SEP 17 1998
Sta-4 58

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 622475

2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	Models and Inventory	N/A
5. Proj./Prog./Dept./Div.:	**6. Design Authority/ Design Agent/Cog. Engr.:**	**7. Purchase Order No.:**
Project W-030/Waste Management/M&I/Process Engineering	S. A. Barker	N/A

8. Originator Remarks:
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9. Equip./Component No.: N/A

10. System/Bldg./Facility: 702-AZ

11. Receiver Remarks: For release.

11A. Design Baseline Document? [ ] Yes [X] No

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

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

14. Required Response Date: 09/11/98

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	HNF-3335	N/A	0	Project W-030 Flammable Gas Verification Monitoring Test	SQ	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

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2	1	Design Authority W.M. Harty 9/16/98	1	1	D.G. Baide 09-16-98 S5-05
		Design Agent	1		M.S. Harrington 9-17-98 R2-58
2	1	Cog.Eng. S.A. Barker 9-14-98 R2-11	1	1	N.W. Kirch 9-14-98 R2-11
2	1	Cog. Mgr. K.M. Hodgson 9-14-98 R2-11	1	1	J.G. Kristofzski for 9/14/98 R2-11
2	1	QA J.J. Verderber for C.A. Sams 9-16-98 S5-12	1	1	G.R. Tardiff 9/14/98 S5-05
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18. A.E. Young — Signature of EDT Originator — 9-11-98 Date

19. N/A — Authorized Representative for Receiving Organization — Date

20. K.M. Hodgson — Design Authority/ Cognizant Manager — 9-14-98 Date

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

BD-7400-172-2 (05/96) GEF097

Project W-030 Flammable Gas Verification Monitoring Test

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

EDT/ECN: EDT-622475 UC: 2070
Org Code: 7A140 Charge Code: E57230
B&R Code: EW 3120074 Total Pages: 31

Key Words: Aging Waste, Flammable Gas, 702-AZ Ventilation System

Abstract: This document describes the verification monitoring campaign used to document the ability of the new ventilation system to mitigate flammable gas accumulation under steady state tank conditions. This document reports the results of the monitoring campaign. The ventilation system configuration, process data, and data analysis are presented.

9/17/98
Release Approval Date

DATE: SEP 17 1998
STA: 4 HANFORD RELEASE ID: 58
Release Stamp

Approved for Public Release

Project W-030 Flammable Gas Verification Monitoring Test

HNF-3335, Rev. 0

Steven A. Barker

September 11, 1998

1.0 INTRODUCTION AND SCOPE

1.1 INTRODUCTION

The approach to managing flammable gas related risks for tank waste storage consists of a combination of ignition source controls, flammable gas monitoring, and tank ventilation. Tank ventilation dilutes and removes flammable gases released from the stored wastes into the dome space and connected vapor spaces. Safety margins can be maintained by assuring that the ventilation system is able to maintain a flow rate sufficient to keep vapor space flammable gas concentrations to values less than 25 % of the lower flammability limit (LFL). The objective of this test is to determine operating conditions for the 702-AZ ventilation system that will maintain flammable gas concentrations at acceptable levels.

1.2 Scope

This document reports the results of the test described in *Project W-030 Flammable Gas Verification Monitoring Plan* (Fowler 1998). The purpose of the test is to verify that the 702-AZ Ventilation System is capable of mitigating flammable gas accumulation in Aging Waste Facility (AWF) tanks under steady-state storage conditions. The appropriate Combustible Gas Monitor (CGM) calculation is presented and statistical analyses of the test data are presented following the methodology presented in Fowler (1998).

2.0 Background and Objective

2.1 Background

On July 31, 1996, the Tank Waste Remediation System (TWRS) contractor recommended an expansion to the open flammable gas unreviewed safety question (USQ) to include the AWF. At that time, a deflagration sequence analysis under development indicated off-site dose above risk guidelines. This resulted in a Safety Class function to prevent or mitigate the postulated accident. The Safety Class function was identified as the provision of air flow out of the tanks. Adequate air flow will assure that flammable gas cannot accumulate in the vapor spaces of AWF tanks and, therefore, cannot result in the vapor space flammable gas concentration exceeding 25 % LFL.

2.2 Objective

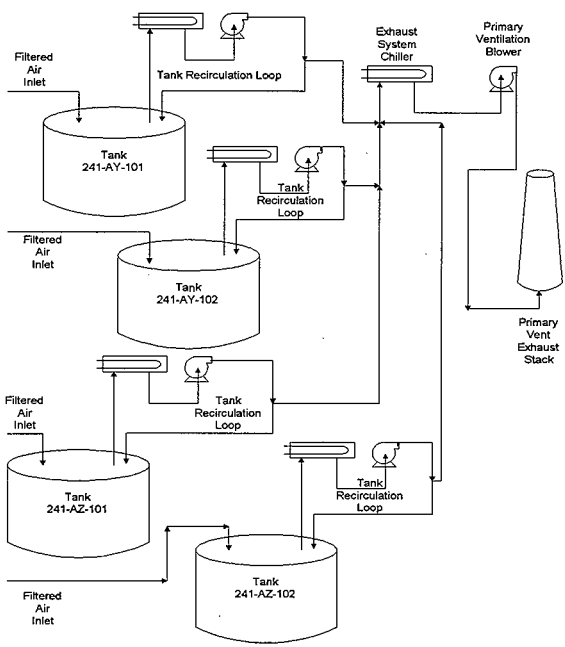
The purpose of this test is to establish the information and data needed to demonstrate the 702-AZ Ventilation System's ability to maintain the concentration of flammable gas in the vapor space of each AWF tank below 25 % LFL. This is accomplished by:

- Monitoring the flammable gas concentration in the vapor space of each AWF tank, verifying that each will remain below 25 % LFL.
- Monitoring the ventilation flow rate for each AWF tank over a predetermined time period to assure the system is capable of consistently delivering a flow rate sufficient to maintain flammable gas concentrations at acceptable levels.

3.0 System Configuration

The AWF Ventilation system is shown in Figure 1. There are two parts to the AWF ventilation system. There is cooled recirculating ventilation air on each tank to control tank temperature and to perform initial condensate removal (flowrate is not monitored). A second ventilation system cools, filters, and exhausts the 4 combined ventilation gas purge streams to control flammable gas concentrations. For this report, the ventilation flowrate is the volumetric flowrate of ventilation air from the individual tanks being sent through the second system and exhausted through the stack. The recirculation flowrate is the volumetric flowrate of ventilation air being recirculated to the tank used for temperature control and is not measured.

Figure 1 Simplified Flow Diagram for the Aging Waste Facility Ventilation System



4.0 Data Collection

4.1 Combustible Gas Monitor Calibration

Wilkins (1996) reported on the results of calibration testing of the hand held CGM. The CGM, model LTX 310, operation was checked against known concentrations of hydrogen in various air mixtures. Wilkins reported several findings.

- The CGM lower detection limit was determined to be 1200 ppm H_2 (3 % LFL).
- When calibrated against pentane, the reading on the CGM should be divided by 2 to determine a corrected and conservative estimate of the combustible gas concentration.
- When calibrated against pentane, the corrected combustible gas concentration determined by the CGM is 5 to 40% higher than the actual flammable gas concentration.
- Ammonia and/or nitrous oxide affects the CGM calibration by increasing the CGM combustible gas concentration reading.

A review of the test data presented in Wilkins (1996), finds that the CGM is very consistent and a satisfactory calibration curve can be prepared. The resulting calibration (from Figure A-1) used for the CGM during this test is

$$[\text{FG concentration}] = 0.32 \times (\text{CGM reading}) + 0.018 \qquad \text{[Eq A-1]}$$

The presence of ammonia and nitrous oxide will affect the calibration of the CGM. Since ammonia and nitrous oxide will raise the "corrected" flammable gas concentration, this will add conservatism to the results of this test and will not invalidate the findings.

4.2 Results of Testing

Appendix B presents the raw data sheets used during the W-030 Flammable Gas Verification Test. Tables 1 through 4 present the relevant data grouped by tank. In addition, the tables present the average value of the flammable gas concentration (CGM and Standard Hydrogen Monitoring System [SHMS]), temperature, liquid level, waste temperature, and ventilation rate along with the associated confidence intervals at a 95% confidence level.

Table 1 241-AY-101 Data Summary

Date	Time	CGM (% LFL)	Corrected CGM (% LFL)	Liquid Level (in)	Temperature			Vent Rate			
					Time	Supernate	Sludge	Time	Flowrate (cfm)	Time	Flowrate (cfm)
8/13/98	10:00 AM	0	< 2.8%	62.35	9:50 AM	83	112	10:00 AM	228	2:00 PM	226
8/14/98	10:00 AM	3	2.8%	62.35	10:00 AM	82	112	10:56 AM	194	3:31 PM	198
8/15/98	9:15 AM	5	3.4%	62.35	9:00 AM	83	113	8:40 AM	200	3:43 PM	203
8/16/98	8:40 AM	0	< 2.8%	62.34	9:00 AM	82	113	8:00 AM	200	12:53 PM	206
8/17/98	8:30 AM	1	< 2.8%	62.35	9:00 AM	82	113	8:30 AM	201	2:00 PM	204
8/18/98	8:40 AM	0	< 2.8%	62.34	9:58 AM	82	112	10:35 AM	210	1:41 PM	202
8/19/98	8:45 AM	0	< 2.8%	62.35	8:20 AM	82	113	8:15 AM	200	2:35 PM	196
8/20/98	8:45 AM	3	2.8%	62.34	8:45 AM	82	113	7:25 AM	200	1:25 PM	194
8/21/98	8:35 AM	1	< 2.8%	62.34	7:40 AM	82	113	7:00 AM	199	11:30 AM	210
8/22/98	8:45 AM	0	< 2.8%	62.33	7:50 AM	82	113	8:50 AM	198	2:00 PM	200
8/23/98	8:30 AM	3	2.8%	62.33	8:46 AM	82	112	9:15 AM	200	1:15 PM	198
8/24/98	8:05 AM	0	< 2.8%	62.33	9:00 AM	82	112	10:43 AM	203	2:05 PM	218
8/25/98	9:30 AM	0	< 2.8%	62.33	10:55 AM	81	112	11:00 AM	201	3:05 PM	208
8/26/98	9:00 AM	0	< 2.8%	62.33	9:35 AM	82	112	9:48 AM	207	1:20 PM	205
8/27/98	8:30 AM	0	< 2.8%	62.32	10:00 AM	81	112	10:30 AM	202	2:30 PM	218
8/28/98	8:15 AM	0	< 2.8%	62.32	8:20 AM	81	112	8:20 AM	200	1:05 PM	204
8/29/98	10:40 AM	2	< 2.8%	62.31	8:30 AM	82	112	7:30 AM	201	11:30 AM	197
8/30/98	10:15 AM	2	< 2.8%	62.31	10:00 AM	81	112	10:00 AM	195	2:00 PM	186
8/31/98	8:00 AM	0	< 2.8%	62.31	9:30 AM	79	112	9:50 AM	203	2:42 PM	202
9/1/98	8:15 AM	0	< 2.8%	62.31	8:20 AM	82	112	9:00 AM	202	2:10 PM	204
Average		1.0	2.8%	62.3		81.8	112.4		201.8		
Standard Deviation		1.49	0.1%	0.01		0.85	0.49		5.98		
Number of Observations		20	20	20		20	20		38		
Confidence Level		95%	95%	95%		95%	95%		95%		
Confidence Interval		0.7	0.1%	0.0		0.4	0.2		1.9		
Range (95% C.I.)		0.3 to 1.7	0.0 to 2.9 %	62.3		81.4 to 82.1	112.1 to 112.6		199.9 to 203.7		
Alternate form of Range (95% C.I.)		1.0 +/- 0.7	2.8% - 2.8 + 0.1	62.3 +/- 0.0		81.8 +/- 0.4	112.4 +/- 0.2		201.8 +/- 1.9		

Table 2 241-AY-102 Data Summary

Date	Time	CGM (% LFL)	Corrected CGM (% LFL)	SHMS (% VOL)	SHMS (% LFL)	Liquid Level (in)	Temperature			Vent Flow			
							Time	Supernate	Sludge	Time	Flowrate (cfm)	Time	Flowrate (cfm)
8/13/98	10:00 AM	3	2.8%	0.070 0.066	1.75% 1.65%	167.24	10:20 AM	79	89	10:00 AM	262	2:00 PM	255
8/14/98	10:00 AM	4	3.1%	0.076 0.061	1.90% 1.53%	167.22	9:45 AM	79	89	10:56 AM	210	3:31 PM	207
8/15/98	9:15 AM	5	3.4%	0.045 0.055	1.13% 1.38%	167.22	8:35 AM	79	89	8:40 AM	210	3:43 PM	209
8/16/98	8:40 AM	0	< 2.8%	0.044 0.048	1.10% 1.20%	167.22	8:50 AM	79	87	8:00 AM	210	12:53 PM	216
8/17/98	8:30 AM	2	< 2.8%	0.053 0.043	1.33% 1.08%	167.09	8:30 AM	80	86	8:30 AM	208	2:00 PM	205
8/18/98	8:40 AM	0	< 2.8%	0.050 0.038	1.25% 0.95%	167.08	9:58 AM	79	84	10:35 AM	216	1:41 PM	216
8/19/98	8:45 AM	0	< 2.8%	0.017 0.036	0.43% 0.90%	167.08	8:20 AM	79	85	8:15 AM	209	2:35 PM	209
8/20/98	8:45 AM	2	< 2.8%	0.033 0.033	0.83% 0.83%	167.08	8:45 AM	79	85	7:25 AM	210	1:25 PM	285
8/21/98	8:35 AM	1	< 2.8%	0.030 0.032	0.75% 0.80%	167.04	7:40 AM	79	85	7:00 AM	210	11:30 AM	210
8/22/98	8:45 AM	0	< 2.8%	0.027 0.028	0.68% 0.70%	167.06	7:50 AM	79	86	8:50 AM	213	2:00 PM	210
8/23/98	8:30 AM	3	2.8%	0.026 0.025	0.65% 0.63%	167.06	8:46 AM	79	85	9:15 AM	204	1:15 PM	203
8/24/98	8:05 AM	0	< 2.8%	0.020 0.024	0.50% 0.60%	167.06	9:00 AM	79	85	10:43 AM	218	2:05 PM	207
8/25/98	9:30 AM	1	< 2.8%	0.024 0.023	0.60% 0.58%	167.06	10:55 AM	79	84	11:00 AM	208	3:05 PM	217
8/26/98	9:00 AM	0	< 2.8%	0.019 0.021	0.48% 0.53%	167.07	9:35 AM	79	85	9:48 AM	205	1:20 PM	210
8/27/98	8:30 AM	0	< 2.8%	0.022 0.020	0.55% 0.50%	167.06	10:00 AM	79	84	10:30 AM	218	2:30 PM	212
8/28/98	8:15 AM	0	< 2.8%	0.016	0.40%	167.06	8:20 AM	79	85	8:20 AM	210	1:05 PM	214

Table 2 241-AY-102 Data Summary

Date	Time	CGM (% LFL)	Corrected CGM (% LFL)	SHMS (% VOL)	SHMS (% LFL)	Liquid Level (in)	Temperature			Vent Flow			
							Time	Supernate	Sludge	Time	Flowrate (cfm)	Time	Flowrate (cfm)
				0.018	0.45%								
8/29/98	10:40 AM	0	< 2.8%	0.022	0.55%	167.05	8:30 AM	79	85	7:30 AM	216	11:30 AM	203
				0.018	0.45%								
8/30/98	10:15 AM	0	< 2.8%	0.02	0.50%	167.05	10:00 AM	79	85	10:00 AM	210	2:00 PM	202
				0.017	0.43%								
8/31/98	8:00 AM	0	< 2.8%	0.015	0.38%	167.04	9:30 AM	79	86	9:50 AM	211	2:42 PM	222
				0.015	0.38%								
9/1/98	8:15 AM	0	< 2.8%	0.014	0.35%	167.04	8:20 AM	79	86	9:00 AM	215	2:10 PM	212
				0.008	0.20%								
Average		1.1	2.8%	0.0318	0.80%	167.1		79.1	85.8		212.6		
Standard Deviation		1.57	0.2%	0.0170	0.42%	0.07		0.22	1.59		12.91		
Number of Observations		20	20	40	40	20		20	20		38		
Confidence level		95%	95%	95%	95%	95%		95%	95%		95%		
Confidence Interval		0.7	0.1%	0.0053	0.13%	0.0		0.1	0.7		4.1		
Range (95% C.I.)		0.4 to 1.7	2.7%to 2.9%	0.0265 to 0.0371	0.66% to 0.93%	167.1 to 167.1		79.0 to 79.1	85.1 to 86.4		208.5 to 216.7		
Alternate form of Range (95% C.I.)		1.1 +/- 0.7	2.8% +/- 0.1%	0.032 +/- 0.0053	0.80% +/- 0.13%	167.1 +/- 0.0		79.1 +/- 0.1	85.8 +/- 0.7		212.6 +/- 4.1		

Table 3 241-AZ-101 Data Summary

Date	Time	CGM (% LFL)	Corrected CGM (% LFL)	SHMS (% VOL)	SHMS (% LFL)	Liquid Level (in)	Temperature			Vent Flow			
							Time	Supernate	Sludge	Time	Flowrate (cfm)	Time	Flowrate (cfm)
8/13/98	10:00 AM	2	< 2.8%	0.022	0.55%	304.57	10:20 AM	136	139	10:00 AM	153	2:00 PM	151
8/14/98	10:00 AM	5	3.4%	0.024	0.60%	304.54	9:45 AM	136	140	10:56 AM	116	3:31 PM	118
8/15/98	9:15 AM	5	3.4%	0.025	0.63%	304.52	8:35 AM	137	141	8:40 AM	120	3:43 PM	122
8/16/98	8:40 AM	0	< 2.8%	0.023	0.58%	304.49	8:50 AM	137	141	8:00 AM	120	12:53 PM	120
8/17/98	8:30 AM	1	< 2.8%	0.022	0.55%	304.49	8:30 AM	137	141	8:30 AM	123	2:00 PM	123
8/18/98	8:40 AM	2	< 2.8%	0.024	0.60%	304.44	9:58 AM	135	139	10:35 AM	123	1:41 PM	122
8/19/98	8:45 AM	0	< 2.8%	0.022	0.55%	304.43	8:20 AM	136	140	8:15 AM	120	2:35 PM	121
8/20/98	8:45 AM	4	3.1%	0.024	0.60%	304.42	8:45 AM	136	140	7:25 AM	123	1:25 PM	117
8/21/98	8:35 AM	1	< 2.8%	0.027	0.68%	304.39	7:40 AM	136	140	7:00 AM	125	11:30 AM	125
8/22/98	8:45 AM	0	< 2.8%	0.027	0.68%	304.06	7:50 AM	136	140	8:50 AM	123	2:00 PM	120
8/23/98	8:30 AM	3	2.8%	0.025	0.63%	304.34	8:46 AM	135	139	9:15 AM	120	1:15 PM	119
8/24/98	8:05 AM	1	< 2.8%	0.025	0.63%	304.32	9:00 AM	136	140	10:43 AM	119	2:05 PM	120
8/25/98	9:30 AM	2	< 2.8%	0.028	0.70%	304.3	10:55 AM	135	139	11:00 AM	124	3:05 PM	124
8/26/98	9:00 AM	0	< 2.8%	0.026	0.65%	304.28	9:35 AM	135	139	9:48 AM	119	1:20 PM	118
8/27/98	8:30 AM	0	< 2.8%	0.028	0.70%	304.26	10:00 AM	135	139	10:30 AM	125	2:30 PM	116
8/28/98	8:15 AM	1	< 2.8%	0.028	0.70%	304.25	8:20 AM	136	140	8:20 AM	120	1:05 PM	119
8/29/98	10:40 AM	3	2.8%	0.028	0.70%	304.24	8:30 AM	136	140	7:30 AM	118	11:30 AM	119
8/30/98	10:15 AM	2	< 2.8%	0.028	0.70%	304.22	10:00 AM	135	139	10:00 AM	124	2:00 PM	116
8/31/98	8:00 AM	0	< 2.8%	0.026	0.65%	304.2	9:30 AM	136	139	9:50 AM	123	2:42 PM	124
9/1/98	8:15 AM	0	< 2.8%	0.023	0.58%	304.19	8:20 AM	136	140	9:00 AM	124	2:10 PM	121
Average		1.6	2.8%	0.0253	0.63%	304.3		135.9	139.8		120.9		
Standard Deviation		1.67	0.2%	0.0022	0.05%	0.14		0.67	0.72		2.67		
Number of Observations		20	20	20	20	20		20	20		38		
Confidence level		95%	95%	95%	95%	95%		95%	95%		95%		
Confidence Interval		0.7	0.1%	0.0010	0.02%	0.1		0.3	0.3		0.8		
Range (95% C.I.)		0.9 to 2.3	2.8 to 29%	0.0242 to 0.0262	0.61 to 0.66%	304.3 to 304.4		135.6 to 136.1	139.4 to 140.1		120.0 to 121.7		
Alternate form of Range (95% C.I.)		1.6 +/- 0.7	2.8 +/- 0.1%	0.0253 +/- 0.001	0.63 +/- 0.02%	304.3 +/- 0.1		135.9 +/- 0.3	139.8 +/- 0.3		120.9 +/- 0.8		

Table 4 241-AZ-102 Data Summary

Date	Time	CGM (% LFL)	Corrected CGM (% LFL)	Liquid Level (in)	Temperature			Vent Flow			
					Time	Supernate	Sludge	Time	Flowrate (cfm)	Time	Flowrate (cfm)
8/13/98	10:00 AM	4	3.1%	322.55	10:20 AM	124	176	10:00 AM	100	2:00 PM	100
8/14/98	10:00 AM	5	3.4%	322.5	9:45 AM	124	175	10:56 AM	103	3:31 PM	112
8/15/98	9:15 AM	5	3.4%	322.55	8:35 AM	124	176	8:40 AM	110	3:43 PM	109
8/16/98	8:40 AM	0	< 2.8%	322.5	8:50 AM	124	176	8:00 AM	105	12:53 PM	113
8/17/98	8:30 AM	2	< 2.8%	322.5	8:30 AM	124	176	8:30 AM	114	2:00 PM	110
8/18/98	8:40 AM	0	< 2.8%	322.4	9:58 AM	123	175	10:35 AM	116	1:41 PM	116
8/19/98	8:45 AM	0	< 2.8%	322.45	8:20 AM	124	176	8:15 AM	114	2:35 PM	108
8/20/98	8:45 AM	3	2.8%	322.45	8:45 AM	123	175	7:25 AM	107	1:25 PM	100
8/21/98	8:35 AM	2	< 2.8%	322.4	7:40 AM	123	175	7:00 AM	113	11:30 AM	110
8/22/98	8:45 AM	0	< 2.8%	322.3	7:50 AM	123	175	8:50 AM	111	2:00 PM	107
8/23/98	8:30 AM	5	3.4%	322.35	8:46 AM	122	174	9:15 AM	112	1:15 PM	107
8/24/98	8:05 AM	1	< 2.8%	322.3	9:00 AM	122	175	10:43 AM	108	2:05 PM	108
8/25/98	9:30 AM	1	< 2.8%	322.25	10:55 AM	119	173	11:00 AM	107	3:05 PM	116
8/26/98	9:00 AM	0	< 2.8%	322.25	9:35 AM	121	174	9:48 AM	111	1:20 PM	111
8/27/98	8:30 AM	0	< 2.8%	323.7	10:00 AM	121	173	10:30 AM	108	2:30 PM	107
8/28/98	8:15 AM	0	< 2.8%	323.7	8:20 AM	122	174	8:20 AM	110	1:05 PM	104
8/29/98	10:40 AM	2	< 2.8%	323.8	8:30 AM	122	175	7:30 AM	118	11:30 AM	102
8/30/98	10:15 AM	2	< 2.8%	323.75	10:00 AM	121	173	10:00 AM	116	2:00 PM	106
8/31/98	8:00 AM	0	< 2.8%	323.8	9:30 AM	122	174	9:50 AM	109	2:42 PM	102
9/1/98	8:15 AM	0	< 2.8%	323.8	8:20 AM	122	173	9:00 AM	107	2:10 PM	113
Average		1.6	2.9%	322.8		122.5	174.7		109.5		
Standard Deviation		1.88	0.2%	0.64		1.36	1.09		4.33		
Number of Observations		20	20	20		20	20		38		
Confidence level		95%	95%	95%		95%	95%		95%		
Confidence Interval		0.8	0.1%	0.3		0.6	0.5		1.4		
Range (95% C.I.)%)		0.8 to 2.4	2.8 to 3.0%	322.5 to 323.1		121.9 to 123.1	174.2 to 175.1		108.1 to 110.9		
Alternate form of Range (95% C.I.)%		1.6 +/- 0.8	2.9 +/- 0.1	322.8 +/- 0.3		122.5 +/- 0.6	174.7 +/- 0.5		109.5 +/- 1.4		

5.0 Data Evaluation

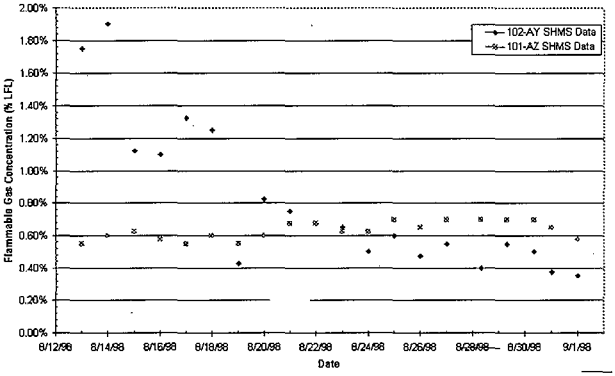
The Flammable Gas Monitoring Verification Plan (Fowler 1998) presents the data analysis required for acceptance of the ventilation systems. The ventilation system must meet the following criteria in order to be accepted:

- SHMS data when available must not indicate an increase in flammable gas concentrations;
- Tank waste levels should be analyzed for unexplained level increases which may indicate gas retention.
- 702-AZ ventilation system header gas measurements should verify acceptable flammable gas concentrations;
- AWF tank SHMS data should pass a one-sided hypothesis test at a 95% confidence level that the tank will remain below 25 % LFL at least 90% of the time at the conditions of the test;
- The range of ventilation flow rate should be determined for each tank. Using the lower value of the range, along with maximum waste level and waste temperature the number of days to reach 25 % LFL shall be determined.
- Supernatant and Solid waste temperatures should be monitored and evaluated to determine if the ventilation rates are sufficient to maintain constant temperatures.

5.1 Flammable Gas Concentration Analysis

SHMS data is available for only 2 of the tanks — 241-AY-102 and 241-AZ-101. There is limited hydrogen concentration data from SHMS, since there is a problem with sample line filters being plugged due to condensation. The SHMS equipment is run for 30-minute durations, one or two times a day. Over the 21-day period of the test, tank 241-AY-102 data show a decreasing hydrogen concentration with a slope of -0.0007 ± 0.0001 %LFL/day. During the same period, tank 241-AZ-101 SHMS data show a slight increase in slope with a slope of 0.00006 ± 0.00004 %LFL/day, a slope about one-tenth the magnitude of tank 241-AY-102. If the rate of increase of hydrogen concentration experienced in tank 241-AZ-101 were maintained, it would take about 1,200 years for the flammable gas concentration in the tank to exceed 25% LFL. The magnitude of both slopes are essentially zero and the ventilation rate used in the tanks is considered to be sufficient to maintain low flammable gas concentrations.

Figure 2 AWF Ventilation Test - SHMS Data for Tanks 241-AY-102 and 241-AZ-101

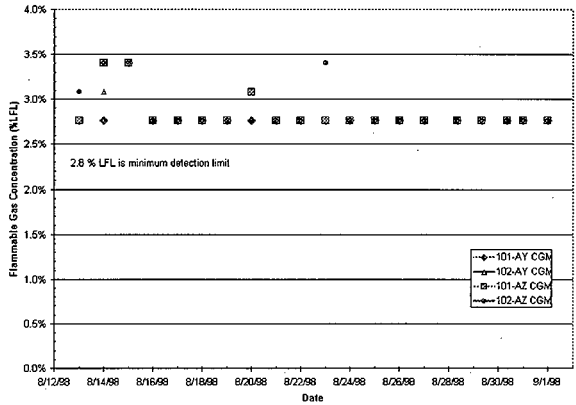


The SHMS data for tank 241-AY-102 also passes a one-sided nonparametric tolerance limit test. This test indicates that the tank will remain below 25 %LFL at least 90% of the time for the conditions of the test at 95 % confidence level. This test is passed when sufficient measurements are taken (29 or more measurements) and when 100% of the measurements have been less than the 25 %LFL level. All remaining AWF tanks had insufficient SHMS data for the test to be applicable.

Since SHMS data is not available in all tanks, daily CGM readings were taken. Figure 3 presents the results of the analysis of CGM data. In all tanks, there were no CGM readings above the minimum detection limit, 2.8 % LFL, for the last 9 days of the test (Figure 3). The in-tank CGM readings indicate that the ventilation rates used in this test are acceptable for maintaining low flammable gas concentrations.

In addition to the in-tank CGM readings, daily CGM readings were taken at the exhaust stack (Appendix B). Only 3 times did the CGM reading reach the minimum detection limit of 2.8 %LFL. The remaining readings were all below the minimum detection limit. Consistent with the in-tank readings, there were no CGM readings above the minimum detection limit, 2.8 %LFL, for the last 9 days of the test. The exhaust CGM readings confirm that the ventilation rates used in this test are acceptable for maintaining low flammable gas concentrations.

Figure 3 AWF Ventilation Test -
CGM Data for Tanks 241-AY-101, 241-AY-102, 241-AZ-101, 241-AZ-102



5.2 Waste Level Anaylsis

Tank waste levels in all tanks show no unexplained level increases. Because of the consistency of evaporative level changes in the tanks, increasing gas retention is not occurring in these tanks. Figures 4 and 5 present the level profiles for the AY tanks since their last major tank fill. Figures 6 and 7 present the level profiles for the AZ tanks since September 1997. Since the AZ tanks are higher temperature tanks, evaporation rates are high and frequent additions are made to the tanks from the condensate catch tanks. Table 5 contains information from PCSACS and the tank transfer data sheets that explain the jumps in the surface level for tank 241-AZ-102 during the past year. Note that Figures 4, 5, 6, and 7 have different scales on the vertical axis, which makes direct comparisons more difficult.

Figure 4 Tank 241-AY-101 Surface Level

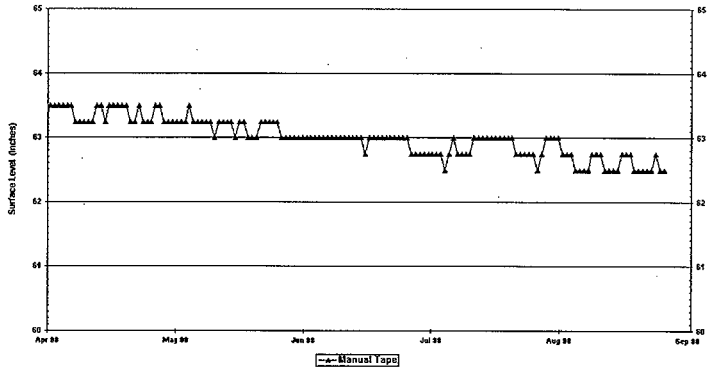


Figure 5 Tank 241-AY-102 Surface Level

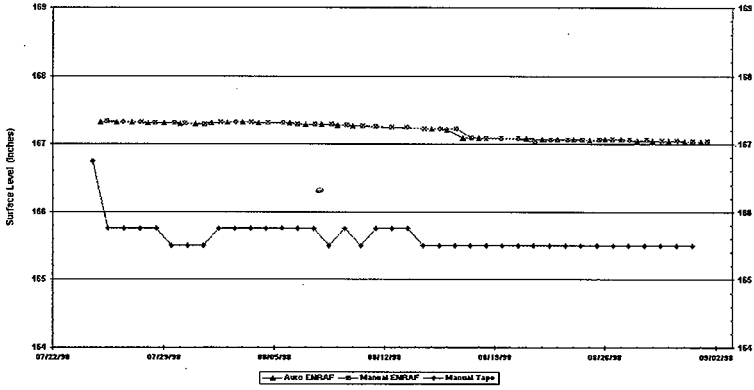


Figure 6 Tank 241-AZ-101 Surface Level

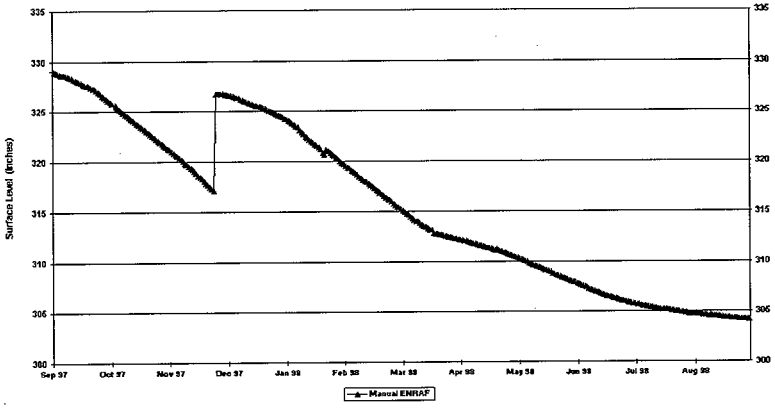


Figure 7 Tank 241-AZ-102 Surface Level

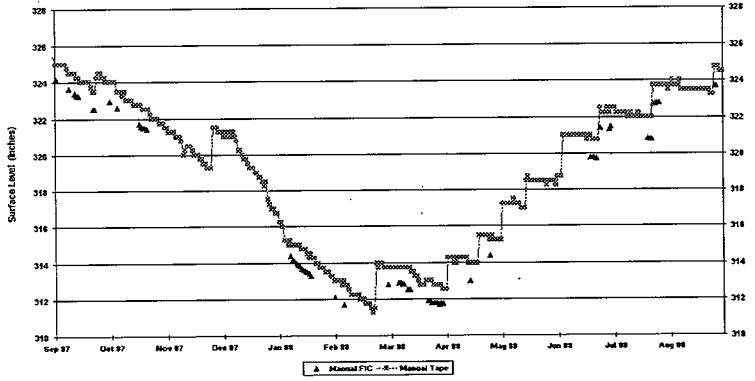


Table 5 Comment Report For Tank AZ102

Date	Instrument Reading	Comments
9/25/1997	Auto FIC	2,475 Gal. from AZ151
11/27/1997	Auto FIC	Received from AZ151 (7,217 pumped)
2/24/1998	Auto FIC	Received appr. 6000 Gal. from AZ151
4/ 4/1998	Auto FIC	Received appr. 4,262.5 Gal. from A-417
4/20/1998	Auto FIC	Received appr. 4,400 Gal. from AZ151.
5/ 4/1998	Auto FIC	Received appr. 5225 Gal. from AZ151
5/16/1998	Auto FIC	Received appr. 4848 Gal. from AZ151
6/ 2/1998	Auto FIC	Transfer from AZ151 started. Not completed. 1100 Gallons received
6/ 5/1998	Auto FIC	Transfer from AZ151 completed. 6325 Gal. + 1100 on 6/2 = 7425 received.
6/25/1998	Auto FIC	received 4,675 Gal. from AZ151
7/24/1998	Manual FIC	Received from AZ151 (5,565 Gal.)
8/27/1998	Manual FIC	4,120 Gallons sent from AZ151

5.3 Ventilation Flow Rate

The ventilation rates used in this test are at least 60 times higher than the minimum ventilation rate required to keep the tank from exceeding 25 %LFL as reported by Hu (1998). This meets the requirements spelled out in Fowler (1998). The ventilation rates selected for this test, are based on minimum ventilation rates that can be sustained during normal operations. The rates reflect operating requirements to maintain tank pressures and for connected tank farm equipment ventilation.

Table 6 AWF Ventilation Test - Tank Ventilation Rates

Tank	Flow Rate at Lower end of One-Sided 95% Confidence Interval (cfm)	Mean Flow Rate (cfm)	Minimum Ventilation Rate Not to Exceed 25% LFL Limit (cfm)
241-101-AY	200.2	201.8	0.77
241-102-AY	209.2	212.6	1.95
241-101-AZ	120.2	120.9	2.00
241-102-AZ	108.3	109.5	1.82

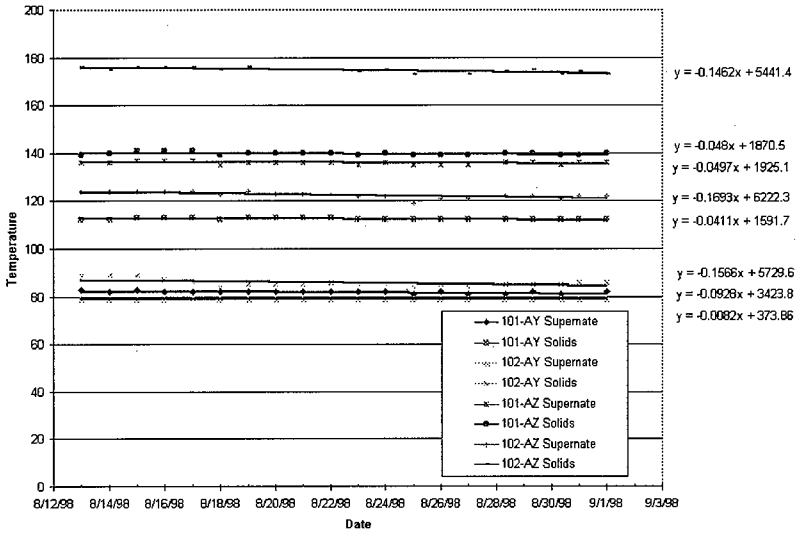
5.4 Waste Temperature

Tank supernatant and solid waste temperatures (Table 7) are low compared to the maximum temperatures presented by Fowler (1998). Figure 8 presents the temperature trend data during the process test. All in-tank temperatures decreased throughout the test, meeting the requirement that the supernate and solid waste temperatures show a steady or decreasing trend. Hydrogen generation rates decrease as temperatures are reduced. The lower generation rates will contribute to low steady-state flammable gas concentrations in the tank dome space.

Table 7 Comparison of Waste Temperatures During Ventilation Test to Predicted Maximum Waste Temperatures

Tank	Predicted Maximum Supernate Temperature °C (°F)	Actual Maximum Supernate Temperature °C (°F)	Predicted Maximum Solid Temperature °C (°F)	Actual Maximum Solid Temperature °C (°F)
241-AY-101	42 (107)	28 (82)	59 (138)	45 (112)
241-AY-102	38 (102)	26 (79)	44 (111)	30 (86)
241-AZ-101	66 (150)	57 (136)	93 (200)	60 (140)
241-AZ-102	61 (142)	50 (123)	94 (202)	80 (174)

Figure 8 AWF Ventilation Test - Waste Temperature Trends



5.5 Flammable Gas Generation Rate and Time to Reach 25 % LFL

Tank conditions during the AWF ventilation test are very similar to previous operating conditions. The tank waste temperatures are maintained by recirculation of cooled ventilation gases. Flammable gas concentrations are maintained to acceptable levels by the exhaust ventilation rate. Based on the tank conditions during the test, there is no significant difference between the hydrogen generation rates and the associated "time to 25 %LFL" during the test to the values determined and published prior to the project W-030 tank farm ventilation modifications (Hu 1998) (Table 8).

Table 8 Dome Space Hydrogen Concentrations Upon Loss of Ventilation for DSTs Using Hydrogen Generation Model

	Calculation of Hydrogen Concentration in Steady State Using Model HGR			Calculation for the Condition of Lost Active Ventilation Using Barometric Breathing Rate				
Tanks	Measured Active Ventilation Rate (cfm)	Hydrogen Generation Rate from Model (cfm)	Steady State Hydrogen Concen. (ppmv)	Barometric Breathing Rate (cfm)	Time to Reach 25% LFL (day)	Time to Reach LFL (day)	Steady State Hydrogen Concen. (%)	Minimum Ventilation Rate Not to Exceed 25% LFL Limit (cfm)
Values based on results of AWF Ventilation Test								
241-AY-101	202	7.26E-03	12	.211	70	Not Occur	3.3	0.77
241-AY-102	213	1.83E-02	26	0.241	29	167	7.0	1.95
241-AZ-101	121	1.88E-02	30	0.218	25	139	7.9	2.00
241-AZ-102	110	1.71E-02	30	0.209	27	149	7.6	1.82
Values published by Hu (1998)								
241-AY-101	600	7.25E-03	12	0.211	71	Not Occur	3.3	0.77
241-AY-102	700	1.83E-02	26	0.241	29	167	7.0	1.95
241-AZ-101	629	2.01E-02	32	0.218	24	127	8.4	2.14
241-AZ-102	563	1.71E-02	30	0.209	27	148	7.6	1.82

6.0 Conclusions

The AWF Ventilation Test has demonstrated that the project W-030 Ventilation System can meet the requirements presented in the Flammable Gas Monitoring Verification Plan (Fowler 1998). The ventilation system has met the following criteria:

- SHMS data indicates a decreasing or steady flammable gas concentration in the two tanks instrumented. CGM data confirm acceptable flammable gas concentrations in all four tanks.
- Tank waste levels are steady or decreasing, indicating that gas is not being retained,
- The 702-AZ ventilation system header gas measurements verify acceptable flammable gas concentrations.
- Tank 241-AY-102 SHMS data pass a one-sided nonparametric test at a 95% confidence level that the tank will remain below 25 %LFL at least 90% of the time at the conditions of the test;
- The range of ventilation flow rates have been determined for each tank. The ventilation rates exceed the required 4 times the calculated minimum ventilation rate required to maintain tank flammable gas concentrations below 25 %LFL.; and
- Supernatant and solid waste temperatures were evaluated to confirm that ventilation rates are sufficient to maintain constant temperatures.

This report validates safe AWF ventilation system operations for maintenance of dome space flammable gas concentrations below 25 %LFL at the operating conditions listed in Table 9. These conditions are based on the worst conditions in any of the aging waste tanks, tank 241-AZ-102.

Table 9 Controlling Conditions for Operation of the AWF Ventilation System

Maximum Sludge Temperature (°C [°F])	80 (175)
Minimum Tank Ventilation Flow Rate to Stack (cfm)	110 cfm
Minimum Tank Ventilation Recirculation Flow Rate (cfm)	As required to maintain sludge temperature above.

7.0 References

Fowler, K. D., 1998, *Project W-030 Flammable Gas Verification Monitoring Test*, HNF-SD-W030-TC-001, Revision 1, Lockheed Martin Hanford Company, Richland, Washington.

Hu, T. A., 1998, *Calculations of Hydrogen Release Rate at Steady State for Double-Shell Tanks*, HNF-SD-WM-CN-117, Revision 0A, Lockheed Martin Hanford Company, Richland, Washington.

Wilkins, N. E., 1996, Test Evaluation of Industrial Hygiene Hand Held Combustible Gas Monitor, WHC-SD-WM-TRP-256, Westinghouse Hanford Company, Richland, Washington.

Appendix A

Combustible Gas Monitor Calibration

Data from Wilkins (1996) tests 1, 2, 3, 4, and 5 are re-evaluated and a calibration curve is created. This calibration applies to gas mixtures with H_2 in air only, The presence of ammonia and nitrous oxide will raise the gas concentration and will be conservative (report the flammable gas concentration higher than actual) in flammable gas concentration.

CGM Test 1, 2, 3, 4, & 5

Gas bottle A contains 6330 ppm H_2 in air
Gas bottle B contains air

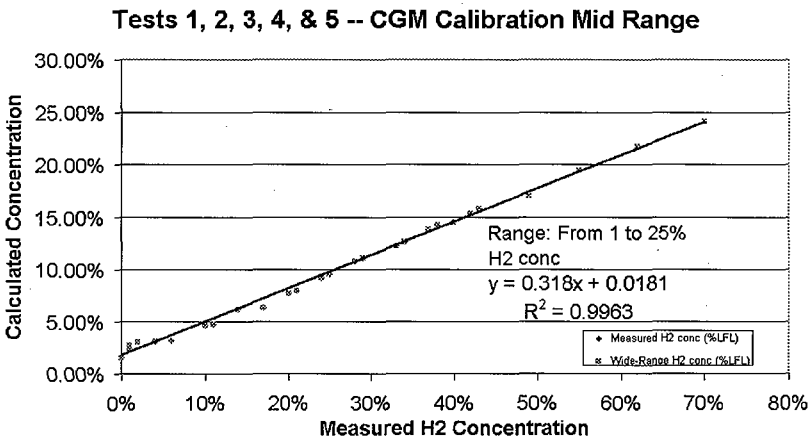
Fraction of bottle "A"	H2 concentration (ppm)	calculated H2 concentration (%LFL)	Measured H2 concentration (%LFL)
10%	633	1.58%	0%
20%	1266	3.17%	6%
30%	1899	4.75%	11%
40%	2532	6.33%	17%
50%	3165	7.91%	21%
60%	3798	9.50%	25%
70%	4431	11.08%	29%
80%	5064	12.66%	34%
90%	5697	14.24%	38%
100%	6330	15.83%	43%
10%	633	1.58%	0%
20%	1266	3.11%	4%
30%	1899	4.64%	10%
40%	2532	6.16%	14%
50%	3165	7.69%	20%
60%	3798	9.21%	24%
70%	4431	10.74%	28%
80%	5064	12.27%	33%
90%	5697	13.78%	37%
100%	6330	15.32%	42%
80%	976	2.44%	1.0%

Fraction of bottle "A"	H2 concentration (ppm)	calculated H2 concentration (%LFL)	Measured H2 concentration (%LFL)
90%	1098	2.74%	1.0%
100%	1220	3.07%	2.0%
80%	976	2.44%	1.0%
90%	1098	2.75%	1.0%
100%	1220	3.05%	2.0%
	6000	14.50%	40.0%
	7000	17.00%	49.0%
	8000	19.50%	55.0%
	9000	21.75%	62.0%
	10000	24.18%	70.0%

Figure A-1 presents the data graphed with the linear calibration curve. The resulting calibration used for the CGM is

$$[\text{FG concentration}] = 0.32 \times (\text{CGM reading}) + 0.018 \qquad \text{[Eq A-1]}$$

Figure A-1 Hydrogen in Air Calibration Data for the Combustible Gas Monitor Model LTX 310



Reference

Wilkins, N. E., 1996, Test Evaluation of Industrial Hygiene Hand Held Combustible Gas Monitor, WHC-SD-WM-TRP-256, Westinghouse Hanford Company, Richland, Washington.

Appendix B

W-030 Flammable Gas Monitoring Data Sheets

W-030 FLAMMABLE GAS MONITORING SHEET

HYDROGEN

DATE	TIME	INITIALS	101-AY	102-AY PROBE	102-AY SKMS	101-AZ PROBE	101-AZ SKMS	102-AZ PROBE	102-AZ SKMS	VENT HEADER HV-AZK1-3
8-13-98	10:00	RAS	0.0%	3.0%	N/A	2.0%	OFF	4.0%	OFF	0.0%
8-14-98	10:00	RAS	3.0%	4.0%	N/A	5.0%	OFF	5.0%	OFF	0.0%
8-15-98	0915	DFS	5.0%	5.0%	N/A	5.0%	OFF	5.0%	OFF	5.0%
8-16-98	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	OFF	[illegible]	OFF	[illegible]
8-17-98	0830	RAS	1.0%	2.0%	N/A	1.0%	OFF	2.0%	OFF	2.0%

LIQUID LEVEL

DATE	TIME	INITIALS	101-AY	102-AY	101-AZ	102-AZ	
8-13-98	950	GPO	62.35	167.24	304.57	322.55	ENRAF OR FIC OR MANUAL READING IN FIELD
8-14-98	1000	KZJ	62.35	167.22	304.54	322.50	
8-15-98	0800	KZJ	62.35	167.22	304.52	322.55	
8-16-98	0900	KZJ	62.34	167.22	304.49	322.50	
8-17-98	0900	MOL	62.35	167.09	304.47	322.5	

TEMPERATURE

DATE	TIME	INITIALS	101-AY Super	101-AY Sludge	102-AY Super	102-AY Sludge	101-AZ Super	101-AZ Sludge	102-AZ Super	102-AZ Sludge	THERMOCOUPLE POINTS Super	THERMOCOUPLE POINTS Sludge
8-13-98	1020	GPO	83	112	79	89	136	139	124	176	101-AY-60 102-AY-151 101-AZ-232 102-AZ-320	101-AY-62 102-AY-154 101-AZ-236 102-AZ-332
8-14-98	0945	KZJ	82	112	79	89	136	140	124	175		
8-15-98	0835	KZJ	83	113	79	89	137	141	124	176		
8-16-98	0955	KZJ	82	113	79	87	137	141	124	176		
8-17-98	0830	MOL	82	113	80	86	137	141	124	176		

VENT FLOW

DATE	TIME FIRST	TIME SECOND	INITIALS	FI-AY1K1-2 FIRST	FI-AY1K1-2 SECOND	FI-AY2K1-2 FIRST	FI-AY2K1-2 SECOND	FI-AZ1K1-2 FIRST	FI-AZ1K1-2 SECOND	FI-AZ2K1-2 FIRST	FI-AZ2K1-2 SECOND	TWO READINGS EACH DAY. READINGS NEED TO BE TAKEN A MINIMUM OF 4-HOURS APART
8-13-98	1000	1400	GPO	228	226	262	255	153	151	100	100	
8-14-98	1056	1531	KZJ	194	195	210	207	116	118	103	112	
8-15-98	0826	1547	KZJ	200	203	210	209	120	122	112	109	
8-16-98	0800	1253	KZJ	200	206	210	216	120	120	105	113	
8-17-98	0830	1200	MOL	201	204	208	205	123	123	114	110	

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W-030 FLAMMABLE GAS MONITORING SHEET

HYDROGEN

DATE	TIME	INITIALS	101-AY	102-AY		101-AZ		102-AZ		VENT HEADER HV-AZK1-3
				PROBE	SHMS	PROBE	SHMS	PROBE	SHMS	
8-18-98	0840	RAS	1.0%	0.0%	N/A	.02%	N/A	0.0	N/A	0.0%
8-19-98	0845	RAS	0.0%	0.0%	N/A	0.0	N/A	0.0	N/A	0.0%
8-20-98	0845	RAS	3.0%	2.0%	N/A	4.0%	N/A	3.0%	N/A	0.0%
8-21-98	0835	DFS	1.0%	1.0%	N/A	1.8%	OFF	2.0%	OFF	3.0%
8-22-98	845	RDG	0%	0%	N/A	0.0%	OFF	0.0%	OFF	0.0%

LIQUID LEVEL

DATE	TIME	INITIALS	101-AY	102-AY	101-AZ	102-AZ	
8-18-98	1002	AEM	62.34	167.08	304.44	322.4	ENRAF OR FIC OR MANUAL READING IN FIELD
8-19-98	930	RS	62.35	167.08	304.43	322.45	
8-20-98	845	RS	62.34	167.08	304.42	322.45	
8-21-98	745	BD	62.34	167.04	304.39	322.4	
8-22-98	0750	BD	62.33	167.06	304.06	322.3	

TEMPERATURE

DATE	TIME	INITIALS	101-AY		102-AY		101-AZ		102-AZ		THERMOCOUPLE POINTS	
			Super	Sludge	Super	Sludge	Super	Sludge	Super	Sludge	Super	Sludge
8-18-98	958	AEM	82	112	79	84	135	139	123	175	101-AY-60 102-AY-151 101-AZ-232 102-AZ-320	101-AY-62 102-AY-154 101-AZ-236 102-AZ-332
8-19-98	820	RS	82	113	79	85	136	140	124	176		
8-20-98	845	RS	82	113	79	85	136	140	123	175		
8-21-98	740	BD	82	113	79	85	136	140	123	175		
8-22-98	750	BD	82	113	79	86	136	140	123	175		

VENT FLOW

DATE	TIME		INITIALS	FI-AY1K1-2		FI-AY2K1-2		FI-AZ1K1-2		FI-AZ2K1-2		TWO READINGS EACH DAY. READINGS NEED TO BE TAKEN A MINIMUM OF 4-HOURS APART
	FIRST	SECOND		FIRST	SECOND	FIRST	SECOND	FIRST	SECOND	FIRST	SECOND	
8-18-98	1035	1341	AEM	210	202	216	216	123	122	116	116	
8-19-98	815	1435	RS	200	196	209	209	120	121	114	108	
8-20-98	725	1325	RS	200	194	210	285	123	117	107	100	
8-21-98	0700	1130	BD	199	210	210	210	125	125	113	110	
8-22-98	850	1400	BD	198	200	213	210	123	120	111	107	

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W-030 FLAMMABLE GAS MONITORING SHEET

HYDROGEN

DATE	TIME	INITIALS	101-AY	102-AY PROBE	102-AY SHMS	101-AZ PROBE	101-AZ SHMS	102-AZ PROBE	102-AZ SHMS	VENT HEADER HV-AZK1-3
8-23-98	0830	DFS	3%	3%	N/A	3%	OFF	5%	OFF	3%
8-24-98	0805	DAS	0%	0%	N/A	1%	OFF	1%	OFF	0%
8-25-98	0930	DAS	0%	1%	N/A	2%	OFF	1%	OFF	0%
8-26-98	0900	RAS	0%	0%	N/A	0%	OFF	0%	OFF	0%
8-27-98	0830	RAS	0%	0%	N/A	0%	OFF	0%	OFF	0%

LIQUID LEVEL

DATE	TIME	INITIALS	101-AY	102-AY	101-AZ	102-AZ	
8-23-98	750	BD	62.33	167.06	304.34	322.35	ENRAF OR FIC OR MANUAL READING IN FIELD
8-24-98	0900	AAA	62.33	167.06	304.32	322.30	
8-25-98	1055	KJM	62.33	167.06	304.30	322.25	
8-26-98	0935	RLH	62.33	167.07	304.28	322.25	
8-27-98	10:00	RBL	62.32	167.06	304.26	323.7	

TEMPERATURE

DATE	TIME	INITIALS	101-AY Super	101-AY Sludge	102-AY Super	102-AY Sludge	101-AZ Super	101-AZ Sludge	102-AZ Super	102-AZ Sludge	THERMOCOUPLE POINTS Super	THERMOCOUPLE POINTS Sludge
8/23/98	846	BD	82	113	79	85	135	139	122	174	101-AY-60	101-AY-62
8/24/98	0900	AAA	82	112	78	85	136	140	122	175	102-AY-151	102-AY-154
8-25-98	1050	KJM	81	112	79	84	135	139	119	173	101-AZ-232	101-AZ-236
8-26-98	0848	RLH	82	112	79	85	135	139	121	174	102-AZ-320	102-AZ-332
8-27-98	10:00	RBL	81	112	79	84	135	139	121	173		

VENT FLOW

DATE	TIME FIRST	TIME SECOND	INITIALS	FI-AY1K1-2 FIRST	FI-AY1K1-2 SECOND	FI-AY2K1-2 FIRST	FI-AY2K1-2 SECOND	FI-AZ1K1-2 FIRST	FI-AZ1K1-2 SECOND	FI-AZ2K1-2 FIRST	FI-AZ2K1-2 SECOND	TWO READINGS EACH DAY. READINGS NEED TO BE TAKEN A MINIMUM OF 4-HOURS APART
8/23/98	915	1315	BD	200	198	204	203	120	119	112	107	
8-24-98	1043	1405	AAA	203	204	218	207	119	120	108	108	
8-25-98	1100	1505	KJM	201	190	208	217	124	124	107	116	
8-26-98	0948	1320	RLH	207	197	205	210	119	118	111	111	
8-27-98	10:30	1430	RBL	202	202	218	212	125	116	108	107	

Work Package 2E-98-00466/W

W-030 FLAMMABLE GAS MONITORING SHEET

HYDROGEN

DATE	TIME	INITIALS	101-AY	102-AY PROBE	102-AY SHMS	101-AZ PROBE	101-AZ SHMS	102-AZ PROBE	102-AZ SHMS	VENT HEADER HV-AZK1-3
8/28/98	0815	RMS	0.0%	0%	N/A	1%	OFF	0%	OFF	0%
8/29/98	10:40	RLH	2%	0%	n/a	3%	off	2%	off	1%
8-30-98	10:15	RLH	2%	0%	n/a	2%	off	2%	off	1%
8-31-98	0800	BAS	0.0%	0%	N/A	0%	OFF	0%	OFF	0%
9-1-98	0815	BAS	0.0%	0%	N/A	0%	OFF	0%	OFF	0%

LIQUID LEVEL

DATE	TIME	INITIALS	101-AY	102-AY	101-AZ	102-AZ	
8/24/98	0930	RP	62.32	167.06	304.25	323.7	ENRAF OR FIC OR MANUAL READING IN FIELD
8-29-98	0835	RP	62.31	167.05	304.24	323.8	
8/30/98	1000	RP	62.31	167.05	304.22	323.75	
8/31/98	0930	DC	62.31	167.04	304.20	323.80	
9/1/98	0815	TF	62.31	167.04	304.19	323.80	

TEMPERATURE

DATE	TIME	INITIALS	101-AY Super	101-AY Sludge	102-AY Super	102-AY Sludge	101-AZ Super	101-AZ Sludge	102-AZ Super	102-AZ Sludge	THERMOCOUPLE POINTS Super	THERMOCOUPLE POINTS Sludge
8/28/98	0820	RP	81	112	79	85	136	140	122	174		
8-29-98	0830	RP	82	112	79	85	136	140	122	175	101-AY-60 102-AY-151 101-AZ-232 102-AZ-320	101-AY-62 102-AY-154 101-AZ-236 102-AZ-332
8/30/98	1000	RP	81	112	79	85	135	139	121	173		
8/31/98	0930	D.C	79	112	79	86	136	139	122	174		
9/1/98	0820	TF	82	112	79	86	136	140	122	173		

VENT FLOW

DATE	TIME FIRST	TIME SECOND	INITIALS	FI-AY1K1-2 FIRST	FI-AY1K1-2 SECOND	FI-AY2K1-2 FIRST	FI-AY2K1-2 SECOND	FI-AZ1K1-2 FIRST	FI-AZ1K1-2 SECOND	FI-AZ2K1-2 FIRST	FI-AZ2K1-2 SECOND	
8/28/98	0820	1305	RP	200	204	210	214	120	119	110	104	TWO READINGS EACH DAY. READINGS NEED TO BE TAKEN A MINIMUM OF 4-HOURS APART
8/29/98	0730	1130	RP	201	197	216	203	118	119	115	102	
8/30/98	1000	1400	RP	195	186	210	202	124	116	116	106	
8-31-98	0950	1442	BS	203	202	211	222	123	124	109	102	
9-1-98	0900	1410	TF	202	204	215	212	124	121	107	113	

Work Package 2E-98-00488/NW

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Models and Inventory	Date 09/17/98
Project Title/Work Order		EDT No. EDT-622475
HNF-3335, Rev. 0, "Project W-030 Flammable Gas Verification Monitoring Test"		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
DE&S Hanford, Inc.					
G. D. Johnson	S7-73	X			
Fluor Daniel Hanford					
P. L. Smith	S3-97	X			
Lockheed Martin Hanford Corp.					
D. G. Baide	S5-05	X			
S. A. Barker	R2-11	X			
W. B. Barton	R2-11	X			
T. W. Bohan	S5-04	X			
C. B. Bryan	S5-07	X			
K. G. Carothers	R2-11	X			
R. N. Dale	S7-12	X			
K. D. Fowler	R2-11	X			
M. S. Harrington	R2-BB	X			
W. M. Harty	S5-13	X			
K. M. Hodgson	R2-11	X			
T. A. Hu	R2-11	X			
N. W. Kirch	R2-11	X			
J. G. Kristofzski	R2-12	X			
P. G. O'Connor	S5-04	X			
R. K. P'Pool	S5-03	X			
L. M. Sasaki	R2-12	X			
R. D. Schreiber	R2-12	X			
G. R. Tardiff	S5-05	X			
R. R. Thompson	R2-12	X			
J. J. Verderber	S5-0B	X			
W. D. Winkelman	R2-12	X			
S. U. Zaman	S5-12	X			
T.C.S.R.C.	R1-10	X			
Project File	G3-11	X			
Project File	R1-29	X			
Lockheed Martin Services, Inc.					
Central Files	B1-07	X			
Numatec Hanford Corp.					
S. R. Briggs	S2-4B	X			
K. Sathyanarayana	H0-34	X			