DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 2110135
T-641102

PERIODIC REACTOR PLANT LEAK RATE TEST

CORE I SEED 2

Section 1 of 1 Section

First Issue, January 20, 1961

DISCLAIMER

TEST RESULTS
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Purpose

To determine the magnitude of leakage of reactor coolant through the Reactor Relief Valve, 06-H15-8, and the Pressurizer Relief Valves, 06-H15-1 and 06-H15-10.

Conclusions

The leak rate of Pressurizer Relief Valves (06-H15-1 and 10) have not changed significantly from the previous performance of this test. The leak rate of Reactor Relief Valve (06-H15-8) decreased considerably and the data taken for this valve is considered to be more valid than for the previous performance. It is felt that this decrease in leak rate is due to the allowance of more time for the existing water in the piping to drain out before taking leak rate measurements.

Description of Test Equipment and Test Procedure

DLCS 2110135, Periodic Reactor Plant Leak Rate Test, was performed in accordance with the fifth issue of the procedure dated October 20, 1960.

With the Reactor Coolant System pressure at 1785 $\pm$ 20 psig and an average temperature of 500 F, the reactor coolant leakage through the Reactor Relief Valve (06-H15-8) and the Pressurizer Relief Valves (06-H15-1 and 10) was obtained. The motor operated valve downstream of each relief valve was opened for several minutes and then closed. This permitted time for any water in the discharge pipe to drain to the Blow-off tank. Appropriate valving was performed to individually allow each relief valve leakage to drain into the collection vessel. After a period of time the leak rate was measured by observing the rise of water in the collection vessel sight glass. The leakage of each valve was checked on three consecutive days.

The Reactor and Pressurizer Relief Valves were also checked for leakage by measuring the temperatures on both the inlet and outlet of the valve with a surface pyrometer. Any reactor coolant leakage was indicated by high temperatures on the inlet and outlet nipples and the associated discharge piping of the valve being checked.

Results

DLCS 2110135, Periodic Reactor Plant Leak Rate Test, was performed on October 21 through 23, 1960.

The following tables and figure are presented in this report:

Table I - Relief valve number, Date, Time, Water accumulated in the collection vessel (inches and gallons), Leak Rate (gal/hr and lb/hr), pressure in the collection vessel, pipe temperatures at the valve inlet, outlet, one and two feet downstream of the valve outlet.

Table II - Date, Time, and Blow-off Tank Level.

Figure 1 - Collection Vessel and associated piping.

The Reactor Relief Valve (06-H15-8) and the Pressurizer Relief Valves (06-H15 and 10) leakage can be seen in Table I. The valve having the greatest amount of leakage is the Pressurizer Relief Valve (06-H15-10) which showed a leak rate of 13.9 gal/hr (102.45 lb/hr) on October 22, 1960. The valve having the smallest leak rate is the Reactor Relief Valve (06-H15-8), 2.2 gal/hr (13.1 lb/hr) on October 22, 1960.

Generally, the Pressurizer relief valves have not changed significantly from the previous performance. When each valve was tested, it was found that steam pressure built up in the collection vessel which indicates that each valve is leaking considerably. The three day average leak rate for relief valve (06-H15-1) was 11.8 gal/hr (87.7 lb/hr) and for valve (06-H15-10) was 13.3 gal/hr (91.0 lb/hr).

The Reactor Relief Valve (06-H15-8) indicated a very low leak rate (average 3.3 gal/hr) compared to the previous performance (approximately 14 gal/hr) of this test. The data obtained for this test is considered to be more valid than previously because more time was taken to allow the water initially in the line to drain into the collection vessel and Blow-off tank. Also, the absence of steam pressure in the discharge line would indicate low leakage. The 20-30 psig collection vessel pressure indicated in Table I is really the lowest pressure which the gage indicates when the collection vessel is vented to the Blow-off tank.

The performance of the test did not follow the Test Procedure in its entirety, because only the three relief valve leak rates were required. These three valves were checked because they exhibited the highest leak rate in the previous performance.

The leak rate was also recorded in lb/hr, because of the high temperature of the water draining into the collection vessel. With the cooler removed, the temperature of the water in the collection vessel approaches the Saturation temperature for the collection vessel pressure. This is the basis on which the lb/hr leak rate was calculated for Table I.

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Figure 1

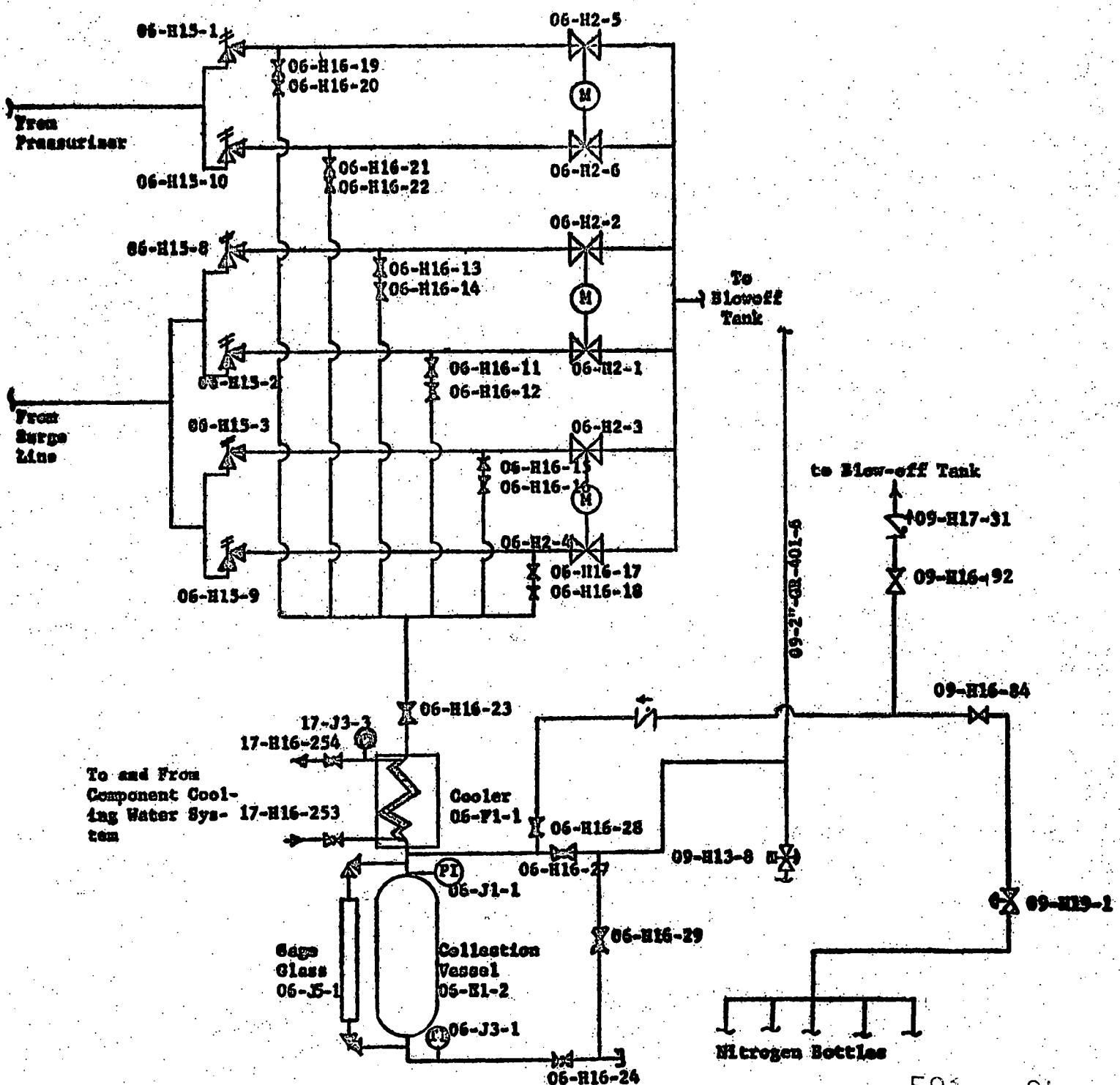

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TABLE I

Relief Valve Leak Rate

Relief Valve	Date	Time	Water accumulated in Collection Vessel (inches)	Water accumulated in Collection Vessel (gallons)	Leak Rate gal/hr	Leak Rate lb/hr
	10/21/60	1055	0	0	0	0
		1125	23.0	5.7	11.3	83.86
06-H15-1	10/22/60	0945	0	0	0	0
		1015	25.8	6.3	12.7	93.40
	10/23/60	0920	0	0	0	0
		0950	23.5	5.8	11.6	85.85
	10/21/60	1345	0	0	0	0
		1405	28.0	6.7	*20.6	*80.77
	10/22/60	1030	0	0	0	0
		1115	13.0	3.2	4.2	33.6
06-H15-8		1445	0	0	0	0
		1525	4.5	1.1	1.6	13.08
	10/23/60	1102	0	0	0	0
		1137	8.8	2.2	3.5	29.2
	10/21/60	1005	0	0	0	0
		1035	21.5	5.3	10.6	78.91
06-H15-10	10/22/60	0905	0	0	0	0
		0935	28.3	7.0	13.9	102.45
	10/23/60	1015	0	0	0	0
		1030	12.5	3.1	12.3	91.75

* Incorrect valving sequence employed.

TABLE I (cont'd)

Relief Valve Leak Rate

Relief Valve	Date	Time	Pressure in the Collection Vessel (psig)	Pipe Temperature			
				Valve inlet (F)	Valve outlet (F)	One foot past outlet (F)	Two feet past outlet (F)
	10/21/60	1055	125 at 1110				
		1125	150 at 1120	590	330	330	330
06-H15-1	10/22/60	0945	60				
		1015	170	570	248	248	248
	10/23/60	0920	40				
		0950	130	590	275	270	270
	10/21/60	1345	40 at 1350				
		1405		295	210	205	195
	10/22/60	1030	30	295	190	185	185
		1115	30	310	210	205	205
06-H15-8		1445	30				
		1525	30	315	220	220	220
	10/23/60	1102	20				
		1137	30	280	203	200	195
	10/21/60	1005	60				
		1035	130	590	200	195	195
06-H15-10	10/22/60	0905	53	540	270	250	250
		0935	170				
	10/23/60	1015	40	540	310	290	275
		1030	130				

TABLE II

Blow-off Tank Level (in.)

Date	10/21/60	10/22/60	10/23/60
Beginning of Test	60	59.5	61.5
End of Test	61	62	62.5

The Blow-off tank was not pumped down during the performance of the test.

LOG OF EVENTS

Date	Time	Event
10/21/60	0930	The nitrogen line to the Blow-off Tank was shut off by closing the valve, 09-H16-92. The water line to collection vessel opened by valves 06-H16-21 and 22. The Blow-off Tank level at 60 inches.
10/21/60	0955	The motorized valves were recylcled. The following represents "open" position: 06-H2-5 to 06-H2-6 and back to 06-H2-5. The Collection Vessel Vent Valve, 06-H16-27, was closed.
10/21/60	1005	Began obtaining a leak rate on valve, 06-H15-10.
10/21/60	1007	The pressure gage read 60 psig.
10/21/60	1030	The pressure gage read 130 psig.
10/21/60	1035	The leak rate test of valve, 06-H15-10, was completed.
10/21/60	1040	The motorized valves were cycled. The following represents "open" position: 06-H2-5 to 06-H2-6.
10/21/60	1055	Began obtaining a leak rate on the valve 06-H15-1.
10/21/60	1110	The pressure gage read 125 psig.
10/21/60	1120	The pressure gage read 150 psig.
10/21/60	1125	The leak rate test of valve, 06-H15-1, was completed.
10/21/60	1130	The motor operated valve selector switches are in the 06-H15-10, 9, and 2 position.
10/21/60	1320	The motorized valves were recycled. The following represents the "open" position: 06-H2-1 to 06-H2-2 and back to 06-H2-1.
10/21/60	1340	A leak was noticed in the tap plug of relief valve, 06-H15-1.

LOG OF EVENTS (cont'd)

Time	Date	Event
10/21/60	1345	Started to obtain a leak rate on the valve, 06-H15-8. The following motorized valves were open, 06-H2-1, 4, and 5.
10/21/60	1350	The pressure gage read 40 psig.
10/21/60	1405	The leak rate test on the valve 06-H15-8 was completed.
10/21/60	1415	The nitrogen line to the Blow-off Tank was opened by opening the valve, 09-H16-92.
10/22/60	0810	The Blow-off Tank level was 64.8 inches.
10/22/60	0811	The Blow-off Tank level was 59.1 inches.
10/22/60	0845	The nitrogen line to the Blow-off Tank was closed by closing the valve, 09-H16-92.
10/22/60	0850	The motorized valves were recycled. The following represents the "open" position: 06-H2-5 to 06-H2-6 and back to 06-H2-5.
10/22/60	0905	The leak rate test on the valve, 06-H15-10, was started. The pressure gage read 53 psig.
10/22/60	0910	The temperature readings of the valve, 06-H15-10 were obtained.
10/22/60	0920	The pressure gage read 110 psig.
10/22/60	0935	The pressure gage read 170 psig. The leak rate test on the valve, 06-H15-10, was completed.
10/22/60	0940	The motorized valves were cycled. The following represent "open" position: 06-H2-5 to 06-H2-6.
10/22/60	0945	The pressure gage read 60 psig. The leak rate test of valve, 06-H15-1, was started.
10/22/60	0950	The temperature reading of the valve, 06-H15-1, was obtained.

LOG OF EVENTS (cont'd)

Date	Time	Event
10/22/60	1000	The pressure gage read 110 psig.
10/22/60	1015	The pressure gage read 170 psig. The leak rate test on the valve, 06-H15-1, was completed.
10/22/60	1025	The motorized valves were recycled. The following represent "open" position: 06-H2-1 to 06-H2-2 and back to 06-H2-1.
10/22/60	1030	The pressure gage read 30 psig. The leak rate test on the valve, 06-H15-8, was started.
10/22/60	1035	The temperature readings of the valve, 06-H15-8, were obtained.
10/22/60	1045	The valve, 06-H15-8, was not leaking as it had on October 21, 1960.
10/22/60	1050	The pressure gage read 30 psig. The motorized valves were recycled. The following represent "open" position: 06-H2-1 to 06-H2-2 and back to 06-H2-1. The level of the water in the sight glass began decreasing before the motorized valves were recycled, but, when the valves were recycled, the water level increased approximately 5 inches.
10/22/60	1110	The temperatures of the valve, 06-H15-8 were obtained.
10/22/60	1115	The pressure gage read 30 psig. The leak rate test on the valve, 06-H15-8, was completed.
10/22/60	1130	The motor operated valve selector switches are in the 06-H2-1, 4 and 6 position.
10/22/60	1350	The following valves were opened: 06-H16-13, 14, and 23.
10/22/60	1355	The water level in the sight glass of the collection vessel increased 14 inches or 3.44 gallons from 1120 to 1355 hours.

LOG OF EVENTS (cont'd)

10/22/60	1400	The following valves were opened, 06-H16-19, 20, and 23. The sight glass water level increased approximately 50 inches, from 0940 to 1400 hours.
10/22/60	1415	The Pressurizer Relief Valve, 06-H15-1, leaking steam under pressure. The motorized valves were cycled. The following represents "open" position: 06-H2-6 to 06-H2-5.
10/22/60	1420	The motorized valves were recycled. The following represents "open" position: 06-H2-1 to 06-H2-2 and back to 06-H2-1.
10/22/60	1455	The pressure gage read 30 psig. The leak rate test on the valve, 06-H15-8, was started.
10/22/60	1510	The temperature readings of the valve, 06-H15-8, were obtained.
10/22/60	1525	The pressure gage read 30 psig. The leak rate test on the valve, 06-H15-8, was completed.
10/23/60	0820	The motor operated valves, 06-H15-2, 9, and 1 were open.
10/23/60	0845	The motorized valves were recycled. The following represent the "open" position: 06-H2-5 to 06-H2-6 and back to 06-H2-5.
10/23/60	0850	The excess water was purged from the collection vessel. When the vent valve was closed the water level in the sight glass rose in spurts. (possibly due to ball check action). Sight glass tapped to correct situation and repeated for each test level reading.
10/23/60	0920	The pressure gage read 40 psig. The leak rate test on valve, 06-H15-10, was started.
10/23/60	0935	The temperature readings of the valve, 06-H15-10, were recorded.

LOG OF EVENTS (cont'd)

10/23/60	0940	The pressure gage read 95 psig.
10/23/60	0950	The pressure gage read 130 psig. The leak rate test on the valve, 06-H15-10, was completed.
10/23/60	0951	The collection vessel was purged by blowing the lines with nitrogen to the Blow-off Tank.
10/23/60	0955	The motorized valves were recycled. The following represents the "open" position: 06-H2-5 to 06-H2-6.
10/23/60	1015	The leak rate test on the valve, 06-H15-1, was started. The pressure gage read 40 psig.
10/23/60	1020	The temperatures of the valve, 06-H15-1, was recorded.
10/23/60	1022	The pressure gage read 80 psig.
10/23/60	1030	The leak rate test on the valve, 06-H15-1, was completed. The pressure gage read 130 psig.
10/23/60	1031	The motorized valves were recycled. The following represents the "open" position: 06-H2-1 to 06-H2-2 and back to 06-H2-1.
10/23/60	1040	The collection vessel was purged by blowing the lines with nitrogen to the Blow-off Tank.
10/23/60	1102	The pressure gage read 20 psig. The leak rate test on the valve, 06-H15-8, was started.
10/23/60	1110	The temperature of the valve, 06-H15-8, was recorded.
10/23/60	1115	The pressure gage read 20 psig.
10/23/60	1137	The pressure gage read 30 psig. The leak rate test of valve, 06-H15-8, was completed.
10/23/60	1138	All valves were closed except 06-H2-1, 4 and 6 which were open.

Sample Calculations

DATE: 10/21/60

TIME: 1055 - 1125

Change in sight glass level = 23 in.

Time of change = 30 min.

Leak Rate

$$\frac{23 \text{ in.}}{30 \text{ min.}} \times \frac{60 \text{ min}}{\text{hr}} \times 0.246 \text{ gal.} = \frac{11.3 \text{ gal}}{\text{hr}}$$

Collection vessel pressure gage reading = 150 psig

Zero correction for gage = 30 psig

True pressure in collection vessel = 120 psig or 135 psia

v at 135 psia = 0.01800 ft^3/lb

$$11.3 \text{ gal} \times \frac{ft^2}{7.48 \text{ gal}} \times \frac{1b}{0.01800 \text{ } ft^3} = \frac{83.9 \text{ lb}}{\text{hr}}$$

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