DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 2130201
T-641124-A

MODIFIED PURIFICATION SYSTEM PERFORMANCE TEST

CORE I, SEED 2

Section 2 of 3 Sections

First Issue, July 21, 1961

DISCLAIMER

TEST RESULTS

DLCS 2130201
T-641124-A

MODIFIED PURIFICATION SYSTEM PERFORMANCE TEST

CORE I, SEED 2

Purpose

To determine the effectiveness of purification in controlling plant radioactivation rates.

Conclusions

The effectiveness of purification in controlling plant radioactivation rates was determined through comparison of the actual effects produced from plant operation with and without purification. With the Purification System in service, there was no appreciable difficulty in maintaining the reactor coolant within reference water specifications. In addition, there was no discernable increase of crud deposition in the Reactor Coolant System as determined by direct radiation measurements of the purification hairpin loop. However, without demineralization as a controlling agent, the gross non-volatile gamma activity levels of the reactor coolant increased and the specific activities of long-lived fission products were at higher levels.

Some conclusions can be made as to the effect of no purification flow on general plant contamination levels. Although the general levels of water borne activities increased during the test period, the associated plant systems did not exceed their limits.

Description of Test Equipment and Test Procedure

Following the completion of DLCS 3620101, Reactivity Lifetime, general plant radiation levels were determined, the resin was discharged from the 1BD demineralizer, and a new test section of piping was installed in the 1BD purification hairpin loop. The no purification test was performed in accordance with the approved test procedure of DLCS 21301, Modified Purification System Performance Test, issued June 15, 1960. The plant was operated for 1475 EFPH with the 1AC purification loop isolated and the 1BD purification loop in service without resin in the demineralizer. Coolant flow rate through the 1BD purification loop was regulated at approximately 20,000 lb/hr, providing flow conditions similar to those of normal purification. The Coolant Sampling System was utilized to obtain reactor coolant water samples from the 1BD demineralizer influent, for chemical and radiochemical analyses. The 1BD hairpin loop was used for direct measurement of the radiation increase due to crud build-up in the Reactor Coolant System. At the beginning of the run, and every 300 EFPH thereafter, the hairpin loop was temporarily isolated. During each isolation, radiation level measurements were taken at the vertical and horizontal leg shield penetrations provided on the

hairpin loop. After 1475 EFPH of plant operation without by-pass purification, the test was terminated, general plant radiation levels were determined and the test section of piping was removed from the hairpin loop for performance of an analysis in accordance with DLCS 36501, Analysis and Radiation Measurements of Hairpin Loop Sections of the Purification System.

The 1BD hairpin loop was not drained and surveyed the first time it was isolated, (June 24, 1960) since the plant heat-up was already in progress.

A portable Jordan radiation survey meter with the ionization chamber on an extension cord was used to determine the radiation levels of the hairpin loop. Table V contains the meter calibration data.

Results

DLCS 2130201, Modified Purification System Performance Test, was started June 23, 1960 and concluded September 12, 1960. The plant was operated for about 1475 EFPH while the 1BD purification loop was in service with no resin in its demineralizer and the 1AC purification loop was isolated. Plant operation with no purification extended between 773.1 and 2247.7 EFPH of Core I Seed 2. The data recorded for this period was included in Tables I, II, III and IV.

Table I summarizes the analytical data related to reactor coolant chemical control. Reference water specifications for reactor coolant were maintained within the prescribed limits, although conductivity increased slightly during the test and averaged higher than values obtained previously. Four additions of $LiOH \cdot H_2O$ were required for pH control of the Reactor Coolant System.

The observed values of gross non-volatile gamma activity after 15 minute decay increased at start-up of the plant and remained about a factor of 2 higher than the gross gamma levels experienced with the Purification System in service. The initial increase of activity was due to a burst of fission products and crud during start-up. Without the aid of purification these activities and crud are removed only by plant leakage. The long-lived gross non-volatile gamma activity after 120 hour decay increased from an average value of 2,000 cpm/ml, before the test began, to 9,000 cpm/ml after the test began. The long-lived activities ranged up to an average of 17,000 cpm/ml near the midpoint of the test, then decreased to values similar to those observed at the beginning of the test. The long-lived activity was due almost entirely to Iodine-133 and Xenon-133. Iodine-133 accounted for 62% of the long-lived activity and Xenon-133 for about 30%.

All data for fission product activities are reported in Table II. The data shows some scattering, but in general, the specific activities of fission products in the reactor coolant were at higher levels, without the use of purification, than during any previous phase of plant operation. The activity levels of short-lived fission products fluctuated slightly after the initial build-up, and did not differ significantly from levels observed during half-purification operation of Seed 1. The activity of Cesium-138 (32 minutes half-life) is a typical example

which averages about 16,500 dpm/ml during both periods. The intermediate and long-lived fission products showed increased activity levels over previous Seed 2 observations. The trend of Cesium fission products demonstrates the circumstances. The specific activities of Cesium-136 (13 days half-life) and Cesium-137 (30 years half-life) increased by factors of 2 and 5 respectively, immediately after start-up June 23, 1960, and they continued to increase until midway through the run. Cesium-136 activity increased by a factor of 100, to 850 dpm/ml; Cesium 137 activity increased by a factor of 20, to 2990 dpm/ml. There also was a significant increase in Iodine-131 (8.05 days half-life) fission product activity. It increased to a maximum of 64,000 dpm/ml, which is the highest value observed during Seed 2. While this increase is large, it was probably due to load swings and student training, since the iodine activity levels declined with steady state operation near the end of the run. Evidence which might indicate the effectiveness of purification is the observation of Bromine-82 (35 hours half-life). It was never detected during Seed 1 operation or during Seed 2 operation when the Purification System was in service. However, during no purification its specific activity attained a maximum value of 2,000 dpm/ml.

At this time, the data indicate that purification is effective at controlling the concentration of long-lived fission products, but it is difficult to evaluate the effectiveness of purification in controlling fission products, since crucial to the analysis is a comparison of activity levels while establishing the effects of any relevant variables. For example, when comparing no purification data with Seed 1 data, there is no way of establishing that the fission product activity was equivalent during both periods (additions of iodine products from fuel may be different, etc.). Also, there are considerations necessary when making comparisons with previous Seed 2 data. The limited data, acquired prior to operation without purification, suggests the possibility that fission product activity had not reached equilibrium, due to the purification half-life.

Data for reactor coolant corrosion products are shown in Table III. The concentration of water borne corrosion products was approximately 45 ppm when the plant returned to power after being cooled down for several days. The concentration after two days operation decreased to a range of 2 to 6 ppb and increased during power and temperature transients to approximately 10 to 15 ppb.

A summary of data concerning the radiation intensities (on contact) of the 1BD hairpin loop is given in Table IV. There was no trend apparent throughout the test and there were no significant changes in radiation levels. The radiation levels measured 3 hours after isolation of the hairpin loop varied between 20 and 55 mr/hr. The levels indicated that there was no discernable increase of crud deposition in the Reactor Coolant System during no purification operation. This conclusion was corroborated by test results DLCS 3410102 and 05, External Radiation Levels of Reactor Coolant Loop Piping and Components, performed June 10-18, 1960, and September 12-16, 1960, respectively. These results indicated that there was no significant increase in radiation levels from operation

without purification. The majority of the points surveyed in the coolant loops had radiation levels varying from 2 to 5 mr/hr. These results also report the existance of "hot spots" with levels ranging from 90 to 400 mr/hr. This verifies that there is corrosion product "Plate Out", but none of the hot spots showed significant changes in radiation level over the no purification period.

One problem of operation with no purification is the build-up of activity on the secondary side of the Heat Exchangers. The small leaks which are normally not a problem remained constant, however the amount of activity introduced per ml of leakage increased. This means that the constant risk of contaminating the boiler was present during the no purification test.

Radiation surveys can give an indication of crud build-up, however, a more complete evaluation will be available with the issuance of DLCS 36501, Analysis and Radiation Measurement of Hairpin Loop Sections of the Purification System, which is being performed on the test section of piping installed for the no purification test.

DUQUESNE LIGHT COMPANY
POWER STATIONS DEPARTMENT
SHIPPINGPORT ATOMIC POWER STATION

MODIFIED PURIFICATION SYSTEM
PERFORMANCE TEST
DLCS 2130201 (T-641124-A)

TABLE I

REACTOR COOLANT CHEMISTRY

Date		Sample Source	Elect. Cond. Mmhos	pH at 25 C	Li ppm	O_2 ppm	Cl ppm	Gross Non-volatile Gamma Activity cpm/ml x 10^3 15 min.	Gross Non-volatile Gamma Activity cpm/ml x 10^3 120 hr.	Gas Analysis cc/kg Total	Gas Analysis cc/kg H_2	Gas Analysis cc/kg Inert	Chemical Additions H_2 Ft^3	Chemical Additions LiOH g
6/23/60		BD-BIX	11.5	9.71		0.005					40		80	
24			11.6	9.73	0.37			79.76	18.13		38			
25		BD-BIX	10.2	9.60	0.32	0.010		56.84	17.60		35			115
26		BD-BIX	30.2	10.12			<0.05	85.10	9.55		33			
27		BD-BIX						56.56	8.22		30			
28		BD-BIX	30.0	10.10				85.48	15.73		24			
29		BD-BIX			0.89	0.005	<0.05	89.11	6.49		20		90	
30		BD-BIX						62.28	2.71		51			
7/ 1/60		BD-BIX	29.9	10.09				101.67	8.87		38			
2		BD-BIX				0.000		104.37	7.13		30			
3		BD-BIX	27.1	9.98	0.82		<0.05	109.37	11.35		28			
4		BD-BIX						90.19	6.84		24			
5	Load Swings Student Training	BD-BIX	24.0	10.00	0.74			111.67	10.02		20			
6		BD-BIX				0.010	<0.05	101.98	5.09		38			
7		BD-BIX						98.09			30			
8		BD-BIX	22.6	9.95	0.71			94.75	6.30		25			
9		BD-BIX				0.000		99.70	6.75		25			
10		BD-BIX	17.6	9.90			<0.05				20			
11		BD-BIX						91.58	15.79		18		80	
12		BD-BIX	16.4	9.81	0.48			41.08	17.66		36			
13		BD-BIX				0.000	<0.05	41.02	22.19		32			
14		BD-BIX						41.05						
15		BD-BIX						38.94						
16		BD-BIX	14.9	9.60	0.36	<0.005					32			227
17		BD-BIX	24.0	10.00	0.78	<0.005	<0.05							
18		BD-BIX						68.26	24.18					
19		BD-BIX									44		95	
20		BD-BIX									35			
21		BD-BIX									30			
22		BD-BIX						83.98	21.65	28	24	4		
23		BD-BIX									21		80	
24		BD-BIX	20.2	9.89			<0.05				39			
25		BD-BIX						84.64	15.56	36	30	6		
26		BD-BIX	19.6	9.89				47.41	16.40		27			
27		BD-BIX				0.005	<0.05	79.07	9.43		25			
28		BD-BIX						84.15			21		85	
29		BD-BIX	16.5	9.80				77.88			41			
30		BD-BIX									36			151
31							<0.05							

TABLE I (cont'd)

REACTOR COOLANT CHEMISTRY

Date	Source	Elect. Cond. Mmhos	pH at 25 C	Li ppm	O_2 ppm	Cl ppm	Gross Non-volatile Gamma Activity cpm/ml x 10^3 15 min.	Gross Non-volatile Gamma Activity cpm/ml x 10^3 120 hr.	Gas Analysis cc/kg Total	Gas Analysis cc/kg H_2	Gas Analysis cc/kg Inert	Chemical Additions H_2 Ft^3	Chemical Additions LiOH gs
8/ 1/60	BD-BIX								↑	24			
2	BD-BIX									24		80	
3	BD-BIX					<0.05				37			
4	BD-BIX	23.7	10.00		0.000		111.78	28.52		24			
5	BD-BIX									27			
6	BD-BIX									28			
7	BD-BIX						93.18	18.65		44		75	
8	BD-BIX									38			
9	BD-BIX						113.40	29.31		30			
10	BD-BIX				0.000		186.36	17.87		30			
11	BD-BIX	23.9	10.00				120.37			30			
12	BD-BIX	22.0	9.60	0.74						24			
13	BD-BIX				0.000		117.27		27	23	4		240
14	BD-BIX	22.8	9.81					15.00		20			
15										42			
16	BD-BIX	22.5					89.42	12.84	41	38	3	85	
17	BD-BIX	42.1	9.89	0.89	<0.005			12.97		41			
18	BD-BIX							20.73		32			
19	BD-BIX							13.17	28	26	2		
20	BD-BIX				<0.005		106.70	15.60		25			
21	BD-BIX	27.5	9.99	0.91			111.00			25			
22	BD-BIX	27.0	9.98	0.90			105.10			43		80	
23													
24	BD-BIX				<0.005		110.60			33			
25	BD-BIX						100.04	12.61		33			
26	BD-BIX	27.1	9.97	0.84			96.90	10.99		30			
27	BD-BIX				<0.005			8.92		27			
28	BD-BIX	26.7	10.04	0.82						22			
29	BD-BIX						94.74	10.74		46		90	
30	BD-BIX						99.59	8.34		43			
31	BD-BIX						100.51	8.04		35			
9/ 1/60	BD-BIX						104.33	8.08		31			
2	BD-BIX						83.79	8.52					
3	BD-BIX	24.2	9.90	0.78			98.74	6.37		24		80	
4	BD-BIX	22.4	9.98				121.45	5.90		43			
5	BD-BIX						89.62			36			
6	BD-BIX	23.4	9.95	0.66			89.81			31			
7	BD-BIX				<0.005		97.91			28			
8	BD-BIX						96.85			23			
9	BD-BIX	23.0		0.69						20			

Midway of Test

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TABLE II

REACTOR COOLANT FISSION PRODUCT SPECIFIC ACTIVITIES

	Reactor Power Level		Specific Activity - 1000 dpm/ml																			H-3
Date	Hrs.	%	Cs-136	Cs-137	Cs-138	Cs-139	Kr-85m	Kr-87	Kr-88	Br-82	Br-83	Br-84	Xe-133	Xe-135	I-131	I-133	Sr-89	Sr-90	Sr-91	Sr-92	Ba-139	Ba-140	A-41	μc/l
6/23/60			0.0075	0.142											17.3									118.4
24	12	74			12.5										13.2	5.25								
25	2	52													16.2	16.2								
26	22	100																						
27	46	100	0.284	0.853	13.7	4.2																		
28	71	100													14.9	14.6	0.0018				0.300			
29	95	100			17.5														0.132	0.049				
30	119	100					4.97	4.32	14.0				49.3	16.4									5.45	
7/ 1/60	212	100							13.5															
2	237	100																						
3	264	100																						194.4
4	285	100																						
5	308	100							12.7	0.578	1.74						0.0042					0.0025		
6	332	100			15.0															0.038				
7	356	75													14.1	13.0								
8	380	80			16.7				16.3						17.7	14.7								
9	406	100																						
10																								
11		*																						
12		*	0.478	1.215											45.	15.8								
13		*													63.	12.6								
14		*													64.	11.1								
15		*																						
16																								
17																								
18	---	72													44.3	4.80								
19															45.3	8.82								
20															47.0	20.5								
21															40.5	14.6								
22	0	---			8.55		2.38	1.28					26.4	9.90	45.	27.1							5.40	

* Training School Operation - Criticality once per shift and approximately 1/2 hour at 35% reactor power

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TABLE II (cont'd)

REACTOR COOLANT FISSION PRODUCT SPECIFIC ACTIVITIES

	Reactor Power Level		Specific Activity - 1000 dpm/ml																				H-3
Date	Hrs.	%	Cs-136	Cs-137	Cs-138	Cs-139	Kr-85m	Kr-87	Kr-88	Br-82	Br-83	Br-84	Xe-133	Xe-135	I-131	I-133	Sr-89	Sr-90	Sr-91	Sr-92	Ba-139	Ba-140	A-41	µc/l
7/23/60	0	---																						
24	90	1																						
25	50	4	0.514	2.27	17.5										45	37.5								
26	64	1							10.9	0.678	1.15	1.47									0.751			
27	56	7	0.521	2.24											42.6	24.7	0.0112		0.085	0.088		0.0085		
28	38	2																						
29	40	5													60.5	39.5								
30	---	0																						
31	---	0																						
8/ 1/60	3	60	0.651	2.71					23.6						49.5	12.0								
2	2	75					4.50	3.90	16.9	0.470	2.36	1.62	68.0	21.8			0.0116					0.0098	2.58	
3	12	100	0.650	2.99	17.8														0.077	0.086				
4	36	100					3.75	3.36					40.7	16.9									5.20	
5	48	100			14.5				13.7						45.2	15.8								
6	66	100																						
7	1	46																						150.2
8	13	100	0.645	2.36	13.2										38.8	21.3								
9	37	100					4.78	3.92	19.1	1.35	3.35		70.5	16.9			0.0469				0.954	0.0421	2.38	
10	67	100	0.722	2.53	18.9				15.0															
11	80	100																	0.090	0.182				
12	99	103			17.2				19.0						30.3	19.0								
13	---	0																						
14																								
15	5	100								0.835					40.0	16.0								
16	21	104							16.9		2.94										0.885	0.0040		
17	46	100	0.854	2.64	17.2	3.85																		
18	73	100					3.26	2.62					85.5	9.20									1.74	
19	3	100	0.345	2.72					20.4						43.6	41.8								
20	30	100																						
21	54	106																						
22	79	106	0.402	2.71	16.1																			265.1

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TABLE II (cont'd)

REACTOR COOLANT FISSION PRODUCT SPECIFIC ACTIVITIES

	Reactor Power Level		Specific Activity - 1000 dpm/ml																				H-3
Date	Hrs.	%	Cs- 36	Cs-137	Cs-138	Cs-139	Kr-85m	Kr-87	Kr-88	Br-82	Br-83	Br-84	Xe-133	Xe-135	I-131	I-133	Sr-89	Sr-90	Sr-91	Sr-92	Ba-139	Ba-140	A-41	µc/l
8/23/60	103	104					2.95	5.1	13.8	1.98	3.98		73.2	10.1	35.6	20.7	0.045				0.745	0.034	3.52	
24	122	104	0.422	2.45	15.0														0.061	0.065				
25	150	105																						
26	171	102	0.147	2.48	17.8				17.3						29.5	16.6								
27	196	106																						
28	---	---																						
29	243	100	0.152	2.79	17.0	2.23																		
30	267	100	0.274	1.40						1.35	3.89				18.8	12.9					0.640			
31	297	100			18.9																			
9/ 1/60	319	100							15.3						21.7	17.4								
2	345	100																						
3	367	100																						
4	391	100																						
5	416	100													16.2	13.7								
6	439	100							19.3	2.04	4.21						0.045				0.837			
7	458	100			16.0														0.074	0.072		0.008		
8	488	100																						
9	506	100							14.4						17.5	16.5								
10	530	100																						
12	0	0	0.760	2.48																				

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TABLE III

REACTOR COOLANT CORROSION PRODUCTS

In Service		Out Service			Crud Weight	Crud Conc.	% Fe_3O_4	Fe mg/mg	Co mg/mg	Sp Activity (cpm/mg)10^6	Induced Activity dpm/mg at T^o							% of Total
Date	Time	Date	Time	Source	mg	ppb	In Crud	of Crud	of Crud	T^o + 120hrs	Fe-59	Co-58	Co-60	Mn-54	Zr-95	Hf-181	Cr-51	Activity
6/23/60	0905	6/24/60	1245	BD-BIX	24.71	45.20												
24	1250	25	1410	BD-BIX	20.18	44.20	90.8	0.63	0.0031	11.70	2.60×10^6		1.58×10^7	1.81×10^6	1.10×10^5	6.80×10^5	2.85×10^6	79.8
25	1415	26	1915	BD-BIX	5.54	8.61												
26	1920	27	1445	BD-BIX	4.30	10.66												
27	1450	28	1415	BD-BIX	4.32	9.00												
28	1420	29	1500	BD-BIX	2.13	5.24	98.2			19.0								
29	1505	7/ 1/60	1315	BD-BIX	5.12	5.05												
7/ 1/60	1320	5	1115	BD-BIX	6.45	4.28												
5	1120	8	1040	BD-BIX	6.00	3.85	95.4			15.9								
8	1045	11	1500	BD-BIX	5.64	7.08												
11	1505	12	1115	BD-BIX	2.30	11.61												
12	1120	13	1245	BD-BIX	5.59	7.09												
13	1250	14	0845	BD-BIX	2.42	9.68				19.0								
14	0850	16	1345	BD-BIX	6.88	8.05												
16	1410	18	0915	BD-BIX	15.11	18.61												
18	0920	19	0845	BD-BIX	6.59	14.87												
19	0850	20	0900	BD-BIX	16.82	16.78												
20	0905	21	0850	BD-BIX	0.45	1.07												
21	0850	22	0945	BD-BIX	5.00	8.71			0.00084	16.30	2.87×10^6	1.96×10^6	2.49×10^7	2.07×10^6	2.33×10^5	9.54×10^5	1.75×10^6	88.4
22	0950	23	1430	BD-BIX	0.92	1.82	98.6											
23	1630	25	1000	BD-BIX	1.61	3.04	88.9			15.00								
25	1040	28	1255	BD-BIX	4.03	2.99												
28	1300	8/ 1/60	0900	BD-BIX	19.60	10.30												
8/ 1/60	0905	4	0930	BD-BIX	6.52	5.65												
4	0930	8	0950	BD-BIX	12.66	10.08	98.8			17.30								
8	1015	15	1130	BD-BIX	19.11	8.25	92.0			19.30								
15	1145	22	1100	BD-BIX	23.41	6.42	94.0											
22	1105	29	0845	BD-BIX	13.06	3.90	93.5	0.657	0.00018	16.10	2.64×10^6	2.54×10^6	1.85×10^7	2.01×10^6	0.9×10^5	12.2×10^5	0.81×10^6	73.2
29	1015	9/ 6/60	0945	BD-BIX	14.23	2.82	90.0			16.00								
9/ 6/60	0950	12	0900	BD-BIX	6.20	1.95	97.0											

TABLE IV

1BD HAIRPIN LOOP RADIATION LEVELS

Date	Time	Total Core I EFPH	Gross Gen. Output mw	Radiation Levels		Remarks
				Vertical Section mr/hr	Horizontal Section mr/hr	
6/24/60	1120	6592.4	60	32	25	Loop filled and isolated.
6/24/60	1210					Loop returned to service.
7/ 7/60	1045	6879.6	67			Loop isolated.
7/ 7/60	1400			30	40	
7/ 7/60	1608			33	40	
7/ 8/60	0220			30	35	
7/ 8/60	0710	6900.2	67			Loop returned to service
8/ 5/60	0600	7180.8	48			Loop isolated
8/ 5/60	0900			43	50	
8/ 5/60	1100			35	40	
8/ 5/60	2100			30	40	
8/ 5/60	2120	7193.8	67			Loop returned to service
8/22/60	0610	7533.9	66			Loop isolated
8/22/60	0910			21	24	
8/22/60	1116			18	22	
8/22/60	2110			10	12	
8/22/60	2130	7549.8	66			Loop returned to service
9/ 1/60	0600	7784.7	67			Loop isolated.
9/ 1/60	0907			30	28	
9/ 1/60	1105			24	35	
9/ 1/60	2105			35	28	
9/ 1/60	2110	7800.6	67			Loop returned to service
9/ 9/60	0600	7985.0	66			Loop isolated
9/ 9/60	0905			51	55	
9/ 9/60	1100			42	44	
9/ 9/60	2100			32	25	
9/ 9/60	2100			23	28	
9/ 9/60	2130	8001.1	67			Loop returned to service

TABLE V

METER CALIBRATION DATA

Jordan Survey Meter No. 733 (with extension cord on probe)

Calibration Date (Source Co 60)					
6/10/60 mr/hr		7/7/60 mr/hr		8/5/60 mr/hr	
Calc.	Meas.	Calc.	Meas.	Calc.	Meas.
5	5	5	5.7	5	5
10	11.5	10	12	10	11
15	16	25	28	25	28
54	54	50	60	50	58
100	105	100	115	100	110
150	145	150	155	250	255
250	250	250	250	500	500
500	500	500	500	1000	1000
1000	1000	1000	1000	1500	1500
1500	1500	1500	1500		

Log of Events

June 1960

June 24	Reactor critical, system temperature 500 F and pressure 1800 psig. The main unit generator was placed on the line and gross output increased to 58 mw. The 1A, 1B and 1C reactor coolant pumps on fast speed. The 1D coolant loop isolated with the 1D reactor coolant pump off. The 1AC purification demineralizer was isolated. The 1BD purification demineralizer is in service without resin. (The resin was flushed from the 1BD demineralizer on June 17, 1960).
1120	1BD hairpin loop isolated
1210	1BD hairpin loop returned to service
1218	Load increased to 67.5 mw gross
1355	Load decreased to 57 mw gross
1800	Load increased to 60 mw gross
1824	Safety shutdown and main generator off the line
June 25	
0440	Reactor critical with primary system temperature 497 F and pressure 1800 psig.
0658	Generator synchornized
1710	Load increased to 32 mw gross
1011	Load increased to 67.5 mw gross
June 27	
0658	Load decreased to 62 mw gross
1710	Load decreased to 52 mw gross
1015	1D coolant loop depressurized to primary storage tank pressure
1610	Load decreased to 47 mw gross
1835	Load increased to 67 mw gross
June 28	
0300	1D coolant loop steam flushed and drained
0620	Load decreased to 53 mw gross
0645	Load decreased to 47 mw gross
1108	Load increased to 61.5 mw gross
1323	Load increased to 67.5 mw gross
June 30	
0708	Load decreased to 54 mw gross
0935	Load increased to 67 mw gross

Log of Events
(cont'd)

July 1__	
1838	Throttle tripped and main generator off the line
1914	Generator synchronized
1950	Load increased to 48 mw gross
2320	Load increased to 67 mw gross
July 7__	
0703	Load decreased to 50 mw gross
0950	Load increased to 67 mw gross
1045	1BD hairpin loop isolated
1300	1D coolant loop filled to top of 1D reactor coolant pump vent
July 8__	
0710	1BD hairpin loop returned to service
0720	Load decreased to 56 mw gross
1110	Load increased to 67 mw gross
2210	1D reactor coolant loop drained
July 9__	
1645	Main generator taken off the line
1721	All control rods placed on the bottom of the reactor
1750	1A, 1B and 1C reactor coolant pumps transferred to slow speed
July 10__	
0630	1A and 1C reactor coolant pumps removed from service
July 11__	
1122	Reactor critical, primary system at temperature of 494° F and pressure of 1750 psig. 1A, 1B and 1C reactor coolant pumps on fast speed
1229	Main generator on the line at load of 45 mw gross
1420	Load increased to 60 mw gross
1820	Main generator taken off the line

Log of Events
(cont'd)

July 11 to July 17__

From July 12 through July 15, students from the Nuclear Training School performed station start-ups and shutdowns, and the reactor was critical for a total of approximately 26 hours. On July 14 the 1AC purification demineralizer was flushed and on July 15 the 1D reactor coolant loop was filled, hydro-tested, and made available for service.

On July 17 the primary system was cooled to 170 F and 450 psig to permit placing the 1D loop in service. The plant was heated up with flow in four loops and all the reactor coolant pumps operating on slow speed.

July 18__

0545	1B reactor coolant pump removed from service. 1A, 1C and 1D reactor coolant pumps transferred to fast speed.
0620	Reactor critical, primary system at temperature of 494 F and pressure of 1790 psig.
0920	Main generator put on the line and load increased to 35 mw gross
1318	Load increased to 57 mw gross
1710	Load decreased to 17 mw gross
1855	Load decreased to 5 mw gross
2025	Load increased to 25 mw gross

July 19__

0306	Load increased to 34 mw gross
1028	Load increased to 41 mw gross
1312	Load increased to 48 mw gross
1801	Main generator taken off the line
1828	All control rods placed on the bottom of the reactor

July 20__

0249	Reactor critical, primary system at temperature of 490 F and pressure of 1800 psig.
0418	Main generator put on the line and load increased to 47 mw gross
0550	Load increased to 61 mw gross
0627	Load decreased to 48 mw gross
1120	Load decreased to 34 mw gross
1707	Load increased to 61 mw gross
1930	Load increased to 64 mw gross

Log of Events
(cont'd)

July 21__

0627	Load decreased to 25 mw gross
1125	Main generator taken off the line
1205	All control rods placed on the bottom of the reactor
1804	Reactor critical, primary system at temperature of 480 F and pressure of 1800 psig.
1928	Main generator put on the line and load increased to 25 mw gross

July 22__

0040	Load increased to 54 mw gross
0250	Load increased to 60 mw gross
0703	Load decreased to 34 mw gross
1155	Load increased to 48 mw gross
1733	Load increased to 60 mw gross

July 23__

0729	Main generator taken off the line
0804	All control rods placed on the bottom of the reactor
1243	Reactor critical, primary system at temperature of 510 F and pressure of 1800 psig.
1412	Main generator put on the line
1420	Load increased to 15 mw gross
1457	Load increased to 25 mw gross
1957	Load increased to 34 mw gross

July 24__

0050	Load increased to 48 mw gross
0550	Load increased to 57 mw gross
2000	Main generator taken off the line
2037	All rods placed on the bottom of the reactor

July 25__

0039	Reactor critical, primary system at temperature of 520 F and pressure of 1960 psig.
0147	Main generator put on the line
0154	Load increased to 25 mw gross
0710	Load increased to 34 mw gross
1212	Load increased to 48 mw gross
1730	Load increased to 54 mw gross
1953	Load increased to 58 mw gross

Log of Events
(cont'd)

July 26__

0652	Main generator taken off the line
0730	All rods placed on the bottom of the reactor
1120	Reactor critical, primary system at temperature of 490 F and pressure of 1785 psig.
1153	Main generator put on the line and at 10 mw gross
1210	Load increased to 43 mw gross
1510	Load increased to 48 mw gross
1955	Load increased to 54 mw gross
2055	Load increased to 57 mw gross

July 27__

0650	Load decreased to 33 mw gross
1406	Main generator taken off the line
1440	All control rods placed on the bottom of the reactor
1906	Reactor critical, primary system at temperature of 507 F and pressure of 1950 psig.
2022	Main generator put on the line
2100	Load increased to 34 mw gross
2130	Load increased to 45 mw gross
2325	Load increased to 60 mw gross

July 28__

0120	Load increased to 65 mw gross, primary system at temperature of 520 F and pressure of 1985 psig.
0618	Main generator taken off the line
0652	All control rods placed on the bottom of the reactor
0912	1A, 1C and 1D reactor coolant pumps transferred to slow speed
1108	Reactor critical, primary system at temperature of 517 F
1150	Main generator placed on the line
1220	Load at 25 mw gross
1223	Load decreased to 21 mw gross
1720	Main generator taken off the line
1802	All control rods placed on the bottom of the reactor
2002	Reactor critical, primary system at temperature of 478 F and pressure of 1800 psig
2100	Main generator put on the line
2110	Load increased to 21 mw gross
2317	Safety shutdown and main generator off the line
2323	1A, 1C and 1D reactor coolant pumps transferred to fast speed

Log of Events
(cont'd)

July 29__

0521	1A, 1C and 1D reactor coolant pumps transferred to slow speed
0602	Reactor critical, primary system temperature at 483.5 F and pressure of 1800 psig
0725	Main generator put on the line and increasing to 21 mw gross
0800	Load increased to 22.5 mw gross
1506	Main generator taken off the line
1530	All control rods placed on the bottom of the reactor
1555	1A, 1C and 1D reactor coolant pumps transferred to fast speed
1755	1A, 1C and 1D reactor coolant pumps transferred to slow speed
1838	Reactor critical, primary system at temperature of 473 F and pressure of 1800 psig.
1924	Main generator put on the line
1940	Load increased to 20 mw gross

July 30__

0020	Main generator taken off the line
0044	All control rods placed on the bottom of the reactor
0315	Reactor critical, primary system at temperature of 473.5 F and pressure of 1800 psig.
0359	Main generator put on the line and at 5 mw gross
0405	Load increased to 22 mw gross
0851	Main generator taken off the line
0904	1A, 1C and 1D reactor coolant pumps transferred to fast speed. 1B reactor coolant pump put in service on fast speed.
1114	All reactor coolant pumps transferred to slow speed
2011	All reactor coolant pumps transferred to fast speed

July 31__

0940	All reactor coolant pumps transferred to slow speed
1849	All reactor coolant pumps transferred to fast speed
2219	1A, 1C and 1D reactor coolant pumps transferred to slow speed. 1B reactor coolant pump removed from service.
2308	Reactor critical, primary system at temperature of 510 F and pressure of 1900 psig.

August 1__

0117	Main generator put on the line and at 5 mw gross
0122	Load increased to 15 mw gross
0648	Main generator taken off the line.
0710	All control rods placed on the bottom of the reactor

Log of Events
(cont'd)

August 1__

0907	1A, 1C and 1D reactor coolant pumps transferred to fast speed. 1B reactor coolant pump put in service on fast speed.
0957	1B reactor coolant pump removed from service
1017	Reactor critical
1140	Main generator put on the line
1152	Load increased to 40 mw gross
1355	Load decreased to 5 mw gross
1445	Load increased to 23 mw gross
1514	Load increased to 43 mw gross
1535	Load decreased to 35 mw gross, primary system at temperature of 500 F and pressure of 1800 psig.
1750	Load increased to 55 mw gross
2050	Load decreased to 43 mw gross
2117	Load increased to 63 mw gross
2140	Load decreased to 43 mw gross
2200	Load decreased to 23 mw gross
2232	Load decreased to 5 mw gross
2245	Load increased to 63 mw gross

August 2__

0650	Load decreased to 20 mw gross
0825	Load increased to 59 mw gross
0915	Load decreased to 50 mw gross
0942	Load decreased to 40 mw gross
1230	Load increased to 50 mw gross
1807	Load increased to 64.5 mw gross

August 4__

0845	Load decreased to 50 mw gross
1108	Load decreased to 38 mw gross
1313	Load increased to 45 mw gross
1530	Load increased to 60 mw gross
1615	Load increased to 64 mw gross

August 5__

0033	Main generator taken off the line
0105	All control rods placed on the bottom of the reactor
0240	1B reactor coolant pump put in service on fast speed
0346	Reactor critical, primary system at temperature of 500 F

Log of Events
(cont'd)

August 5__

0436	Main generator put on the line and at 8 mw gross
0530	Load increased to 48 mw gross
0600	1BD hairpin loop isolated
1510	Load increased to 60 mw gross
1747	Load increased to 66 mw gross
2120	1BD hairpin loop returned to service

August 7__

1205	Load decreased to 28 mw gross
1510	Load increased to 48 mw gross
2050	Load increased to 65 mw gross, primary system at tempetature of 500 F and pressure of 1785 psig

August 8__

0120	Load increased to 66 mw gross

August 9__

0707	Load decreased to 47 mw gross
0830	Load increased to 66 mw gross

August 10__

0840	Load decreased to 60.5 mw gross
0930	Load increased to 65.5 mw gross

August 11__

0652	Load decreased to 50 mw gross
0703	Load decreased to 37 mw gross
0727	Load increased to 49 mw gross
0920	Load increased to 66 mw gross

August 13__

0825	Performed rapid station shutdown in accordance with DLCS 34401
1013	1B reactor coolant pump removed from service
1015	1B reactor coolant loop main hydraulic valves closed
1751	1B reactor coolant pump put in service at slow speed with loop by-pass valve open.
1225	Performed xenon transient test DLCS 1560109

Log of Events
(cont'd)

August 14__

1833	1B reactor coolant pump removed from service
1838	1B reactor coolant pump put in service at slow speed

August 15__

0046	1B reactor coolant pump removed from service
0047	1B reactor coolant loop main hydraulic valves opened and 1B reactor coolant pump put in service at fast speed.
0100	1B reactor coolant loop by-pass valve closed
0620	Reactor critical, primary system at temperature 500 F and pressure of 1790 psig.
0702	Main generator put on the line
0710	Load increased to 37 mw gross
0729	Load increased to 58 mw gross
1115	Load increased to 63 mw gross
1710	Load increased to 66 mw gross

August 18__

1602	Main generator taken off the line

August 19__

0029	Main generator put on the line and at 10 mw gross
0035	Load increased to 47 mw gross
0650	Load increased to 66 mw gross

August 22__

0610	1BD hairpin loop isolated
2130	1BD hairpin loop returned to service

August 26__

0315	Safety insertion

September 1__

0600	1BD hairpin loop isolated
2110	1BD hairpin loop returned to service

Log of Events
(cont'd)

September 6__

1640	Load decreased to 50 mw gross
1743	Load increased to 61 mw gross

September 7__

1305	Load decreased to 50 mw gross
1400	Load increased to 66 mw gross

September 9__

0600	1BD hairpin loop isolated
2130	1BD hairpin loop returned to service

TEST RESULTS DLCS 2130201
T-641124-A
MODIFIED PURIFICATION SYSTEM PERFORMANCE TEST

Results Prepared By Thomas H. Seberry Jr.

Results Reviewed By Edward Jones

Approved (Duquesne Light Company) George A. Santel Date 7-21-61