ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 640355

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental KN ~~[x]~~ Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	B. A. Higley, LMHC, H5-27	[] Yes [X] No	8-11-97
	6. Project Title/No./Work Order No. Tank 241-T-108	7. Bldg./Sys./Fac. No. NA	8. Approval Designator NA
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-WM-ER-554, Rev. 0A	10. Related ECN No(s). NA	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? [] Yes [X] No

Add Appendix B, Evaluation to Establish Best-Basis Inventory for Single-Shell Tank 241-T-108.

14a. Justification (mark one)

Criteria Change	[]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[X]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

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-T-108 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

15. Distribution (include name, MSIN, and no. of copies)

Central Files	A3-88	K. M. Hall	R2-12
DOE Reading Room	H2-53	K. M. Hodgson	R2-11
TCSRC	R1-10	J. G. Field	R2-12
File	H5-49	J. H. Baldwin	R2-12
B. A. Higley	H5-27		
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 640355

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
[] Yes	Additional [] $	Additional [] $	Improvement []
[X] No	Savings [] $	Savings [] $	Delay []

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	M. J. Kupfer *M J Kupfer*	8-25-97	PE		
Cog. Mgr.	K. M. Hodgson *K.M. Hodgson*	8-14-97	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other	J. H. Baldwin *John Baldwin*	8/19/97	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-T-108

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

EDT/ECN: 640355 UC: 712
Org Code: 74610 Charge Code: N4G3A
B&R Code: EW3120074 Total Pages: 120

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-T-108 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

Karen A. Noland 8/25/97
Release Approval Date

AUG 25 1997
DATE:
STA: 34
HANFORD RELEASE
ID: 21
Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-554	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-T-108

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	Authorized for Release (6) Cog. Mgr. Date
0	(7) Initially released 04/02/96 on EDT-615369.	J.H. Baldwin	J.G. Kristofzski
RS 0-A	Incorporate per ECN-629979.	J.H. Baldwin	J.G. Kristofzski
		[signature]	[signature] 4/30/96
0B RS	Incorporate per ECN-640355	M.J. Kupfer	K.M. Hodgson
		MJ Kupfer 8-21-97	K.M. Hodgson 8/19/97

A-7320-005 (08/91) WEF168

APPENDIX B

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-T-108

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APPENDIX B

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-T-108

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-T-108 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

B1.0 CHEMICAL INFORMATION SOURCES

Appendix A provides characterization results from the July 1995 characterization event for tank 241-T-108. Three auger samples were obtained. A sample-based inventory was prepared based on the analytical results, a waste density of 2.35 g/mL, and a waste volume of 167 kL. The Hanford Defined Waste (HDW) model (Agnew et al. 1997a) provides tank contents estimates, derived from process flowsheets and waste volume records.

B2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The sample-based inventory estimate from Appendix A and the inventory estimate from the HDW model (Agnew et al. 1997a) for tank 241-T-108 is shown in Table B2-1 and B2-2. (The chemical species are reported without charge designation per the best-basis inventory convention.) A waste volume of 167 kL was used for both of these estimates. However, the estimates use different waste densities. The sample-based inventory uses a measured bulk density of 2.35 g/mL (based on the method used, this appears to be particle density and biases the sample-based inventory). The current HDW model uses a waste density of 1.57 g/mL. The sample-based and HDW density values used result in 33 percent difference in the sample-based and HDW inventories. Estimates obtained from the two methods for Bi, Ca, Cr, F, Na, NO_3, PO_4, SO_4, and U vary by a factor of two or more.

Table B2-1. Sample and Hanford Defined Waste Model-Based Inventory Estimates for Nonradioactive Components in Tank 241-T-108.

Analyte	Sample-based inventory estimate[a] (kg)	HDW model inventory estimate[b] (kg)	Analyte	Sample-based inventory estimate[a] (kg)	HDW model inventory estimate[b] (kg)
Al	915	1,300	NO_3	157,000	55,700
Bi	242	1,310	Pb	213	0
Ca	70.7	564	P as PO_4	49,900	19,400
Cl	<362	296	Si	599	543
Cr	7.67	39.6	S as SO_4	2,970	1,300
F	4,270	354	Sr	8.63	0
Fe	2,440	2,180	TIC as CO_3	NR	1,400
K	<95.5	61.9	TOC	NR	0.2
La	<15.9	0	U_{TOTAL}	451	5,320
Mn	72.7	0	Zn	21.0	17.8
Na	89,100	37,700	Zr	4.35	4.64
Ni	6.35	65.7	H_2O (wt%)	19.5	48.8
NO_2	2,480	1,700	Density (kg/L)	2.35	1.57

HDW = Hanford Defined Waste
NR = Not reported
[a] Appendix A.
[b] Agnew et al. (1997a).

Table B2-2. Sample-Based and Hanford Defined Waste Model-Based Inventory Estimates for Radioactive Components in Tank 241-T-108.

Analyte	Sample-based inventory estimate[a] (Ci)	HDW model inventory estimate[b] (Ci)	Analyte	Sample-based inventory estimate[a] (Ci)	HDW model inventory estimate[b] (Ci)
^{60}Co	<5.31	0.00971	^{155}Eu	<16.3	0.854
^{90}Sr	NR	1,580	^{239}Pu	NR	6.68
^{137}Cs	799	5,900	^{241}Am	<49.1	0.0733
^{154}Eu	<18.2	0.169	Total α	28	NR

HDW = Hanford Defined Waste
NR = Not reported
[a] Appendix A (sample obtained July 1995)
[b] Agnew et al. (1997a), decayed to January 1, 1994.

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B3.0 COMPONENT INVENTORY EVALUATION

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

B3.1 CONTRIBUTING WASTE TYPES

Tank 241-T-108 was put into service in September 1945 as the second tank in a three tank cascade involving tanks 241-T-107, 241-T-108, and 241-T-109. Tank 241-T-108 received 1C waste from T Plant starting the third quarter of 1945, and was full by the first quarter of 1946. The tank remained full until the second quarter of 1951 and third quarter of 1952 when the supernatant from tank 241-T-108 was pumped to tank 241-TX-118.

The tank was refilled in the fourth quarter of 1952 with TBP waste cascaded from tank 241-T-107. In the third quarter of 1953 tri-butyl phosphate (TBP) supernatant was sent to tank 241-TX-118 to feed the 242-T evaporator. Tank 241-T-108 was refilled with evaporator bottoms supernatant from tank 241-TX-117 in the first quarter of 1954. In the first and second quarters of 1967 supernatant was again pumped to 241-TX-118. Tank 241-T-108 received Hanford Laboratory Operations waste and 100-N waste during the first and second quarters of 1973. Supernatant was sent to tank 241-S-110 in 1974. the rest of the supernatant in tank 241-T-108 was sent to tank 241-T-101 in 1975. Saltwell pumping was completed in the first quarter of 1977.

The current waste volumes for tank 241-T-108 are shown in Table B3-1 (Hanlon 1997). The types of solids accumulated in tank 241-T-108 reported by various authors is compiled in Table B3-2 and Table B3-3.

Table B3-1. Waste Inventory of Tank 241-T-108 (Hanlon 1997).

Waste	Volume (kL)	Volume (kgal)
Sludge	167	44
Salt cake	0	0
Supernatant	0	0
Drainable Interstitial Liquid	0	0
Total Waste	167	44

Table B3-2. Expected Solids for Tank 241-T-108.

Reference	Waste Type
Anderson (1990)	1C, TBP, EB, HLO, BNW, BL, IX
SORWT Model (Hill et al. 1995)	1C, TBP, EB, HLO
WSTRS (Agnew et al. 1997b)	1C, TBP, EB, HLO, BNW, BL, IX, NCPLX
HDW Model (Agnew et al. 1997a)	1C1, T1SltCk

1C = First cycle Bismuth phosphate process waste
1C1 = First cycle Bismuth phosphate process waste (1944-1949)
BL = B Plant low level waste
BNW = Battelle Northwest - 300 Area waste
EB = Evaporator Bottoms
HDW = Hanford Defined Waste
HLO = Hanford Laboratory Operations
IX = B Plant ion exchange waste
NCPLX = Non-complexed waste
SORWT = Sort on radioactive waste type
T1SltCk = 242-T Evaporator salt cake
TBP = Tri-butyl phosphate - uranium recovery waste
WSTRS = Waste Status and Transaction Record Summary.

Table B3-3. Hanford Defined Waste Model Solids for Tank 241-T-108.

HDW solids layer	kL	kgal
1C1	79.5	21
T1SltCk	87.1	23

1C1 = First cycle Bismuth phosphate process waste (1944-1949)
HDW = Hanford Defined Waste
T1SltCk = 242-T Evaporator salt cake (1951-1955).

B3.2 EVALUATION OF PROCESS KNOWLEDGE

The waste types and tank layers defined by the HDW model (Agnew et al. 1997a) seem reasonable based on the process history of the tank. The HDW model predicts that tank 241-T-108 contains 79.5 kL of sludge consisting of 1C waste and perhaps some TBP waste. The rest of the tank contains T1SltCk from the 242-T evaporator.

Hanlon (1997) reports a sludge volume of 167 kL (44 kgal) and no salt cake for tank 241-T-108. Based on the process knowledge for this tank and the sample description (Section 5.3), it appears that the tank contents are better defined by Agnew et al. (1997a). As a result, the Agnew et al. values are used for this evaluation. The 167 kL sludge volume reported by Hanlon (1997) appears to represent solids accumulated prior to 1973, i.e. the solids volume prior to 242-S Evaporator operation.

B3.3 ENGINEERING EVALUATION OF TANK SAMPLE INFORMATION

In July 1995 three auger samples from three separate risers were obtained and analyzed. Sample recovery was acceptable, however, analytical data indicate that the auger sampler only captured material from the salt cake layer and did not penetrate the sludge layer. Thus the analytical results in Appendix A likely represent only the top 87 kL of waste in the tank.

B3.3.1 Engineering Evaluation for the 1C Sludge Layer

In the Bismuth Phosphate Process 1C waste was combined with the cladding waste (CW) stream after being discharged from the plant. An estimate of the 1C1 sludge layer was made by assuming the sludge in tank 241-T-108 is similar to the 1C/CW sludge in other tanks. Tanks 241-T-104 and 241-T-107 provide the best examples of T Plant 1C/CW sludge composition. The composition of these two tanks, based on the analytical results documented in corresponding tank characterization reports (Sasaki et al. 1997a and 1997b), is provided in Table B3-4. The average C1/CW composition of these two tanks was used to estimate the composition of the 1C/CW layer in tank 241-T-108.

The 1C/CW layer volume of 79.5 kL, and average concentrations and density from Table B3-4 were used to estimate the 1C/CW inventory for tank 241-T-108. Table B3-5 compares the sample-based sludge inventories with HDW model estimates. The HDW model estimate is based on a density of 1.38 and a volume of 79.5 kL.

Table B3-4. Sludge Composition for Tanks 241-T-104 and 241-T-107, and Hanford Defined Waste Predictions for 1C1 Waste. (2 Sheets)

Analyte	Tank 241-T-104[a] (μg/g)	Tank 241-T-107[b] (μg/g)	Average concentration[c] (μg/g)	HDW estimate for 1C1[d] (μg/g)
Ag	1.09	<7.37	<4.2	NR
Al	16,200	16,400	16,300	11,700
Bi	18,900	11,200	15,100	9,440
Ca	1,450	1,500	1,480	2,210
Cd	5.44	6.40	5.92	NR
Cl	670	547	609	794
CO_3	<500	14,850	7,680	3,310
Cr	901	354	628	183
F	8,570	11,500	10,000	1,910
Fe	9,020	31,500	20,300	14,300
K	89.0	316	203.0	190
La	<10.4	<2	<10	0
Mn	61.8	222	142	0
Na	64,500	130,000	97,400	87,000
Ni	11.3	292	152	50.8
NO_2	4,080	11,800	7,940	7,860
NO_3	58,000	74,400	66,700	46,500
Pb	49.8	796	423	0
PO_4	75,700	114,000	94,900	79,200
Si	6,520	6,050	6,300	4,550
SO_4	3,830	10,600	7,220	3,620
Sr	99.1	962	531	0
TOC	<570	1,700	1,140	0
U_{TOTAL}	897	22,600	11,700	35,000
Zr	67.5	113	90	15.8

Table B3-4. Sludge Composition for Tanks 241-T-104 and 241-T-107, and Hanford Defined Waste Predictions for 1C1 Waste. (2 Sheets)

Radionuclide	Tank 241-T-104[a] (μCi/g)	Tank 241-T-107[b] (μCi/g)	Decayed average[c,e] (μCi/g)	HDW[d] estimate for 1C1 (μCi/g)
^{241}Am	0.0173	<0.0723	<0.0447	2.2 E-05
^{14}C	<4.5 E-05	<1.91 E-04	1.18 E-04	6.3 E-05
^{60}Co	3.0 E-04	<0.0145	<0.00647	8.7 E-06
^{134}Cs	NR	<0.0138	<0.00969	7.5 E-08
^{137}Cs	0.199	12.3	6.11	6.21
^{154}Eu	0.00326	<0.0528	<0.0259	1.2 E-04
^{155}Eu	0.00342	<0.0650	<0.030	9.3 E-04
^{3}H	<3.36 E-04	<8.06 E-04	<5.4 E-04	2.5 E-04
^{129}I	<0.0185	<5.16 E-05	<0.00923	8.1 E-07
^{237}Np	<0.0326	NR	<0.0326	2.6 E-06
^{238}Pu	<0.018	0.0114	<0.0146	3.9 E-05
$^{239/240}$Pu	0.14	0.150	0.145	0.0129
^{106}Ru	NR	<0.356	<0.179	2.1 E-13
^{79}Se	<1.52 E-04	NR	<1.52 E-04	1.3 E-05
^{90}Sr	2.63	108	54.0	5.51
^{99}Tc	6.3 E-04	<0.0505	0.256	4.3 E-04
Density (g/mL)	1.29	1.51	1.40	1.38
H_2O (wt%)	70.5	46.0	58.3	64.0

HDW = Hanford Defined Waste
NR = Not reported
1C1 = First cycle bismuth phosphate process waste (1944 - 1951)
[a] Sasaki et al. (1997a)
[b] Sasaki et al. (1997b)
[c] Average of tanks 241-T-104 and 241-T-107 concentrations
[d] Agnew (1997a), radionuclides decayed to January 1, 1994
[e] Average radionuclide values decayed to January 1, 1994.

Table B3-5. Estimated Inventory of 1C/CW Layer in Tank 241-T-108. (2 Sheets)

Analyte	Estimated concentration [a] ($\mu g/g$)	Estimated inventory[b] (kg)	HDW model estimate for 1C1/CW waste[c] (kg)
Ag	<4.2	0.467	NR
Al	16,300	1,810	1,280
Bi	15,100	1,680	1,040
Ca	1,480	165	243
Cd	5.92	0.659	NR
Cl	609	67.8	87.1
CO_3	7,680	855	364
Cr	628	69.9	20.1
F	10,000	1,110	209.8
Fe	20,300	2,260	1,560
K	203	22.6	20.1
La	<10	<1.1	0
Mn	142	15.8	0
Na	97,400	10,800	9,550
Ni	152	16.9	5.58
NO_2	7,940	884	862
NO_3	66,700	7,420	5,100
OH	NR	NR	5,490
Pb	423	47.1	0
PO_4	94,900	10,600	8,690
Si	6,300	701	499
SO_4	7,220	803	397
Sr	531	59.1	0
TOC	1,140	127	0
U_{TOTAL}	11,700	1,300	3,850
Zr	90	10.0	1.73

Table B3-5. Estimated Inventory of 1C/CW Layer in Tank 241-T-108. (2 Sheets)

Radionuclide[d]	Estimated concentration[a] (μCi/g)	Estimated inventory[b] (Ci)	HDW model estimate for 1C1/CW waste[c] (Ci)
^{60}Co	<0.00647	<0.720	9.5 E-04
^{137}Cs	6.11	680	680
^{154}Eu	<0.0259	2.88	0.013

1C1 = First cycle bismuth phosphate process waste (1944 - 1951)
CW = Cladding waste
HDW = Hanford Defined Waste
NR = Not reported.
[a] Average of tank 241-T-104 (Sasaki (1997a) and tank 241-T-107 (Sasaki 1997b)
[b] Based on a 1C/CW volume of 79.5 kL and an average density of 1.4 g/mL
[c] Agnew (1997a)
[d] Radionuclides decayed to January 1, 1994.

A sample-based estimate of the salt cake layer, based on a waste layer volume of 87.1 kL, a waste layer density of 1.74 g/mL (from Table B3-5), and the concentrations shown in Appendix A is compiled in Table B3-6. HDW model inventory estimates for T1SltCk, based on Agnew et al. (1997a) composition estimates, a waste volume of 87.1 kL, and density of 1.75 g/mL, are included for comparison.

Table B3-6. Estimated Inventory of Salt Cake Layer in Tank 241-T-108. (2 Sheets)

Analyte	Auger sample concentration (μg/g)	Estimated salt cake inventory (kg)	HDW[a] model estimate for T1SltCk (kg)
Al	2,290	346	21.3
Bi	605	91.8	275
Ca	177	26.8	322
Cl	<905	<137	210
Cr	19.2	2.91	19.6
F	10,700	1,620	144
Fe	6,110	925	615

Table B3-6. Estimated Inventory of Salt Cake Layer in Tank 241-T-108. (2 Sheets)

Analyte	Auger sample concentration ($\mu g/g$)	Estimated salt cake inventory (kg)	HDW[a] model estimate for T1SltCk (kg)
K	<239	<36.2	41.1
La	<39.8	<6.0	0
Mn	182	27.5	0
Na	223,000	33,700	28,300
Ni	<15.9	2.41	60.3
NO_2	6,210	940	841
NO_3	392,000	59,300	50,800
Pb	533	80.7	0
P as PO_4	125,000	18,900	10,750
Si	1,500	227	43.8
S as SO_4	7,430	1,120	910
Sr	21.6	3.27	0
U_{TOTAL}	1,130	171	5,340
Zr	10.9	1.65	2.92
Radionuclide	Auger sample concentration[b] ($\mu Ci/g$)	Estimated salt cake inventory (Ci)	HDW[a] model estimate for T1SltCk
^{60}Co	<0.0173	<2.62	0.00879
^{137}Cs	2.1	318	5,250
^{154}Eu	<0.0535	<8.11	0.156
^{155}Eu	<0.0538	<8.14	0.755
^{241}Am	<0.0133	<2.00	0.071
Density (g/mL)	1.74		1.75
Water (wt%)	19.5		37.7

HDW = Hanford Defined Waste
[a] Agnew (1997a)
[b] Decayed to January 1, 1994.

Table B3-7 compiles the total inventory estimate for tank 241-T-108 by adding the 1C/CW layer estimate from Table B3-5 and the salt cake layer estimate from Table B3-6. HDW Model total inventory estimates are included for comparison.

Table B3-7. Engineering Estimates of Total Inventory for Tank 241-T-108. (2 Sheets)

Analyte	1C/CW inventory (kg)	Salt cake inventory (kg)	Total inventory (kg)	HDW[a] inventory (kg)
Al	1,810	346	2,160	1,300
Bi	1,680	91.8	1,770	1,310
Ca	165	26.8	192	564
Cl	67.8	<137	<205	296
TIC as CO_3	855	NR	NR	1,400
Cr	69.9	2.91	72.8	39.6
F	1,110	1,620	2,730	354
Fe	2,260	925	3,190	2,180
K	22.6	<36.2	<58.8	61.9
La	<1.1	<6.0	<7.1	0
Mn	15.8	27.5	43.3	0
Na	10,800	33,700	44,500	37,700
Ni	16.9	2.41	19.3	65.7
NO_2	884	940	1,820	1,700
NO_3	7,420	59,300	66,700	55,700
Pb	47.1	80.7	128	0
P as PO_4	10,600	18,900	29,500	19,400
Si	701	227	928	543
S as SO_4	803	1,120	1,920	1,300
Sr	59.1	3.27	62.4	0
U_{TOTAL}	1,300	171	1,470	5,320
Zr	10.0	1.65	11.7	4.64
Radionuclide	(Ci)	(Ci)	(Ci)	(Ci)
^{60}Co	<0.72	<2.62	<3.34	0.00971
^{137}Cs	680	318	998	5,900

Table B3-7. Engineering Estimates of Total Inventory for Tank 241-T-108. (2 Sheets)

Analyte	1C/CW inventory (kg)	Salt cake inventory (kg)	Total inventory (kg)	HDW[a] inventory (kg)
^{154}Eu	2.88	<8.11	<11.0	0.169
^{155}Eu	3.34	<8.14	<11.5	0.854
^{241}Am	4.98	<2.0	<6.98	0.0733

HDW = Hanford Defined Waste
NR = Not reported.
1C/CW = First cycle bismuth phosphate process waste/cladding waste
[a] Agnew (1997a).

B3.4 DOCUMENT ELEMENT BASIS

This section compares the engineering based estimate from Table B3-7, and the inventory estimate calculated by the HDW model (Table B2-1). The sample-based inventory based on auger samples from tank 241-T-108 was likely representative of the T1 salt cake only. An engineering assessment was performed using auger sample data to estimate the inventory of the salt cake layer and sample data from other tanks to account for the inventory of analytes in the 1C/CW waste layer.

Aluminum. The estimates derived from the engineering evaluation and the HDW model for aluminum were 2,160 kg and 1,300 kg, respectively. Solubility assumptions in the HDW model are the likely source of the low aluminum inventory estimate by the HDW model.

Bismuth. The estimates derived from engineering evaluation and the HDW model for bismuth were 1,770 kg and 1,310 kg, respectively. The HDW model estimate is 74 percent of the engineering evaluation estimate.

Calcium. The estimates derived from the engineering evaluation and the HDW model for calcium were 192 kg, and 564 kg, respectively. Solubility assumptions in the model are likely the source of the high calcium inventory estimate by the HDW model.

Iron. The estimates derived from the engineering evaluation and the HDW model for iron were 3,190 kg and 2,180 kg, respectively. The HDW model based estimate is 32 percent lower than the engineering evaluation value. The iron concentration for this tank appears to be higher than has been observed in other salt cakes.

Manganese. The estimates derived from the engineering evaluation and the HDW model for manganese were 43.3 kg, and 0 kg, respectively. The HDW model does not have an identified source of manganese for this tank.

Phosphate. The estimates derived from the engineering evaluation and the HDW model for phosphate were 29,500 kg, and 19,400 kg, respectively. Solubility assumptions are the likely source of error in the HDW model.

Silicon. The estimates derived from the engineering evaluation and the HDW model for silicon were 928 kg, and 543 kg, respectively. The HDW model appears to under estimate silicon in the 1C/CW layer and the T1SltCk layer.

Sulfate. The estimates derived from the engineering evaluation and the HDW model for sulfate were 1,920 kg, and 1,300 kg, respectively. Solubility assumptions are the likely source of error in the HDW model.

Total Hydroxide. 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 was 1,400 kg. This compares to a HDW model value of 6,850 kg.

Total Inorganic Carbon. The estimate derived by the HDW model for TIC was 1,400 kg. Total inorganic carbon in the 1C/CW layer was estimated at 855 kg, however, data were not obtained for TOC in the 1C/CW layer. As a result, the HDW model estimate is used as the best-basis inventory for TIC.

Uranium. The estimates derived from the engineering evaluation and the HDW model for uranium were 1,470 kg, and 5,320 kg, respectively. The HDW model appears to substantially over estimate the amount of uranium cascaded to tank 241-T-108 from tank 241-T-107 during T-Plant transfers of bismuth phosphate waste.

B4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about the chemical and/or physical properties of tank wastes is used to perform safety analyses, engineering evaluations, and risk assessments associated with waste management activities, as well as to address regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities involve designing equipment, processes, and facilities for retrieving wastes and processing them into a form that is suitable for long-term storage. Chemical inventory information generally is derived using two approaches: (1) component inventories are estimated using the results of sample analyses; or (2) component inventories are predicted using a model based on process knowledge and historical information. The most recent model was developed by Los Alamos National Laboratory (LANL) (Agnew et al. 1997a). Information derived from these two different approaches is often inconsistent.

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 chemical information for tank 241-T-108 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

The results from this evaluation support using the sample-based estimate as modified by the engineering evaluation as the best basis for Tank 241-T-108 for the following reasons.

1. For the salt cake layer analytical results from auger samples from three different risers were used to estimate the component inventories. The sample recovery for the salt cake layer was acceptable.

2. The 1C/CW layer can be estimated from an average composition of two tanks (241-T-104 and 241-T-107) containing 1C/CW waste. The 1C/CW waste for tanks 241-T-104, 241-T-107, and 241-T-108 all came from T Plant. In addition tank 241-T-107 was the "upstream" tank from 241-T-108 in the cascade.

3. The waste types that are present in the salt cake layer cannot be predicted from process flowsheets.

Best-basis tank inventory values 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. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am, etc., have been infrequently reported. For this reason it has been necessary to derive most of the 46 key radionuclides by computer models. These models 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. 1997). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result if available. (No attempt has been made to ratio or normalize model results for all 46 radionuclides when values for measured radionuclides 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.

Best-basis inventory estimates for tank 241-T-108 are presented in Tables B4-1 and B4-2. The projected inventory is based on an engineering evaluation of the tank and the auger sample data. The radionuclide inventories shown in Table B4-2 are decayed to January 1, 1994. 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.

Table B4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-T-108 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	2,160	E	
Bi	1,770	E	
Ca	192	E	
Cl	<205	E	
TIC as CO_3	1,400	M	
Cr	72.8	E	
F	2,730	E	
Fe	3,190	E	
Hg	1.78	M	
K	61.9	M	
La	<7.1	E	
Mn	43.3	E	
Na	44,500	E	
Ni	19.3	E	
NO_2	1,820	E	

Table B4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-T-108 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E, or C)[1]	Comment
NO_3	66,700	E	
OH_{TOTAL}	1,400	E/C	Calculated from charge balance
Pb	128	E	
P as PO_4	29,500	E	
Si	928	E	
S as SO_4	1,920	E	
Sr	62.4	E	
TOC	20.3	M	
U_{TOTAL}	1,470	E	
Zr	11.7	E	

[1]S = Sample-based
M = Hanford Defined Waste model-based
E = Engineering assessment-based
E/C = Calculated by a charge balance of engineering evaluation values.

Table B4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-T-108, Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	0.287	M	
^{14}C	0.0457	M	
^{59}Ni	0.0807	M	
^{60}Co	<3.34	E	
^{63}Ni	7.26	M	
^{79}Se	0.00978	M	
^{90}Sr	1,580	M	
^{90}Y	1,580	M	Determined from ^{90}Sr value.
^{93}Zr	0.0465	M	
^{93m}Nb	0.0394	M	
^{99}Tc	0.322	M	
^{106}Ru	3.49 E-09	M	
^{113m}Cd	0.109	M	
^{125}Sb	0.00845	M	
^{126}Sn	0.0147	M	
^{129}I	6.05 E-04	M	
^{134}Cs	3.76 E-04	M	
^{137}Cs	998	E	
^{137m}Ba	944	E	Determined from ^{137}Cs value.
^{151}Sm	36.5	M	
^{152}Eu	0.0105	M	
^{154}Eu	<11.0	E	
^{155}Eu	<11.5	E	
^{226}Ra	2.96 E-06	M	
^{227}Ac	1.52 E-05	M	
^{228}Ra	4.83 E-11	M	
^{229}Th	9.35 E-09	M	
^{231}Pa	3.27 E-05	M	

Table B4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-T-108, Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{232}Th	1.35 E-11	M	
^{232}U	2.53 E-05	M	
^{233}U	1.39 E-06	M	
^{234}U	1.75	M	
^{235}U	0.0785	M	
^{236}U	0.0126	M	
^{237}Np	0.00197	M	
^{238}Pu	0.0364	M	
^{238}U	1.78	M	
^{239}Pu	6.68	M	
^{240}Pu	0.514	M	
^{241}Am	<6.98	E	
^{241}Pu	1.23	M	
^{242}Cm	1.65 E-04	M	
^{242}Pu	5.43 E-06	M	
^{243}Am	4.97 E-07	M	
^{243}Cm	3.35 E-06	M	
^{244}Cm	1.09 E-05	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based
E = Engineering assessment-based.

[2]H = High
M = Medium
L = Low

B5.0 APPENDIX B REFERENCES

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