ENGINEERING CHANGE NOTICE

0050782

1. ECN 653787

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 []	T. A. Hu, Data Assessment and Interpretation, R2-12, 373-4098	[] Yes [X] No	05/24/99
	6. Project Title/No./Work Order No. Tank 241-SX-101	7. Bldg./Sys./Fac. No. 241-SX-101	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-SD-WM-ER-660, Rev. 1	10. Related ECN No(s). ECN-643828	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, 2-2, 2-5, 2-6, 4-1, 4-2 and 5-1 through 5-4.

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.

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1. ECN (use no. from pg. 1) ECN-653787

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. T.A. Hu	[signature]	5-27-99	PE		
Cog. Mgr. K.M. Hall	[signature]	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 Single-Shell Tank 241-SX-101

T. A. Hu
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

EDT/ECN: ECN-653787 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
B&R Code: EW 3120074 Total Pages: 289

Key Words: Waste Characterization, Single-Shell Tank, SST, Tank 241-SX-101, Tank SX-101, SX-101, SX Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

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RECORD OF REVISION	(1) Document Number HNF-SD-WM-ER-660	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-SX-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
0	(7) Initially released 08/28/97 on EDT-622669.	M.J. Kupfer	K.M. Hodgson
1 RS	Incorporate per ECN-643828.	T.A. Hu	K.M. Hall
		9/14/98	9/14/98
1-A RS	Incorporate per ECN-653787.	T.A. Hu	K.M. Hall
	5/27/99	5/27/99	5/27/99

A-7320-005 (08/91) WEF168

2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-SX-101 (Brown et al. 1997).

- **Safety screening**: Does the waste pose or contribute to any recognized potential safety problems?
- **Organic complexants**: Does the possibility exist for a point source ignition in the waste followed by a propagation of the reaction in the solid/liquid phase of the waste?
- **Organic solvents**: Does an organic solvent pool exist that may cause a fire or ignition of organic solvents in entrained waste solids?
- **Historical model**: Does the waste inventory generated by a model based on process knowledge and historical information (Agnew et al. 1997a) represent the current tank waste inventory?

The sampling and analysis plan (SAP) (Hu 1997b) provides the types of sampling and analysis used to address the above issues. Data from the analysis of rotary core samples and headspace measurements, along with available historical information, provided the means to respond to the technical issues. Sections 2.1 through 2.7 present the responses. Data from the July 1995 vapor sample provided the means to address the vapor screening issue. See Appendix B for sample and analysis data for tank 241-SX-101.

2.1 SAFETY SCREENING

The data needed to screen the waste in tank 241-SX-101 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. Each condition is addressed separately below. Two rotary core samples were collected. Because of the hardness of the waste, core 225 samples were obtained through segment 7, but segment 8 samples could not be recovered. Core 227 samples were obtained through segment 6, but the last two segments could not be recovered. Although full depth profiles were not obtained, sufficient sample was recovered to resolve safety screening issues (Reynolds et al. 1999).

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure there are not sufficient exothermic constituents (organic or ferrocyanide) in tank 241-SX-101 to pose a safety hazard. Because of this requirement, energetics in tank 241-SX-101 waste were evaluated. The safety screening DQO required that the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine whether the energetics exceeded the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry weight basis. Results obtained using differential scanning calorimetry (DSC) indicated no sample exceeded the notification limit. Exotherms were detected, on a dry weight basis, ranging from 22.7 J/g to 92.1 J/g (see Appendix C). As a result, it was concluded that a propagating reaction is highly unlikely.

2.1.2 Flammable Gas

Headspace measurements were taken before obtaining the 1997/98 rotary core samples. The flammable gas level was zero percent. This is below the safety screening limit of 25 percent of the lower flammability limit (LFL). July 1995 vapor samples also showed low concentrations in flammable gases. Data for the combustible gas headspace gas tests (sniff tests) and the July 1995 vapor samples are presented in Appendix B. In addition, the SHMS data (Wilkins et al. 1997) shows that the maximum hydrogen concentration reading is 400 ppm on August 22, 1995, and the hydrogen concentration from grab data ranged from 5 to 10 ppm with an average of 8 ppm in the time period of June 2 to September 25, 1995. All these hydrogen concentration data are well below the hydrogen concentration of 9,300 ppm (Hu 1997a), which is equivalent to the level of 25 percent LFL in the tank headspace.

2.1.3 Criticality

The safety screening DQO threshold for criticality, based on the total alpha activity, is 1 g/L. Because total alpha activity is measured in μCi/g instead of g/L, the 1 g/L limit is converted into units of μCi/g by assuming that all alpha decay originates from ^{239}Pu. The safety threshold limit is 1 g ^{239}Pu per liter of waste. Assuming that all alpha is from ^{239}Pu, for a maximum solids density of 1.92, this limit corresponds to 32.0 μCi/g of total alpha for solids. The maximum total alpha activity dry weight result was 2.66 μCi/g (core 225, segment 2, lower half). The maximum upper limit to a 95 percent confidence interval on the mean was 3.08 μCi/g (core 225, segment 2, lower half), indicating that the potential for a criticality event is extremely low. Therefore, criticality is not a concern for this tank. Appendix C contains the method used to calculate confidence limits.

compares closely to the heat load estimate based on tank temperature of 3,692 W (12,600 Btu/hr) (Kummerer 1995) and the heat load estimate based on the tank process history of 6,300 W (21,500 Btu/hr) (Agnew et al. 1997a). All these estimates are well below the limit of 11,700 W (40,000 Btu/hr) that separates high- and low-heat-load tanks (Smith 1986).

Table 2-1. Heat Load Estimate for Tank 241-SX-101 Based on Radionuclide Inventory.

Radionuclide	Inventory[1] (Ci)	Decay Heat Rate (W/Ci)	Heat Load (W)
^{137}Cs	313,000	0.00472	1,477
^{90}Sr	369,000	0.00670	2,472
Total			3,949

Note:

[1]See Appendix D.

2.6 SUMMARY

The results of all analyses performed to address potential safety issues showed that no exothermic activity exceeded safety decision threshold limits. Although, full depth profiles were not obtained, sufficient sample was recovered to resolve safety screening issues for this tank (Reynolds etal. 1999). Requirements for organic complexant safety issues were also met.

Historical DQO requirements were performed. In general, it may be concluded that the tank exhibits a marginal match only to the SMMS1 waste type, while the HDW models predicted waste types of REDOX waste, REDOX salt, SMMS1, and SMMS2.

Vapor samples were taken to meet the organic solvents safety screening DQO requirements.

Sample results are summarized in Table 2-3.

Table 2-2. Summary of Technical Issues. (2 sheets)

Issue	Sub-issue	Result
Safety screening	Energetics	No exotherms exceeded 480 J/g.
	Flammable gas	Vapor data showed 0% of the LFL .
	Criticality	All analyses were well below 32.0 μCi/g total alpha (within 95% confidence limit on each sample).

Table 2-2. Summary of Technical Issues. (2 sheets)

Issue	Sub-issue	Result
Organic complexants[1]	Safety categorization	Tank was classified as safe, with low TOC and no visible separate layers.
Organic solvents[1]	Solvent pool size	Total nonmethane organic compounds were 0.98 mg/m^3. Organic solvent pool size is not estimated.
Historical (gateway analysis)	Total mass of gateway analytes	Fingerprint analytes for the SMMS1 waste type accounted for greater than 85% of the weight for about half of the segments. Most of samples failed the analysis for REDOX, REDOX salt, and SMMS2 waste types.
	Selected segment comparison with ≤10% of DQO values	About half of the segments passed the analysis for the SMMS1 waste type. Most segments failed the analysis for REDOX, REDOX salt, and SMMS2 waste types.

Note:

[1]The organic solvent and organic complexant safety issues are expected to be closed in fiscal year 1998.

4.0 RECOMMENDATIONS

Rotary-mode core samples and vapor samples were taken to satisfy applicable issues for tank 241-SX-101. Two rotary core samples were collected. Analytical results for the samples obtained showed no exotherm, total alpha, or TOC values exceeded safety screening limits. Therefore, there are no safety screening issues or organic complexant issues of concern, and no further sampling and analyses are required by the safety screening DQO.

Vapor samples showed that the LFL in the tank headspace is 0 percent. Although the organic solvent pool size was not estimated, the risk assessment (Meacham et al. 1997b) shows that the organic solvent pool is no longer a concern and will be closed out for all tanks.

The historical gateway analysis failed for most segments. The HDW model (Agnew et al. 1997a) predicts waste layers of REDOX waste, REDOX salt, SMMS1, and SMMS2 for tank 241-SX-101. Based on gateway analysis results, about half the segments match the SMMS1 waste type for this tank. The other segments did not match any of the waste types predicted by the HDW model. This concludes that the waste of tank 241-SX-101 is quite complex and can be marginally defined as SMMS1 waste. No further sampling and analysis are required by the historical DQO.

Table 4-1 summarizes the Project Hanford Management Contractor (PHMC) TWRS Program review status and acceptance of the sampling and analysis results reported in this tank characterization report. All issues required to be addressed by sampling and analysis are listed in column 1 of Table 4-1. Column 2 indicates by "yes," "no," or "partial" whether the requirements were met in full or in part by the sampling and analysis activities performed. Column 3 indicates concurrence and acceptance by the responsible PHMC TWRS program that the sampling and analysis activities performed adequately. A "yes" or "no" in column 3 indicates acceptance or disapproval of the sampling and analysis information in the tank characterization report.

Table 4-1. Acceptance of Tank 241-SX-101 Sampling and Analysis.

Issue	Sampling and Analysis Performed	Program[1] Acceptance
Safety screening DQO	Yes	Yes
Organic complexant MOU	Yes	Yes
Organic solvents DQO	Yes	Yes
Historical evaluation DQO	Yes	Yes

Notes:
[1]PHMC TWRS Program Office

Table 4-2 summarizes the status of PHMC TWRS Program review and acceptance of the evaluations and other characterization information contained in this report. Column 1 lists the different evaluations performed in this report. Columns 2 and 3 are in the same format as in Table 4-1. The manner in which concurrence and acceptance are summarized is also the same as that in Table 4-1. The safety screening categorization of the tank is listed as "partial" in Table 4-2 because two full-depth cores were not obtained. However, the safety program has determined that the samples obtained were representative of tank contents, and no additional sampling is required to resolve this issue.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-SX-101.

Issue	Evaluation Performed	TWRS[1] Program Acceptance
Safety screening DQO	Yes	Yes
Organic complexant memorandum of understanding	Yes, Classified as "Safe"	Yes
Organic solvents DQO	Yes	Yes
Historical evaluation DQO	Yes	Yes

Notes:
[1]PHMC TWRS Program Office

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