

R U N R E P O R T

INTEGRATED RADIOACTIVE WASTE TREATMENT SYSTEM

CAMPAIGN NO. 14, November 13, 1989 - December 15, 1989

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SRC3381

LIST OF TABLES

Table 1 - Summary Table of Run Statistics

Table 2 - Comparison of Statistics from Previous Campaigns to this Campaign

Table 3 - Detailed Tables of Run Statistics

Table 4 - Drum Testing Results

Table 5 - Drum Production Rates

Table 6 - STS Process History

LIST OF FIGURES

Figure 1 - STS Breakthrough Curve

Figure 2 - Drum Cell Radiation Levels

Figure 3 - STS System DF

Figure 4 - IRTS High Level Waste Tanks, 8D-1 and 8D-2

RUN REPORT
IRTS
CAMPAIGN NO. 14

SUMMARY:

Integrated Radwaste Treatment System (IRTS) Campaign No. 14 was concluded on December 15, 1989 after processing approximately 33,873 gallons of 8D-2 liquid. The Supernatant Treatment System (STS) used a three column sequence of B-C-A. The target dilution ratio was 1.4:1 with a nominal system flow rate of 6 GPM. The average Campaign No. 14 Decontamination Factor for STS was 34,370.

Liquid Waste Treatment System (LWTS) received a total of 9 batch transfers from STS totaling 83,240 gallons of process liquid.

Cement Solidification System (CSS) processed 24,440 gallons of concentrates and produced 611 drums at 40 gallons per drum. Average drum dose rate was 33 mR/hr. The total CSS production, at the completion of Campaign No. 14 was 6,532 drums.

Table 1 shows a summary of run statistics. Process completion status at the end of this campaign is 50%.

Table 2 compares this campaign to the two previous campaigns. Campaign No. 14 processed more supernatant than the two previous campaigns.

DISCUSSION:STS OPERATION

Campaign No. 14 supernatant processing commenced on November 13, 1989 with a 1:4:1 dilution ratio. No major problems developed to impact STS operations. Minor chiller problems did develop due to cold weather but did not require repairs.

The "Vee-Arc" variable speed controller for pump 50-G-002 was returned to service between the first and second week of STS processing for Campaign No. 14. Failure of this unit occurred during Campaign No. 13 (see Campaign No. 13 Run Report).

Campaign No. 14 was scheduled to be a three-column run in a A-B-C sequence following Campaign No. 13's four-column run in sequence D-A-B-C. The effluent activity from column C at the end of Campaign No. 13 precluded its use as a final column (see also Campaign No. 13 Run Report). Therefore, column A was loaded with additional cesium, discharged and charged with fresh zeolite. Campaign No. 14 was thus run in a B-C-A sequence with column D isolated and vented.

A total of 35,413 gallons of supernatant was processed during Campaign No. 14. Of this total volume, 33,873 gallons of supernatant, at an average DF of 34,370, was acceptable for transfer to LWTS. In an effort to load the lead column as much as practicable, supernatant processing continued until the 8D-3 analysis for decontaminated supernatant approached the level which would produce 230 mR/Hr CSS product drums. Because of the resulting high dose drums and ALARA concerns in CSS, it was decided to return 1,540 gallons of decontaminated supernatant back to 8D-2.

Following completion of Campaign No. 14 supernatant processing, the lead column (column B), was sluiced of the bulk of its zeolite via the "J"-nozzle, then the heel was dumped using the bottom dump valve. The bottom dump valve opened normally and the column discharged. When the dump valve remote operator was actuated to "close", there was no indication that the valve closed (see UOR 89-11-STS-1 and Critique No. CM89150). Subsequent checkout determined the valve did not close. Because of this failure of the column B dump valve in the open position, column B is temporarily not available for use. Two courses of action shall be followed to resolve the dump valve failure problem: 1) get IRTS back into operation as soon as practical. 2) continue efforts, in parallel, to plug column B.

In order for column C to function as a third (final) column, it was required to dump the zeolite from column C, which had been the second column for Campaign No. 14. To more fully utilize the zeolite in column C, 17,640 gallons of supernatant was pumped through the column with the column effluent directed back to 8D-2. The total volume of supernatant processed and recycled to 8D-2 is 19,180 gallons (17,640 + 1,540). The next campaign will be run following installation of a plug on the column C dump valve. With columns A, C and D available and column D only suitable as a lead column, the sequence for Campaign No. 15 will be D-A-C.

Table 6, showing a historical summary of the STS process, has been adapted from the "Cesium-137 Processed" table of previous reports. New values for the Cesium-137 concentration during each campaign have been developed after reviewing all available analytical data.

LWTS OPERATION:

Operation of evaporator 31017 and its associated sub-systems continued to produce acceptable results. Early in Campaign No. 14, a valve reset

alarm caused all LWTS valves to automatically switch to the "fail safe" position. When the alarm cleared and the valves returned to the operating position, concentrates from the evaporator were directed to tank 5D-15A2 instead of 5D-15A1. The approximately 928 litres of concentrates was held in 5D-15A2 and was included in the volume intentionally processed to that tank. No process delays occurred as a result of this valve switching because LWTS was to start processing to 5D-15A2 within a few hours. If this event had occurred after 5D-15A2 was sampled for analysis prior to processing in CSS, a significant delay could have occurred because the tank would have to be resampled and the analysis repeated. SOP 71-2 was modified to provide a different valve lineup, thereby preventing this problem from reoccurring. On December first, a transfer from STS to LWTS was delayed for several hours. Power to heat trace the pipe that supplies seal water to transfer pump 71-P-01 was switched off in May 1989. Shortly after power to the heat trace was activated, operators were able to establish seal water flow to the transfer pump and the transfer started.

CSS OPERATION

CSS continued production on November 20, 1989 at 0030 hours, solidifying Campaign No. 14 material. A leaky antifoam check valve was discovered after processing 22 drums. A critique was held to document and discuss this situation, see CM89135. Drums produced between sequence numbers 5923 and 5944 (total of 22) were found to have a less than the requisite amount of antifoam emulsion as specified in the CSS Process Control Plan, WVNS-PCP-001. Inspection of the drums (S/N 77401 and 77330) found the freeboard was 1 inch from the bottom of the fill spout (96 percent full), cemented waste had a smooth consistency and there was no free liquid. A total of eight drums were subjected to testing (W.O. 8902966) after they were retrieved from RTS Drum Cell. Critique CM89135 was defined as a UOR (No. 89-9-CSS-2) and all affected drums are segregated in the RTS Drum Cell for future testing and resolution.

On December 7, 1989, the Data Acquisition System (DAS) "C-Drive" was filled up to maximum capacity. Information for 30 drums was not inputted automatically recorded during processing (WVNS QA NR#89-156). CSS operators noted the abnormality in DAS processing, and ensured that data taken by hand was accurate. The following day, irrelevant CSS files were deleted, and data from the 300 drum run was refiled to make enough room on the "C" drive for all future drums. Additionally, maintenance was performed on the hard disk (C drive) to optimize the file storage pattern and to back up all data. The hand written data was used to document the actual processes and all data has been inputted into the DAS memory.

No other major system upsets were experienced during this campaign.

DRUM CELL

The Drum Cell continued to store drums produced by the CSS, at a rate compatible with CSS operation.

Drum load-in operations were temporarily halted when the load-in shuttle car failed to move. The cause, low air pressure at the air receiver, was corrected by adjusting the pressure regulator to its recommended setting. Shuttle car motions resumed immediately.

Printing of drum placement data would not function in the automatic mode. This was caused by a buildup of "Molykote" lubricant on the drum grabber release switch. Closing of this switch signals the PLC to print drum placement data: drum number, date, time, row and layer. The switch was cleaned and lubricated with a silicone-based lubricant. The system has functioned properly since relubrication.

The drum cell barcode decoder failed. A replacement decoder was obtained prior to the end of the campaign, but it functioned only intermittently. Repair and troubleshooting of the decoder by IRTS

Engineering and the manufacturer continues. All drum serial numbers were entered manually during this period.

Radiation levels at selected locations around the Drum Cell are shown in Figure 2. The dose in all areas is increased slightly from Campaign No. 13.

DECONTAMINATION FACTORS:

A graph of the Decontamination Factors (DF) obtained in STS is shown in Figure 3. Transfer DF is the instantaneous factor, calculated for each transfer from STS to LWTS. Cumulative DF is the Weighted average of the transfer DF's. The shape of the lines shown in Figure 3 is typical of previous campaigns.

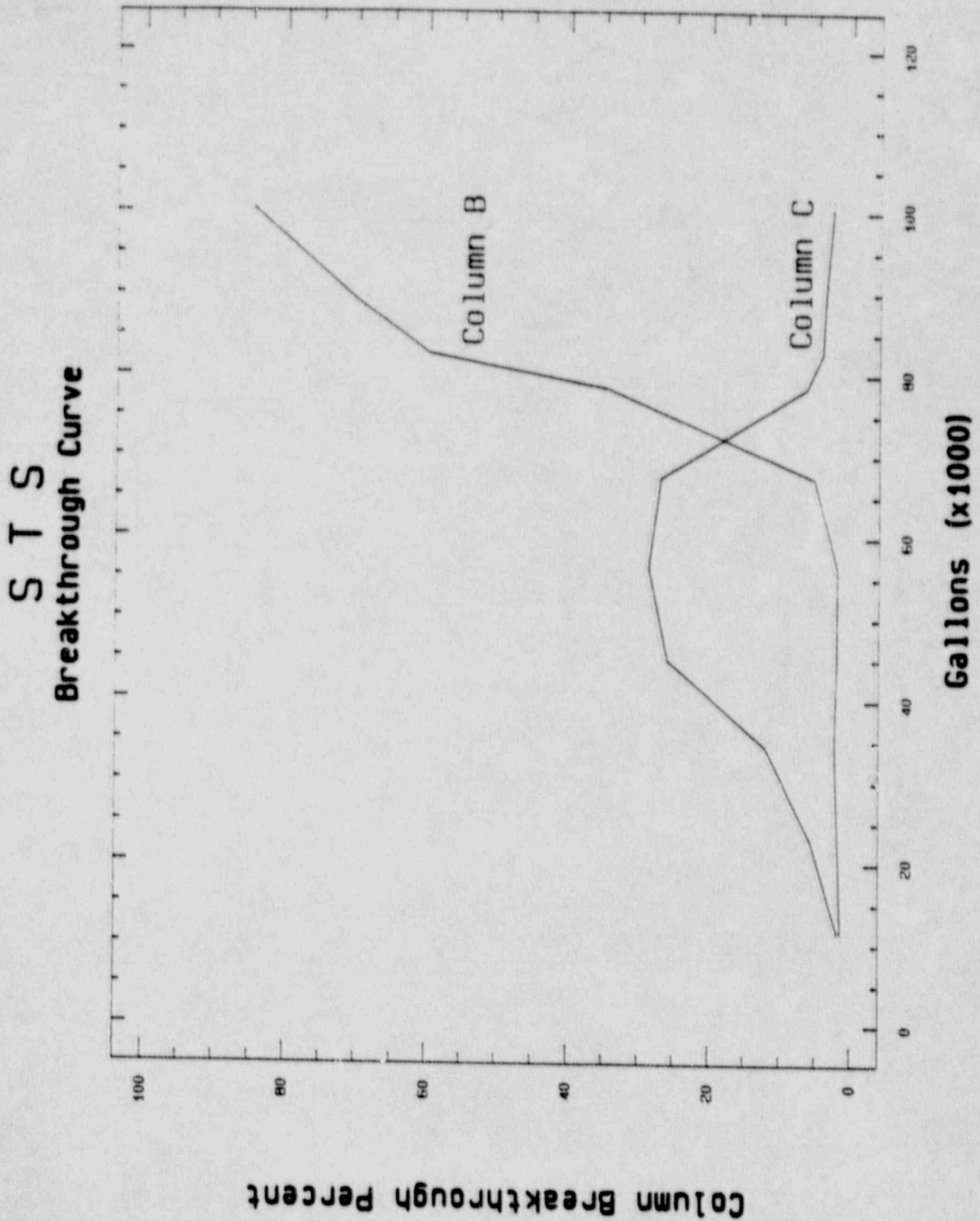
TANK LEVELS:

Campaign No. 14 continued to reduce the volumes in Tank 8D-2 by processing supernatant. A graph of 8D-1 and 8D-2 levels since January 1988 is included for information, see Figure 4. The level in 8D-1 will be maintained as its current level for ballast and shielding. A target level of 32 inches is shown for 8D-2.

PRODUCT ACCEPTANCE:

The waste form classification analysis for drums produced in Campaign Nos. 1-11 has been completed. All drums produced in Campaign Nos. 1-11 are Class "C" Low Level waste.

FIGURE 1



DRUM CELL RADIATION LEVELS

SRC3381

-8-

RADIATION LEVEL (mR/Hr)

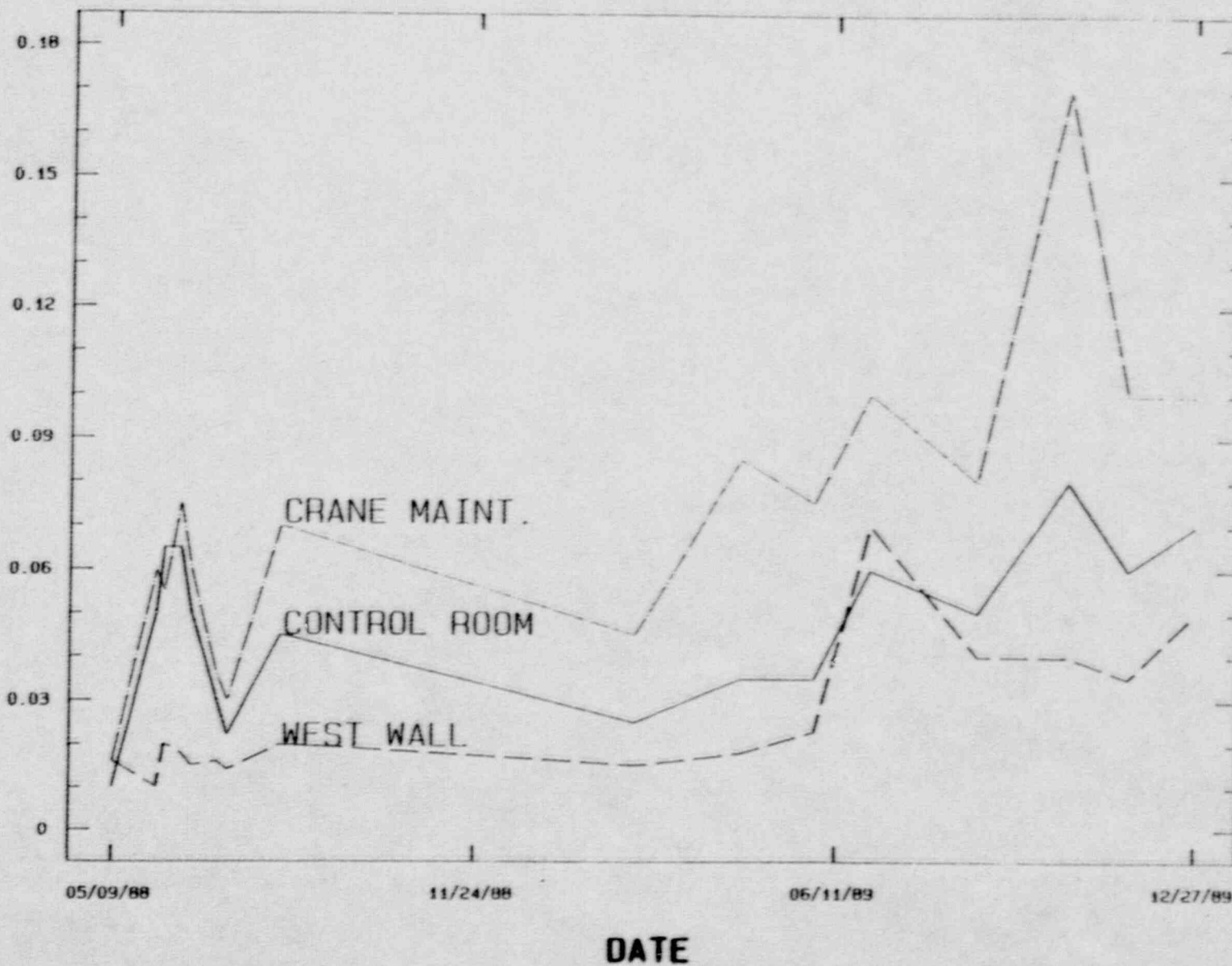


FIGURE 2

January 17, 1990

DC:90:0007

S T S DECONTAMINATION FACTOR

DECONTAMINATION FACTOR (x1000)

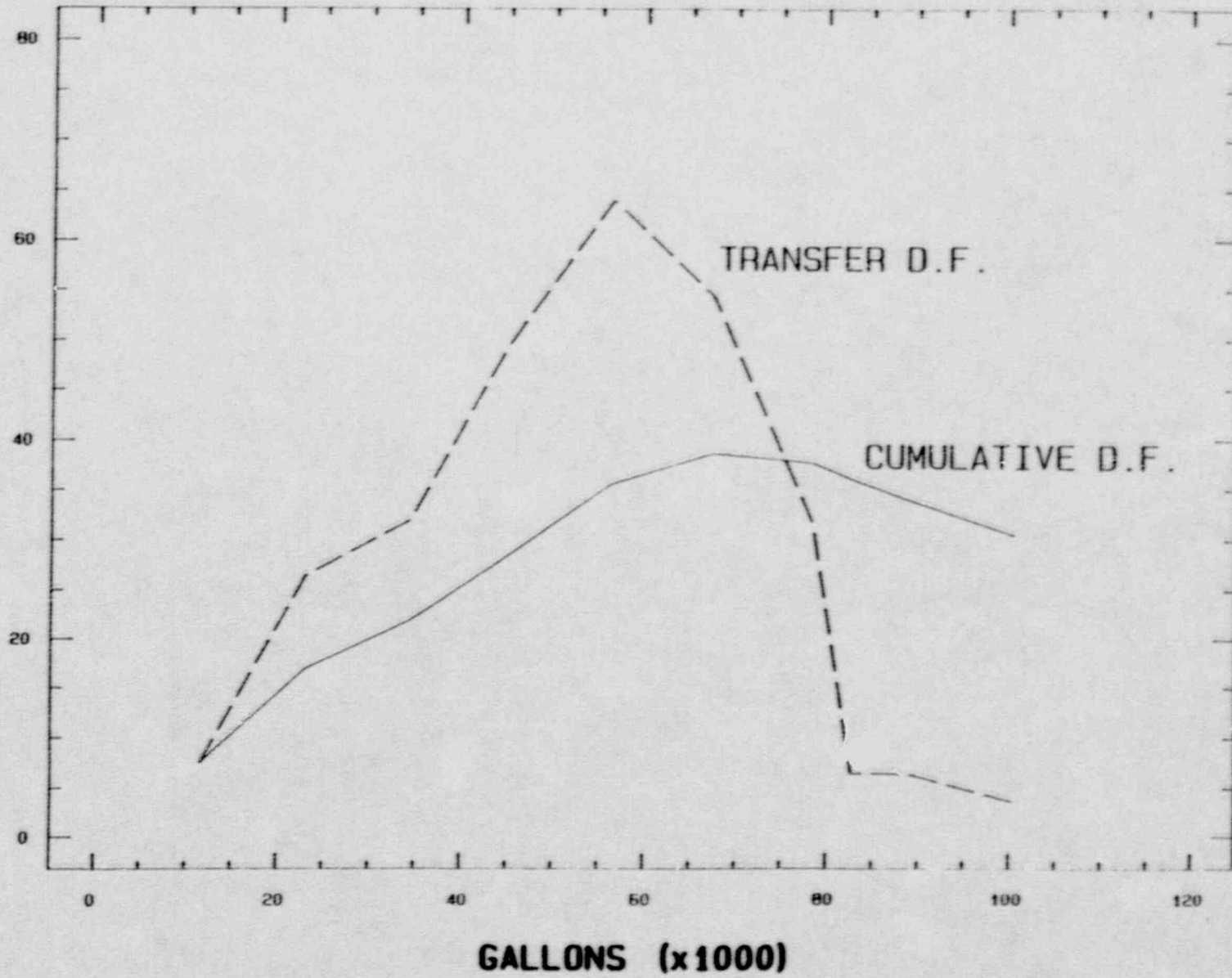


FIGURE 3

January 17, 1990

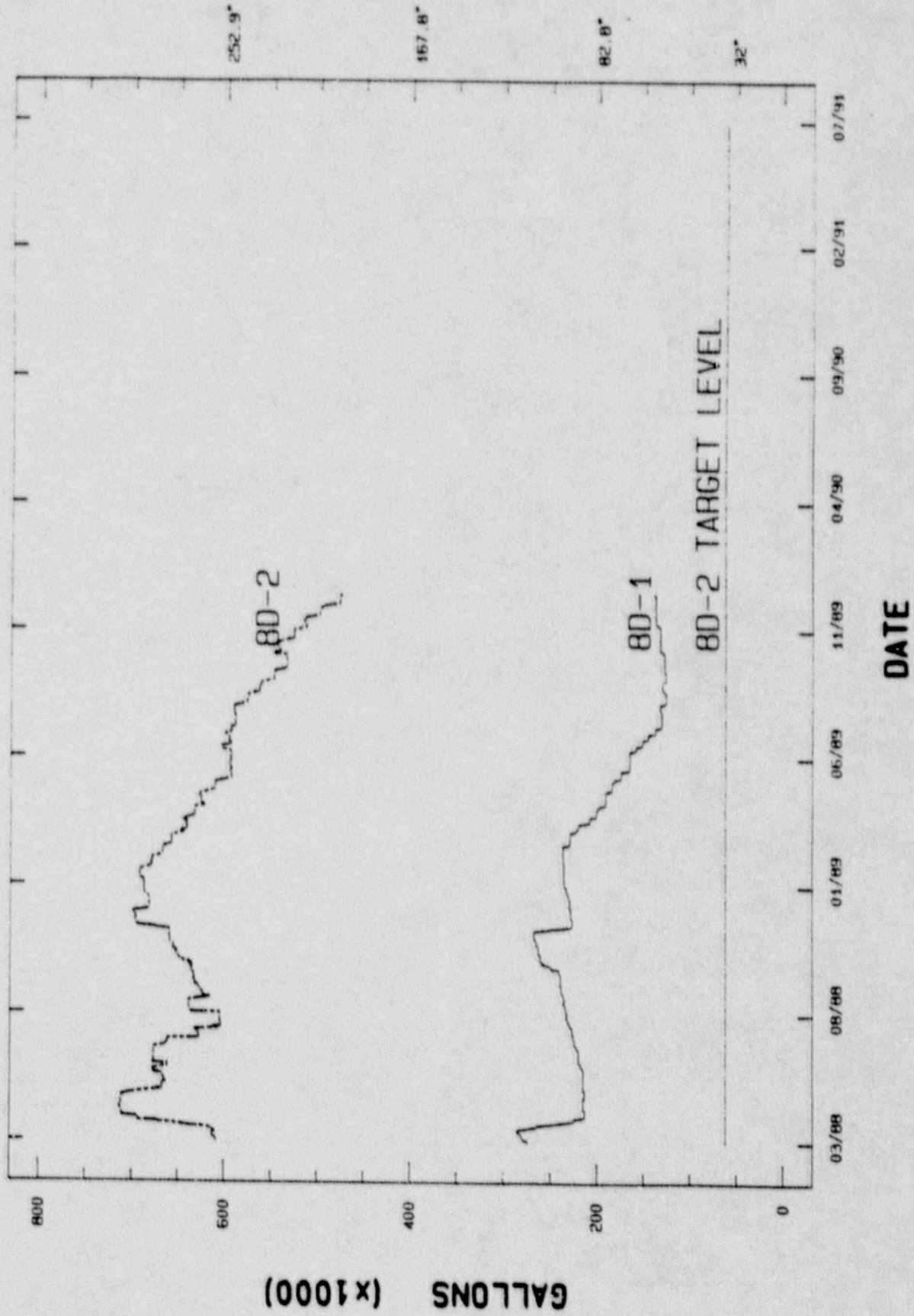
DC:90:0007

SRC3381

-9-

FIGURE 4

IRTS HIGH LEVEL WASTE TANKS 80-1 & 80-2



REVISED

TABLE 1

IRTS CAMPAIGN NO. 14 RUN REPORT
SUMMARY TABLE OF RUN STATISTICS

1.	TRANSFERS 8D-3 TO 5D-15B		
	A. Campaign Nos. 1 thru 13	3.051 ML	.805 MG
	B. Campaign No. 14 Total	<u>.356 ML</u>	<u>.094 MG</u>
	TOTAL TO DATE	3.407 ML	.899 MG
2.	LWTS PROCESS VOLUMES		
2.1	Total Feed to Evaporator		
	A. Campaign Nos. 1 thru 13	3.050 ML	.805 MG
	B. Campaign No. 14	<u>.363 ML</u>	<u>.096 MG</u>
	TOTAL TO DATE	3.413 ML	.901 MG
2.2	Total Concentrate		
	C. Campaign Nos. 1 thru 13	.885 ML	.234 MG
	D. Campaign No. 14	<u>.092 ML</u>	<u>.024 MG</u>
	TOTAL TO DATE	.968 ML	.258 MG
3.	DRUMS PRODUCED*		
	A. Campaign Nos. 1 thru 13	5,921	
	B. Campaign No. 14	<u>611</u>	
	TOTAL TO DATE	6,532	
4.	CURIES OF CESIUM 137 REMOVED FROM 8D-2		
	A. IRTS Campaign Nos. 1 thru 13		2,910.0 K Ci
	B. IRTS Campaign No. 14		<u>363.0 K Ci</u>
	TOTAL		3,273.0 K Ci
5.	PROCESS COMPLETION		
	A. Curies Percent Complete:		
		$\frac{3,273}{7,089-499} = 0.497$	or 50 percent
	B. Drums Percent Complete:		
		$\frac{6,532}{13,000} = 0.502$	or 50 percent

* Includes 5 drums removed from pile and core bored (#72847, 72791, 72949, 71004, 72813) which are now located in Lag Storage and does not include 1 drum which was left in the CSS Process Cell.

Includes a total of 494 process drums which qualified as shield drums.

ML = Mega Litres or $1 \times E + 6$ Litres
 MG = Mega Gallons or $1 \times E + 6$ Gallons

TABLE 2
IRTS CAMPAIGN NO. 14 RUN REPORT
COMPARISON OF STATISTICS FROM PREVIOUS CAMPAIGNS TO THIS CAMPAIGN

	<u>CAMPAIGN NO. 12</u>	<u>CAMPAIGN NO. 13</u>	<u>CAMPAIGN NO. 14</u>
<u>S T S</u>			
Volume of 8D-2 Supernatant Processed (Gal.)	33,363	28,333 ^(a)	33,873
Total Volume Processed (Includes flush and dilution water) (Gal.)	100,478	79,358	94,069
Column Breakthrough (%)			
- Lead Column	79	58.4	84.6
- 2nd Column	8.0	5.6	2.7
Average System DF	67,430	24,240	30,414
Average Cs-137 in Effluent (uCi/mL)	.034	.061	.046

L W T S

Concentrates			
- Volume (Gal.) ^(b)	27,125	19,209	24,440
- Average Cs-137 (uCi/mL)	.26	.24	.24

C S S

Drums Produced	643	498	611
Average Cs-137/Drum (Ci)	.037	0.036	0.036
Average Drum Contact Dose Rate (mR/hr)	37	36	33

(a) An additional 14,767 gallons of supernatant for saturation of Column A was returned to 8D-2.

(b) Tank heels:

	<u>CAMPAIGN 12</u>	<u>CAMPAIGN 13</u>	<u>CAMPAIGN 14</u>
5D-15A1	- 25 Gallons	21 Gallons	695 Gallons
5D-15A2	- 15 Gallons	2 Gallons	21 Gallons
70-D-1	- 70 Gallons	61 Gallons	103 Gallons
TOTAL	110 Gallons	84 Gallons	819 Gallons

TABLE 3
I R T S CAMPAIGN NO. 14 RUN REPORT
DETAILED TABLE OF RUN STATISTICS

COLUMN SEQUENCE: C-D-A-B

1. Transfer 8D-3 to 5D-15B

	1	2	3	4	5*	6	7	8A	8B	9
A. Date	11/13/89	11/15/89	11/16/89	11/17/89	11/27/89	11/28/89	11/30/89	12/1/89	12/4/89	12/12/89
B. STS Flow Rate (gpm)	6.1	6.1	6.1	5.5	6.0	6.0	6.0	5.5	6.0	6.0
C. D-001 Sample No.	8905174	8905214	8905247	8905287	8905384	8905391	8905426	8905443	8905443	8905517
i. Cs-137 (uCi/mL)	841	944	814	833.0	765	739	772	775	775	745
ii. TDS (wt %)	13.98	15.12	14.78	14.78	14.44	14.44	14.21	14.21	14.21	13.87
iii. Density (gr/mL)	1.099	1.109	1.106	1.106	1.103	1.103	1.101	1.101	1.101	1.098
D. Cesium-137 Activity (Column Effluents) (uCi/mL)										
i. Lead Column B	11	17.6	18.5	15.8	15	39	267	462	536.0	630
ii. 2nd Column C	0.20	0.99	2.23	4.08	4.20	10.40	16.60	18.60	20.00	17.00
E. Column Breakthrough (%)										
i. Lead Column C	1.3	1.9	2.3	1.9	1.9	5.3	34.6	59.6	69.2	84.6
ii. 2nd Column D	1.8	5.6	12.1	25.8	28.6	26.7	6.2	4.0	3.7	2.7
F. 8D-3 Sample No.	8905177	8905225	8905265	8905308	8905387	8905404	8905429	8905446	8905446	8905516
i. Cs-137 (uCi/mL)	0.0653	0.0301	0.0220	0.0169	0.0068	0.0122	0.0241	0.1120	0.1120	0.1260
ii. TDS (wt %)	8.43	12.95	12.95	14.78	8.6	13.06	13.98	13.06	13.06	8.71
iii. Density (gr/mL)	1.051	1.090	1.090	1.106	1.052	1.091	1.099	1.091	1.091	1.053
G. STS System DF										
i. Transfer DF	7,476	26,436	31,964	49,290	63,866	54,189	31,405	6,302	6,302	3,561
ii. Cumulative DF	7,476	16,897	21,899	28,313	35,520	38,583	37,571	35,958	33,933	30,414
H. 5D-15B Sample No.	8905196	8905253	8905297	8905353	8905394	8905420	8905438	8905468	8905468	8905527
i. Cs-137 (uCi/mL)	0.0740	0.0347	0.0212	0.0146	0.0104	0.0136	0.0387	0.1040	0.1040	0.2460
ii. TDS (wt %)	10.08	12.72	13.18	12.37	10.77	12.60	13.29	11.92	11.92	9.93
iii. Density (gr/mL)	1.065	1.088	1.092	1.085	1.071	1.087	1.093	1.081	1.081	1.064
I. Volume Received (Litres) in 5D-15B	40,993	40,489	40,489	37,299	40,489	39,219	39,219	15,139	21,490	41,263
J. Cumulative Volume** for Campaign (Litres)	40,993	81,482	121,971	159,270	199,759	238,978	278,197	293,336	314,826	356,089

* These are flush transfers. No DF calculated.

** Does not include flush of 37,328 Litres from transfers 5 and 9.

TABLE 4
I R T S CAMPAIGN NO. 14 RUN REPORT
DRUM TESTING RESULTS

CONCENTRATES BATCH	46	47	48	49
LWTS TANK	5D-15A1	5D-15A1	5D-15A2	5D-15A1
LAB ANALYSIS NO.	#56 8905332	#61 8905433	#23 8905448	#63 8905536
TOTAL SOLIDS %	38.61	39.98	40.09	38.72
Cs-137 CONCENTRATION (uCi/mL)	2.39 E-01	5.57 E-02	1.10 E-01	6.06 E-01
POUNDS CEMENT +CaNo ₃	95,304	89,376	36,480	57,456
NUMBER OF DRUMS	209	196	80	126
TOTAL GALLONS	8,360	7,840	3,200	5,040
CURIES PER DRUM (AVERAGE)	0.036	0.008	0.017	0.092
RADIATION DOSE (mR/hr) PER DRUM	34	10	15	80
PRESOLIDIFICATION RESULTS	>700 PSI	>700 PSI	>700 PSI	>700 PSI
IN-CELL TEST RESULTS DRUM NO./PSI	77401 >700 PSI	77757 >700 PSI	77429 >700 PSI	77847 >700 PSI
Total Cement & CaNo ₃	278,616	LBS.		
Total Number of Drums	611			
Total Volume Solidified	24,440	Gallons		
Total Curies Solidified	22.11	Ci		

TABLE 5
I R T S CAMPAIGN NO. 14 RUN REPORT
DRUM PRODUCTION RATES

	<u>DATE</u>	<u>DAILY AVERAGE</u>	<u>WEEKLY TOTAL</u>	<u>CUMULATIVE TOTAL</u>
Campaign #1	6/1 to 6/17	33		401
Campaign #2	6/27 to 7/8	45		783
Campaign #3	7/18 to 8/5	35		1347
Campaign #4	8/22 to 9/26	30		1681
Campaign #6	12/5 to 12/13	45		2009
Campaign #7	1/23 to 2/23	50		2607
Campaign #8	3/6 to 4/13	60		3303
Campaign #9	4/24 to 5/26	58		3988
Campaign #10	6/19 to 6/22	37		4136
Campaign #11	7/26 to 8/24	58		4778
Campaign #12	9/5 to 10/13	50		5421
Campaign #13	10/23 to 11/10	62		5921
Campaign #14	11/20	72		
	11/21	79		
	11/22	58	209	6130
	12/4	69		
	12/5	88		
	12/6	75		
	12/7	44	276	6406
	12/14	77		
	12/15	49	126	6532

TABLE 6 (REVISED)
IRTS CAMPAIGN NO. 14 RUN REPORT
STS PROCESS HISTORY

CAMPAIGN	DATE	NOMINAL DILUTION RATIO	COLUMN SEQUENCE	NUMBER OF COLUMNS DUMPED	Cs-137 CONCENTRATION IN 8D-2 (uCi/mL)	SUPERNATANT PROCESSED				TOTAL Cs-137 REMOVED KCi	Cs-137 INVENTORY REMAINING IN 8D-2(a)(b) KCi
						AND TRANSFERRED TO LWTS GALLONS	Cs-137 REMOVED KCi	AND RECYCLED TO 8D-2 GALLONS	Cs-137 REMOVED KCi		
1	5/88	no dilute	B-C-D-A	1	2860	24,185	262	0	0	262	6,836
2	6/88	no dilute	C-D-A-B	1	2600	15,800	155	0	0	155	6,681
3	7/88	no dilute	D-A-B-C	1	2600	26,356	259	0	0	259	6,422
4	8/88	no dilute	A-B-C	1	2600	17,000	167	4,000	39	206	6,215
5	9-10/88	no dilute	N/A	2	2400	0	0	30,200	274	274	5,942
6	12/88	no dilute	A-B-C-D	1	1980 (c)	17,800	133	0	0	133	5,809
7	1-2/89	2:1	B-C-D-A	1	1980 (c)	35,342	265	0	0	265	5,544
8	2-3/89	2:1	C-D-A-B	1	1980 (c)	34,040	255	0	0	255	5,289
9	4-5/89	2:1	D-A-B-C	1	1980 (c)	35,101	263	0	0	263	5,026
10	6/89	2:1	A-B-C	1	1885 (c)	10,900	78	13,200	31	109	4,917
11	8/89	2:1	B-C-A	1	1885 (c)	35,096	250	0	0	250	4,667
12	10/89	2:1	C-D-A-B	1	1885 (c)	33,363	238	0	02	238	4,429
13	10-11/89	2:1	D-A-B-C	2	1855 (c)	28,333	199	14,767	42	241	4,188
14	12/89	2:1	B-C-A	2	1810 (c)	33,873	232	19,180	131	363	3,825
						347,189	2,756	81,347	517	3,273	

1) Total curies of Cesium-137 reported in Safety Analysis Report (SAR) report decayed to 7-21-88 = 7,098 KCi minus curies of Cesium-137 processed.

2) Includes approximately 0.499 MCi Cesium-137 left in 32-inch heel in Tank 8D-2 at the end of supernatant processing estimated as follows:

Volume of 32 inch heel = 80,464 gallons
 Volume of solids in heel = 7,548 gallons
 (Ref.: DOE/NE-44139-14, Page A2)
 Volume of supernatant in heel = 72,916 gallons
 Curies of CS-137 in heel = 499 KCi

$$\frac{[(7.29 \text{ E}+04 \text{ gal})(3.785 \text{ E}+03 \text{ mL/gal})(1.81 \text{ E}+03 \text{ uCi/mL})]}{10^6 \text{ uCi/Ci}}$$

3) Cesium concentration in 8D-2 has been reevaluated. Based on analyses obtained from Tank 50-D-001, during column saturation. Reference MSWI-IE-338.