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ENGINEERING CHANGE NOTICE

1. ECN 635524

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 []	Leela M. Sasaki, Data Assessment and Interpretation, R2-12, 373-1027	[] Yes [X] No	08/06/97
	6. Project Title/No./Work Order No. Tank 241-AW-105	7. Bldg./Sys./Fac. No. 241-AW-105	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-WM-ER-364, Rev. 1	10. Related ECN No(s). ECN-635466	11. Related PO No. N/A

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)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

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

This ECN was generated to include additional explanatory text in the best-basis narrative, and to update the comprehensive radionuclide inventory estimates for the tank.

SEP 1997

14a. Justification (mark one)

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

14b. Justification Details

Initial release of this document was deficient.

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

See attached distribution.

RELEASE STAMP

DATE: HANFORD RELEASE STA: 4 ID: AUG 22 1997

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-635524

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
N/A		

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng. L.M. Sasaki	L. M. Sasaki	8/20/97	PE		
Cog. Mgr. K.M. Hall	Kathleen M Hall	8/20/97	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Double-Shell Tank 241-AW-105

Leela M. Sasaki
Lockheed Martin Hanford, Corp., Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: ECN-635524 UC: 2070
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Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AW-105, 241-AW-105, AW-105, AW Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-AW-105. This report supports the requirements of the Tri-Party Agreement Milestone M-44-05.

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(2) Title
Tank Characterization Report for Double-Shell Tank 241-AW-105

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3.0 BEST-BASIS INVENTORY ESTIMATE

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. Waste management 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 the wastes 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; and 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. 1997). Not surprisingly, 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 information for the various waste management activities (Hodgson and LeClair 1996). Appendix D contains the complete narrative regarding the derivation of the inventory estimates presented in Tables 3-1 and 3-2.

Table 3-1. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 as of October 31, 1996. (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,530	S	
Bi	112	M	
Ca	7,300	M	
Cl	743	S	
TIC as CO_3	11,400	S	
Cr	1,170	S	
F	77,600	S	
Fe	2,770	S	Sludge inventory only.
Hg	347	M	
K	11,900	S	
La	443	S	Sludge inventory only.
Mn	1,420	S	Sludge inventory only.

Table 3-1. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 as of October 31, 1996. (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Na	1.64E+05	S	
Ni	200	S	Sludge inventory only.
NO_2	11,500	S	
NO_3	54,900	S	
OH	14,200	S	
Pb	1,080	S	Sludge inventory only.
PO_4	2,110	S	
Si	5,310	S	
SO_4	1,640	S	
Sr	12.0	S	Sludge inventory only.
TOC	8,380	S	
U_{TOTAL}	12,800	S	Sludge inventory only.
Zr	98,800	S	Sludge inventory only.

Note:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.

Table 3-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-AW-105, Decayed to January 1, 1994 (Effective October 31, 1996). [1] (3 Sheets)

Analyte	Total Inventory (Ci)	Basis (S,M or E)[2]	Comment
^{3}H	13.6	S	Sludge Inventory Only
^{14}C	2.26	S	Sludge Inventory Only
^{59}Ni	0.135	M/E	
^{60}Co	3.15	M/E	
^{63}Ni	15.6	M/E	
^{79}Se	0.0256	M/E	
^{90}Sr	263,000	S	
^{90}Y	263,000	S	based on ^{90}Sr
^{93m}Nb	0.0520	M/E	

Table 3-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-AW-105, Decayed to January 1, 1994 (Effective October 31, 1996). [1] (3 Sheets)

Analyte	Total Inventory (Ci)	Basis (S,M or E)[2]	Comment
^{93}Zr	0.123	M/E	
^{99}Tc	108	S	Sludge inventory only
^{106}Ru	491	M/E	
^{113m}Cd	1.33	M/E	
^{125}Sb	1,860	S	Sludge inventory only
^{126}Sn	0.040	M/E	
^{129}I	0.00172	M/E	
^{134}Cs	33.8	M/E	Sludge inventory only
^{137m}Ba	50,800	S	based on ^{137}Cs
^{137}Cs	53,700	S	
^{151}Sm	88.3	M/E	
^{152}Eu	0.995	M/E	
^{154}Eu	273	S	
^{155}Eu	199	S	
^{226}Ra	2.06E-07	M/E	
^{227}Ac	1.18E-06	M/E	
^{228}Ra	9.01E-11	M/E	
^{229}Th	1.03E-08	M/E	
^{231}Pa	6.75E-06	M/E	
^{232}Th	3.45E-11	M/E	
^{232}U	0.00113	M/E	
^{233}U	1.16E-05	M/E	
^{234}U	5.09	M/E	
^{235}U	0.194	M/E	
^{236}U	0.419	M/E	
^{237}Np	0.0125	M/E	
^{238}Pu	69.1	S	Sludge inventory only
^{238}U	3.49	M/E	
$^{239/240}Pu$	821	S	
^{241}Am	472	S	
^{241}Pu	14,800	M/E	
^{242}Cm	0.0876	M/E	
^{242}Pu	0.0553	M/E	

Table 3-2. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-AW-105, Decayed to January 1, 1994 (Effective October 31, 1996). [1] (3 Sheets)

Analyte	Total Inventory (Ci)	Basis (S,M or E)[2]	Comment
^{243}Am	0.00332	M/E	
$^{243/244}Cm$	184	S	Sludge inventory only

[1]Note: All M/E based radionuclide inventories are for sludge only and are Agnew et al (1997) values times the volume ratio 1,060:908 (kL). Sample based inventories are for sludge (1060 kL) and supernatant (606 kL), except as indicated..

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

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY DOUBLE-SHELL TANK 241-AW-105

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR TANK 241-AW-105

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-AW-105 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.

D1.0 CHEMICAL INFORMATION SOURCES

Available composition information for tank 241-AW-105 is as follows:

- Appendix B of this report provides characterization results from the January 1986 grab sampling event, the July and September 1986 core sampling events, the 1990 core sampling event, and the 1996 grab sampling event.

- An estimate of neutralized current acid waste and NCRW made in 1991 (Schofield 1991) provides tank content estimates based on a reconciliation of flowsheet records, process tests, and the January 1986 and July 1986 sampling events.

- The letter report, *Characterization of Actual Zirflex Decladding Sludge*, (Scheele and McCarthy 1986) provides characterization results of the grab samples taken in January 1986 and analyzed by Pacific Northwest Laboratory.

- The internal memorandum, *Analysis of Neutralized Coating Removal Waste (NCRW) Core Samples from Tank 105-AW*, (Peters 1986) summarizes the results obtained by the Rockwell Hanford Operations laboratories of the July 1986 core sample analyzed by Pacific Northwest Laboratory.

- The HDW model document (Agnew et al. 1997) provides tank content estimates in terms of component concentrations and inventories.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Tables D2-1 and D2-2 compare sample-based sludge inventories derived from the July 1986, September 1986, and May 1990 core samples; and HDW model sludge inventories generated by the Los Alamos National Laboratory model (Agnew et al. 1997). (The chemical species are reported without charge designation per the best-basis inventory convention). The January 1986 grab sample data is not included in these tables because these samples did not include the bottom layer of the tank where a 30.5 cm (12 in.) uranium-rich waste heel resides. Sludge volumes used to calculate sample-based inventories are from Hanlon (1996b).

The sludge volume reported by Hanlon is 1,060 kL (280 kgal). The sludge volume reported by the HDW model is 908 kL (240 kgal). Hanlon values are based on sludge measurements taken from a maximum of six sludge measurement ports by an ENRAF™ surface-level gauge. The decrease in volume could be caused by a compaction of the solids, shifting of the uneven surface of the solids layer from liquid transfers into the tank, dissolution of soluble solids, or a combination of all these.

Supernatant values are not included in Table D2-1 because the SMM (Agnew et al. 1997) model tracks supernatant transfers only through January 1994 while the latest analytical data for supernatant were taken in August 1996. No supernatant samples were taken around January 1994 to make a comparison.

Table D2-1. Sample-Based and Hanford Defined Waste Model-Based Sludge Inventory Estimates for Nonradioactive Components.[1] (2 sheets)

Analyte	July 1986 Sampling Sludge Inventory Estimate (kg)	September 1986 Sampling Sludge Inventory Estimate (kg)	May 1990 Sampling Sludge Inventory Estimate (kg)	HDW Model Sludge Inventory Estimate (kg)
Al	3,830	3,180	14,800	0
Bi	NR	NR	NR	0
Ca	NR	714	1,400	4,840
Cl	NR	594	3,160	126
CO_3	NR	10,200	45,500	7,760
Cr	1,470	865	6,030	35.0
F	NR	77,300	1.51E+05	81,700
Fe	3,540	1,990	9,620	26,600
Hg	NR	NR	NR	342

Table D2-1. Sample-Based and Hanford Defined Waste Model-Based Sludge Inventory Estimates for Nonradioactive Components.[1] (2 sheets)

Analyte	July 1986 Sampling Sludge Inventory Estimate (kg)	September 1986 Sampling Sludge Inventory Estimate (kg)	May 1990 Sampling Sludge Inventory Estimate (kg)	HDW Model Sludge Inventory Estimate (kg)
K	10,300	11,100	28,700	6,100
La	442	443	2,030	0
Mn	1,770	1,060	2,650	27.8
Na	1.64E+05	1.45E+05	40,300	1.04E+05
Ni	NR	200	500	621
NO_2	NR	10,700	26,200	383
NO_3	NR	38,600	69,800	18,100
OH	NR	11,400	NR	80,700
Pb	NR	NR	1,080	0.758
PO_4	NR	NR	2,050	556
Si	NR	5,270	9,540	0
SO_4	NR	1,500	4,240	32.7
Sr	NR	12.0	NR	0
TOC	NR	7,240	12,900	41.2
U_{total}	15,800	9,860	26,900	8,980
Zr	1.02E+05	95,600	2.77E+05	68,800

Note:

[1] Sample-based estimates are based on a sludge volume of 1,060 kL (280 kgal) (Hanlon 1996b). Data was obtained from Appendix B-- July 1986 data obtained from Table B2-51; September 1986 data from Table B2-52; May 1990 data from Table B2-57.

Table D2-2. Sample-Based and Hanford Defined Waste Model-Based Sludge Inventory Estimates for Radioactive Components. (Decayed to January 1, 1994)[1]

Analyte	July 1986 Sampling Inventory Estimate (Ci)	September 1986 Sampling Inventory Estimate (Ci)	May 1990 Sampling Inventory Estimate (Ci)	HDW Model Inventory Estimate (Ci)
^{3}H	NR	NR	13.6	14.2
^{14}C	NR	NR	2.26	0.175
^{60}Co	NR	127	486	2.70
^{90}Sr	NR	NR	2.63E+05	3,430
^{99}Tc	NR	NR	108	0.731
^{125}Sb	NR	1,860	7,780	65.3
^{129}I	NR	NR	3.76	0.00147
^{134}Cs	NR	95.8	424	29.0
^{137}Cs	NR	53,200	1.42E+05	4,050
^{154}Eu	NR	273	3,830	20.2
^{155}Eu	NR	199	2,550	155
^{238}Pu	NR	69.1	658	124
$^{239/240}Pu$	937	831	3,280	1,316
^{241}Am	582	361	3,190	13.5
$^{243/244}Cm$	NR	NR	184	0.0643

Note:

[1] Sample-based estimates are based on a sludge volume of 1,060 kL (280 kgal) (Hanlon 1996b). Data was obtained from Appendix B.

D3.0 COMPONENT INVENTORY EVALUATION

An 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.

Results from the July 1986 core sample and the September 1986 core sample were consistent with each other (see Section B2.9.3). The 1990 core sample concentrations for nonradioactive components, except for sodium and nickel, were roughly two to five times higher than the 1986 results. This was probably caused by uranium interference during ICP analysis. Yet, sodium and nickel inventory estimates were significantly lower in the 1990 core sample results. For radioactive components, the differences were even more pronounced; the 1990 concentrations range from approximately 3 to 14 times higher than the 1986 results.

Each core sample was taken from a different riser: the July 1986 core sample was taken from riser 13A (see Figure A2-1); the September 1986 core sample was taken from riser 15A; and the May 1990 core sample was taken from riser 16B. There is a possibility that some variation between the core sample results was caused by lateral heterogeneity in the tank.

The HDW model predictions, while being closer to the 1986 concentrations, still do not agree well with the sample-based numbers. The smallest differences between the HDW model predictions and the 1986 core composite results are reported for fluoride, zirconium, and sodium. The RPD[1] for these components are 5, 33, and 33 percent, respectively. The RPDs for fluoride, zirconium, and sodium between the HDW model predictions and the 1990 core composite results are 59, 120, and 88 percent, respectively.

In Section D3.1, analytical results from the January 1986 grab sampling event and the August 1996 grab sampling event are introduced and compared to the other sample results. In Section D3.2, comparisons are made between the sample-based results and estimates based on the PUREX Plant flowsheet for NCRW and a method for estimating the amount of waste constituents that accumulated in tank 241-AW-105 as sludge. This is done to help decide which sample results are the best basis for sample-based inventories. Section D3.3 discusses contributions made by other waste types.

[1] $RPD = \frac{|S_2 - S_1|}{(\frac{1}{2}(S_1 + S_2))}$ where S_n = sample concentration.

D3.1 COMPARISON OF CORE SAMPLE DATA

The January 1986 grab samples do not include the bottom layer of waste in the tank. This 30.5 cm (12 in.) heel displays different physical and chemical properties from the sludge above it (see Section B1.4.2). These solids are assumed to have been deposited in tank 241-AW-105 from the 7,030 kL (1857 kgal) of PXMSC waste sent to the tank before it began receiving NCRW waste in 1984 (see Table A3-1).

The August 1996 grab sampling event did not collect sludge samples from the entire depth of the sludge layer; it includes solids added since 1986. Included with these solids were additions of 8,220 kg of uranium and 6.97 kg of plutonium present in a dilute nitric acid solution that had been stored in the PUREX plant (Sasaki 1995). Samples were collected from depths ranging from 168 cm (66 in.) to 241 cm (95 in.) from the tank bottom. The sludge occupies 259 cm (102 in.) of the tank. Although the sludge level did not increase between 1987 and 1996 (it actually decreased), there were solids added to tank 241-AW-105 after 1986. Table A3-1 shows that 121 kL (32 kgal) of PUREX Plant spent metathesis solids and decladding wastes were added in addition to some TRU solids that may have settled from a dilute complexed waste stream sent from the Hot Semi-Works pilot plant. Solids formed a layer of 29.6 cm (11.6 in.) in the tank. To account for this, samples taken at 241 cm (95 in.) from the tank bottom during the August 1996 sampling event were not included in the comparison. This should eliminate solids added after 1986 thereby enabling a direct comparison of the August 1996 means with the other core sample results. To see the changes in composition from this omission, compare Table B3-11 mean concentrations for all August 1996 samples with the mean concentrations in Table D3-1.

As mentioned earlier, the July 1986 core sample was taken from riser 13A, the September 1986 core sample was taken from riser 15A, the May 1990 core sample was taken from riser 16B, and the August 1986 grab samples were taken from risers 10A and 15A. Figure A2-1 shows that the samples were distributed across the eastern half of the tank. It is not known from which riser the January 1986 grab samples were taken.

Instead of comparing the entire core composites with the January 1986 and August 1996 data, the average of segments 5 through 9 from the July 1986 core sample; the average of segments 2A, 3A, 4A, and 5A from the September 1986 core sample; and the composite of segments 3 through 6 from the 1990 core were used for the comparison. These portions of the three cores do not include the 12-in. heel. The 1990 core sample may include solids added after 1986, but sample depths could not be determined (see Section B1.4.4). In the absence of this information, the entire core composite was used in the comparison. For segment concentrations below the detection limit, the detection limits were included to compute the average.

Table D3-1. Comparison of Analytical Concentrations from the Sludge Sampling Events for Tank 241-AW-105.

Analyte	January 1986 Sludge[1] (μg/g)	July 1986 Sludge[2] (μg/g)	September 1986 Sludge[3] (μg/g)	May 1990 Sludge[4] (μg/g)	August 1996 Sludge[5] (μg/g)
Al	960	1,010	1,180	3,520	1,130
Ca	200	NR	132	1,340	<1,530
Cl	2,000	NR	341	1,500	231
CO_3	NR	NR	4,470	9,500	3,150
Cr	170	<100	115	868	228
F	75,000	NR	58,300	51,700	23,000
Fe	320	420	270	5,680	1,850
Hg	<5,100	NR	NR	NR	NR
K	12,300	9,600	9,440	36,500	NR
La	340	440	395	2,550	1,200
Mn	10	NR	6.11	2,110	1,250
Na	1.12E+05	1.01E+05	99,600	2.58E+05	72,200
Ni	60	NR	59.4	261	NR
NO_2	NR	NR	4,960	7,700	3,410
NO_3	NR	NR	20,100	21,500	21,100
OH	11,000	NR	8,450	NR	2,050
Pb	3,100	NR	NR	598	NR
PO_4	<25,000	NR	NR	1,000	630
Si	1,100	NR	4,230	6,590	849
SO_4	85,000[6]	NR	905	1,000	1,430
Sr	NR	NR	5.28	NR	NR
TOC	5,200	NR	3,520	15,000	1,880
U_{TOTAL}		5,920	5,280	19,000	45,700
Zr	79,000	70,000	70,500	2.32E+05	47,000

Notes:

[1]Core composite concentrations
[2]Average of segments 5, 6, 7, 8, and 9
[3]Average of segments 2A, 3A, 4A, and 5A
[4]Composite of segments 3, 4, 5, and 6
[5]Samples 96-5 and 96-15 were excluded.
[6]This concentration is an outlier. See text for discussion.

The July 1986 and September 1986 samples were observed to possess compositions and properties consistent with each other (see Section D3.0). The January 1986 results also are consistent with the July 1986 and September 1986 core sample results minus the 30.5 cm (12 in.) heel. Except for chloride, silicon, and sulfate, the RPDs between the January 1986 results and averages of the July 1986 and September 1986 results are less than 50 percent. The degree of agreement between the three 1986 sampling events suggests that the earlier samples may be a better basis for sample-based inventories than the 1990 core sample data, but further verification is needed. In the following section, an estimate of NCRW sludge in tank 241-AW-105 is made from the PUREX Plant flowsheet and process knowledge to compare with the sample results and results obtained from the HDW model.

D3.2 EVALUATION OF TECHNICAL FLOWSHEET INFORMATION

In 1991, an evaluation of the NCRW sent to the 241-AW tank farm was made (Schofield 1991). Schofield used PUREX Plant flowsheets, personal knowledge of how the process ran, and other information to develop estimates which he compared to the January and July 1986 sample results. Much of his work was used in the following evaluation.

D3.2.1 Technical Flowsheet Estimate Assumptions

The PUREX flowsheet-based NCRW sludge composition developed in this engineering evaluation is based on:

1. The PUREX flowsheet for Reprocessing N Reactor Fuels (RHO 1982)

2. A methodology that estimates the amount of NCRW that partitioned to the sludge

3. A report that estimates the contents of NCRW based on a reconciliation of flowsheet information, process knowledge, and sample data (Schofield 1991).

In his analysis, Schofield included the following: N Reactor fuel cladding composition (including impurities); the amount and composition of dissolved fuel, fission products, and actinides lost to the NCRW stream; and the process chemicals added as shown in the PUREX Plant flowsheet with adjustments based on his knowledge of how the process ran. Some adjustments included the following: increasing sodium hydroxide additions by five weight percent to account for excess sodium hydroxide added for neutralization; increasing potassium hydroxide additions by 20 percent to account for excess potassium hydroxide added for metatheses; increasing the amount potassium carryover to the NCRW stream; and the addition of extra water to account for extra flushes and jet dilutions.

One change was made to Schofield's assessment of the flowsheet-based NCRW composition. Schofield assumed that potassium hydroxide was added in 20 percent excess of the flowsheet composition. Yet an engineering evaluation of the potassium content in tank 241-AW-103 NCRW sludge, based on the reference flowsheet concentration for potassium, agreed extremely well with the sample-based inventory for that tank (Kupfer et al. 1996). This same flowsheet value for potassium was used in the engineering evaluation for tank 241-AW-105. A corresponding decrease in the hydroxide concentration was made as well.

The adjusted PUREX Plant flowsheet NCRW composition is compared in Table D3-2 to the PUREX Plant flowsheet NCRW composition (RHO 1982), and the HDW model composition for NCRW, or CWZR2 as it is called in the HDW model. Schofield does not provide estimates for calcium, while the PUREX Plant flowsheet reports a value of 0.018*M*. The calcium concentration reported by the flowsheet was used in this evaluation. Except for potassium, hydroxide, and calcium, Schofield's NCRW composition was assumed to be the better basis in this evaluation than the reference flowsheet values.

Table D3-2. Estimated Concentrations of Neutralized Cladding Removal Waste (NCRW) in Tank 241-AW-105.

Analyte	Adjusted Flowsheet NCRW Composition[1] (*M*)	Flowsheet NCRW Composition[2] (*M*)	HDW Model NCRW Composition[3] (*M*)
NO_3	0.0259	0.024	0.39
NO_2	0.0105	0.011	0.007
Fe	0.0192	NR	0.04
Cr	0.00072	NR	0
Ni	3.37E-04	NR	0
Zr	0.155	0.18	0.1
Na	1.638	1.634	1.02
OH	NR	0.72	0.64
F	1.30	1.36	0.77
K	0.513	0.47	0.22
Ca	NR	NR	0.018
CO_3	0.00111	NR	0.018
U	6.92E-04	7.54E-04	0.0078

Notes:

[1]Schofield, (1991), with modifications
[2]RHO (1982)
[3]Agnew et al. (1997)

The amount of NCRW sent to tank 241-AW-105 derived from the numbers in column 2 of Table D3-2 was calculated based on the following assumptions:

- 4,169 L per metric ton of uranium (MTU) of NCRW waste were processed at the PUREX plant from 1983 to 1988 (Schofield 1991).
- Total production at the PUREX Plant from 1983 to 1988 was 3,920 MTUs (Schofield 1991).
- 36 percent of the NCRW produced at the PUREX Plant was transferred to tank 241-AW-105 based on historical transfer records (Koreski 1995).

An example calculation for estimating the flowsheet-based sodium inventory for the sludge in tank 241-AW-105 is:

(1.638 moles Na/L x 4,169 L/MTU x 3,920 MTU x 0.36 x 23 g Na/mole Na x 1 kg Na/1000 g Na) = 222,000 kg Na sent to tank 241-AW-105.

Table D3-3 shows the amounts for other constituents sent to the tank calculated similarly.

Table D3-3. Estimated Inventory of Neutralized Cladding Removal Waste (NCRW) Sent to Tank 241-AW-105.

Analyte	Adjusted Flowsheet-Based NCRW Inventory[1] (kg)
NO_3	9,440
NO_2	2,830
Fe	629
Cr	220
Ni	116
Zr	83,400
Na	2.22E+05
OH	NR
F	1.45E+05
K	1.18E+05
Ca	NR
CO_3	393
U	969

Note:

[1]Schofield (1991)

Not all this inventory is in the sludge in tank 241-AW-105. For some constituents, only a fraction of the amounts shown above precipitated from the NCRW waste stream as sludge. The remainder was decanted to the 242-A Evaporator feed tank, concentrated to double-shell slurry feed, and sent to other double-shell tanks. To estimate the amounts partitioned to the sludge, partition factors (PFs), developed for the NCRW in tank 241-AW-103, were used (Kupfer et al. 1996). The PFs were developed by taking the ratio of the core sample concentration for an insoluble component, zirconium in this case, to the PUREX flowsheet concentration for zirconium in NCRW. This ratio is called the concentration factor for zirconium (CF_{Zr}). For other components in NCRW, concentration factors (CFs) can be calculated. For components that are less soluble than zirconium, the CFs will be lower. The ratio of CF_N to CF_{Zr} is the fraction of component N that precipitated as sludge. This fraction, CF_N/CF_{Zr} is called the partitioning factor for component N, or PF_N.

In the case of tank 241-AW-103, these PFs multiplied by the amount sent to that tank (as determined from the PUREX Plant flowsheet) were the amounts estimated to be in the sludge of that tank. These PFs were applied in this evaluation to the NCRW inventory for tank 241-AW-105 to produce a sludge inventory that is compared to the sample-based results and the HDW model predictions in Table D3-2. The PFs used in this evaluation were:

Zr	1.0
Na	0.81
OH	0.19
F	0.51
K	0.42
Ca	0.27

The PFs calculated for chromium, iron, and nickel were 1.3, 1,6, and 1.3, respectively, which indicates that the estimates for corrosion products may have been understated by 30 to 60 percent. A PF of 1.0 was assumed for uranium, chromium, iron, and nickel in this evaluation. Nitrate and nitrite were assumed to remain in solution so that the concentration of the interstitial liquid is approximately the same as the flowsheet concentration.

The 1986 sample-based inventory in Table D3-4 represents an average of the three 1986 core samples. If a concentration was available from only one source, it was assumed to be the concentration for all three sources. If only two concentrations were available, they were averaged and reported as the final result. Less than values were included to compute the average. The other set includes the results from the 1990 core sample. The August 1996 data is omitted because the data do not reflect the entire NCRW waste layer.

The sample concentrations in Table D3-4 reflect only a portion of the sludge layer in tank 241-AW-105. The sludge portion under consideration does not include the 30 cm (12 in.) heel at the tank bottom. It does include solids that may have accumulated from non-NCRW waste streams including solids precipitated from the 2,320 kL (613 kgal) of slurry sent to the tank in 1987 and 121 kL (32 kgal) of PUREX plant spent metathesis solids transferred in 1989

(See Table A3-1). This creates some error when making comparisons with flowsheet estimates, but a comparison of these data sets and the flowsheet estimate should help determine which data set best reflects the actual NCRW concentrations.

Table D3-4. Comparison of Neutralized Cladding Removal Waste (NCRW) Sludge Inventories in Tank 241-AW-105.

Analyte	Adjusted Flowsheet-Based NCRW Inventory (kg)	1986 Sample-Based NCRW Inventory (kg)	1990 Sample-Based NCRW Inventory (kg)	HDW Model Sludge Inventory (kg)
Fe	629	485	9,620	26,600
Cr	220	175	6,030	35.0
Ni	116	82.0	500	621
Zr	83,400	101,000	2.77E+05	68,800
Na	1.79E+05	1.43E+05	40,300	1.04E+05
OH	NR	13,300	NR	80,700
F	74,000	90,900	151,000	81,700
K	49,600	14,300	28,700	6,100
Ca	NR	227	1,400	4,840
CO_3	NR	6,010	45,500	7,760
NO_3	9,440	27,100	69,800	18,100
NO_2	2,830	6,680	26,200	383
U	969	7,410	26,900	8,980

The comparison in Table D3-4 provides further evidence that the 1986 sample data are the best basis for the NCRW inventory estimate in tank 241-AW-105. Not only are the three 1986 samples consistent with each other (and not consistent with the 1990 core sample [see Tables D2-1 and D2-2]), but inventories generated from the 1986 data are consistent, in most cases, with the flowsheet-based estimates generated in this evaluation. When matched with the 1986 data, the flowsheet based inventories for iron, chromium, nickel, zirconium, sodium, hydroxide, fluoride, calcium, and carbonate display RPDs less than 25 percent.

The comparison of zirconium is particularly important. The amount of zirconium charged to the PUREX Plant is accurately known. The solubility of zirconium is very low, and almost all of the zirconium exited the PUREX Plant in the declad waste stream. Based on this

information, the amount of zirconium in the NCRW stream was in the range of 265,000 to 285,000 kg (Schofield 1991). For this evaluation 275,000 kg was used. This is the amount of zirconium used by Schofield in his evaluation (1991). Historical transfer records indicate that 36 percent of the NCRW went to tank 241-AW-105 (Koreski 1995). This amounts to 99,000 kg of zirconium compared to 98,200 kg from the sample-based inventory estimate. The 1990 core sample estimate is 2.8 times higher at 277,000 kg. The HDW model under-predicts the zirconium inventory by about 30,000 kg.

Inventories for iron, chromium, and nickel came primarily from corrosion of process vessels. The ratio of iron, chromium, and nickel in type 304 stainless steel is roughly 6:2:1. The 1986 sample-based results show a Fe:Cr:Ni ratio of 5.8:2.1:1.0. The 1990 sample-based ratio is 19:12:1, and the HDW model ratio is 43:0.057:1 although the HDW model source terms for these three components do not derive exclusively from corrosion assumptions.

The adjusted flowsheet composition in Table D3-4 was checked for electroneutrality. There is an imbalance of +0.35 mole equivalents in the adjusted flowsheet composition. This imbalance could be caused by low nitrite and nitrate concentrations. Increasing these concentrations to achieve a charge balance would bring these concentrations into general agreement with the sample results. To illustrate, the nitrate concentration in the September 1986 data is approximately 0.4*M*. The HDW model used a nitrate concentration of 0.39*M*. Concentrations for nitrite and nitrate in the flowsheet appear to be in error.

The previous evaluation is for the NCRW inventory only. Section D3.2.3 evaluates the contribution made by the 12-in. uranium-rich heel. Section D3.2.4 provides information for the supernatant currently stored in the tank.

D3.2.2 Evaluation of the 12-Inch Heel

When tank 241-AW-105 began service in July 1980, it received flush water followed by a transfer of complexed waste from the 242-A Evaporator. However, little or no solids formed in the tank from this complexed waste (Teats 1982). Tank 241-AW-105 next received DN wastes until it was nearly filled in 1983. The tank was emptied except for a small heel. The tank then received approximately 7,030 kL (1,857 kgal) of PXMSC wastes and some DN waste from tank 241-AW-103 through 1983 and 1984. Starting in 1984, tank 241-AW-105 received NCRW waste in addition to small transfers of PXMSC and flush water.

The 12-in. heel of dark solids in the tank bottom probably came from these PXMSC additions (Peters 1984). Twelve inches of waste corresponds to a volume of 125 kL (33 kgal). This means the 7,030 kL (1,857 kgal) of PXMSC contained an average of 1.8 volume percent solids, which is not an unreasonable number.

A composition for the 12-in. heel can be estimated by assuming that 7 in. of the 19-in. core segment, taken in July 1986, has the same composition as the segment above it (assumed to

represent NCRW); then back-calculating the composition of the remaining 12 in. Only July 1986 data were used to do this because the January 1986 core sample did not include the 12-in. heel during the sampling event, and the May 1990 results are assumed to have a high bias. Table D3-5 shows the calculated heel composition, which is compared to the HDW model composition for PXMSC, referred to in the model as PUREX low-level waste.

Table D3-5. Composition of 12-Inch Heel in Tank 241-AW-105.

Analyte	Sample-Based Composition Estimate[1] (*M*)	HDW Model-Based Composition Estimate[2] (*M*)
Al	0.347	0
Cr	0.0929	0.00712
Fe	0.257	1.90
K	0.0726	0.00610
La	0.00102	0
Mn	0.146	0.00534
Na	6.61	0.570
U	0.357	0.0561
$^{239/240}$Pu (Ci/L)	7.62E-04	0.00293
^{241}Am (Ci/L)	0.00238	0

Notes:

[1]Based on July 1986 core, segment 10. The assumed sludge density is 1.42 g/L.
[2]Agnew et al. (1997), Appendix B, PUREX low-level waste stream.

Agreement between the sample-based values and the HDW model-based values are poor. The source of the sample-based values are assumed to be the better basis because of good agreement of the NCRW portion of the same core sample with the flowsheet basis (see Section D3.2.1).

D3.2.3 Best-Basis for Sludge Inventory in Tank 241-AW-105

The core samples taken in 1986 provide a better basis for the sludge in tank 241-AW-105 than the 1990 core sample and the HDW model predictions. The January 1986 data were omitted because the data do not include the 30.5 cm (12 in.) heel. Where available, average concentrations for analytes taken from the July 1986 and September 1986 data were used for the best basis inventory. For analytes reported in the 1990 core sample data but not in any 1986 data sets, the 1990 core sample results were used. These values should be viewed with

caution because the 1990 results do not compare well with the 1986 data in many cases, particularly for cations and radionuclides.

The differences between the 1990 and 1986 results may be caused by waste heterogeneity. If this is so, then the May 1990 results, although accurate, must be highly localized based on the flowsheet evaluation.

Tables D4-1 and D4-2 show the best-basis inventories for the sludge in tank 241-AW-105.

D3.2.4 Evaluation of the Supernatant

Supernatant data from core sample events and predictions made by the HDW model have been made irrelevant by periodic transfers of waste into and out of tank 241-AW-105. The most recent data obtained for the supernatant come from the August 1996 grab sampling event. The previous supernatant sampling event was in August 1995 when three grab samples were taken. Transfers of PXMSC waste into tank 241-AW-105 and transfers from tank 241-AW-105 to tank 241-AP-104 in December 1995 have made the August 1995 sample results no longer applicable. Relatively few analyte concentrations were reported from that sample analysis, which was conducted for waste compatibility purposes only.

The August 1996 supernatant sample concentrations have a high pedigree associated with them. These samples covered a range of 300 to 394 cm (118 to 155 in.) from the tank bottom. The supernatant layer begins at approximately 259 cm (102 in.) and rises up to 406 cm (160 in.) from the tank bottom. From Table B2-1 through B2-43, there is evidence of some waste stratification. There is a concentration gradient for most components that increases with increasing depth. Mean interstitial liquid concentrations generally exceed the mean for the supernatant analyses.

The August 1996 supernatant data is the best basis for the supernatant in tank 241-AW-105 in the absence of other relevant data. Since August 1996, there have been no significant transfers into or out of the tank. For the best-basis inventories in Table D4-3 and D4-4, means from the supernatant samples and interstitial liquid sample 5AW-96-5 were calculated. Interstitial liquid sample 5AW-96-5 was taken very close to the interface between the supernatant and the sludge layers. A supernatant volume of 606 kL (160 kgal) was used to generate the inventories.

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

The results from this evaluation support using the July 1986 and September 1986 core sample data as the best basis for the inventory in tank 241-AW-105 sludge for the analytes provided and the 1990 sampling data as the best basis for analytes not reported in 1986. The August 1996 liquid samples provide the best-basis for the supernatant. These choices provide the best-basis for the following reasons:

1. Cation data from the May 1990 core sample are biased high apparently because of inter-element interferences during the ICP analyses. Anion concentrations deviate from the 1986 concentrations to a lesser extent than the cations and radionuclides, but significant differences still exist for several key anions.

2. The January 1986 grab samples do not include the 30.5 cm (12 in.) heel at the tank bottom.

3. The August 1996 grab sample data does not reflect the entire sludge layer.

4. Data from the core samples taken in July and September 1986 are consistent.

5. The fraction precipitated basis used for this analysis for major components result in inventory predictions that compare favorably with 1986 sample analyses.

6. The flowsheet bases and waste volumes used for this independent assessment are believed to reflect the processing conditions more closely than those that govern the HDW model inventories.

7. Supernatant data from the August 1996 sampling event are the latest published results available.

Tables D4-1 through D4-6 shows the best-basis inventory estimates for tank 241-AW-105. 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.

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. (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.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (2 Sheets)

Analyte	Sludge Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,505	S	Average of 7/86[2] and 9/86 samples results. 5/90 = 14,800
Ca	1,400		5/90 sample result
Cl	594	S	9/86 sample result. 5/90 = 3,160
TIC as CO_3	10,200	S	9/86 sample result. 5/90=45,500
Cr	1,170	S	Average of 7/86 and 9/86 results. 5/90 = 6,030
F	77,300	S	9/86 sample result. 5/90 = 151,000
Fe	2,760	S	Average of 7/86 and 9/86 results. 5/90 = 9,620
K	10,700	S	Average of 7/86 and 9/86 sample results. 5/90 = 28,700
La	443	S	Average of 7/86 and 9/86 sample results. 5/90 = 2,030
Mn	1,420	S	Average of 7/86 and 9/86 sample results. 5/90 = 2,650
Na	1.55E+05	S	Average of 7/86 and 9/86 sample results. 5/90 = 40,300
Ni	200	S	9/86 sample result. 5/90 = 500
NO_2	10,700	S	9/86 sample result. 5/90 = 26,200
NO_3	38,600	S	9/86 sample result. 5/90 = 69,800
OH	11,400	S	9/86 sample result.
Pb	1,080	S	5/90 sample result.
PO_4	2,050	S	5/90 sample result.
Si	5,270	S	9/86 sample result. 5/90 = 9,540

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996. (2 Sheets)

Analyte	Sludge Inventory (kg)	Basis (S, M, or E)[1]	Comment
SO_4	1,500	S	9/86 sample result. 5/90 = 4,240
Sr	12.0	S	9/86 sample result.
TOC	7,240	S	9/86 sample result. 5/90 = 12,900
U_{TOTAL}	12,800	S	Average of 7/86 and 9/86 sample results. 5/90 = 26,900
Zr	98,800	S	Average of 7/86 and 9/86 samples results. 5/90 = 277,000

Notes:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.

[2]Dates are in the mm/yy format.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996 (Decayed to January 1, 1994). (2 sheets)

Analyte	Sludge Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	13.6	S	5/90[2] sample result.
^{14}C	2.26	S	5/90 sample result.
^{60}Co	486	S	5/90 sample result.
^{90}Sr	2.63E+05	S	5/90 sample result.
^{90}Y	2.63E+05	S	5/90 sample result.
^{99}Tc	108	S	5/90 sample result.
^{125}Sb	1,860	S	9/86 sample result. 5/90 = 7,780
^{134}Cs	95.8	S	9/86 sample result. 5/90 = 424
^{137}Cs	53,200	S	9/86 sample result. 5/90 = 142,000
^{137m}Ba	50,300	S	9/86 sample result. 5/90 = 135,000
^{154}Eu	273	S	9/86 sample result. 5/90 = 3,830
^{155}Eu	199	S	9/86 sample result. 5/90 = 2,550
^{238}Pu	69.1	S	9/86 sample result. 5/90 = 658

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Sludge as of October 31, 1996 (Decayed to January 1, 1994). (2 sheets)

Analyte	Sludge Inventory (Ci)	Basis (S, M, or E)[1]	Comment
$^{239/240}Pu$	831	S	9/86 sample result. 5/90 = 3,280
^{241}Am	472	S	Average of 7/86 and 9/86 sample results. 5/90 = 3,190
$^{243/244}Cm$	184	S	5/90 sample result.

Notes:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.
[2]Dates are in the mm/yy format.

Table D4-3. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 Supernatant as of October 31, 1996.

Analyte	Supernatant Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	26.3	S	
Cl	148	S	
TIC as CO_3	980	S	
Cr	1.28	S	
F	291	S	
K	1,200	S	
Na	9,010	S	
NO_2	776	S	
NO_3	16,400	S	
OH	2,340	S	
PO_4	112	S	
Si	32.5	S	
SO_4	183	S	
TOC	1,290	S	

Note:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.

Table D4-4. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-105 Supernatant as of October 31, 1996. (Decayed to January 1, 1994)

Analyte	Supernatant Inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{60}Co	0.3169	S	
^{79}Se	NR	S	
^{90}Sr	26.7	S	
^{90}Y	26.7	S	
^{137}Cs	1,300	S	
^{137m}Ba	1,230	S	
$^{239/240}Pu$	0.0965	S	
^{241}Am	0.0581	S	

Note:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.

Table D4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 as of October 31, 1996. (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
Al	3,530	S	
Cl	743	S	
TIC as CO_3	11,400	S	
Cr	1,170	S	
F	77,600	S	
Fe	2,770	S	Sludge inventory only.
K	11,900	S	
La	443	S	Sludge inventory only.
Mn	1,420	S	Sludge inventory only.
Na	1.64E+05	S	
Ni	200	S	Sludge inventory only.
NO_2	11,500	S	

Table D4-5. Best-Basis Total Inventory Estimates for Nonradioactive Components in Tank 241-AW-105 as of October 31, 1996. (2 Sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1]	Comment
NO_3	54,900	S	
OH	14,200	S	
Pb	1,080	S	Sludge inventory only.
PO_4	2,110	S	
Si	5,310	S	
SO_4	1,640	S	
Sr	12.0	S	Sludge inventory only.
TOC	8,380	S	
U_{TOTAL}	12,800	S	Sludge inventory only.
Zr	98,800	S	Sludge inventory only.

Note:

[1]S = sample-based, M = HDW model-based, and E = engineering assessment-based.

Table D4-6. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-AW-105, Decayed to January 1, 1994 (Effective October 31, 1996). [1] (3 Sheets)

Analyte	Total Inventory (Ci)	Basis (S,M or E)[2]	Comment
^{3}H	13.6	S	Sludge Inventory Only
^{14}C	2.26	S	Sludge Inventory Only
^{59}Ni	0.135	M/E	
^{60}Co	3.15	M/E	
^{63}Ni	15.6	M/E	
^{79}Se	0.0256	M/E	
^{90}Sr	263,000	S	
^{90}Y	263,000	S	based on ^{90}Sr
^{93m}Nb	0.0520	M/E	
^{93}Zr	0.123	M/E	
^{99}Tc	108	S	Sludge inventory only
^{106}Ru	491	M/E	
^{113m}Cd	1.33	M/E	

Table D4-6. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-AW-105, Decayed to January 1, 1994 (Effective October 31, 1996). [1] (3 Sheets)

Analyte	Total Inventory (Ci)	Basis (S,M or E)[2]	Comment
^{125}Sb	1,860	S	Sludge inventory only
^{126}Sn	0.040	M/E	
^{129}I	0.00172	M/E	
^{134}Cs	33.8	M/E	Sludge inventory only
^{137m}Ba	50,800	S	based on ^{137}Cs
^{137}Cs	53,700	S	
^{151}Sm	88.3	M/E	
^{152}Eu	0.995	M/E	
^{154}Eu	273	S	
^{155}Eu	199	S	
^{226}Ra	2.06E-07	M/E	
^{227}Ac	1.18E-06	M/E	
^{228}Ra	9.01E-11	M/E	
^{229}Th	1.03E-08	M/E	
^{231}Pa	6.75E-06	M/E	
^{232}Th	3.45E-11	M/E	
^{232}U	0.00113	M/E	
^{233}U	1.16E-05	M/E	
^{234}U	5.09	M/E	
^{235}U	0.194	M/E	
^{236}U	0.419	M/E	
^{237}Np	0.0125	M/E	
^{238}Pu	69.1	S	Sludge inventory only
^{238}U	3.49	M/E	
$^{239/240}Pu$	821	S	
^{241}Am	472	S	
^{241}Pu	14,800	M/E	
^{242}Cm	0.0876	M/E	
^{242}Pu	0.0553	M/E	

Table D4-6. Best-Basis Inventory Estimate for Radioactive Components in Tank 241-AW-105, Decayed to January 1, 1994 (Effective October 31, 1996). [1] (3 Sheets)

Analyte	Total Inventory (Ci)	Basis (S,M or E)[2]	Comment
^{243}Am	0.00332	M/E	
$^{243/244}$Cm	184	S	Sludge inventory only

[1]Note: All M/E based radionuclide inventories are for sludge only and are Agnew et al (1997) values times the volume ratio 1,060:908 (kL). Sample based inventories are for sludge (1060 kL) and supernatant (606 kL), except as indicated..

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

D5.0 APPENDIX D REFERENCES

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