low-Activity Waste by Ci
Supernate	8/0.04	840/32.6	654/0.14	80,767	32.78	85.2	54.9
Sludge	13/3.35	150/23.6	0/0	14,085	26.95	14.8	45.1
Total	21/3.39	990/56.2	654/0.14	94,852	59.73	100.0	100.0

3.2 Radionuclide Constituents in Low-Activity Waste

The radionuclide distribution for the sludge fraction of sludge-contaminated waste has been previously determined and documented for sludge waste tanks in both F- and H-Tank Farms (Ref. 1 and 2). The distribution developed for waste stream HTK-00002, as documented in Reference 2, is considered to be the most representative of the sludge fraction of low-activity waste, as the bulk of waste is currently generated in the H-Area Tank Farm (68% of the volume and 99% of the activity over the last 5 years per WITS Reports). This waste stream identifies 20 radionuclides present in H-Area Tank Farm sludge waste. The waste stream consists primarily of Sr-90 and its daughter Y-90, which together comprise approximately 91% of the total activity in sludge.

The radionuclide distribution for the supernate fraction of sludge-contaminated waste has been previously determined and documented; Reference 4 identifies 26 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 94% of the total activity in supernate.

3.3 Hazardous Constituents in Low-Activity Waste

To determine whether low-activity waste is Resource Conservation and Recovery Act (RCRA; 40 CFR 261) characteristically hazardous, hazardous constituents in both the supernate and sludge fractions must be considered. Mercury is the limiting hazardous constituent in F- and H-Area Tank Farm sludge and sludge process supernate (Ref. 7 and 8). Tank 48 has contained precipitate from the in-tank precipitation process, in which benzene is the limiting hazardous constituent (Ref. 3). This hazardous evaluation for low-activity waste is restricted to the limiting hazardous constituents, mercury and benzene. The following sections determine the hazardous scaling factors for LAW.

3.3.1 Mercury

3.3.1.1 Determination of Mercury in Sludge Fraction

Mercury (Hg) and Sr-90 inventories for the sludge fraction of waste stored in F- and H-Area high level waste tanks are known (Appendix II). Hg-to-Sr-90 scaling factors can be derived from these data. An average scaling factor representing the average contribution from all tank farm sludge sources is accepted practice and is utilized here. The average scaling factor for F- and H-Area high level waste tank sludge, g Hg/Ci Sr-90, is 1.17E+00 (Appendix II).

3.3.1.2 Determination of Mercury in Supernate Fraction

Hg and Cs-137 inventories for the supernate fraction of waste stored in F- and H-Area high level waste tanks are known (Appendix III). Hg-to-Cs-137 scaling factors can be derived from these data. The use of an average scaling factor representing the average contribution from all tank farm supernate sources is utilized here. Note that Tanks 11, 19, 21, 22, 23, and 50 have not been included in the average due to their extremely low Cs-137 inventories. The average scaling factor for F- and H-Area high level waste tank supernate, g Hg/Ci Cs-137, is 5.02E-01 (Appendix III).

3.3.1.3 Combined Mercury Scaling Factor for Low-Activity Waste

A single scaling factor, combining known scaling factors and generation rates for sludge and supernate fractions of low-activity waste, will be developed for mercury. The development of this scaling factor conservatively assumes that all Cs-137 in the low-activity waste distribution is derived from supernate, and all Sr-90 is derived from sludge. The combined scaling factor is 1.42 g Hg/Ci Cs-137, as shown in Table 3.2.

Table 3.2. Combined Mercury Scaling Factor for Low-Activity Waste

Radionuclide	**Scaling Factors for Low-Activity Waste, Ci/Ci Cs-137 (Appendix IV)**	**Mercury Scaling Factors**			**g Hg per Ci Cs-137**
	A	B	Units	Reference	C=A*B
Sr-90	7.84E-01	1.17E+00	g Hg/Ci Sr-90	Appendix II	9.17E-01
Cs-137	1.00E+00	5.02E-01	g Hg/Ci Cs-137	Appendix III	5.02E-01
Total					**1.42E+00**

3.3.2 Benzene

Tank 48 contains supernate and precipitate solids only. Tank 48 is currently the only tank in the F- and H-Tank Farms containing precipitate solids.

Benzene (Bz) is present only in precipitate solids in Tanks 48 and is the limiting hazardous constituent. Scaling factors for Bz potential in the supernate and precipitate fractions, separately and combined were developed previously (Ref. 3). The Bz scaling factor for the total contents of Tank 48 is 50.8 g Bz/Ci Cs-137.

Tank 48 contains less than 1% (0.34%) of the curies of Cs-137 in the F- and H-Area Tank Farms (Appendix V). Accounting for all the curies of Cs-137 in the tank farms that could be present in low-activity waste, the adjusted Bz scaling factor can be calculated as follows:

$$\text{g Bz/Ci Cs-137} = \frac{50.8 gBz}{CiCs-137_{Tank48}} * \frac{0.0034 CiCs-137_{Tank48}}{CiCs-137_{allTanks}} = 0.17\text{g Bz/Ci Cs-137}$$

The RCRA characteristically hazardous regulatory level (40 CFR 262.24, Table 1) for Bz is 2.5 times that of mercury:

Benzene regulatory level = 0.5 mg/L
Mercury regulatory level = 0.2 mg/L

Therefore, the benzene scaling factor can be up to 2.5 times that of Hg before Bz becomes the limiting hazardous constituent. The Hg scaling factor, developed in the previous section, is 1.42 g Hg/Ci Cs-137, so the Bz scaling factor would have to be 1.42 g Hg x 2.5 = 3.55 g Bz/Ci Cs-137 in order to be a limiting hazardous constituent. Since Bz is present in low-activity waste at only 0.17 g/Ci Cs-137, it is determined that Hg is the single limiting hazardous constituent in all low-activity waste from F- and H-Area Tank Farm sources, including supernate, sludge, and precipitate (Tank 48) tanks.

4.0 Quantification

4.1 Average LAW Container

4.1.1 Identification of LAW Containers

LAW containers are assumed to be Sealand or Roll-Off containers as follows:

Container	Dimensions			Volume	Payload Capacity
	Length	Width	Height		
	ft	ft	ft	ft^3	lbs
Sealand					
20’	19.33	7.79	7.79	1,173	48,150
40’	39.46	7.79	7.79	2,394	58,955
Roll-Off					
19 yd^3	21.16	7.32	3.31	513.2	37,790
30 yd^3	22.0	8.0	6.25	783.0	55,260

For conservatism, these containers are assumed to contain 100% metal in the waste. The maximum and minimum weights for each container are shown in Table 4.1 (Ref. 9).

Table 4.1. Waste Weights for LAW Containers

Container	Maximum Weight lbs	Minimum Weight lbs
20’ Sealand	24,000	1,500
40’ Sealand	48,000	3,000
19 yd^3 Roll-Off	10,300	650
30 yd^3 Roll-Off	15,700	980

4.1.2 Calculation of Curies of Cs-137 for LAW Containers

The DTC program was used to determine the appropriate DTC conversion factors. The maximum dose rates of 50mrem/hr at 5cm for the Sealand containers and 35mrem/hr at 5cm for the Roll-Off containers were established to ensure that hazardous limits are not exceeded. Using these maximum dose rates and maximum weights for each container, the curies of Cs-137 can be determined as shown in Table 4.2 (Ref. 9).

Table 4.2. Curies of Cs-137 for LAW Containers

Container	Dose Rate mrem/hr	DTC Value mrem/hr-Ci	Cs-137 Ci
	A	B	C=A/B
20’ Sealand	50	39.52	1.27E+00
40’ Sealand	50	19.51	2.56E+00
19 yd^3 Roll-Off	35	69.58	5.03E-01
30 yd^3 Roll-Off	35	41.25	8.48E-01

4.1.3 Hazardous Evaluation for LAW Containers

In Section 3.0, Hg was shown to be the single limiting hazardous constituent in LAW from the F and H Tank Farms including supernate, sludge, and precipitate tanks.

To determine if the waste is hazardous, the concentration of Hg in the waste is compared to the Toxic Characteristic Leaching Procedure (TCLP) limit for Hg of 0.2 ppm (mg/kg).

The Hg concentration will be highest at the minimum waste weight and maximum dose rates resulting in Cs-137 values shown in Table 4.3 (Ref. 9). The curies of Cs-137 and the scaling factor of 1.42 g Hg/Ci Cs-137 can be used to determine the Hg in each container.

Table 4.3. Mercury Content for LAW Containers

Container	**Cs-137** Ci	**Hg Scaling Factor** g Hg/Ci Cs-137	**Conversion** mg/g	**Hg** mg
	A	B	C	D=A*B*C
20’ Sealand	5.98E-01	1.42	1.00E+03	8.49E+02
40’ Sealand	1.18E+00	1.42	1.00E+03	1.68E+03
19 yd^3 Roll-Off	3.06E-01	1.42	1.00E+03	4.34E+02
30 yd^3 Roll-Off	4.29E-01	1.42	1.00E+03	6.09E+02

The concentration of Hg in each container is calculated by dividing the mercury values in Table 4.3 by the total waste weight in kg and the TCLP dilution factor of 20. If the Hg in the waste is less than the TCLP limit of 0.2ppm, then the waste is non-hazardous.

Table 4.4. Mercury Comparison for LAW Containers

Container	**Hg** mg	**Dilution Factor**	**Waste Weight** lbs	**Conversion** kg/lb	**Hg** ppm
	A	B	C	D	E=A/(B*C*D)
20’ Sealand	8.49E+02	20	1,500	0.454	0.062
40’ Sealand	1.68E+03	20	3,000	0.454	0.062
19 yd^3 Roll-Off	4.34E+02	20	650	0.454	0.074
30 yd^3 Roll-Off	6.09E+02	20	980	0.454	0.068

All of LAW containers are below the Hg TCLP limit of 0.2 ppm; therefore, they are non-hazardous.

4.1.4 Quantification of Transuranic Radionuclides in LAW Containers

The LAW transuranic (TRU) radionuclides scaling factors taken from Appendix IV are summarized in Table 4.5.

Table 4.5. LAW Transuranic Radionuclides	
Transuranic Radionuclide	**TRU Scaling Factors Ci/Ci Cs-137**
Np-237	5.77E-07
Pu-238	3.16E-02
Pu-239	3.75E-04
Pu-240	7.62E-04
Pu-242	4.77E-05
Am-241	2.63E-03
Am-242m	1.60E-05
Am-243	3.61E-05
Cm-245	1.87E-07
Cm-246	4.94E-07
Cm-247	2.40E-12
Total	**3.54E-02**

The total TRU is calculated using the curies of Cs-137 (Ref. 9), TRU scaling factors, and the minimum waste weights as shown in Table 4.6.

Table 4.6. LAW TRU Activity						
Container	**Cs-137**[a] Ci	**TRU Scaling Factor** Ci	**Waste Weight** lbs	**Conversion** g/lbs	**Conversion** nCi/Ci	**TRU** nCi/g
	A	B	C	D	E	F=A*B*E/(C*D)
20' Sealand	5.98E-01	3.54E-02	1,500	454	1.00E+09	3.11E+01
40' Sealand	1.18E+00	3.54E-02	3,000	454	1.00E+09	3.07E+01
19 yd^3 Roll-Off	3.06E-01	3.54E-02	650	454	1.00E+09	3.67E+01
30 yd^3 Roll-Off	4.29E-01	3.54E-02	980	454	1.00E+09	3.41E+01

a – Reference 9, Table 6.5.2

The TRU activity in each container is less than the 100 nCi/g limit.

4.1.5 Calculation of Curies of Total Activity for LAW Containers

The radionuclide curie content for each LAW container can be determined using the low-activity waste scaling factors and the Cs-137 from Table 4.2 and Appendix IV as shown in Table 4.7.

Table 4.7. Curie Content of LAW Containers

Radionuclide	**Scaling Factors for Low-Activity Waste,** Ci/Ci Cs-137	**20' Sealand Total Activity** Ci	**40' Sealand Total Activity** Ci	**19 yd^3 Roll-Off** Ci	**30 yd^3 Roll-Off** Ci
	A	B=A*1.27 Ci Cs-137	C=A*2.56 Ci Cs-137	D=A*5.03E-01 Ci Cs-137	E=A*8.48E-01 Ci Cs-137
H-3	3.16E-03	4.01E-03	8.08E-03	1.59E-03	2.68E-03
C-14	1.90E-06	2.41E-06	4.85E-06	9.53E-07	1.61E-06
Co-60	2.00E-02	2.55E-02	5.13E-02	1.01E-02	1.70E-02
Sr-90	7.84E-01	9.96E-01	2.01E+00	3.94E-01	6.65E-01
Y-90	7.84E-01	9.96E-01	2.01E+00	3.94E-01	6.65E-01
Tc-99	3.99E-04	5.07E-04	1.02E-03	2.01E-04	3.39E-04
I-129	1.98E-07	2.52E-07	5.07E-07	9.96E-08	1.68E-07
Cs-137	1.00E+00	1.27E+00	2.56E+00	5.03E-01	8.48E-01
Ba-137m	9.46E-01	1.20E+00	2.42E+00	4.76E-01	8.02E-01
Pm-147	2.23E-02	2.83E-02	5.70E-02	1.12E-02	1.89E-02
U-233	1.39E-06	1.77E-06	3.57E-06	7.01E-07	1.18E-06
U-234	5.94E-07	7.54E-07	1.52E-06	2.99E-07	5.04E-07
U-235	3.71E-08	4.71E-08	9.50E-08	1.87E-08	3.15E-08
U-238	4.05E-08	5.14E-08	1.04E-07	2.04E-08	3.43E-08
Np-237	5.77E-07	7.33E-07	1.48E-06	2.90E-07	4.90E-07
Pu-238	3.16E-02	4.01E-02	8.08E-02	1.59E-02	2.68E-02
Pu-239	3.75E-04	4.76E-04	9.59E-04	1.88E-04	3.18E-04
Pu-240	7.62E-04	9.68E-04	1.95E-03	3.84E-04	6.47E-04
Pu-241	1.86E-02	2.37E-02	4.77E-02	9.37E-03	1.58E-02
Pu-242	1.32E-05	1.68E-05	3.38E-05	6.64E-06	1.12E-05
Am-241	2.63E-03	3.34E-03	6.72E-03	1.32E-03	2.23E-03
Am-242m	1.60E-05	2.04E-05	4.10E-05	8.06E-06	1.36E-05
Am-243	3.61E-05	4.59E-05	9.25E-05	1.82E-05	3.06E-05
Cm-245	1.87E-07	2.38E-07	4.79E-07	9.41E-08	1.59E-07
Cm-246	4.94E-07	6.28E-07	1.27E-06	2.49E-07	4.19E-07
Cm-247	2.40E-12	3.05E-12	6.15E-12	1.21E-12	2.04E-12
Total	**3.61E+00**	**4.59E+00**	**9.25E+00**	**1.82E+00**	**3.06E+00**

4.1.6 Comparison to Other WAC Criteria

The majority of low-activity waste will be disposed in the Engineered Trench; however, a comparison of low-activity waste characteristics to all of the WAC criteria (Ref. 10) will be performed.

4.1.6.1 Comparison to Waste Package Guidelines

Administrative Waste Package Radiological Concentration Guidelines apply to waste disposed in the Solid Waste Disposal Facility. These guidelines will be used for comparison utilizing the combined sludge/supernate distribution for low-activity. The comparison indicates that the package limits are not exceeded for low-activity waste at any of the disposal facilities because the sum-of-fractions are less than one (Appendix VI).

4.1.4.2 Nuclear Criticality Safety Criteria

Comparison of the FGE U-235 in an average LAW container (App. VI) against the Treatment, Storage, Disposal Facility (TSDF) safety limit indicates that the average LAW container would contain less than 1g FGE U-235 and would not exceed the limit.

4.2 Non-Routine Waste

4.2.1 Quantification of Radionuclides in Non-Routine Waste

Waste that does not meet the criteria for low-activity waste, i.e., contact (5 cm) dose rate greater than 50mrem/hr for Sealands and 35mrem/hr for Roll-Offs, will be considered non-routine waste and will be quantified on a case-by-case basis using dose-to-curie (DTC) methods. The relative ease with which gamma radiation from Cs-137 is detected makes estimation of the curie content of this waste straightforward. DTC methods for quantification of Cs-137 in approved containers have been well developed and are currently in use (Reference 12).

In addition to being non-hazardous and non-TRU, meeting the WAC package guidelines, sum of fractions criteria, and the fissile content criteria (see Sections 4.2.2 – 4.2.5), to avoid special handling, low-level waste must be in a package that has a dose rate less than 200 mrem/hr at contact (Reference 11). Although unlikely to be exceeded, this criterion is probably the one that will be limiting for the disposal of high-curie waste in a LAW container. If there is a possibility that this will be a problem, the high-activity waste should be placed in the center with lower-activity waste on the sides.

4.2.2 Comparison of Non-Routine Waste Against Waste Package Guidelines

Administrative Waste Package Radiological Concentration Guidelines (Reference 11) apply to waste disposed in any onsite TSDF. These guidelines will be used for comparison for non-routine waste. The comparisons will be performed utilizing the combined sludge/supernate distribution for low-activity waste (Table 4.2). The average concentration of each radionuclide (Ci/Sealand container; Table 4.2) and their corresponding WAC limits (Reference 11)

In order to determine the maximum radionuclide activity within a LAW container that would still meet the radiological concentration guidelines for disposal, the number of LAW container volumes of non-routine waste and, thus, the associated maximum curie level present in a LAW container to still meet the disposal limits will be calculated a case-by-case basis. In addition, the transuranic radionuclide content of non-routine waste will be determined on a case-by-case basis. Those containers exceeding TRU waste limits will, upon entry into WITS, be flagged as TRU waste and not be sent to for disposal.

4.2.3 Sum-of-Fractions Calculation

For acceptance of non-routine waste packages sent to the TSDF in LAW containers, the radiological content of each 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
<u>+ activity concentration of isotope N/limit of isotope N</u>
≤ 1

In order to determine the maximum radionuclide activity within a LAW container that would still meet the radiological concentration sum-of-fractions criteria, the number of LAW container volumes of non-routine waste and, thus, the associated maximum curie level present in a LAW container to still meet the disposal sum-of-fractions limit will be calculated on a case-by-case basis .

4.2.4 Nuclear Criticality Safety Criteria

The maximum fissile radionuclide activity level of non-routine waste that could be placed in a LAW container prior to exceeding the TSDF (FGE) U-235 limit for disposal would calculated on a case-by-case basis (Reference 11).

4.2.5 Quantification of Hazardous Constituents

The concentration of hazardous constituents in non-routine waste will be determined on a case-by-case basis, utilizing the combined scaling factors for Hg or Bz in low-activity waste, as appropriate for the waste origin, as summarized in Section 3.3.

5.0 Validation

Provisions of WSRC 1S SRS Waste Acceptance Criteria Manual, Procedure 2.02, Revision 8 (Reference 10), require generators of routine wastes, including supernate- and sludge-contaminated waste, to review and confirm the certification of each waste stream on a periodic basis. The two waste streams, supernate (FHW-00001) and sludge (HTK-00002), that in combination provide the basis for the LAW containers, low-activity waste stream, FHW-00003, are currently on 5-year and 2-year revalidation schedules, respectively. The impacts to the Low-Activity Waste stream, FHW-00003, due to any changes to the supernate and sludge waste streams will be evaluated on the same schedule, and appropriate changes made concurrently.

6.0 References

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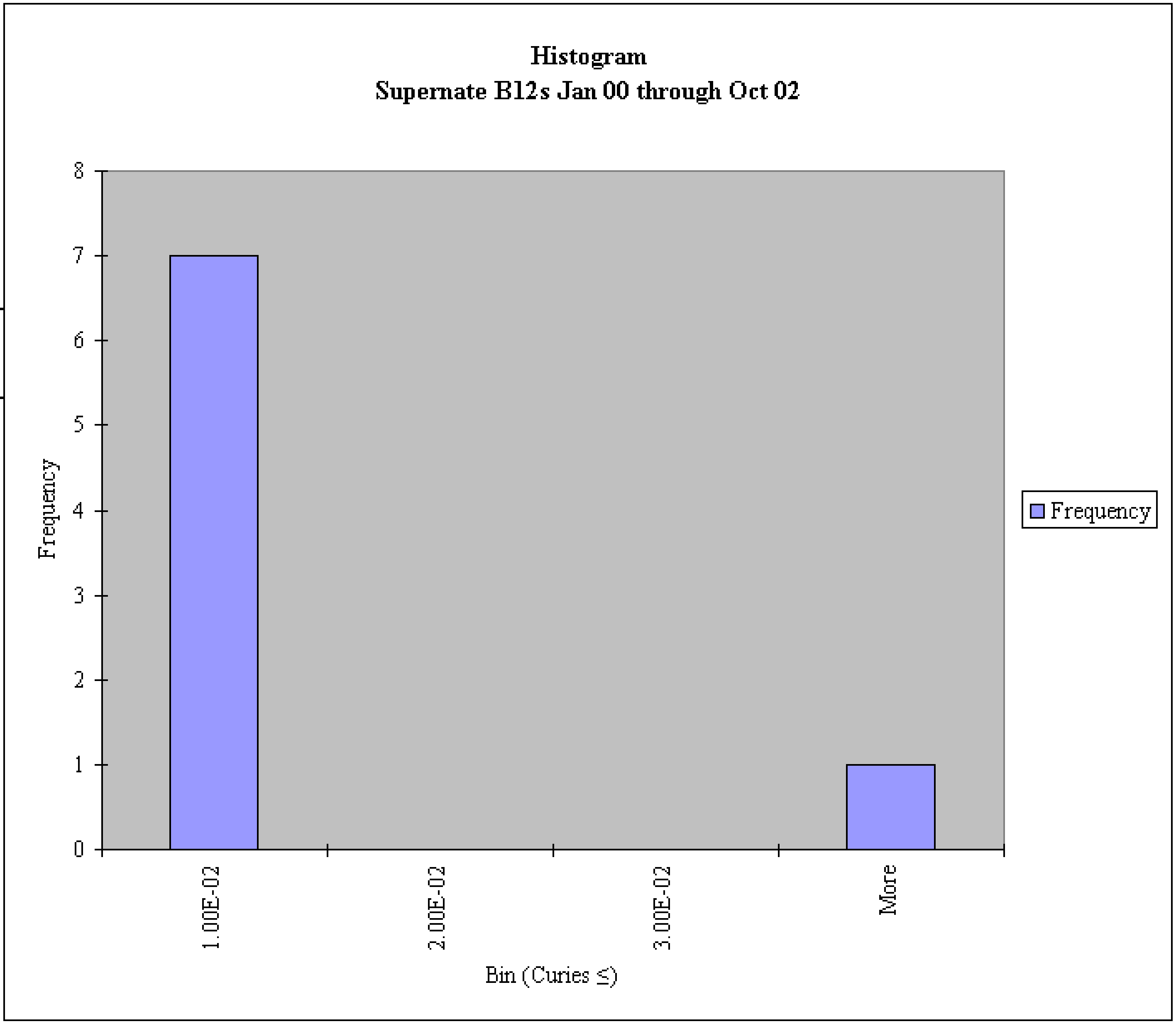
Appendix I

Low-Activity Waste at the F- and H-Tank Farms

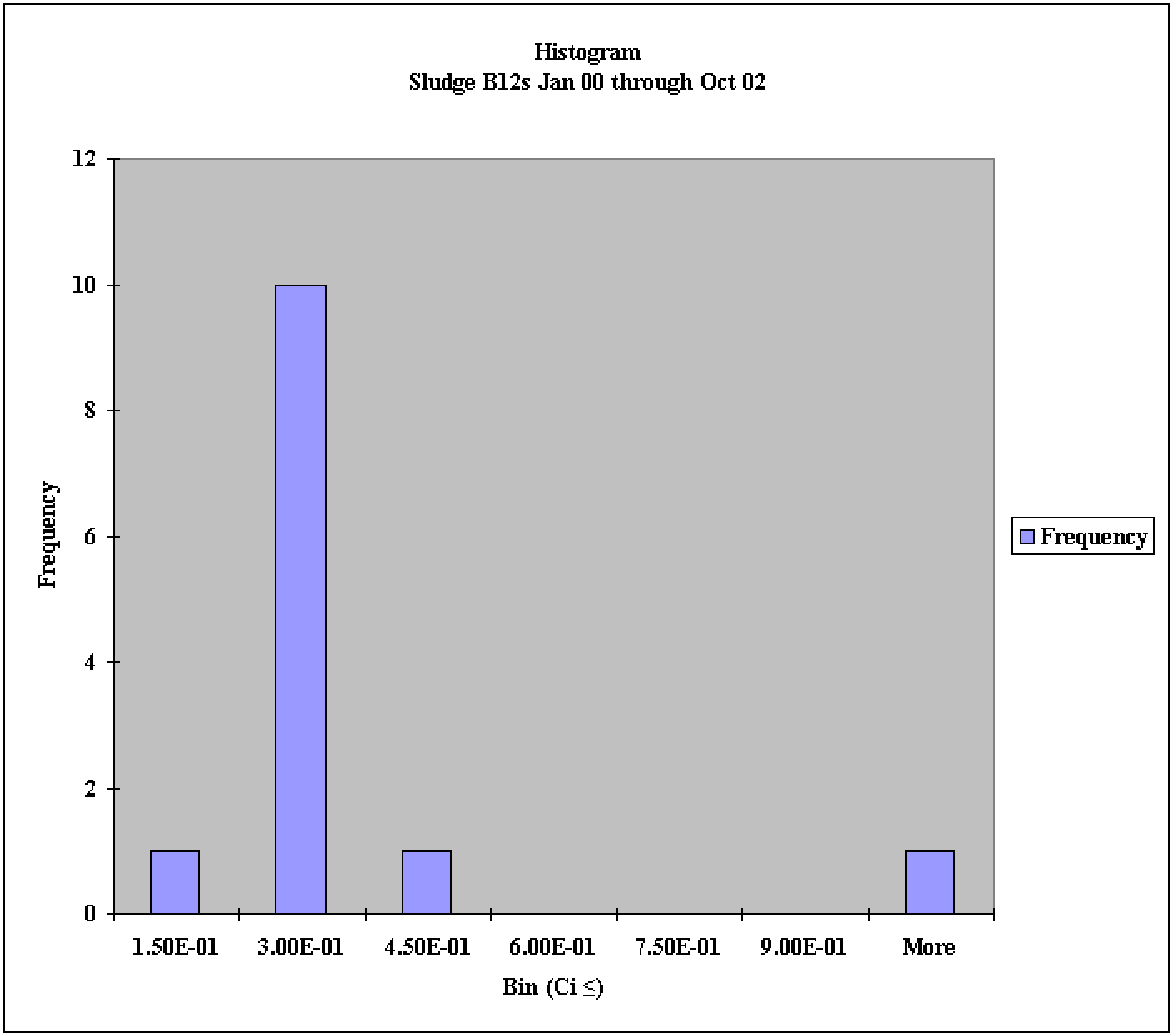
Bin (Ci≤)	Frequency	Avg Ci
1.00E-02	7	1.51E-03
2.00E-02	0	
3.00E-02	0	
More	1	3.18E-02

total curies =	4.23E-02
median curies =	1.77E-04
average curies =	5.29E-03

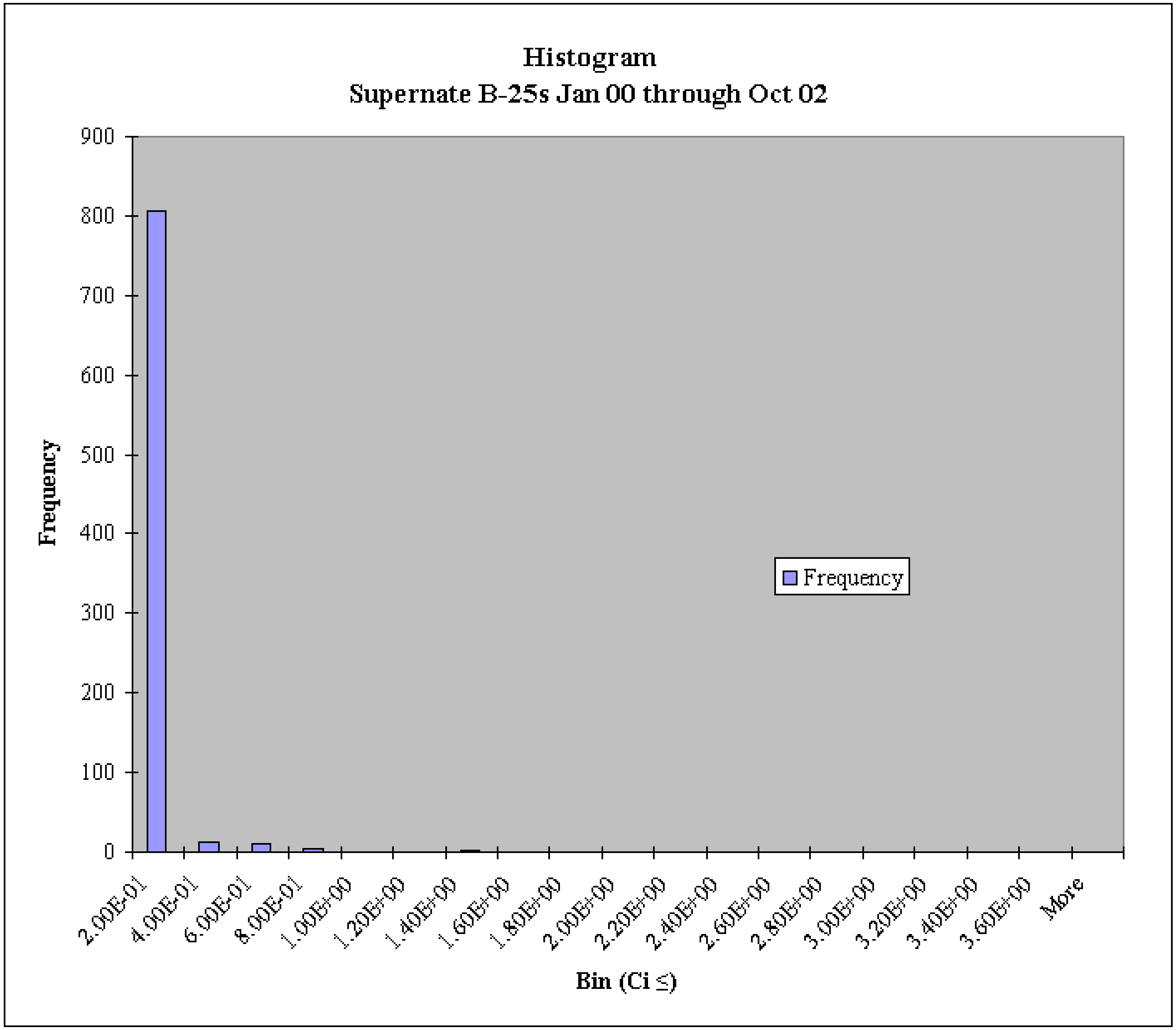


Bin (Ci≤)	Frequency	Avg Ci
1.50E-01	1	2.01E-03
3.00E-01	10	1.96E-01
4.50E-01	1	3.48E-01
6.00E-01	0	
7.50E-01	0	
9.00E-01	0	
More	1	1.04E+00

total curies =	3.35E+00
median curies =	1.74E-01
average curies =	2.58E-01



Bin (Ci≤)	Frequency	Avg Ci
2.00E-01	805	9.89E-03
4.00E-01	13	2.78E-01
6.00E-01	10	4.70E-01
8.00E-01	4	5.79E-01
1.00E+00	1	8.28E-01
1.20E+00	1	1.04E+00
1.40E+00	3	1.27E+00
1.60E+00	0	
1.80E+00	1	1.60E+00
2.00E+00	0	
2.20E+00	0	
2.40E+00	0	
2.60E+00	1	2.49E+00
2.80E+00	0	
3.00E+00	0	
3.20E+00	0	
3.40E+00	0	
3.60E+00	0	

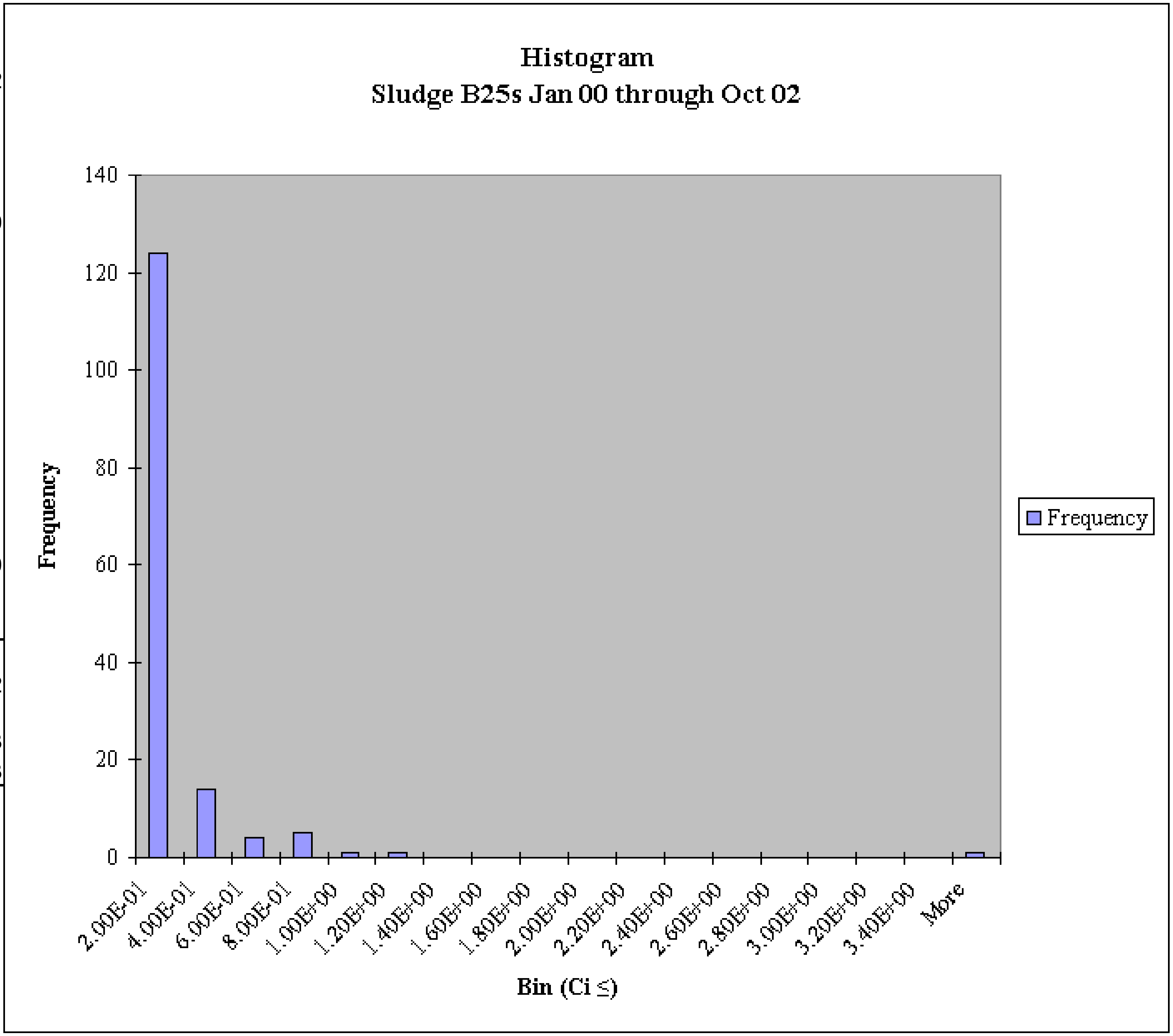


0		
More	1	3.73E+00

total curies =	3.26E+01
median curies =	8.35E-04
average curies =	3.88E-02

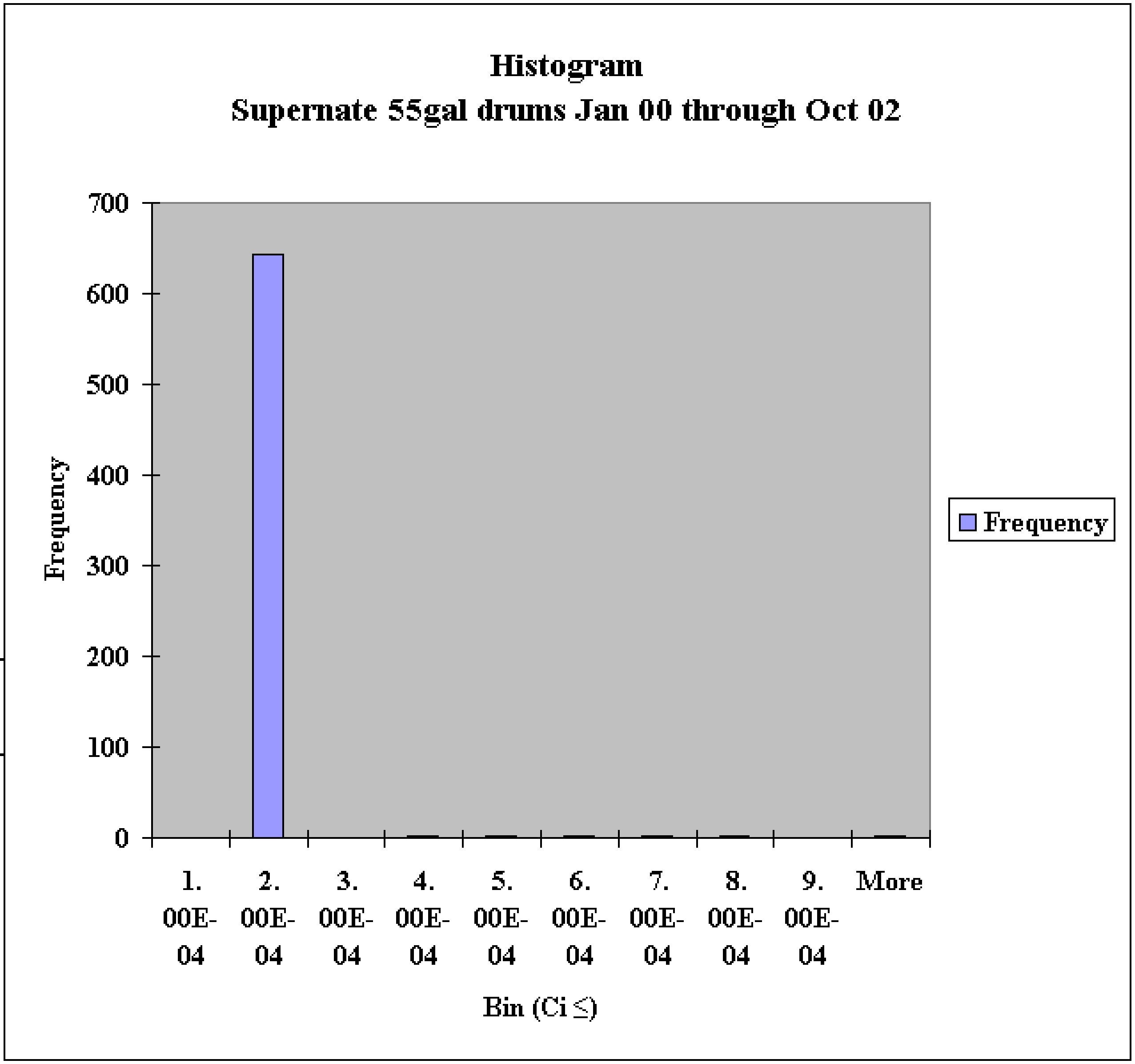
Bin (Ci≤)	Frequency	Avg Ci
2.00E-01	124	7.23E-02
4.00E-01	14	2.57E-01
6.00E-01	4	5.03E-01
8.00E-01	5	7.12E-01
1.00E+00	1	8.89E-01
1.20E+00	1	1.04E+00
1.40E+00	0	
1.60E+00	0	
1.80E+00	0	
2.00E+00	0	
2.20E+00	0	
2.40E+00	0	
2.60E+00	0	
2.80E+00	0	
3.00E+00	0	
3.20E+00	0	
3.40E+00	0	
More	1	3.59E+00

total curies =	2.36E+01
median curies/B25 =	8.69E-02
average curies/B25 =	1.58E-01
median curies/Bag =	3.95E-03
average curies/Bag =	7.16E-03



Bin (Ci≤)	Frequency	Avg Ci
1.00E-04	0	
2.00E-04	644	2.00E-04
3.00E-04	0	
4.00E-04	2	3.95E-04
5.00E-04	2	4.93E-04
6.00E-04	2	5.78E-04
7.00E-04	1	6.75E-04
8.00E-04	2	7.80E-04
9.00E-04	0	
More	1	9.64E-04

total curies =	1.35E-01
median curies =	2.00E-04
average curies =	2.06E-04



Appendix II
Mercury and Sr-90 Inventories in Tank Farm Sludge

Tank	HgO[1]	Hg[2]	Sr-90[1]	g Hg/Ci Sr-90
	kg	kg	Ci	
1	1.26E+01	1.17E+01	5.20E+05	2.25E-02
2	1.59E+00	1.47E+00	7.11E+04	2.07E-02
3	2.81E+00	2.60E+00	6.24E+04	4.17E-02
4	9.87E+01	9.14E+01	3.16E+06	2.90E-02
5	7.98E+01	7.40E+01	2.58E+06	2.86E-02
6	5.05E+01	4.67E+01	2.74E+06	1.70E-02
7	3.06E+01	2.83E+01	1.84E+05	1.54E-01
8	1.60E+00	1.48E+00	2.84E+04	5.20E-02
9	1.51E+00	1.39E+00	7.67E+04	1.82E-02
10	2.59E-01	2.40E-01	7.99E+03	3.01E-02
11	7.43E+02	6.88E+02	7.00E+05	9.83E-01
12	6.12E+03	5.67E+03	7.78E+06	7.30E-01
13	1.16E+04	1.07E+04	6.92E+06	1.55E+00
14	4.46E+01	4.13E+01	1.76E+05	2.35E-01
15	5.59E+03	5.18E+03	6.79E+06	7.63E-01
17	1.61E+00	1.49E+00	6.13E+02	2.42E+00
18	9.79E+00	9.07E+00	1.40E+03	6.48E+00
19	7.23E-01	6.70E-01	1.64E+02	4.08E+00
21	2.13E+02	1.97E+02	5.43E+04	3.63E+00
22	4.43E+02	4.11E+02	1.07E+05	3.86E+00
26	9.65E+01	8.94E+01	1.72E+05	5.20E-01
30	2.02E+01	1.87E+01	3.81E+04	4.90E-01
32	1.28E+04	1.18E+04	9.56E+06	1.24E+00
33	2.14E+02	1.98E+02	7.62E+06	2.60E-02
34	1.12E+02	1.03E+02	7.37E+06	1.40E-02
35	9.79E+03	9.07E+03	8.55E+06	1.06E+00
36	6.13E+00	5.67E+00	9.45E+03	6.00E-01
39	7.80E+03	7.22E+03	1.20E+07	6.03E-01
40	9.80E+02	9.08E+02	3.28E+06	2.77E-01
41	7.82E+01	7.25E+01	1.17E+04	6.20E+00
42	3.21E+02	2.97E+02	2.87E+05	1.04E+00
43	1.93E+03	1.79E+03	1.84E+06	9.73E-01
47	8.89E+01	8.24E+01	1.30E+05	6.35E-01
51	4.73E+03	4.38E+03	4.60E+06	9.51E-01
Average	1.88E+03	1.74E+03	2.57E+06	1.17E+00

[1]Data Source: WCS1.5Prod/WCS1.5/T-SldgInv, Ref. Date 4/28/05

[2][Hg] = [HgO]* MWHg/MWHgO, where MW Hg= 201, MW HgO=217
Retrieved: 7/21/05

Appendix III
Mercury and Cs-137 Inventories in Tank Farm Supernate

Tank	Hg[1]	Cs-137[1]	g Hg/Ci Cs-137
	kg	Ci	
1	1.91E+01	3.33E+06	5.73E-03
2	1.24E+01	1.21E+06	1.03E-02
3	1.24E+01	1.22E+06	1.02E-02
4	1.85E+01	3.16E+06	5.85E-03
5	3.89E+00	3.09E+04	1.26E-01
6	3.26E+02	9.94E+04	3.28E+00
7	1.29E+02	4.73E+05	2.72E-01
8	1.54E+00	7.06E+03	2.18E-01
9	8.32E+01	1.22E+06	6.83E-02
10	6.92E+01	8.22E+04	8.42E-01
12	1.35E+02	1.09E+05	1.24E+00
13	3.42E+02	1.18E+07	2.91E-02
14	3.12E+01	1.25E+06	2.49E-02
18	6.25E-02	1.38E+02	4.54E-01
24	3.88E+02	4.73E+05	8.20E-01
25	1.38E+00	1.38E+06	1.00E-03
26	7.76E+01	4.92E+06	1.58E-02
27	2.47E+01	3.31E+06	7.44E-03
28	1.88E+01	2.22E+06	8.47E-03
29	3.60E+01	4.74E+05	7.59E-02
30	7.34E+01	1.67E+07	4.40E-03
31	2.17E+02	5.23E+06	4.14E-02
32	4.91E+01	6.39E+06	7.67E-03
33	4.55E+02	3.81E+06	1.19E-01
34	3.07E+02	3.17E+06	9.69E-02
35	2.60E+02	2.80E+06	9.28E-02
36	2.60E+02	1.11E+07	2.35E-02
37	2.18E+02	4.83E+06	4.51E-02
38	1.18E+02	1.50E+05	7.86E-01
39	2.92E+02	5.61E+05	5.19E-01
40	2.50E+02	4.03E+04	6.19E+00
41	9.23E+00	3.49E+05	2.65E-02
42	6.14E+02	1.23E+07	4.99E-02
43	2.03E+02	1.85E+05	1.10E+00
44	2.86E+02	2.99E+06	9.55E-02
45	2.62E+02	2.56E+06	1.02E-01
46	3.32E+02	4.94E+06	6.73E-02
47	2.77E+02	8.45E+05	3.28E-01
48	2.00E+01	1.33E+04	1.50E+00
49	3.26E+02	5.67E+05	5.74E-01
51	3.67E+02	2.86E+05	1.28E+00
Average*	1.69E+02	2.84E+06	5.02E-01

[1]Data Source: WCS1.5Prod/WCS1.5/T-SuprInv, Ref. Date 4/28/05

*Tanks 11, 19, 21, 22, 23 and 50 removed due to low Cs-137 activities skewing average

Appendix IV

Combined Radionuclide Distribution for Low-Activity Waste

Radionuclide	Ci Present Per Ci Sludge[1]	Ci Present Per Ci Supernate[2]	Ci Present Per Ci Low-Activity Waste[3]	Scaling Factors for Low-Activity Waste, Ci/Ci Cs-137
	A	B	C=A*0.451+B*0.549	$=C_{isotope}/C_{Cs\text{-}137}$
H-3		1.59E-03	8.73E-04	3.16E-03
C-14	1.34E-08	9.44E-07	5.24E-07	1.90E-06
Co-60		1.01E-02	5.54E-03	2.00E-02
Sr-90	4.53E-01	2.29E-02	2.17E-01	7.84E-01
Y-90	4.53E-01	2.29E-02	2.17E-01	7.84E-01
Tc-99	1.28E-04	9.60E-05	1.10E-04	3.99E-04
I-129	4.66E-10	9.94E-08	5.48E-08	1.98E-07
Cs-137	2.54E-02	4.83E-01	2.77E-01	1.00E+00
Ba-137m	2.40E-02	4.57E-01	2.62E-01	9.46E-01
Pm-147	1.24E-02	1.04E-03	6.16E-03	2.23E-02
U-233	7.94E-07	4.98E-08	3.85E-07	1.39E-06
U-234	3.07E-07	4.71E-08	1.64E-07	5.94E-07
U-235	5.47E-09	1.42E-08	1.03E-08	3.71E-08
U-238		2.04E-08	1.12E-08	4.05E-08
Np-237	3.26E-07	2.31E-08	1.60E-07	5.77E-07
Pu-238	1.86E-02	6.24E-04	8.73E-03	3.16E-02
Pu-239	2.14E-04	1.30E-05	1.04E-04	3.75E-04
Pu-240	1.39E-04	2.70E-04	2.11E-04	7.62E-04
Pu-241	1.10E-02	3.47E-04	5.15E-03	1.86E-02
Pu-242	2.90E-07	6.41E-06	3.65E-06	1.32E-05
Am-241	1.32E-03	2.39E-04	7.27E-04	2.63E-03
Am-242m	8.36E-07	7.39E-06	4.43E-06	1.60E-05
Am-243		1.82E-05	9.99E-06	3.61E-05
Cm-245	2.36E-08	7.49E-08	5.18E-08	1.87E-07
Cm-246		2.49E-07	1.37E-07	4.94E-07
Cm-247		1.21E-12	6.64E-13	2.40E-12
Total	1.00E+00	1.00E+00	1.00E+00	3.61E+00

[1]From Reference 2.
[2]From Reference 4.
[3]Factors for % of low-activity waste by Ci from Table 3.1.

Appendix V
Cs-137 in Tank 48 vs. All Tanks

Tank	Sludge Cs-137 (Ci)	Supernate Cs-137 (Ci)	Precipitate Cs-137 (Ci)	Total Cs-137	Tank 48 Only Total Cs-137
1	3.68E+04	3.33E+06		3.37E+06	
2	5.07E+03	1.21E+06		1.21E+06	
3	4.44E+03	1.22E+06		1.23E+06	
4	2.21E+05	3.16E+06		3.38E+06	
5	1.82E+05	3.09E+04		2.13E+05	
6	1.93E+05	9.94E+04		2.92E+05	
7	1.30E+04	4.73E+05		4.86E+05	
8	1.99E+03	7.06E+03		9.05E+03	
9	5.47E+03	1.22E+06		1.22E+06	
10	5.69E+02	8.22E+04		8.27E+04	
11	3.86E+04	3.90E+02		3.90E+04	
12	4.40E+05	1.09E+05		5.49E+05	
13	4.19E+05	1.18E+07		1.22E+07	
14	1.19E+04	1.25E+06		1.26E+06	
15	3.77E+05	0.00E+00		3.77E+05	
17	4.28E+01	0.00E+00		4.28E+01	
18	1.22E+04	1.38E+02		1.23E+04	
19	1.14E+01	2.12E+02		2.23E+02	
21	3.07E+03	6.30E+03		9.37E+03	
22	5.81E+03	5.02E+03		1.08E+04	
23	4.23E+02	2.48E+02		6.71E+02	
24	0.00E+00	4.73E+05		4.73E+05	
25	0.00E+00	1.38E+06		1.38E+06	
26	1.18E+04	4.92E+06		4.93E+06	
27	0.00E+00	3.31E+06		3.31E+06	
28	0.00E+00	2.22E+06		2.22E+06	
29	0.00E+00	4.74E+05		4.74E+05	
30	2.06E+03	1.67E+07		1.67E+07	
31	0.00E+00	5.23E+06		5.23E+06	
32	5.23E+05	6.39E+06		6.92E+06	
33	5.20E+05	3.81E+06		4.33E+06	
34	5.06E+05	3.17E+06		3.67E+06	
35	4.65E+05	3.06E+06		3.52E+06	
36	5.16E+02	1.11E+07		1.11E+07	
37	0.00E+00	3.97E+06		3.97E+06	
38	0.00E+00	1.50E+05		1.50E+05	
39	6.46E+05	5.61E+05		1.21E+06	
40	2.25E+05	4.03E+04		2.65E+05	
41	6.33E+02	3.49E+05		3.49E+05	
42	1.59E+04	1.23E+07		1.23E+07	
43	9.91E+04	1.77E+05		2.76E+05	
44	0.00E+00	2.99E+06		2.99E+06	
45	0.00E+00	2.56E+06		2.56E+06	
46	0.00E+00	4.94E+06		4.94E+06	
47	8.91E+03	8.45E+05		8.54E+05	
48	0.00E+00	1.33E+04	4.02E+05	1.33E+04	4.15E+05
49	0.00E+00	5.67E+05		5.67E+05	
50	0.00E+00	1.26E+01		1.26E+01	
51	2.55E+05	2.54E+05		5.09E+05	
Total	5.25E+06	1.16E+08		1.21E+08	4.15E+05
% of total			0.33%	100.00%	0.34%

Source of data: WCS1.5Prod/WCS1.5, Ref. Date 4/28/05

Appendix VI

Comparison of F- and H-Area Non-Routine Waste in LAW Containers Against WAC 3.17, Rev. 9, Requirements

Waste Acceptance Criteria Evaluation for 20' Sealand

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Total Curies of Cs-137 =**	1.27E+00	Ci										
2	**Volume of a 20' Sealand =**	1.17E+03	ft^3										
3													
4	**Radionuclide**	**Category**	**FHW-00003 Waste Stream Normalized Distribution (App. IV)**	**Scaling Factors Ci/Ci Cs-137 (App. IV)**	**Total Activity of Sealand**	**Activity per Volume**	**Slit Trench Limits (Ref. 11)**	**Slit Trench Sum of Fractions**	**Engineered Trench Limits (Ref. 11)**	**Engineered Trench Sum of Fractions**	**LAWV Limits (Ref. 11)**	**LAWV Sum of Fractions**	**FGE Check**
5			(%)		(Ci)	(Ci/ft^3)	(Ci/ft^3)		(Ci/ft^3)		(Ci/ft^3)		(g)
6					E=D*B1	F=E/B3		H=F/G		J=F/I		L=F/K	Eq. From Ref. 11
8	H-3	SA	8.73E-02	3.16E-03	4.01E-03	3.42E-06	1.90E-05	1.80E-01	1.20E-05	2.85E-01	1.50E+01	2.28E-07	
9	C-14	PA	5.24E-05	1.90E-06	2.41E-06	2.05E-09	4.50E-05	4.56E-05	2.90E-05	7.08E-05	5.00E-05	4.10E-05	
10	Co-60		5.54E-01	2.00E-02	2.55E-02	2.17E-05							
11	Sr-90		2.17E+01	7.84E-01	9.96E-01	8.49E-04							
12	Y-90	Daughter	2.17E+01	7.84E-01	9.96E-01	8.49E-04							
13	Tc-99	PA	1.10E-02	3.99E-04	5.07E-04	4.32E-07	3.20E-06	1.35E-01	1.00E-06	4.32E-01	1.10E-04	3.93E-03	
14	I-129	PA	5.48E-06	1.98E-07	2.52E-07	2.14E-10	5.30E-09	4.05E-02	1.70E-09	1.26E-01	7.80E-07	2.75E-04	
15	Cs-137		2.77E+01	1.00E+00	1.27E+00	1.08E-03							
16	Ba-137m	Daughter	2.62E+01	9.46E-01	1.20E+00	1.02E-03							
17	Pm-147		6.16E-01	2.23E-02	2.83E-02	2.41E-05							
18	U-233	Fissile	3.85E-05	1.39E-06	1.77E-06	1.51E-09							2.57E-04
19	U-234	PA	1.64E-05	5.94E-07	1.77E-06	1.51E-09					2.20E-03	6.86E-07	
20	U-235	Fissile	1.03E-06	3.71E-08	4.71E-08	4.02E-11							2.18E-02
21	U-238	PA	1.12E-06	4.05E-08	5.14E-08	4.38E-11							
22	Np-237	TRU	1.60E-05	5.77E-07	7.33E-07	6.25E-10							
23	Pu-238	TRU	8.73E-01	3.16E-02	4.01E-02	3.42E-05							
24	Pu-239	Fissile/TRU	1.04E-02	3.75E-04	4.76E-04	4.06E-07							1.24E-02
25	Pu-240	TRU	2.11E-02	7.62E-04	9.68E-04	8.26E-07							
26	Pu-241	Fissile	5.15E-01	1.86E-02	2.37E-02	2.02E-05							8.01E-04
27	Pu-242	TRU	3.65E-04	1.32E-05	1.68E-05	1.43E-08							
28	Am-241	TRU	7.27E-02	2.63E-03	3.34E-03	2.84E-06							
29	Am-242m	Fissile/TRU	4.43E-04	1.60E-05	2.04E-05	1.74E-08							1.13E-04
30	Am-243	TRU	9.99E-04	3.61E-05	4.59E-05	3.91E-08							
31	Cm-245	Fissile/TRU	5.18E-06	1.87E-07	2.38E-07	2.03E-10							3.32E-05
32	Cm-246	TRU	1.37E-05	4.94E-07	6.28E-07	5.35E-10							
33	Cm-247	Fissile/TRU	6.64E-11	2.40E-12	3.05E-12	2.60E-15							5.19E-08
34	**Total**		**1.00E+02**	**3.61E+00**	**4.59E+00**	**3.91E-03**		**3.55E-01**		**8.43E-01**		**4.25E-03**	**3.54E-02**

Waste Acceptance Criteria Evaluation for 40' Sealand

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Total Curies of Cs-137 =**	2.56E+00	Ci										
2	**Volume of a 40' Sealand =**	2.40E+03	ft^3										
3													
4	**Radionuclide**	**Category**	**FHW-00003 Waste Stream Normalized Distribution (App. IV)**	**Scaling Factors Ci/Ci Cs-137 (App. IV)**	**Total Activity of Sealand**	**Activity per Volume**	**Slit Trench Limits (Ref. 11)**	**Slit Trench Sum of Fractions**	**Engineered Trench Limits (Ref. 11)**	**Engineered Trench Sum of Fractions**	**LAWV Limits (Ref. 11)**	**LAWV Sum of Fractions**	**FGE Check**
5			(%)		(Ci)	(Ci/ft^3)	(Ci/ft^3)		(Ci/ft^3)		(Ci/ft^3)		(g)
6					E=D*B1	F=E/B3		H=F/G		J=F/I		L=F/K	Eq. From Ref. 11
8	H-3	SA	8.73E-02	3.16E-03	8.08E-03	3.37E-06	1.90E-05	1.77E-01	1.20E-05	2.80E-01	1.50E+01	2.24E-07	
9	C-14	PA	5.24E-05	1.90E-06	4.85E-06	2.02E-09	4.50E-05	4.49E-05	2.90E-05	6.97E-05	5.00E-05	4.04E-05	
10	Co-60		5.54E-01	2.00E-02	5.13E-02	2.14E-05							
11	Sr-90		2.17E+01	7.84E-01	2.01E+00	8.36E-04							
12	Y-90	Daughter	2.17E+01	7.84E-01	2.01E+00	8.36E-04							
13	Tc-99	PA	1.10E-02	3.99E-04	1.02E-03	4.26E-07	3.20E-06	1.33E-01	1.00E-06	4.26E-01	1.10E-04	3.87E-03	
14	I-129	PA	5.48E-06	1.98E-07	5.07E-07	2.11E-10	5.30E-09	3.99E-02	1.70E-09	1.24E-01	7.80E-07	2.71E-04	
15	Cs-137		2.77E+01	1.00E+00	2.56E+00	1.07E-03							
16	Ba-137m	Daughter	2.62E+01	9.46E-01	2.42E+00	1.01E-03							
17	Pm-147		6.16E-01	2.23E-02	5.70E-02	2.38E-05							
18	U-233	Fissile	3.85E-05	1.39E-06	3.57E-06	1.49E-09							5.18E-04
19	U-234	PA	1.64E-05	5.94E-07	3.57E-06	1.49E-09					2.20E-03	6.76E-07	
20	U-235	Fissile	1.03E-06	3.71E-08	9.50E-08	3.96E-11							4.40E-02
21	U-238	PA	1.12E-06	4.05E-08	1.04E-07	4.32E-11							
22	Np-237	TRU	1.60E-05	5.77E-07	1.48E-06	6.16E-10							
23	Pu-238	TRU	8.73E-01	3.16E-02	8.08E-02	3.37E-05							
24	Pu-239	Fissile/TRU	1.04E-02	3.75E-04	9.59E-04	4.00E-07							2.50E-02
25	Pu-240	TRU	2.11E-02	7.62E-04	1.95E-03	8.13E-07							
26	Pu-241	Fissile	5.15E-01	1.86E-02	4.77E-02	1.99E-05							1.61E-03
27	Pu-242	TRU	3.65E-04	1.32E-05	3.38E-05	1.41E-08							
28	Am-241	TRU	7.27E-02	2.63E-03	6.72E-03	2.80E-06							
29	Am-242m	Fissile/TRU	4.43E-04	1.60E-05	4.10E-05	1.71E-08							2.28E-04
30	Am-243	TRU	9.99E-04	3.61E-05	9.25E-05	3.85E-08							
31	Cm-245	Fissile/TRU	5.18E-06	1.87E-07	4.79E-07	2.00E-10							6.70E-05
32	Cm-246	TRU	1.37E-05	4.94E-07	1.27E-06	5.27E-10							
33	Cm-247	Fissile/TRU	6.64E-11	2.40E-12	6.15E-12	2.56E-15							1.05E-07
34	**Total**		**1.00E+02**	**3.61E+00**	**9.25E+00**	**3.85E-03**		**3.50E-01**		**8.31E-01**		**4.18E-03**	**7.14E-02**

Appendix VI

Waste Acceptance Criteria Evaluation for 19 ft^3 Roll-Off

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Total Curies of Cs-137 =**	5.03E-01	Ci										
2	**Volume of a 19 ft^3 Roll-Off =**	5.13E+02	ft^3										
3													
4	**Radionuclide**	**Category**	**FHW-00003 Waste Stream Normalized Distribution (App. IV)**	**Scaling Factors Ci/Ci Cs-137 (App. IV)**	**Total Activity of Roll-Off**	**Activity per Volume**	**Slit Trench Limits (Ref.11)**	**Slit Trench Sum of Fractions**	**Engineered Trench Limits (Ref. 11)**	**Engineered Trench Sum of Fractions**	**LAWV Limits (Ref. 11)**	**LAWV Sum of Fractions**	**FGE Check**
5			(%)		(Ci)	(Ci/ft^3)	(Ci/ft^3)		(Ci/ft^3)		(Ci/ft^3)		(g)
6					E=D*B1	F=E/B3		H=F/G		J=F/I		L=F/K	Eq. From Ref. 11
8	H-3	SA	8.73E-02	3.16E-03	1.59E-03	3.09E-06	1.90E-05	1.63E-01	1.20E-05	2.58E-01	1.50E+01	2.06E-07	
9	C-14	PA	5.24E-05	1.90E-06	9.53E-07	1.86E-09	4.50E-05	4.13E-05	2.90E-05	6.41E-05	5.00E-05	3.72E-05	
10	Co-60		5.54E-01	2.00E-02	1.01E-02	1.96E-05							
11	Sr-90		2.17E+01	7.84E-01	3.94E-01	7.68E-04							
12	Y-90	Daughter	2.17E+01	7.84E-01	3.94E-01	7.68E-04							
13	Tc-99	PA	1.10E-02	3.99E-04	2.01E-04	3.91E-07	3.20E-06	1.22E-01	1.00E-06	3.91E-01	1.10E-04	3.56E-03	
14	I-129	PA	5.48E-06	1.98E-07	9.96E-08	1.94E-10	5.30E-09	3.66E-02	1.70E-09	1.14E-01	7.80E-07	2.49E-04	
15	Cs-137		2.77E+01	1.00E+00	5.03E-01	9.80E-04							
16	Ba-137m	Daughter	2.62E+01	9.46E-01	4.76E-01	9.27E-04							
17	Pm-147		6.16E-01	2.23E-02	1.12E-02	2.18E-05							
18	U-233	Fissile	3.85E-05	1.39E-06	7.01E-07	1.37E-09							1.02E-04
19	U-234	PA	1.64E-05	5.94E-07	7.01E-07	1.37E-09					2.20E-03	6.21E-07	
20	U-235	Fissile	1.03E-06	3.71E-08	1.87E-08	3.64E-11							8.64E-03
21	U-238	PA	1.12E-06	4.05E-08	2.04E-08	3.97E-11							
22	Np-237	TRU	1.60E-05	5.77E-07	2.90E-07	5.66E-10							
23	Pu-238	TRU	8.73E-01	3.16E-02	1.59E-02	3.09E-05							
24	Pu-239	Fissile/TRU	1.04E-02	3.75E-04	1.88E-04	3.67E-07							4.92E-03
25	Pu-240	TRU	2.11E-02	7.62E-04	3.84E-04	7.47E-07							
26	Pu-241	Fissile	5.15E-01	1.86E-02	9.37E-03	1.83E-05							3.17E-04
27	Pu-242	TRU	3.65E-04	1.32E-05	6.64E-06	1.29E-08							
28	Am-241	TRU	7.27E-02	2.63E-03	1.32E-03	2.57E-06							
29	Am-242m	Fissile/TRU	4.43E-04	1.60E-05	8.06E-06	1.57E-08							4.48E-05
30	Am-243	TRU	9.99E-04	3.61E-05	1.82E-05	3.54E-08							
31	Cm-245	Fissile/TRU	5.18E-06	1.87E-07	9.41E-08	1.83E-10							1.32E-05
32	Cm-246	TRU	1.37E-05	4.94E-07	2.49E-07	4.84E-10							
33	Cm-247	Fissile/TRU	6.64E-11	2.40E-12	1.21E-12	2.35E-15							2.06E-08
34	**Total**		**1.00E+02**	**3.61E+00**	**1.82E+00**	**3.54E-03**		**3.22E-01**		**7.63E-01**		**3.84E-03**	**1.40E-02**

Waste Acceptance Criteria Evaluation for 30 ft^3 Roll-Off

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Total Curies of Cs-137 =**	8.48E-01	Ci										
2	**Volume of a 30 ft^3 Roll-Off =**	7.83E+02	ft^3										
3													
4	**Radionuclide**	**Category**	**FHW-00003 Waste Stream Normalized Distribution (App. IV)**	**Scaling Factors Ci/Ci Cs-137 (App. IV)**	**Total Activity of Roll-Off**	**Activity per Volume**	**Slit Trench Limits (Ref. 11)**	**Slit Trench Sum of Fractions**	**Engineered Trench Limits (Ref. 11)**	**Engineered Trench Sum of Fractions**	**LAWV Limits (Ref. 11)**	**LAWV Sum of Fractions**	**FGE Check**
5			(%)		(Ci)	(Ci/ft^3)	(Ci/ft^3)		(Ci/ft^3)		(Ci/ft^3)		(g)
6					E=D*B1	F=E/B3		H=F/G		J=F/I		L=F/K	Eq. From Ref. 11
8	H-3	SA	8.73E-02	3.16E-03	2.68E-03	3.42E-06	1.90E-05	1.80E-01	1.20E-05	2.85E-01	1.50E+01	2.28E-07	
9	C-14	PA	5.24E-05	1.90E-06	1.61E-06	2.05E-09	4.50E-05	4.56E-05	2.90E-05	7.08E-05	5.00E-05	4.11E-05	
10	Co-60		5.54E-01	2.00E-02	1.70E-02	2.17E-05							
11	Sr-90		2.17E+01	7.84E-01	6.65E-01	8.49E-04							
12	Y-90	Daughter	2.17E+01	7.84E-01	6.65E-01	8.49E-04							
13	Tc-99	PA	1.10E-02	3.99E-04	3.39E-04	4.32E-07	3.20E-06	1.35E-01	1.00E-06	4.32E-01	1.10E-04	3.93E-03	
14	I-129	PA	5.48E-06	1.98E-07	1.68E-07	2.14E-10	5.30E-09	4.05E-02	1.70E-09	1.26E-01	7.80E-07	2.75E-04	
15	Cs-137		2.77E+01	1.00E+00	8.48E-01	1.08E-03							
16	Ba-137m	Daughter	2.62E+01	9.46E-01	8.02E-01	1.02E-03							
17	Pm-147		6.16E-01	2.23E-02	1.89E-02	2.41E-05							
18	U-233	Fissile	3.85E-05	1.39E-06	1.18E-06	1.51E-09							1.71E-04
19	U-234	PA	1.64E-05	5.94E-07	1.18E-06	1.51E-09					2.20E-03	6.86E-07	
20	U-235	Fissile	1.03E-06	3.71E-08	3.15E-08	4.02E-11							1.46E-02
21	U-238	PA	1.12E-06	4.05E-08	3.43E-08	4.38E-11							
22	Np-237	TRU	1.60E-05	5.77E-07	4.90E-07	6.25E-10							
23	Pu-238	TRU	8.73E-01	3.16E-02	2.68E-02	3.42E-05							
24	Pu-239	Fissile/TRU	1.04E-02	3.75E-04	3.18E-04	4.06E-07							8.29E-03
25	Pu-240	TRU	2.11E-02	7.62E-04	6.47E-04	8.26E-07							
26	Pu-241	Fissile	5.15E-01	1.86E-02	1.58E-02	2.02E-05							5.35E-04
27	Pu-242	TRU	3.65E-04	1.32E-05	1.12E-05	1.43E-08							
28	Am-241	TRU	7.27E-02	2.63E-03	2.23E-03	2.84E-06							
29	Am-242m	Fissile/TRU	4.43E-04	1.60E-05	1.36E-05	1.74E-08							7.55E-05
30	Am-243	TRU	9.99E-04	3.61E-05	3.06E-05	3.91E-08							
31	Cm-245	Fissile/TRU	5.18E-06	1.87E-07	1.59E-07	2.03E-10							2.22E-05
32	Cm-246	TRU	1.37E-05	4.94E-07	4.19E-07	5.35E-10							
33	Cm-247	Fissile/TRU	6.64E-11	2.40E-12	2.04E-12	2.60E-15							3.47E-08
34	**Total**		**1.00E+02**	**3.61E+00**	**3.06E+00**	**3.91E-03**		**3.55E-01**		**8.43E-01**		**4.25E-03**	**2.37E-02**