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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 644457

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [X] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	M. J. Kupfer, LMHC, H5-49 376-6631	[] Yes [X] No	08/26/97
	6. Project Title/No./Work Order No. Tank 241-S-107	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-589, 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 E, Evaluation to Establish Best-Basis Inventory for Single-Shell Tank 241-S-107.

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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-S-107 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	B. C. Simpson	R2-12
File	H5-49		
R. T. Winward	H5-49		
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

RELEASE STAMP

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A-7900-013-1

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1. ECN (use no. from pg. 1): 644457

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	8-28-97	PE		
Cog. Mgr. K. M. Hodgson	K. M. Hodgson	8-27-97	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other B. C. Simpson	B. C. Simpson	8-27-97	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-S-107

R. T. Winward (Meier Associates) and M. J. Kupfer
Lockheed Martin Hanford Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

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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-S-107 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task.

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Janis Bishop 8/28/97
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RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-589	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-S-107

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 09/19/96 on EDT-617543.	B.C. Simpson	J.G. Kristofzski
0-A RS	Incorporate per ECN-627062.	B.C. Simpson	K.M. Hall 1/9/97
0-B RS	Incorporate per ECN-644457	M.J. Kupfer 8-28-97	K.M. Hodgson 8-28-97

A-7320-005 (08/91) WEF168

APPENDIX E

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-S-107

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APPENDIX E

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-S-107

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-S-107 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.

E1.0 CHEMICAL INFORMATION SOURCES

Available waste (chemical) information for tank 241-S-107 includes the following:

- Data from three, eight segment, push mode cores taken in 1995 that are contained in Section 4.0 and Appendix A of this Tank Characterization Report (TCR).

- The inventory estimate for this tank (Agnew et al. 1997) generated from the Hanford Defined Waste model (HDW), which was developed at the Los Alamos National Laboratory (LANL).

- Data from TCRs from other tanks with the same SMMS1 salt cake waste type: 241-S-101 (Kruger et al. 1996), 241-S-102 (Eggers et al. 1996), 241-U-106 (Brown et al. 1997), and 241-U-109 (Baldwin and Stephens 1996).

- Data from TCRs from other tanks with the same SMMS2 salt cake waste type: 241-S-101 (Kruger et al. 1996), 241-S-102 (Eggers et al. 1996), 241-U-102 (Hu et al. 1997), 241-U-107 (Jo et al. 1996), and 241-U-109 (Baldwin and Stephens 1996).

- Data from TCRs from tanks with the same Reduction-Oxidation (REDOX [R]) sludge waste type: 241-S-104 (DiCenso et al. 1994) and 241-S-101 (Kruger et al. 1996).

E2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The sample-based inventories and the HDW model inventories are listed in Tables E2-1 and E2-2. Table E2-1 lists nonradioactive components on a kilogram (kg) basis, and Table E-2 lists the radioactive components on a curie basis. The tank volume used to generate the sample-based inventories is 1,423 kL (376 kgal) total waste, based on Hanlon (1996). This includes a sludge layer of 1,109 kL (293 kgal), 261 kL (69 kgal) of salt cake, and 53 kL (14 kgal) of supernatant.

Agnew et al. (1997) also reports 1,423 kL (376 kgal) of total waste, consisting of 458 kL (121 kgal) of salt cake, 912 kL (241 kgal) of sludge, and 53 kL (14 kgal) of supernatant. The sample-based density used to calculate the inventory was 1.78 g/mL. The HDW model density estimates the waste density to be 1.61 g/mL. The chemical species are reported without charge designation per the best-basis inventory convention.

Table E2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-S-107. (2 Sheets)

Analyte	Sampling[a] inventory estimate (kg)	HDW[b] inventory estimate (kg)	Analyte	Sampling[a] inventory estimate (kg)	HDW[b] inventory estimate (kg)
Al	121,000	210,000	Ni	3,120	1,230
Ag	89.5	NR	NO_2	75,300	78,000
B	344	NR	NO_3	141,000	241,000
Ba	54.1	NR	OH	NR	524,000
Bi	<101	81.3	oxalate	10,200	1.46
Ca	1,190	7,590	Pb	290	19,000
Cl	5,080	3,690	PO_4	52,700	2,640
Cr	8,610	5,520	Si	5,210	1,170
Cu	63.2	NR	SO_4	5,930	8,550
F	34,800	7,210	Sr	588	NR
Fe	5,610	27,600	TIC as CO_3	26,000	19,600
Hg	NR	655	TOC	4,150	5,800
K	1,310	1,550	U_{TOTAL}	16,700	35,400
La	<44.5	1.75	Zn	544	NR
Mg	341	NR	Zr	23,700	5,770
Mn	1,380	67.2	H_2O (wt%)	32.1	36.7

Table E2-1. Sample-Based and Hanford Defined Waste-Based Inventory Estimates for Nonradioactive Components in Tank 241-S-107. (2 Sheets)

Analyte	Sampling[a] inventory estimate (kg)	HDW[b] inventory estimate (kg)	Analyte	Sampling[a] inventory estimate (kg)	HDW[b] inventory estimate (kg)
Mo	46.6	NR	density (kg/L)	1.78	1.61
Na	211,000	255,000			
NH_4	NR	2,740			

HDW = Hanford Defined Waste
NR = Not reported
[a] Section 4.2 of this TCR
[b] Agnew et al. (1997).

Table E2-2. Sample-Based and Hanford Defined Waste Predicted Inventory Estimates for Radioactive Components in Tank 241-S-107.

Analyte	Sampling[a] inventory estimate (Ci)	HDW[b] inventory estimate (Ci)
^{90}Sr	404,000	380,000
^{137}Cs	214,000	134,000
$^{239/240}Pu$	2,200[c]	1,710
Total α	2,200	NR

HDW = Hanford Defined Waste
NR = Not reported
[a] Section 4.2 of this TCR, radionuclides decayed to January 1, 1994
[b] Agnew et al. (1997), radionuclides decayed to January 1, 1994
[c] All total alpha activity assumed to be $^{239/240}Pu$.

E3.0 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.

See Section 2.3 of this TCR for a detailed waste transfer history of tank 241-S-107. Tank 241-S-107 is the first in a three-tank cascade series that includes tanks 241-S-108 and 241-S-109.

A brief summary of the waste transfer history (Anderson 1990 and Agnew et al. 1995) is as follows:

- Received REDOX waste and REDOX cladding waste 1952 through 1967
- Received zirconium cladding waste 1967
- Received transfers of REDOX evaporator bottoms, cladding waste, supernatant waste such as 242-T Evaporator (salt cake) waste, B Plant low-level waste (LLW), organic wash waste, REDOX ion exchange waste, decontamination waste, PUREX high-level waste, PUREX LLW, N Reactor waste, partially neutralized feed, double-shell slurry feed, laboratory waste, REDOX waste, Battelle Northwest waste, cesium supernatant recovery waste, 224-U (LaF_3) waste, and noncomplexed waste from 1968 through 1980

E3.1 CONTRIBUTING WASTE TYPES

The following are reported waste types in tank 241-S-107:

Agnew et al. (1995) and (1997): R, CWR, CW/Z1, RSltCk, SMMT2, SMMS1, SMMS2
Hill et al. (1995): R, EB, CW, IX-MIX

Waste abbreviations:

R	=	high-level REDOX waste
CWR1	=	REDOX cladding waste (aluminum clad fuel) 1952 to 1957
CWR2	=	REDOX cladding waste (aluminum clad fuel) 1958 to 1966
CW/Z1	=	PUREX Zr Cladding Waste 1968 to 1972
RSltCk	=	REDOX salt cake
SMMT2	=	Supernatant Mixing Model T, (1965 to 1976, later period), a mixture of concentrated supernatant coming from the 242-T Evaporator that is a blend of waste types that upon cooling precipitated as a salt cake
SMMS1	=	Supernatant Mixing Model S, (1973 to 1976, early period), a mixture of concentrated supernatant coming from the 242-S Evaporator that is a blend of waste types that upon cooling precipitated as a salt cake
SMMS2	=	Supernatant Mixing Model S, (1977 to 1980, later period), a mixture of concentrated supernatant coming from the 242-S Evaporator that is a blend of waste types that upon cooling precipitated as a salt cake
EB	=	Evaporator bottoms (same as salt cake)
IX	=	Ion exchange waste
MIX	=	Mixture of smaller quantities of miscellaneous waste types

Table E3-1 provides estimated volumes for these waste types from Agnew et al., 1997. Those assumed for the engineering assessment are also shown in Table E3-1. The bases for the assumed volumes are discussed in the following paragraphs.

Table E3-1. Hanford Defined Waste and Engineering Assessment Solids Volumes for Tank 241-S-107.

HDW Solids Layer	kL	kgal	Engineering Assessment	kL	kgal
R1	348.2	92	R	1,041	275
CWR1	336.9	89	CWR	none	none
CWR2	159	42	CWR2	none	none
CW/Z1	68.1	18	CW/Z1	68.1	18
RSltCk	49.2	13	RSltCk	none	none
SMMT2	147.6	39	SMMT2	none	none
SMMS1	177.9	47	SMMS1	177.9	47
SMMS2	83.3	22	SMMS2	83.3	22
Total Solids	1,370	362	Total Solids	1,370	362
Supernatant	53	14	Supernatant	53	14
Total Tank	1,423	376	Total Tank	1,423	376

HDW = Hanford Defined Waste.

Based on the evaluation of segment level data in Appendix A, the top portion of the cores appears to be salt cake, while the majority of the cores appeared to be sludge like material. The three cores all appear quite different as if different layers are sometimes represented in the same segment in the three different cores. It is not possible to separate out all these waste types from the segment data. The CWR, SMMT2, and RSltCk are either blended with the R waste or are present in such small proportions that they cannot be distinguished.

CW/Z1 waste is contained in more than one segment and in non adjoining segments in the three cores. The engineering assessment assumes that the "RSltCk" reported in this tank to be somewhat equivalent to R waste and will treat all sludge as "R" waste, except for the CW/Z1 waste layer. Page Att-8 of Attachment 1 to this TCR shows the data anomalies from a statistical approach, which comes to a different conclusion than either Hanlon (1996) or Agnew et al. (1997). Upon examining these regions, it appears that some contain mixtures of the waste types, a good example being the wider distribution of the CW/Z1 pattern in the

overall waste. This engineering assessment could not spatially break out all these component layers in the waste. Therefore, the more simple approach stated in Table E3-1 was adopted.

The sample-based inventory did not quantitate the supernatant contribution to the inventory and, therefore, to maintain the parallel for comparison, the engineering assessment-based inventory did not incorporate the supernatant in its calculations. Ignoring the supernatant causes very little difference in the projected inventory. The engineering assessment used the commonly reported total waste volume of 1,423 kL (376 kgal) and the supernatant volume of 53 kL (14 kgal). The Hanlon (1996) assignment of 261.2 kL (69 kgal) of salt cake and 1,109 kL (293 kgal) of sludge was used in the engineering assessment as there was no justification found in substituting Agnew et al.'s (1997) salt cake and sludge volumes instead. The Hanlon based volumes are the official volume unless compelling evidence demonstrates the volumes should be modified.

D3.2 ASSUMPTIONS

The following evaluation provides an engineering assessment of tank 241-S-107 contents. For this evaluation, the following assumptions and observations are made:

- Tank waste mass is calculated using the measured average density from tanks with similar waste types and the total tank volume listed in Hanlon (1996). The Hanlon salt cake and sludge volumes are used.

- Only the SMMS1 and SMMS2 salt cake waste streams and the "R" and CW/Z1 sludge waste streams contributed to solids formation. The "R" waste stream does contain some portion of CWR waste and RSltCk waste but these all appear to be similar to the R waste type.

- The salt cake and sludge can be estimated by using sample-based concentrations or inventories from similar wastes for calculating the predicted engineering data set (see Section E1.0 for which tanks are involved). For the CW/Z1 waste stream, the Hill (1995) flowsheet was used to approximate the analyte inventories from this waste type.

- No radiolysis of NO_3 to NO_2 and no additions of NO_2 to the waste for corrosion purposes are factored into this evaluation.

E3.3 BASIS FOR CALCULATIONS USED IN THIS ENGINEERING EVALUATION

The general approach in this engineering assessment is to identify waste types and their approximate volumes within the tank of interest. The sources of information may include analytical data from samples taken from the tank of interest, analytical data from other tanks thought to contain waste types similar to those thought to be in the tank of interest, and data

from models utilizing historical process records. The confidence level assigned to the best-basis inventory values then depends on the level of agreement among the various information sources, and the number of different waste types in the tank. This approach is, of course, best suited for cases where extensive analytical data exist from multiple sampling events from a number of tanks containing similar waste types. The fact that Agnew et al. (1997) predicts 9 separate waste types to exist in this tank makes an accurate comparison very difficult.

E3.3.1 Basis for Salt Cake Calculations Used in this Engineering Evaluation

Sample concentrations from other TCR Based tanks with SMMS1 and SMMS2 salt cakes were used to predict the salt cake inventories. Waste records and sample-based data for tank 241-S-107 indicate that the salt cake in this tank should be similar to those used to predict the inventories.

After reviewing existing TCRs, four tanks were chosen which contained analytical characterization data that could be ascribed to layers of SMMS1 salt cake. In addition, five tanks were chosen that contained analytical characterization data that could be ascribed to layers of SMMS2 salt cake.

Analytical concentration data of certain segments from tank 241-S-101, 241-S-102, 241-U-106, and 241-U-109 were selected as being representative of SMMS1 salt cake. Other analytical concentration data from different segments from tank 241-S-101, 241-S-102, 241-U-102, 241-U-107, and 241-U-109 were selected as being representative of SMMS2 salt cake.

The mean analyte concentrations for each tank are listed in Table E3-2 for non-radionuclides and radionuclides for SMMS1 salt cake and Table E3-3 for non-radionuclides and radionuclides for SMMS2 salt cake. The SMMS1 and SMMS2 average waste concentration derived from the composite average of the tanks is also shown in Table E3-2 and Table E3-3 respectively. The last column in each of these tables uses the average concentrations for the SMMS salt cake tanks to estimate the salt cake inventory for tank 241-S-107.

Calculations for Table E3-2 and Table E3-3 are: (average concentration of analyte in μg/g) x (waste in kgal) x 3,785 L/kgal x 1,000 mL/L x (density in g/mL) x kg/(1E+09) μg = total kg for this waste type in the tank.

Table E3-2. SMMS1 Salt Cake Concentrations. (2 Sheets)

Analyte	241-S-101[a] segments 2L-4U[a] (μg/g)	241-S-102 segments 7L-10U[b] (μg/g)	241-U-106 segments 2U-4L[c] (μg/g)	241-U-109 segments 5U-8L[d] (μg/g)	Average concentration[e] (μg/g)	Calculated SMMS1 Inventory for tank 241-S-107[f] (μg/g)
Al	18,000	15,085	13,620	13,625	15,100	4,380
Ag	12	17	16	NR	15	4.4
B	110	75	80	NR	88	26
Bi	71	76	<DL	<DL	73.5	21
Ca	273	237	336	<DL	282	82
Cl	4,500	4,099	2,926	NR	3,842	1,110
Cr	10,000	4,359	3,170	4,233	5,440	1,578
F	500	13,596	4,669	NR	6,255	1,810
Fe	508	1,298	3,096	<DL	1,630	474
K	1,109	898	1,309	NR	1,110	320
La	<DL	37	43	NR	40	11.6
Mn	266	597	1,189	<DL	684	198
Na	150,000	189,500	170,500	218,300	182,000	52,770
Ni	114	49	304	<DL	155	45
NO_2	91,000	40,100	56,000	42,900	57,500	16,670
NO_3	110,000	99,200	147,200	297,000	163,000	47,300
Pb	91	137	348	NR	192	56
PO_4	9,500	114,500	5,888	5,970	34,000	9,900
P	2,290	33,900	1,949	<DL	12,700	3,700
S	5,940	2,683	3,878	NR	4,170	1,208
Si	5,269	517	176	<DL	1,990	576
SO_4	20,700	12,500	10,774	11,100	13,800	4,000
Sr	7	<DL	<DL	NR	7	2
TOC	1,900	5,340	24,626	3,920	8,950	2,594
U	560	1,403	781	<DL	914	265
Zn	30	32	54	<DL	39	11.2
Zr	14	39	88	NR	47	13.6
Oxalate	15,400	15,700	9,880	NR	13,700	3,970
Density g/mL	1.58	1.69	1.57	1.67	1.63	NA

Table E3-2. SMMS1 Salt Cake Concentrations. (2 Sheets)

Analyte	241-S-101 segments 2L-4U[a] (μg/g)	241-S-102 segments 7L-10U[b] (μg/g)	241-U-106 segments 2U-4L[c] (μg/g)	241-U-109 segments 5U-8L[d] (μg/g)	Average concentration[e] (μg/g)	Calculated SMMS1 Inventory for tank 241-S-107[f] (μg/g)
Radionuclides[g] (μCi/g)						
^{90}Sr	252	23	77	9	90	27,600
^{137}Cs	175	121	175	142	153	44,620

<DL = Less then the Detectable Limit.
HDW = Hanford Defined Waste
NA = Not applicable
NR = Not reported
SMMS1 = Supernatant Mixing Model 242-S Evaporator salt cake generated from 1973 until 1976

[a] Kruger et al. (1996)
[b] Eggers et al. (1996)
[c] Brown et al. (1997)
[d] Baldwin and Stephens (1996)
[e] Average of tank 241-S-101, 241-S-102, 241-U-106, and 241-U-109 concentrations
[f] Agnew et al. (1996), radionuclides decayed to January 1, 1994
[g] Radionuclides are reported as of the date of sample analysis.

Table E3-3. SMMS2 Salt Cake Concentrations. (2 Sheets)

Analyte	241-S-101 segments 1U-2U[a] (μg/g)	241-S-102 segments 2U-5L[b] (μg/g)	241-U-102 segments 2U[c] (μg/g)	241-U-107 segments 2U-6L[d] (μg/g)	241-U-109 segments 1L-4U[e] (μg/g)	Average concentration[f] μg/g	Tank 241-S-107 SMMS2 salt cake inventory[g] (kg)
Al	16,925	7,450	10,505	10,612	9,487	10,996	1,492
Ag	12	17	13	16	NR	14	1.9
B	111	58	67	89	NR	81	11
Bi	51	<DL	<DL	270	<DL	161	22
Ca	274	233	310	298	<DL	279	38
Cl	4,607	2,981	4,550	2,515	3,560	3,643	494
Cr	8,163	1,577	2,417	2,570	2,570	3,459	470
F	638	267	896	501	299	520	71
Fe	453	65	565	767	1,630	696	94
K	1,225	748	1,360	914	NR	1,062	144
Mn	541	26	137	330	<DL	258	35

Table E3-3. SMMS2 Salt Cake Concentrations. (2 Sheets)

Analyte	241-S-101 segments 1U-2U[a] (μg/g)	241-S-102 segments 2U-5L[b] (μg/g)	241-U-102 segments 2U[c] (μg/g)	241-U-107 segments 2U-6L[d] (μg/g)	241-U-109 segments 1L-4U[e] (μg/g)	Average concentration[f] μg/g	Tank 241-S-107 SMMS2 salt cake inventory[g] (kg)
Na	153,000	207,000	176,000	205,667	237,333	195,800	50
Ni	115	19	77	56	<DL	67	9
NO_2	58,150	28,939	36,250	27,600	42,900	38,768	5,260
NO_3	218,500	514,000	293,000	455,333	407,333	377,633	54,200
Pb	66	47	<DL	149	NR	87	12
PO_4	9,230	15,589	19,950	13,509	5,970	12,850	1,740
P	2,333	2,860	6,187	2,580	7,780	4,348	590
S	4,713	1,325	4,037	1,090	NR	2,791	379
Si	<DL	219	148	194	1,220	445	60
SO_4	21,185	8,553	12,785	4,112	11,000	11,527	1,560
Sr	48	<DL	<DL	9	NR	28	3.80
TOC	NR	1,898	6,417	2,414	2,330	3,265	443
U	1,497	<DL	<DL	430	<DL	964	131
Zn	33	21	33	29	NR	29	3.9
Zr	13	<DL	<DL	13	NR	13	1.7
Radionuclide[h] (μCi)							
^{90}Sr	252	NR	<DL	0.297	4.81	86	11,660
^{137}Cs	160.15	NR	136.5	62.06	89.1	112	15,190

<DL = Less than detectable limit15,190
HDW = Hanford Defined Waste
NR = Not reported
SMMS2 = Supernatant Mixing Model 242-S Evaporator salt cake generated from 1977 until 1980
[a] Kruger et al. (1996)
[b] Eggers et al. (1996)
[c] Hu et al. (1997)
[d] Jo et al. (1996)
[e] Baldwin and Stephens (1996)
[f] Average of tank 241-S-101, 241-S-102, 241-U-102, 241-U-107, and 241-U-109 concentrations
[g] Agnew et al. (1997), radionuclides decayed to January 1, 1994
[h] Radionuclides are reported as of the date of sample analysis.

The average SMMS combined concentrations for key components in tank 241-S-107 are shown in Table E3-4. The SMMS1 and SMMS2 average concentrations from the engineering assessment-based data were weighted to give the combined average concentration to compare to the HDW average SMM concentrations for this tank. The HDW predicted concentrations for the combined (SMMS) salt cake are compared to the weighted average SMMS1 and SMMS2 concentration values of the engineering assessment in Table E3-4.

Table E3-4. Tank 241-S-107 SMM Average Concentration Comparisons. (2 Sheets)

Analyte	Tank 241-S-107 SMMS1 and SMMS2 weighted average (μg/g)	HDW model SMM for tank 241-S-107 (average)[a] (μg/g)
Al	13,800	20,300
Bi	102	126
Ca	281	668
Cl	3,780	4,120
Cr	4,810	3,450
F	4,430	562
Fe	1,340	311
K	1,090	1,220
La	NR	2.72
Mn	548	104
Na	186,000	154,000
Ni	127	182
NO_2	51,540	52,100
NO_3	231,000	142,000
Pb	159	95.4
PO_4	27,270	4,090
P	10,040	NR
S	3,730	NR
Si	1,500	1,120
SO_4	13,060	11,700
Sr	13.7	0
TOC	7,140	8,980
U	930	1,100
Zr	36.2	10.1
Oxalate	11,300	2.25

Table E3-4. Tank 241-S-107 SMM Average Concentration Comparisons. (2 Sheets)

Analyte	Tank 241-S-107 SMMS1 and SMMS2 weighted average (μg/g)	HDW model SMM for tank 241-S-107 (average)[a] (μg/g)
Radionuclide (μCi/g)		
^{90}Sr	88.7[b]	64.6
^{137}Cs	140[b]	149
wt% H_2O	29	49.0

HDW = Hanford Defined Waste (Agnew et al. 1996)
NR = Not reported
[a] Agnew et al. (1997) radionuclides decayed to January 1, 1994
[b] Reported as of the sample analysis date.

E3.3.2 Basis for Sludge Calculations used In This Engineering Evaluation.

Sample concentrations from TCR based tanks with R sludge were used to predict the sludge inventories. Waste records and sample-based data for tank 241-S-107 indicate that the sludge in this tank should be similar in waste type to those used to predict the inventories. This tank is included in the tanks used for comparison, because this group of tanks is used to predict sludge in tanks without sample-based data. See Table E3-5.

The R1 Sludge ("R") concentrations used in this engineering assessment were developed with analytical data taken from TCRs for tanks 241-S-102, 241-S-104, and 241-S-107. While some CWR waste may be intermixed in tank 241-S-107, the same situation applies in the other tanks used to predict the R1 waste concentration. Thus, the R1 waste is probably a mixture including some CWR and RSltCk waste and may be considered typical of the R1 material in the tanks. Data were selected based on general predicted sludge location from Agnew et al. (1997) and in looking carefully at the segment data to see if slight adjustments were needed to produce consistent data. The data included those segments, that should be the waste type of interest and excluded top or bottom half segments that showed significant differences. The average concentrations from each tank and the segments used in the calculation are shown in Table E3-5. The mean from each tank was averaged to obtain the projected concentration for each analyte for the R1 sludge.

The HDW model values for R1 sludge are also listed in Table E3-5 for comparison with the R1 Sludge engineering assessment concentration values. The sludge layer inventory estimates using the engineering assessment values for R1 Sludge are also listed in the last column of Table E3-5. This inventory was calculated from the average value of the three comparison tanks.

Calculations for Table E3-5 are: (average concentration of analyte in $\mu g/g$) x (waste in kgal) x 3,785 L/kgal x 1,000 mL/L x (density in g/mL) x kg/(1E+09) μg = total kg for this waste type in the tank.

Table E3-5. R1 Sludge Concentration Estimate. (2 Sheets)

Analyte	241-S-101 segments 7U-8L[a] ($\mu g/g$)	241-S-104 (total sludge concentration)[b] ($\mu g/g$)	241-S-107 segments[c] ($\mu g/g$)	Average concentration[d] ($\mu g/g$)	R1 sludge for tank 241-S-107[e] (kg)
Al	127,000	117,000	56,400	100,000	184,200
Bi	<38.8	<45.7	NR	<42.2	<77.75
Ca	322	247	234	268	493.7
Cl	2,050	3,200	1,860	2,370	4,366
Cr	2,230	2,350	1,180	1,920	3,537
F	<65.7	145	150	<120	<221
Fe	1,960	1,720	1,160	1,613	2,972
K	539	300	457	432	795.9
Mn	2,750	1,150	83	1,330	2,450
Na	112,000	121,000	60,400	97,800	180,200
Ni	90.7	56	206	118	217.4
NO_2	31,100	25,900	34,300	30,433	56,070
NO_3	119,000	191,000	57,600	122,500	225,700
Pb	37	29.6	33	33.2	61.17
PO_4	1,360	<2,190	1,630	<1,730	<3,187
Si	1,360	1,330	1,060	1,250	2,303
SO_4	897	2,270	1,300	1,489	2,743
Sr	456	424	378	420	774
TOC	NR	1,730	NR	1,730	3,187
U	7,684	6,690	8,685	7,690	14,170
Zr	36	33.6	131	66.9	123.3

Table E3-5. R1 Sludge Concentration Estimate. (2 Sheets)

Analyte	241-S-101 segments 7U-8L[a] (μg/g)	241-S-104 (total sludge concentration)[b] (μg/g)	241-S-107 segments[c] (μg/g)	Average concentration[d] (μg/g)	R1 sludge for tank 241-S-107[e] (kg)
Radionuclides (μCi/g)					
^{90}Sr	NR	301[f]	276[f]	288[f]	530,600
^{137}Cs	98[f]	60.5[f]	74[f]	77.6[f]	143,000
density (g/mL)	1.77	1.64	1.90	1.77	1.77

HDW = Hanford Defined Waste
NR = Not reported
REDOX = Reduction oxidation process
R1 = REDOX waste generated between 1952 and 1957
[a] Kruger et al. (1996)
[b] DiCenso et al. (1994)
[c] Statistically determined median R1 sludge concentrations for tank 241-S-107 contained in the attachment to Simpson et al. (1996)
[d] Average of analyte concentrations for tank 241-S-101, 241-S-104, and 241-S-107
[e] Agnew et al. (1997)
[f] Radionuclides decayed to January 1, 1994.

The presence of Zirconium Cladding Waste is obvious in this tank, based on high concentrations of Zr data from Appendix B. To estimate what major contributions came from this waste type in tank 241-S-107, the approximate composition of Zirconium Cladding Waste listed in Hill (1995) was used. The HDW model composition for these analytes is listed in Table E3-6 for comparison only.

To estimate these analytes, the g/L of Zr were divided into 23,700 kg (the total Zr reported by the sample-based inventory) to determine the volume in kL of Zirconium cladding waste discharged to produce the Zr inventory found in this tank.

The third column of Table E3-6 converts the concentration of each analyte from a mol/L to a g/L basis, so that a single formula can be used to calculate the inventory (the molecular weight of the individual analyte is needed in mol/L). By dividing 23,700 kg by 5.67 g/L, the measured amount of Zr in this waste type (and adjusting to proper units) an estimate of 838 kL (221.4 kgal) of this type of waste is obtained. More CW/Z1 could have flowed through this tank but the amount of Zr in the tank originally was contained in 838 kL (221.4 kgal) of the original waste. This volume was used to estimate the other listed analytes of this waste type.

The third to last column lists the assumed ratio of precipitation of the analytes in this waste. In this case 1 means, 100 percent precipitated and 0.1 means, 10 percent precipitated. These are approximations based on experience with similar waste types and tanks, and are not based on actual observations for this waste type. Fluoride is an exception, as it usually partitions between the solids and liquid layers, but in this case it appears to precipitate almost fully in a complex compound with sodium and phosphate. This is based on the amount of original fluoride in the 838 kL (221.4 kgal) of process waste compared to the sludge volume presently in the tank. This data is used for comparison purposes only as an attempt to identify and quantitate the origin of this waste. The actual calculations are: (g/L from Hill [1995])(amount precipitated) (1.0 or 0.1) (838 kL) (1,000 L/kL) (1 kg/1000 g) = (inventory in kg).

Table E3-6. Tank 241-S-107 Zirconium Cladding Waste (CW/Z1) Calculations and Comparisons.

Analyte	HDW[a] mol/L	Hill et al. (1995) mol/L	Hill et al. (1995) g/L	Assumed precipitated	Zr cladding in 241-S-107 (kg)[c]
Al	0	0.21	5.67	1.0	4,750
F	0.77	2.25	42.75	1.0	35,800
Na	1.07	3.73	85.79	0.1	7,190
NO_2	0.007	0.17	7.82	0.1	655
NO_3	0.313	0.97	60.14	0.1	5,040
P	NR	8 E-06	2.48 E-04	1.0	0.208
U	0.012	0.018	4.284	1.0	3,590
Zr	0.1	0.31	28.28	1.0	23,700[b]

NR = Not reported

[a] HDW = Hanford Defined Waste, shown for comparison only, it is not used in calculations

[b] Sample based number not calculated from flowsheet

[c] Based on a volume of 838 kL.

E3.3.3 Inventory Comparisons

Table E3-7 contains the total engineering assessment-based inventories calculated by summing the four waste layer inventories to produce the tank inventory as shown below. Appendix B of this TCR did not account for the contribution from the supernatant (which is very minimal), and it was not accounted for in this engineering assessment either.

Table E3-7. Tank 241-S-107 Engineering Assessment Total Inventory Calculations. (2 Sheets)

Element	241-S-107 SC (kg)	241-S-107 SC (kg)	241-S-107 SL (kg)	241-S-107 SL (kg)	Total tank
	SMMS1 Salt Cake	SMMS2 salt cake	R Sludge	CW/Z1	Total kg
Al	4,380	1,492	184,200	4,750	194,800
Bi	21	22	<77.75	NR	<77.75
Ca	82	38	493.7	NR	613.7
Chloride	1,110	494	4,366	NR	5,970
Cr	1,578	470	3,537	NR	5,585
Fluoride	1,810	71	<221	35,800	37,900
Fe	474	94	2,972	NR	3,540
Pb	56	12	61.17	NR	129.2
Mn	198	35	2,450	NR	2,683
Ni	45	9	217.4	NR	271.4
NO_3	47,300	51,200	225,700	5,040	329,200
NO_2	16,670	5,260	56,070	655	78,660
Oxalate	3,970	842	NR	NR	4,812
PO_4	9,900	1,740	<3,187	NR	<14,830
P	3,700	590	468	0.208	4,758
K	320	144	795.9	NR	1,260
Si	576	60	2,303	NR	2,939
Na	52,770	26,550	180,200	7,190	266,700
Sr	2	3.80	774	NR	779.8
SO_4	4,000	1,560	2,743	NR	8,303
S	1,208	379	679.8	NR	2,267
TOC	2,594	443	3,187	NR	6,224
U	265	131	14,170	3,590	18,160
Zr	13.6	1.7	123.3	23,700	23,840

Table E3-7. Tank 241-S-107 Engineering Assessment Total Inventory Calculations. (2 Sheets)

Element	241-S-107 SC (kg)	241-S-107 SC (kg)	241-S-107 SL (kg)	241-S-107 SL (kg)	Total tank
	SMMS1 Salt Cake	SMMS2 salt cake	R Sludge	CW/Z1	Total kg
Radionuclides[a] (Ci)					
^{90}Sr	27,600	12,330	561,000	NR	600,900
^{137}Cs	44,620	15,270	143,800	NR	203,700

NR = Not reported
SC = Salt cake
SL = Sludge
[a] Radionuclides decayed to January 1, 1994.

The engineering assessment-based inventory values, the sample-based inventories, and the HDW model-based values are compared in Table E3-8. Selected comparisons follow:

Table E3-8. Comparison of Selected Component Inventory Estimates for Tank 241-S-107 Waste. (2 Sheets)

Component	Engineering Assessment (kg)	Sample-Based (kg)	HDW model-based (kg)
Al	194,800	121,000	210,000
Ca	614	1,190	7,590
Cl	5,970	5,080	3,690
Cr	5,585	8,610	5,520
F	37,900	34,800	7,210
Fe	3,540	5,610	27,600
K	1,260	1,310	1,550
Mn	2,683	1,380	67.2
Na	266,700	211,000	255,000
Ni	271	3,120	1,230
NO_2	78,660	75,300	78,000
NO_3	329,200	141,000	241,000
Oxalate	4,812	10,200	1.46
Pb	129	290	19,000

Table E3-8. Comparison of Selected Component Inventory Estimates for Tank 241-S-107 Waste. (2 Sheets)

Component	Engineering Assessment (kg)	Sample-Based (kg)	HDW model-based (kg)
PO_4	14,830	52,700	2,640
Si	2,940	5,210	1,170
SO_4	8,300	5,930	8,550
Sr	780	588	NR
TIC as CO_3	NR	26,000	19,600
TOC	6,224	4,150	5,800
U	18,160	16,700	35,400
Zr	23,840	23,700	5,770
Radionuclides[a] (Ci)			
^{90}Sr	600,900	404,000	380,000
^{137}Cs	203,700	214,000	134,000
$^{239/240}Pu$	NR	2,200	1,710
H_2O (percent)	NR	32.1	36.7

HDW = Hanford Defined Waste
NR = Not reported
[a] Radionuclides decayed to January 1, 1994.

Aluminum. Both the HDW estimated inventory and the engineering assessment-based inventory over estimate the amount of aluminum, by about two thirds for this tank. However the aluminum analytical results are from an acid digest and are probably low, as a prediction of fusion results is 363,000 kg. Since the fusion value is only a prediction and it was not used as the base number in other sections of this TCR it is not used as the best basis. Fusion analysis is necessary to determine the aluminum inventory of this tank. Acid digestion of aluminum almost always underestimates aluminum in the sludge portion of the inventory.

Calcium. The engineering assessment is about one half the sample-based value. The HDW model over predicts Ca by about 6 times. The HDW model concentrations for both sludge and salt cake is significantly higher than that of the engineering assessment-based concentration. The sludge concentration is by far the highest in the HDW model.

Chromium. For tank 241-S-107, both the HDW estimated inventory and the engineering assessment-based inventory underestimate the amount of chromium by about one third. Since there were so many waste types and transfers through this tank, the actual

physical and chemical interactions are unknown. Some unique situation within this tank, made the other predictions underestimate the inventory. For the situation found in this tank it appears both the R1 and SMM waste solubility assumptions for the HDW model are not correct.

Fluoride. The sample-based inventory estimate for tank 241-S-107 was about the same as the engineering assessment-based inventory for this analyte. The amount of fluoride shown in the tank CW/Z1 layer in the engineering assessment is probably too high with more fluoride actually ending up in the SMMS1 layer (based on tank 241-S-102 and the segment data in Appendix A of this TCR). The fluoride came from the CW/Z1 waste and is underestimated in the HDW model-based inventory. The HDW model shows a CW/Z1 starting concentration that is only one third that of what was used from the Hill, 1995 document.

Iron. The engineering assessment and the sample-based inventory agree fairly well. The HDW model over predicts Fe by about 5 times. The major source of this iron is due to the HDW model prediction, that the REDOX defined wastes for R and CWR contain significantly higher concentrations of iron, than is indicated by the known chemical REDOX flowsheets.

Lead. The engineering assessment is about half the sample-based inventory, whereas the HDW model is at least 65 times higher than the sample-based value. The beginning waste type concentrations for lead are actually much lower in the HDW model, therefore, the reason for such a large overprediction is not clear.

Manganese. The sample-based inventory estimate is about one half the engineering assessment-based inventory. The HDW model is over 20 times lower and has a very low concentration of Mn in these waste streams. REDOX flowsheets added Mn up through 1959. The HDW model doesn't assume any Mn in R flowsheets.

Nickel. The engineering assessment-based inventory is about one tenth of the sample-based inventory. The HDW model-based inventory, which is usually much higher than the sample-based inventory, is about 60 percent lower in this case. With the variety of waste types and possible pH shifts in this tank, several possibilities exist as to why Ni is higher in this tank. One possible explanation is that the Zr cladding composition changed from 0.1 percent up to 1 percent, which would have provided the additional nickel.

Nitrate. Both the HDW estimated inventory and the engineering assessment-based inventory overestimate the amount of nitrate in this tank by 70 to 90 percent. Since there were so many waste types and so much waste transferring through this tank, the actual physical and chemical interactions are unknown.

Nitrite. All three inventories are in good agreement (within less than 10 percent).

Phosphate. Like tank 241-S-102, the sample-based inventory for this tank for phosphate is at least 7 times higher than is predicted from the engineering assessment-based inventory and 20 times higher than the HDW model-based inventory. Apparently multiple waste types combined with the right physical conditions, caused a complex sodium, phosphate and fluoride compound to precipitate. Phosphate would have normally been much more soluble and would have been like the inventory predicted by the engineering assessment. The phosphate solubility is also unusual in that the water digest predicts more phosphate than does the acid digest. Phosphate is concentrated in the upper portion of the tank where the evaporator concentrates are, appears to be readily soluble and in very high concentration. The HDW model does not show phosphate in it's R1 sludge waste and seriously under estimates phosphate. The CW/Z1 waste contributed the fluoride that drove this precipitation.

Sodium. The three inventories agree within about 25 percent for this analyte.

Sulfate. Both the HDW estimated inventory and the engineering assessment-based inventory overestimate the amount of sulfate, by about one third, in this tank. Since there were so many waste types and so much waste transferring through this tank, the actual physical and chemical interactions are unknown. Some unique situation, within this tank, made the other inventories overpredict the inventory.

TOC. The engineering assessment and HDW model overpredicts TOC by about 50 and 40 percent respectively. The concentrations of TOC in the comparative waste types varies considerable between the HDW model estimates and the engineering assessment-based estimated concentrations. Other factors are involved which combined coincidentally make the comparisons appear to be more equal on a total inventory basis.

Uranium. The engineering assessment-based and sample based inventories agree quite well but the HDW model overpredicts Uranium by about 100 percent. This appears to be based on a combination of source term errors and prediction of incorrect volume of certain waste.

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 is consistent with that used by Agnew et al. (1997).

E4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as 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, processing and facilities for retrieving wastes and processing them into a form that is suitable for long-term storage.

Chemical and radiological inventory information are generally derived using three approaches: (1) component inventories are estimated using results of sample analyses, (2) component inventories are estimated using the HDW Model based on process knowledge and historical information, or (3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data. Not surprisingly, the information derived from these 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 available chemical information for tank 241-S-107 was performed, including the following:

- An inventory estimate generated by the HDW model (Agnew et al. 1997)
- A sample-based inventory estimate from three, eight segment, push cores from 1996
- An engineering evaluation which produced a predicted SMMS1 and SMMS2 salt cake; and "R" and CW/Z1 sludge inventory estimates based on comparisons developed by evaluation of similar tanks (except that the CW/Z1 was estimated from flow sheet information)

Based on this evaluation, a best-basis inventory was developed for tank 241-S-107 for which sampling information was available. The sample-based evaluation inventory was chosen as the best basis for those analytes for which sample-based analytical values were available for the following reasons:

- The sample-based inventory analytical concentrations of the other tanks compared favorably with each other and tank 241-S-107 for SMMS1 and SMMS2 salt cakes and R sludge
- No independent data sources are available to predict SMMS1 and SMMS2 compositions from process flowsheet or historical records

- The engineering assessment supported the assumption that the sample-based data appears reasonable

- For those few analytes where no values were available from the sample-based inventory, the engineering assessment-based or the HDW model values were used with notation that they also were of lower reliability

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.

The best-basis inventory for tank 241-S-107 is presented in Tables E4-1 and E4-2. The inventory values reported in Tables E4-1 and E4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Table E4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-S-107 (Effective May 31, 1997).

Analyte	Total inventory (kg)	Basis (S, M, C, or E)[1]	Comment
Al	121,000	S	Acid result, predict 363,000 for Fusion
Bi	<78	E	
Ca	1,190	S	
Cl	5,080	S	
TIC as CO_3	26,000	S	
Cr	8,610	S	
F	34,800	S	
Fe	5,610	S	
Hg	655	M	
K	1,310	S	
La	1.75	M	
Mn	1,380	S	
Na	211,000	S	
Ni	3,120	S	
NO_2	75,300	S	
NO_3	141,000	S	
OH_{TOTAL}	275,000	C	
Pb	290	S	
P as PO_4	52,700	S	
Si	5,210	S	
S as SO_4	5,930	S	
Sr	588	S	
TOC	4,150	S	
U_{TOTAL}	16,700	S	
Zr	23,700	S	

[1]S = Sample-based
M = Hanford Defined Waste model-based (Agnew et al. 1997)
E = Engineering assessment-based
C = Calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_3, NO_2, PO_4, SO_4, and SiO_3.

Table E4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-S-107 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	99.9	M	
^{14}C	13.1	M	
^{59}Ni	6.28	M	
^{60}Co	317	S	
^{63}Ni	591	M	
^{79}Se	1.74	M	
^{90}Sr	404,000	S	
^{90}Y	404,000	S	Referenced to ^{90}Sr
^{93}Zr	8.47	M	
^{93m}Nb	6.35	M	
^{99}Tc	93.0	M	
^{106}Ru	0.0036	M	
^{113m}Cd	36.9	M	
^{125}Sb	60.6	M	
^{126}Sn	2.65	M	
^{129}I	0.179	M	
^{134}Cs	1.46	M	
^{137}Cs	214,000	S	
^{137m}Ba	203,000	S	Referenced to ^{137}Cs
^{151}Sm	6,160	M	
^{152}Eu	4.91	M	
^{154}Eu	247	M	
^{155}Eu	252	M	
^{226}Ra	4.51 E-04	M	
^{227}Ac	0.00212	M	
^{228}Ra	0.0453	M	
^{229}Th	0.00106	M	
^{231}Pa	0.00224	M	
^{232}Th	0.00301	M	
^{232}U	0.235	M	

Table E4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-S-107 Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{233}U	0.895	M	
^{234}U	14.9	M	
^{235}U	0.587	M	
^{236}U	0.767	M	
^{237}Np	0.358	M	
^{238}Pu	71.6	M	
^{238}U	11.9	M	
$^{239/240}Pu$	2,200	S	
^{241}Am	30.9	M	
^{241}Pu	3,910	M	
^{242}Cm	0.151	M	
^{242}Pu	0.0223	M	
^{243}Am	0.00119	M	
^{243}Cm	0.0110	M	
^{244}Cm	0.152	M	

[1]S = Sample-based
M = Hanford Defined Waste model-based (Agnew et al. 1997)
E = Engineering assessment-based.

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E5.0 APPENDIX D REFERENCES

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