S

ENGINEERING CHANGE NOTICE

0050779

1. ECN 653805

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 []	Steve G. McKinney, Data Assessment and Interpretation, R2-12, 372-1945	[] Yes [X] No	05/26/99
	6. Project Title/No./Work Order No. Tank 241-AP-102	7. Bldg./Sys./Fac. No. 241-AP-102	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-WM-ER-358, Rev. 1-B	10. Related ECN No(s). ECNs: 635422, 635518, 644499	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, and 5-2

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.

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DATE: MAY 27 1999

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

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-653805

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. S.G. McKinney	Steve McKinney	5/27/99	PE		
Cog. Mgr. K.M. Hall	for	5/27/99	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

S

Tank Characterization Report for Double-Shell Tank 241-AP-102

Steve G. McKinney
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

EDT/ECN: ECN-653805 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
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Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AP-102, Tank AP-102, AP-102, AP Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

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5/27/99

Release Approval Date

DATE:
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2

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RECORD OF REVISION	(1) Document Number HNF-SD-WM-ER-358	Page 1

(2) Title
Tank Characterization Report for Double-Shell Tank 241-AP-102

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-608043.	B.S. Simpson	J.G. Kristofzski
1 RS	Incorporate per ECN-635422.	J.H. Baldwin	K.M. Hall 1/27/97
1-A RS	Incorporate per ECN-635918.	J.H. Baldwin	K.M. Hall
1B RS	Incorporate per ECN-644499	M.J. Kupfer 8-26-98	K.M. Hodgson 8-26-98
1-C RS	Incorporate per ECN-653805.	B.G. McKinney	K.M. Hall 5/27/99

A-7320-005 (08/91) WEF168

2.0 RESPONSE TO TECHNICAL ISSUES

One technical issue has been identified for tank 241-AP-102:

- Does the waste pose or contribute to any recognized potential safety problems?

The safety screening DQO (Dukelow et al. 1995) provides the sampling requirements and the types of analysis used to address the above issue. Data from the analysis of two grab sampling events, as well as available historical information, provided the means to respond to these issues. This response is detailed in Sections 2.1 and 2.2. See Appendix B for sample and analysis data for tank 241-AP-102.

2.1 SAFETY SCREENING

The data needed to screen the waste in tanks for three potential safety problems are documented in the tank safety screening DQO (Dukelow et al. 1995). The first potential safety problem is the potential for a propagating exothermic reaction; the second is flammable gases in the headspace; and the third is the potential for a critical nuclear reaction. These three conditions are addressed separately below. Specific gravity, which is required by Dukelow et al. (1995) for the purpose of calculating total alpha activity limits, was measured on the 1993 grab samples. The safety screening DQO did not exist at the time of the 1993 sampling of tank 241-AP-102.

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQOs is to ensure that there is no fuel with sufficient exothermic constituents (organic or ferrocyanide) to cause a safety hazard. Measurements of the fuel content of the waste were not required at the time of the 1993 sampling of tank 241-AP-102. Analysis of the energetics was not performed, but the total organic carbon (TOC) was 1.2 wt % (dry) and the tank is 75% water. Therefore, energetics is not an issue with this tank.

2.1.2 Flammable Gas

Vapor phase measurements, normally taken in the tank headspace prior to sampling, were not required at the time of the 1993 sampling of tank 241-AP-102.

2.1.3 Criticality

The safety threshold limit is 1 g ^{239}Pu per liter of waste. Assuming that all alpha is from ^{239}Pu and assuming a density of 1.20 g/mL, 1 g/L of ^{239}Pu is equivalent to 51.2 μCi/mL of alpha activity. Total alpha activity was not measured on the 1993 grab samples. The only alpha-emitting radionuclide measured at a detectable level was ^{241}Am, which exhibited a mean activity of 4.32E-04 μCi/mL. Plutonium-239 was below the detection limit of 51.2 μCi/mL at < 7.48E-05 μCi/mL; therefore, there is no criticality concern.

2.2 OTHER TECHNICAL ISSUES

2.2.1 Heat Load from Radioactive Decay

A factor in assessing tank safety is the heat generation from radioactive decay. The heat load value calculated using the data from the 1993 grab sampling effort (Welsh 1994) was 4,510 W (15,400 Btu/hr). The HTCE (Agnew et al. 1996) prediction for heat load is 4,060 W (13,900 Btu/hr), and the estimate according to Kummerer (1995) was 0.0146 W (0.05 Btu/hr). All of these estimates are well below the design specification limit of 20,500 W (70,000 Btu/hr) for the 241-AP tank farm (Harris 1994). Because a maximum temperature has been exhibited (Section A4.2), it may be concluded that any heat generated from radioactive sources is dissipated throughout the year. The heat load was calculated using ^{137}Cs and $^{89/90}$Sr, which have the highest contributions to the heat load. Other radionuclides exhibited activities greater than the detection limit, but at a level which did not change the total when calculated to three significant figures. The calculated heat load is given in Table 2-1.

Table 2-1. Tank 241-AP-102 Radionuclide Inventory and Projected Heat Load.

Radionuclide	Projected Inventory (Ci)	Decay Heat Generation Rate (W/Ci)	Decay Heat Generation (W)
^{137}Cs	9.48E+05	0.00472	4,470
$^{89/90}$Sr	5,990	0.00670	40.1
Total Watts			4,510

2.2.2 Mixer Pump Operation

The mixer pump installed in tank 241-AP-102 was operated for 53 days prior to the 1993 grab sampling event. One goal of the analysis of the 1993 grab samples was to evaluate the ability of the pump to thoroughly mix, or homogenize, the tank contents. The purpose of the evaluation was to ensure that the grab samples were representative of the tank contents. Representative samples are important because the waste in the tank originally consisted of three layers: two layers from tank 241-AN-106 and one already present in tank 241-AP-102. Another consideration is the possibility of the precipitation of phosphates. Although the grout program has been canceled, it is nonetheless valuable to know the capabilities of the mixer pump.

The following discussion of homogeneity in tank 241-AP-102 was taken from Welsh (1994).

The characterization test plan required that the homogeneity of the waste in tank 241-AP-102 be determined based on the analytical results of sodium, ^{137}Cs, and phosphate. Differences between the analytical results at the 15 locations sampled within tank 241-AP-102 were used to address this request. The composite analytical results are included as a sixteenth location for the statistical analysis and random analytical error estimate calculation.

A statistical procedure known as the analysis of variance (ANOVA) was used to analyze the data. An F test was used to determine if the variability between locations ($\hat{\sigma}_L^2$) is significantly greater than zero. If the test indicates that $\hat{\sigma}_L^2$ is significantly greater than zero, then it is concluded that the tank is not homogenous with respect to that analyte. If the test indicates that $\hat{\sigma}_L^2$ is not significantly different from zero, then it is concluded that the tank is homogenous with respect to that analyte. These tests, one for each analyte (sodium, ^{137}Cs, and phosphate), were conducted at the 0.05 level of significance. The p-values from the statistical tests were 0.7952 for sodium, 0.5178 for ^{137}Cs, and 0.2447 for phosphate; if the p-value was less than 0.05 then $\hat{\sigma}_L^2$ is significantly different than zero.

For all three analytes the ANOVA indicated that $\hat{\sigma}_L^2$ is not significantly different from zero. Therefore, based on the sodium, ^{137}Cs, and phosphate analytical results, the contents of tank 241-AP-102 are considered to be homogenous.

The ANOVA procedure was used to analyze the sample results for the remaining analytes that were reported at concentrations greater than the detection limit. The results from the ANOVA indicated that $\hat{\sigma}_L^2$ is not significantly different from zero at the 0.05 level of significance for aluminum, barium, cadmium, chromium, iron, nickel, potassium, phosphorus, chloride, nitrite, nitrate, sulfate, total organic carbon (TOC), percent water, hydroxide, ^{90}Sr, ^{14}C, ^{99}Tc, ^{241}Am, selenium, HEDTA, EDTA, and citrate. Also, $\hat{\sigma}_L^2$ is significantly different from zero for beryllium and total inorganic carbon (TIC).

2.3 SUMMARY

The Safety Screening DQO has been met for the condensed phase. Sufficient sampling and analysis has been performed to satisfy the requirements of the Safety Screening DQO (Reynolds et al. 1999). The high water content of the waste makes the occurrence of a propagating exothermic reaction incredible. The fissile content of the waste was estimated by the $^{239/240}Pu$ activity rather than total alpha. The highest $^{239,240}Pu$ non-detected value was < 7.48E-05 μCi/mL which precludes the occurrence of a nuclear criticality.

Energetics is not an issue with this tank because TOC was measured and is only 1.2 wt% (dry) and the tank is 75 percent water.

4.0 RECOMMENDATIONS

The waste was characterized primarily for the purposes of the grout program. The activities of the predominant alpha-emitting radionuclides were measured, with results well below the DQO limits. A sample-based, best-basis inventory was developed for the tank contents. TOC is 1.2 wt % (dry) and the tank is 75% water.

Table 4-1 summarizes the status of TWRS Program review and acceptance of the sampling and analysis results reported in this tank characterization report. All DQO issues required to be addressed by sampling and analysis are 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; this question is answered with a "yes" or a "no." The third column indicates concurrence and acceptance by the program in TWRS that is responsible for the DQO 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-AP-102 Sampling and Analysis.

Issue	Evaluation Performed	PHMC Program Acceptance
Safety Screening DQO	Yes	Yes

Table 4-2 summarizes the status of PHMC Program 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.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AP-102.

Issue	Evaluation Performed	PHMC Program Acceptance
Safety categorization	Yes	Yes

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.

5.0 REFERENCES

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. Fitzpatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1996, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 3*, LA-UR-96-858, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

Brevick, C. H., L. A. Gaddis, and S. D. Consort, 1995, *Supporting Document for the Southeast Quadrant Historical Tank Farm Estimate for AP Tank Farm*, WHC-SD-WM-ER-315, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Dukelow, G. T., J. W. Hunt, H. Babad, and J. E. Meacham, 1995, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

Ecology, EPA, and DOE, 1996, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, United States Environmental Protection Agency, and the United States Department of Energy, Olympia, Washington.

Fowler, K. D., 1995, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, WHC-SD-WM-DQO-001, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hanlon, B. M., 1996, *Waste Tank Summary Report for Month Ending August 31, 1996*, WHC-EP-0182-101, Westinghouse Hanford Company, Richland, Washington.

Harris, J. P., 1994, *Operating Specifications for 241-AN, AP, AW, AY, AZ, and SY Tank Farms*, OSD-T-151-00007, Rev. H-8, Westinghouse Hanford Company, Richland, Washington.

Hendrickson, D. W., T. L. Welsh, and D. M. Nguyen, 1993, *Hanford Grout Disposal Program Campaign 102 Characterization and Test Plan*, WHC-SD-WM-TP-136, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Kummerer, M., 1995, *Heat Removal Characteristics of Waste Storage Tanks*, WHC-SD-WM-SARR-010, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Reynolds, D. A., W. T. Cowley, J. A. Lechelt, and B. C. Simpson, and C. DeFigh-Price, 1999, *Evaluation of Tank Data for Safety Screening,* HNF-4217, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington

Welsh, T. L. 1994, *Tank 241-AP-102 Characterization and Grout Product Test Results*, WHC-SD-WM-TRP-168, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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B. C. Simpson	R2-12	X			
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