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### RUN REPORT

# INTEGRATED RADIOACTIVE WASTE TREATMENT SYSTEM

CAMPAIGN NO. 15, January 15, 1990 - February 16, 1990

Information Contributed By:

M. N. Baker A. L. Nasol S. R. Reeves G. J. Robbins C. F. Ross

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# RUN REPORT IRTS CAMPAIGN NO. 15

#### SUMMARY:

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Integrated Radwaste Treatment System (IRTS) Campaign No. 15 was concluded on February 16, 1990 after processing approximately 33,300 gallons of 8D-2 liquid. The Supernatant Treatment System (STS) used a three column sequence of D-A-C. The target dilution ratio was 1.4:1 with a nominal system flow rate of 6 GPM. The actual dilution ratio relative to the original 39 wt% TS concentration of 8D-2 was 2.3 to 1. The average Campaign No. 15 Decontamination Factor for STS was 27,900

The total volume of supernatant removed from 8D-2 is now at 380,489 gallons which is equivalent to 51.2 percent of the total supernatant to be processed. As of the end of Campaign 15, approximately 362,000 gallons remain to reduce the 8D-2 tank level down to a 32-inch heel.

Liquid Waste Treatment System (LWTS) received a total of 10 batch transfers from STS totaling 88,071 gallons of process liquid.

Cement Solidification System (CSS) processed 23,680 gallons of concentrates and produced 592 drums at 40 gallons per drum. Average drum dose rate was 33 mR/hr. The total CSS production, at the completion of Campaign No. 15 was 7,124 drums.

Table 1 shows a summary of run statistics. Process completion status at the end of this campaign is 55% based on drum production.

Table 2 compares this campaign to the two previous campaigns. Campaign No. 15 processed less supernatant than the two previous campaigns.

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#### DISCUSSION:

#### STS OPERATION

Campaign No. 15 Supernatant Processing commenced on January 15, 1990 with a nominal dilution ratio of 1.4:1 dilution ratio. No major problems developed to impact STS Operations.

As reported in the Campaign No. 14 Run Report, at the completion of Campaign No. 14, column B dump valve failed to close (see UOR 89-11-STS-1 and Critique No. CM89150). As a result of that event, the decision was made to bypass column B during Campaign No. 15 while remote equipment and tooling could be procured and installed in the M-4 riser to plug column B. Campaign No. 15 was a three column run with a column sequence of D-A-C.

The STS production portion of Campaign No. 15 processed 33,300 gallons of supernatant during the two week run. The overall weighted DF for STS during Campaign No. 15 was 30,242. A total of 7,890 gallons of demineralized water was used to flush the columns.

Prior to the start of Campaign No. 15, the STS operators installed replacement jumpers in the STS valve aisle. Among the items installed was a new STS Sample Manifold. Sampling at STS is accomplished remotely with the use of manipulators. The locations of some of the sampling jumpers on the back wall of the valve aisle have caused sampling errors and breakage of manipulators (see Critique No's. CM88114 and CM89015). The sample manifold makes the sampling operation more accessible for the manipulators, thereby alleviating the problems described above. The station was tested successfully during Campaign No. 15 and will be used in future campaigns. Valve aisle jumpers containing the supernatant recirculation valve (50-FV-064) and the raw supernatant flow measuring element (50-FE-015) were also replaced remotely.

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At the completion of Campaign No. 15, columns D and A were at 45.3% and 5% breakthrough respectively (see Figure 1). This is equivalent to approximately 30 and 50 percent cesium loading, respectively. Columns D and A were then loaded to cesium saturation with 34,434 gallons of raw supernatant which was returned to 8D-2 (WO-9000396). After saturation, the columns were flushed with demineralized water to Tank 8D-2 and the spent zeolite was sluiced from columns D and A. Column D was placed offline and vented awaiting sparge installation. The zeolite heel remaining in column A was dumped through the bottom dump valve, leaving the valve in the open position.

Due to the problems experienced with the column B dump valve at the completion of Campaign No. 14, the bottom discharges of columns A and B were both plugged with the dump valves locked and tagged in the open position. This was accomplished using the mechanical arm placed in the 8D-1 M-4 riser. Table 6 shows a historical summary of the STS process.

#### LWTS OPERATION:

Operation of evaporator 31017 and its associated subsystems continued to produce acceptable results. No major problems developed to impact LWTS Operations. Prior to Campaign No. 15, several modifications were performed to the LWTS system to enhance performance.

Piping located in the Product Purification Cell (PPC) was modified to prevent an inadvertent discharge of decontaminated supernatant to the interceptor system. Modification of this piping eliminated the need for an Operational Safety Requirement (OSR), and eliminated the need for an operator to issue and release a series of danger tags for each transfer from STS to LWTS.

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A condensate return pump was installed downstream of evaporator 31017. Since the start of dilution in IRTS (Campaign No. 7), evaporator 31017 has been the controlling component in the IRTS system. The increased proportion of water in the supernatant from STS required a higher steam rate (than previous campaigns) in the evaporator, to concentrate the supernatant. The problem was determined to be condensed steam (condensat:) building up in the evaporator heat exchanger and condensate return piping. Several attempts to fix this situation were tried, but the system simply did not have enough energy to push the condensed steam out of the evaporator heat exchanger, and up approximately 20 feet to the condensate return header. It was determined that the evaporator could achieve a sufficient boil off rate if the condensate was directed to a floor drain in the Lower Extraction Aisle (LXA). By installing this pump, we can maintain a sufficient boil off rate in LWTS and recycle the condensate to the return system for reuse in the site boiler instead of routing it to the floor drain and eventually to the O2 Plant interceptors.

An air filter was installed at the PSC-2 sample station. This sample station is used to obtain representative samples of the liquid contained in the primary LWTS process tanks (5D-15A1, 5D-15A2 and 5D-15B). Rust and scale in the air line that supplies the station frequently plugged the equipment used in obtaining the samples. This filter will allow LWTS operators to obtain samples in a timely manner.

#### CSS OPERATION

Operation of the Cement Solidification System continued on January 22, 1990. No major problems developed to impact CSS Operations.

The CSS Mixer #1 was refitted with a new antifoam check valve after a broken assembly was found during prestart checkout.

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Approximately 20 gallons of AF9020 antifoam solution (P.O. 39279) in 5 gallon pails was obtained from CTS operations. The antifoam solution certification document was submitted by the manufacturer and accepted for use in CSS after Quality Control released.

CSS continued production on January 22, 1990 at approximately 0030 hours solidifying Campaign No. 15 concentrates using Mixer #1. An abnormal mixer weight reading for "net waste delivered" was experienced. The problem was caused by the PLC reading the mixer weight while the mixer was rotating in its coastdown cycle. The PLC timer setting was lengthened to 40 seconds to correct the problem. Drums produced in batch number 51, (see Table 4, lab log #9000123) were found to be suitable for shield drums. These drums were placed in the 9th layer at the RTS Drum Cell.

During operations on January 24, 1990, it was discovered that the outer airlock shield door M18-1 hydraulic cylinder support bracket was not securely fastened to its mounting position. CSS Operations was temporarily placed on hold until the damaged was evaluated by management, Process Control Engineering and Maintenance. The door was braced to its open position, the air in the vicinity of the open outer door was continuously monitored for radioactivity, and CSS Operations continued. Post operation investigation by Maintenance, Process Control Engineering and Quality Assurance concluded that the problem was caused by loose hold down bolts. Neither structural damage to the support area nor stress on the mounting bolts were observed (W.O. 9000291). All hold down bolts were retorqued to approved specifications and will be inspected as part of preoperational checklist.

On February 2, 1990, the waste delivery value 71-V-2 failed to operate. Maintenance made a process room entry to repair the limit switch housing and reset the switches to continue operations. Adjustments were also made on the lid handler vacuum switch.

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The CSS robot became entangled in the process room camera #6 cables during a swiping sequence. A process room entry was made to secure the cables away from the robots swing area. The robot was reprogrammed to continue operations. The CSS operation was placed on hold due to RTS Drum Cell problems with the power cable takeup reel (see the Drum Cell Section). During the CSS shutdown, Maintenance repaired the leaking flange down stream of the Moyno pump.

CSS completed Campaign No. 15 run on February 16, 1990 ending with 7,124 cumulative drums to date processed.

#### DRUM CELL

Operation of the Drum Cell continued in support of CSS Operations. At one point during the campaign, a broken wire in the drum transporter conveyor power cable caused intermittent stopping of the transporter tailgate conveyor. The power cable was replaced and operation resumed with no impact on operations.

On February 6, 1990, a drum grabber control cable takeup reel spring broke causing the cable to uncoil. The cable was manually retracted, and the crane taken to the crane repair bay. New return springs were ordered and installed. Drum Cell operations resumed on February 9, 1990. Repair of this equipment is discussed in CM90016.

Radiation levels at selected locations around the Drum Cell are shown in Figure 2. The dose rate for the Crane Maintenance Area and the Control Room have decreased slightly while that for the West Wall has increased slightly when compared to Campaign 14 results.

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#### 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. 15 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 at its current level for ballast and shielding. A target level of 32 inches is shown for 8D-2.

#### PRODUCT ACCEPTANCE:

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

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FIGURE 2

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FIGURE 3

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FIGURE 4

	<u>1</u> 5	RTS CAMPAI	TABLE 1 GN NO. 15 RUN BLE OF RUN STAT	REPORT ISTICS
•	TRANSFERS 8D-3 TO 5D A. Campaign Nos. 1 B. Campaign No. 15 TOTAL TO	-15B thru 14 Total DATE	3,405,649 L <u>332,301</u> L 3,737,950 L	899,680 G 87,785 G 987,465 G
•	LWTS PROCESS VOLUMES	1.11		
.1	Total Feed to Evapor A. Campaign Nos. 1 B. Campaign No. 15 TOTAL TO	thru 14	3,413,098 L 333,385 L 3,746,483 L	901,648 G <u>88,071</u> G 989,719 G
. 2	Total Concentrate C. Campaign Nos. 1 D. Campaign No. 15 TOTAL TO	thru 14 DATE	968,843 L 88,972 L 981,815 L	258,865 G 23,504 G 259,369 G
•	DRUMS PRODUCED* A. Campaign Nos. 1 B. Campaign No. 15 TOTAL TO	thru 14 DATE	6,532 <u>592</u> 7,124	
•	CURIES OF CESIUM 137 A. IRTS Campaign N B. IRTS Campaign N	REMOVED los. 1 thr lo. 15	FROM 8D-2 u 14 Total	3,273.0 K Ci <u>430.0 K Ci</u> 3,703.0 K Ci
•	PROCESS COMPLETION A. Curies Percent 3,703 7,089-49	Complete: = 0.56	2 or 56 percent	
	B. Drums Percent C <u>7,124</u> = 13,000	complete: 0.548 or	55 percent	

\* Includes 6 drums removed from pile and core bored (#72847, 72791, 72949, 71004, 72813, 71144) which are now located in Lag Storage.

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# TABLE 2

# IRTS CAMPAIGN NO. 15 RUN REPORT

# COMPARISON OF STATISTICS FROM PREVIOUS CAMPAIGNS TO THIS CAMPAIGN

		CAMPAIGN NO. 13	CAMPAIGN NO. 14	CAMPAIGN NO. 15
S T	<u>s</u>			
	Volume of 8D-2 Supernatant(a) Processed (Gal.)	28,333( <b>a</b> )	33,873	33,300
	Total Volume Processed (Includes flush and dilution Water) (Gal.)	79,358	94,069	88,071
	Column Breakthrough (%) - Lead Column - 2nd Column	58.4 5.6	84.6 2.7	33.5 6.3
	Average System DF	24,240	30,414	27,900
	Average Cs-137 in Effluent (uCi/	mL) .061	.046	0.072
LW	TS			
	Concentrates - Volume (Gal.)(b) - Average Cs-137 (uCi/mL)	19,209 .24	24,440	23,504 .21
c s	<u>s</u>			
	Drums Produced	498	611	592
	Average Cs-137/Drum (Ci)	0.036	0.036	0.041
	Average Drum Contact Dose Rate (	mR/hr) 36	33	33
(a)	See Table 6 for volume of supern	atant recycled.		

(b) Tank heels

	CAMPAIGN 13			CAMI	PAIGN 14	CAMPAIGN 15		
5D-15A1		21	Gallons	695	Gallons	40	Gallons	
5D-15A2	-	2	Gallons	21	Gallons	2	Gallons	
0-D-1		61	Gallons	103	Gallons	50	Gallons	
TOTAL		84	Gallons	819	Gallons	92	Gallons	

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		<u>1 R</u>	T S CAMP	TABLE 3 AIGN NO. 1 RLE OF RUN	5 RLN REPO	RI					
1. Tr	<u>N SEQUENCE: D-A-C</u> ransfer 8D-3 to 5D-15B	1	2	3	4	5	6	7	8	9	10
A.	Date	01/15/90	01/17/90	1/18/90	01/19/90	01/22/90	01/28/90	01/31/90	02/01/90	02/02/90	02/03/90
B.	STS Flow Rate (gpm)	6.0	6.0	6.0	6.0	Flush	6.0	6.0	6.0	6.0	Flush
c.	C. D-001 Sample No. i. Cs-137 (uCi/mL) ii. TDS (wt %) iii. Density (gr/mL)		9000049 650 13.99 1.099	9000074 795 14.67 1.105	9000097 728.0 14.44 1.103	0097 N/A 8.0 N/A .44 N/A 103 N/A	9000145 669 13.18 1.092	9000163 698 14.32 1.102	9000181 786 14.55 1.104	9000206 811 15.00 1 104	9000206 811 15.00 1.104
D.	Cesium-137 Activity (Column Effluents) (uCi/mL) i. Lead Column D ii. 2nd Column A	8.60 0.00	15.3 2.33	13.4 11.40	12.0 4.23	N/A N/A	7.20 5.70	37.0 10.20	84.00 13.80	272.0 11.70	352 20.00
E.	Column Breakthrough (%) i. Lead Column D ii. 2nd Column A	1.2 0.0	2.4 15.2	1.7 85.1	1.6 35.3	N/A N/A	4.1 79.2	5.3 27.3	10.7 16.4	33.5 4.3	43.4 5.7
F.	8D-3 Sample No. i. Cs-137 (uCi/mL) ii. TDS (wt %) iii. Density (gr/mL)	9000040 0.1410 8.82 1.054	9000056 0.0727 12.6 1.087	9000075 0.0244 13.75 1.097	9000096 0.0124 13.75 1.097	9000115 0.0176 10.86 1.072	9000148 0.0073 8.56 1.052	9000171 0.0109 13.52 1.095	9000186 0.0263 14.22 1.101	9000209 0.1228 14.31 1.102	9000228 0.3620 14.21 1.101
G.	STS System DF i. Transfer DF ii. Cumulative DF	3,122 3,122	7,965 5,501	30,243 13,818	55,600 21,244	N/A N/A	57,340 29,060	60,186 34,600	29,131 33,774	6, <b>4</b> 83 30,242	N/A N/A
H.	5D-15B Sample No. i. Cs-137 (uCi/mL) ii. TDS (wt %) iii. Density (gr/mL)	9000043 0.1360 11.57 1.078	9000068 0.0568 13.43 1.094	9000082 0.0270 14.20 1.101	9000105 0.0034 14.21 1.101	9000118 0.0116 11.69 1.079	9000154 0.0098 10.72 1.071	9000180 0.0114 13.05 1.091	9000202 0.0376 14.09 1.100	9000221 0.1540 14.29 1.102	9000240 0.2460 12.20 1,084
1.	Volume Received (Litres) in 50-158	39,406	38,052	39,219	25,219	13,039	39,219	39,219	39,219	38,589	21,120
J.	Cumulative Volume* for Campaign (Litres)	39,406	77,458	116,677	141,896	141,896	118,115	220,334	259,553	298,142	298,142

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

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I R T S CAMPAIGN NO. 15 RUN REPORT DRUM TESTING RESULTS								
CONCENTRATES BATCH	50	51	52	53				
LWTS TANK	5D-15A1	5D-15A2	5D-15A2	5D-15A1				
LAB ANALYSIS NO.	9000101	9000123	9000191	#9 9000258				
TOTAL SOLIDS %	40.44	40.06	40.78	39.06				
Cs-137 CONCENTRATION (uCi/mL)	3.85 E-01	6.23 E-02	4.88 E-02	3.52 E-01				
POUNDS CEMENT +CaNo3	93,480	30,418	49,486	97,904				
NUMBER OF DRUMS	205	67	109	211				
TOTAL GALLONS	8,200	2,680	4,360	8,440				
CURIES PER DRUM (AVERAGE)	0.0584	0.009	0.0074	0.053				
RADIATION DOSE (mR/hr) PER DRUM	45	10	10	40				
PRESOLIDIFICATION RESULTS	>700 PSI	>700 PSI	>700 PSI	>700 PS1				
IN-CELL TEST RESULTS DRUM NO./PSI	78119 >700 PSI	77845 >700 PSI	78240 >700 PSI	78349 >700 FSI				
Total Cement & CaNo <sub>3</sub> Total Number of Drums Total Volume Solidified Total Curies Solidified	271,288 592 23,680 24,625	LBS. Gallons						

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# TABLE 5

		<u>1 R T</u>	S CAMPAIGN NO	0. 15 RUN REPO	RT				
		DRUM PRODUCTION RATES							
		DATE	DAILY AVERAGE	WEEKLY TOTAL	CUMULATIVE				
Campaign #	11 (	5/1 to 6/17	33		401				
Campaign #	12 (	5/27 to 7/8	45		783				
Campaign #	13	7/18 to 8/5	35		1347				
Campaign #	4 8	8/22 to 9/26	30		1681				
Campaign #	6	12/5 to 12/13	45		2009				
Campaign #	17 1	1/23 to 2/23	50		2607				
Campaign #	18 3	3/6 to 4/13	60		3303				
Campaign #	19 4	1/24 to 5/26	58		3988				
Campaign #	10 6	5/19 to 6/22	37		4136				
Campaign #	11 7	7/26 to 8/24	58		4778				
Campaign #	12 9	9/5 to 10/13	50		5421				
Campaign #	13 1	0/23 to 11/10	62		5921				
Campaign #	14 1	1/20 to 12/15	67		6532				
Campaign #	15 1 1 1	/22 /23 /24 /25	78 82 70 42	272	6804				
		2/5 2/6 2/9	41 55 47	143	6947				
	2222	2/12 2/13 2/14	68 61 48	177	7124				

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#### TABLE 6 IRTS CAMPAIGN NO. 15 RUN REPORT STS PROCESS HISTORY

			Nominal Ilution column Ratio sequence			SUPERNATANT PROCESSED					Cs-137
CAMPAIGN	N DATE	NOMINAL DILUTION RATIO		NUMBER OF C COLUMNS DUMPED	CS-137 CONCENTRATION IN 8D-2 (uCi/mL)	AND TRANSFERRED TO LIMTS GALLONS	Cs-137 Removed KCi	AND RECYCLED TO 80-2 GALLONS	Cs-137 REMOVED KCi	TOTAL Cs-137 Removed KCi	INVENTORY REMAINING IN 80-2(a)(b) KCi
1	5/88	no dilute	B-C-D-A	В	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	8/38	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	В	1980	35,342	265	0	0	265	5,544
8	2-3/89	2:1	C-D-A-B	С	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	В	1885	35,096	250	0	0	250	4,667
12	10/89	2:1	C-D-A-B	С	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	<u>33,300</u> 380,489	228	<u>34,434</u> 115,781	202 719	4 <u>30</u> 3,703	3,395

- (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 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 [(7.29 E+04 gal)(3.785 E+03 mL/gal)(1.81 E+03 uCi/mL)]

10<sup>6</sup> uCi/Ci