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DUQUESNE LIGHT COMPANY
SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 1600102
T-550126

INITIAL APPROACH TO CRITICALITY

CORE I, SEED 2

Section 1 of 1 Section

First Issue, June 1, 1960

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Purpose

The purpose of this test was to bring Core I, Seed 2 to the critical condition and to determine the critical rod bank height.

Conclusions

Core I, Seed 2 was brought to criticality on a rod bank consisting of the control rods on inverters one and seven (Rods 11, 12, 13, 14, 71, 72, 73 and 74) at a rod bank height of 24.70 inches.

Description of Equipment and Test Procedure

The control rods on inverters one and seven were withdrawn alternately in one inch increments to the 20 inch level. The withdrawal increment was then decreased to one-half inch until the 24.5 inch level was reached. The control rods were withdrawn in one-tenth inch increments until criticality was attained.

The Nuclear Instrumentation System source range readings were observed on each channel during the approach to criticality. The inverse count rate was plotted versus rod height for each of the source range instruments (Channels A, B, C and D). Points on the curve were plotted at each new rod bank level. A straight line extrapolation of the curves was performed each time a new point was plotted in order to estimate the critical height. At a bank height of 24.5 inches, the curves showed that criticality would be reached in the next one inch withdrawal. Therefore, the rod bank withdrawal was changed to one-tenth inch increments until criticality was attained.

A tracing of the Channel D intermediate range signal during the approach to criticality was obtained utilizing a Keithley μ ammeter connected to a Brown recorder.

Results

Core I, Seed 2 was brought critical at 8:06 PM of April 12, 1960 after withdrawing the control rods from one inch at 6:31 PM.

During the approach to criticality, the reactor coolant temperature and pressure were 140 ± 10 F and 440 ± 50 psig, respectively. The A and D reactor coolant pumps were operating on slow speed.

INITIAL APPROACH TO CRITICALITY, CORE I, SEED 2 (cont'd)

Figure 1 shows the location of the source range and intermediate range nuclear instrumentation with respect to those rods in the critical bank.

Figures 2, 3, 4 and 5 are graphs showing a plot of the inverse count rate versus control rod height for the source range instruments "Channel A, B, C and D," respectively. They show that the position of the rods for criticality was approximately 24.7 inches.

All original data obtained is contained in Tables I and II.

The tracing of the Channel D intermediate range signal obtained using the Keithley μ i ammeter connected to a Brown recorder was not suitable for determining the point of criticality. Sufficient time was not allowed for the trace to either increase or decrease before another rod withdrawal was made. Also, the trace was erratic and smeared preventing any accurate analysis. However, criticality was determined by observing the start up rate meter and the plot of the inverse count rate.

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TABLE I

Date	Time	Rod Bank Position (Inches)	CPS	Channel A 1/CPS	CPS	Channel B 1/CPS	CPS	Channel C 1/CPS	CPS	Channel D 1/CPS
4/12/60	1831	1	25	0.40×10^{-1}	2	5.0×10^{-1}	8	1.3×10^{-1}	220	0.45×10^{-2}
	1834	2	22	0.45×10^{-1}	2.1	4.8×10^{-1}	10	1.0×10^{-1}	230	0.44×10^{-2}
	1835	3	27	0.37×10^{-1}	2	5.0×10^{-1}	5.5	1.8×10^{-1}	220	0.45×10^{-2}
	1837	4	22	0.45×10^{-1}	2.2	4.5×10^{-1}	5	2.0×10^{-1}	220	0.45×10^{-2}
	1839	5	23	0.44×10^{-1}	2.2	4.5×10^{-1}	4.5	2.2×10^{-1}	220	0.45×10^{-2}
	1840	6	25	0.40×10^{-1}	2.5	4.0×10^{-1}	5.5	1.8×10^{-1}	240	0.41×10^{-2}
	1842	7	30	0.33×10^{-1}	2.8	3.6×10^{-1}	4.5	2.2×10^{-1}	250	0.40×10^{-2}
	1844	8	30	0.33×10^{-1}	2.3	4.4×10^{-1}	5.5	1.8×10^{-1}	230	0.44×10^{-2}
	1846	9	28	0.36×10^{-1}	2.9	3.5×10^{-1}	6.0	1.7×10^{-1}	220	0.45×10^{-2}
	1847	10	30	0.33×10^{-1}	2.3	4.4×10^{-1}	6.2	1.6×10^{-1}	230	0.44×10^{-2}
	1858	11	30	0.33×10^{-1}	4.0	2.5×10^{-1}	6.5	1.5×10^{-1}	230	0.44×10^{-2}
	1900	12	35	0.24×10^{-1}	4.5	2.2×10^{-1}	6.5	1.5×10^{-1}	230	0.44×10^{-2}
	1903	13	35	0.29×10^{-1}	5.5	1.8×10^{-1}	8.9	1.1×10^{-1}	260	0.38×10^{-2}
	1906	14	45	0.22×10^{-1}	7.0	1.4×10^{-1}	10.2	0.98×10^{-1}	270	0.37×10^{-2}
	1910	15	50	0.20×10^{-1}	7.2	1.39×10^{-1}	16.5	0.61×10^{-1}	290	0.35×10^{-2}
	1914	16	60	0.17×10^{-1}	10	1.00×10^{-1}	19	0.53×10^{-1}	290	0.35×10^{-2}
	1917	17	70	0.14×10^{-1}	12	0.80×10^{-1}	15	0.67×10^{-1}	300	0.33×10^{-2}
	1920	18	80	0.13×10^{-1}	18	0.60×10^{-1}	35	0.29×10^{-1}	320	0.31×10^{-2}
	1923	19	100	0.10×10^{-1}	28	0.40×10^{-1}	45	0.22×10^{-1}	350	0.29×10^{-2}
	1926	20	130	0.80×10^{-2}	40	0.25×10^{-1}	70	0.14×10^{-1}	400	0.25×10^{-2}
	1930	20.5	160	0.60×10^{-2}	50	0.20×10^{-1}	90	0.11×10^{-1}	420	0.24×10^{-2}
	1934	21	200	0.50×10^{-2}	55	0.18×10^{-1}	100	0.10×10^{-1}	450	0.22×10^{-2}
	1938	21.5	180	0.55×10^{-2}	75	0.13×10^{-1}	120	0.83×10^{-2}	500	0.20×10^{-2}
	1941	22	210	0.48×10^{-2}	100	0.10×10^{-1}	180	0.55×10^{-2}	550	0.18×10^{-2}
	1944	22.5	240	0.41×10^{-2}	130	0.80×10^{-2}	230	0.44×10^{-2}	600	0.17×10^{-2}
	1947	23	330	0.40×10^{-2}	180	0.55×10^{-2}	320	0.31×10^{-2}	750	0.13×10^{-2}
	1953	23.5	450	0.22×10^{-2}	300	0.33×10^{-2}	500	0.20×10^{-2}	1000	0.10×10^{-2}
	1955	24	750	0.13×10^{-2}	580	0.17×10^{-2}	900	0.11×10^{-2}	1600	0.60×10^{-3}
	1959	24.5	2000	0.50×10^{-3}	2000	0.50×10^{-3}	2300	0.44×10^{-3}	4000	0.25×10^{-3}
	2003	24.6	3900	0.26×10^{-3}	4200	0.24×10^{-3}	4000	0.25×10^{-3}	7600	0.13×10^{-3}
	2006	24.7	15000	0.67×10^{-4}	19000	0.53×10^{-4}	5000	0.20×10^{-3}	32000	0.31×10^{-4}
	2009	24.8	32000	0.31×10^{-4}	48000	0.21×10^{-4}	10000	1.00×10^{-4}	85000	0.12×10^{-4}

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TABLE II

Date	Time	Reactor Pressure (PSIG)	Reactor Coolant Loop Temperature, Avg. of 1A, 1C and 1D (Calibrating) Tc F
4/12/60	1800	490	142.9
	1815	490	143.6
	1830	445	144.2
	1834	445	144.5
	1836	445	144.6
	1837	450	144.7
	1839	450	144.8
	1841	450	144.8
	1843	410	144.9
	1845	410	145.1
	1846	410	145.1
	1848	410	145.1
	1858	400	138.7
	1900	395	138.7
	1903	415	138.9
	1906	405	139.2
	1910	395	139.2
	1914	415	139.5
	1917	410	139.6
	1920	395	134.7
	1924	410	139.1
	1925	405	139.1
	1930	420	138.6
	1938	410	135.7
	1941	410	135.1
	1945	410	134.5
	1948	400	134.8
	1953	405	134.6
	1955	395	134.6
	2000	400	134.5
	2006	400	134.3

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FIGURE 1

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TEST RESULTS DLCS 1600102

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INITIAL APPROACH TO CRITICALITY, CORE I, SEED 2 (cont'd)

Results Prepared By Nicholas Pazuchanics by RM

Results Reviewed By Roger J. Lawrence

Approved (Duquesne Light Company) Charles Jones Date 6-1-60