EDMC # 47699

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PAGE COUNT D197247143

ACCESSION # 22

47160

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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 635522

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 []	Jim G. Field, Data Assessment and Interpretation, R2-12, 376-3753	[] Yes [X] No	08/05/97
	6. Project Title/No./Work Order No. Tank 241-AP-107	7. Bldg./Sys./Fac. No. 241-AP-107	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-WM-ER-362, Rev. 1	10. Related ECN No(s). ECN-635439	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.

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: AUG 22 1997 HANFORD RELEASE STA: 4 ID: 3

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-635522

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. J.G. Field	J G Field	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-AP-107

Jim G. Field
Lockheed Martin Hanford, Corp., Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: ECN-635522 UC: 2070
Org Code: 74620 Charge Code: N4G3A
B&R Code: EW 3120074 Total Pages: 133

Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AP-107, 241-AP-107, AP-107, AP 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-AP-107. This report supports the requirements of the Tri-Party Agreement Milestone M-44-05.

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Kara J. Broz 8/22/97
Release Approval Date

DATE STA 4 MANAGER RELEASE ID: AUG 22 1997
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RECORD OF REVISION	(1) Document Number HNF-SD-WM-ER-362	Page 1

(2) Title
Tank Characterization Report for Double-Shell Tank 241-AP-107

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 09/06/94 on EDT-608045.	B.C. Simpson	C.S. Haller
1 RS	Incorporate per ECN-635439.	J.G. Field J.G. Field 3-14-97	K.M. Hall Kathleen M. Hall 3/18/97
1-A RS	Incorporate per ECN-635522.	J.G. Field J.G. Field 8/20/97	K.M. Hall Kathleen M. Hall 8/20/97

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 Inventory Estimates for Nonradioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1,2,3]
Al	28.9	S
Bi	0	M/E
Ca	30.1	M/E
Cl	2.73	M/E
CO_3	178	S
Cr	0	M
F	368	S
Fe	9.33	M/E
Hg	0	M
K	0.65	M/E
La	0	M

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1, 2, 3]
Mn	0	M
Na	1,230	S
Ni	0	M
NO_2	263	S
NO_3	551	S
OH	575	S
Pb	0	M
PO_4	0	M
Si	0	M
SO_4	0	M
Sr	0	M
TOC	26.0	S
U	0.630	S
Zr	0	M

Notes:

[1]S = Sample-based, M = HDW model-based, E = Engineering assessment-based

[2]Inventories are based on a volume of 83 kL (22 kgal). Sample inventories are based on February 1995 grab samples (see Appendix B) adjusted for evaporation losses (see Section D2.3).

[3]M/E values = (HDW inventory) x (22/1,110), see Section D4.0

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1, 2]
^{3}H	3.09	S
^{14}C	0.00192	S
^{59}Ni	0	M
^{60}Co	0	M
^{63}Ni	0	M
^{79}Se	0	M
^{90}Sr	16.3	S
^{90}Y	16.3	S
^{93}Zr	0	M
^{93m}Nb	0	M
^{99}Tc	0.249	S
^{106}Ru	0	M
^{113m}Cd	0	M
^{125}Sb	0	M
^{126}Sn	0	M
^{129}I	0	M
^{134}Cs	0	M
^{137}Cs	15.6	S
^{137m}Ba	14.8	S
^{151}Sm	0	M
^{152}Eu	0	M
^{154}Eu	0	M
^{155}Eu	0	M
^{226}Ra	0	M
^{227}Ac	0	M

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1, 2]
^{228}Ra	0	M
^{229}Th	0	M
^{231}Pa	0	M
^{232}Th	0	M
^{232}U	0	M
^{233}U	0	M
^{234}U	0	M
^{235}U	0	M
^{236}U	0	M
^{237}Np	0.00284	S
^{238}Pu	0	M
^{238}U	0	M
$^{239/240}Pu$	0.00937	S
^{241}Am	0	M
^{241}Pu	0	M
^{242}Cm	0	M
^{242}Pu	0	M
^{243}Am	0	M
^{243}Cm	0	M
^{244}Cm	0	M

Notes:

[1]S = Sample-based, M = HDW model-based, E = Engineering assessment-based

[2]Inventories are based on a volume of 83 kL (22 kgal). Sample inventories are based on February 1995 grab samples (see Appendix B) adjusted for evaporation losses (see Section D2.3).

APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AP-107

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APPENDIX D

EVALUATION TO ESTABLISH BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AP-107

Key waste management activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with tank wastes. Disposal activities include designing equipment, processes, and facilities for retrieving wastes and processing them into a form suitable for long-term storage. Information about chemical, radiological, 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.

Chemical and radiological inventory information generally is derived using three approaches: 1) component inventories are estimated using the results of sample analyses, 2) component inventories are predicted using a the HDW model based on process knowledge and historical information, or 3) a tank-specific process estimate is made based on process flow sheets, reactor fuel data, use, and other operating data.

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available chemical information for tank 241-AP-107 was performed, and a best-basis inventory was established. This work follows the methodology that was established by the standard inventory task (Kupfer et al. 1997).

The following evaluation provides a best-basis inventory estimate for chemical and radionuclide components in tank 241-AP-107.

The waste type is expected to be dilute noncomplexed.

D1.O CHEMICAL INFORMATION SOURCES

The 1995 sample data (see Appendix B) are the only sources of composition information used in this engineering evaluation.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Typically, best-basis inventory documents compare sample-based inventories derived from analytical concentration data to inventories generated by the HDW model (Agnew et al. 1997). However, the HDW model estimates for all tanks are valid as of January 1, 1994. Since that time tank 241-AP-107 has been emptied, filled, and emptied again. The 1995 analytical data should represent the 83 kL (22 kgal) of waste remaining in the tank. No comparisons to the HDW model estimates were made. The sample-based density is 1.01 g/mL. No solids are expected to be in the tank.

D3.0 COMPONENT INVENTORY EVALUATION

There is little justification or incentive to dispute the analytical results for the small volume of dilute liquid in tank 241-AP-107. Tank 241-AP-107 remains in service and has been designated as the receiver tank for most of the 3,070 kL (810 kgal) of supernatant in tank 241-AY-102 in preparation of that tank for retrieval of tank 241-C-106 solids (Strode and Koreski 1996). Tank 241-AP-107 probably will continue to be the receiver of the dilute noncomplexed waste that will eventually be concentrated in the 242-A Evaporator.

D3.1 CONTRIBUTING WASTE TYPES

Before 1994, tank 241-AP-107 contained 4,200 kL (1,110 kgal) of diluted PUREX ammonia scrubber waste. In the fall of 1994, tank 241-AP-107 was pumped down to a 106 kL (28 kgal) heel before receiving 500 kL (132 kgal) of dilute noncompelxed waste from tank 241-AW-103 and 3,270 kL (863 kgal) of dilute noncomplexed waste from tank 241-AP-101 in the first quarter of fiscal year 1995. These wastes consisted mostly of PUREX ammonia scrubber waste and other PUREX low-level miscellaneous waste streams. In May and June 1995, all but 106 kL (28 kgal) of waste in tank 241-AP-107 was sent to the 242-A Evaporator.

D3.2 INVENTORY EVALUATION

The last sampling event for tank 241-AP-107 was completed February 2, 1995. At that time, tank 241-AP-107 contained approximately 3,770 kL (996 kgal) of unstratified, low-level PUREX miscellaneous wastes. It was assumed that after the tank was pumped down to 106 kL (28 kgal), the remaining heel had the same composition as the February 1995 samples. Further losses of 23 kL (6.0 kgal) were also reported (Koreski 1996). Because the tank was classified as a non-leaker and the uncertainty of the FIC level gauge was restricted to $\pm$ 2.6 kL (0.70 kgal), losses were assumed the result of in-tank evaporation.

Accordingly, the February 1995 sample concentrations were assumed to increase by a ratio of 106/83 kL (28/22 kgal) as a result of in-tank evaporation without the precipitation of salts. Table D3-1 shows adjusted concentrations. (The chemical species are reported without charge designation per the best-basis inventory convention). The average error of available density correlations (Agnew and Watkin 1996) are too large to be useful in calculating a new specific gravity. A specific gravity of 1.01 was assumed for the adjusted sample concentrations. A weight percent water value for a specific gravity of 1.01 g/mL was calculated to be 99.0.

Table D3-1. January 1997 Analyte Concentrations for Tank 241-AP-107[1]

Analyte	Concentration (μg/mL)
OH	6,910
U	7.56
Acetone	5.14
Al	347
F	4,420
Na	14,800
NH_4	1,320
CO_3	2,130
NO_2	3,160
NO_3	6,620
Radionuclide	**Concentration (μCi/mL)**
^{3}H	0.0371
^{14}C	2.30E-05
^{99}Tc	3.00E-03
^{137}Cs	0.187
^{237}Np	3.41E-05
$^{239/240}Pu$	1.13E-04
^{90}Sr	0.191

Table D3-1. January 1997 Analyte Concentrations for Tank 241-AP-107[1]

Analyte	Concentration (μg/mL)
TOC	312
Percent water[2]	99.0
SpG[3]	1.01

Notes:

[1]Based on February 1995 grab sample results, adjusted for evaporation losses (see Section D3.2).
[2]Based on an assumed SpG of 1.01 g/mL.
[3]An assumed value.

D4.0 DEFINE THE BEST BASIS AND ESTABLISH COMPONENT INVENTORIES

The engineering assessment in this evaluation should serve as the basis for the best-estimate inventory to tank 241-AP-107 for the following reasons:

1. The February 1995 samples are the only representative samples of waste currently in tank 241-AP-107.

2. The HDW model estimate is outdated because of a large number of waste transfers that have occurred subsequent to the date the HDW model estimate is valid.

Tables D4-1 and D4-2 show the best-basis inventory estimates for tank 241-AP-107. Radionuclide values are decayed to January 1, 1994. The inventory values reported in Tables D4-1 and D4-2 are subject to change. Refer to the Tank Characterization Database (TCD) for the most current inventory values.

Although outdated, the HDW model provides the only estimate available for many of the analytes in Tank 241-AP-107. Consequently, model-based/engineering estimates were derived by multiplying HDW inventories by the ratio of current and HDW waste volumes (22:1110). The HDW model estimates that there are no radionuclides present and only a few metals and anions. Except for the sample-based analyte inventories, the inventories are rough estimates only.

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-AP-107. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1, 2, 3]
Al	28.9	S
Bi	0	M/E
Ca	30.1	M/E
Cl	2.73	M/E
CO_3	178	S
Cr	0	M
F	368	S
Fe	9.33	M/E
Hg	0	M
K	0.65	M/E
La	0	M
Mn	0	M
Na	1,230	S
Ni	0	M
NO_2	263	S
NO_3	551	S
OH	575	S

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, or E)[1, 2, 3]
Pb	0	M
PO_4	0	M
Si	0	M
SO_4	0	M
Sr	0	M
TOC	26.0	S
U	0.630	S
Zr	0	M

Notes:

[1]S = Sample-based, M = HDW model-based, E = Engineering assessment-based

[2]Inventories are based on a volume of 83 kL (22 kgal). Sample inventories are based on February 1995 grab samples (see Appendix B) adjusted for evaporation losses (see Section D2.3).

[3]M/E values = (HDW inventory) x (22/1,110), see Section D4.0

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1, 2]
^{3}H	3.09	S
^{14}C	0.00192	S
^{59}Ni	0	M
^{60}Co	0	M
^{63}Ni	0	M
^{79}Se	0	M
^{90}Sr	16.3	S
^{90}Y	16.3	S
^{93}Zr	0	M
^{93m}Nb	0	M
^{99}Tc	0.249	S
^{106}Ru	0	M
^{113m}Cd	0	M
^{125}Sb	0	M
^{126}Sn	0	M
^{129}I	0	M
^{134}Cs	0	M
^{137}Cs	15.6	S
^{137m}Ba	14.8	S
^{151}Sm	0	M
^{152}Eu	0	M
^{154}Eu	0	M
^{155}Eu	0	M
^{226}Ra	0	M
^{227}Ac	0	M

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AP-107. (2 sheets)

Analyte	Total Inventory (Ci)	Basis (S, M, or E)[1, 2]
^{228}Ra	0	M
^{229}Th	0	M
^{231}Pa	0	M
^{232}Th	0	M
^{232}U	0	M
^{233}U	0	M
^{234}U	0	M
^{235}U	0	M
^{236}U	0	M
^{237}Np	0.00284	S
^{238}Pu	0	M
^{238}U	0	M
$^{239/240}Pu$	0.00937	S
^{241}Am	0	M
^{241}Pu	0	M
^{242}Cm	0	M
^{242}Pu	0	M
^{243}Am	0	M
^{243}Cm	0	M
^{244}Cm	0	M

Notes:

[1]S = Sample-based, M = HDW model-based, E = Engineering assessment-based

[2]Inventories are based on a volume of 83 kL (22 kgal). Sample inventories are based on February 1995 grab samples (see Appendix B) adjusted for evaporation losses (see Section D2.3).

D5.0 APPENDIX D REFERENCES

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