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0050793

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 653781

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 []	John M. Conner, Data Assessment and Interpretation, R2-12, 373-2711	[] Yes [X] No	05/25/99
	6. Project Title/No./Work Order No.: Tank 241-AW-106	7. Bldg./Sys./Fac. No.: 241-AW-106	8. Approval Designator: N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.): HNF-SD-WM-ER-365, Rev. 1-B	10. Related ECN No(s).: ECNs: 635464, 635525, 644493	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 has been generated in order to update the document to reflect results of recent data/information evaluation.

Replace pages:

2-1 through 2-4, 4-1, 4-2, 5-1, 5-2, B-3, B-4, B-25, and B-26

JUN 1999 RECEIVED EDMC

14a. Justification (mark one)

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

14b. Justification Details

A tank characterization report page change revision is required to reflect the results of recent evaluation of data/information pertaining to adequacy of tank sampling for safety screening purposes (Reynolds et al. 1999, Evaluation of Tank Data for Safety Screening, HNF-4217, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington).

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

See attached distribution.

RELEASE STAMP

DATE: JUN 3 1999

STA: 4

HANFORD RELEASE

ID: 58

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

A-7900-013-1

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): ECN-653781

16. Design Verification Required	17. Cost Impact — ENGINEERING		17. Cost Impact — CONSTRUCTION		18. Schedule Impact (days)	
[] 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.M. Conner *for [signature]*	6/3/99	PE	
Cog. Mgr. K.M. Hall *Kathleen M. Hall*	6/3/99	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

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

John M. Conner
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

EDT/ECN: ECN-653781 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
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Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AW-106, Tank AW-106, AW-106, AW Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

6/3/99

Release Approval Date

Release Stamp

Approved for Public Release

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

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

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 09/28/94 on EDT-608071.	B.C. Simpson	C.S. Haller
1 RS	Incorporate per ECN-635464. cim 5/2/97	J.G. Field J.G. Field 4/30/97	K.M. Hall Kathleen M. Hall 4/30/97
1-A RS	Incorporate per ECN-635525.	J.G. Field J.G. Field 8/20/97	K.M. Hall Kathleen M. Hall 8/20/97
1B RS	Incorporate per ECN-644493	M.J. Kupfer M.J. Kupfer 8-28-98	K.M. Hodgson K.M. Hodgson 9-8-98
1-C RS	Incorporate per ECN-653781.	J.M. Conner [signature]	K.M. Hall Kathleen M. Hall 4/3/99

A-7320-005 (08/91) WEF168

2.0 RESPONSE TO TECHNICAL ISSUES

The technical issues identified for tank 241-AW-106 (Brown et al. 1996) are:

- Safety Screening: Does the waste pose or contribute to any recognized potential safety problems?
- Hazardous Vapor Screening: Are there hazardous storage conditions or regulatory compliance issues associated with gases and vapors in the tank?
- Compatibility: Will safety problems be created as a result of commingling was tes under interim storage? Are there any operations issues to be addressed before transferring waste?

Data from the 1995 grab sample analysis provided the means to respond to these issues. This response is discussed in the following sections. See Appendix B for sample and analysis data for tank 241-AW-106. Tank 241-AW-106 receives the evaporator bottoms waste after evaporation. However, it was not sampled in accordance with the evaporator DQO for normal evaporator operations (Von Bargen 1995) because it was sampled before the evaporator campaigns started (Brown et al. 1996).

2.1 SAFETY SCREENING

The data needed to screen the waste in tank 241-AW-106 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. Two full vertical profiles were not obtained of the solid waste; however, the 1995 grab sampling performed is considered sufficient for performing a safety screening assessment (Reynolds et al. 1999). The bulk of the solids layer in this double-shell tank is considered to be one waste type (Lambert 1998). Each safety screening issue is addressed separately in the following sections.

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure that there are not enough exothermic constituents (organic or ferrocyanide) present to cause a safety hazard. Differential scanning calorimetry (DSC) analyses were not performed for waste solids. Total organic carbon (TOC) analyses provide an acceptable alternative to assess energetics. TOC results (2,160 μg/g C) were well below safety screening limits. The maximum exotherm for liquid samples (86.2 J/g) was found in sample AW-106-2.

2.1.2 Flammable Gas

Tank headspace flammability in the headspace was not required at the time of sampling, and was not available for this tank. However, operations must stop if a lower flammability level (LFL) of greater than 5 percent is encountered during headspace monitoring. Operations records during the 1995 grab sample event show that sample operations were never required to stop as a result of high LFL readings. The LFL is expected to be low (near 0 percent LFL) because the tank is actively ventilated and radionuclide and organic concentrations are low. Therefore, the headspace vapor is below the DQO limit of 25 percent of the LFL.

2.1.3 Criticality

The safety threshold limit for criticality is 1 g ^{239}Pu per liter of waste. Assuming that all alpha activity is from ^{239}Pu, for a measured density of the centrifuged solids of 1.95 g/mL, 1 g/L of ^{239}Pu is greater than or equivalent to 31.5 μCi/g of alpha activity. The maximum result for total alpha was 0.3 μCi/g. The maximum 95 percent confidence interval on the mean was 0.32 μCi/g. These values are well below the threshold limit. As a result, criticality is not a concern for this tank.

2.2 VAPOR SCREENING

The data needed to assess waste for the vapor screening issue (Osborne and Buckley 1995) have not been obtained for this tank. Vapor samples are scheduled to be taken in 1999.

2.3 COMPATIBILITY

Before transferring 241-AW-106 tank waste, a waste compatibility assessment using the August 1995 grab sample results was performed by Tank Farm Operations. Sampling and analysis of grab samples were performed to the requirements of the waste compatibility DQO (Fowler 1995) as specified in the *Compatibility Grab Sampling and Analysis Plan* (Jones 1995). Results of the compatibility evaluation showed that there were no compatibility concerns. Additional grab samples are expected to be obtained and new compatibility evaluations performed prior to future waste transfers.

2.4 OTHER TECHNICAL ISSUES

A factor in assessing tank safety is heat generation from radioactive decay. The tank heat load calculated from the best-basis inventory for radioisotopes (Section 3.0) was 844 W (2,880 Btu/hr) (Table 2-1). This is well below the 20,500-W (70,000-Btu/hr) operating specification limit for double-shell tanks (LMHC 1996).

Table 2-1. Tank 241-AW-106 Radionuclide Inventory and Projected Heat Load.

Radionuclide	Projected Inventory (Ci)	Decay Heat Generation Rate (W/Ci)	Decay Heat Generation (W)
^{137}Cs	5.24E+04	0.00472	247
$^{89/90}$Sr	8.93E+04	0.00669	597
Total watts			844

2.3 SUMMARY

Tank 241-AW-106 is an active receiver tank for the 242-A Evaporator. Analyses of grab samples taken August 1995 to address compatibility issues also address the safety screening issues. Safety screening, vapor screening and waste compatibility results are summarized in Table 2-2. The LFL during sampling was less than the limit of five percent and, therefore, was below the DQO limit of 25 percent of the LFL.

Table 2-2. Summary of Safety Screening, Vapor Screening and Waste Compatibility Results.

Issue	Sub-issue	Result
Safety screening	Fuel content/ Energetics	Exotherms were analyzed for in liquid samples, all results well below limits. TOC analyses of solids were below limits.
	Criticality	All analyses well below 31.5 μCi/g (safety screening limit) and 0.810 μCi/g (waste compatibility limit).
	Flammable gas accumulation	The LFL was $<$ 5% during the sampling event and is expected to be near 0% because the tank is actively ventilated and radionuclide and organic concentrations are very low.
Vapor screening	Flammability	The LFL was $<$ 5%.
	Toxicity	This issue has been closed (Hewitt 1996).
	Organic pool	Vapor samples are scheduled for 1999.
Compatibility	Waste compatibility assessment	All analyses met compatibility requirements. Additional grab samples will be required for future waste transfers.

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4.0 CONCLUSIONS AND RECOMMENDATIONS

Tank 241-AW-106 is a receiver tank for the 242-A Evaporator. Samples were obtained in August 1995 to satisfy the compatibility DQO in support of 242-A Evaporator campaign 95-1. Analytical results were also used to address flammability, energetics, and criticality issues for the safety screening DQO, and were well within the safety notification limits for LFL, TOC, and total alpha. The tank currently contains 931 kL (246 kgal) of waste, of which 852 kL (225 kgal) are solids (Hanlon 1997). Supernatant concentrations have changed since the 1995 grab samples were taken, but solids contents are assumed to be the same. A best-basis inventory for the solids was developed based on limited August 1995 data and estimates from Agnew (1997). Tank 241-AW-106 is active, and additional transfers are anticipated to and from the tank.

Table 4-1 summarizes the status of the Project Hanford Management Contractor (PHMC) TWRS Program office review and acceptance of the sampling and analysis results reported in this TCR. The DQO issue required to be addressed by sampling and analysis is listed in column one of Table 4-1. The second column indicates whether the requirements of the DQO were met by the sampling and analysis activities performed. The third column indicates concurrence and acceptance by the program in TWRS responsible for the DQO and that the sampling and analysis activities performed adequately meet the needs of the DQO. A "Yes" or "No" in column three indicates acceptance or disapproval of the sampling and analysis information presented in the TCR.

Table 4-1. Acceptance of Tank 241-AW-106 Sampling and Analysis.

Issue	Sampling and Analysis Performed	TWRS[1] Program Acceptance
Safety screening DQO	Yes	Yes
Vapor screening	No	No
Compatibility DQO	Yes	Yes

Note:
[1]PHMC TWRS Program Office

Table 4-2 summarizes the status of the PHMC TWRS Program office review and acceptance of the evaluations and other characterization information contained in this report. The evaluations specifically outlined in this report are the best-basis inventory evaluation and the evaluation to determine whether the tank is safe, conditionally safe, or unsafe. Column one lists the different evaluations performed in this report. Columns two and three are in the same format as Table 4-1. The manner in which concurrence and acceptance are summarized is also the same as that in Table 4-1.

No additional samples and analyses are required to meet safety screening DQO requirements. Although compatibility analyses met all DQO's, because the tank contents have changed since grab samples were taken, the tank may need to be resampled and a new evaluation performed before additional waste transfers occur.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AW-106.

Issue	Evaluation Performed	PHMC TWRS Program Acceptance
Safety categorization	Yes	Yes
Vapor screening	No	No
Compatibility	Yes	Yes

5.0 REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-AW-106

Appendix B contains sampling and analysis information for each known sampling event for tank 241-AW-106, and an assessment of the grab sample results.

Future sampling of tank 241-AW-106 will be appended to the above list.

B1.0 TANK SAMPLING OVERVIEW

This section describes 1995 grab samples, 1994 grab samples, 1991 grab samples, and historical samples for tank 241-AW-106.

Three grab samples were taken in August 1995 to satisfy the *Data Quality Objectives for Tank Farms Waste Compatibility Program* (Fowler 1995). Sampling and analyses were performed in accordance with the *Compatibility Grab Sampling and Analysis Plan* (Jones 1995). Supernatant in the tank has changed since these samples were taken. However, the sludge samples are expected to be representative of current tank contents.

Grab samples were taken in April 1994 and from July to August 1991 to determine whether the waste was acceptable feed for the 242-A Evaporator. The 1994 samples from tank 241-AW-106 were mixed with samples from tanks 241-AW-102 and 241-AP-103.

Other grab samples taken in support of the 242-A Evaporator Campaign are described in Section 2.4.

Sampling and analytical requirements for tank 241-AW-106 are summarized in Table B1-1.

Table B1-1. Integrated Requirements for Tank 241-AW-106.

Sampling Event	Applicable DQOs	Sampling Requirements	Applicable References
Grab sampling	SAFETY SCREENING - Energetics - Total alpha - Flammable gas	Core samples from two risers separated radially to the maximum extent possible.	Dukelow et al. (1995)
	COMPATIBILITY		Fowler (1995)

B2.0 DESCRIPTION OF SAMPLING EVENTS

The 1995 grab sampling event, 1994 composite samples, 1991 grab samples, and historical sampling events are described in this section. Analytical results are presented in Tables B2-5 through B2-44. The 1995 grab sample analyses and analytical results were used to satisfy the compatibility DQO and the safety screening DQO.

B2.1 AUGUST 1995 GRAB SAMPLES

Tank 241-AW-106 was sampled on August 24, 1995. Three samples were taken from riser 16B at depths of 1,270 cm (500 in.), 1,549 cm (610 in.), and 1,626 cm (640 in.) from the top of the riser to the mouth of the sample bottle. The "bottle-on-a-string" method (De Lorenzo et al. 1994) was used to collect the samples from the tank. Each glass sample bottle collected approximately 100 mL of liquid and/or sludge.

Analyses were performed by the 222-S Laboratory. Table B2-1 summarizes sample numbers, dates and locations.

Table B2-44. Tank 241-AW-106 Analytical Results: Technetium-99.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μCi/mL	μCi/mL	μCi/mL
S95T002017	Riser 16B	Whole	0.0352	none	0.0352

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

The purpose of this chapter is to discuss the overall quality and consistency of the current sampling results for tank 241-AW-106. This section also evaluates sampling and analysis factors that may impact interpretation of the data. These factors are used to assess the overall quality and consistency of the data and to identify any limitations in the use of the data. Supernatant transfers have occurred since grab samples were taken in August 1995. Consequently, supernatant results may not represent current tank contents. As a result, only the results for the centrifuged solids samples are assessed in this section. Analytical data for supernatant and sludge samples are included in the Appendix B data tables.

B3.1 FIELD OBSERVATIONS

Grab samples were obtained from Riser 16B for the August 1995 sampling. Centrifuged solids obtained were sufficient for a safety screening assessment. Samples were obtained from three different risers in July 1991. However, those supernatant samples obtained do not reflect current tank contents.

B3.2 QUALITY CONTROL ASSESSMENT

The usual quality control assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. Spike recovery tests were not performed and field blanks were not obtained for the 1994 grab sample analyses. Samples that had one or more QC results outside the specified criteria were identified by footnotes in the data summary tables.

The standard recovery results provide an estimate of the accuracy of the analysis. If a standard is above or below the given criterion, then the analytical results may be biased high or low, respectively. No standards were available to assess recovery for many of the radionuclides. The analytical precision is estimated by the relative percent difference (RPD), which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, multiplied by one hundred.

The majority of the QC results were within specified boundaries. Discrepancies are footnoted in the data summary tables. QC discrepancies noted should not impact either the validity or use of the data.

B3.3 DATA CONSISTENCY CHECKS

Comparisons of different analytical methods can help to assess the consistency and quality of the data. The mass and charge balance could not be calculated because neither IC nor ICP analyses were conducted for the centrifuged solids. The only checks that could be made were to compare total alpha and isotopic alpha, and to compare total beta and isotopic beta. Close agreement between the two methods strengthens the credibility of both results, whereas poor agreement brings the reliability of the data into question. All mean centrifuged solids results were taken from tables in Section B3.4 and data summary tables.

B3.3.1 Total Alpha vs. Isotopic Alpha

Total alpha analyses were compared with the sum of $^{239/240}Pu$ and ^{241}Am analyses. As shown in Table B3-1, the mean total alpha result was 0.22 μCi/g and the sum of the isotopic radionuclides was 0.196 μCi/g, for a relative percent difference of 11 percent. This is reasonably close agreement. Differences maybe attributed to the low level of alpha in the sample and the other alpha isotopes in the sample not accounted for by this comparison.

Table B3-1. Comparison of Total Alpha and Isotopic Alpha Analyses.

Analyte	Concentration (μCi/g)
$^{239/240}Pu$	0.046
^{241}Am	0.150
$^{239/240}Pu$ + ^{241}Am	0.196
Total alpha	0.221
Relative percent difference (total alpha:$^{239/240}Pu$+^{241}Am)	11%

DISTRIBUTION SHEET

To	From	Page 1 of 2
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Project Title/Work Order		EDT No. N/A
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Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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B. C. Simpson	R2-12	X			
R. R. Thompson	R2-12	X			
ERC (Environmental Resource Center)	R1-51	X			
T.C.S.R.C.	R1-10	5			
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Pacific Northwest National Laboratory					
A. F. Noonan	K9-91	X			
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