MASTER

DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 2390201
T-641317

PERIODIC WASTE DISPOSAL SYSTEM MATERIAL BALANCE TEST

CORE I SEED 2

Section 2 of 4 Sections

First Issue,

DISCLAIMER

TEST RESULTS

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PERIODIC WASTE DISPOSAL SYSTEM MATERIAL BALANCE TEST

Purpose

To determine the acceptability of the present operational procedures in containing, processing and disposing of all wastes received by the RWD System from the plant during a steady state operation by comparison to design criterion.

Conclusion

The Radioactive Waste Disposal System adequately contained, processed, and disposed of all wastes created by the Plant during this steady state power operation and always had 60,000 gallon available in the Surge and Decay tanks for Safety Injection.

Description of Test Equipment and Test Procedure

The test was performed in accordance with the first issue of the test procedure DLCS 23902, Periodic Waste Disposal System Material Balance Test, dated September 30, 1959.

The Station was operated at normal temperature (500 F) and pressure (1800 psia) with four loops in service at a net Station load of sixty (60) MW for a period of one week. All process equipment in the Radioactive Waste Disposal System was in proper operating condition. Data were obtained at the beginning of the test and at 24 hour intervals thereafter until the completion of the test.

Gross β-γ activity was not reported for the Radioactive Waste Disposal Gas System since the γ activity of gas samples could not be determined by existing equipment at Shippingport.

Results

DLCS 2390201, Periodic Waste Disposal System Material Balance Test, was performed from August 22 through August 29, 1960.

The Radioactive Waste Disposal System adequately contained, processed, and disposed of all wastes created by the Plant during this steady state power operation and always had 60,000 gallons available in the Surge Tanks for Safety Injection.

The RWD System was a flexible system and could easily process, with no build-up or accumulation and discharge to the river, the received liquid waste during the test because of the large capacity of the RWD liquid tanks and the relatively low activity of the received volume.

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Even though the RWD System easily handled the received liquids, there were two events which were normal occurances during this test where the operational data exceeded the design criterion. These instances are directly related to each other and were the excessive volume of liquid received by the Surge and Decay Tanks and the high activity received by the Chemical Waste Tanks.

The Chemical Waste Tank receives all liquid wastes, such as ones containing soap, that should not go through the ion exchangers. The fairly high activity in the Chemical Waste Tanks during this test can be attributed primarily to the crud and resin received from the Decontamination Room. This necessitated the use of the evaporator more frequently than was anticipated when designed. When this test was performed, a Chemical Tank was being evaporated about once per week. It takes approximately 24 hours to evaporate the 4000 gallon tank.

The distillate from the evaporator goes to the receiving Surge Tank, but this was low in activity and merely reduced the activity in the Surge Tank by dillution. The resulting increased volume reduced the maximum hold-up time of the Surge Tank from 45 days to a maximum of approximately 10 or 11 days

During this test, a total of 28,800 gallons was discharged to the river with a total gross activity of 522 μc (Table IV). The gross activity of the daily discharges never exceeded or even approached the limitation set up by the State of Pennsylvania which is 1590 μc/day average or 6200 μc/day maximum at 1×10^{-8} μc/ml. The average discharge was 74.5 μc/day (4.6%) at 0.076×10^{-8} μc/ml and the maximum discharge was 124.7 μc/day (2.0%) at 0.132×10^{-8} μc/ml.

The actual volume discharged by the non-active waste tank during this week was 5,800 gallons. This volume was approximately 15% of the expected volume. The activity of this discharge was 1.92×10^{-2} μc/gal which was 36.85% of the anticipated activity.

The Special Waste Tank received, during this test, approximately 460 gal/day which was 15.6% of the expected volume. This volume had an activity of 6.08×10^{-2} μc/gal which was 16% of the anticipated activity.

The average volume received by the Chemical Waste Tanks was 462 gal/day which was 185% of the expected volume. However, this volume includes approximately 2,400 gallons of high chromate wastes transferred from the Special Waste Tank. Not including this volume, the average volume received would be 126 gal/day or about 50% of expected volume. The activity of the volume could not be taken, but the activities of the samples taken from the tanks were too high to discharge to the river and had to be evaporated..

The average volume of liquid waste received during this test by the Surge Tanks was approximately 2,800 gal/day which was 600% of the expected volume. The average activity of the discharged volume after being processed by the four ion-exchangers and the gas stripper was approximately 1.87×10^{-2} μc/gal. or approximately 11% of the anticipated activity.

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The Tables presented in this report contain the following information:

Table I 1A, 1B, 1C and 1D Surge and Decay Tank Levels - 1A and 1B Test Tank Levels - Spray Recycle Tank Level - 1A and 1B Chemical Waste Tank Level - 1A and 1B Special Waste Tank Level - 1A and 1B Non-Active Tank Level - 1A, 1B, 1C and 1D Gas Decay Drum Pressure - Vent Gas Surge Drum Pressure - Vent Gas Compressor Suction - RPC Gravity Drainage Tank Level - Flash Tank Level - Blow-off Tank Level and Pressure - Average Coolant Temperature - Pressurizer Pressure

Table II Gross β Activity of 1A, 1B, 1C and 1D Surge Decay Tanks - 1A and 1B Chemical Waste Tanks - Spray Recycle Tank - 1A and 1B Special Waste Tank - 1A and 1B Non-Active Tanks - 1A and 1B Test Tanks

Table III Chemical Data of the Surge Tank in Process Ion Exchanger Flow Path, Ion Exchanger Effluent, Surge Tank (Laboratory Determined), Gas Stripper

Table IV Date, Time, Amount Discharged to River, Rate of Discharge, Permit No., Gross Total Activity, and Type of Tank Discharge

Table V Log of Events

Table VI Notes on the Log of Events

Table VII Flow rate and Gross Gamma Activity in the Coolant Sample Trains

TABLE I

READINGS TAKEN AT 24 HOUR INTERVALS

Date	8/22/60	8/23/60	8/24/60	8/25/60	8/26/60	8/27/60	8/28/60	8/29/60
Time	1600	1600	1600	1600	1600	1600	1600	1600
1A Surge & Decay Tank Level (%)	31	34	35	37	37	39	41	41
1B Surge & Decay Tank Level (%)	62	50	39	25	37	45	50	52
1C Surge & Decay Tank Level (%)	36	39	50	56	62	72(a)	72(a)	72(a)
1D Surge & Decay Tank Level (%)	8	0	0	4	11	10	12	10
1A Test Tank Level (%)	60	90	0	85	2	1	2	2
1B Test Tank Level (%)	90	0	75	0	65	65	65	65
Spray Recycle Tank Level (%)	88	87	88	88	88	87	88	88
1A Chemical Waste Tank Level (%)	86	81	81	81	83	83	83	72
1B Chemical Waste Tank Level (%)	56 T	67	58	25	1	2	6	67
1A Special Waste Tank Level (%)	0	0	0	0	0	0	0 T	12
1B Special Waste Tank Level (%)	2	33	50	61	80	80	79	0
1A Non-active Waste Tank Level (%)	12	12	12	12	12	18	22	32
1B Non-active Waste Tank Level (%)	25	41	52	67	80	89	13	13
1A Gas Decay Drum Pressure (psig)	26.8	25.5	22.9	30.8	32.3	36.6	40.1	40.9
1B Gas Decay Drum Pressure (psig)	17.8	17.8	17.1	17.0	16.9	17.0	17.0	17.0
1C Gas Decay Drum Pressure (psig)	22.8	22.6	22.1	22.1	23.0	23.2	23.4	23.3
1D Gas Decay Drum Pressure (psig)	24.4	24.3	24.1	24.0	25.0	25.1	25.4	25.5
Vent Gas Surge Drum Pressure (psig)	25.0	23.2	20.4	33.9	31.6	37.6	40.2	40.2
Vent Gas Compressor Suction Pressure (psia)	12.1	12.1	*12.1	12.2	12.5	12.2	12.0	12.0
RPC Gravity Drainage Tank Level (in.)	44	56	19.5	38	50	4	26	44
Flash Tank Level (in.)	37	37	37.5	37.5	37.8	36	36	36
Blow-off Tank Level (in.)	63	63	62.5	63	62	62	60	62
Blow-off Tank Pressure (psig)	2.6	2.6	2.6	3.0	2.6	2.8	2.1	3.1
Average Coolant Temperature (°F)	500	500	500	500	500	500	500	500
Pressurizer Pressure (psig)	1790	1800	1790	1790	1800	1790	1800	1800

* Air added to the surge drum.
(a) Readings in error
(T) Transfer of Tanks (See Log of Events, Table V)
NOTE: The RWD Tank levels readings, particularly those on the Surge Tanks, were not always accurate. The water in the saturated gas which supplies pressure to the RWD System settles in one of the legs of the D/P cells used for level measurement. Differential level readings, when filling or emptying, were considered accurate.

TABLE II

GROSS β ACTIVITY OF RWD TANKS

Date	8-22-60	8-26-60*
	Gross β Activity dpm/ml	Gross β Activity dpm/ml
1A Surge & Decay Tank	Empty	510.5 ± 16.0
1B Surge & Decay Tank	1521.0 ± 6.95	308.0 ± 12.45
1C Surge & Decay Tank	1086.0 ± 5.85	702.0 ± 48.50
1D Surge & Decay Tank	Empty	554.5 ± 17.0
1A Chemical Waste Tank	541.0 ± 4.29	362.0 ± 4.40
1B Chemical Waste Tank	385.0 ± 3.61	Empty
Spray Recycle Tank	172.0 ± 1.68	105.5 ± 3.63
1A Special Waste Tank	Empty	Empty
1B Special Waste Tank	Empty	35.7 ± 2.14
1A Non-active Waste Tank	21.0 ± 1.03	3.8 ± 0.13
1B Non-active Waste Tank	5.8 ± 0.13	2.3 ± 0.18
1A Test Tank	6.7 ± 0.13	3.0 ± 0.70
1B Test Tank	7.5 ± 0.38	5.9 ± 0.18

* Readings taken after 5 day work week and not after 7 day calender week.

TABLE III

CHEMISTRY DATA

Date	Surge Tank in Proc.	Flow Path	Ion Exchangers (IX)								Laboratory Ion Exchanger		Gas Stripper	
			Sp. Cond. - μ mhos					Gross β - dpm/ml			Gross β - dpm/ml		Dis. O_2-PPM	
			Leaving Surge Tank	A	B	C	D	Leaving Surge Tank	Leaving First IX	Leaving Last IX	Entering	Leaving	In	Out
8/20/60	1-B	BADC	428	102	151	2.8	20.1	3780 ± 16.6	123.5 ± 2.6	10.01 ± 1.6		Not performed	205.5 ± 4.3	Not performed
8/21/60	1-B	BADC	441	295	389	3.58	197	5960 ± 20.8	51.5 ± 2.1	3.94 ± 1.5			11.8 ± 2.3	
8/23/60	1-B	BADC	443	361	411	23.7	27.6	974 ± 8.6	297 ± 5.1	8.59 ± 2.2			716 ± 2.2	
8/24/60	1-B	ADCB	471	433	2.1	17.9	55.8	307 ± 7.9	65.5 ± 2.9	7.88 ± 2.2			Neg.	
8/25/60	1-B	ADCB	454	419	1.73	17.2	44.7	1561 ± 7.6	122.8 ± 2.5	24.3 ± 1.7			25.1 ± 1.7	

NOTE: No chromate analysis performed.

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TABLE IV

WASTE DISPOSAL DISCHARGE TO THE OHIO RIVER

Date	Time Start	Time End	Approximate Discharge (gallons)	Nominal rate of discharge as specified in permit (gpm)	Permit No.	Activity in Effluent $\mu c/ml \times 10^8$	*Total Gross Activity per Tank (μc)	Type Tank
8/22/60	1510	1915	4700	20	1201	0.080	88.83	1A Test Tank
8/22/60	1915	2315	4700	20	1203	0.062	65.33	1B Test Tank
8/24/60	1040	1415	4200	20	1204	0.132	124.74	1A Test Tank
8/25/60	0840	1245	4700	20	1205	0.110	121.73	1B Test Tank
8/26/60	1110	1520	4700	20	1206	0.042	46.53	1A Test Tank
8/27/60	2210	----	5800	80	1207	0.032	74.82	1B Non-active Tank
8/28/60	----	0710						
Total			28800				521.98	

* Gross activity total of each discharge was calculated by multiplying the activity of the sample taken (μC/gallon) by the total number of gallons discharged.

TABLE V

LOG OF EVENTS

Date	Time	Event
8/22/60	1600	Initial readings taken for DLCS 2390201. B Non-active waste tank receiving. B Special waste tank receiving. B Chemical waste tank receiving C Surge and decay tank receiving. B Test tank receiving
	1510 to 1915	"A" test tank discharged to river, permit No. 1201, 4700 gallons at 20 gpm - gross activity 1.89×10^{-2} μc/gal.
	1915	"A" test tank receiving water being stripped from the 1B surge tank.
	1915 to 2315	"B" test tank discharged to the river, permit No. 1203, 4700 gallons at 20 gpm - gross activity 1.39×10^{-2} μc/gal.
8/23/60	1130	Added 10% (400 gallon) to the 1B special waste tank from the 1A chemical waste tank. The Beta Activity was 547 $\pm$ 1 dpm/ml.
	1420	Started the incinerator to burn combustible solids.
	1630	Isolated the 1A test, 1B test tank now receiving. Continuing to process B surge tank through the BADC IX's through the stripper to the B test tank.
	1715	Reloaded the incinerator with combustible solids.
8/24/60	1030 - "B" ION EXCHANGER FLUSHED AND RECHARGED	
	1040 to 1415	"A" test tank discharged to the river, permit No. 1204, 4200 gallon at 20 gpm, gross activity 2.97×10^{-2} μc/gal.
	1330	Pumped the gravity drain tank to 19 inches (1600 gallons) to the "C" surge tank, chromate concentration 0.
	1630	Evaporating the "B" waste tank, continuing to process the "B" surge tank through ADCB IX's and the strippper to the "B" test tank.

TABLE V (cont'd)

LOG OF EVENTS

Date	Time	Event
8/25/60	0840 to 1245	"B" test tank discharge to the river, permit No. 1205, 4700 gallon at 20 gpm - gross activity 2.59 x 10^{-2} μc/gal.
	1050	Evaporator shut down.
	1115	Pumped out the evaporator bottom.
	1415	Evaporator on the line using the "B" chemical waste tank.
	1600	Continuing to process the "B" surge tank through the ADCB IX's and the stripper to the "B" test tank.
8/26/60	0820	The "B" surge and decay tank empty. The stripper shut down.
	0920	The evaporator shut down.
	1110 to 1520	"A" test tank discharged to the river, permit No. 1206, 4700 gallon at 20 gpm - gross activity 0.99 x 10^{-2} μc/gal.
8/27/60	1400	Pumped 2200 gallons from the gravity drain tank to the "B" surge tank, chromate concentration 0.
	2210	Started to discharged the "B" non-active tank to the river, permit No. 1207, 5800 gallons at 80 gpm - gross activity 1.29 x 10^{-2} μc/gal.
8/28/60	0001 to 0710	Continued discharging the "B" non-active tank to the river as per permit No. 1207.
	0840	Approximately 2400 gallons were transferred from the "B" Special Waste Tank to the "B" chemical waste tank because of high chromate content. The beta activity was 705 $\pm$ 9 dpm/ml.
	0915	Started to evaporate the "A" chemical waste tank.
	1600	Final readings taken for DLCS 23902.

TABLE VI

NOTES TO LOG OF EVENTS

Test Procedure Section VIII	Event
0 - 1	No delays were encountered or abnormal plant operations required during the performance of this test.
0 - 2	Activity was not determined for the two discharges of the Reactor Plant Container Gravity Drain Tank to the surge and decay tank since the discharges were mostly boiler water.
0 - 3	No discharges of resin from the Reactor Plant demineralizer occurred during this performance of the test.
0 - 4	Discharges of any tanks in the Radioactive Waste Disposal System to the effluent channel are tabulated in Table IV.
0 - 5	No gas decay drums were discharged to the atmosphere while the test was in progress.
0 - 6	The Blow-off tank was not vented during this test performance.
0 - 7	Processing of the surge tanks is listed in Table III. Chemical waste tanks were evaporated as recorded in the log of events.
0 - 8	Incinerator operations were recorded. Approximately 90 pounds of combustible waste was burned with an initial average contact activity of 5 MR/HR.
0 - 9	Approximately 600 pounds of non-combustible evaporator wastes were barreled with an average contact activity of 10 MR/HR.
0 - 10	The coolant sample train operated continuously at approximately 40 lbs/hr throughout the test. The sample flow rate and gross soluble beta-gamma activity recorders were out of service during this test but the activity was obtained from samples taken daily and are tabulated in Table VII.
0 - 11	The volume of laundry drainage could not be reported because the pump has a local float switch control and is pumped out automatically; all water goes to the special waste tank.

TABLE VII

COOLANT SAMPLE TRAINS
Flow Rate and Gross Gamma Activity

Date	Percent Power	Operational Time	Approx. Flow Rate	Specific Degassed Activity after 15 min.	Specific Degassed Activity after 120 hrs.
	%	Hrs.	lb/hr	dpm/ml x 10^3	dpm/ml x 10^3
8/22/60	106	79	40	98.3	12.3
8/23/60	104	103	40	105.0	----
8/24/60	104	122	40	110.6	12.6
8/25/60	105	150	40	100.0	11.0
8/26/60	102	171	40	97.0	----
8/27/60	106	196	40	106.4	----
8/29/60	100	243	40	97.7	10.7

DUQUESNE LIGHT COMPANY
POWER STATIONS DEPARTMENT
SHIPPINGPORT ATOMIC POWER STATION

PERIODIC WASTE DISPOSAL SYSTEM
MATERIAL BALANCE TEST
DLCS 2390201, T-641317

Results Prepared By John F. Kunzie Jr.

Results Reviewed By Roger J. Lawrence

Approved (Duquesne Light Company) George A. Sintle Date 3-17-61