S

ENGINEERING CHANGE NOTICE

0050801

Page 1 of 2

1. ECN 653792

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	05/24/99
	6. Project Title/No./Work Order No.: Tank 241-AN-106	7. Bldg./Sys./Fac. No.: 241-AN-106	8. Approval Designator: N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.): WHC-SD-WM-ER-569, Rev. 0-B	10. Related ECN No(s).: ECNs: 644458, 644486	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:
ES-3 through ES-6, 5-7, 5-8, 6-1 through 6-4, 7-3, and 7-4

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.

RELEASE STAMP

DATE: MAY 27 1999

STA: 4

HANFORD RELEASE

ID: 2

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

A-7900-013-1

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) ECN-653792

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.M. Conner [signature]	5/27/99	PE		
Cog. Mgr.	K.M. Hall [signature: Kathleen M. Hall]	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-AN-106

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

EDT/ECN: ECN-653792 UC: 2070
Org Code: 74B20 CACN/COA: 102217/EI00
B&R Code: EW 3120074 Total Pages: 102

Key Words: Waste Characterization, Double-Shell Tank, DST, Tank 241-AN-106, Tank AN-106, AN-106, AN Farm, Tank Characterization Report, TCR, Waste Inventory, TPA Milestone M-44

Abstract: N/A

5/27/99

Release Approval Date

DATE: HANFORD RELEASE
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MAY 27 1999
Release Stamp

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-WM-ER-569	Page 1

(2) Title
Tank Characterization Report for Double-Shell Tank 241-AN-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 08/22/96 on EDT 617508.	J. G. Douglas	J. G. Kristofzski
0A RS	Incorporate per ECN-644458.	M. J. Kupfer	K. M. Hodgson
		M J Kupfer 8-27-97	K.M. Hodgson 8-27-97
0B RS	Incorporate per ECN-644486	M. J. Kupfer	K.M. Hodgson K.M. Hodgson 7-17-98
		JW Cammann for 7/21/98	
O-C RS	Incorporate per ECN-653792.	J. M. Conner	K. M. Hall
		[signature] for	Kathleen M. Hall

A-7320-005 (08/91) WEF168

Table ES-1. Description and Status of Tank 241-AN-106.

TANK DESCRIPTION		
Type	Double-shell	
Constructed	1980 to 81	
In service	1981	
Diameter	22.9 m (75.0 ft)	
Maximum operating depth	10.7 m (35.2 ft)	
Capacity	4,390 kL (1,160 kgal)	
Bottom shape	Flat	
Ventilation	Active	
TANK STATUS		
	November 30, 1995[1]	May 31, 1996[2]
Waste classification	Double-shell slurry feed	
Total waste volume[3]	1,580 kL (418 kgal)	1,570 kL (415 kgal)
Supernatant volume[3]	1,520 kL (401 kgal)	1,510 kL (398 kgal)
Sludge volume[4]	64 kL (17 kgal)	64 kL (17 kgal)
Drainable interstitial liquid[3]	0.00	0.00
Waste surface level[3]	3.861 m (12.66 ft.)	3.833 m (12.57 ft)
Temperature (July 1983 to March 1996)[5]	14 to 47 °C (58 to 116 °F)	
Integrity	Sound	
Watch List	None	
SAMPLING DATES		
Grab samples and tank headspace flammability	November 21 and 22, 1995	
Grab samples	April 4 and 5, 1995	
SERVICE STATUS		
In service		

Notes:

[1]Hanlon (1996a)

[2]Hanlon (1996b)

[3]Tank 241-AN-106 is an active tank; the waste volumes and surface levels reported in this table are subject to change as waste is added or removed from the tank.

[4]Grab sampling could not sample deeply enough to provide sufficient sludge material for characterization.

[5]WHC (1996)

47 °C (116 °F). Hanlon (1996b) showed a waste level of 3.833 m (12.58 ft) as of May 31, 1996.

This report summarizes the collection and analysis of eight grab samples taken in November 1995. The sampling event was performed to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). The sampling and analyses were performed in accordance with the *Tank 241-AN-106 Grab Sampling and Analysis Plan* (Conner 1995). Six grab samples were recovered from the supernatant layer in the tank. An attempt to obtain an additional two grab samples of the sludge layer on the tank bottom yielded supernate with less than a gram of solids; these two samples were taken 13 cm (5 in.) from the tank bottom. The sludge layer could not be sampled most likely because the sludge layer was too thin for the grab sampler to adequately penetrate and sample. While, the characterization results do not reflect the composition of the sludge layer, the grab sampling event was sufficient for safety screening assessment. (Reynolds et al. 1999).

As required by the safety screening data quality objective (DQO), the grab samples were analyzed for moisture content using thermogravimetric analysis (TGA), for energetics content using differential scanning calorimetry (DSC), for total alpha activity using an alpha proportional counter, and for density. The DQO also required a determination of the flammability of tank headspace gases. This requirement was met by sampling the headspace prior to grab sampling. Finally, a total organic carbon (TOC) analysis was performed in an attempt to verify the type of waste in tank 241-AN-106.

Table ES-2 summarizes the analytical results and, where applicable, the error associated with each result. These results apply only to the supernate because the sludge layer was not adequately sampled. For the supernate, which constitutes 96 percent of the waste volume in tank 241-AN-106, none of the safety screening DQO criteria were exceeded. No exothermic reactions were observed in any November 1995 grab samples. The average weight-percent water was 76.6 percent. The overall mean total alpha activity was < 0.00684 μCi/mL, far below the notification limit of 61.5 μCi/mL. The approximately 5 inch sludge layer, which forms only four percent of the tank waste volume, was not sampled. However, no further assessment of the sludge regarding the tank safety DQO is necessary because the grab sampling was sufficient for safety screening (Reynolds et al. 1999). Combustible gas meter readings of the vapor samples revealed that the concentration of flammable gases was 0 percent of the lower flammability limit (LFL), far less than the safety screening DQO limit of 25 percent of the LFL. Total organic carbon was determined to assist in verifying the type of waste in tank 241-AN-106. However, the TOC result of 4,390 μg C/mL could support a waste designation of either dilute complexed or noncomplexed waste.

Table ES-2. Tank 241-AN-106 Analytical Averages.[1]

Analyte	Average Result	Percent RSD (Mean)[2]
Total alpha activity	< 0.00684 μCi/mL	n/a
Bulk density	1.19 g/mL	0.63 percent
Energetics	No exothermic reactions	n/a
Flammable gas	0 percent of lower flammability limit	n/a
Percent water	76.6 weight percent water	1.10 percent
TOC	4,390 μg C/mL	15.3 percent

Notes:

n/a = not applicable

[1]Esch (1996a)

[2]Percent relative standard deviation of the mean (average) result; %RSD = 100 x standard deviation of the overall mean ÷ overall mean value.

Statistical analysis of the analytical results suggests the supernate layer exhibits a slight vertical heterogeneity in percent water content. The tank shows a definite increase in grab-sample dose rate with sample depth. This implies the concentration of beta/gamma-emitting radionuclides also increases with sample depth. Horizontally, the supernate appears to be fairly homogeneous.

Evidence from sludge weight measurements and the attempts to grab sample the sludge layer indicates that the sludge layer is about 13 to 16 cm (5 to 6 in.) deep. The increase in radionuclide concentration with depth implies that the sludge layer is likely to have a greater radionuclide concentration than the supernate.

in any tank 241-AN-106 sample. Large amounts of moisture reduce the potential for propagating exothermic reactions in the waste. Reported results for all samples were above 70 weight percent water; the overall tank mean was 76.6 weight percent water with a percent relative standard deviation of the mean of 1.1.

The criticality safety issue can be assessed from the total alpha activity data. No reported result above detection limits from the sampling event was greater than 0.00173 μCi/mL total alpha activity, and the largest nondetected result was < 0.0633 μCi/mL. The overall mean was < 0.00684 μCi/mL. This was well below the notification limit of 1 g/L, or 61.5 μCi/mL, as specified in the safety screening DQO (see footnote 2, Table 5-1).

The DQO notification limit for flammable gas concentration is 25 percent of the LFL. The combustible gas meter used to measure flammable gas concentrations in the tank reported results as a percent of the lower explosive limit (LEL). Because the National Fire Protection Association defines the two terms identically, the terms may be used interchangeably (NFPA 1995). Combustible gas meter readings taken at the time of sampling showed the concentration of flammability gases was 0 percent of the LFL (Esch 1996a).

In summary, the November 1995 grab sampling event met all the requirements of the safety screening DQO for the tank supernate and headspace; none of the safety screening DQO criteria were exceeded. While the sludge layer could not be sampled, the 1995 grab sampling event was sufficient for safety screening assessment (Reynolds et al. 1999). Table 5-1 lists the safety issues, the characteristics of concern and their notification limits, and the corresponding analytical results.

Another factor in assessing the safety of the tank waste is the heat generation and waste temperature. Heat is generated in tanks from radioactive decay. The temperature data (see Section 2.4.2) indicate the tank waste high-temperature extreme was recorded when waste was added in September 1994. Because the temperature extreme occurred at the time that the thermally warm evaporator product was transferred from tank 241-AW-106 to tank 241-AN-106, the conclusion is that heat generated from the radioisotopes in the waste is being dissipated adequately.

Tank 241-AN-106 is not currently classified as a Watch List tank; however, three other tanks in the 241-AN tank farm are on the flammable gas Watch List (tanks 241-AN-103, -104, and -105). Estey and Guthrie (1996) indicate that, for all tanks exhibiting gas release events, the depth of the nonconvective (sludge) layer in the tank times the specific gravity of the supernate layer is greater than 5.8 m (19.2 ft). Tanks 241-AN-103, -104, and -105 exceed this value. However, no tank with a product of sludge layer thickness times supernate specific gravity less than 3.8 m (12.5 ft) exhibits gas release event behavior. Tank 241-AN-106 has a sludge layer approximately 13 cm (5 in.) deep and a supernate density of 1.19 g/mL. Using the density to approximate the supernate specific gravity, this yields a sludge depth times specific gravity product of 0.15. A value of 0.15 suggests that tank 241-AN-106 should be grouped with the non-gas release event tanks.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The waste in tank 241-AN-106 has been sampled and analyzed for safety screening according to the requirements listed in the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). The tank was grab sampled in April 1995 for process control purposes and in November 1995 for safety screening. The safety screening DQO required analyses for percent water, energetics, total alpha activity, and flammable gas to assess tank safety. Total organic carbon was determined in an attempt to verify the classification of the tank waste. All samples were analyzed at the 222-S Laboratory.

The November 1995 grab sampling event sufficiently met the requirements of the safety screening DQO (Reynolds et al. 1999). No safety screening DQO criteria were exceeded. No exothermic reactions were observed in the DSC analysis. The average percent water value by TGA was 76.6 percent. The total alpha activity overall mean was < 0.00684 μCi/mL, well below the DQO notification limit of 61.5 μCi/mL. Finally, the concentration of flammable gas in the tank headspace was 0 percent of the LFL.

Although no heat load estimates were available, it appears heat generation is not a problem because the tank exhibited its upper temperature extreme when waste was added to the tank in September 1994.

The mean TOC value for the supernate based on two November 1995 grab samples is 4,390 μg C/mL and could support a designation of dilute complexed or dilute noncomplexed waste. The additional information required to establish the waste designation are the concentrations of aluminum, sodium, the IC anions, carbonate (total inorganic carbon), and hydroxide. Based on analyses of samples from tank 241-AW-106 and the 242-A Evaporator 94-1 Campaign, which are the two major sources for the waste in tank 241-AN-106, the bulk of the organic carbon in the tank waste is likely to consist of organic complexing agents and their breakdown products. If the bulk of the TOC consists of complexing agents, then the waste would be designated as dilute complexed.

The analytical results and tank surveillance data show the waste in tank 241-AN-106 as consisting of approximately 1,510 kL (398 kgal) of supernate with a tank heel of approximately 52 to 64 kL (14 to 17 kgal). The statistical results suggest that the supernate layer exhibits a slight vertical heterogeneity in weight percent water content. The tank shows a definite increase in the concentration of beta/gamma-emitting radionuclides with sample depth. Horizontally, the supernate appears to be fairly homogeneous.

The available evidence based on the tank transfer history, sludge level measurements, and the visual description of the samples taken near the tank bottom imply that a sludge layer resides on the tank bottom. Evidence from sludge weight measurements and the attempts to grab sample the sludge layer indicates that the sludge layer is about 13 to 16 cm (5 to 6 in.) deep. The increase in radionuclide concentration with depth implies that the sludge layer is likely to have a greater radionuclide concentration than the supernate.

Mixing compatibility and boildown studies were conducted on mixtures of tank 241-AN-106 supernate from the April 1995 sampling event and supernate from tank 241-AY-101. Mixing 25:75 and 30:70 ratios of tank 241-AN-106:241-AY-101 supernates generated no major color changes, heat generation, foaming, precipitations, or obvious density differences. The 30:70 and 50:50 mixtures of tank 241-AN-106:241-AY-101 supernates had free-hydroxide values of 0.046 *M* (780 μg/mL) and 0.197 *M* (3,350 μg/mL) respectively. Differential scanning calorimetry scans to 500 °C of aliquots of the 25:75 and 30:70 mixtures revealed no exotherms; the only endotherm observed was attributed to water loss. A boildown of a 30:70 mixture of tank 241-AN-106:241-AY-101 supernates yielded a final waste volume reduction of 76 percent. The final product of the boildown had a density of 1.55 mg/L and was a thick, orange-yellow, pourable sludge containing visible granular material and some clumps of stiff, nonpourable sludge.

Three tanks in the AN tank farm are on the flammable gas Watch List, but tank 241-AN-106 is not. The three AN tank farm tanks on the flammable gas Watch List have significant nonconvective sludge layers and supernate-specific gravities greater than 1.41. In contrast, tank 241-AN-106 has a very small sludge layer and a supernate layer with a density of only 1.19 g/mL.

6.2 RECOMMENDATIONS

Because tank 241-AN-106 is in active service, the tank contents are subject to change during future tank farm operations. Future operations will likely require analysis of the contents of tank 241-AN-106 for compatibility, and it is recommended that the existing grab samples be archived to avoid future expense in sampling the tank supernate. Additional analysis of the archived samples should provide most of the information required for any future tank farm operations involving tank 241-AN-106. However, this recommendation would be invalid if the contents of tank 241-AN-106 changed because of future additions of waste to the tank. Future additions of waste would change the composition of the waste and would require new samples be taken to address any future tank waste safety and compatibility issues. This recommendation also would be invalid if the samples remained in archival storage for more than one year because there would be no guarantee that the samples would remain representative after a long storage period.

When the supernate contents of tank 241-AN-106 are completely emptied from the tank, and as program funding and priorities allow, the sludge heel in the tank should be auger sampled.

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DISTRIBUTION SHEET

To	From	Page 1 of 2
Distribution	Data Assessment and Interpretation	Date 05/24/99
Project Title/Work Order: Tank Characterization Report for Double-Shell Tank 241-AN-106, WHC-SD-WM-ER-569, Rev. 0-C		EDT No. N/A
		ECN No. ECN-653792

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>OFFSITE</u>					
<u>Sandia National Laboratory</u> P.O. Box 5800 MS-0744, Dept. 6404 Albuquerque, NM 87815					
D. Powers		X			
<u>Nuclear Consulting Services Inc.</u> P. O. Box 29151 Columbus, OH 43229-01051					
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B. C. Hudson		X			
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H. Sutter		X			
<u>Los Alamos Laboratory</u> CST-14 MS-J586 P. O. Box 1663 Los Alamos, NM 87545					
S. F. Agnew		X			
<u>Tank Advisory Panel</u> 102 Windham Road Oak Ridge, TN 37830					
D. O. Campbell		X			

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Project Title/Work Order: Tank Characterization Report for Double-Shell Tank 241-AN-106, WHC-SD-WM-ER-569, Rev. 0-C		EDT No. N/A
		ECN No. ECN-653792

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>ONSITE</u>					
<u>Department of Energy - Richland Operations</u>					
W. S. Liou	S7-54	X			
DOE/RL Reading Room	H2-53	X			
<u>DE&S Hanford, Inc.</u>					
G. D. Johnson	S7-73	X			
<u>Fluor Daniel Hanford Corporation</u>					
J. S. Hertzel	H8-67	X			
<u>Lockheed Martin Hanford, Corp.</u>					
J. W. Cammann	R2-11	X			
J. M. Conner	R2-11	X			
L. M. Sasaki	R2-12	X			
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			
<u>Lockheed Martin Services, Inc.</u>					
B. G. Lauzon	R1-08	X			
Central Files	B1-07	X			
EDMC	H6-08	X			
<u>Numatec Hanford Corporation</u>					
J. S. Garfield	R3-73	X			
D. L. Herting	T6-07	X			
<u>Pacific Northwest National Laboratory</u>					
A. F. Noonan	K9-91	X			
<u>Scientific Applications International Corporation</u>					
M. D. LeClair	R3-75	X			