

R U N R E P O R T

INTEGRATED RADIOACTIVE WASTE TREATMENT SYSTEM

CAMPAIGN NO. 12, AUGUST 2nd, 1989 - OCTOBER 12, 1989

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RUN REPORT
IRTS
CAMPAIGN NO. 12

SUMMARY:

Integrated Radwaste Treatment System (IRTS) Campaign No. 12 was concluded on October 12, 1989 after processing approximately 33,363 gallons of 2D-2 liquid. The Supernatant Treatment System (STS) returned to a four column sequence used of C-D-A-B. The target dilution ratio was 1.4:1 with a nominal system flow rate of 6 GPM. The average Campaign No. 12 Decontamination Factor for STS was 67,430.

Liquid Waste Treatment System (LWTS) received a total of 12 batch transfers from STS totaling 106,478 gallons of process liquid.

Cement Solidification System (CSS) processed 25,084 gallons of concentrates and produced 626 drums at 39.0 gallons per drum plus 7 drums at 40.0 gallons per drum. Average drum dose rate was 37 mR/hr. The total CSS production, at the completion of Campaign No. 12 was 5,421 drums.

Table 1 shows a summary of run statistics. Process completion status at the end of this campaign is 41%.

Table 2 compares this campaign to the two previous campaigns. Campaign No. 12 processed more supernatant than Campaign No. 10, a three column run. Campaign No. 11 processed 5 percent more supernatant than Campaign No. 12.

DISCUSSION:**STS OPERATION**

Early in Campaign No. 12, a decrease in feed tank level (50D-001) was noted. The leak rate was measured to be approximately 1 percent per day. Investigation during the recirculation period was performed by opening the bleed valves on column feed and effluent isolation valves (X-01 and X-02B series). The feed valve on column A was observed to be leaking slightly. This valve was subsequently cycled several times and the leak stopped. Additionally, each column was independently removed from the recirculation sequence and subjected to the one-hour pressure decay test. All columns passed the test and the level in 50D-001 did not decrease.

The restart of Phase III of Campaign No. 12 was postponed until leak detection alarms on the supernatant transfer piping containment system (i.e., Rovanco Pipe) could be cleared. Three leak detectors were in alarm mode and did not clear upon opening the drain valves:

- 1) LAH 613/614 which detects liquid in the 4-inch containment for line #6-50-2 1/2-00-2 (supernatant return line to 8D-2).
- 2) LAH 615/616 which detects liquid in the 4-inch containment for line #6-50-1 1/2-140 (spare supernatant transfer line which is not in service.)
- 3) LAH 617/618 which detects liquid in the 20-inch containment line for all transfer lines.

The problem was originally thought to be caused by condensation of water vapor within the containment lines and not due to a supernatant leak. This theory was supported by low radiation readings obtained by surveying

the pipes in question in the M-8 pump pit. Further investigation found that most of the alarms were caused by water, short circuiting detector wires in the conduit and junction box. Approximately one quart of water was found inside a "weather tight" junction box. One short circuit inside the junction box was corrected and alarm 617 cleared. Other alarms cleared when warm dry air was forced into the conduit. Only alarm LAH 618 did not clear. Campaign No. 12, Phase III resumed on October 2, 1989. Critique minutes CM89113 have been issued to document this event.

In the remaining week of STS processing, individual column decontamination factors did not behave normally. Cesium 137 concentration in the effluent of column A was greater than the Cesium 137 input concentration. This phenomenon could be caused by the leaking valves discussed previously or by Cesium 137 eluting from the heel in column D. If similar abnormal decontamination factors occur in Campaign No. 13, to column B, the theory of elution from the column D heel will be supported. Elution may also explain why this campaign did not process as much supernatant as the previous campaign.

LWTS OPERATION:

Operation of the evaporator subsystem continued to produce steady and reliable result. No new problems were encountered during Campaign No. 12.

CSS OPERATION:

Operation of the Cement Solidification System continued to produce a quality product. The dry cement feed problems encountered in Campaign No. 11 did not reoccur in Campaign No. 12.

Two similar process upsets occurred during this campaign. Product drums leaked from lid penetrations while the drums were being loaded into the

Drum Cell. Drum No. 76240 leaked from the inspection port bung on September 7, 1989 (see Critique No. CM89104). Drum No. 76351 leaked from the fill spout lid seal on September 18, 1989 (see Critique No. CM89110). In both cases, immediate corrective actions stabilized the situation and long term corrective actions have been implemented to prevent reoccurrence of these problems. Faulty fill spout lid crimps caused the leak from drum number 76351. Changes and adjustments have been made to the lid crimper resulting in excellent crimper performance. Each crimp will continue to be inspected until we are confident that acceptable crimps will be produced.

Another process upset occurred on October 11, 1989 (see Critique No. CM89118) when approximately 1.5 gallons of cement/waste slurry spilled onto the top surface of drum number 76891. The spill was the result of two lids being placed on the drum. The lid handler automatically picked up one lid, but the second lid was not detected when the fill nozzle entered the drum. Corrective actions have been identified and are being implemented.

DRUM CELL OPERATION:

Evaluation of the space available in the Drum Cell was performed. Based on data from Campaign Nos. 1 through 12, the total number of drums to be produced was projected. This projection indicated that all CSS process drums evolving from Supernatant Treatment System (STS), and Sludge Mobilization System (SMS) operations will fit in the Drum Cell. However, because of the uncertainty of the prediction of drums resulting from SMS, a program was instituted to conserve as much space as possible in the Drum Cell. Part of this program is to increase the volume of waste that will be solidified in each drum. Previously, each drum contained a nominal waste loading of thirty nine gallons per drum. The last seven drums produced during this campaign contained a nominal forty gallons of waste. Continuation of this practice over the remainder of supernatant processing will result in a savings of approximately 180 drums.

The last two solidification batches from CSS were so low in Cs-137 activity that they qualified as "shield drums" for use in the Drum Cell stacking plan. This is directly attributable to the excellent Decontamination Factor (DF) being obtained in the STS during Campaign No. 12. For every "process drum" that qualifies as a "shield drum", one less cold shield drum must be produced and one more position in the Drum Cell pile becomes available for a process drum.

Radiation levels at selected areas around the Drum Cell are shown in Figure 2. The dose at both the crane maintenance area and the control room show an increase that can be related to the higher dose drums produced at the end of this campaign.

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 not typical of previous campaigns. The dip in the transfer DF appears to be caused by using 8D-1 liquid for flushing the columns. Acceptable product was produced, therefore using 8D-1 liquid for flushing will be used when necessary to control tank volume.

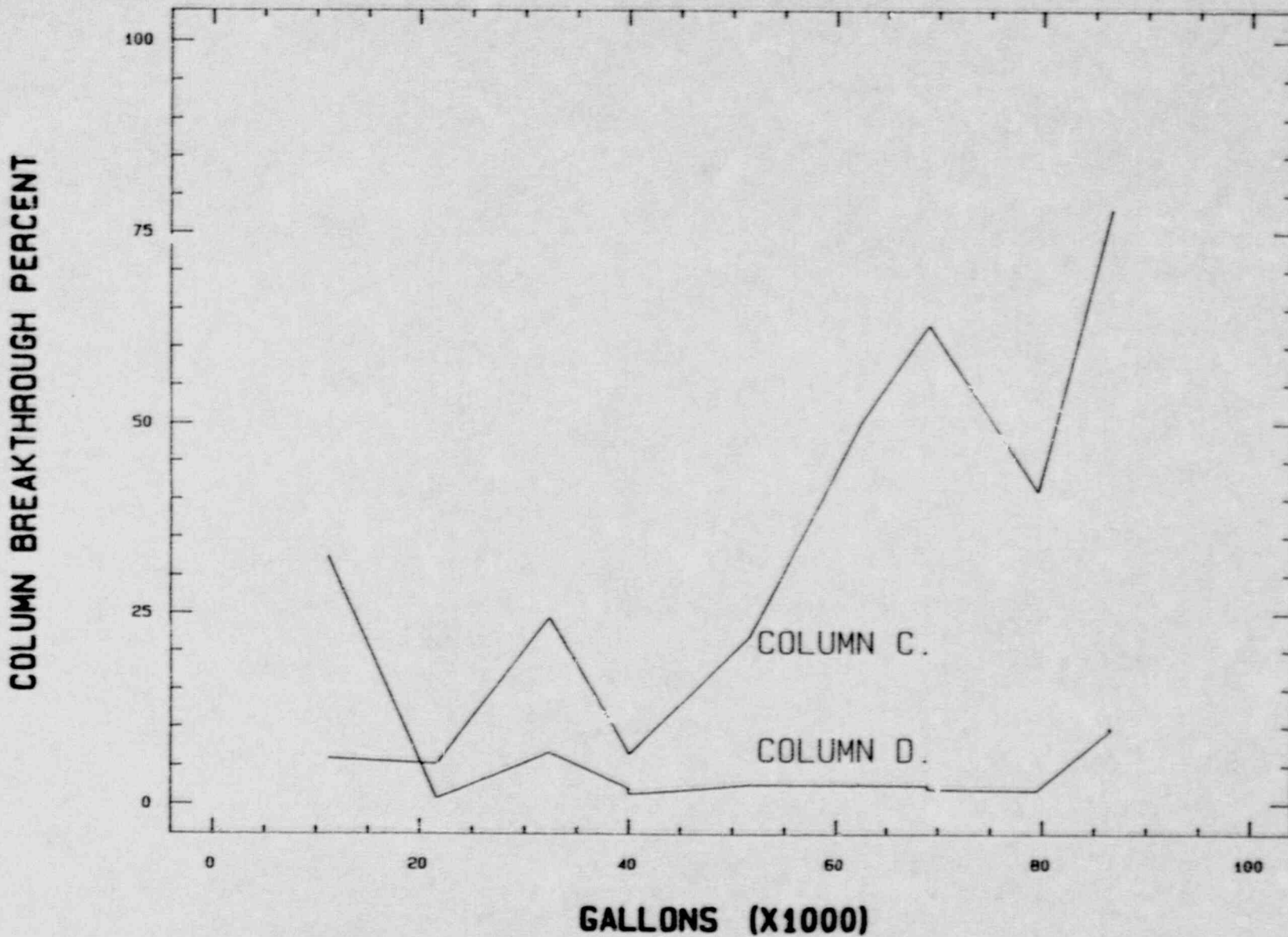
TANK LEVELS:

Campaign No. 12 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. 1-10 has been completed. All drums produced in Campaign Nos. 1-10 are Class "C" Low Level waste.

S T S
CAMPAIGN 12 BREAKTHROUGH CURVE



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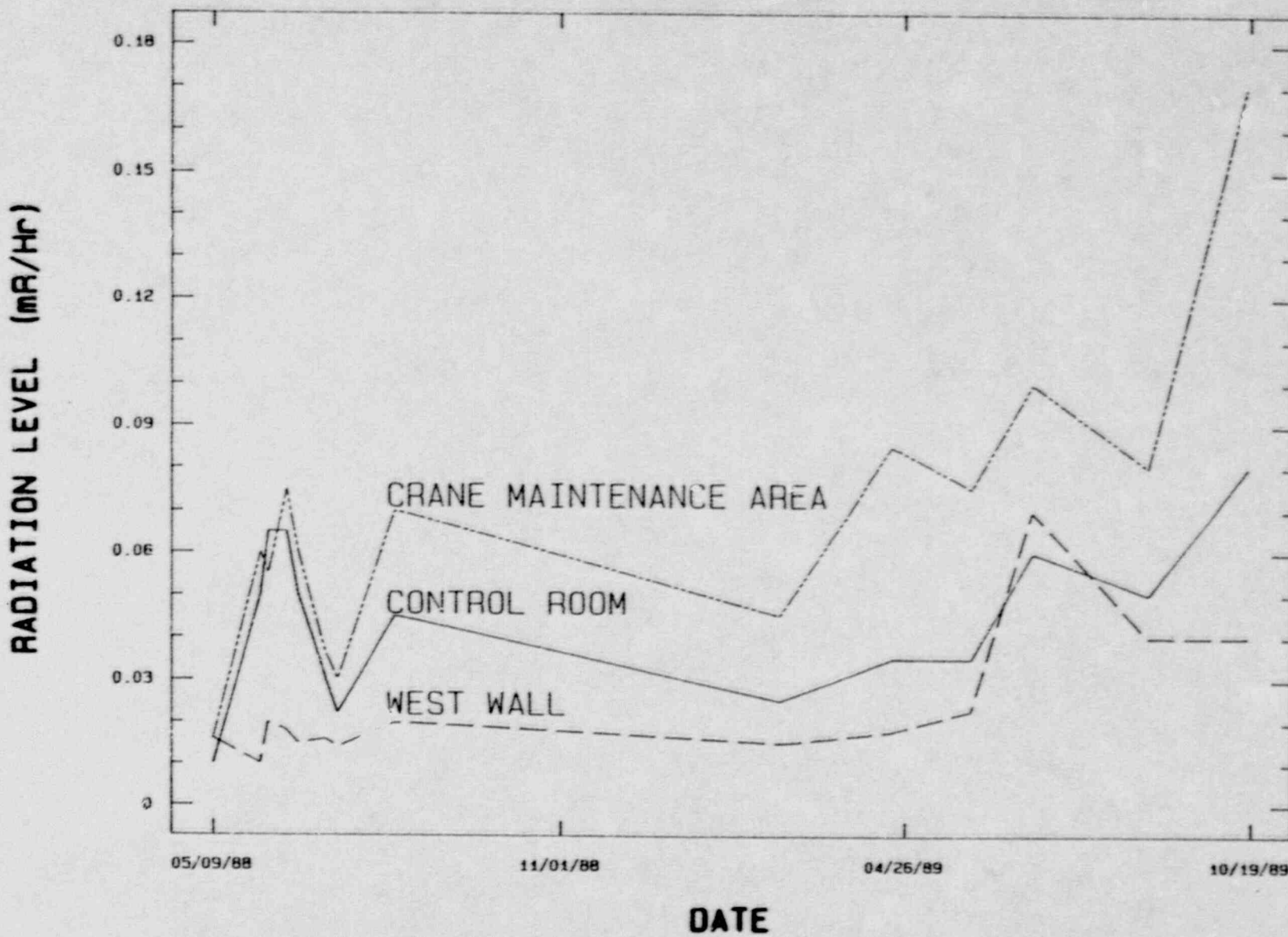
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FIGURE 1

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IRTS DRUM CELL RADIATION LEVELS



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FIGURE 2

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S T S

CAMPAIGN 12 DECONTAMINATION FACTOR

DECONTAMINATION FACTOR (X1000)

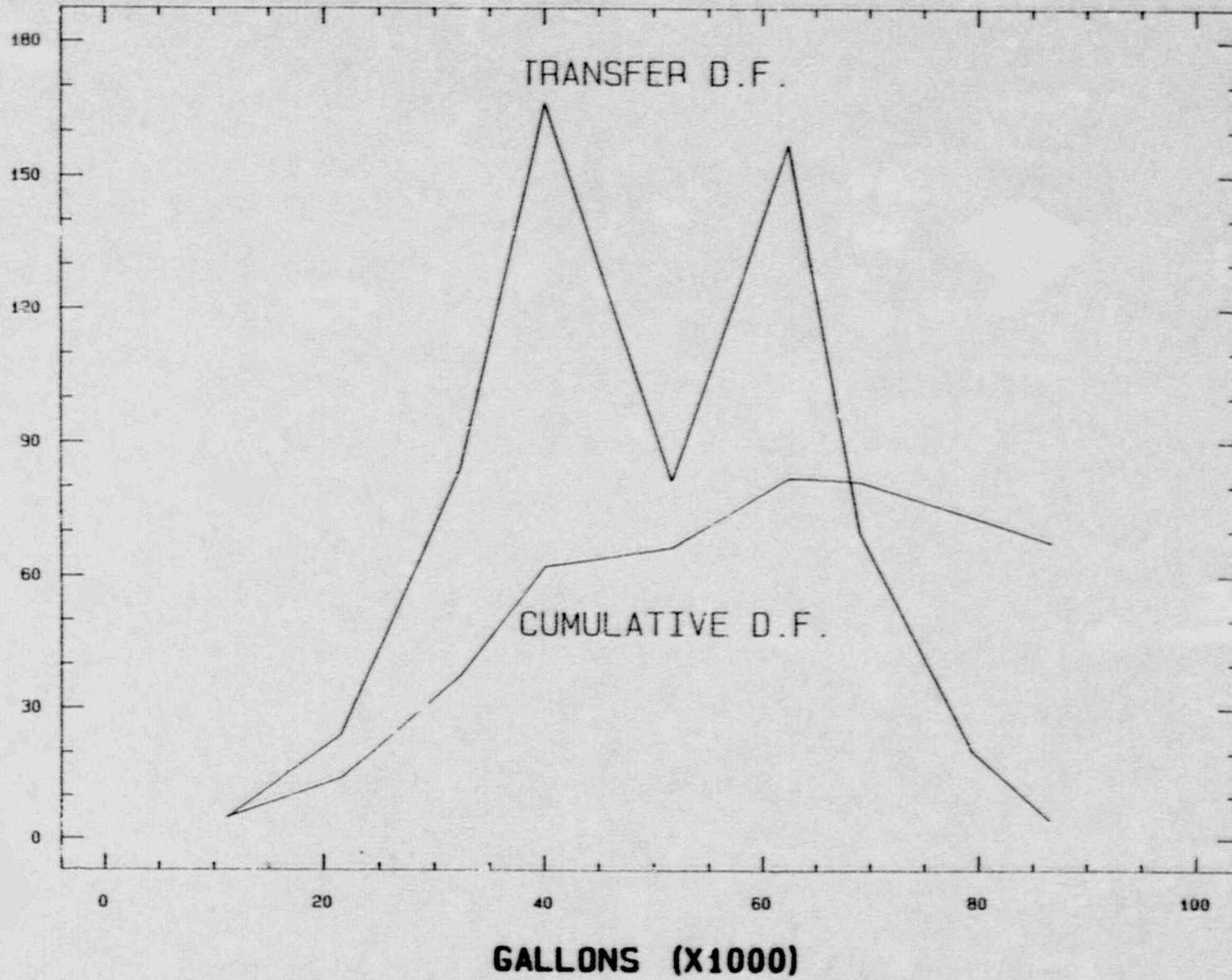


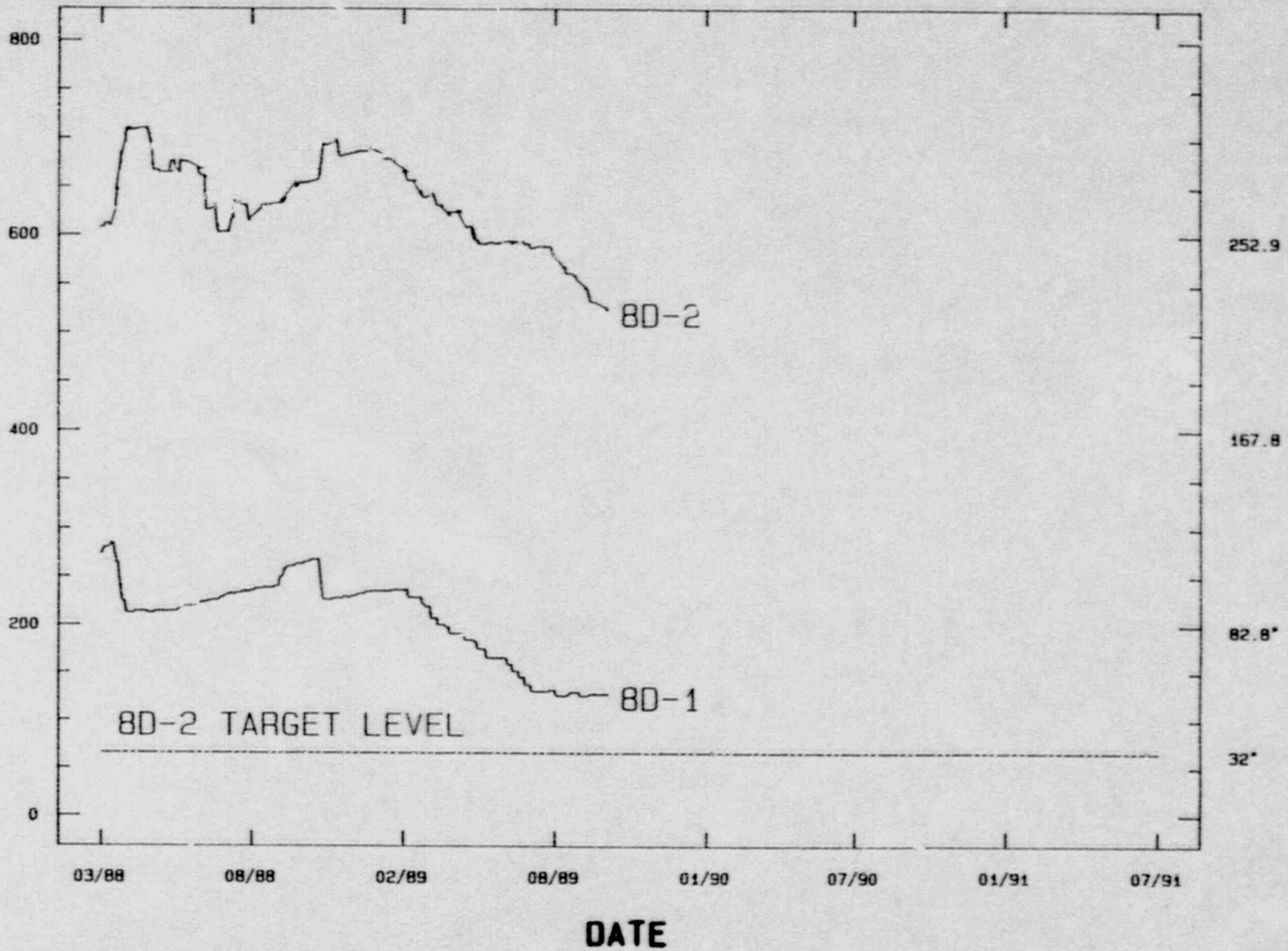
FIGURE 3

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

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GALLONS (x1000)



October 21, 1989

FIGURE 4

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TABLE 1
IRTS CAMPAIGN NO. 12 RUN REPORT
SUMMARY TABLE OF RUN STATISTICS

1. TRANSFERS 8D-3 TO 5D-15B			
A.	Campaign Nos. 1 thru 11	2,369,856 Litres	626,066 Gallons
B.	Campaign No. 12 Total	<u>380,349 Litres</u>	<u>100,478 Gallons</u>
	TOTAL TO DATE	2,750,205 Litres	726,544 Gallons
2. IRTS PROCESS VOLUMES			
A.	Campaign Nos. 1 thru 11	2,336,553 Litres	617,268 Gallons
	Total Feed to Evaporator		
B.	Campaign No. 12	<u>421,757 Litres</u>	<u>111,417 Gallons</u>
	Total Feed to Evaporator		
	TOTAL TO DATE	2,758,310 Litres	728,685 Gallons
C.	Campaign Nos. 1 thru 11	710,561 Litres	165,180 Gallons
	Total Concentrate		
D.	Campaign No. 12	<u>102,678 Litres</u>	<u>27,125 Gallons</u>
	Total Concentrate		
	TOTAL TO DATE	813,238 Litres	192,305 Gallons
3. DRUMS PRODUCED (B)(C)			
A.	Campaign Nos. 1 thru 11	4,778	
B.	Campaign No. 12	<u>643</u>	
	TOTAL TO DATE	5,421	
4. CURIES OF CESIUM 137 REMOVED FROM 8D-2			
A.	IRTS Campaign Nos. 1 thru 11		2,458.0 K Ci
B.	IRTS Campaign No. 12		<u>232.0 K Ci</u>
	TOTAL		2,690.0 K Ci
5. PROCESS COMPLETION			
A.	Curies Percent Complete:		
	$\frac{2,690.}{7,089. - 508.}$	= 0.409 or 41 percent	
B.	Drums Percent Complete:		
	$\frac{5,421}{13,000}$	= 0.417 or 42 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.

** There are also a total of 245 process drums which qualified as shield drums. There are 160 drums currently available for shield drum use.

TABLE 2
IRTS CAMPAIGN NO. 12 RUN REPORT
COMPARISON OF STATISTICS FROM PREVIOUS CAMPAIGNS TO THIS CAMPAIGN

	<u>CAMPAIGN NO. 10</u>	<u>CAMPAIGN NO. 11</u>	<u>CAMPAIGN NO. 12</u>
<u>S T S</u>			
Volume of 8D-2 Supernatant Processed (Gal.)	10,900 ^(a)	35,096	33,363
Total Volume Processed (Includes flush and dilution Water) (Gal.)	37,057	111,896	100,478
Column Breakthrough (%)			
- Lead Column	54.8	86.6	79
- 2nd Column	5.6	10	8.0
Average System DF	23,356	26,854	67,430
Average Cs-137 in Effluent (uCi/mL)	.1493	.062	.034
<u>L W T S</u>			
Concentrates			
- Volume (Gal.)	7,365	35,096 ^(b)	27,125
- Average Cs-137 (uCi/mL)	.627	.31	.26
<u>C S S</u>			
Drums Produced	148	642	643
Average Cs-137/Drum (Ci)	.0922	.045	.037
Average Drum Contact Dose Rate (mR/hr)	80	44	37

(a) An additional 2,400 gallons of supernatant for testing and 10,800 gallons of supernatant for saturation of Column A which was returned to 8D-2.

(b) Tank heels:
 5D-15A1 - 25 Gallons
 5D-15A2 - 15 Gallons
 70-D-1 - 70 Gallons

TABLE 3
I R T S CAMPAIGN NO. 12 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	8	9	10	11	12
A. Date	8/28/89	8/29/89	8/31/89	9/01/89	9/05/89	9/11/89	9/13/89	9/14/89	9/15/89	10/02/89	10/04/89	10/05/89
B. STS Flow Rate (gpm)	6.0	6.0	6.0	6.0	N/A	6.0	6.0	6.0	N/A	6.0	6.0	6.0
C. D-001 Sample No.	8903285	8903297	8903314	8903374	N/A	8903443	8903477	8903477	N/A	8903799	8903812	N/A
i. Cs-137 (uCi/mL)	724	913	888	848.0	N/A	795	838	827	N/A	876	839	N/A
ii. TDS (wt %)	13.19	14.7	14.40	14.78	N/A	13.63	14.32	14.55	N/A	15.35	14.67	N/A
iii. Density (gr/mL)	1.092	1.105	1.103	1.106	N/A	1.096	1.102	1.104	N/A	1.111	1.105	N/A
D. Cesium-137 Activity (Column Effluents) (uCi/mL)												
i. Lead Column C	42	46.8	217.0	54.0	176	174	419	521	318.5	358	655	658
ii. 2nd Column D	13.70	0.36	14.60	1.10	2.34	4.60	10.68	12.63	6.30	6.40	62.50	65.70
E. Column Breakthrough (%)												
i. Lead Column C	5.9	5.1	24.4	6.4	N/A	21.9	50.0	63.0	N/A	40.9	78.1	N/A
ii. 2nd Column D	32.3	0.8	6.7	2.0	1.3	2.6	2.5	2.4	2.0	1.8	9.5	10.0
F. 8D-3 Sample No.	8903289	8903313	8903332	8903380	8903399	8903450	8903485	8903538	8903583	8903800	8903819	8903845
i. Cs-137 (uCi/mL)	0.0795	0.0342	0.0102	0.0045	0.0054	0.0053	0.0052	0.0110	0.0138	0.0198	0.1680	0.3125
ii. TDS (wt %)	7.56	13.52	13.98	13.2	10.2	7.68	14.09	13.63	10.66	7.56	13.75	13.86
iii. Density (gr/mL)	1.043	1.095	1.099	1.092	1.066	1.044	1.100	1.096	1.070	1.043	1.097	1.098
G. STS System DF												
i. Transfer DF	4,990	24,300	84,200	166,000	0*	81,300	157,400	69,900	0*	20,500	4,650	0*
ii. Cumulative DF	4,990	14,300	37,500	62,300	0*	66,500	82,100	81,000	0*	73,000	67,400	67,400
H. 5D-15B Sample No.	8903296	8903322	8903366	8903401	8903433	8903466	8903527	8903566	8903700	8903809	8903831	8903368
i. Cs-137 (uCi/mL)	0.0937	0.0334	0.0115	0.0050	0.0075	0.0059	0.0055	0.0146	0.0112	0.0469	0.1940	0.2180
ii. TDS (wt %)	10.43	13.41	13.63	12.15	8.60	10.08	13.41	13.74	9.63	10.43	13.29	11.69
iii. Density (gr/mL)	1.068	1.094	1.095	1.083	1.052	1.065	1.094	1.097	1.061	1.068	1.093	1.079
I. Volume Received (Litres) in 5D-15B	42,389	39,426	40,489	29,082	15,150	43,889	40,489	25,219	14,923	39,443	26,709	22,319
J. Cumulative Volume** for Campaign (Litres)	42,389	81,815	122,304	151,386	151,386	195,275	235,764	260,983	260,983	300,426	327,135	327,135

* These are flush transfers. No DF calculated.

** Does not include flush of 52,392 litres from transfers 5, 9, and 12.

TABLE 4
I R T S CAMPAIGN NO. 12 RUN REPORT
DRUM TESTING RESULTS

CONCENTRATES BATCH	40	18	43	47
LWTS TANK	5D-15A1	5D-15A2	5D-15A1	5D-15A1
LAB ANALYSIS NO.	8903381	8903407	8903587	8903925
TOTAL SOLIDS %	39.98	40.21	38.03	39.75
Cs-137 CONCENTRATION (μ Ci/mL)	4.18 E-1	4.74 E-2	4.39 E-2	4.16 E-1
POUNDS CEMENT +CaNO ₃	95,444	24,084	99,458	68,096
NUMBER OF DRUMS	214	54	223	152
TOTAL GALLONS	8,346	2,106	8,697	35
CURIES PER DRUM (AVERAGE)	.062	.0070	.0065	.061
RADIATION DOSE (mR/hr) PER DRUM	60	7	7	60
PRESOLIDIFICATION RESULTS	>700 PSI	>700 PSI	>700 PSI	>700 PSI
IN-CELL TEST RESULTS	76226	76709	76436	76884
DRUM NO./PSI	>700	>700	>700	>700
Total Cement & CaNO ₃	287,082 LBS.			
Total Number of Drums	643			
Total Volume Solidified	25,084 Gallons			
Total Curies Solidified	24.37 Ci			

TABLE 5
I R T S CAMPAIGN NO. 12 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 9/8	50	199	4977
	9/11	8	8	4985
	9/18 to 9/22	57	283	5268
	10/10 to 10/13	51	153	5421

TABLE 5

IRTS CAMPAIGN NO. 12 RUN REPORT
CESIUM-137 PROCESSED

CAMPAIGN	DATE	Cs-137 CONCENTRATION IN 8D-2 uCi/mL	SUPERNATANT REMOVED (GALLONS)	Cs-137 REMOVED (KCi)	Cs-137 INVENTORY ^{(a)(d)} REMAINING IN 8D-2 (MCI)
1	5/88	2,860	24,185	203	6.895
2	6/88	2,600	15,800	155	6.740
3	7/88	2,600	26,356	259	6.481
4(f)	8/88	2,600	17,000	207	6.274
5A	9/88)				
5B	10/88)	2,400	0(b)	274(b)	6.000(b)
6	12/88	2,150	17,800	145	5.855
7(c)	1-2/89	2,150	35,342	288	5.567
8(c)	2-3/89	2,150	34,040	277	5.290
9(c)	4-5/89	2,150	35,101	286	5.004
10(c)(f)	6/89	1,840	10,900(e)	109	4.895
11(c)(f)	8/89	1,840	35,096	255	4.640
12(c)	10/89	1,840	33,363	232	4.408
			<u>289,863</u>	<u>2,690</u>	

- (a) Total curies of Cesium-137 reported in Safety Analysis Report (SAR) report decayed to 7-21-88 = 7.098 MCI minus curies of Cesium-137 processed.
- (b) Totals for Campaign Nos. 5A & 5B. Two columns were dumped, no supernatant transferred to LWTS.
- (c) Diluted runs at a nominal 2:1 dilution.
- (d) Includes approximately 0.508 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

Vol. of solids in heel = 7,548 gallons

(Ref.: DOE/NE-44139-14, Page A2)

Vol. of supernatant in heel = 72,916 gallons

Curies of Cs-137 in heel = 0.508 MCI

$$\frac{[(7.29 \text{ E}+04 \text{ gal})(3.785 \text{ E}+03 \text{ mL/gal})(1.84 \text{ E}+03 \text{ uCi/mL})]}{10^6 \text{ uCi/Ci}}$$

- (e) An additional 13,200 gallons were recycled back to Tank 8D-2.
- (f) Three column campaigns.