

R U N R E P O R T

INTEGRATED RADIOACTIVE WASTE TREATMENT SYSTEM

CAMPAIGN NO. 18, June 18, 1990 - July 26, 1990

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SRC3740

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RUN REPORT  
IRTS  
CAMPAIGN NO. 18

SUMMARY:

Integrated Radwaste Treatment System (IRTS) campaign 18 was initiated on June 18, 1990 and concluded on July 26, 1990 after processing approximately 39,804 gallons of 8D-2 liquid. The target dilution ratio was 3.0:1 with a nominal system flow rate of 6 gpm. This dilution ratio is based on the original 39 wt% concentration of 8D-2 supernatant. The average campaign 18 Decontamination Factor for STS was 33,642.

As of the end of campaign 18, the total volume of supernatant removed from 8D-2 is 512,107 gallons, with approximately 271,656 gallons remaining to be processed to reduce the 8D-2 tank level down to a 32-inch heel.

Liquid Waste Treatment System (LWTS) received a total of 12 batch transfers from STS totaling 112,510 gallons of process liquid.

Cement Solidification System (CSS) processed 21,960 gallons of concentrates and produced 549 drums at 40 gallons of waste per drum. Average drum dose rate was 20 mR/hr. The total CSS production, at the completion of campaign 18 was 9,000 drums.

Table 1 shows a summary of run statistics. Process completion status at the end of this campaign is 69% based on a total drum production of 13,000 drums.

DISCUSSION:STS OPERATION

Campaign 18 STS Operations commenced on June 18, 1990 and consisted of three STS operating weeks, with a total supernatant throughput of 39,804 gallons. STS was operated at a nominal flow rate of 6 gpm and a dilution ratio of 3.0:1 water to supernatant (referenced to 39 weight percent supernatant).

STS started phase I of campaign 18 on June 18, 1990 at 0030 hours with a four column sequence of B-C-D-A. The system was temporarily placed in standby at 0800 hours due to frequent power interruptions from a passing thunderstorm. The system was restarted at 1000 hours. On June 19, 1990 at 1045 hours, the STS flow rate was adjusted down to 4 gpm. The main plant utility room boiler was down with instrumentation problems and no steam was available to the LWTS evaporator. The STS flow rate was maintained at this reduced flow rate until June 20, 1990 at 0630 to allow the LWTS time to work off 5D-15B inventory once the boiler was returned to service. The STS completed phase I of campaign 18 on June 22, 1990 with 14,001 gallons processed.

During phase I of campaign 18 it was noted that the effluent from column D had a consistently higher cesium concentration than the effluent from column C. The effluent of column D was at  $3.6 \text{ E-1 uCi/mL}$  at the completion of phase I although column C, which was feeding column D maintained an effluent concentration of  $7.2 \text{ E-2 uCi/mL}$ . This "bleeding" from column D indicated that there was some amount of spent zeolite remaining in the column after sparging. Due to this "bleeding", column D was placed off-line and vented for the remainder of campaign 18.

Phases II and III of campaign 18 for STS were run with a three column sequence of B-C-A. These phases ran smoothly and concluded on July 13 with 39,804 gallons of supernatant processed. At the completion of campaign 18, the lead column was at 65 percent breakthrough or 87 percent loaded.

The smooth operation of STS through campaign 18 is highlighted when the other activities occurring on the HLW tank farm during that time frame are considered. These included excavation and electrical tie-ins by construction contractors and testing of particulate transmission from the PVS stack by S/EA.

Following termination of campaign 18, column B was sluiced out through the J-nozzle. The column was then dewatered and the bottom plug removed utilizing the remote hydraulic arm installed in the 8D-1 M-4 riser. The remaining zeolite heel was then washed out of the column through the open bottom dump valve.

A reversing motor was installed on the plug removal tool for servicing column B to maintain the dose to personnel As-Low-As-Reasonably-Achievable (ALARA). The reversing motor was utilized to avoid having to bring the hydraulic arm up into the riser to switch tooling. During the preparation for the installation of the new tooling, the camera mast in the 8D-1 M-4 riser separated at a weld joint but was prevented from falling into tank 8D-1. (See UOR 90-11-ST5-2) The mast end and camera were successfully retrieved and a new redesigned mast was installed. Total personnel exposure for the recovery effort was less than the original estimate. This was accomplished in part by removing the majority of the spent zeolite from column B using the J-nozzle, spreading the spent zeolite pile in 8D-1 and adding approximately 6 inches (14,000 gallons) of demineralized water to tank 8D-1 for shielding.

LWTS OPERATION

Operation of the High TDS System, specifically Evaporator 31017 and its associated subsystems, was satisfactory throughout campaign 18. Processing was interrupted at the beginning of campaign 18 due to the loss of the main plant utility room boiler. The evaporator was placed in standby for approximately 11 hours due to loss of steam supply.

Progress was made in identifying and isolating the source of the "valve reset alarms". The nuisance alarms on I/O Rack 104 are down to approximately twice per shift.

Slow processing and low steam flow rates through evaporator 31017 required a thorough examination of the condensate return system. The pressure powered pump internals and float mechanism were disassembled and found to be in good condition. The pressure powered pump was, however, installed with no upstream trap or vent. These components will be installed in the future, making the system conform to the manufacturer's recommended arrangement. In the meantime, the upstream knockout pot was reinstalled to cool the condensate before collection.

A middle of the run change in the method used by the Analytical and Process Chemistry Lab (A&PC) to calculate the Total Dissolved Solids (TDS) in the evaporator concentrates required adjustments in 71-DIC-029 (Evaporator Density Controller) setpoint, as well as dilution of four batches of concentrates.

### CSS OPERATION

The High Shear Cement Solidification System encapsulated 21,960 gallons of concentrates, producing a total of 549 drums of low level waste. A grand total of 9,000 drums have been processed to date. During campaign 18, a total of 108 low dose shield drums, suitable for placement in the Drum Cell top layer, were produced and have been segregated in the Drum Cell.

Cement "blowby" of 30 pounds was noted on the first batch of campaign 18. The second batch of the drum was adjusted accordingly and no other instances of "blowby" were encountered.

A failure of the main plant emergency electrical power system on July 7, 1990 caused CSS to be placed in standby per OSR-GP-3. Refer to UOR 90-12-WV-1 for further discussion of this occurrence.

During operation in the "manual" mode, the sodium silicate addition was omitted from the second batch of drum #79835. Critique CM90077 was held and the drum set aside as suspect.

Due to operator error while inputting a setpoint, drum #79915 was produced on July 25, 1990 with an additional 100 pounds of cement/ $\text{CaNO}_3$  blend added to the second batch. Due to the low water/cement ratio, this drum was set aside as "suspect" at the Drum Cell. For more details see Critique CM90093.

### DRUM CELL

Prior to the start of campaign 18, Kranco, the drum cell crane supplier, leveled the drum cell crane rails. An inspection of all welds and joints was performed in accordance with CMAA Standard #70.



During the campaign, the crane bridge camera picture was lost. An extensive troubleshooting effort determined that a computer circuit board in the camera had failed. A computer board from a seldom used wall camera was installed in the crane bridge camera until a spare board could be procured. No drum placement time was lost during the repair period.

#### 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:

This campaign continued to reduce the volume 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. This figure shows a slight increase in 8D-1 for this campaign. This was due to the water added for shielding during the camera mast repairs. The level in 8D-1 will be maintained at a minimum of 50 inches for ballast and shielding purposes. A target level of 32 inches for completion of supernatant processing is shown for 8D-2.

PRODUCT ACCEPTANCE:

The waste form classification analyses for drums produced is as follows:

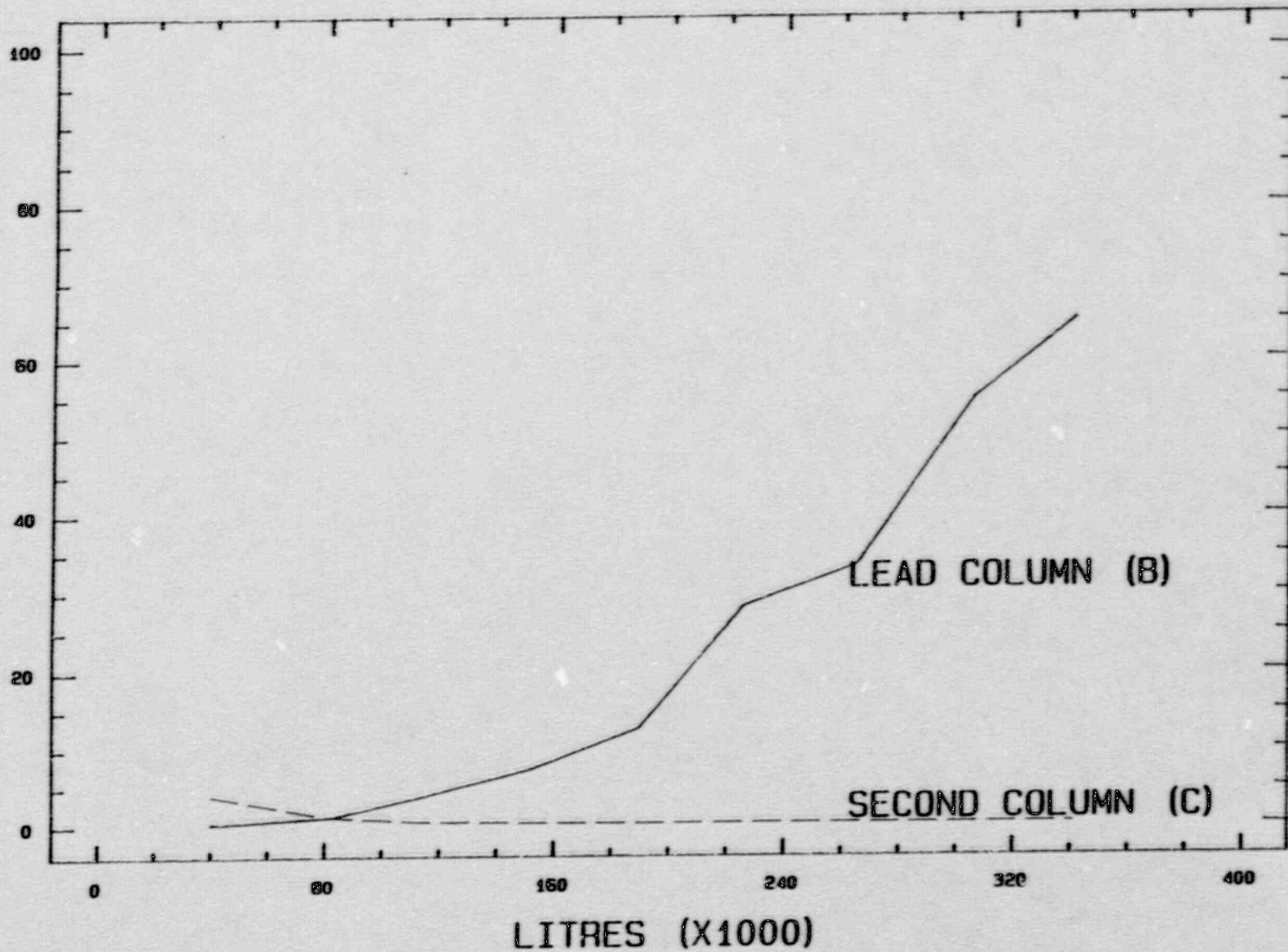
- Campaign 11, Class "C" Low Level Waste; Verification complete.
- Campaign 12, Class "C" Low Level Waste; Verification complete.
- Campaign 13, Class "C" Low Level Waste; Verification in progress.
- Campaign 14, QA update in progress.
- Campaign 15, Awaiting QA update.
- Campaign 16, Awaiting QA update.
- Campaign 17, Awaiting QA update.

Table 7, "Summary of Suspect Drums and Test Results" contains a list of all drums that have not been produced in accordance with the Process Control Plan (PCP).

FIGURE 1

### STS BREAKTHROUGH CURVE

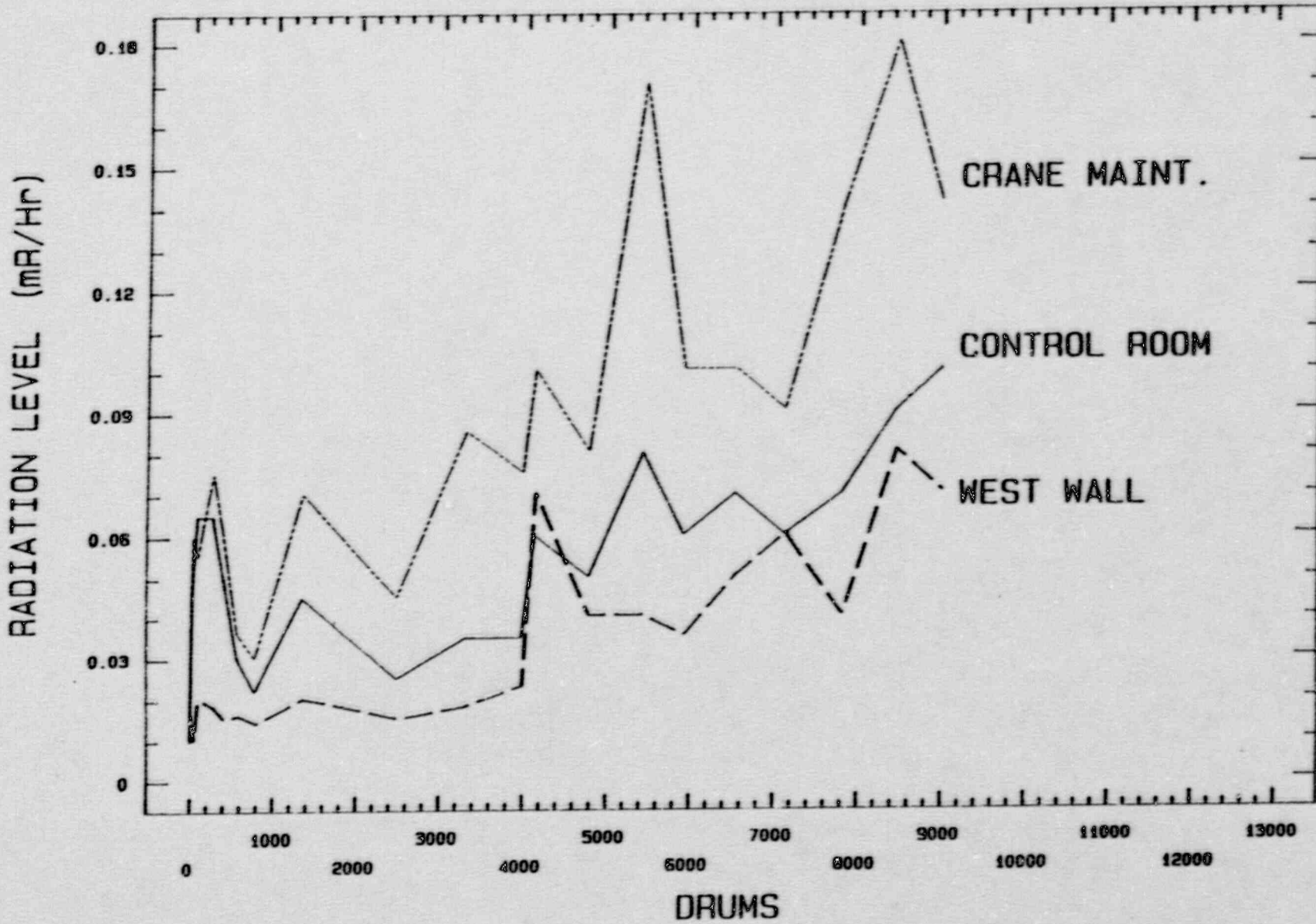
COLUMN BREAKTHROUGH PERCENT



# DRUM CELL RADIATION LEVELS

September 25, 1990

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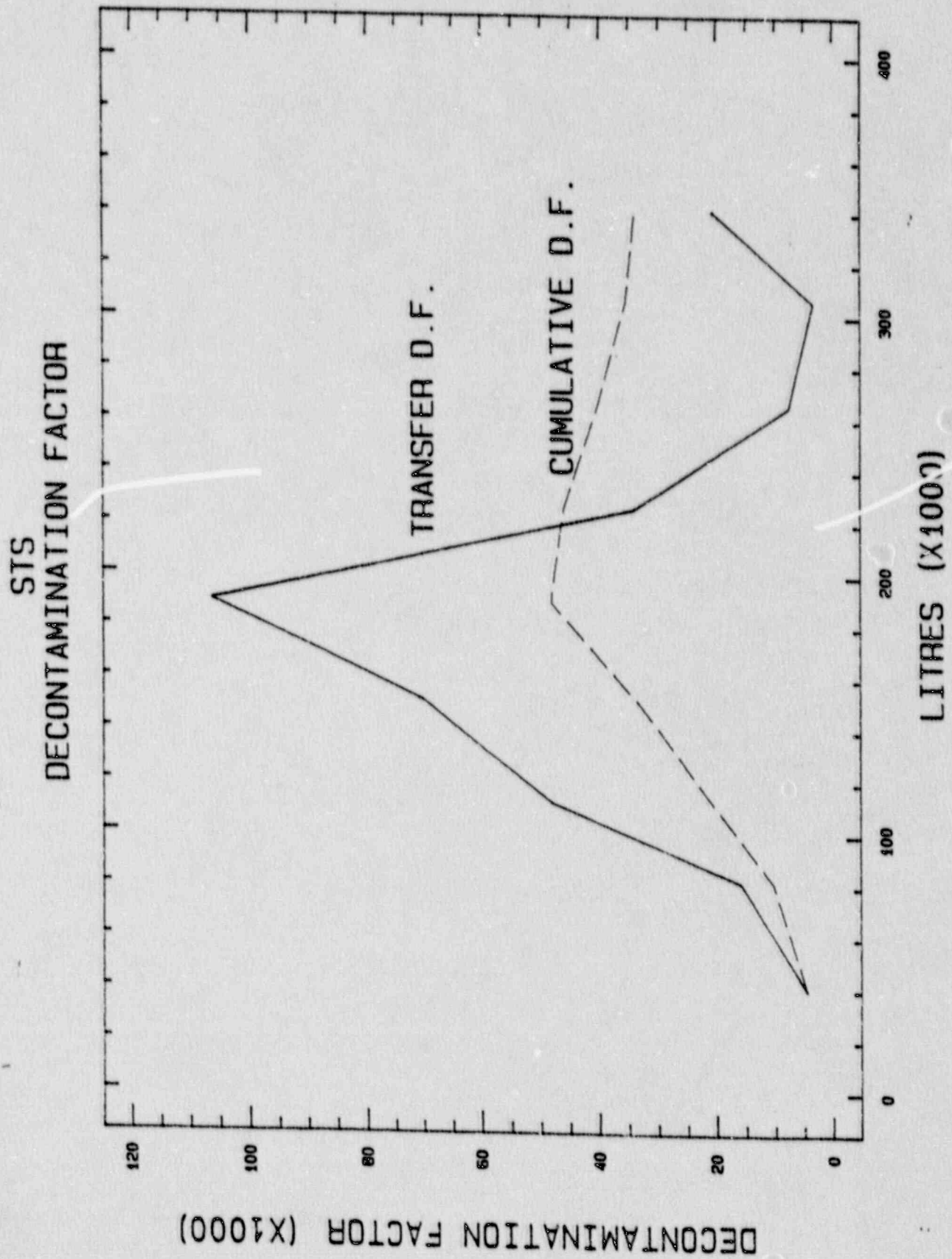


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FIGURE 2

DC:90:0099

FIGURE 3



# IRTS HIGH LEVEL WASTE TANKS 8D-1 & 8D-2

GALLONS (X1000)

-11-

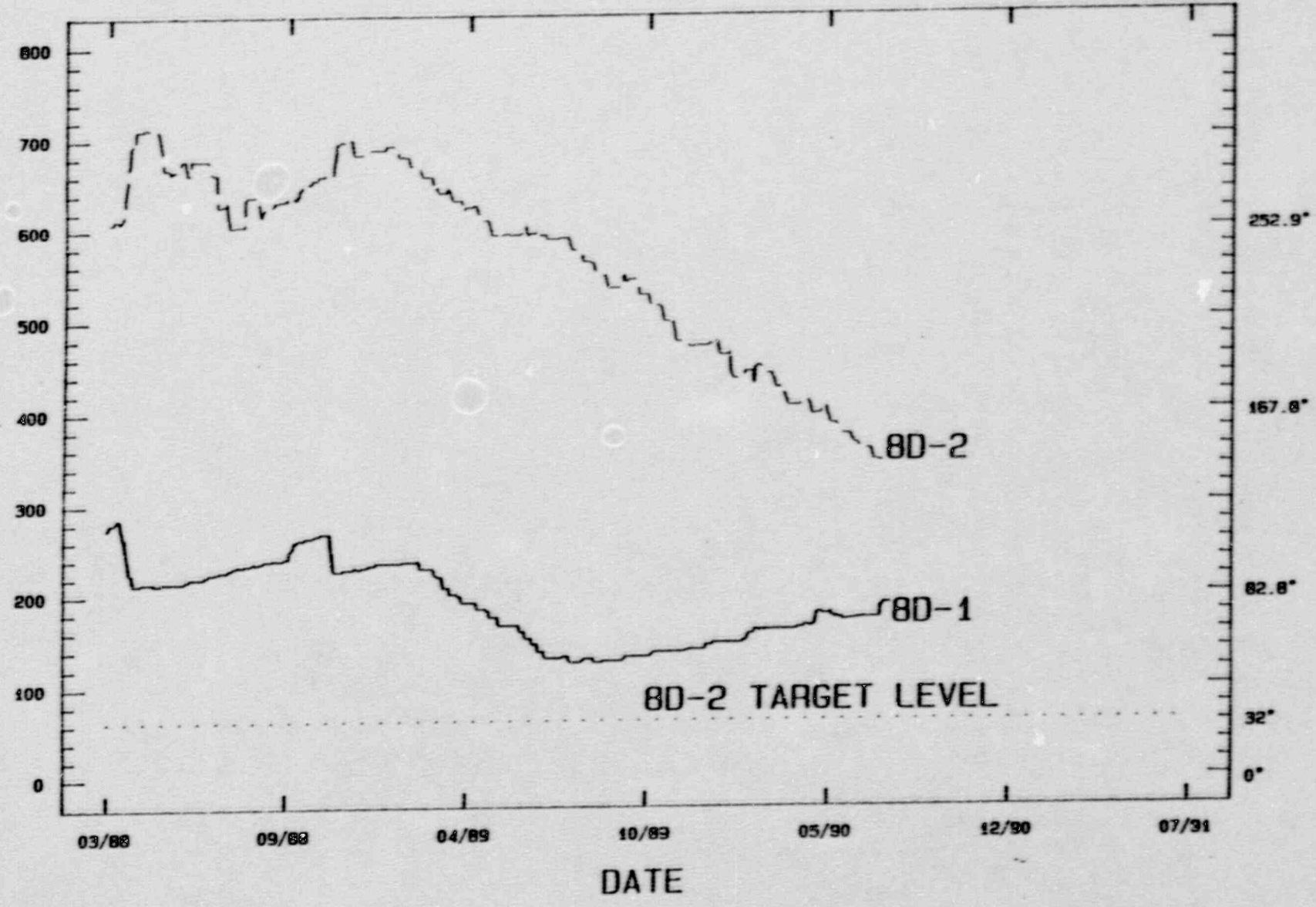


FIGURE 4

TABLE 1  
IRTS CAMPAIGN NO. 18 RUN REPORT  
SUMMARY TABLE OF RUN STATISTICS

1. TRANSFERS 8D-3 TO 5D-15B			
A.	Campaign Nos. 1 thru 17	4,813,237 L	1,271,661 gal.
B.	Campaign No. 18 Total	<u>425,897 L</u>	<u>112,510 gal.</u>
	TOTAL TO DATE	5,239,134 L	1,384,171 gal.
2. LWTS PROCESS VOLUMES			
2.1 Total Feed to Evaporator			
A.	Campaign Nos. 1 thru 17	4,825,375 L	1,274,733 gal.
B.	Campaign No. 18	<u>431,462 L</u>	<u>113,981 gal.</u>
	TOTAL TO DATE	5,256,837 L	1,388,714 gal.
2.2 Total Concentrate			
A.	Campaign Nos. 1 thru 17	1,182,445 L	312,370 gal.
B.	Campaign No. 18	<u>82,204 L</u>	<u>21,747 gal.</u>
	TOTAL TO DATE	1,264,649 L	334,117 gal.
3. DRUMS PRODUCED*			
A.	Campaign Nos. 1 thru 17	8,451	
B.	Campaign No. 18	<u>549</u>	
	TOTAL TO DATE	9,000	
4. CURIES OF CESIUM 137 REMOVED FROM 8D-2			
A.	IRTS Campaign Nos. 1 thru 17		4,334 K Ci
B.	IRTS Campaign No. 18		<u>270 K Ci</u>
	TOTAL		4,604 K Ci
5. PROCESS COMPLETION			
A.	Curies Percent Complete:		
	$\frac{4604}{7,089-489}$	= 0.698 or 69.8 percent	
B.	Drums Percent Complete:		
	$\frac{9,000}{13,000}$	= 0.692 or 69.2 percent	
*	Includes 7 drums removed from pile and core bored (#72847, 72791, 72949, 71004, 72813, 71144, 72835) which are now located in Lag Storage.		

TABLE 2  
IRTS CAMPAIGN NO. 18 RUN REPORT  
COMPARISON OF STATISTICS FROM PREVIOUS CAMPAIGNS TO THIS CAMPAIGN

	<u>CAMPAIGN NO. 16</u>	<u>CAMPAIGN NO. 17</u>	<u>CAMPAIGN NO. 18</u>
<u>S T S</u>			
Volume of 8D-2 Supernatant <sup>(a)</sup> Processed (Gal.)	46,578	45,236	39,804
Total Volume Processed (Includes flush and dilution Water) (Gal.)	141,446	142,616	112,510
Column Breakthrough (%)			
- Lead Column	87	75	65
- 2nd Column	.098	0.2	1
Average System DF	27,900	34,401	33,642
Average Cs-137 in Effluent (uCi/mL)	0.040	.032	0.02
<u>L W T S</u>			
Concentrates			
- Volume (Gal.) <sup>(b)</sup>	27,486	26,134	21,747
- Average Cs-137 (uCi/mL)	.16	.22	.11
<u>C S S</u>			
Drums Produced	684	643	549
Average Cs-137/Drum (Ci)	0.024	.028	.021
Average Drum Contact Dose Rate (mR/hr)	26	32	20

(a) See Table 6 for volume of supernatant recycled.

(b) Tank heels:

	<u>CAMPAIGN 16</u>	<u>CAMPAIGN 17</u>	<u>CAMPAIGN 18</u>
5D-15A1 - 20 Gallons	20 Gallons	20 Gallons	20 Gallons
5D-15A2 - 2 Gallons	2 Gallons	2 Gallons	2 Gallons
70-D-1 - 150 Gallons	40 Gallons	50 Gallons	50 Gallons
TOTAL	172 Gallons	62 Gallons	72 Gallons



TABLE 3  
I R T S CAMPAIGN NO. 18 RUN REPORT  
DETAILED TABLE OF RUN STATISTICS

## COLUMN SEQUENCE: A-B-C-D

Transfer 8D-3 to 5D-15B	1	2	3	4	5	6	7	8	9	10	11	12
A. Date	6/18/90	6/20/90	6/21/90	6/22/90	6/25/90	6/26/90	6/28/90	6/29/90	7/10/90	7/11/90	7/12/90	7/16/90
B. STS Flow Rate (gpm)	6.0	6.0	6.0	Flush	6.0	6.0	6.0	Flush	6.0	6.0	6.0	FLUSH
C. D-001 Sample No.	9001879	9001910	9001929	9001955	9001974	9001996	9002010	9002026	9002066	9002087	9002106	9002142
i. Cs-137 (uCi/mL)	430	560	535	529.0	556	535	525	461	547.0	555	555	109.0
ii. TDS (wt %)	9.97	11.69	11.92	11.57	12.03	11.46	11.34	10.77	11.7	11.80	11.32	10.6
iii. Density (gr/mL)	1.064	1.079	1.081	1.078	1.082	1.077	1.076	1.071	1.1	1.080	1.080	1.1
D. Cesium-137 Activity (Column Effluents) (uCi/mL)												
i. Lead Column A	1.50	6.7	19.0	25.6	40.50	67.30	95.00	130.00	183.0	300	300	N/A
ii. 2nd Column B	0.07	0.07	0.08	0.07	0.07	0.07	0.31	0.26	0.10	0.34	0.44	0.65
E. Column Breakthrough (%)												
i. Lead Column A	0.3	1.2	3.6	4.8	7.3	12.6	18.1	28.2	33.5	54.1	55.7	N/A
ii. 2nd Column B	4.8	1.0	0.4	0.3	0.2	0.1	0.3	0.2	0.1	0.1	0.1	N/A
F. 8D-3 Sample No.	9001889	9001915	9001939	9001960	9001978	9002000	9002020	9002035	9002074	9002095	9002117	9002151
i. Cs-137 (uCi/mL)	0.0671	0.0319	0.0108	0.0087	0.0049	0.0045	0.0141	0.0040	0.0500	0.1680	0.0268	0.0514
ii. TDS (wt %)	6.99	10.66	11.57	11.8	7.68	10.43	10.43	10.31	8.09	11.46	11.27	11.3900
iii. Density (gr/mL)	1.038	1.070	1.078	1.080	1.043	1.068	1.068	1.067	1.048	1.077	1.080	1.0810
G. STS System DF												
i. Transfer DF	4,383	15,875	47,949	N/A	70,038	106,354	33,992	N/A	7,351	3,199	20,617	N/A
ii. Cumulative DF	4,383	10,248	20,467	20,467	33,362	48,031	45,771	45,771	40,020	35,141	33,642	33,642
H. 5D-15B Sample No.	9001897	9001936	9001953	9001970	9001987	9002009	9002025	9002039	9002081	9002111	9002141	9002165
i. Cs-137 (uCi/mL)	0.0620	0.0278	0.0159	0.0083	0.0053	0.0046	0.0040	0.0031	0.0337	0.0230	0.0297	0.0345
ii. TDS (wt %)	8.82	10.31	10.77	10.54	9.28	9.97	10.31	8.82	9.05	10.19	11.03	9.67
iii. Density (gr/mL)	1.054	1.067	1.071	1.069	1.058	1.064	1.067	1.054	1.056	1.071	1.078	1.067
I. Volume Received (Litres) in 5D-15B	39,952	41,643	30,340	33,346	39,357	38,050	36,320	21,795	39,723	40,542	35,210	29,619
J. Cumulative Volume* for Campaign (Litres)	39,952	81,595	111,935	111,935	151,292	189,342	225,662	225,662	265,385	305,927	341,137	341,137

\* Does not include flush (see Row "B") transfers.

**TABLE 4**  
**I R T S CAMPAIGN NO. 18 RUN REPORT**  
**DRUM TESTING RESULTS**

CONCENTRATES BATCH	67	68	69	70	71
LWTS TANK	5D-15A1	5D-15A2	5D-15A2	5D-15A1	5D-15A2
LAB ANALYSIS NO.	9002005	9002038	9002150	9002157	9002176
TOTAL SOLIDS %	40.32	40.55	39.38	40.1	39.14
Cs-137 CONCENTRATION (uCi/mL)	2.17 E-01	2.83 E-02	2.44 E-02	1.38 E-01	1.52 E-01
POUNDS CEMENT +CaNo <sub>3</sub>	94,392	49,248	16,416	72,504	17,784
NUMBER OF DRUMS	207	108	36	159	39
TOTAL GALLONS	8,280	4,320	1,440	6,360	1,560
CURIES PER DRUM (AVERAGE)	0.033	0.004	0.004	0.021	0.023
RADIATION DOSE (mR/hr) PER DRUM	30	6	5	19	22
PRESOLIDIFICATION RESULTS	>700 PSI	>700 PSI	>700 PSI	>700 PSI	>700 PSI
IN-CELL TEST RESULTS DRUM NO./PSI	79518 >700 PSI	79878 >700 PSI	79961 >700 PSI	79700 >700 PSI	80039 >700 PSI
Total Cement & CaNo <sub>3</sub>	250,344		LBS.		
Total Number of Drums	549				
Total Volume Solidified	21,960		Gallons		
Total Curies Cs-137 Solidified	11.62		Ci		

TABLE 5

I R T S CAMPAIGN NO. 18 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 to 12/15	67		6532
Campaign #15	1/22 to 2/14	59		7124
Campaign #16	3/12 to 4/16	42		7808
Campaign #17	5/08 to 6/15	60		8451
Campaign #18	6/28	65		
	6/29	41	106	8557
	7/2	55		
	7/3	53		
	7/5	51		
	7/6	52	211	8768
	7/16	58		
	7/17	50		
	7/18	54		
	7/19	51	213	8981
	7/25	19	19	9000

TABLE 6  
IRTS CAMPAIGN NO. 19 RUN REPORT  
STS PROCESS HISTORY

CAMPAIGN	DATE	NOMINAL DILUTION RATIO	COLUMN SEQUENCE	COLUMN(S) DUPPED	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 LMTS GALLONS	Cs-137 REMOVED KCi	AND RECYCLED TO 8D-2 GALLONS	Cs-137 REMOVED KCi		
1	5/88	no dilute	B-C-D-A	B	2860	24,185	262	0	0	262	6,836
2	6/88	no dilute	C-D-A-B	C	2600	15,800	155	0	0	155	6,681
3	7/88	no dilute	D-A-B-C	D	2600	26,356	259	0	0	259	6,422
4	8/88	no dilute	A-B-C	A	2600	17,000	167	4,000	39	206	6,215
5	9-10/88	no dilute	N/A	B&C	2400	0	0	30,200	274	274	5,942
6	12/88	no dilute	A-B-C-D	A	1980	17,800	133	0	0	133	5,809
7	1-2/89	2:1	B-C-D-A	B	1980	35,342	265	0	0	265	5,544
8	2-3/89	2:1	C-D-A-B	C	1980	34,040	255	0	0	255	5,289
9	4-5/89	2:1	D-A-B-C	D	1980	35,101	263	0	0	263	5,026
10	6/89	2:1	A-B-C	A	1885	10,900	78	13,200	31	109	4,917
11	8/89	2:1	B-C-A	B	1885	35,096	250	0	0	250	4,667
12	10/89	2:1	C-D-A-B	C	1885	33,363	238	0	02	238	4,429
13	10-11/89	2:1	D-A-B-C	D&A	1855	28,333	199	14,767	42	241	4,188
14	12/89	2:1	B-C-A	B&C	1810	33,873	232	19,180	131	363	3,825
15	1-2/90	2:1	D-A-C	D&A	1810	33,300	228	34,434	202	430	3,395
16	3-4/90	3.6:1	C-A-B	C	1790	46,578	316	0	0	316	3,079
17	6/90	3.6:1	A-B-C-D	A	1790	45,236	315	1,458	7	315	2,764
18	8/3/90	3.0:1	B-C-D-A	B	1790	39,804	270	0	0	270	2,494
						512,107	3,885	117,239	726	4,608	

(a) 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.

(b) Includes approximately .489 kCi 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 = 489 KCi

$[(7.29 \text{ E}+04 \text{ gal})(3.785 \text{ E}+03 \text{ mL/gal})(1.79 \text{ E}+03 \text{ uCi/mL})]$

$10^6 \text{ uCi/Ci}$

TABLE 7  
IRTS CAMPAIGN NO. 18 RUN REPORT  
SUMMARY OF SUSPECT DRUMS

DATE PRODUCED	CAMPAIGN NUMBER	DRUM SERIAL NUMBER	CRITIQUE NUMBER	NON-CONFORMANCE REPORT	DESCRIPTION OF SUSPECT CONDITION
7/29/88	3	72847	CM88083	NR 88-055	One batch in drum produced without sodium silicate.
2/06/89	7	73033	CM89013	NR 89-011	
5/10/89	9	74014	CM89056	N/A	
4/12/90	16	78922	CM90049	NR 90-017	
6/29/90	18	79835	CM90077	N/A	
8/11/89	11	75903	CM89101	NR 89-066	One gallon of raw waste added on top of finished product.
1/23/89	7	71397	N/A	NR 89-015	Low water-to-cement ratio (i.e. 0.526). Acceptable range is 0.54 to 0.70.
11/20/89	14	77074	CM89135	NR 89-148	Incomplete antifoam addition to mixer.
14	77073				
14	77314				
14	77305				
14	77304				
14	77405				
14	77331				
14	77401				
14	77330				
14	77333				
14	77344				
14	77345				
14	77402				
14	77404				
14	77403				
14	77328				
14	77303				
14	77399				
14	76994				
14	77212				
14	77228				
14	77222				
7/05/88	2	71542	CM90042	N/A	Low water-to-cement ratio.
7/24/88	3	72539	CM90042	N/A	
8/23/88	4	72331	CM90042	N/A	
10/10/89	12	76392	CM90042	N/A	
11/20/89	14	77401	CM90042	N/A	
11/20/89	14	77213	CM90042	N/A	
12/15/89	14	77829	CM90042	N/A	
12/14/89	14	77523	CM90042	N/A	
3/26/90	16	78091	CM90042	N/A	
4/19/90	16	78671	N/A	NR 90-019	
7/25/90	18	79915	CM90093	N/A	