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DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 3070201

T-643700

REACTOR PLANT SELF-ACTUATED RELIEF VALVE OPERATION

CORE I SEED 1

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TEST RESULTS

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REACTOR PLANT SELF-ACTUATED RELIEF VALVE OPERATION

CORE I SEED 1

Purpose

To insure the reliable operation of the four self-actuated reactor coolant loop relief valves (06-H15-4, 5, 6 and 7) and the four self-actuated Purification System relief valves (07-H15-1, 2, 3 and 4).

Conclusions

All eight of the self-actuated relief valves tested operated at or within the prescribed limits of 2530 ± 50 psig in the "as left" condition. The final "as left" operating or "popping" pressures as indicated by the Hiese gage* were as follows:

Reactor Coolant Loop Relief Valves

Valve No.	Operating Pressure*
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06-H15-4	2475 psig
06-H15-5	2580 psig
06-H15-6	2570 psig
06-H15-7	2480 psig

Purification System Relief Valves

Valve No.	Operating Pressure*
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07-H15-1	2500 psig
07-H15-2	2525 psig
07-H15-3	2495 psig
07-H15-4	2500 psig

Description of Test Equipment and Test Procedure

The operating pressure of each of the eight self-actuated relief valves was determined one at a time in the following manner:

1. All relief valves except the one being tested were gagged.
2. With the 1A, 1B and 1C reactor coolant pumps operating on fast speed and a reactor coolant temperature (T_{avg}) and pressure of 525 F and 1785 psig respectively temperatures were measured at various locations on the ungagged relief valve with a pyrometer.
3. The Reactor Coolant System pressure was then increased by energizing additional pressurizer heaters until the pressure was within 200 psig of the prescribed set pressure of the ungagged relief valves.
4. The relief valve was then fully opened manually for approximately five seconds and then closed. This operation insured that the valve was free to operate.

* This data were obtained from Tables I and II and corrected as per Table III.

REACTOR PLANT SELF-ACTUATED RELIEF VALVE OPERATION

5. After the above operation the valve was allowed to cool down until the bonnet temperature of the valve was within 20 F of the bonnet temperature measured just prior to manually opening the valve. The pressurizer pressure was then increased until the relief valve popped. If the valve did not pop within its prescribed set pressure tolerance, it was adjusted and retested. The bonnet temperature was used since it was considered a better indication of the valve's spring temperature than was the valve's outlet nipple temperature. None of the valve outlet nipple temperatures were ever less than 120 F. It is important that the valve's spring temperature be comparable (within 20 F) to its initial temperature prior to any retesting as a valve's popping pressure is a direct function of its spring temperature.

Pressurizer pressures were measured using a Heise gage installed at the pressurizer test connection valve (06-H16-24).

Results

DLCS 3070201, Reactor Plant Self-Actuated Relief Valve Operation, was performed on October 11 through 13, 1959. The data obtained during the reactor coolant loop and purification loop relief valve operations are tabulated in Tables I and II. The Heise gage calibration data are tabulated in Table III.

The four self-actuated reactor coolant relief valves (06-H15-4, 5, 6 and 7) and the four self-actuated purification loop relief valves (07-H15-4, 5, 6 and 7) all popped within their prescribed set pressure tolerance in the "as left" condition. Most of the relief valves tested had to be popped and adjusted several times, however, before the valves would pop at a pressure within these limitations.

Some difficulties that were encountered were that coolant loop relief valve (06-H15-7) started to simmer before popping and relief valve (06-H15-2) chattered violently just prior to popping. Nothing further was done about these conditions. No piping movement of the valve discharge lines were noticed when any of the relief valves popped. Some of the relief valves, after popping, had to be gagged to reseal them. Gagging a relief valve which would not reseal, before the pressurizer pressure reached 1785 psig, was considered to be more effective than isolating the loop which contained the blowing relief valve. In order to prevent low level in the pressurizer while a relief valve is open, the pressurizer level was established at approximately 130 inches prior to testing.

Using pressurizer level prior to and after valve operation, relief valve capacity was calculated. The design flow of all tested relief valves is 50 gpm. The calculated relief valve capacities are listed in Table I. Generally, the valve capacities "as left" were fairly close to the design flow. The reason for the discrepancies for some of the valves is not known.

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While bonnet temperatures should have been allowed to return as near as possible (within 20 F) to the pre-popping temperature before retesting this was not always done and it is not known what effect, if any, this will have on the final set popping pressure. Future tests will be performed with more emphasis on this requirement.

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REACTOR PLANT SELF-ACTUATED RELIEF LVE OPERATION
DLCS 3070201 (T-643700)

TABLE I

REACTOR COOLANT LOOP RELIEF VALVES

Reactor Coolant Loop Relief Valve			06-H15-4		06-H15-5		06-H15-5		06-H15-5	
Date			10-12-59		10-11-59		10-12-59		10-12-59	
Time			Popping	Reseated	Popping	Reseated	Popping	Reseated	Popping	Reseated
			1449	1456	1524	1529	0250	0253	0325	0329
Pressurizer Press. (Heise Gage)	PSIG		2470	2160	2385	2100	2445	2175	2575	2280
Pressurizer Press. (AIP)	PSIG		2470	2150	2400	2140	2475	2175	2600	2275
Pressurizer Temp.	°F		667	646	665	645.8	664.5	648.0	673	655
Pressurizer Level	Inches		111	106	88	72	87.5	71.5	113	82.5
1A Coolant Loop T _h	°F		524.2	524.2	524.5	524.5	521.5	521.5	539.5	522.0
1B Coolant Loop T _h	°F		524.1	524.1	525.0	524.5	521.0	521.0	522.1	521.5
1C Coolant Loop T _h	°F		524.8	524.1	525.0	525.0	522.0	522.0	523.0	521.0
1D Coolant Loop T _h	°F		488.7	492.3	508.6	508.5	500.5	500.5	527.0	511.0
1A Coolant Loop T _c	°F		525.0	524.8	525.0	525.5	521.5	521.5	522.5	521.5
1B Coolant Loop T _c	°F		525.0	524.9	525.0	525.0	521.5	521.5	522.5	522.0
1C Coolant Loop T _c	°F		524.0	523.0	525.0	525.0	521.2	521.2	522.0	518.5
1D Coolant Loop T _c	°F		520.9	519.0	523.0	522.5	518.5	518.5	519.5	518.0
1A Coolant Loop Pressure	PSIG		2520	2200	2450	2190	2545	2230	2620	2310
1B Coolant Loop Pressure	PSIG		2520	2200	2480	2190	2545	2230	2615	2305
1C Coolant Loop Pressure	PSIG		2480	2150	2450	2150	2550	2200	2620	2320
1D Coolant Loop Pressure	PSIG		2540	2220	2500	2210	2545	2220	2610	2310
Relief Valve Temperature										
Time			1449	1456	1523	1535	0143	0300	-	-
Body	°F		190	300	260	330	115	220	-	-
Bonnet	°F		120	130	115	115	95	95	-	-
Inlet Nipple	°F		260	490	470	460	160	355	-	-
Outlet Nipple	°F		260	220	250	270	135	215	-	-
Relief Valve Flow Rate	gpm		7.11		31.84		53.07		75.87	

TABLE I (cont'd)

REACTOR COOLANT LOOP RELIEF VALVES

Main Coolant Loop Relief Valves			06-H15-6		06-H15-6		06-H15-7	
Date			10-12-59		10-13-59		10-11-59	
			Popping	Reseat*	Popping	Reseat	Popping	Reseat
Time			1121	1130	0357	0405	1411	1418
Pressurizer Press. (Heise Gage)	PSIG		2475	-	2565	2035	2475	2060
Pressurizer Press. (ALP)	PSIG		2455	2025	2575	2075	2480	2150
Pressurizer Temp.	°F		667	640	671	640	655	655
Pressurizer Level	°F		120.5	89.5	114	76.5	84	67
1A Coolant Loop T _h	°F		525.2	525.6	526.5	526.0	524.5	524.5
1B Coolant Loop T _h	°F		525.2	526.0	526.0	525.0	524.5	524.5
1C Coolant Loop T _h	°F		526.0	526.2	527.0	526.0	524.5	524.5
1D Coolant Loop T _h	°F		506.0	506.8	2450.0	2450.0	506.0	506.0
1A Coolant Loop T _c	°F		525.6	526.1	527.0	526.0	525.0	525.0
1B Coolant Loop T _c	°F		526.0	526.3	527.0	526.5	525.0	525.0
1C Coolant Loop T _c	°F		525.2	526.0	526.0	524.0	525.0	525.0
1D Coolant Loop T _c	°F		522.8	522.6	2450.0	2450.0	522.0	522.0
1A Coolant Loop Pressure	PSIG		2540	2055	2620	2100	2550	-
1B Coolant Loop Pressure	PSIG		2540	2070	2610	2110	2550	-
1C Coolant Loop Pressure	PSIG		2505	2045	2615	2060	2550	-
1D Coolant Loop Pressure	PSIG		2570	2090	2600	2040	2600	-
Relief Valve Temperatures								
Time			1121	1130	3040	0405	1407	1415
Body	°F		120	340	200	395	200	370
Bonnet	°F		95	120	142	130	110	130
Inlet Nipple	°F		200	420	225	480	235	475
Outlet Nipple	°F		200	280	145	340	185	300
Relief Valve Flow Rate	gpm		34.27		46.64		24.16	

* Gagged

TABLE II

PURIFICATION LOOP RELIEF VALVES

Purification Relief Valves			07-H15-1		07-H15-1		07-H15-4		07-H15-4	
Date			10-12-59		10-12-59		10-11-59		10-13-59	
Time			Popping	* Reseated	Popping	Reseated	Popping	Reseated	Popping	Reseated
			1424	1429	2017	2022	0658	0705	1940	1949
Pressurizer Press. (Heise Gage)	PSIG		2460	2210	2490	2330	2375	1900	2495	1875
Pressurizer Press. (AIP)	PSIG		2460	2190	2500	2350	2425	1925	2520	1910
Pressurizer Temp.	°F		667	649	670	657	661	625	669	631
Pressurizer Level	Inches		101.0	87.0	104.5	77	109.0	69.0	114	62.0
1A Coolant Loop T _h	°F		526.7	527.9	532.5	533.0	521.5	521.5	534.7	533.4
1B Coolant Loop T _h	°F		527.0	522.9	532.5	532.5	521.0	521.0	534.0	533.0
1C Coolant Loop T _h	°F		527.4	528.0	533.5	533.0	521.8	521.5	535.5	533.8
1D Coolant Loop T _h	°F		510.0	474.9	2450	2450	508.0	507.0	2450	2450
1A Coolant Loop T _c	°F		527.1	528.0	533.0	534.5	521.5	521.5	534.6	533.6
1B Coolant Loop T _c	°F		527.3	528.4	533.0	533.0	521.5	521.5	534.8	533.6
1C Coolant Loop T _c	°F		526.5	527.0	532.0	531.0	521.5	521.5	534.2	532.8
1D Coolant Loop T _c	°F		524.5	512.1	2450	2450	520.0	519.5	2450	2450
1A Coolant Loop Pressure	PSIG		2520	2230	2500	2350	2470	1950	2535	1990
1B Coolant Loop Pressure	PSIG		2520	2250	2500	2375	2460	1950	2535	2000
1C Coolant Loop Pressure	PSIG		2490	2210	2450	2300	2450	1950	2495	1980
1D Coolant Loop Pressure	PSIG		2520	2270	2500	2300	2470	2000	2450	1920
Relief Valve Temperatures										
Time			1424	1429	2017	2022	0645	0710	1935	1950
Body	°F		110	290	125	345	230	310	320	350
Bonnet	°F		110	110	120	125	140	165	140	150
Inlet Nipple	°F		390	340	128	405	305	405	430	435
Outlet Nipple	°F		210	220	128	230	220	265	210	245
Relief Valve Flow Rate	gpm		27.9		54.7		56.9		57.5	

* Gagged

TABLE II (cont'd)

PURIFICATION LOOP RELIEF VALVES

Purification Relief Valves			07-H15-2		07-H15-2		07-H15-2		07-H15-3	
Date			10-11-59		10-12-59		10-12-59		10-13-59	
			Popping	* Reseated	Popping	Reseated	Popping	Reseated	Popping	Reseated
Time			1443	1457	0357	0408	0548	0559	1826	1834
Pressurizer Press. (Heise Gage)	PSIG		2405	1850	2460	1895	2520	1930	2490	1960
Pressurizer Press. (AIP)	PSIG		2425	1860	2500	1925	2550	1950	2510	2000
Pressurizer Temp	°F		655	630	666	625	670	630	670	635
Pressurizer Level	Inches		97.0	65.0	114.5	75.0	111.0	63.5	119.0	81.9
1A Coolant Loop T _h	°F		525.0	526.0	522.0	522.0	525.0	524.5	534.2	535.3
1B Coolant Loop T _h	°F		525.5	526.0	521.5	521.5	524.8	524.0	534.0	534.9
1C Coolant Loop T _h	°F		525.0	526.0	522.5	522.0	525.0	524.5	534.8	535.8
1D Coolant Loop T _h	°F		507.0	507.5	504.0	530.5	508.0	507.5	2450	2450
1A Coolant Loop T _c	°F		526.0	526.7	522.0	522.0	524.5	524.5	534.7	535.8
1B Coolant Loop T _c	°F		525.5	526.4	522.0	522.0	525.0	524.5	534.8	535.3
1C Coolant Loop T _c	°F		525.5	526.5	522.0	522.0	524.8	524.5	534.0	535.0
1D Coolant Loop T _c	°F		522.2	522.5	519.5	519.0	522.9	521.8	2450	2450
1A Coolant Loop Pressure	PSIG		2475	1940	2550	2000	2575	2000	2540	2025
1B Coolant Loop Pressure	PSIG		2475	1950	2560	2000	2570	2000	2530	2030
1C Coolant Loop Pressure	PSIG		2475	1900	2555	1950	2580	1960	2500	2000
1D Coolant Loop Pressure	PSIG		2525	1960	2540	2000	2575	2000	2460	1955
Relief Valve Temperatures										
Time			1441	1515	0337	-	0545	0600	1815	1835
Body	°F		150	260	225	315	145	300	360	385
Bonnet	°F		105	120	100	110	115	110	210	250
Inlet Nipple	°F		320	260	140	355	145	330	210	335
Outlet Nipple	°F		230	220	220	250	145	250	130	150
Relief Valve Flow Rate	gpm		22.7		35.7		42.96		46.1	

* Gagged

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REACTOR PLANT SELF-ACTUATED RELIEF VALVE
 OPERATION, DLCS 3070201 (T-643700)

TABLE III
 CALIBRATION DATA

Instrument: Heise Pressure Gage		
Serial Number: H16203		
Date Calibrated: September 7, 1959		
Deadweight Tester Indication (PSIG)	READING	
	UP PSIG	DOWN PSIG
0	0	0
250	250	254
500	500	505
750	750	752
1000	1000	1002
1250	1250	1252
1500	1500	1500
1750	1745	1745
2000	1995	1995
2250	2245	2245
2500	2485	2490
2750	2735	2740
3000	2985	2990
3250	3240	3245
3500	3490	3500
3750	3745	3750
4000	3995	4000
4250	4245	4255
4500	4495	4505
4750	4750	4755
5000	5000	5000

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REACTOR PLANT SELF-ACTUATED RELIEF VALVE
OPERATION, DLCS 3070201 (T-643700)

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