Sta 4. 6. S

NOV 19 1999 **ENGINEERING DATA TRANSMITTAL** 0052176

1. EDT 702348

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Requirements Planning and Support	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: TIRs/Req. Planning/Proc. Eng./RPP	6. Design Authority/Design Agent/Cog. Engr.: M. R. Adams	7. Purchase Order No.: N/A

8. Originator Remarks:

These documents are being released into the supporting document system for retrievability purposes. For further information on Tank Interpretive Reports (TIRs), go to URL address http://twins.pnl.gov/twins3/twins.htm

9. Equip./Component No.: N/A

10. System/Bldg./Facility: N/A

12. Major Assm. Dwg. No.: N/A

11. Receiver Remarks: N/A

11A. Design Baseline Document? ☐ Yes ☒ No

13. Permit/Permit Application No.: N/A

14. Required Response Date: 11/17/99

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	RPP-5417	N/A	0	Auto Tank Interpretive Report for Tank 241-AN-103	N/A	2	1	1
2	RPP-5418	N/A	0	Auto Tank Interpretive Report for Tank 241-AN-104	N/A	2	1	1
3	RPP-5419	N/A	0	Auto Tank Interpretive Report for Tank 241-AN-105	N/A	2	1	1
4	RPP-5420	N/A	0	Auto Tank Interpretive Report for Tank 241-AW-101	N/A	2	1	1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D OR N/A (See WHC-CM-3-5, Sec. 12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority									
		Design Agent									
2	1	Cog. Eng. M. R. Adams	M R Adams	11/18/99							
2	1	Cog. Mgr. J. W. Hunt	JW Hunt	11/18/99							
		QA									
		Safety									
		Env.									

DEC 1999 RECEIVED EDMC

18. Ann E. Young — Signature of EDT Originator — Date 11/17/99

19. Authorized Representative for Receiving Organization — Date

20. John W. Hunt — Cognizant Manager — Date 11/18/99

21. DOE APPROVAL (if required) Ctrl No.
☐ Approved
☐ Approved w/comments
☐ Disapproved w/comments

BD-7400-172 (05/96)

ENGINEERING DATA TRANSMITTAL

(CONTINUATION PAGE)

5. Proj./Prog./Dept.Div.:	6. Cog. Eng.	1. EDT	
TIRs/Req. Planning/Proc. Eng.	M. R. Adams	EDT-702348	Page 2 of 2

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Desig-nator	(G) Reason for Trans-mittal	(H) Origi-nator Dispo-stion	(I) Receiv-er Dispo-sition
5	RPP-5421	N/A	0	Auto Tank Interpretive Report for Tank 241-BY-105	N/A	2	1	1
6	RPP-5422	N/A	0	Auto Tank Interpretive Report for Tank 241-S-110	N/A	2	1	1
7	RPP-5423	N/A	0	Auto Tank Interpretive Report for Tank 241-S-111	N/A	2	1	1
8	RPP-5424	N/A	0	Auto Tank Interpretive Report for Tank 241-SX-102	N/A	2	1	1
9	RPP-5425	N/A	0	Auto Tank Interpretive Report for Tank 241-SX-105	N/A	2	1	1
10	RPP-5426	N/A	0	Auto Tank Interpretive Report for Tank 241-T-110	N/A	2	1	1
11	RPP-5427	N/A	0	Auto Tank Interpretive Report for Tank 241-U-107	N/A	2	1	1
12	RPP-5428	N/A	0	Auto Tank Interpretive Report for Tank 241-U-109	N/A	2	1	1
13	RPP-5429	N/A	0	Auto Tank Interpretive Report for Tank 241-U-112	N/A	2	1	1

S

Auto Tank Interpretive Report for Tank 241-AW-101

M. R. Adams
Lockheed Martin Hanford, Corp., Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: EDT-702348 UC: 2070
Org Code: 74B10 CACN/COA: 102230/ES30
B&R Code: EW 3120074 Total Pages: 9

Key Words: Tank 241-AW-101, 241-AW-101, AW-101, AW Farm, Tank Interpretive Report, TIR

Abstract: N/A

11/18/99

Release Approval Date

Approved for Public Release

This report prepared especially for Auto TIR on 11/09/99

Some of the reports herein may contain data that has not been reviewed or edited. The data will have been reviewed or edited as of the date that a Tank Interpretive Report (TIR) is prepared and approved. The TIR for this tank was approved on September 8, 1998.

Tank: 241-AW-101

Sampling Events:
- 132
- 139
- 1AW-9-98
- 1AW-98-1
- 1AW-98-10
- 1AW-98-2
- 1AW-98-3
- 1AW-98-4
- 1AW-98-5
- 1AW-98-6
- 1AW-98-7
- 1AW-98-8
- 1AW-98-9
- 1AW-98-99
- 95AUG001
- 95AUG004
- 95AUG005

Reports:
- Tank Interpretive Report

Constituent Groups:

Table of Contents

Data Dictionary to Reports in this Document

Report	Field	Description
Tank Interpretive Report		Interprets information about the tank answering a series of six questions covering areas such as information drivers, tank history, tank comparisons, disposal implications, data quality and quantity, and unique aspects of the tank.

Tank Interpretive Report For 241-AW-101

Tank Information Drivers

Question 1: What are the information drivers applicable to this tank? What type of information does each driver require from this tank? (Examples of drivers are Data Quality Objectives, Mid-Level Disposal Logic, RPP Operation and Utilization Plan, test plans and Letters of Instruction.) To what extent have the information and data required in the driving document been satisfied to date by the analytical and interpretive work done on this tank?

The information drivers for tank 241-AW-101 include the Safety Screening DQO, Flammable Gas DQO, Organic Solvents DQO, Pretreatment DQO and Privatization DQO.

Safety Screening DQO: Does the waste pose or contribute to any recognized potential safety problems?

The data needed to screen the waste in tank 241-AW-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.

The threshold limit for energetics is 480 J/g on a dry weight basis. Results obtained using differential scanning calorimetry (DSC) indicated that 2 samples obtained from tank 241-AW-101 had mean exothermic reactions (on a dry-weight basis) exceeding the safety screening DQO limit. The maximum dry weight exotherm observed was 1030 J/g. The maximum upper limit to a 95 percent confidence interval on the mean was 1230 J/g from core 139, segment 21 upper half.

Flammable gas was not detected in the tank headspace (0 percent of the lower flammability limit [LFL]) before sampling. During sampling, the LFL in the tank headspace reached 3 percent. This is below the safety screening limit of 25 percent of the LFL.

The threshold limit for criticality, based on the total alpha activity, is 1 g/L. Assuming that all alpha is from ^{239}Pu, for a sample density of 1.86 g/mL, 1 g/L of ^{239}Pu is 33.1 μCi/g of alpha activity. The maximum total alpha activity result was 0.163 μCi/g. Therefore, criticality is not a concern for this tank.

Flammable Gas DQO: Does a possibility exist for releasing flammable gases into the headspace of the tank or releasing chemical or radioactive materials into the environment?

The flammable gas DQO has been extended to apply to all tanks (Bauer and Jackson 1997). Analyses and evaluations will change according to program needs until this issue is resolved. The unreviewed safety question for flammable gas safety issues is expected to be closed in FY 1998 and final resolution of the flammable gas data quality objective is expected to be completed by September 30, 2001 (Johnson 1997). These dates are consistent with milestone M-40-09 and M-40-00 (Ecology et al. 1997) to close out the USQ for watchlist tanks and to close out all flammable gas issues for high priority tanks.

Retained gas samples (RGS) were analyzed to address flammable gas issues. The results of RGS testing are reported in (Shekarriz et al. 1997). The total standard gas volume in AW-101 is 209 +/- 46 m^3, with 115 +/- 12 m^3 in the bottom solids layer, 32 +/- 34 m^3 in the supernate layer, and an estimated crust gas volume of 63 +/- 22 m^3 at 1 atm. The gas composition included 60 mole % N_2, 31 mole % H_2, and 5.7 mole % NO_2. Remaining gas is composed of ammonia, methane, & other hydrocarbons. Measured local ammonia concentrations ranged from 960 to 2900 umole/l of waste, more than 99.9 % of which dissolved in the liquid.

Organic Solvents DQO: Does an organic solvent pool exist that may cause a fire or ignition of organic solvents in entrained waste solids?

The data required to support the organic solvent screening issue are documented in the *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue* (Meacham et al. 1997). No vapor samples have been taken to estimate the organic pool size. However, the organic program has determined that even if an organic solvent pool does exist, the consequence of a fire or ignition of organic solvents is below risk evaluation guidelines for all of the tanks (Brown et al 1998). Consequently, vapor samples are not required for this tank. The organic solvents issue is expected to be closed for all tanks in FY 1998.

Pretreatment DQO: What fraction of the waste is soluble when treated by sludge washing and leaching?

Samples were archived for future pretreatment analyses and evaluation in accordance with Strategy for Sampling Hanford Site Tanks for Development of Disposal Technology (Kupfer et al. 1995).

Privatization DQO: Do the samples taken from tank 241-AW-101 and the subsequent laboratory analysis meet the needs of the privatization low-activity waste DQO ?

Tank 241-AW-101 is within the scope of the privatization low-activity waste DQO (Jones and Wiemers 1996). The purpose of the low-activity waste DQO is to address technical issues pertinent to pretreatment, immobilization, and balance-of-plant for low-activity waste processing. Waste will be characterized to determine whether it falls within the defined process design envelope. Data collected in support of this DQO will be used primarily for planning activities of TWRS privatization contractors as specified in the privatization request for proposals. As of May 31, 1998 no data was analyzed to address this DQO for this tank.

Heat Load Estimate:

The estimated heat load for this tank is 648 BTU/hr based on a 1996 sample event. The heat load based on tank process history is 629 BTU/hr. Both values are well below the limit of 40,000 BTU/hr that separates high from low heat load tanks.

Data from the analysis of push core samples and tank vapor space measurements, along with available historical information, provided the means to respond to the technical issues.

Tank History

Question 2: What is known about the history of this tank as it relates to waste behavior?

Tank 241-AW-101 is located in the 200 East Area AW Tank Farm on the Hanford Site. The tank went into service in 1980 and had an active transfer history until 1986. The major waste types received by the tank were Plutonium-Uranium Extraction (PUREX) process miscellaneous waste and water. The tank was also a receiver of concentrated waste from the 242-A Evaporator. In 1986, the tank was nearly emptied in preparation for Evaporator Campaign 86-5. The two receipts of double-shell slurry feed from this evaporator run were the last transfers received by the tank and raised the volume of waste in the tank to its current level. Tank 241-AW-101 remains in active service. It is on the Watch List for Flammable Gas (Public law 101-510). An unreviewed safety question regarding the potential accumulation of flammable mixtures of hydrogen and nitrous oxide gas under the crust was closed in 1995, based on auger sample results which showed no self-heating or exothermic activity.

The tank has an operating capacity of 4,320 kL (1,140 kgal), and presently contains 4,258 kL (1,125 kgal) of double-shell slurry feed waste (Hanlon 1998). The tank was added to the Watch List for flammable gas (Public Law 101-510) in June 1993.

Tank Comparisons

Question 3: What other tanks have similar waste types and waste behaviors, and how does knowledge of the similar tanks contribute to the understanding of this tank?

Tanks 241-AN-103, 104, 106 and 107 and tanks 241-AW-101, 102 an 106 also contain mostly SMMA2 waste (Agnew 1997a). The sample composition was similar for each of these tanks.

On a volume percent basis, tank AW-101 is expected to contain more PL2 waste than any other tank (Agnew et al. 1997a). Tanks 241-AP-105, 241-AW-102, and 241-AW-106 are also expected to contain greater than 10% by volume of PL2 (Agnew 1997a). Little tank sample data is available for PL2 waste.

Statistical grouping studies are recommended to further compare tanks containing similar waste types and to assess differences in the waste composition between tanks.

Disposal Implications

Question 4: Given what is known about the waste properties and waste behaviors in this tank, what are the implications of the waste properties and behaviors to the waste retrieval/processing methodologies and equipment selection?

obThe waste in the tank 241-AW-101 consists of three layers: a crust layer in the top two segments resembling wet sludge, a supernatant layer (segments 3 through 16) consisting mostly of A1 salt cake, and a bottom sludge layer (segments 17 through 22) of PUREX low level waste. Although a drier layer was observed in the bottom of the tank, sample results indicate that little or no PUREX low level waste was recovered.

Tank 241-AW-101 is currently active and waste is non-complexed. However, waste has not been transferred from the tank since the third quarter of 1986. Sample results showed that the tank waste has low total alpha concentrations greatly alleviating criticality concerns during retrieval and processing. Organic solvent surface areas are also low compared to threshold limits. The waste in the tank is not exothermic and the flammable gas concentrations are low (< 1 percent of the lower flammability limit).

The primary concern for this tank is the retained gas in the crust, supernatant and sludge waste layers. Flammable gas issues should be carefully considered before saltwell pumping or other waste retrieval methods are implemented.

Assessments that could be conducted to better address disposal implications include: investigating blending strategies, evaluating potential impediments to pretreatment and estimating the number of glass logs that tank 241-AW-101 will make. These assessments are beyond the scope of the current effort.

Scientists Assessment of Data Quality and Quantity

Question 5: Given the current state of understanding of the waste in this tank on the one hand and the information drivers on the other; should additional tank data be sought via sampling/analysis from a strictly technical point-of-view? Can the waste behavior in this tank be adequately understood by other means (eg. archive samples, tank grouping studies, modeling) without additional sampling and analysis? If so, what characteristics of the tank waste lend themselves to a non-sample alternative? Is the quality of the data from this tank adequate from a field sampling and analytical laboratory point-of-view? Are there any clarifications or explanations needed for the data tables and figures?

Sampling/Analysis

Additional sampling may be required to meet regulatory air emissions issues recently applied to tank 241-AW-101 (Mulkey and Markilie 1995) and for additional flammable gas evaluations. Standard hydrogen monitoring system (SHMS) data are collected and evaluated routinely. Privatization and pretreatment analysis and evaluations are in progress. Future tank transfers may require supernatant grab samples and compatibility analyses (Mulkey and Miller 1997). The organic solvents issue is expected to be closed in FY 1998. The TWRS safety program has determined that no vapor samples are required from tank 241-AW-101 to resolve this issue.

Data Quality

Grab sample, auger sample, and core sample results obtained between 1990 and 1997 were of sufficient quality and quantity to address safety screening, flammable gas RGS, pretreatment and privatization requirements. The vast majority of QC results for the samples were within the boundaries specified in the SAPs. Discrepancies mentioned here and in the analytical data reports should not impact data validity or use.

All pertinent QC tests were conducted on these samples, allowing a full assessment regarding the accuracy and precision of the data. The standard and spike recovery results provide an estimate of analysis accuracy. If a standard or spike recovery is above or below the given criterion, the analytical results may be biased high or low, respectively. The 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, times 100.

Eighteen solid samples were re-tested because of failures with percent standard recovery, percent spike recovery, and RPD values. Most samples improved, however a few did not. No additional testing was requested because all sample and duplicate results, as well as the upper limits to the one-sided 95% confidence interval, were well below the notification limit.

Many samples exhibited RPDs greater than 15%. Analytes that had more than three RPD failures or poor spike recoveries were boron, calcium, silicon, potassium, iron, chromium, and aluminum. Reruns were performed on solid samples from core 132, segment levels 1, 2, 3, 4, 5, 7 and from core 139, segment levels 1, 2, 3, 4, 13, 14, 15, 19, 21. The waste samples contain large amounts of potassium, aluminum, and sodium, which may have contributed to the poor spike recovery values for these constituents. Finally, no sample exceeded the criterion for preparation blanks; thus, contamination was not a problem.

The vast majority of QC results were within the boundaries specified in the sampling and analysis plans. Small discrepancies noted in the analytical reports and footnoted in the analytical results standard report (standard report #10) should not impact the data validity or use.

Unique Aspects of the Tank

Question 6: What are unique chemical, physical, historical, operational or other characteristics of this tank or its contents?

There are no exceptional unique chemical, physical, historical, operational or other characteristics of this tank or its contents. Although expected, a PUREX low level waste heel was not observed in samples. Little sample data is available for the PL2 waste type. The A1 saltcake waste has been sampled for several of the A-Farm and AX-Farm tanks and is well understood.

The March 1988, photographic montage of the interior of tank 241-AW-101 shows a dark liquid mixed with a white saltcake. Equipment visible in the photograph are: a level probe, a thermocouple tree, a FIC level probe, a supernatant pump, a high level sensor, and a number of risers. Although tank 241-AW-101 is considered an active tank, there have been no large changes in the waste volume since the photographs were taken. Most changes in volume are attributed to slurry growth from gas generation. Therefore, the photographic montage should closely resemble the current appearance of the waste surface.