0050233

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 644493

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [x] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	M. J. Kupfer, LMHC, H5-49, 376-6631	[] Yes [X] No	08/12/98
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
	Tank 241-AW-106	NA	NA
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
	HNF-SD-WM-ER-365, Rev. 1A	NA	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

This ECN compiles all reconciliation changes made to the Best-Basis Inventory in FY 1998 and should replace Section 3.0 and Appendix D, Evaluation to Establish Best-Basis Inventory for Double-Shell Tank 241-AW-106, of the Tank Characterization Report. The reconciliation process involved correction of errata, reassessment of data outlyers, verification of uranium isotopic distribution and other alpha isotope distribution, and removal of "less than" values, etc. Changes were made to both text and tables. The inventory estimates of several waste components were revised.

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

Tank waste inventory estimates are being provided as standard source term for the various waste management activities. FY 1997 evaluation of available information for all 177 underground storage tanks was performed and published in TCRs, preliminary TCRs, or revisions to existing TCRs. In FY 1998, a reconciliation process is being performed to update the best-basis inventories. This process ensures that the latest inventory estimates are available as a consistent source-term to support the activities of TWRS disposal and other users.

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

Central Files	B1-07	K. M. Hodgson	R2-11
DIMC	H6-15	M. J. Kupfer	~~H5-49~~ R3-75
DOE Reading Room	H2-53	M. D. LeClair (3)	~~H5-49~~ R3-75
TCSRC	R1-10	J. M. Conner	R2-11
K. M. Hall	R2-12		

RELEASE STAMP

SEP 18 1998

DATE: STA: 37 HANFORD RELEASE ID: 22

A-7900-013-2 (05/96) GEF095

RECEIVED FEB 1999 EDMC

A-7900-013-1

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 644493

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	[]	Other	[X]
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	8-28-98	PE		
Cog. Mgr. K. M. Hodgson	K. M. Hodgson	9-8-98	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other J. M. Conner R2-11	J M Conner	8-31-98	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Double-Shell Tank 241-AW-106

S. L. Lambert
COGEMA Engineering Corporation, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 644493 UC: 721
Org Code: 7A110 Charge Code: N4G3A
B&R Code: EW3120074 Total Pages: 112 ja

Key Words: TCR, best-basis inventory, standard inventory

Abstract: The best-basis inventory provides waste inventory estimates that serve as standard characterization source terms for the various waste management activities. To establish a best-basis inventory for double-shell tank 241-AW-106, an evaluation of available information was performed. This work follows the methodology established in *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*, HNF-SD-WM-TI-740, Rev. 0A (Kupfer et al. 1997).

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SEP 18 1998
DATE:
STA: 37
HANFORD RELEASE
ID: 22

Christine Willingham 9-18-98
Release Approval Date Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number HNF-SD-WM-ER-365	Page 1

(2) Title
Tank Characterization Report for Double-Shell Tank 241-AW-106

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 09/28/94 on EDT-608071.	B.C. Simpson	C.S. Haller
1 RS	Incorporate per ECN-635467. CLM 5/3/97	J.G. Field J.G. Field 4/30/97	K.M. Hall Kathleen M. Hall 4/30/97
1-A RS	Incorporate per ECN-635525.	J.G. Field J.G. Field 8/20/97	K.M. Hall Kathleen M. Hall 8/20/97
1B RS	Incorporate per ECN-644493	M.J. Kupfer M.J. Kupfer 8-28-98	K.M. Hodgson K.M. Hodgson 9-8-98

A-7320-005 (08/91) WEF168

3.0 BEST-BASIS INVENTORY ESTIMATE

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 assessment of available chemical information for tank 241-AW-106 was performed, including the following:

- An inventory estimate generated by assuming the solids to be comparable with the A1sltck Saltcake formulation (Agnew et al. 1997). A1sltck saltcake concentrations were multiplied by a tank volume of 852 kL and solids density of 1.895 g/mL.

- Analytical results from a solids sample collected in 1995.

Based on this HDW model/engineering assessment, a best-basis inventory was developed for tank 241-AW-106 using the limited amount of analytical data and by assuming the other solids would be comparable to the SMMA1 formulation reported by Agnew et al. (1997). These inventories are shown in Tables 3-1 and 3-2.

Best-basis inventories based on the SMMA1 waste type are estimates only, and should be considered suspect. Core samples of the solids layer in Tank 241-AW-106 are needed for more reliable analyte inventories. The inventory values reported in Tables 3-1 and 3-2 are for tank solids only and are subject to change. Refer to the Tank Characterization Database (TCD) (LMHC 1998) for the most current inventory values.

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 Hanford Defined Waste 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. For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. 1997, Section 6.1.10.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Solids Components in Tank 241-AW-106 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, C or E)[1]	Comment
Al	51,200	M/E	
Bi	0	M/E	Bi not soluble in supernate
Ca	1,940	M/E	
Cl	3,490	M/E	
TIC as CO_3	18,100	S	
Cr	6,180	M/E	
F	1,840	M/E	
Fe	736	M/E	
Hg	0	M/E	Simpson 1998
K	3,530	M/E	
La	0	E	La not soluble in supernate
Mn	256	M/E	
Na	376,000	M/E	
Ni	510	M/E	
NO_2	121,400	M/E	
NO_3	425,000	M/E	
OH_{TOTAL}	175,000	C	
Pb	184	M/E	
PO_4	34,000	M/E	
Si	4,150	M/E	
SO_4	33,600	M/E	

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Solids Components in Tank 241-AW-106 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, C or E)[1]	Comment
Sr	2.24	S/E	Assuming 30% of Sr consists of ^{90}Sr
TOC	3,590	S	
U_{TOTAL}	2,330	S	
Zr	169	M/E	

[1]S = Sample-based (Based on 1995 Grab Sample, see Appendix B)
M = Hanford Defined Waste model-based (Agnew et al. 1997)
E = Engineering assessment-based
C = Calculated by charge balance; includes hydroxides, not including NO_2, NO_3, PO_4, and SiO_3.

Table 3-2. Best-Basis Inventory Estimates for Radioactive Solids Components in Tank 241-AW-106 Decayed to January 1, 1994 (Effective May 31, 1997). (3 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	158	M/E	
^{14}C	41.9	M/E	
^{59}Ni	2.77	M/E	
^{60}Co	34.9	S/E	Upper bounding estimate
^{63}Ni	277	M/E	
^{79}Se	4.60	M/E	
^{90}Sr	93,200	S	
^{90}Y	93,200	S	Based on ^{90}Sr
^{93}Zr	22.8	M/E	
^{93m}Nb	16.3	M/E	
^{99}Tc	204	M/E	
^{106}Ru	0.0121	M/E	
^{113m}Cd	125	M/E	

Table 3-2. Best-Basis Inventory Estimates for Radioactive Solids Components in Tank 241-AW-106 Decayed to January 1, 1994 (Effective May 31, 1997). (3 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{125}Sb	284	M/E	
^{126}Sn	6.95	M/E	
^{129}I	0.399	M/E	
^{134}Cs	3.51	M/E	
^{137}Cs	54,600	S	
^{137m}Ba	51,600	S	Referenced to ^{137}Cs
^{151}Sm	16,100	M/E	
^{152}Eu	6.61	M/E	
^{154}Eu	924	M/E	
^{155}Eu	386	M/E	
^{226}Ra	1.83E-04	M/E	
^{227}Ac	0.00107	M/E	
^{228}Ra	0.399	M/E	
^{229}Th	0.00947	M/E	
^{231}Pa	0.00515	M/E	
^{232}Th	0.0499	M/E	
^{232}U	0.308	S/M	Based on total U: Used HDW isotopic ratios
^{233}U	1.18	S/M	Based on total U: Used HDW isotopic ratios
^{234}U	1.07	S/M	Based on total U: Used HDW isotopic ratios
^{235}U	0.0409	S/M	Based on total U: Used HDW isotopic ratios
^{236}U	0.0768	S/M	Based on total U: Used HDW isotopic ratios
^{237}Np	0.714	M/E	
^{238}Pu	4.39	S/M	Based on ^{239}Pu: Used HDW isotopic ratios

Table 3-2. Best-Basis Inventory Estimates for Radioactive Solids Components in Tank 241-AW-106 Decayed to January 1, 1994 (Effective May 31, 1997). (3 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{238}U	0.777	S/M	Based on total U: Used HDW isotopic ratios
^{239}Pu	59.7	S/M	Based on $^{239/240}Pu$: Used HDW isotopic ratios
^{240}Pu	14.2	S/M	Based on $^{239/240}Pu$: Used HDW isotopic ratios
^{241}Am	250	S	
^{241}Pu	402	S/M	Based on ^{239}Pu: Used HDW isotopic ratios
^{242}Cm	0.416	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{242}Pu	0.00173	S/M	Based on ^{239}Pu: Used HDW isotopic ratios
^{243}Am	0.0227	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{243}Cm	0.0436	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{244}Cm	0.776	S/M	Based on ^{241}Am: Used HDW isotopic ratios

[1]S = Sample-based (Based on 1995 Grab Samples, see Appendix B)
M = Hanford Defined Waste model-based (Agnew et al. 1997)
E = Engineering assessment-based
M/E values based on A1sltck, 852 kl of sludge and a sludge density of 1.95 g/ml.

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AW-106

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AW-106

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 double-shell tank (DST) 241-AW-106 was performed, and a limited best basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

Available waste (chemical) information for tank 241-AW-106 includes:

- Statistical report for limited analytical data on two sludge grab samples obtained in August 1995
- M.D. Guthrie, 242-A Campaign 96-1 Post Run Document, WHC-SD-WM-PE-056, Rev 0, 1996
- Mauss, B.M., 1988, *242-A Evaporator/Crystallizer Fiscal Year 1987 Campaign Run 87-2 Post-Run Document*, WHC-SD-WM-PE-035
- Inventory estimates for this tank generated from the Hanford Defined Waste (HDW) model (Agnew, et al. 1997) developed at the Los Alamos National Laboratory (LANL).

A list of references used in this evaluation is provided at the end of this Appendix (Section D5.0).

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Tank 241-AW-106 is currently used as the slurry receiver tank for Evaporator 242-A. The slurry waste produced during 242-A Evaporator operations is initially transferred to tank 241-AW-106. The slurry waste is then either transferred to another double-shell tank for storage or rerouted back to 241-AW-102 for further volume reduction. Between A-Evaporator campaigns tank 241-AW-106 receives miscellaneous waste transfers for temporary storage.

The tank inventory estimates reported in Agnew et al. (1997) were valid as of January 1, 1994. There have been multiple evaporator campaigns in Evaporator 242-A since that date. Thus, the tank inventory estimates in Agnew et al. (1997) are no longer valid.

D3.0 COMPONENT INVENTORY EVALUATION

The following evaluation was conducted to assess various estimates of tank contents.

D3.1 WASTE HISTORY TANK 241-AW-106

The double-shell tank 241-AW-106 went into service in 1980. Initially, the tank received concentrated phosphate waste, non-complexed waste from B Plant cesium recovery, and flush water. Beginning in January 1983 the tank became a slurry receiver tank for the 242-A Evaporator. Over the next decade approximately 400 million liters of waste were transferred through this tank as part of the 242-A Evaporator operations. For a more complete history of the waste in this tank refer to the supporting document (Brevick, 1995) and the *Waste Volume Projection Historical Database* (Koreski, 1997). Also, see Section 2.3 of this TCR.

D3.2 EXPECTED TYPE OF WASTE BASED ON THIS ASSESSMENT

The following waste types are expected based on Agnew et al. (1997), and Hanlon (1997):

SMMA2 = a mixture of concentrated supernatant coming from the 242-A Evaporator that are a blend of other waste types that upon cooling partially precipitated as a saltcake.

BL = B Plant low-level waste

DSSF = Double shell slurry feed from the 242-A Evaporator 97-1Campaign

As of January 1, 1994, Agnew et al. (1997) identify the waste in the tank as 3.785 kL (1 kgal) of BL sludge and 4,200 kL (1,110 kgal) of SMMA2 supernatant. This waste (minus the solids heel) was processed through the 242-A Evaporator during Campaign 94-1. Tank 241-AW-106 was the slurry receiver tank for A-Evaporator campaigns 94-1, 94-2, 95-1 and 96-1. Therefore, the HDW Model values published in Agnew et al. (1997) do not provide a current estimate of tank contents.

Hanlon (1997) currently lists the tank as containing 863 kL (228 kgal) of sludge and 1,329 kL (351 kgal) of double shell slurry feed (DSSF) supernatant. The solids level in this tank has remained relatively constant since 1994 (Guthrie, 1996), but the supernatant level has changed continously. The DSSF supernatant was from the 242-A evaporator 97-1 campaign.

D3.3 ASSUMPTIONS USED

The following evaluation provides an engineering assessment of tank 241-AW-106 contents. For this evaluation, the following assumptions and observations are made:

- The HDW Model information for tank 241-AW-106 is of limited value in developing a best-basis tank inventory estimate.
- Limited analytical data from sludge grab samples offer a limited basis for tank inventory estimates.
- The waste transfer history for tank 241-AW-106 is too complex to allow accurate identification of the solids heel.
- To a first approximation, the DSSF solids layer in tank 241-AW-106 is assumed to be comparable to the A1 Sltck composition listed in Agnew et al. (1997).
- Because the supernatant level changes frequently, supernatant inventories for this tank were not included as part of the best basis.

D3.4. BASIS FOR CALCULATIONS USED IN THIS ENGINEERING EVALUATION

The general approach in this engineering assessment was to utilize all available information to formulate the best-basis estimate of the tank's contents. The sources of information may include analytical data from samples taken from the tank of interest, analytical data from other tanks believed to contain waste types similar to those believed 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. However, the liquids in tank 241-AW-106 change frequently because

this tank is part of the ongoing 242-A Evaporator operations. The waste transfer records indicate that ~400 million liters of waste passed through this tank between 1983 and 1993. Because this is an active tank with frequent waste transfers, there is no attempt in this engineering assessment to develop a tank inventory estimate for the liquid phase presently in the tank. This assessment only addresses the solids layer.

Based on information in the 242-A Campaign 96-1 Post Run Document (Guthrie, 1996), the solids level in this tank has remained relatively constant at 852 kL (225 kgal) since the completion of Campaign 94-2. However, the solids level measurement information reported in Guthrie (1996) indicates there is an ~30% relative standard deviation associated with the solids volume estimate. Hanlon (1997) currently lists the solids volume as 863 kL. Because of the solids level uncertainty, 852 kL (225 kgal) is assumed in this report. The uncertainty estimate is based on the large variations in solid levels among the risers measured.

It is likely the solids layer in this tank accumulated from solids separating from A-Evaporator slurry feed. Because of the large volume of waste that has passed through this tank, and uncertainties associated with solids settling for each transfer, it was not feasible to estimate the analyte concentrations in the solids heel based on A-Evaporator process history. Therefore, assuming the solids composition to be similar to that estimated for A1-sltck reports by Agnew et al. (1997), the limited analytical data from grab samples together with A1-sltck estimates were used to estimate current tank inventories.

D3.4.1 ANALYTICAL RESULTS FROM SOLIDS GRAB SAMPLES

Two solids grab samples were taken from a single riser in tank 241-AW-106 in August 1995. As can be seen by the information in Table D3-1, the scope of analyses for these samples was limited.

Table D3-1. Tank 241-AW-106, Solids Sample Analytical Results (Radionuclides decayed to January 1, 1994).

Radiochemical Analyte	Solids Radio-chemical Analysis Values (uCi/g)	Tank Inventory based on Analytical Results (Ci)	Non-radio-chemical Analytes	Solids Chemical Analysis Values (ug/g)	Tank Inventory based on Analytical Results (kg)
^{241}Am	0.15	249	TIC (as CO_3)	2,180 (10,900)	3,620 (18,100)
^{137}Cs	32.8	52,600	Total Carbon (TOC)	4,340 (2,160)	7210 (3,590)
$^{89/90}Sr$	56.1	93,200	U_{Total}	1,400	2,330
$^{239/240}Pu$	0.0445	73.9			
Total Alpha	0.222	369			
Total Beta	154	256,000			
^{60}Co	<0.0265	<44			

D3.4.2. INVENTORY ESTIMATES BASED ON A1 SALTCAKE (A1 Sltck) VALUES

It was assumed that the DSSF solids in tank 241-AW-106 are similar to those for A1sltck waste composition estimated by Agnew et al. (1997). The resulting tank inventory estimates based on saltcake values and 1995 grab sample analytical data, when available, are included in Tables D3-2 and D3-3.

Table D3-2. Estimated Tank Inventory for Non-Radioactive Components in Tank 241-AW-106 Solids, Based on A1sltck and Grab Sample Analysis.

Analyte	A1-sltck Composition[b] (ug/g)	Inventory Estimate (kg)	Analyte	A1-sltck Composition[b] (ug/g)	Inventory Estimate (kg)
Al	31,700	51,200	Ni	316	510
Bi	788	1,270	NO_2	75,169	121,400
Ca	1,200	1,940	NO_3	263,183	425,000
Cl	2,160	3,490	OH	101,369	164,000
Cr	3,830	6,180	Pb	114	184
F	1,140	1,840	PO_4	21,100	34,000
Fe	456	736	Si	2,570	4,150
Hg	4.44	7.16	SO_4	20,800	33,600
K	2,190	3,540	TIC as CO_3[c]	10,900	18,100
Mn	159	256	TOC[d]	2,160	3,590
Na	233,000	376,000	Zr	105	169
NH_3	1,290	2,080	U_{TOTAL}	1,400	2,330
H_2O (Wt%)	22.8		Density (g/mL)	1.895	

[a]Solids volume = 852 kL, Density = 1.895 g/mL
[b]Agnew et al. (1997)
[c]Based on the mean grab sample TIC value of 3,620 kg multiplied by 5
[d]Based on the mean grab sample total carbon value 7,210 kg

Table D3-3. Comparison of A1sltck and Grab Sample Radioactive Inventory Estimates for Tank 241-AW-106 Solids[a,b]. (Radionuclides decayed to January 1, 1994)

Analyte	A1-sltck Composition[c] (uCi/g)	A1-sltck Inventory estimated (Ci)	Solids Grab Sampled (Ci)	Analyte	A1-sltck Composition[c] (uCi/g)	A1-sltck Inventory estimate (Ci)	Solids Grab Sample (Ci)
$^{89/90}Sr$	88.4	142,700	93,200	^{137}Cs	151	243,800	54,600
$^{239/240}Pu$	0.048	77.5	73.9	^{241}Am	0.030	48.4	249
^{60}Co	0.0367	59.3	<44				

[a]Density = 1.895 g/mL
[b]Solids volume = 852 kL
[c]Agnew et al. (1997)

A sludge density of 1.895 g/ml was used to estimate the composition of tank 241-AW-106 solids because this value was used in the HDW model to represent the composition of the A1 saltcake. This value is relatively close to the measured sludge density of the centrifuged solids (1.95 g/ml). The sample-based value of 1.95 g/ml is based on two grab samples obtained from this tank in August 1995. Both samples were processed through a centrifuge so the reported density reflects the measured density of the centrifuged solids (a total of four measurements, including duplicate measurements). The HDW sludge density was used with A1-sltck data from the HDW model to predict the composition and inventory of solids in this tank. The 1995 grab sample results are presented in the 1997 tank characterization report (HNF-SD-WM-ER-365).

D4.0 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 assessment of available chemical information for tank 241-AW-106 was performed, including the following:

- An inventory estimate generated by assuming the solids to be comparable with the A1sltck Saltcake formulation (Agnew et al. 1997). A1sltck saltcake concentrations were multiplied by a tank volume of 852 kL and solids density of 1.895 g/mL.

- Analytical results from a solids sample collected in 1995.

Based on this HDW model/engineering assessment, a best-basis inventory was developed for tank 241-AW-106 using the limited amount of analytical data and by assuming the other solids would be comparable to the SMMA1 formulation reported by Agnew et al. (1997). These inventories are shown in Tables D4-1 and D4-2.

Best-basis inventories based on the SMMA1 waste type are estimates only, and should be considered suspect. Core samples of the solids layer in Tank 241-AW-106 are needed for more reliable analyte inventories. The inventory values reported in Tables D4-1 and D4-2 are for tank solids only and are subject to change. Refer to the Tank Characterization Database (TCD) (LMHC 1998) for the most current inventory values.

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 Hanford Defined Waste 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. For a discussion of typical error between model derived values and sample derived values, see Kupfer et al. 1997, Section 6.1.10.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Solids Components in Tank 241-AW-106 (Effective May 31, 1997).

Analyte	Total inventory (kg)	Basis (S, M, C or E)[1]	Comment
Al	51,200	M/E	
Bi	0	M/E	Bi not soluble in supernate
Ca	1,940	M/E	
Cl	3,490	M/E	
TIC as CO_3	18,100	S	
Cr	6,180	M/E	
F	1,840	M/E	
Fe	736	M/E	
Hg	0	M/E	Simpson 1998
K	3,530	M/E	
La	0	E	La not soluble in supernate
Mn	256	M/E	
Na	376,000	M/E	
Ni	510	M/E	
NO_2	121,400	M/E	
NO_3	425,000	M/E	
OH_{TOTAL}	175,000	C	
Pb	184	M/E	
PO_4	34,000	M/E	
Si	4,150	M/E	
SO_4	33,600	M/E	
Sr	2.24	S/E	Assuming 30% of Sr consists of ^{90}Sr
TOC	3,590	S	
U_{TOTAL}	2,330	S	
Zr	169	M/E	

[1]S = Sample-based (Based on 1995 Grab Sample, see Appendix B)
M = Hanford Defined Waste model-based (Agnew et al. 1997)
E = Engineering assessment-based
C = Calculated by charge balance; includes hydroxides, not including NO_2, NO_3, PO_4, and SiO_3.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Solids Components in Tank 241-AW-106 (Effective May 31, 1997). Radionuclides decayed to January 1, 1994. (3 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	158	M/E	
^{14}C	41.9	M/E	
^{59}Ni	2.77	M/E	
^{60}Co	34.9	S/E	Upper bounding estimate
^{63}Ni	277	M/E	
^{79}Se	4.60	M/E	
^{90}Sr	93,200	S	
^{90}Y	93,200	S	Based on ^{90}Sr
^{93}Zr	22.8	M/E	
^{93m}Nb	16.3	M/E	
^{99}Tc	204	M/E	
^{106}Ru	0.0121	M/E	
^{113m}Cd	125	M/E	
^{125}Sb	284	M/E	
^{126}Sn	6.95	M/E	
^{129}I	0.399	M/E	
^{134}Cs	3.51	M/E	
^{137}Cs	54,600	S	
^{137m}Ba	51,600	S	Referenced to ^{137}Cs
^{151}Sm	16,100	M/E	
^{152}Eu	6.61	M/E	
^{154}Eu	924	M/E	
^{155}Eu	386	M/E	

Table D4-2. Best-Basis Inventory Estimates for Radioactive Solids Components in Tank 241-AW-106 (Effective May 31, 1997). Radionuclides decayed to January 1, 1994. (3 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{226}Ra	1.83E-04	M/E	
^{227}Ac	0.00107	M/E	
^{228}Ra	0.399	M/E	
^{229}Th	0.00947	M/E	
^{231}Pa	0.00515	M/E	
^{232}Th	0.0499	M/E	
^{232}U	0.308	S/M	Based on total U: Used HDW isotopic ratios
^{233}U	1.18	S/M	Based on total U: Used HDW isotopic ratios
^{234}U	1.07	S/M	Based on total U: Used HDW isotopic ratios
^{235}U	0.0409	S/M	Based on total U: Used HDW isotopic ratios
^{236}U	0.0768	S/M	Based on total U: Used HDW isotopic ratios
^{237}Np	0.714	M/E	
^{238}Pu	4.39	S/M	Based on ^{239}Pu: Used HDW isotopic ratios
^{238}U	0.777	S/M	Based on total U: Used HDW isotopic ratios
^{239}Pu	59.7	S/M	Based on $^{239/240}Pu$: Used HDW isotopic ratios
^{240}Pu	14.2	S/M	Based on $^{239/240}Pu$: Used HDW isotopic ratios
^{241}Am	250	S	
^{241}Pu	402	S/M	Based on ^{239}Pu: Used HDW isotopic ratios

Table D4-2. Best-Basis Inventory Estimates for Radioactive Solids Components in Tank 241-AW-106 (Effective May 31, 1997). Radionuclides decayed to January 1, 1994. (3 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{242}Cm	0.416	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{242}Pu	0.00173	S/M	Based on ^{239}Pu: Used HDW isotopic ratios
^{243}Am	0.0227	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{243}Cm	0.0436	S/M	Based on ^{241}Am: Used HDW isotopic ratios
^{244}Cm	0.776	S/M	Based on ^{241}Am: Used HDW isotopic ratios

[1]S = Sample-based (Based on 1995 Grab Samples, see Appendix B)
M = Hanford Defined Waste model-based (Agnew et al. 1997)
E = Engineering assessment-based.
M/E values based on A1sltck, 852 kl of sludge and a sludge density of 1.95 g/ml.

D5.0 APPENDIX D REFERENCES

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