AUG 25 1997 Sta34 (67)

ENGINEERING DATA TRANSMITTAL

1. EDT 161457

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) J. G. Field, LMHC, R2-12	4. Related EDT No.: NA
5. Proj./Prog./Dept./Div.: Tank 241-B-105	6. Design Authority/ Design Agent/Cog. Engr.: MJ Kupfer	7. Purchase Order No.: NA
8. Originator Remarks: For Release gm 8/25/97		9. Equip./Component No.: NA
		10. System/Bldg./Facility: NA
11. Receiver Remarks: 11A. Design Baseline Document? [] Yes [X] No		12. Major Assm. Dwg. No.: NA
		13. Permit/Permit Application No.: NA
		14. Required Response Date:

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	HNF-SD-WM-ER-722	-	0	Preliminary Tank Characterization Report for Single-Shell Tank 241-B-105: Best-Basis Inventory	NA	1,2	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN	(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN
		Design Authority	3	—	Central Files A3-88
		Design Agent	3	—	DOE Reading Room H2-53
1	1	Cog.Eng. M. J. Kupfer [signature] 8-11-97	3	—	B. A. Higley H5-27
1	1	Cog. Mgr. K. M. Hodgson [signature] 8-12-97	3	—	TCSRC R1-10
		QA	3	—	M. D. LeClair (4) H0-50
		Safety	3	—	K. M. Hall R2-12
		Env.	3	—	J. G. Field R2-12

18.	19.	20.	21. DOE APPROVAL (if required)
M. J. Kupfer [signature] 8-11-97 Signature of EDT Originator Date	Authorized Representative for Receiving Organization Date	K. M. Hodgson [signature] 8-12-97 Design Authority/ Cognizant Manager Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (05/96) GEF097

Preliminary Tank Characterization Report for Single-Shell Tank 241-B-105: Best-Basis Inventory

B. A. Higley and J. G. Field
Lockheed Martin Hanford Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 161457 UC: 712
Org Code: 74610 Charge Code: N4G3A
B&R Code: EW3120074 Total Pages: ~~24~~ 23 gm 8/25/97

Key Words: TCR, best-basis inventory

Abstract: An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities. As part of this effort, an evaluation of available information for single-shell tank 241-B-105 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

AUG 25 1997
DATE: HANFORD
STA: 34 RELEASE ID: 67

gmahan 8/25/97

Release Approval Date Release Stamp

Approved for Public Release

HNF-SD-WM-ER-722
Revision 0

PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-B-105: BEST-BASIS INVENTORY

July 1997

B. A. Higley and J. G. Field
Lockheed Martin Hanford Corporation
Richland, Washington

Prepared for
U.S. Department of Energy
Richland, Washington

This page intentionally left blank.

PRELIMINARY TANK CHARACTERIZATION REPORT FOR SINGLE-SHELL TANK 241-B-105: BEST-BASIS INVENTORY

This document is a preliminary Tank Characterization Report (TCR). It only contains the current best-basis inventory (Appendix D) for single-shell tank 241-B-105. No TCR has been previously issued for this tank, and current core sample analyses are not available. The best-basis inventory, therefore, is based on an engineering assessment of waste type, process flowsheet data, early sample data, and/or other available information.

The *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes* (Kupfer et al. 1997) describes standard methodology used to derive the tank-by-tank best-basis inventories. This preliminary TCR will be updated using this same methodology when additional data on tank contents become available.

REFERENCE

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, and R. A. Watrous (LMHC), S. L. Lambert, and D. E. Place (SESC), R. M. Orme (NHC), G. L. Borsheim (Borsheim Associates), N. G. Colton (PNNL), M. D. LeClair (SAIC), R. T. Winward (Meier Associates), and W. W. Schulz (W^2S Corporation), 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

This page intentionally left blank.

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-B-105

This page intentionally left blank.

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-B-105

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for single-shell tank 241-B-105 was performed, and a best-basis inventory was established. This work, detailed in the following sections, provides a best-basis inventory estimate for chemical and radionuclide components in tank 241-B-105 and follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available chemical and radiological inventory estimates for tank 241-B-105 were reviewed and are summarized below:

- Surface sample of salt cake taken in January, 1976 (Horton 1976).
- Surface sample of salt cake taken before January, 1980 (Schulz 1980).
- The inventory estimate for tank 241-B-105 generated from the Hanford Defined Waste model (HDW) (Agnew et al. 1997a).

A full-depth core sample has not yet been taken from tank 241-B-105, and current sample information is not available.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

D2.1 WASTE VOLUME BASIS

Before a comparison of the HDW model-based inventory to a sample-based inventory can be made, the volume of waste in the tank must be established. A discrepancy between the volume presented in the *Waste Tank Summary Report* (Hanlon 1997) and the volume used in revision 4 of the HDW model (Agnew et al. 1997a) was noted. The basis for each of these volumes will be discussed and one volume will be selected as a basis for the calculations in this report.

Tank 241-B-105 has a very uneven surface. When the tank was salt well pumped, the majority of the waste surface sunk to a base level of about 102 cm (40 inches) (as measured at the side of the tank). However, some of the salt cake remained at the pre-pumping level, so that a ledge of waste exists near the tank walls.

One attempt at evaluating the volume of the waste is documented in *Single-Shell Tank Leak Stabilization Record* (Boyles 1996). This waste volume is the volume reported in Hanlon (1997). The Boyles document assumes that the waste ledge is a 3.7 m high (over the 102 cm base level), 3.1 m wide, annular shelf that completely encircles the inside of the tank walls. Boyles (1996) reports a total waste volume of 306 kgal (1,158 kL). Another evaluation, performed for the HDW model in Agnew et al. (1997a) assumes that the ledge is 3.1 m high (over the 102 cm base level) and 3.1 m wide, but does not completely encircle the inside of the tank walls. Agnew et al. (1997a) reports a total waste volume of 158 kgal (598 kL).

A close look at the photographs taken inside the tank shows two ledges, one on the northwest end and one on the southeast end of the tank walls, supporting the HDW approach. One other observation that supports the HDW approach is that the highest recorded solids level in the tank over the transfer history is only about 3.4 m above the 102 cm base level, indicating that the Boyles assumption of 3.1 m could not be possible (assuming the depth measurements are accurate). For these two reasons the Agnew et al. (1997a) waste volume will be considered the correct volume throughout the remainder of this evaluation.

D2.2 COMPARISON OF SAMPLING INVENTORY TO MODEL INVENTORY

Tables D2-1 and D2-2 compare tank inventory estimates for nonradioactive and radioactive analytes, based on 1976 samples, 1980 samples, and the HDW model (Agnew et al. 1997a). (The chemical species are reported without charge designation per the best-basis inventory convention). One sample-based inventory is developed from the salt cake sample presented in Schulz (1980). This inventory is calculated assuming that the salt cake sample reported in Schulz (1980) is representative of the entire tank contents. This assumption may be inaccurate since the transfer history indicates that other sludge waste types may exist on the bottom of the tank waste. A second sample-based inventory reported by Horton (1976) includes water, which is not reported in Schulz (1980). Both the Agnew et al. (1997a) and Schulz (1980) inventories assume a waste volume of 158 kgal (598 kL).

Table D2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-B-105.

Analyte	Sampling inventory estimate[a] (kg)	Sampling inventory estimate[b] (kg)	HDW model inventory estimate[c] (kg)
Al	520	< 67.8	741
Cr	NR	< 4.36	163
Fe	3,290	<5.68	5,980
Mn	6,590	< 2.63	0
Na	71,300	75,400	154,000
Ni	1.09	1.09	250
NO_2	4,410	32,800	6,080
NO_3	135,000	33,700	271,000
P as PO_4	97,900	27,800	56,900
Si as SiO_3	NR	15.3	913
S as SO_4	13,800	NR	6,640
TIC as CO_3	1,550	< 359	6,280
H_2O (wt%)	45.7	NR	44.4

HDW = Hanford Defined Waste
NR = Not reported
[a] Horton (1976)
[b] Schulz (1980)
[c] Agnew et al. (1997a).

Table D2-2. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Radioactive Components in Tank 241-B-105 (Decayed to January 1, 1994).

Analyte	Sampling inventory estimate[a] (Ci)	Sampling inventory estimate[b] (Ci)	HDW model inventory estimate[c] (Ci)
$^{89/90}Sr$	3,890	277	6,730
^{137}Cs	422	160	24,500
^{134}Cs	NR	<0.419	0.00143
^{99}Tc	NR	0.335	1.82
$^{239/240}Pu$	NR	<0.0430	32.95
^{241}Am	NR	<0.0425	0.469

HDW = Hanford Defined Waste
NR = Not reported
[a] Horton (1976)
[b] Schulz (1980)
[c] Agnew et al. (1997a).

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents is performed to identify potential errors and/or missing information that would influence the sample-based and HDW model component inventories.

D3.1 CONTRIBUTING WASTE TYPES

Tank 241-B-105 was put into service in February 1947 as the second tank in the 241-B-104, 241-B-105, and 241-B-106 cascade (referred to as the 241-B-104 cascade). The cascade received second cycle decontamination waste (2C) from B Plant. The tank was filled and waste began overflowing to tank 241-B-106 in August 1947. After tank 241-B-106 was filled in May 1948, supernatant from the 241-B-104 cascade was pumped to cribs. In July 1950, the B Plant 2C waste was diverted back to the 241-B-110 cascade (consisting of tanks 241-B-110, 241-B-111, and 241-B-112).

Starting in the third quarter of 1950, tank 241-B-105 began receiving first cycle decontamination waste (1C) from B Plant via tank 241-B-104. Supernatant was removed in the third quarter of 1952, and evaporator bottoms waste was routed to the tank.

The current waste volumes for the tanks 241-B-104, 241-B-105, and 241-B-106 cascade are shown in Table D3-1 (Agnew et al. 1997a).

Table D3-1. Waste Inventory for 241-B-104, 241-B-105, and 241-B-106 Cascade.[a]

Tank	241-B-104	241-B-105	241-B-106
Sludge volume (kL)	1,170	106	0
Salt cake volume (kL)	231	492	439

[a] Agnew et al (1997a).

The types of solids accumulated in tank 241-B-105 reported by various authors is compiled in Table D3-2. The SORWT model (Hill et al. 1995) indicates that the largest type of wastes are evaporator bottoms followed by bismuth phosphate 1C and 2C waste.

Table D3-2. Expected Solids for Tank 241-B-105.

Reference	Type
(Anderson 1990)	2C, 1C, EB
SORWT model (Hill et al. 1995)	EB, 1C, 2C
WSTRS (Agnew et al. 1997b)	2C1, 1C1, BSltCk
HDW model (Agnew et al. 1997a)	2C1, 1C2, BSltCk

1C = First cycle decontamination waste from the bismuth phosphate process
1C1 = First cycle decontamination waste from the bismuth phosphate process generated from 1944 through 1951
2C = Second cycle decontamination waste from the bismuth phosphate process
2C1 = Second cycle decontamination waste from the bismuth phosphate process generated from 1944 through 1951
BSltlCk = Salt cake waste generated from the 242-B Evaporator from 1951 until 1955
EB = Evaporator bottoms
HDW = Hanford Defined Waste
SORWT = Sort on Radioactive Waste Type
WSTRS = Waste Status and Transaction Record Summary.

D3.2 EVALUATION OF PROCESS FLOWSHEET INFORMATION

D3.2.1 Sludge Estimate

An estimate of the amount of 2C waste discharged to each cascade can be made from the fuel process history and flowsheet information (Agnew et al. 1997b). The technical manual flowsheet (GE 1944) was applied to the first time period and the Schneider flowsheet (Schneider 1951) was applied to the last two time periods (Kupfer et al. 1997, Appendix C). The results of calculations are shown in Table D3-3.

Table D3-3. Disposition of B Plant 2C Waste.

Time period	May 1945 through August 1946[a]	September 1946 through June 1950[b]	July 1950 through August 1952[b]	Total
Cascade	B-110[c]	B-104[d]	B-110[c]	B Plant
Fuel processed (MTU)	631.1	1,311.8	822.8	2,765.8
Waste component (kg)				
Bi	8,990	23,900	15,000	47,900
Cr	421	1,190	748	2,360
F	19,900	54,100	33,900	108,000
Fe	8,610	31,000	19,400	59,000
Na	283,000	675,000	423,000	1.38 E+06
NO_3	364,000	1.13 E+06	708,000	2.2 E+06
Si	4,970	13,100	8,200	26,300
PO_4	235,000	423,000	265,000	923,000
SO_4	29,500	107,000	66,800	203,000

MTU = Metric tons uranium
[a] GE (1944)
[b] Schneider (1951)
[c] The 241-B-110 cascade consists of tanks 241-B-110, 241-B-111, and 241-B-112
[d] The 241-B-104 cascade consists of tanks 241-B-104, 241-B-105, and 241-B-106.

Comparison of the calculated discharge to the 241-B-104 tank cascade with the sample-based inventory in tank 241-B-104 is shown in Table D3-4. Table D3-4 shows that most of the 2C sludge discharged to the 241-B-104 tank cascade collected in tank 241-B-104, and very little of the 2C solids overflowed to tank 241-B-105. This is consistent with the sludge volumes shown in Table D3-1 and the assumptions regarding solids retention behavior in the cascades.

Assuming that most of the sludge in tank 241-B-105 is 2C waste that overflowed from tank 241-B-104, the composition of 2C waste can be estimated from the flowsheet. Table D3-4 distributes the flowsheet projected discharge to the 241-B-104 tank cascade between tank 241-B-104 and tank 241-B-105 based on the sludge volume reported in Table D3-1.

Table D3-4. Distribution of the 241-B-104 Tank Cascade Receipts Based on Sludge Volume.

Waste component	Calculated inventory discharged to cascade (kg)	Inventory distributed to tank 241-B-104[a] (kg)	Inventory distributed to tank 241-B-105[a] (kg)
Bi	23,900	21,100	1,990
Cr	1,190	1,050	99
F	54,100	47,800	4,490
Fe	31,000	27,400	2,580
Na	675,000	596,000	56,100
NO_3	1.13 E+06	998,000	93,900
Si	13,100	11,600	1,090
PO_4	423,000	374,000	35,100
SO_4	107,000	94,000	8,890

[a] The flowsheet projected discharge to the tank 241-B-104 cascade is distributed between tanks 241-B-104 and 241-B-105 based on the sludge volumes reported by Agnew et al. (1997a).

D3.2.2 B Salt Cake Estimates

The best basis for the B salt cake in tank 241-B-105 is the Schulz (1980) sample data. This is compared with tank 241-B-106 B salt cake sample results in Table D3-5. A tank 241-B-105 salt cake inventory estimate was calculated using the best-basis B salt cake concentrations (Schulz 1980), where available, the salt cake volume of 492 kL (Agnew et al. 1997a), and a sample density of 1.48 g/mL.

Table D3-5. Tank 241-B-105 Salt Cake Inventory Estimates.

Waste component	241-B-105 sample-based concentration[a] (μg/g)	241-B-106 sample-based concentration[b] (μg/g)	Tank 241-B-105 salt cake inventory estimate[c] (kg)
Bi	NR	7,110	5,180
Cr	6.63	393	4.83
F	NR	4,450	3,240
Fe	8.63	15,000	6.28
Na	114,500	112,000	83,400
NO_3	51,200	72,600	37,300
NO_2	49,800	7,430	36,300
Si	23.2	1,820	16.9
PO_4	42,200	72,100	30,700
SO_4	NR	16,500	12,000

[a] Schulz (1980)
[b] McCain et al. (1996)
[c] Based on 241-B-105 sample data, except where only 241-B-106 data were available.

D3.2.3 Total Inventory Estimate

A total flowsheet inventory estimate was obtained by adding the sludge and B salt cake component inventories. These inventory results and comparisons with the HDW inventory are shown in Table D3-6.

Table D3-6. Tank 241-B-105 Total Inventory Estimate.

Waste component	Sludge inventory[a] (kg)	B salt cake inventory estimate[b] (kg)	Total inventory (kg)	HDW inventory estimate[c] (kg)
Bi	1,990	5,180	7,170	3,580
Cr	99	4.83	104	163
F	4,490	3,240	7,730	1,280
Fe	2,580	6.28	2,590	5,980
Na	56,100	83,400	139,500	154,000
NO_3	93,900	37,300	131,000	271,000
NO_2	NR	36,300	36,300	6,080
Si	1,090	16.9	1110	913
PO_4	35,100	30,700	65,800	56,900
SO_4	8,890	12,000	20,900	6,640

HDW = Hanford Defined Waste

[a] The flowsheet projected discharge to the tank 241-B-104 cascade is distributed between tanks 241-B-104 and 241-B-105 based on the sludge volumes reported by Agnew et al. (1977a)

[b] Based on 241-B-105 sample data except where only 241-B-106 data were available

[c] Agnew et al. (1997a).

D3.3 DOCUMENT ELEMENT BASIS

The total flowsheet estimate and HDW inventory estimates are within a factor of 2 or 3 for all analytes.

Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valences of other analytes. In some cases this approach requires that other analyte (e.g., sodium or nitrate) inventories be adjusted to achieve the charge balance. During such adjustments the number of significant figures is not increased. This charge balance approach was consistent with that used by Agnew et al. (1997a). The calculated total hydroxide inventories based on engineering assessments and HDW model estimates were 10,200 kg and 11,700 kg, respectively.

D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

The results from this evaluation support using a combination of the sampling data and the flowsheet projection as the basis for tank 241-B-105 inventory for the following reasons:

- Sample data representative of the salt cake layer are available.

- The evaluation of tank 241-B-105 indicates that the flowsheet projection is better than the HDW model at estimating the composition of 2C solids.

The best-basis inventory estimate for nonradioactive analytes in tank 241-B-105 is presented in Table D4-1. The estimate is based on a flow sheet evaluation for the sludge and sample results for B salt cake. HDW model results are used where sample data or flowsheet results were not available.

Best-basis tank inventory radionuclide values (Table D4-2) are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. In general, waste samples have been routinely analyzed for only ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium, while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{241}Am, etc., have been infrequently analyzed. For this reason it has been necessary to derive most of the 46 key radionuclides by computer models that estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. These computer models are described in Kupfer et al. (1997), Section 6.1 and in Watrous and Wootan (1997). Model generated values for radionuclides in any of 177 tanks are reported in the HDW Rev. 4 model results (Agnew et al. 1997a). Best-basis values may be a combination of model results and sample or engineering assessment-based results where available. (No attempt has been made to ratio or normalize model results for all 46 radionuclides when values for measured nuclides disagree with the model.) For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. (1997), Section 6.1.10.

The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

D4-1. Best-Basis Inventory Estimate for Nonradioactive Components in Tank 241-B-105.

Analyte	Total inventory (kg)	Basis (M, E or C)[1]	Comment
Al	741	M	
Bi	7,170	E	
Ca	1,880	M	
Cl	1,570	M	
TIC as CO_3	6,280	M	
Cr	104	E	
F	7,730	E	
Fe	2,590	E	
Hg	2.82	M	
K	314	M	
La	0	M	
Mn	0	M	
Na	139,500	E	
Ni	250	M	
NO_2	36,300	E	
NO_3	131,000	E	
OH	10,200	C	Mass balance calculation
Pb	0	M	
PO_4	65,800	E	
Si	1,110	E	
SO_4	20,900	E	
Sr	0	M	
TOC	1.38	M	
U_{TOTAL}	9,790	M	
Zr	7.74	M	

[1] M = Hanford Defined Waste model-based
E = Engineering assessment-based
C = Calculated by charge balance; includes oxides as hydroxides, not including Co_3, No_2, No_3, Po_4, So_4, and SiO_3.

Table D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-105, Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (Ci)	Basis (M)[1]	Comment
^{3}H	1.79	M	
^{14}C	0.262	M	
^{59}Ni	0.312	M	
^{60}Co	0.058	M	
^{63}Ni	28	M	
^{79}Se	0.0553	M	
^{90}Sr	6,730	M	
^{90}Y	6,730	M	
^{93m}Nb	0.222	M	
^{93}Zr	0.263	M	
^{99}Tc	1.82	M	
^{106}Ru	2.29 E-08	M	
^{113m}Cd	0.633	M	
^{125}Sb	0.0525	M	
^{126}Sn	0.0832	M	
^{129}I	0.00343	M	
^{134}Cs	0.00143	M	
^{137m}Ba	23,200	M	
^{137}Cs	24,500	M	
^{151}Sm	206	M	
^{152}Eu	0.0404	M	
^{154}Eu	1.03	M	
^{155}Eu	3.08	M	
^{226}Ra	1.58 E-05	M	
^{227}Ac	8.07 E-05	M	
^{228}Ra	1.59 E-10	M	
^{229}Th	3.09 E-08	M	
^{231}Pa	1.74 E-04	M	
^{232}Th	7.54 E-11	M	

Table D4-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-B-105, Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total Inventory (Ci)	Basis (M)[1]	Comment
^{232}U	6.99 E-05	M	
^{233}U	3.30 E-06	M	
^{234}U	3.22	M	
^{235}U	0.143	M	
^{236}U	0.0306	M	
^{237}Np	0.0112	M	
^{238}Pu	0.166	M	
^{238}U	3.27	M	
^{239}Pu	30.6	M	
^{240}Pu	2.35	M	
^{241}Am	0.469	M	
^{241}Pu	5.61	M	
^{242}Cm	7.33 E-04	M	
^{242}Pu	2.47 E-05	M	
^{243}Am	3.24 E-06	M	
^{243}Cm	1.50 E-05	M	
^{244}Cm	7.65 E-05	M	

[1] M = Hanford Defined Waste model-based.

D5.0 APPENDIX D REFERENCES

Agnew, S. F., J. Boyer, R. Corbin, T. Duran, J. FitzPatrick, K. Jurgensen, T. Ortiz, and B. Young, 1997a, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, LA-UR-96-3860, Los Alamos National Laboratory, Los Alamos, New Mexico.

Agnew, S. F., R. A. Corbin, T. B. Duran, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1977b, *Waste Status and Transaction Record Summary (WSTRS REV. 4)*, LA-UR-97-311, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

Anderson, J. D., 1990, *A History of the 200 Area Farms*, WHC-MR-0132, Westinghouse Hanford Company, Richland, Washington.

Boyles, V. C., 1996, *Single-Shell Tank Leak Stabilization Record*, WHC-SD-RE-TI-178, Rev. 5, Westinghouse Hanford Company, Richland, Washington.

GE, 1944, *Hanford Engineer Works Technical Manual, Section C - Separations (Bismuth Phosphate Manual)*, HW-10475C, Hanford Engineer Works, General Electric Company, Richland, Washington.

Hanlon, B. M., 1997, *Waste Tank Summary Report for Month Ending January 31, 1997*, HNF-EP-0182-106, Lockheed Martin Hanford Corporation, Richland, Washington

Hill, J. G., G. S. Anderson, and B. C. Simpson, 1995, *The Sort on Radioactive Waste Type Model: A Method to Sort Single-Shell Tanks into Characteristic Groups*, PNL-9814, Rev. 2, Pacific Northwest Laboratory, Richland, Washington.

Hodgson, K. M. and M. D. LeClair, 1996, *Work Plan for Defining a Standard Inventory Estimate for Wastes Stored in Hanford Site Underground Tanks*, WHC-SD-WM-WP-311, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

Horton, J. E., 1976, *Analyses of 105-B Tank*, Letter to W. R. Christensen dated June 9, 1997, Atlantic Richfield Hanford Company, Richland, Washington.

Kupfer, M. J., A. L. Boldt, B. A. Higley, K. M. Hodgson, L. W. Shelton, and R. A. Watrous (LMHC), S. L. Lambert, and D. E. Place (SESC), R. M. Orme (NHC), G. L. Borsheim (Borsheim Associates), N. G. Colton (PNNL), M. D. LeClair (SAIC), R. T. Winward (Meier Associates), and W. W. Schulz (W^2S Corporation), 1997, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

McCain, D. J., B. C. Simpson and L. C. Amato, 1996, *Tank Characterization Report for Single-Shell Tank 241-B-106*, WHC-SD-WM-ER-601, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Schneider, K. L., 1951, *Flow Sheets and Flow Diagrams of Precipitation Separations Process*, HW-23043, Hanford Atomic Products Operation, Richland, Washington.

Schulz, W. W., 1980, *Removal of Radionuclides from Hanford Defense Waste Solutions*, RHO-SA-51, Rockwell Hanford Company, Richland, Washington.

Watrous, R. A., and D. W. Wootan, 1997, *Activity of Fuel Batches Processed Through Hanford Separations Plants, 1944 Through 1989,* HNF-SD-WM-TI-794, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.