RUN REPORT

INTEGRATED RADIOACTIVE WASTE TREATMENT SYSTEM

CAMPAIGN NO. 8, FEBRUARY 27 - APRIL 13, 1989

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SRS2871

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RUN REPORT
IRTS
CAMPAIGN NO. 8

SUMMARY:

Integrated Radwaste Treatment System (IRTS) Campaign No. 8 was concluded on April 13, 1989 after processing approximately 34,000 gallons of 8D-2 liquid and 42,000 gallons of 8D-1 liquid as flush water. The Supernatant Treatment System (STS) column sequence used was C-D-A-B. The target dilution ratio was 1.4:1 with a nominal system flow rate of 6 GPM.

Liquid Waste Treatment System (LWTS) received a total of 16 batch transfers from STS totaling 123,700 gallons of evaporator feed. There was also 2,130 gallons of water used to flush pump 71-P-16 which was fed to the evaporator.

Cement Solidification System (CSS) processed 27,144 gallons of concentrates and produced 696 drums at 39.0 gallon per drum. Average drum dose rate was 22 mR/hr. The total CSS production, at the completion of campaign 8, was 3,303 drums with a cumulative acceptance rate of 99.94 percent.

DISCUSSION:

STS OPERATION

Campaign No. 8 started at 0125 hours on February 27, 1989 with a column sequence of C-D-A-B. The supernatant prefilter 50-F-001 was used again to reduce the total suspended solids in the raw supernatant feed. The raw supernatant was then diluted with water to increase the ion exchange efficiency. The target dilution ratio was 1.4 parts water to 1 part supernatant producing an effective 2:1 dilution of "Design Basis" (39 weight percent) supernatant.

During the first week of water recirculation, the Waste Tank Farm (WTF) vent system was sampled and analyzed for hydrogen with the system recirculation stopped and all columns vented. After 24 hours with no recirculation, column C heated up to the alarm point. A recirculation loop from tank D-001 through the supernatant cooler, column C, the post filter and back to D-001 was provided to cool column C. The cooling process was terminated due to the migration of Cs-137 from column C to the post filter. Recirculation through columns C-D-A-B was then initiated to cool column C and reduce Cs-137 activity at post filter.

Week 2 of supernatant processing was started after acceptable values of post filter radmonitor readings were achieved. When supernatant flow was started, the flow meter on the raw supernatant to 50-D-001, 50-FI-015 was found to be malfunctioning. After troubleshooting, the problem was identified to be an open electrical circuit in the valve aisle. A decision was made to abandon the 50-F-015 loop until the jumper could be replaced. Supernatant flow was calculated from the dilution water flow into 50-D-001 (50-FI-024), 50-D-001 level (50-LI-016) and the total process flow (50-FI-035) for the remainder of the campaign.

After feeding approximately 832 gallons of supernatant to the process, a flush with 8D-1 water was started due to inoperability of the brine chiller system. The chiller continued to malfunction and the sample results (8900813) of 8D-3 for STS/LWTS transfer #8 showed an unacceptable cesium versus total solids for cement production. According to procedure, this batch of 5,766 gallons was returned to 8D-2.

Two unrelated problems occurred in the brine chiller system refrigerant circuits: 1) The thermostatic expansion valve "power unit" for circuit number 2 was undersized, admitting an insufficient flow of refrigerant to the brine chiller. The power unit was replaced. 2) The head pressure control valve for circuit number 1 had a small piece of slag or weld splatter lodged in the valve seat. This placed the head pressure control valve in an intermediate position preventing flow through the condenser or through the bypass line. This problem is symptomatic of a plugged condenser, but in this case, was remedied by replacing the head pressure control valve.

Both circuits were restored to their as-designed condition, including recharging, resetting the system superheat, and the reconnecting of the hot gas bypass and the cylinder unloader wiring. All work was performed under the supervision of the Davis Refrigeration Company serviceman.

The STS portion of Campaign No. 8 was terminated on April 6, 1989 after processing a total of approximately 34,000 gallons of 8D-2 supernatant. The lead and second columns were at 86 and 20 percent breakthrough respectively. The breakthrough curves are shown on Figure 1.

Column C was taken off-line and the majority of zeolite was removed by sluicing via the "J-nozzle" dip tube. The progress of the sluice operation was monitored by the recently installed radmonitor on the "J-nozzle" manifold. The bottom dump valve was opened to empty the remaining "heel" from the column. Initially, the column dump valve failed pressure tests due to zeolite in the ball seat. The dump valve was cycled and flushed with water. The column then successfully passed the pressure test and was loaded with fresh zeolite.

LWTS OPERATION:

The performance of the LWTS evaporator subsystem was steady and reliable. The revised condensate return and reboiler air purge piping configurations resulted in increased steam flow rates and a corresponding improvement in system throughput. Steadier steam flow also improved the system processing stability. All of the concentrate batches produced were within the target density range.

The average steam flow rate of 5500 lb/hr enabled a 10 gpm feed rate to the evaporator and produced a concentrates rate of 3 gpm.

The LWTS concentrates pump 71-P-16 malfunctioned. During troubleshooting the pump developed no flow and no discharge pressure. A containment tent was erected to allow the Lower Warm Aisle pump niche cover over pump 71-P-16 to be removed. The pump niche was decontaminated, and the pump flexible coupling was replaced. In addition, leaking seals in pump suction shut-off valve (71-H-159) and the pump discharge pressure transmitter (71-PT-050) were replaced. All three components were returned to service and have been operating satisfactorily.

CSS OPERATION:

The performance of the CSS continued at approximately the system design throughput of 4 drums per hour. Prior to processing Campaign No. 8 concentrates, the replacement fill nozzle was installed and the lid handler was modified. The modification to the lid handler eliminated the "flip" motion by utilizing a throw away drip tray. The change has nearly eliminated surface contamination of the drums which had been occurring during the flip cycle of the lid handler. This change has reduced the number of manned entries into the process area for decon of contaminated drums prior to loadout.

Backup Mixer #2 was utilized during the campaign due to problems with the position indicator on the primary Mixer #1 ram valve. Mixer #2 ram valve ceased to operate due to hardened cement blocking the ram travel port. Both ram valves were repaired and returned to service. A new slide indicator was installed on Mixer #1 and the hardened cement cleaned out of the Mixer #2 ram travel port. The antifoam check valve on Mixer #1 was replaced due to leaks.

CSS processing was placed on standby during troubleshooting of drum cell crane problems. The drum cell crane was inoperable in automatic mode. Drums were placed in manual override on a temporary basis to support the completion of CSS operations.

During shutdown time, the CSS loadout door malfunctioned. The problem was traced to defective pulleys. The replacement sheaves and pulleys were procured and installed. The shield door was returned to service in time for CSS startup.

CSS completed Campaign No. 8 on April 13, 1989 producing 696 drums.

DRUM CELL OPERATION:

The Drum Cell (DC) crane failed to operate in automatic sequence. CSS drums were stacked in manual override and stored in a segregated area until the auto sequence was repaired.

The crane problems were caused by a faulty reset relay, a loose connector on an I/O board, a grounded shield data cable and a faulty "inch" hoist overload relay.

A plot of the drum cell radiation levels is provided for information, see Figure 2.

DECONTAMINATION FACTOR (DF):

A graph of the batch transfer DF's along with the campaign commulative DF's is provided, see Figure 3.

TANK LEVELS:

Campaign No. 8 continued to reduce the volumes in tanks 8D-1 and 8D-2 by processing supernatant and using 8D-1 water for flush. A graph of 8D-1 and 8D-2 levels since the start of IRTS processing is included for information, see Figure 4.

PRODUCT ACCEPTANCE:

The waste form classification data for drums produced in Campaign No. 8 is given in Table 6. All drums are class "C" waste.

LESSONS LEARNED:

The revision of TR-IRTS-7 to allow evaporation based on 8D-3 analysis to proceed in parallel with the batch analysis of 5D-15B, allows STS to operate at a steady 6 gpm flow rate. This eliminated STS process upsets and radmonitor fluctuations caused by changes in the flowrate. The revision to TR-IRTS-7 also saved 2-3 hours per evaporator cycle.

The elimination of the use of the air purge on the evaporator reboiler during evaporation was found to be effective. A steady state steam rate of 5500 lb/hr was achievable without the air purge.

The long term shutdown of the STS water recirculation was found to be an undesirable mode of operation. After the temperature in the partially loaded lead column had increased, flow was initiated to cool the column per procedure. This restart of a warmed column, even with water flow, caused migration of cesium off the column to downstream process components.

FIGURE 1

IRTS CAMPAIGN NO. 8 RUN REPORT

STS BREAKTHROUGH CURVE

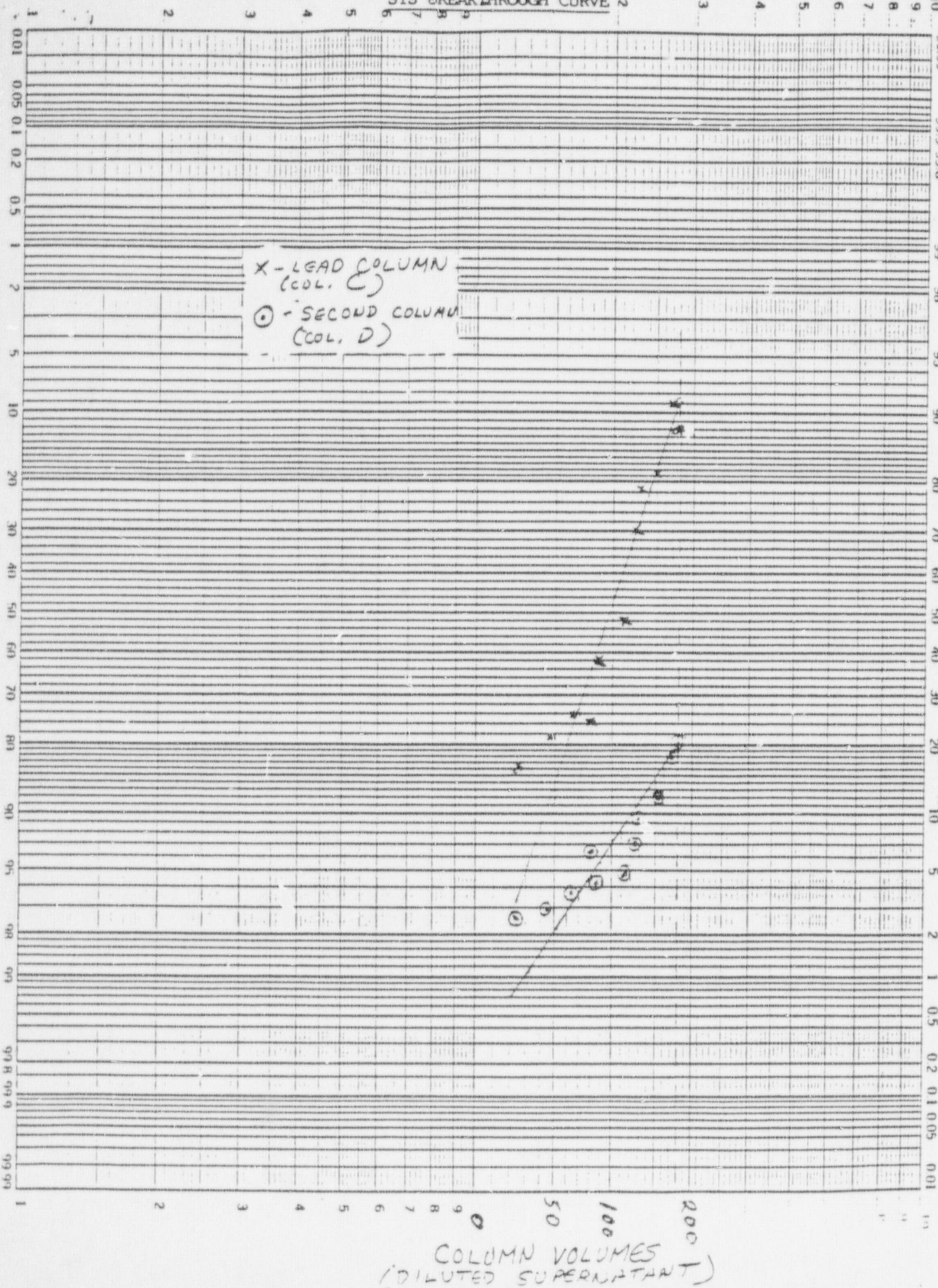

FIGURE 2
IRTS CAMPAIGN NO. 8 RUN REPORT

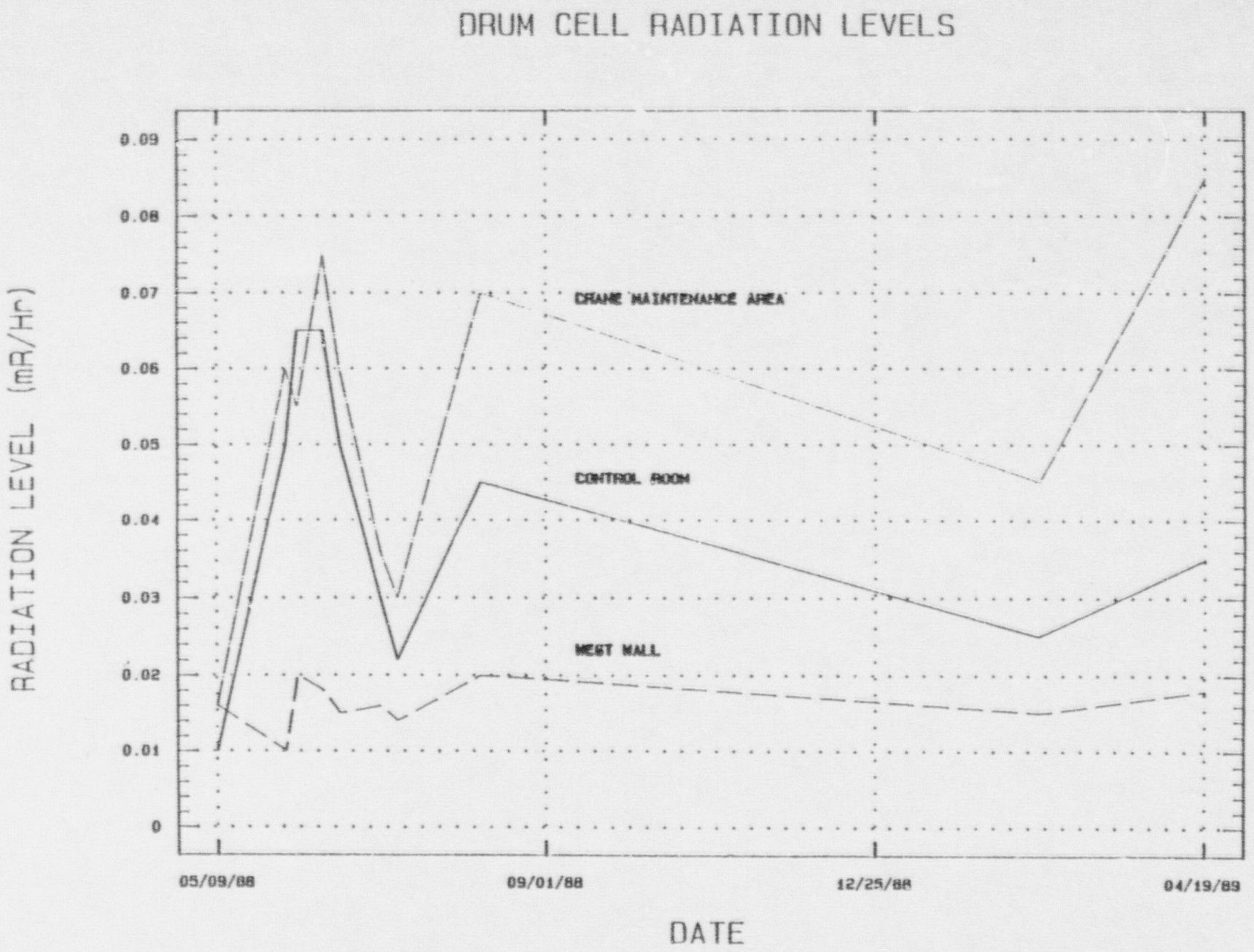

FIGURE 3

IRTS CAMPAIGN NO. 8 RUN REPORT

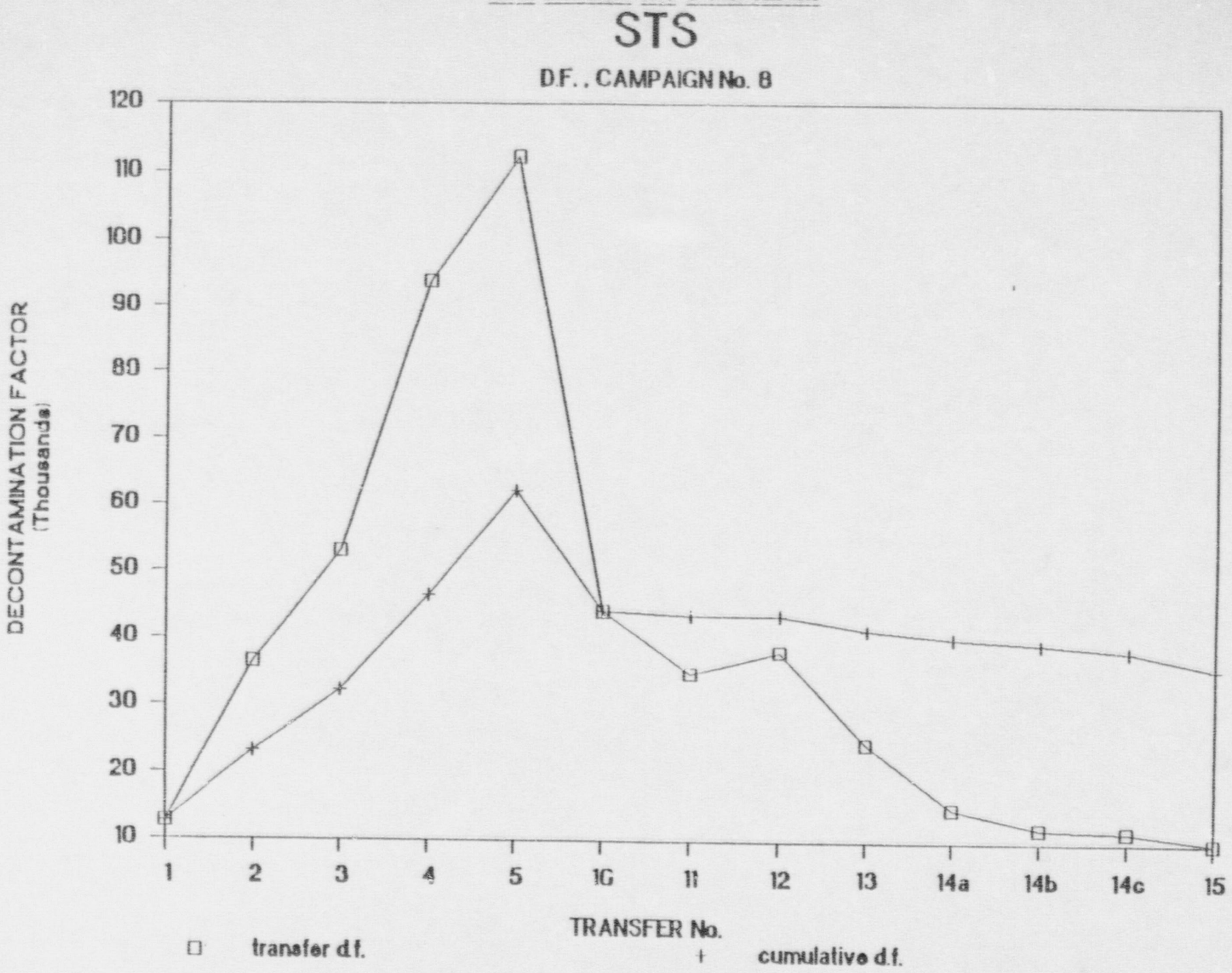

FIGURE 4

IRTS CAMPAIGN NO. 8 RUN REPORT

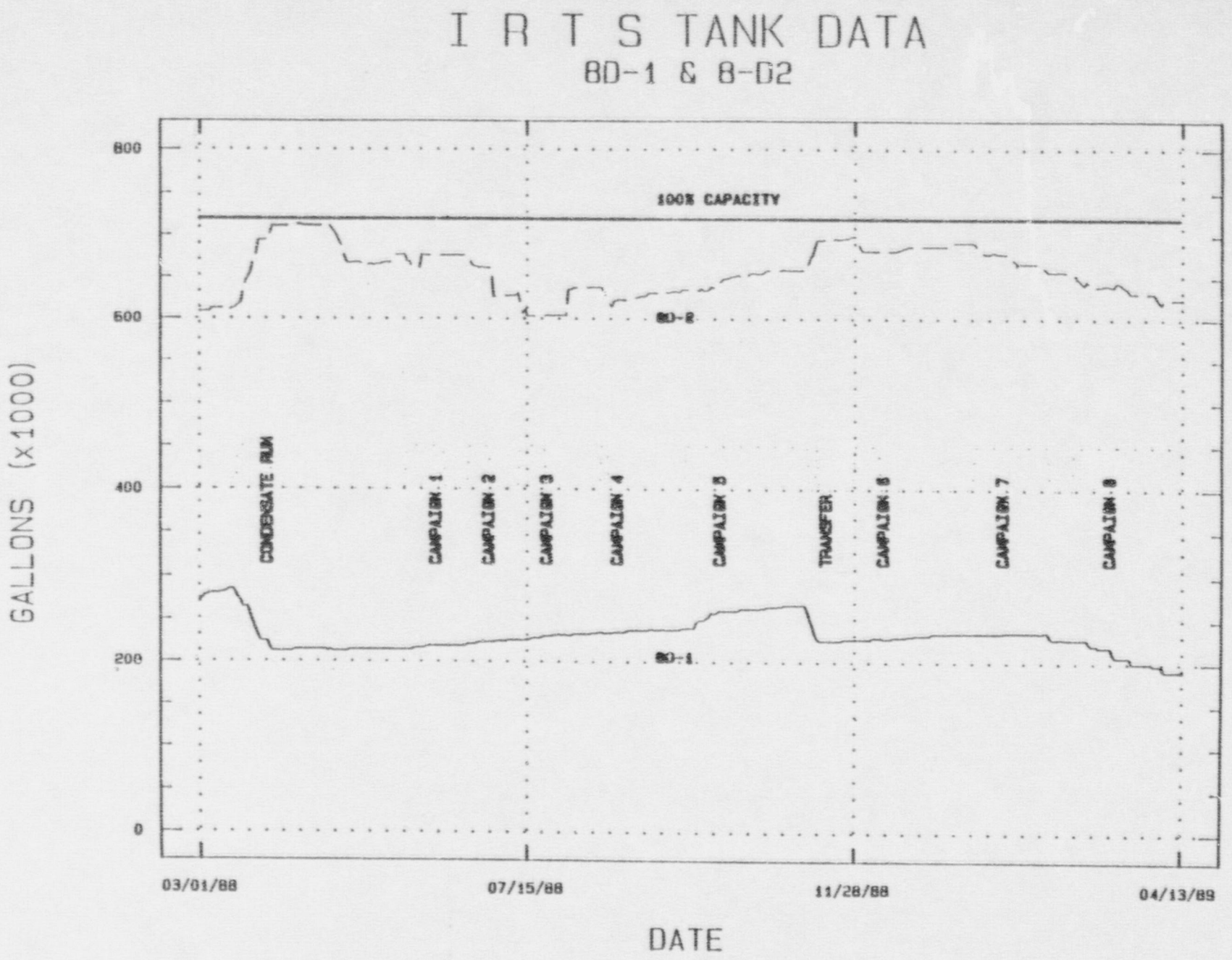

TABLE 1

IRTS CAMPAIGN NO. 8 RUN REPORT

SUMMARY TABLE OF RUN STATISTICS

1. TRANSFERS 8D3 TO 5D-15B

A.	Campaign Nos. 1 thru 7	886,089 Litres	234,080 Gallons
B.	Campaign No. 8 Total	468,253 Litres	123,699 Gallons
	TOTAL TO DATE	1,354,342 Litres	357,779 Gallons

2. PROCESS VOLUMES

A.	Campaign Nos. 1 thru 7 Total Feed	860,700* Litres	227,373* Gallons
B.	Campaign No. 8, Total Feed	476,313** Litres	125,828** Gallons
	TOTAL TO DATE	1,337,013 Litres	353,201 Gallons
C.	Campaign Nos. 1 thru 7 Total Concentrate	395,700 Litres	104,500 Gallons
D.	Campaign No. 8, Total Concentrate	102,751 Litres	27,144 Gallons
	TOTAL TO DATE	498,451 Litres	131,644 Gallons

3. DRUMS PRODUCED

A.	Campaign Nos. 1 thru 7	2,607
B.	Campaign No. 8	696
	TOTAL TO DATE	3,303

4. DRUM CELL

Process drums transferred to Drum Cell	3,303***
Shield drums in Drum Cell	421
TOTAL TO DATE	3,724

5. CURIES OF CESIUM 137 REMOVED FROM 8D-2

A.	IRTS Campaign Nos. 1 thru7	1,531,000
B.	IRTS Campaign No. 8	277,000
	TOTAL	1,808,000

* The last Campaign No. 7 transfer was evaporated during Campaign No. 8. This number is an estimate because out-of-spec concentrates were recycled to the feed tank.

** Added 2,129 gallons of evaporator bottoms and demineralized H_2O to 5D-15B from flushing of valve H159 and concentrates pump 71-P-16 via work order 8771.

*** 4 drums removed for core boring (Nos. 72847, 72791, 72949, 71004).

TABLE 2

IRTS CAMPAIGN NO. 8 RUN REPORT

COMPARISON OF CAMPAIGN NO. 7 TO CAMPAIGN NO. 8 STATISTICS

	CAMPAIGN NO. 7	CAMPAIGN NO. 8
S T S		
Volume of 8D-2 Supernatant Processed (Gal.)	35,400	34,020
Total Volume Processed (Includes flush and dilution Water) (Gal.)	109,900	123,699
Column Breakthrough (%)		
- Lead Column	85 TO 90	86
- 2nd Column	10	20
Average System DF	95,500	37,500
Average Cs-137 in Effluent (uCi/mL)	0.0128	0.0456
L W T S		
Concentrates		
- Volume (Gal.)	25,000	24,144
- Average Cs-137 (uCi/mL)	0.0640	0.1538
C S S		
Drums Produced	598	696
Average Cs-137/Drum (Ci)	0.0095	.0225
Average Drum Contact Dose Rate (mr/hr)	11	22

TABLE 3

IRTS CAMPAIGN NO. 8 RUN REPORT

DETAILED TABLE OF RUN STATISTICS

IRTS CAMPAIGN # 8 RUN REPORT

COLUMN SEQUENCE : C - B - A - B

I.	TRANSFER 803 to SD15B	1	2	3	4	5	6	7	8	9	10	11	12	13	14a	14b	14c	15
A.	DATE	2/27/89	3/01/89	3/2/89	3/3/89	3/4/89	3/9/89	3/14/89	3/15/89	3/21/89	3/22/89	3/23/89	3/29/89	4/3/89	4/4/89	4/5/89	4/5/89	4/6/89
B.	STS FLOW RATE (gpm)	5.9	6.1	5.0	5.0	flush	flush	3.1	to 8-d2	5.5	6.0	6.2	recirc.	6.0	6.0	6.0	4.0	6.0
C.	800l SAMPLE NO.	8900621	8900637	8900667	8900676	8900695	8900747	8900791	-	8900842	8900861	8900886	8900886	8901047	8901117	8901122	8901126	8901198
	i. Cs137 (uCi/ml)	897	837	616	704	732	1	53	-	732	852	806	806	794	927	879	898	898
	ii. TDS (wt%)	15.78	14.85	11.63	13.89	13.96	-	3.85	-	12.54	14.92	13.28	13.28	14.5	15.5	15.06	14.88	14.91
	iii. density (gr/ml)	1.115	1.106	1.080	1.098	1.099	-	1.011	-	1.093	1.107	1.110	1.110	1.104	1.112	1.108	1.105	1.107
B.	CESIUM 137 ACTIVITY (COLUMN EFFLUENTS)																	
	i. lead Column C (uCi/ml)	112	138	163	200	263	6	74	-	171	[illegible]	636	11	649	739	778	776	-
	ii. 2nd Column B (uCi/ml)	2.38	3.77	5.87	6.45	9.68	-	3.93	-	2.30	34.90	57.20	-	34.50	89.80	143.00	155.00	-
	iii. 3rd Column A (uCi/ml)	1.260	0.209	0.154	0.154	0.154	-	0.131	-	0.169	0.268	0.027	-	-	82.100	1.600	1.990	0.079
E.	COLUMN BREAKTHROUGH (%)																	
	i. lead Column C	12.5	16.5	26.5	28.4	35.9	-	139.7	-	23.4	55.8	78.9	-	81.7	79.7	88.5	86.4	-
	ii. 2nd Column B	2.1	2.7	3.6	3.2	3.7	-	5.3	-	1.3	7.3	9.0	-	5.3	12.2	18.4	20.0	-
F.	803 SAMPLE NO.	8900620	8900636	8900673	8900692	8900715	8900768	8900798	8900813	8900845	8900864	8900889	8900911	8901074	8901120	8901128	8901163	8901201
	i. Cs137 (uCi/ml)	0.0247	0.0165	0.0143	0.0071	0.0037	0.0127	0.2430	0.0634	0.0311	0.0168	0.0225	0.0135	0.0167	0.0525	0.0705	0.0759	0.0887
	ii. TDS (wt%)	5.97	10.82	14.47	13.25	12.37	4.68	7.59	0.93	4.71	13.23	14.93	10.2	7.9	13.41	14.56	14.67	14.79
	iii. density (gr/ml)	1.033	1.092	1.103	1.093	1.085	1.019	1.043	1.008	1.034	1.093	1.107	1.066	1.046	1.094	1.104	1.105	1.106
G.	STS SYSTEM D.F.																	
	i. Transfer D.F.	12732	36493	53040	93840	112365	-	-	-	-	44381	34904	38266	24598	15020	12011	11664	10034
	ii. Cumulative D.F.	12732	23161	32281	46669	62197	-	-	-	-	44381	43670	43670	41571	40315	39630	38641	36021
H.	SD15B SAMPLE NO.	8900627	8900666	8900682	8900707	8900719	8900776	8900804	-	8900855	8900881	8900902	8901020	8901085	8901200	8901200	8901200	8901242
	i. Cs137 (uCi/ml)	0.0270	0.0184	0.0132	0.0081	0.0051	0.0079	0.1440	-	0.0367	0.0168	0.0202	0.0210	0.0277	0.0660	0.0600	0.0660	0.0523
	ii. TDS (wt%)	9.44	10.96	11.40	12.89	12.79	8.25	7.00	-	9.39	13.97	12.62	13.94	11.43	13.06	13.06	13.06	9.76
	iii. density (gr/ml)	1.063	1.073	1.076	1.089	1.089	1.049	1.027	-	1.059	1.099	1.087	1.102	1.077	1.091	1.091	1.091	1.062
I.	VOLUME RECEIVED (liters) IN SD15B	40514	31690	31690	31690	41867	19720	31029	-	42899	42806	25470	19000	41969	18946	9930	15040	42893
J.	CUMULATIVE VOLUME FOR CAMPAIGN (liters)	40514	72204	103894	135584	177551	197271	228300	228300	271199	314005	339475	339475	381444	400390	410320	425360	468253

TABLE 4

I R T S CAMPAIGN EIGHT RUN REPORT

DRUM TESTING RESULTS

CONCENTRATES BATCH	21	22	23	24	25
LWTS TANK	5D-15A1 #11	5D-15A2 #9	5D-15A1 #15	5D-15A1 #18	5D-15A2 #10
LAB ANALYSIS NO.	8900702	8900744	8900905	8901221	8901243
TOTAL SOLIDS %	39.29	40.21	39.52	40.55	40.09
Cs-137 CONCENTRATION (uCi/mL)	1.03 E-1	3.01 E-2	2.40 E-1	1.73 E-1	2.23 E-1
POUNDS CEMENT +$CaNO_3$	88,704	48,832	65,856	88,704	19,712
NUMBER OF DRUMS	198	109	147	198	44
TOTAL GALLONS	7,722	4,251	5,733	7,722	1.716
CURIES PER DRUM (AVERAGE)	0.015	0.0044	0.035	.0255	0.0329
RADIATION DOSE (mR/hr) PER DRUM	15	8	35	22	30
PRESOLIDIFICATION RESULTS	>700 PSI	>700 PSI	>700 PSI	>700 PSI	>700 PSI
IN-CELL TEST RESULTS DRUM NO./PSI	73354/ >700 PSI	73930/ >700 PSI	73557/ >700 PSI	74116/ >700 PSI	74549/ >700 PSI

Total Cement	311,808 lbs.
Total Number of Drums	696
Total Volume Solidified	27,144 Gallons
Total Curies Solidified	15.66 Ci

TABLE 5

I R T S CAMPAIGN NO. 8 RUN REPORT

DRUM PRODUCTION RATE

	DATE	DAILY AVERAGE	WEEKLY TOTAL	CUMULATIVE TOTAL
Campaign #1	6/1 to 6/3	20	60	60
	6/6 to 6/9	36	143	203
	6/13 to 6/17	40	198	401
Campaign #2	6/27 to 6/30	31	152	553
	7/5 to 7/8	58	230	783
Campaign #3	7/18 to 7/21	61	342	1026
	7/25 to 7/29	44	222	1248
	8/2 to 8/5	33	99	1347
Campaign #4	8/22 to 8/23	20	39	1386
	9/01 to 9/02	27	55	1441
	9/07 to 9/09	62	185	1626
	9/12	1	1	1627
	9/22	18	18	1645
	9/26	36	36	1681
Campaign #6	12/5 to 12/9	58	287	1968
	12/13	41	41	2009
Campaign #7	1/23 to 1/26	47	188	2197
	2/6 to 2/10	56	283	2480
	2/20 to 2/23	31	127	2607
Campaign #8	3/6	70		
	3/7	70		
	3/8	74		
	3/9	76		
	3/10	17	307	2914
	3/29	42		
	3/30	50		
	3/31	55	147	3061
	4/10	67		
	4/11	72		
	4/12	76		
	4/13	27	242	3303

TABLE 6

IRTS CAMPAIGN NO. 8 RUN REPORT

WASTE FORM CLASSIFICATION INFORMATION

CRITERIA FOR CLASS "C": THE SUM OF LONG LIVED RADIONUCLIDE FRACTION AND THE SUM OF THE SHORT LIVED RADIONUCLIDE FRACTION MUST BOTH BE LESS THAN 1. SEE TEXT.

CAMPAIGN NUMBER	LAB ANALYSIS	NUMBER OF DRUMS	AVERAGE LONG-LIVED	AVERAGE SHORT-LIVED
1	8801605	115	3.37 E-01	7.32 E-05
1	8801607	95	4.54 E-01	5.94 E-05
1	8801831	196	4.11 E-01	4.62 E-05
2	8801932	100	3.30 E-01	2.43 E-05
2	8801963	155	3.69 E-01	4.92 E-05
2	8802011	122	3.91 E-01	2.32 E-05
3	8802094	193	3.55 E-01	3.44 E-05
3	8802108	93	4.39 E-01	4.39 E-05
3	8802159	211	3.83 E-01	5.04 E-05
3	8802220	67	3.53 E-01	6.29 E-05
4	8802345	98	4.07 E-01	1.21 E-04
4	8802373	198	3.92 E-01	1.17 E-04
4	8802611	36	4.07 E-01	1.14 E-04
6	8803744	167	4.38 E-01	4.28 E-05
6	8803754	97	4.24 E-01	5.76 E-05
6	8803854	37	3.97 E-01	5.32 E-05
7	8900176	188	3.48 E-01	1.89 E-05
7	8900330	196	4.32 E-01	1.34 E-05
7	8900384	87	3.88 E-01	9.09 E-06
7	8900531	125	3.88 E-01	2.14 E-05

DOCKET NO. M-32
CONTROL NO. 25642
DATE OF DOC. June 9, 1989
DATE RCVD. June 20, 1989

FCUF ____ PDR ✓
FCAF ✓ LPDR ✓
I & E REF. ✓
SAFEGUARDS ____
FCTC ____ OTHER ✓
DATE 6/21/89 INITIAL SAC