Department of Energy
Richland Field Office
P.O. Box 550
Richland, Washington 99352

9205941

RECEIVED
AUG 27 1992
CORRESPONDENCE CONTROL

92-RPA-239

AUG 16 1992

Mr. Roger Stanley
State of Washington
Department of Ecology
P. O. Box 47600
Olympia, Washington 98504-7600

Dear Mr. Stanley:

TECHNICAL INITIATIVES REGARDING SINGLE-SHELL TANKS C-105 AND C-106

At a meeting in Kennewick on July 22, 1992, representatives of our respective agencies reached agreement on a series of actions associated with improved tank leak detection and contingency response on Tanks C-105 and C-106.

In summary, the commitments require that RL:

- o implement measures to minimize water additions;
- o revise the contingency plan for leaks;
- o complete an evaluation of contingency plan implementation requirements;
- o increase the frequency and quality of monitoring;
- o maintain groundwater monitoring pending review of the current data by the State of Washington Department of Ecology (Ecology).

It is our belief that the specific commitments, which were embodied in signed minutes (Enclosure 1) resolve to a significant extent, the issues raised in your letters of June 1 and July 2, 1992 associated with Milestone M-05. A copy of the WHC report containing the revised evaporative loss calculation, using the corrected data, is provided in Enclosure 2. The technical justification for continued water additions, which we previously committed to supply to your office, is provided in Enclosure 3.

It is our understanding that the new initiatives will be formally incorporated into the Tri-Party Agreement as new milestones. DOE would like to continue to work with Ecology on preparing a Class I Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) change control form. We anticipate discussing your proposals on Milestone M-07 in the near future. We agree to prepare a change control form for M-07 following timely resolution and closure of any remaining issues associated with that milestone.

AUG 1992
RECEIVED
EDMC

AUG 16 1992

If we can provide you with any additional information please feel free to call Mr. Steve Wisness, Chief of the Tri-Party Agreement Project Branch, on (509) 376-6798.

Sincerely,

J. P. Hamric
Principal Deputy Manager

Enclosures:
1. Meeting Minutes
2. Data Computation
3. Change Control Form

cc w/encl:
D. C. Richardson, WHC
C. DeFigh Price, WHC
T. B. Veneziano, WHC
P. T. Day, EPA
J. C. Tseng, EM-36

cc w/o encl:
R. E. Raymond, WHC

Single-Shell Tanks
241-C-105 and 241-C-106
Technical Commitments
July 22, 1992

In response to requests by Washington State Department of Ecology to pursue improved tank leak detection and response, the United States Department of Energy and Ecology jointly committed to the following actions. It is anticipated these commitments will be incorporated into the Hanford Federal Facility Agreement and Consent Order under the auspices of negotiations on milestone M-05-00.

M-05-10
DOE-RL would provide a written basis for the current water addition practices in our July 31, 1992 reply to you, and we will follow that in September 1992 with a status report on our measures to minimize water additions.

M-05-11
DOE-RL will provide a revised contingency plan for leaks from 241-C-106 to Ecology by January 1, 1993. The contingency plan will be revised to stipulate that as soon as practicable after discovery of a leak from this tank, sufficient supernatant and sludge will be removed to eliminate the need for further water addition.

M-05-12
The date is to be determined to complete fabrication and installation of all equipment required for implementation of the contingency plan in response to a leak from tank 241-C-106. DOE-RL has directed WHC to evaluate actions, schedules, and cost impacts for moving tank contents. The results of this evaluation will be provided to Ecology in September 1992.

M-10-13-T1
RL will implement monthly psychometric measurements at 241-C-105 and 241-C-106 commencing fiscal year 1993, to be taken while exhausters are operating.

M-05-13-T2
DOE-RL will by March 1993 complete physical logging of 14 dry wells at 241-C-106 and 241-C-105 using a spectral gamma probe. It is anticipated that this will use a van normally used for CERCLA environmental investigations. Use of this van will be subject to concurrence by EPA.

M-05-13-T3
By 10/92, RL will reduce the logging speed of the gross gamma probes for the 14 dry wells around 241-C-105 and 241-C-106. By 12/92, RL will provide to Ecology and EPA a plan for further improvements in gross gamma probes.

M-05-13-T4

Groundwater monitoring will remain as currently required on the condition that Ecology will review the current data. If such a review results in a determination that a decrease in the interval between samples is necessary, then the interval will be addressed under the milestone M-24.

It is the understanding of the undersigned that these commitments satisfy in principle the expectations to complete negotiations as requested in R. Stanley's (Ecology) letter to P. Hamric (DOE-RL) of June 1, 1992 and July 2, 1992.

For the Washington State Department of Ecology:

Scott E. McKinney 7/22/92

Scott E. McKinney

G. Thomas Tebb 7-22-92

G. Thomas Tebb

For the United States Department of Energy:

Guy E. Bishop 7/22/92

Guy E. Bishop

Al D. Toth 7-22-92

Al D. Toth

Jon R. Yerxa 7-22-92

Jon R. Yerxa

Westinghouse Hanford Company | **Internal Memo**

From: Single-Shell Tank Engineering 7C242-92-013
Phone: 3-5529 R1-49
Date: June 18, 1992
Subject: 241-C-106: WATER ACCOUNTABILITY

To: V. C. Boyles R1-49

cc:	A. T. Alstad	R1-49	T. P. Moberg	R1-49
	S. W. Claybrook	HO-34	C. C. Pitkoff	R1-49
	G. T. Frater	R1-51	R. E. Raymond	R1-80
	S. D. Godfrey	R1-51	J. M. Thurman	R1-49
	W. L. Knecht	HO-34	G. R. Wilson	R2-31
	VCB: File/LB			

This report will give an accountability of the water using both the liquid-level device (FIC) measurements and the psychrometric surveys for the period from December 1990 through September 1991.

Single-Shell Tank (SST) 241-C-106 is a high-heat tank that requires periodic water additions for evaporative cooling. The water additions are monitored using Raw Water Data Sheets and the FIC in the tank. Psychrometric surveys have been completed for determining the evaporation rate from Tank C-106.

EVAPORATION CALCULATIONS:

Table 1, Attachment 1, gives the wet bulb temperatures, dry bulb temperatures, outlet flowrates, inlet flowrates, duct cross-sectional area, and evaporation rates for Tank C-106 from December 1990 through September 1991. The wet bulb temperatures, dry bulb temperatures, and outlet velocities were taken from the psychrometric data sheets (see Attachment 5). The average velocity for July 8, 1991, was recalculated since it was originally calculated wrong on the psychrometric data sheet. The evaporation rates and the air inlet flowrate were calculated from the moisture content and humid volumes using the Psychrometric Charts from "Perry's Chemical Engineering Handbook" (see Attachement 7 for the psychrometric sample calculation for December 7, 1990).

The lowest evaporation rate occurred in February 1991 at 1080 gal/wk and the highest evaporation rate occurred in July 1991 at 3351 gal/wk. The average evaporation rate for Tank C-106 from December 1990 through September 1991 was 1832 gal/wk.

PSYCHROMETRIC SURVEYS:

There is a 7000 scfm exhauster (296-P-16) used to exhaust both C-105 and C-106. Tank C-106 has a 16-inch air duct and Tank C-105 has a 14-inch air duct going to a deentrainer and then to the exhauster. The cross-sectional area of the duct for C-106 is 1.396 sq. ft. The wet bulb temperatures, dry bulb temperatures, and outlet flowrates are taken by Vent and Balance personnel according to maintenance procedure 7-GN-063. Both Wet and dry

bulb thermometers are used to measure their respective wet and dry bulb temperatures in the 16-inch duct extending from C-106 to the deentrainer. A pitot tube is used to measure the velocity (fpm) in the duct.

Maintenance procedure 7-GN-063 does not specify which cross-sectional area to use when calculating the flowrate in cubic feet per minute. The following psychrometric survey data sheets were available:

- December 7, 1990
- January 9, 1991
- February 5, 1991
- March 7, 1991
- April 15, 1991
- May 22, 1991
- June 14, 1991
- July 8, 1991
- August 16, 1991
- September 4, 1991

Only the data sheets for December 7, 1991, February 5, 1991, April 15, 1991, June 14, 1991, and August 16, 1991, used the correct cross-sectional for the 16-inch duct. As seen on the attached data sheets "Airflow and Psychrometric Reading on Underground Waste Storage Tanks" for the above mentioned dates, the data sheets are not always completely filed out. The cross-sections used in the data sheets were 0.66 sq. ft. (11-inch diameter) for July 8, 1991; 1.069 sq. ft. (14-inch diameter) for January 9, 1991; and 1.227 sq. ft. (15-inch diameter) for March 7, 1991, May 22, 1991, and September 4, 1991. The 11-inch, 14-inch, and 15-inch dimensions are not possible based on drawing H-2-93797 sh.2, "HVAC Vent Duct Spool Installation" (see Attachment 6 for drawing).

Vent and Balance personnel have been contacted about this situation. Single-Shell Tank Engineering has provided drawings to ensure that the correct cross-sectional area is used and that a consistent point in the duct is used for the psychrometric surveys.

WATER ACCOUNTABILITY:

Table 2, Attachment 2, gives a surface level comparison and water accountability by comparing the FIC measurements with the evaporation rates given in Table 1 (see Attachment 1). Six water additions were made to C-106 from December 1990 to September 1991. The average evaporation rate according to the FIC measurements is approximately 200 gallons/day. Water accountability was done using the FIC measurements and the calculated evaporation rates. Each water addition to C-106 took about three shifts to complete.

Figure 1, Attachment 3, shows the liquid level changes using FIC measurements and evaporation rates for each month. The evaporation rate of the liquid in C-106 was compared with the decreasing FIC readings. The evaporation rates were greater than indicated by the FIC readings.

Figure 2, Attachment 4, shows the water accountability for C-106 by comparing the water additions with the evaporation losses. The evaporation losses are greater than the water additions using FIC data. Evaporation losses accounted for 21,821 gallons more than the water additions as measured by the FIC.

The difference in accountability could be due to the following:

- Psychrometric data was taken once per month. Changing weather conditions during each month would impact the evaporation rate within the tank. Psychrometric readings may need to be taken more frequently (i.e. weekly) to get a better correlation between the evaporation rate and the decreasing liquid level in the tank.

- The FIC measurement is an automatic surface level gauge that gives a direct level of the liquid within the tank. This gauge has a margin of error equal to 0.25 inches which is equivalent to 689 gallons.

- There is a 3-inch cascade line going from Tank C-105 to C-106. This may account for some of the higher evaporation losses.

- The deentrainer, which is located prior to the 296-P-16 exhauster, removes water droplets from the air stream. Any collected liquid is returned to C-106. This may account for some of the higher evaporation losses.

RECOMMENDATIONS:

Psychrometric surveys should be reviewed to determine if the survey data needs to be taken weekly for C-106 and C-105 at points in the exhaust ducts specified by engineering. Using a specified place to take psychrometric data will allow the correct cross-sectional area to be used with certainty.

The water accountability should be completed after each water addition to verify that the evaporation losses agree with the water addition.

CONCLUSION:

At this time there is no reason to believe that C-106 is leaking. The water additions can be accounted by the evaporation rates.

T. P. Moberg 6/18/92

T. P. Moberg, Engineer
Single-Shell Tank Engineering

lmt

Attachments 7

TABLE 1
PSYCHROMETRIC SURVEY FOR TANK 106-C

Date	Ambient Wet Bulb (F)	Ambient Dry Bulb (F)	Outlet Wet Bulb (F)	Outlet Dry Bulb (F)	Air-OUT Average Velocity (fpm)	Duct (sq.ft.)	Air-IN Flow Rate (cfm)	Air-OUT Flow Rate (cfm)	Evap Rate (gal/wk)	Evap Rate (in/wk)
12/07/90	27	27	66	68	1312	1.396	1663	1832	1552	0.56
01/09/91	24	22	66	66	1316	1.396	1653	1837	1872	0.68
02/05/91	49	59	62	64	1322	1.396	1810	1846	1080	0.39
03/07/91	38	45	70	70	1287	1.396	1811	1797	2144	0.78
04/15/91	50	56	66	68	1334	1.396	1801	1862	1146	0.42
05/22/91	53	65	70	75	1239	1.396	1677	1730	1367	0.50
06/14/91	51	64	77	77	1396	1.396	1860	1949	2566	0.93
07/08/91	63	82	81	84	1308	1.396	1777	1826	3351	1.22
08/15/91	69	86	80	84	1116	1.396	1539	1558	1304	0.47
09/04/91	58	75	78	84	1284	1.396	1717	1792	1940	0.70

NOTES:
- The moisture contents and humid volumes were found using Figures 12-1 and 12-2 (Psychrometric Charts) from "Perry's Chemical Engineering Handbook", 6th Edition, 1984. The Psychrometric Charts are for 1 atm.
- The air-IN flowrate and evaporation rates were calculated.
- ND = No data sheet.
- When data sheet was not found, the value recorded by surveillance was used.

TABLE 2
TANK 106-C
WATER ACCOUNTABILITY

Date	SURFACE LEVEL COMPARISON FIC Level (in)	Liquid Level Using Psychrometrics (in)	WATER ACCOUNTABILITY FIC Volume (gal)	Volume Using Psychrometrics (gal)	Water Additions
12/03/90	78.7	78.7	0	0	Date: 12/2/90
12/10/90	78.3	78.1	1102	1552	Starting Level (in): 75
12/17/90	77.8	77.6	2479	3104	Ending Level (in): 78.7
12/24/90	77.3	77.0	3856	4656	Level Change (gal): 10190
12/31/90	76.7	76.4	5508	6208	Raw Water Usage (gal): NA
01/02/91	76.5	76.3	6059	6743	
01/07/91	76.0	75.8	7436	8080	
01/14/91	75.4	75.1	9088	9952	
01/21/91	74.9	74.4	10465	11824	
01/24/91	74.9	74.1	10465	12627	
01/28/91	78.7	77.6	10762	13697	Date: 1/24/91
02/04/91	78.5	77.1	11313	15116	Starting Level (in): 74.9
02/11/91	78.3	76.7	11864	16195	Ending Level (in): 78.8
02/18/91	77.9	76.3	12965	17275	Level Change (gal): 10741
02/25/91	77.6	75.9	13792	18354	Raw Water Usage (gal): NA
03/04/91	77.0	75.3	15444	20042	
03/11/91	76.4	74.5	17096	22186	
03/18/91	75.7	73.8	19024	24330	
03/25/91	75.1	73.0	20677	26473	
04/01/91	78.6	76.1	20935	28474	Date: 3/25/91
04/08/91	78.3	75.6	21761	29621	Starting Level (in): 75.0
04/15/91	77.9	75.2	22862	30767	Ending Level (in): 78.8
04/22/91	77.5	74.8	23964	31913	Level Change (gal): 10465
04/29/91	76.9	74.4	25616	33059	Raw Water Usage (gal): 10541
05/06/91	76.2	73.9	27544	34395	
05/13/91	75.5	73.4	29472	35762	
05/15/91	75.1	73.3	30574	36153	
05/20/91	78.8	76.7	30880	37129	
05/27/91	78.4	76.2	31981	38497	Date: 5/15/91
06/03/91	78.1	75.5	32807	40378	Starting Level (in): 75.1
06/10/91	77.6	74.6	34184	42944	Ending Level (in): 78.85
06/17/91	77.0	73.6	35837	45511	Level Change (gal): 10328
06/24/91	76.3	72.7	37765	48077	Raw Water Usage (gal): 10838
07/01/91	75.6	71.7	39692	50756	
07/08/91	74.8	70.5	41896	54107	
07/11/91	74.7	69.3	42171	57458	
07/15/91	78.7	72.2	42477	60809	Date: 7/11/91
07/22/91	78.4	71.0	43303	64160	Starting Level (in): 74.7
07/29/91	77.9	69.7	44680	67511	Ending Level (in): 78.8
08/05/91	77.5	69.1	45782	69400	Level Change (gal): 11291
08/12/91	76.8	68.6	47710	70704	Raw Water Usage (gal): NA
08/19/91	76.1	68.1	49637	72008	
08/26/91	75.2	67.6	52116	73312	
08/29/91	74.7	67.4	53493	73871	
09/02/91	78.7	71.3	53846	74239	Date: 8/29/91
09/09/91	78.4	70.6	54672	76180	Starting Level (in): 74.7
09/16/91	78.1	69.9	55498	78120	Ending Level (in): 78.7
09/23/91	77.0	69.2	58527	80060	Level Change (gal): 11016
09/30/91	76.4	68.5	60180	82001	Raw Water Usage (gal): NA

NOTE: - The Psychrometric data on Table 1 was used to estimate the decreasing liquid level in 106-C.

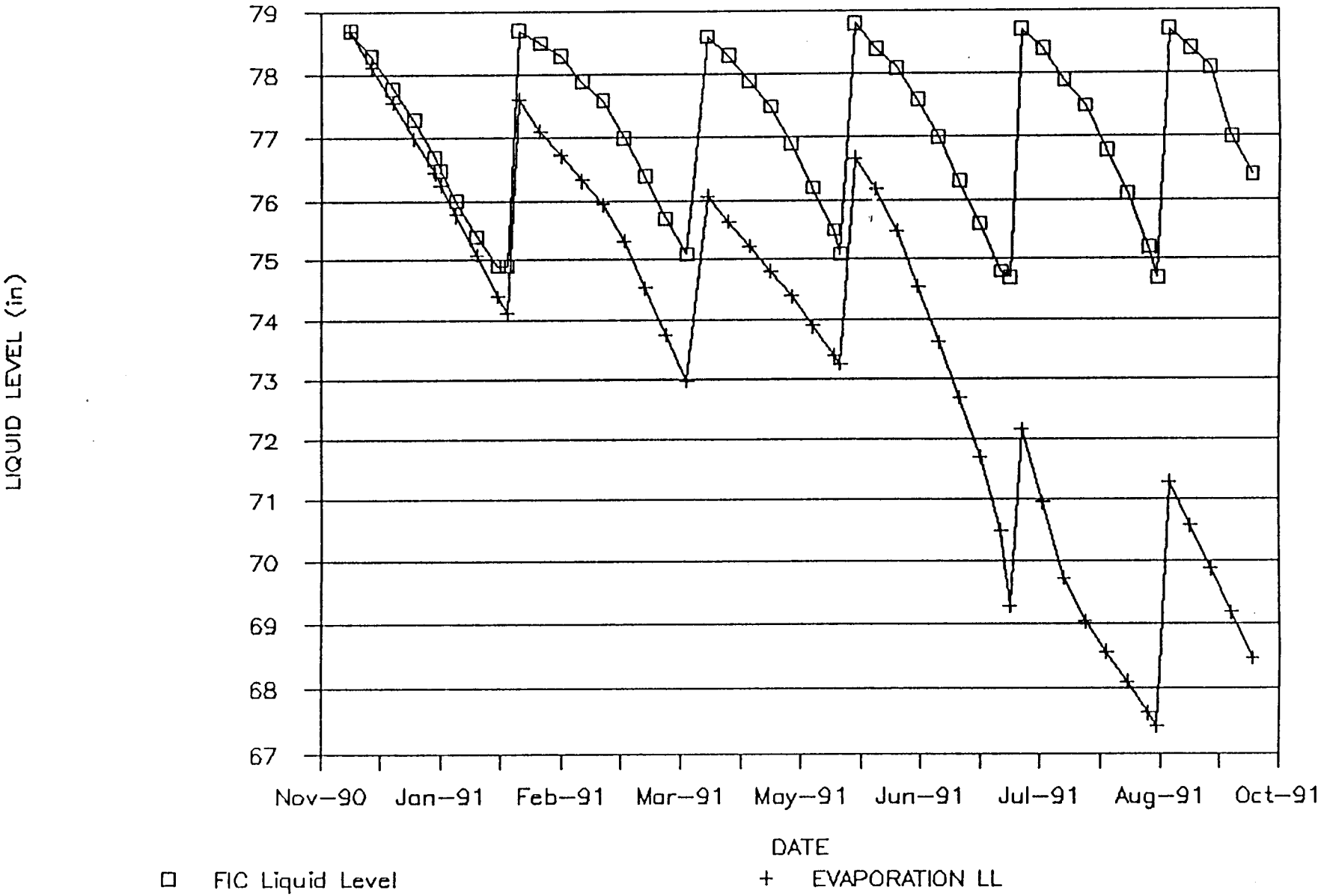
- The evaporation rate is used strictly as an estimate. The true rate of evaporation will vary with changing weather conditions.

- NA = Not Available

- The FIC has a margin of error +/- 0.25 inches (689 gallons)

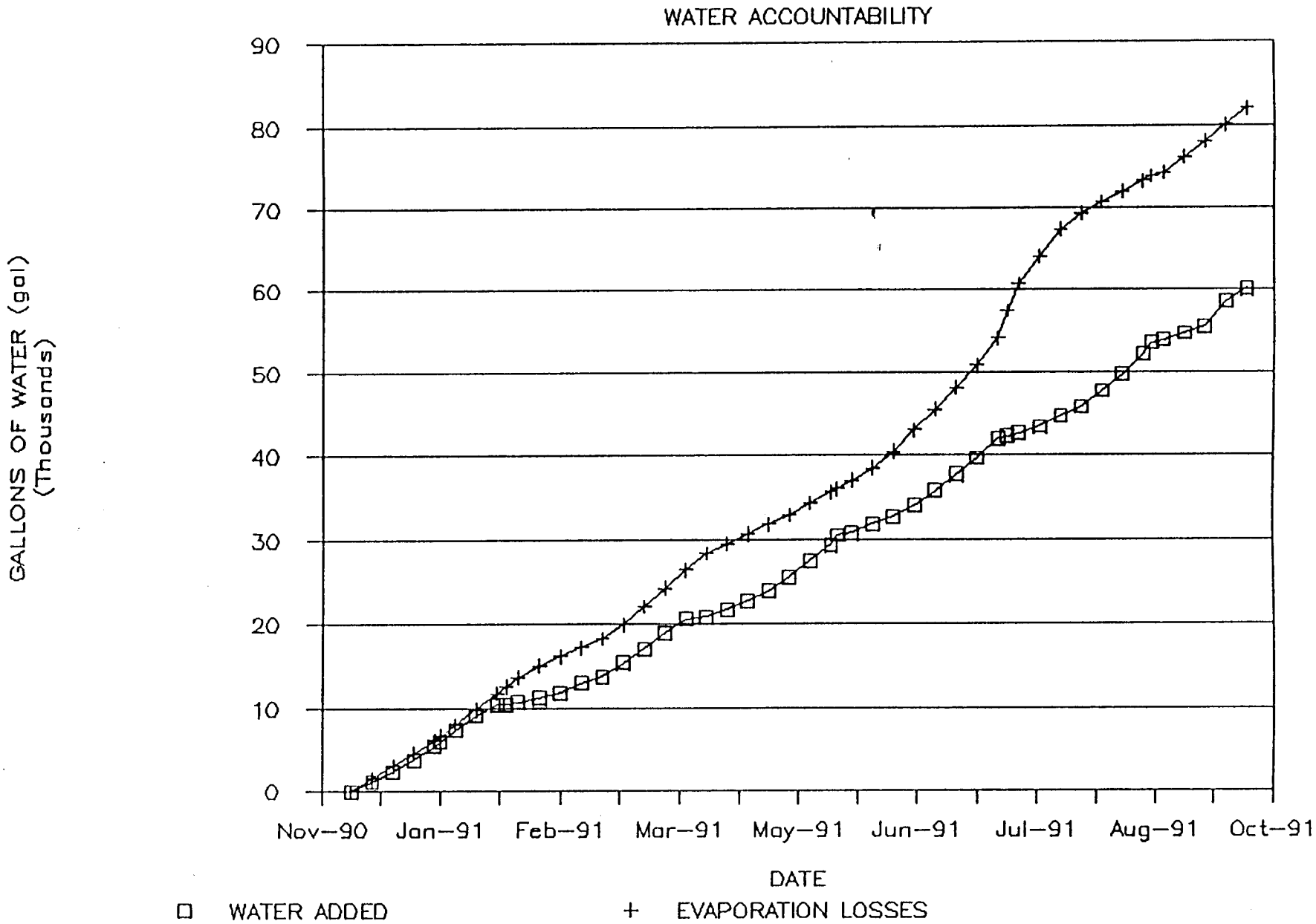
FIGURE 1: TANK 106-C

FIC VERSUS EVAPORATION LIQUID LEVELS



7C242-92-013
ATTACHMENT 3

FIGURE 2: TANK 106-C



7C242-92-013
ATTACHMENT 4

241- C Tank Farm

Instrument Type MicRO Date 12-7-90

Instrument Last Calibration Date 10-3-90 Instrument Code No. 702-28-09-012

Chart Readings on Tank Negative

101	%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	% 108

Time	Ambient Wet. 27 Dry. 2[illegible]	Weather Tower Wet	Dry.
Time	Wet. 660 Dry. 680	Time Wet	Dry.
Duct Static Pressure 2.10	Duct Area Sq. Ft.	Tank Static Pressure	Duct Area Sq Ft
Annulus Negative		Exhaust Damper	% Open
Pre Filter D/P [illegible]		Tank Neg.	
HEPA D/P 1.0 [illegible]			
Annulus Intake Pressure			
Inlet Damper Valve	% Open		
Exhaust Damper Valve	% Open		

	Vel	FPM		Vel	FPM
1.	.088	1188	1.		
2.	.109	1322	2.		
3.	.098	1254	3.		
4.	.115	1355	4.		
5.	.129	1439	5.		
Total FPM		6561	Total FPM		
Average FPM		1312	Average FPM		
CFM		1832	CFM		

Time	Wet. 59 Dry. 75	Time Wet	Dry.
Duct Static Pressure .41	Duct Area Sq. Ft.	Tank Static Pressure	Duct Area Sq Ft
Annulus Negative		Exhaust Damper	% Open
Pre Filter D/P .25 [illegible]		Tank Neg.	
HEPA D/P 1.0			
Annulus Intake Pressure			
Inlet Damper Valve	% Open		
Exhaust Damper Valve	% Open		

	Vel	FPM		Vel	FPM
1.	.043	831	1.		
2.	.045	849	2.		
3.	.046	859	3.		
4.	.050	896	4.		
5.	.049	887	5.		
Total FPM		4322	Total FPM		
Average FPM		864	Average FPM		
CFM		679	CFM		

TEST RECORD SHEET 1.

241- C Tank Farm

nstrument Type MICRO Date 1-9-91

nstrument Last Calibration Date 10-3-90 Instrument Code No. 702-28-09-[illegible]

Chart Readings on Tank Negative

01	%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	% 108
ime	Ambient Wet. 24°	Dry. 22°		Weather Tower Wet 15°		Dry. 14°	
ime	Wet. 52°	Dry. 64°		Time Wet		Dry.	

uct Static Pressure 4.50	Duct Area Sq. Ft.	Tank Static Pressure	Duct Area Sq Ft
nnulus Negative		Exhaust Damper	% Open
re Filter D/P .1		Tank Neg. .41	
EPA D/P .10			
nnulus Intake Pressure			
nlet Damper Valve 30%	% Open		
xhaust Damper Valve	% Open		

Vel	FPM	Vel	FPM
.038	780	1.	
.039	791	2.	
.037	770	3.	
.036	759	4.	
.036	759	5.	
otal FPM	3859	Total FPM	
verage FPM	772	Average FPM	
FM	825	CFM	

ime	Wet. 60° Dry 66°	Time Wet	Dry.
uct Static Pressure 1.92	Duct Area Sq. Ft.	Tank Static Pressure	Duct Area Sq Ft
nnulus Negative		Exhaust Damper	% Open
re Filter D/P .1		Tank Neg. [illegible]	
EPA D/P .29			
nnulus Intake Pressure			
nlet Damper Valve 40	% Open		
xhaust Damper Valve -	% Open		

TANK Vel	FPM	Vel	FPM
.012	1215	1.	
.010	1328	2.	
.105	1298	3.	
.014	1352	4.	
.120	1387	5.	
otal FPM	6580	Total FPM	
verage FPM	1316	Average FPM	
FM	1407	CFM	

.069

TEST RECORD SHEET 1

241-C Tank Farm

ument Type MICRO Date 2-5-91

ument Last Calibration Date 702-28-09-014 Instrument Code No. 10-3-90

Chart Readings on Tank Negative

%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	% 108
Ambient Wet. 47		Drv 59	Weather Tower Wet		Drv.	
Wet. 62		Drv 61	Time Wet		Drv.	

Static Pressure 2.14	Duct Area Sq. Ft.	Tank Static Pressure	Duct Area Sq Ft
us Negative		Exhaust Damper	% Open
ilter D/P .41		Tank Neg. 1.85 "wg	
D/P .40			
us Intake Pressure			
Damper Valve 50	% Open		
ust Damper Valve 70	% Open		

Vel	FPM		Vel	FPM
07	1310	1.		
13	1346	2.		
13	1346	3.		
12	1340	4.		
10	1266	5.		
l FPM	6608	Total FPM		
age FPM	1322	Average FPM		
	1845	CFM		

Wet. 57	Drv. 75	Time Wet	Drv.
Static Pressure 4.86	Duct Area Sq. Ft.	Tank Static Pressure	Duct Area Sq Ft
ulus Negative		Exhaust Damper	% Open
Filter D/P .20		Tank Neg. 1.10 "wg	
A D/P .50			
ulus Intake Pressure			
et Damper Valve 50	% Open		
aust Damper Valve 60	% Open		

Vel	FPM		Vel	FPM
.042	821	1.		
.041	811	2.		
.040	801	3.		
.037	770	4.		
.036	694	5.		
al FPM	3897	Total FPM		
erage FPM	779	Average FPM		
	1087	CFM		

TEST RECORD SHEET 1

241- C Tank Farm

Date 5-7-91

Instrument Type MECR

Instrument Code No. 799-28-09-002

Instrument Last Calibration Date 1-25-91

Chart Readings on Tank Negative

101	% 102	% 103	% 104	% 105	% 106	% 107	% 108

Time Ambient Wet. 38 Dry. 45 Weather Tower Wet 75 Dry. 81

Time Wet. Dry. Time Wet Dry.

Duct Static Pressure Duct Area Sq. Ft. | Tank Static Pressure 59 Duct Area Sq Ft 15

Exhaust Damper 70 % Open

Annulus Negative | Tank Neg. .60"

Pre Filter D/P | 5

HEPA D/P | INLET/SR .17"

Annulus Intake Pressure | HEPA .30" .9213

Inlet Damper Valve % Open | INLET DAMP 60%

Exhaust Damper Valve % Open

	Vel	FPM		Vel	FPM
1.			1.	.052	913
2.			2.	.057	931
3.			3.	.057	951
4.			4.	.057	973
5.			5.	.062	996
Total FPM			Total FPM		4744
Average FPM			Average FPM		959
CFM			CFM		984

Time Wet. Dry. Time Wet 70 Dry. 70

Duct Static Pressure Duct Area Sq. Ft. | Tank Static Pressure 2.17 Duct Area Sq Ft 15

Exhaust Damper 40 % Open

Annulus Negative | Tank Neg. 1.50"

Pre Filter D/P |

HEPA D/P | INLET SKT .38" 1,227 8

Annulus Intake Pressure | HEPA .30"

Inlet Damper Valve % Open | INLET DAMP 75% OPEN

Exhaust Damper Valve % Open

	Vel	FPM		Vel	FPM
1			1.	.110	1328
2.			2.	.109	1323
3.			3.	.107	1308
4.			4.	.107	1305
5.			5.	.103	1295
Total FPM			Total FPM		6557
Average FPM			Average FPM		1287
CFM			CFM		1580

Chec 5-8-91

TEST RECORD SHEET 1.

241-C Tank Farm

Date [illegible]

Instrument Type [illegible]

Instrument Last Calibration Date [illegible]

Instrument Code No. [illegible]

Chart Readings on Tank Negative

1	%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	%. 108

Ambient Wet. [illegible] Dry. [illegible] Weather Tower Wet [illegible] Dry. [illegible]

Time Wet. Dry. [illegible] Time Wet [illegible] Dry. [illegible]

Duct Static Pressure Duct Area Sq. Ft. Tank Static Pressure [illegible] Duct Area Sq Ft [illegible]

Annulus Negative Exhaust Damper [illegible] % Open

Pre Filter D/P Tank Neg. [illegible]

HEPA D/P [illegible]

Annulus Intake Pressure

Inlet Damper Valve % Open

Exhaust Damper Valve % Open

	Vel	FPM		Vel	FPM
1.			1.	[illegible]	[illegible]
2.			2.	[illegible]	[illegible]
3.			3.	[illegible]	[illegible]
4.			4.	[illegible]	[illegible]
5.			5.	[illegible]	[illegible]
Total FPM			Total FPM		[illegible]
Average FPM			Average FPM		[illegible]
CFM			CFM		[illegible]

Time Wet. Dry. [illegible] Time Wet [illegible] Dry. [illegible]

Duct Static Pressure Duct Area Sq. Ft. Tank Static Pressure [illegible] Duct Area Sq Ft [illegible]

Annulus Negative Exhaust Damper [illegible] % Open

Pre Filter D/P Tank Neg. [illegible]

HEPA D/P [illegible]

Annulus Intake Pressure

Inlet Damper Valve % Open

Exhaust Damper Valve % Open

	Vel	FPM		Vel	FPM
1.			1.	[illegible]	[illegible]
2.			2.	[illegible]	[illegible]
3.			3.	[illegible]	[illegible]
4.			4.	[illegible]	[illegible]
5.			5.	[illegible]	[illegible]
Total FPM			Total FPM		[illegible]
Average FPM			Average FPM		[illegible]
CFM			CFM		[illegible]

TEST RECORD SHEET 1.

Checked 11-15-91

241-C Tank Farm

Instrument Type Micro

Date 5-22-91

Instrument Last Calibration Date 2-14-91

Instrument Code No. 702 28 09017

Chart Readings on Tank Negative

01	%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	% 108
Time 1000	Ambient Wet. 53		Drv. 65	1000 Weather Tower Wet 51		Drv. 67	
Time ~~1010~~	~~Wet 60~~		~~Drv. 70~~	1010 Time Wet 60		Drv. 80	

Duct Static Pressure ML Duct Area Sq. Ft.	Tank Static Pressure ~~1.22~~ ML 4" Duct Area Sq Ft 1.227
Annulus Negative	Exhaust Damper 30 % Open
Pre Filter D/P	Tank Neg. .40
HEPA D/P	
Annulus Intake Pressure	
Inlet Damper Valve % Open	
Exhaust Damper Valve % Open	

	Vel	FPM		Vel	FPM
1.			1.	.034	738
2.			2.	.033	727
3.			3.	.032	716
4.			4.	.032	716
5.			5.	.031	705
Total FPM			Total FPM		3602
Average FPM			Average FPM		720
CFM			CFM		884

Time 1020	~~Wet 70~~	~~Drv. 75~~	1020 Time Wet 70		Drv. 75

Duct Static Pressure ~~2.15~~ ~~Duct Area~~ Sq. Ft.	Tank Static Pressure 2.15 Duct Area Sq Ft 1.227
Annulus Negative ML	Exhaust Damper 40 % Open
Pre Filter D/P	Tank Neg. 1.8
HEPA D/P	
Annulus Intake Pressure	
Inlet Damper Valve % Open	
Exhaust Damper Valve % Open	

	Vel	FPM		Vel	FPM
1	.055		1.	.055	939
2.	.0871	ML	2.	.107	1310
3.	.108		3.	.108	1316
4.	.110		4.	.110	1328
5.	.106		5.	.106	1304
Total FPM			Total FPM		6147
Average FPM			Average FPM		1239
CFM			CFM		1521

Checked 5-23-91 WJ

TEST RECORD SHEET 1.

MAINTENANCE ENGINEER SERVICES
MAINTENANCE PROCEDURE
AIRFLOW AND PSYCHROMETRIC READING ON UNDERGROUND WASTE STORAGE TANKS

241-C Tank Farm

Date 6-14-91

Instrument Type MICRO

Instrument Code No. 202-28-09-018

Instrument Last Calibration Date 4-5-91

Chart Readings on Tank Negative

101	%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	%. 108

Time 0915 Amoient Wet. 51°F Dry. 64°F Weather Tower Wet 49°F Dry. 63°F

Time Wet. Dry. 0920 Time Wet 61°F Dry. 81°F

Duct Static Pressure - Duct Area Sq. Ft. Tank Static Pressure -.18" Duct Area Sq Ft .784

Exhaust Damoer 30% % Ooen

Tank Neg. -.40" w.g.

Annulus Negative

Pre Filter D/P

HEPA D/P

Annulus Intake Pressure

Inlet Damoer Valve % Ooen

Exhaust Damoer Valve % Ooen

	Vel	FPM		Vel	FPM
1.			1.	.035	750
2.			2.	.04	801
3.			3.	.044	840
4.			4.	.046	850
5.			5.	.054	931
Total FPM			Total FPM		4211
Average FPM			Average FPM		842
CFM			CFM		661

Time Wet. Dry. 0930 Time Wet 77°F Dry. 77°F

Duct Static Pressure Duct Area Sq. Ft. Tank Static Pressure -2.19" Duct Area Sq Ft 1.396

Exhaust Damoer 40% % Ooen

Tank Neg. -1.90" w.g.

Annulus Negative

Pre Filter D/P

HEPA D/P

Annulus Intake Pressure

Inlet Damoer Valve % Ooen

Exhaust Damoer Valve % Ooen

	Vel	FPM		Vel	FPM
1.			1.	.038	790
2.			2.	.056	943
3.			3.	.147	1536
4.			4.	.22	1879
5.			5.	.21	1835
Total FPM			Total FPM		5978
Average FPM			Average FPM		1396
CFM			CFM		1949

Checked 6/17/91

TEST RECORD SHEET 1.

ANCE ENGINEERING SERVICES
ENANCE PROCEDUR
FLOW AND PSYCHROMETRIC READING ON UNDERGROUND WASTE
ORAGE TANKS

241- C Tank Farm

Instrument Type MTCRO Date 7-8-91

Instrument Last Calibration Date 4-5-91 Instrument Code No. 702-23-09-018

Chart Readings on Tank Negative

101	%. 102	%. 103	%. 104	%. 105	%. 106	%. 107	% 108

Time	Ambient Wet. 63 Dry. 87	Weather Tower Wet	Dry.
Time	Wet. 70 Dry. 86	Time Wet	Dry.
Duct Static Pressure NA	Duct Area Sq. Ft. 141	Tank Static Pressure NA	Duct Area Sq Ft
Annulus Negative NA	1.067	Exhaust Damper NA	% Open
Pre Filter D/P NA		Tank Neg. -.80"	
HEPA D/P NA			
Annulus Intake Pressure NA			
Inlet Damper Valve NA	% Open		
Exhaust Damper Valve NA	% Open		

	Vel	FPM		Vel	FPM
1. ~~.093~~ .036	759		1.		
2. .034	738		2.		
3. .033	727		3.		
4. .035	749		4.		
5. .031	705		5.		
Total FPM	3678		Total FPM		
Average FPM	736		Average FPM		
CFM	786		CFM		

Time	Wet. 81 Dry. 84	Time Wet	Dry.
Duct Static Pressure NA	Duct Area Sq. Ft. NA	Tank Static Pressure NA	Duct Area Sq Ft
Annulus Negative NA	.400	Exhaust Damper NA	% Open
Pre Filter D/P NA		Tank Neg. -1.80"	
HEPA D/P NA			
Annulus Intake Pressure NA			
Inlet Damper Valve NA	% Open		
Exhaust Damper Valve NA	% Open		

	Vel	FPM		Vel	FPM
1 .093	1222		1.		
2. .108	1316		2.		
3. .107	1310		3.		
4. .122	1399		4.		
5. .104	1292		5.		
Total FPM	5360		Total FPM		
Average FPM	1072		Average FPM		
CFM	707		CFM		

Checked 7-10-91 [illegible]

TEST RECORD SHEET 1.

241-C Tank Farm

Instrument Type Micro — Date 8-16-91

Instrument Last Calibration Date 10-3-90 — Instrument Code No. 202 28 09 012

Chart Readings on Tank Negative

% 102	% 103	% 104	% 105	% 106	% 107	% 108

Ambient Wet. 69	Dry. 86	Weather Tower Wet		Dry.
Wet.	Dry.	Time Wet 73		Dry. 78
Time 1030		Tank Static Pressure 4.64	Duct Area Sq Ft 1.069	
Duct Static Pressure	Duct Area Sq. Ft.	Exhaust Damper 25		% Open
Annulus Negative		Tank Neg. .4		
Pre Filter D/P				
HEPA D/P				
Annulus Intake Pressure				
Inlet Damper Valve	% Open			
Exhaust Damper Valve	% Open			

Vel	FPM	Vel	FPM
		1. .028	670
		2. .026	645
		3. .021	580
		4. .028	670
		5. .022	594
Total FPM		Total FPM	3159
Average FPM		Average FPM	632
CFM		CFM	675

Time 1040	Wet.	Dry.	Time Wet 80	Dry. 84
Duct Static Pressure	Duct Area Sq. Ft.	Tank Static Pressure 2.16	Duct Area Sq Ft 1.396	
Annulus Negative		Exhaust Damper 60%		% Open
Pre Filter D/P		Tank Neg. 1.9		
HEPA D/P				
Annulus Intake Pressure				
Inlet Damper Valve	% Open			
Exhaust Damper Valve	% Open			

Vel	FPM	Vel	FPM
		1. .051	904
		2. .100	1766
		3. .097	1247
		4. .067	1052
		5. .077	1110
Total FPM		Total FPM	5580
Average FPM		Average FPM	1116
CFM		CFM	1558

TEST RECORD SHEET 1

241-C Tank Farm

nstrument Type WZCKD Date 9-4-91

nstrument Last Calibration Date 1-23-91 Instrument Code No. 7C2-28-05-01

Chart Readings on Tank Negative

01 % 102 % 103 % 104 % 105 % 106 % 107 % 108

ime Ambient Wet. 58 Dry. 75 Weather Tower Wet. 57 Dry. 76

ime Wet. Dry. Time Wet 68 Dry. 68

uct Static Pressure Duct Area Sq. Ft. | Tank Static Pressure -.91 Duct Area Sq Ft 136

nnulus Negative | Exhaust Damper 30 % Open

re Filter D/P | Tank Neg. -.50

EPA D/P | Dor .25 N/A

nnulus Intake Pressure | N/A .20 7.91

nlet Damper Valve % Open | Inlet 60%

xhaust Damper Valve % Open |

Vel	FPM		Vel	FPM
		1.	.033	727
		2.	.033	727
		3.	.036	759
		4.	.032	716
		5.	.036	759
otal FPM		Total FPM		3684
verage FPM		Average FPM		737
FM		CFM		1580

ime Wet. Dry. Time Wet 64 Dry. 84

uct Static Pressure Duct Area Sq. Ft. | Tank Static Pressure .36 Duct Area Sq Ft 60

nnulus Negative | Exhaust Damper 41 % Open

re Filter D/P | Tank Neg. -.200

EPA D/P | 75% Inlet UNKNOWN

nnulus Intake Pressure | P.P .24" 1.40

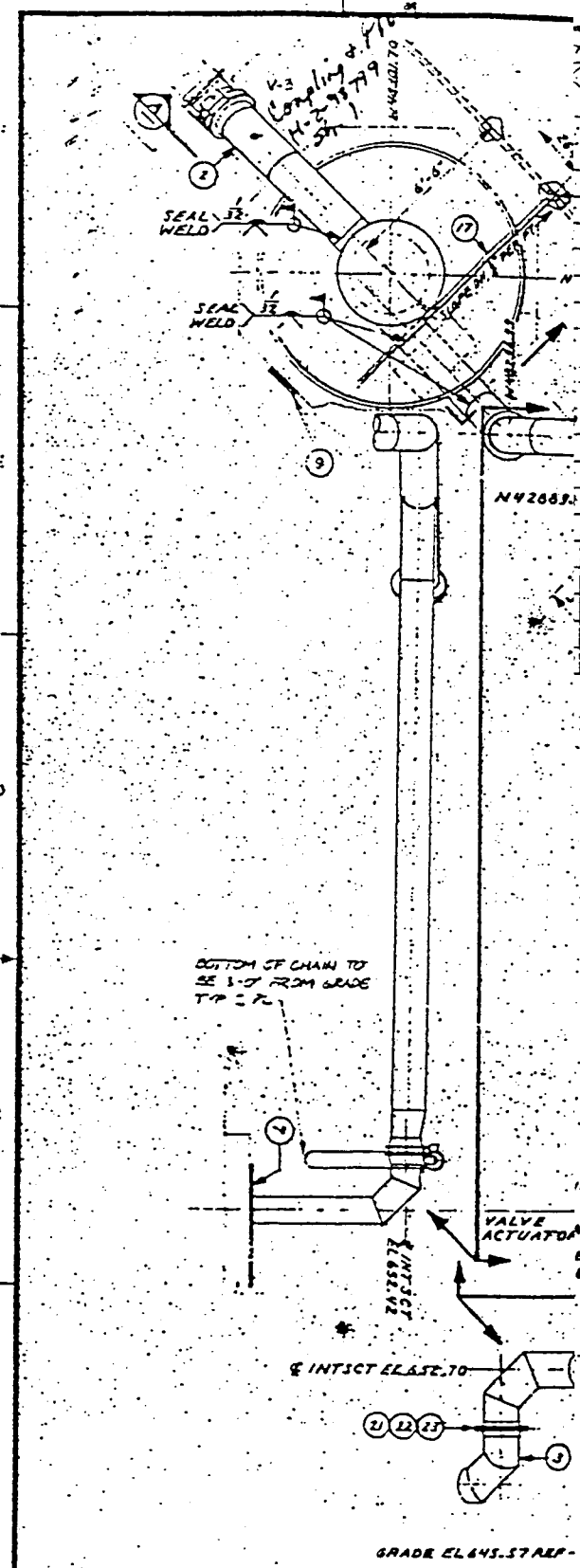
nlet Damper Valve % Open | N/A .40" 1.40

xhaust Damper Valve % Open |

Vel	FPM		Vel	FPM
		1.	.093	1222
		2.	.114	1350
		3.	.095	1250
		4.	.104	1277
		5.	.104	1322
otal FPM		Total FPM		6442
verage FPM		Average FPM		1288
FM		CFM		1580

Checked 9-4-91

TEST RECORD SHEET 1.



PN	DESCRIPTION	MATERIAL
1	INSTALLATION	
2	18" DUCT SPOOL	H-2-93799 SH 1
3	16" DUCT SPOOL	H-2-93799 SH 2
4	14" & 16" DUCT SPOOL	H-2-93799 SH 3
5	18" DUCT SPOOL	H-2-93799 SH 4
6	NOT USED	
7	12" SPOOL & COVER PL	H-2-93799 SH 5
8	14" DUCT SPOOL	H-2-93799 SH 6
9	HVAC VENTILATION VALVE STATION	H-2-93799 SH 7
10	NOT USED	
11	NOT USED	
12	NOT USED	
13	ROLLED ANGLE FLG $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{16}$	ASTM A36 NOTE 2
14	GASKET, $\frac{1}{8}$" THK	NEOPRENE 60 DURO
15	BOLT, $\frac{5}{8}$-16 UNC-2A X 1" LG	ASTM A307 GR B
16	NUT, $\frac{5}{8}$-16 UNC-2B	ASTM A563 GR A
17	PIPE, $1\frac{1}{2}$", SCHED 40	ASTM A106 GR B
18	ELB, $1\frac{1}{2}$", LR, 90°, BUTT WELD, SCHED 40	ASTM A234 GR WPB
19	ELB, $1\frac{1}{2}$", LR, 45°, BUTT WELD, SCHED 40	ASTM A234 GR WPB
20	TEE, $1\frac{1}{2}$", BUTT WELD, SCHED 40	ASTM A234 GR WPB
21	BOLT, 1-8 UNC-2A X $4\frac{1}{2}$" LG	ASTM A307 GR B
22	NUT, 1"-8 UNC-2B	ASTM A563 GR A
23	GASKET, $\frac{1}{8}$" THK	NEOPRENE 60 DURO

IENT ON ALL HORIZONTAL DUCT RUNS EXCEPT 18" DUCT SPOOL.

A HOLES ON 20" BC. BOLT HOLES TO STRADDLE ℄'S.

ETAL PLATE BETWEEN FLANGES DURING LEAK TEST.

GASKET.

U. S. DEPARTMENT OF ENERGY
Richland Operations Office
KAISER ENGINEERS HANFORD COMPANY

HVAC
VENT DUCT SPOOL
INSTALLATION

C FARM VENTILATION UPGRADE

8-480 | X48002 | R484A2
241-C | 5900

NONE | NOT MED | H-2-93797 | 2 | 2 | 1

JOHN LEE

106 - C Psychrometric Calculation

Author: T.P. Mrberg
Date: 5-26-92

Note: Using data from 12/7/90

Given:

Ambient		Outlet	
wet Bulb (°F)	Dry Bulb (°F)	Wet Bulb (°F)	Dry Bulb (°F)
27	27	66	68

Outlet Flowrate = 1832 ft³/min

From Perry's:

Ambient (lb H₂O/lb dry Air)	Outlet (lb H₂O/lb dry Air)
0.0030	0.0125

Ambient (ft³/lb dry Air)	Outlet (ft³/lb dry Air)
12.32	13.57

Calculations:

$$\text{Inlet Flowrate} = \frac{1832\ ft^3}{min} \left| \frac{lb\ dry\ Air}{13.57\ ft^3} \right| \frac{12.32\ ft^3}{lb\ dry\ Air} = 1663\ ft^3/min$$

Using $\rho_{H_2O@70°F} = 8.328\ lb/gal$

$$\text{lb. of } H_2O \text{ removed/wk} = \left[\frac{0.0125\ lb\ H_2O}{lb\ dry\ Air} \left| \frac{lb\ dry\ Air}{13.57\ ft^3} \right| \frac{1832\ ft^3}{min} - \frac{0.003\ lb\ H_2O}{lb\ dry\ Air} \left| \frac{lb\ dry\ Air}{12.32\ ft^3} \right| \frac{1663\ ft^3}{min} \right] \times$$

$$\left[\frac{60\ min}{hr} \left| \frac{24\ hr}{day} \right| \frac{7\ days}{wk} \left| \frac{gal}{8.328\ lb\ H_2O} \right. \right]$$

$$= \underline{1552\ gal/wk}$$

Technical Justification for Water Additions to Tanks 241-C-105 and 241-C-106

One of the postulated safety hazards for waste tanks at the Hanford Site involves the potential release of high-level nuclear waste as a result of structural damage due to overheating the tanks reinforced concrete. The heat generating source originates from the radioactive decay of waste material stored in the tanks. For those tanks that contain enough heat generation to cause overheating, the temperature of the waste is maintained by an active cooling system at a level below 300°F. This is to meet the Operating Safety Requirements (OSD-T-151-00013) that are in place, and which state the following requirements:

- Maximum 300°F for waste
- Maximum 250°F for dome
- Maximum change of 20°F per day

These limits were based on earlier structural analysis and laboratory studies (Portland Cement Association) of the effects of elevated temperature on the Hanford tank concrete per American Concrete Institute criteria. [The Safety Analysis Report limit is 350 °F in the waste; the ODS limits have additional conservatism.]

Based on assessments of all the information available, single-shell tank (SST) 241-C-106 is the only SST that requires more than active ventilation to keep the temperature below 300 °F. For this tank, the active ventilation is supplemented with the periodic addition of water to maintain a liquid cover (supernate) over the sludge for enhanced thermal conductivity and evaporative cooling.

Tank 241-C-105, another high-heat generating SST, is also currently cooled by maintaining cooling liquid in the tank through periodic water additions and active ventilation. Preliminary studies indicate that the cooling liquid is not required and water additions could be terminated. However, WHC employees who have studied the heat transfer analysis have indicated that additional information is needed prior to actually stopping water additions to assure that all potential safety concerns are addressed (Lowe, 1992). Specifically, additional waste sample characterization, additional instrumentation, etc., have been recommended prior to stopping water additions. Activities are underway to address these concerns to assure a process test can be initiated in FY 1993 that which will demonstrate water additions are no longer needed in this tank. These activities will, as well, as provide useful data for better defining minimum cooling water needs for 241-C-106. In this process test, water additions will be stopped and the tank carefully monitored to assure that tank temperatures remain acceptable.

Between 1969 and 1971, high-heat sludge was water-sluiced from aging waste stored in SSTs in the 241-A and 241-AX Tank Farms to recover ^{137}Cs and ^{90}Sr. The sludge washing/decanting step in this process did not function as planned, and resulted in the transfer of strontium-rich solids to SSTs 241-C-105 and 241-C-106. The tanks contain 11,000 and 48,000 gal of drainable liquids, and 150,000 and 197,000 gal of sludge respectively (there is no saltcake in either tank). As of 1988, the waste contained in Tank 241-C-105 was estimated to generate heat at the rate of 12,100 to 52,630 BTU/h, with a best estimate of 52,000 BTU/h. For Tank 241-C-106, the rate of heat generation was estimated to range from 61,550 to 176,000 BTU/h, with a best estimate of 158,000 BTU/h (Pauly 1987).

In mid-1971, when waste temperatures in excess of 210 °F were observed in Tank 241-C-106, both Tank 241-C-105 and Tank 241-C-106 were immediately placed on shared forced air ventilation. Since mid-1971, water has been added periodically to both tanks in order to promote heat transfer and evaporative cooling and to permit accurate in-tank liquid level measurements using Food Instrument Corporation (FIC) gauges. Both tanks are considered to be sound (nonleaking), and were placed on inactive status in 1979. The supernate liquid cover over the solids has averaged over the last 7 yr approximately 1,200 gal/mo for Tank 241-C-105 and 7,700 gal/mo for Tank 241-C-106. When the decrease in the liquid level in the tank reaches a preestablished level (believed to be caused by evaporation only), water is then added to reestablish a maximum liquid level.

Several studies, including one completed in 1987, examined cooling options in support of in situ stabilization (Pauly 1987). This study concluded that no cooling water additions to Tank 241-C-105 were required to maintain temperature below limits. However, the study could find no viable alternative to retrieval of all or part of the Tank 241-C-106 contents if the sludge, when allowed to dry completely, has a thermal conductivity of 0.25 BTU/h-ft/°F or lower. The study recommended that, because of the long lead time, retrieval of Tank 241-C-106 contents be pursued until the thermal conductivity of dry sludge could be established. If the thermal conductivity of dry sludge were to be demonstrated to be significantly greater than 0.25 BTU/h-ft/°F, then acceptable cooling alternatives for Tank 241-C-106 could exist that would not involve adding water to the tank. Any alternatives in which the sludge would be kept moist enough to have a higher than a dry sludge thermal conductivity were not examined in this study. No determination of the actual thermal conductivity has been made, although laboratory efforts to investigate thermal conductivity for simulated sludge were initiated, but not completed.

References:

OSD-T-151-00013, 1983, *Operating Specification of Single-Shell Waste Storage Tanks*, Westinghouse Hanford Company, Richland, Washington.

Portland Cement Association, 1981, *Effects of Long-Term Exposure to Elevated Temperatures on the Mechanical Properties of Hanford Concrete*, RHO-C-54 Rockwell Hanford Operations, Richland, Washington.

Lowe, S.S., 1992, *Interim Stabilization of Single-Shell Tank 241-C-105*, WHC-SD-WM-ER-149, Westinghouse Hanford Company, Richland, Washington.

Pauly, T. R., and M. M. Torgerson, 1987, *Tanks 105-C and 106-C Stabilization Study*, RHO-RE-EV-97, Rockwell Hanford Operations, Richland, Washington.

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
J. P. Hamric, RL	R. Stanley, Ecology	Incoming: 9205941

Subject: TECHNICAL INITIATIVES REGARDING SINGLE-SHELL TANKS C-105 AND C-106

INTERNAL DISTRIBUTION

Approval	Date	Name	Location	w/att
		Correspondence Control	A3-01	X
		President's Office		
		S. L. Bradley	B3-06	
		C. Defigh-Price	R2-31	
		J. C. Fulton	R3-56	
		H. D. Harmon, Level 1	R2-52	
		J. M. Henderson	S4-55	
		R. E. Lerch	B2-35	
		D. W. Lindsey	B2-35	
		P. J. Mackey	B3-15	X
		H. E. McGuire	B3-63	
		W. C. Miller	S4-55	
		R. D. Morrison	B2-35	
		D. B. Pabst	B2-35	
		M. A. Payne, Assignee	R2-50	
		R. E. Raymond	R1-80	
		D. C. Richardson	R2-31	
		J. H. Roecker	G6-02	
		T. B. Veneziano		
		EDMC	H4-22	X

RECEIVED
AUG 27 1992
CORRESPONDENCE CONTROL