0049692

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 612285

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	7/9/97
	6. Project Title/No./Work Order No. Tank 241-C-101	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-473, Rev. 0B	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 C, Evaluation to Establish Best-Basis Inventory for Single-Shell Tank 241-C-101.

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-C-101 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	L. M. Sasaki	R2-12
File	H5-49	R. E. Stout	H5-49
R. T. Winward	H5-49		
M. J. Kupfer	H5-49		
M. D. LeClair (3)	H0-50		

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A-7900-013-1 (06/92)

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 612285

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	8-11-97	PE		
Cog. Mgr. K. M. Hodgson	K. M. Hodgson	8-12-97	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other L. M. Sasaki	L M Sasaki	8/12/97	Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

Tank Characterization Report for Single-Shell Tank 241-C-101

R. E. Stout (Meier Associates), 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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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-C-101 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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RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-473	Page #1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-C-101

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
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APPENDIX C

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-C-101

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APPENDIX C

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR SINGLE-SHELL TANK 241-C-101

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-C-101 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.

C1.0 CHEMICAL INFORMATION SOURCES

As part of this effort an evaluation was made of available chemical information for tank 241-C-101, including the following.

- Analytical data from a 1995 auger sample taken from riser number 8, on March 29, 1995 (Table ES-2).
- The Hanford Defined Waste (HDW) model document (Agnew et al. 1997a) provides tank content estimates in terms of component concentrations and inventories.

C2.0 COMPARISON OF COMPONENT INVENTORY VALUES

The HDW model inventories are shown in Tables C2-1 and C2-2. Analysis of the sample from tank 241-C-101 included only alpha activity, pH, total carbon, density, and energetic properties, and did not estimate concentrations for anions or metals to compare against the HDW model estimate. The tank volume used to generate the HDW model inventory is 333 kL (88 kgal) waste which is all sludge. The HDW model estimates the waste density to be 1.58 g/ml (Agnew et al. 1997a). The chemical species are reported without charge designation per the best-basis inventory convention.

Table C2-1. Hanford Defined Waste Model-Based Inventory Estimates for Nonradioactive Components in Tank 241-C-101.

Analyte	HDW[a] inventory estimate (kg)	Analyte	HDW[a] inventory estimate (kg)
Al	30,700	OH	79,500
Ca	3,370	oxalate	0
Cl	230	Pb	9,150
Cr	36.2	P as PO_4	1,080
F	0	Si as SiO_3	54.4
Fe	13,500	S as SO_4	1,010
Hg	170	CO3	6,840
K	45	TOC	0.23
Na	45,900	U_{TOTAL}	12,400
NH_3	1.3	Zr	0
Ni	20.4	H_2O (Wt%)	41.8
NO_2	5,320	density (kg/L)	1.58
NO_3	101,000		

HDW = Hanford Defined Waste
[a]Agnew et al. (1997a).

Table C2-2. Hanford Defined Waste Model-Based Inventory Estimates for Radioactive Components in Tank 241-C-101.

Analyte	HDW[a] inventory estimate (Ci)
^{14}C	0.0891
^{90}Sr	1,070
^{129}I	8.25E-04
^{137}Cs	1,730
^{155}Eu	12
^{237}Np	0.00278
^{241}Pu	665
^{241}Am	0.166

HDW = Hanford Defined Waste
[a]Agnew et al. (1997a), decayed to January 1, 1994.

C3.0 COMPONENT INVENTORY EVALUATION

The following evaluation of tank contents is performed to identify potential errors and/or missing information that would have an effect upon the HDW model component inventories.

C3.1 WASTE HISTORY TANK 241-C-101

Tank 241-C-101 began receiving metal waste (MW) from the bismuth phosphate process in March 1946. In May 1946, the tank was declared full. During the third and fourth quarters of 1946, additions of MW were transferred by cascade to tank 241-C-102. Tank 241-C-101 received uranium recovery (UR) waste intermittently from U Plant from the second quarter of 1953 until the fourth quarter of 1954. During the third quarter of 1953, supernatant was transferred to tank 241-C-102 and also to tank 241-C-103. This was the last cascade transfer of supernatant to tank 241-C-102 until the first quarter of 1961. It became apparent in the second quarter of 1954 that the overflow outlet of tank 241-C-101 was partially plugged. During the fourth quarter of 1954, most of the contents of tank 241-C-101 supernatant was transferred directly to tank 241-C-103.

During the first quarter of 1956, tank 241-C-101 received supernatant (which probably was tri-butyl phosphate [TBP] waste) from tank 241-C-104. Also, from the first quarter of 1956 until the second quarter of 1957, supernatant was sporadically transferred from tank 241-C-101 to tanks 241-C-109 and 241-C-112 for in-tank settling and scavenging of ^{137}Cs by ferrocyanide. During the second quarter of 1957, tank 241-C-101 received waste of an unknown type from tank 241-BY-101.

Beginning in the fourth quarter of 1960, and intermittently until the second quarter of 1962, tank 241-C-101 received Plutonium-Uranium Extraction (PUREX) cladding waste (CWP). During the second quarter of 1962, the addition of the CWP exceeded the capacity of tank 241-C-101 and subsequently led to the cascade of supernatant to tank 241-C-102. During the third quarter of 1963, tank 241-C-101 received PUREX organic wash waste (OWW) supernatant from tank 241-A-102, while some supernatant was also pumped from tank 241-C-101 to tank 241-B-107. In the first quarter of 1964 tank 241-C-101 received additional PUREX supernatant from tank 241-A-103. In the second quarter of 1965, tank 241-C-101 received CR-Vault waste. The only other transfers for which the destination or the source are known are as follows:

- In the first quarter of 1964, tank 241-C-101 received diluted PUREX supernatant from tank 241-A- 103.
- In the second quarter of 1965, tank 241-C-101 received CR-Vault waste.

- In the fourth quarter of 1969, supernate was transferred out of tank 241-C-101 to tank 241-C-105.

- In the third quarter of 1974, supernate was transferred out of tank 241-C-101 to tank 241-C-104.

Tank 241-C-101 was removed from service in the first quarter of 1976. It was categorized as an assumed leaker in 1980 with an approximate leak volume of 76 kL (20 kgal). Tank 241-C-101 waste is currently defined as non-complexed waste.

C3.2 CONTRIBUTING WASTE TYPES

The HDW model (Agnew et al. 1997a) predicts that the tank contains a total of (88 kgal) of waste all of which is sludge. The sludge waste types are broken down into 11 kL (3 kgal) MW at the bottom of the tank, 114 kL (30 kgal) uranium recovery (UR, also known as TBP waste) and 208 kL (55 kgal) of CWP.

The Sort on Radioactive Waste Type (SORWT) model (Hill et al. 1995) lists TBP as the primary waste in the tank. The secondary waste type is listed as CWP with a tertiary waste listed as neutralized acid waste (P) and the other waste type listed as OWW.

Hanlon (1997) reports 333 kL (88 kgal) of waste which consists of only sludge. No description of the source or type of sludge is given.

C3.3 MAJOR ANALYTES OF CONTRIBUTING WASTE TYPES

From the HDW model, MW is expected to comprise the bottom layer and if present should contain large amounts of sodium, uranium, carbonate, phosphate, sulfate and hydroxide. However, from Rodenhizer (1987), tank 241-C-101 had been sluiced and emptied of metal waste by January 1957 and for the engineering evaluation no MW is assumed to be in the tank.

UR waste (located directly above the metal waste) should contain large quantities of sodium, iron, and nitrate. Strontium and cesium should be present in larger quantities in the uranium recovery waste layer than in the other layers of waste in the tank.

The CWP layer is directly above the UR waste layer and should be rich in aluminum, sodium, nitrate, and uranium. This layer will contain less uranium than in both the UR and the MW layers. Cesium and strontium are present but in such quantities that the activity will be lower than the UR and MW. The CWP layer can be further distinguished from the other two layers by the absence of iron (found in the UR waste layer) and the presence of a significant amount of aluminum (absent in both UR and MW layers).

C3.4 ASSUMPTIONS USED

For this evaluation, the following assumptions and observations are made.

- Tank volume listed in both Agnew et al. (1997a) and Hanlon (1997) are consistent with one another, 333 kL (88 kgal).
- All radionuclide inventories are decayed to January 1, 1994.
- Insufficient analytical data from tank 241-C-101 are available for estimating tank inventories. Tank 241-C-101 1995 auger sample event recorded total alpha activity, percent waster, and energetic properties that were measured in accordance with Babad and Redus (1994).
- Only the UR and CWP waste streams contributed to the sludge waste accumulation.
- The MW is assumed to have been removed from Tank 241-C-101 (Rodenhizer 1987), and the associated 11 kL of MW (Agnew et al. 1997a), is replaced by 11 kL of UR for the engineering assessment.

C3.5 BASIS FOR ENGINEERING EVALUATION

C3.5.1 Assessment of Uranium Recovery Sample Data

Tank 241-C-101 was a primary receiver for UR waste in 1953 (Agnew et al. 1997b). Tank 241-TY-105 was also a primary receiver of UR waste and is estimated to contain 874 kL of sludge which is all UR sludge (Agnew et al. 1997a).

Analytical data from tank 241-TY-105 (Mauss and Weiss 1987) was analyzed to determine the mass inventory of selected analytes in the tank. The mass of each component was then multiplied by a volume ratio of UR waste predicted in tank 241-C-101 verses the UR waste in tank 241-TY-105 (33 kgal / 231 kgal = 0.143). Table C3-1 shows the resulting UR inventory values obtained from this procedure.

C3.5.2 Assessment of PUREX Cladding Waste Sample Data

Tank 241-C-101 was a primary receiver for CWP waste in 1957 (Agnew 1997b). Tank 241-C-105 was also a primary receiver of CWP waste and is estimated to contain 511 kL of sludge which is all CWP waste.

Sample data from tank 241-C-105 Tank Characterization Report (Tusler and Amato 1995) was analyzed to determine the mass inventory of selected analytes in the tank. The mass of each component was then multiplied by a volume ratio of CWP waste predicted in tank 241-C-101 verses the CWP waste in tank 241-TY-105 (55 kgal / 135 kgal = 0.407). The calculated inventory of selected components for the CWP waste are shown in Table C3-1.

For informational purposes, Table C3-1 also shows tanks 241-C-105 and 241-TY-105 analyte inventories used as the basis for the inventories in tank 241-C-101. Also shown is the predicted HDW model inventory for each waste type for comparison. The HDW values were calculated using the concentrations for UR/TBP, CWP1, and CWP2 given on pages B-17 and B-18 in Agnew et al. 1997a. The volumes for the layers is given in Appendix C of Agnew et al. (1997a).

Table C3-1. Comparison of Engineering Evaluation and Hanford Defined Waste Model-Based Inventories for Selected Analytes for Tank 241-C-101. (2 Sheets)

Analyte	CWP Sample Inventory from Tank 241-C-105[a] (kg)	CWP Waste Engineering Assessment Inventory for Tank 241-C-101 (kg)	HDW CWP1 waste Inventory for tank 241-C-101 (kg)	UR Sample Inventory from Tank 241-TY-105[b] (kg)	UR Waste Engineering Assessment Inventory for Tank 241-C-101 (kg)	HDW-UR waste Inventory for tank 241-C-101 (kg)
Al	48,900	19,900	30,700	2,560	366	0
Bi	495	201	0	522	75	0
Ca	6,170	2,510	1,770	NR	NR	1,560
Cl	NR	NR	52	NR	NR	176
Cr	747	304	26.6	177	25	8.6
F	NR	NR	0	NR	NR	0
Fe	8,400	3,420	3,470	28,000	4,000	10,300
Mg	2,920	1,190	NR	NR	NR	NR
Mn	1,960	798	0	218	31.2	0
Na	56,900	23,200	7,890	154,000	22,000	36,500
Ni	1,700	692	19.1	114	16	4.9
NO_2	NR	NR	4,500	NR	NR	790
NO_3	8,320	3,390	6,960	238,000	34,000	93,700
Pb	711	289	9,170	519	74	0

Table C3-1. Comparison of Engineering Evaluation and Hanford Defined Waste Model-Based Inventories for Selected Analytes for Tank 241-C-101. (2 Sheets)

Analyte	CWP Sample Inventory from Tank 241-C-105[a] (kg)	CWP Waste Engineering Assessment Inventory for Tank 241-C-101 (kg)	HDW CWP1 waste Inventory for tank 241-C-101 (kg)	UR Sample Inventory from Tank 241-TY-105[b] (kg)	UR Waste Engineering Assessment Inventory for Tank 241-C-101 (kg)	HDW-UR waste Inventory for tank 241-C-101 (kg)
PO_4	NR	NR	0	NR	NR	641
P	2,000	814	NR	51,900	7,420	NR
Si	31,600	12,900	53.7	492	70	0
SO_4	NR	NR	203	NR	NR	707
TOC	791	322	0	1,080	154	0
U	7,790	3,170	7,650	722	1,030	19
Zr	566	230	0	9.8	1.4	0
Radio-nuclides	Ci					
^{90}Sr	684,000	278,000	466	256,000	36600	583
^{137}Cs	116,000	47,200	518	103,000	14700	1,170
^{241}Am	1,200	488	0.1	424	61	0.069
^{239}Pu	459	187	416	33.4	4.8	0.31

CWP = PUREX cladding waste
HDW = Hanford Defined Waste
NR = Not reported
PUREX = Plutonium-Uranium Extraction
UR=uranium recovery
[a]Tusler and Amato (1995)
[b]Mauss and Weiss (1987)

C3.6 ESTIMATED COMPONENT INVENTORIES

The resulting inventories from the engineering assessment and the HDW model are provided in Table C3-2 for comparison. A summary of conclusions and observations by component follows.

Table C3-2. Comparison of Selected Component Inventory Estimates for Tank 241-C-101.

Component	Engineering Evaluation (kg)	HDW-Based Inventory Estimate (kg)
Al	20,300	30,700
Bi	276	0
Fe	7,420	13,500
Na	45,200	45,900
Ni	708	20.4
NO_3	37,400	101,000
PO_4	NR	1,080
SO_4	NR	1,010
U	4,200	12,400
^{90}Sr (Ci)	315,000	1,070
^{137}Cs (Ci)	61,900	1,730

HDW = Hanford Defined Waste
NR = Not Reported.

Aluminum. The HDW model predicts 1.5 times more Al (30,700 kg) in tank 241-C-101 compared to the engineering assessment (20,300 kg). Nearly all of the Al comes from the CWP waste stream. The engineering assessment value is used as the best-basis inventory for Al.

Bismuth, Manganese, and Zirconium. The HDW model reports no bismuth, manganese, and zirconium on the tank. The HDW model assumes that these three elements did not exist in the CWP or UR waste streams; however, due to uncertainties in transfer data and other impurities that may have been in a waste stream that entered tank 241-C-101, the sample-based engineering assessment is used for the best-basis inventory.

Chloride, Fluoride. Sample data from both the UR and CWP waste did not report any values for chloride or fluoride; therefore, the HDW values are used for the best-basis inventory estimate.

Sodium. The HDW model prediction of the sodium content for tank 241-C-101 is in good agreement with that calculated from the engineering assessment (45,900 kg versus 45,200 kg). This is somewhat surprising considering the different waste volumes used as well as the different methodologies used to arrive at the tank inventory.

Iron. Iron is found in all the waste types added to tank 241-C-101. The HDW model inventory is twice the sample-based engineering assessment inventory. The HDW model assumes a large contribution of iron from MW; however, this assessment assumes MW was sluiced from the tank. The sample-based engineering assessment is used for the best-basis inventory estimate for iron.

Nitrate. Sample-based engineering data indicate low amounts of nitrate in tank 241-C-101 (37,400 kg), compared to that predicted by the HDW model (101,000 kg). The reason for this discrepancy is not clear at the present time. Until sample data are available for the tank, the sample-based engineering assessment is used for the best-basis inventory.

Sulfate, Phosphate, and Nitrite. Sample data from the engineering assessment-based tanks (241-TY-105 and 241-C-105) did not report any values for sulfate, phosphate, or nitrite. Therefore, the HDW value is used for best-basis inventory estimate for these components.

Uranium. The HDW model reports a U inventory over three times that estimated by the engineering assessment. The high uranium concentration in MW (1.75 mol/L), which the engineering assessment assumes is not present in the tank, is a major reason for the difference. The sample-based engineering assessment (4,200 kg) is used as the best-basis inventory for the uranium inventory.

^{90}Strontium and ^{137}Cesium. There are large differences between the engineering assessment data and the HDW model values for both ^{90}Sr and ^{137}Cs. The reasons for these discrepancies are not known at this time. Sample data would help clarify which evaluation correctly predicts the ^{90}Sr and ^{137}Cs inventory.

Total Hydroxide. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valence 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, significant figures are retained. This charge balance approach is consistent with that used by Agnew et al. (1997a).

C4.0 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, process and facilities for retrieving wastes, and processing them into a form that is suitable for long-term storage/disposal. Chemical and radiological inventory information are generally derived using three approaches: (1) component inventories are estimated using the

results of sample analyses, (2) component inventories are predicted 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 the standard characterization for the various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-C-101 was performed including the following:

- The inventory estimate generated by the HDW model (Agnew et al. 1997a)
- An engineering assessment that estimates a waste inventory based on sample data from tanks 241-C-105 (for the CWP waste) and 241-TY-105 (for the UR waste).

Based on this evaluation, a best-basis inventory was developed for tank 241-C-101. The engineering assessment inventory (based on sample data from 241-C-105 and 241-TY-105) was chosen as the best-basis inventory for most analytes, for the following reasons:

- Rodenhizer (1987) reports tank 241-C-101 has been emptied of MW while Agnew et al. (1997a) includes 11 kL (3 kgal) of MW in tank 241-C-101 inventory calculations
- Tanks 241-C-105 and 241-TY-105 contain only CWP and UR waste, respectively. Analyses from these tanks' samples are considered to be a good basis for the component inventories for tank 241-C-101
- Insufficient analytical data were available from the 1995 auger sample to allow estimation of tank 241-C-101 component inventories.

The best-basis inventory estimate for tank 241-C-101 is presented in Tables C4-1 and C4-2. HDW model inventories were used for components where sample data were not available.

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. 1997a). 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 inventory values reported in Tables C4-1 and C4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Table C4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-C-101 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E or C)[1]	Comment
Al	20,300	E	
Bi	276	E	
Ca	2,510	E	
Cl	230	M	
TIC as CO_3	6,840	M	
Cr	329	E	
F	0	M	
Fe	7,420	E	
Hg	170	M	
K	45	M	
La	0	M	
Mn	829	E	
Na	45,200	E	
Ni	708	E	
NO_2	5,320	M	
NO_3	37,400	E	
OH	51,500	C	
Pb	363	E	
P as PO_4	1,080	M	

Table C4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-C-101 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (kg)	Basis (S, M, E or C)[1]	Comment
Si	13,000	E	
S as SO_4	1,010	M	
Sr	0	M	
TOC	476	E	
U_{TOTAL}	4,200	E	
Zr	231	E	

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

Table C4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-C-101. Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	0.427	M	
^{14}C	0.0891	M	
^{59}Ni	0.0176	M	
^{60}Co	0.0284	M	
^{63}Ni	1.63	M	
^{79}Se	0.0132	M	
^{90}Sr	1,070	M	
^{90}Y	1,070	M	
^{93}Zr	0.0624	M	
^{93m}Nb	0.0511	M	
^{99}Tc	0.434	M	
^{106}Ru	1.78 E-05	M	
^{113m}Cd	0.187	M	
^{125}Sb	0.0851	M	
^{126}Sn	0.02	M	
^{129}I	8.25 E-04	M	
^{134}Cs	0.00446	M	
^{137}Cs	1,730	M	
^{137m}Ba	1,640	M	Based on 0.946 times ^{137}Cs activity
^{151}Sm	48.5	M	
^{152}Eu	0.168	M	
^{154}Eu	0.572	M	
^{155}Eu	12	M	
^{226}Ra	4.01 E-06	M	
^{227}Ac	0.0156	M	
^{228}Ra	0.00509	M	
^{229}Th	0.00231	M	

Table C4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-C-101. Decayed to January 1, 1994 (Effective May 31, 1997). (2 Sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{231}Pa	0.0231	M	
^{232}Th	2.37 E-04	M	
^{232}U	0.263	M	
^{233}U	1.02	M	
^{234}U	4.17	M	
^{235}U	0.179	M	
^{236}U	0.0725	M	
^{237}Np	0.00278	M	
^{238}Pu	8.55	M	
^{238}U	4.14	M	
^{239}Pu	416	M	
^{240}Pu	69.7	M	
^{241}Am	549	E	
^{241}Pu	665	M	
^{242}Cm	0.00288	M	
^{242}Pu	0.00207	M	
^{243}Am	1.45 E-06	M	
^{243}Cm	6.75 E-05	M	
^{244}Cm	5.42 E-05	M	

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

C5.0 APPENDIX C REFERENCES

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