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September 21, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. T. M. Novak, Assistant Director
Division of Licensing

Re: McGuire Nuclear Station
Docket Nos. 50-369, 50-370

Dear Mr. Denton:

Attached is the Duke Power Company response to Mr. Thomas M. Novak's letter of July 25, 1983 concerning NUREG-0737, Item II.K.3.2, Report on Pressurizer Power Operated Relief Valve (PORV) Failures. In this response, we have compared the McGuire PORVs and safety valves to other valve designs referenced in WCAP-9804 and conclude that WCAP-9804 is applicable to the McGuire valves.

Question (2)(ii) notes that if the information or methodology in WCAP-9804 is used, then the deficiencies noted in the report should be addressed. WCAP-9804 is a generic report prepared by Westinghouse for the Westinghouse Owners Group. Resolution of any deficiencies should be handled through the Owners Group if these deficiencies are judged to be significant enough to preclude resolution of II.K.3.2.

Please advise if there are further questions on this matter.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

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Attachment

cc: Mr. W. T. Orders
NRC Resident Inspector
McGuire Nuclear Station

Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
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McGuire Nuclear Station
Response to NRC Letter of July 25, 1983
NUREG-0737 II.K.3.2

(1) Identify which plants in Table I.1, "PORV Openings," Table I.2, "PORV and SV Operational Data," and Table I.3, "Post-TMI Modifications," of WCAP-9804 correspond to your plants. Give the information for your plants corresponding to the headings in Table I.1, I.2, and I.3 of WCAP-9804.

Response:

The McGuire units are not among the plants represented in WCAP 9804, Tables I.1, I.2, and I.3., since neither McGuire unit had received an operating license at the time these tables were prepared. The information for McGuire 1 and 2 which would correspond to Tables I.1 (PORV Openings), I.2 (PORV and Safety Valve Operational Data) and I.3 (Post TMI Modifications) is shown on Tables 1, 2, and 3, respectively. The information on the tables is based on data available from the McGuire Unit 1 hot functional testing program (1981) and from McGuire Unit 2 hot functional testing program (1983).

Table 1

McGuire Nuclear Station

Pressurizer PORV Openings

Type of Initiating Events	Number of PORV Openings	
	McGuire 1	McGuire 2
Hot Functional Testing	19 (1)	13
Manual Reactor Trip Upon Loss of the Operating Feedwater Pump		1 (2)
Load Rejection Test	1 (3)	

Notes

(1) PORV openings during the second hot functional testing program at McGuire. After the first hot functional testing program in 1979, the PORV was modified.

(2) One PORV opened briefly (approximately 1 sec.), because the pressurizer pressure control master had not been tuned.

(3) Two PORV's opened for about 3 seconds following a load rejection (50%) test. During the test, the secondary system response was not normal because the main feedwater pumps tripped and the SG PORV actuation was slow.

Table 2

McGuire Nuclear Station - Unit 1

Pressurizer PORV and Safety Valve Operational Data

(Number of Valves, Operating Times, Operation Time with PORVs Isolated)

Number of PORVs	3
Number of Safety Valves	3
Plant operating time, excluding outage time (hours)	9032 (2)
PORV operating time (hour)	27096 (2)
Safety Valve operating time (hour)	27096 (2)
Percentage of power operating time with one PORV isolated (%)	17 (3)
Percentage of power operating time with two PORVs isolated (%)	0
Percentage of power operating time with three PORVs isolated (%)	0

Notes

1) McGuire 2 has no commercial operating experience

2) Modes 1, 2, and 3

3) Estimated

(2) (i) Determine the probability of a small-break LOCA due to a stuck-open PORV for your plants.

(ii) Determine the probability of a small-break LOCA due to a stuck-open SV for your plants.

The methodology of WCAP-9804 and the information from the report may be used if shown applicable to your plants. The deficiencies in WCAP-9804 which have been noted in Enclosure 1 must be addressed.

(iii) Discuss the impact of post-TMI modifications on the PORV/SV challenge frequencies.

RESPONSE

Pressurizer PORV's

WCAP 9804 is a probabilistic analysis of a SBLOCA induced by a stuck open power operated relief valve (PORV) or safety valve. The purpose of this response is to address the issue of the applicability of WCAP 9804 to the McGuire pressurizer relief valves. This has been done by a comparison of the McGuire PORVs and safety valves to other PORVs and safety valves in use at Westinghouse PWRs. The comparison, presented below, shows that the results of WCAP 9804 are applicable to the McGuire Nuclear Station.

The PORVs in use at McGuire are made by Control Components, Inc. (CCI). After the hot functional test of 1979 in which a PORV failed to fully reseat (Ref 3), the valves were modified and tested prior to reinstallation at McGuire (Ref 4). The modifications to the CCI valve included the change to a bolted bonnet design and a drain was provided on the loop seal in the PORV inlet piping at McGuire. These changes eliminated the pressure and thermal loads on the bonnet which previously caused interference between the plug and the bonnet, observed in the first hot functional testing program. Other modifications to the CCI PORV at McGuire included an increase in the size of both the valve operator and closure spring, the removal of the air supply regulator and an increase in the size of the solenoid and air supply tubing sizes.

The PORVs in use at many Westinghouse NSSS's are Copes-Vulcan D-100-160 valves. A comparison of the Copes-Vulcan and the Control Component valves demonstrated that the McGuire PORVs are as reliable as the Copes-Vulcan PORVs with respect to reclosure. The evaluation was based on a comparative study of the valve design and closure response with respect to specific failure mechanisms, and an evaluation of available data on valve closure (Ref 4,5).

Both the modified CCI and Copes-Vulcan valves are globe valves with flow control cages. Both valves use a bolted body to bonnet joint. The modified CCI valve uses a piston type air operator while the Copes-Vulcan valve uses a reverse action diaphragm. While both valves open on air, the modified CCI valve can close either on air or springs (in the case of failed air), while the Copes-Vulcan valve closes on spring force alone. The two valves were compared with respect to mechanisms for failures to close. The evaluation demonstrate that with respect to these mechanisms, the modified CCI valve is no more likely to fail than the Copes-Vulcan valve. The modifications made to the CCI valve eliminated the forces causing binding of the plug. The Copes-Vulcan valve has no bonnet recess area. With respect to the stem binding in the clearance hole in the bonnet, yoke rupture, and plug misalignment with the yoke, neither valve was considered to have any unique susceptibility to failure. On loss of air, both valves would close on spring force. With respect to a stuck solenoid, or blockage or restriction of the solenoid vent, no evidence was found to show that either would be more likely to fail.

Thus, the comparison of the two valves showed no difference in makeup or selected failure mechanisms which would lead to a difference in closure reliability for the modified CCI valve and the Copes-Vulcan valve.

An assessment of the closure reliability of the McGuire PORVs and those in use at other Westinghouse plants was also made using available valve lift and closure data. WCAP 9804 data included over 500 domestic incidents involving PORV openings, including both test and operational openings, at 28 Westinghouse nuclear plants. Data on the openings and closing of the modified CCI PORVs also has been collected and evaluated. The data includes the results of the Marshall and EPRI

testing (Ref 4,5), the second hot functional testing program at McGuire 1, the hot functional testing program at McGuire 2, and transients at McGuire, for a total of 66 cycles. None of these PORV cycles resulted in a stuck open valve. During the hot functional tests conducted at full pressures and temperatures, the valves opened and closed successfully. The Marshall tests performed on the modified CCI PORV's prior to installation at McGuire resulted also in successful lifts and reseatings. The EPRI tests resulted in the modified CCI PORV opening and closing successfully with normal air. For 3 of the 5 steam tests performed with failed air, the PORVs closed after a delay of 2-3s. This delay was attributed to the tightness to which the valve was assembled between the Marshall and EPRI test. For two tests involving failed air and passage of water at 640°F, the valves closed after a delay of 20-40s. The valve inlet pressure at closure was 2035 psig or greater (Ref 5). It should be noted that this pressure is above the low pressure reactor trip and safety injection setpoints. Because of this and the low probability of events occurring as modeled in the EPRI tests, the valve closure performance for air failure following the passage of high temperature water is considered acceptable.

Also tested, during the EPRI tests, was the Copes-Vulcan valve, model D-100-160. The performance of the CCI valves with normal air with respect to closure rates, stroke time, and total closure time was similar to the Copes-Vulcan valve. With failed air, the modified CCI valves did experience closure delays as noted above but closed at inlet pressures 2035 psig or higher. The Copes-Vulcan valves close on spring force only, therefore, no test results with failed air were conducted. In inspection of both the CCI and the Copes-Vulcan valves after inspection showed no damage which would affect future valve performance.

Based on the comparative evaluation of the assembly of the modified Control Components, Inc., and Copes-Vulcan valves, and on an evaluation of the available data, it is concluded that the PORVs in use at McGuire have no less reliability to close compared to the PORVs in use at other Westinghouse plants.

Pressurizer Safety Valves

The safety valves installed at McGuire are Crosby model HB-BP-86 valves, size 6M6. The Crosby model HB-BP-86 valves are in use at many Westinghouse plants, including most of the plants in the database for WCAP 9804. Most of these Crosby valves are size 6M6. Therefore, the safety valves at McGuire are commonly used at many of the Westinghouse nuclear plants in the database of WCAP 9804. Accordingly, the results of the probabilistic analysis of the SBLOCA due to a stuck open PORV or safety valve performed in WCAP 9804 are applicable to the McGuire Nuclear Station.

Post TMI Modification

The post TMI modifications made to the McGuire Station are listed in Table 3. These changes are the same as those changes examined by Westinghouse in their sensitivity study of the impact of post TMI modifications on the probability of a stuck open PORV or safety valve. Thus, the impact of the post-TMI modifications on PORV/SV challenge frequencies predicted in WCAP 9804 likewise applies to McGuire.

Table 3

McGuire Nuclear Station

Post TMI Modifications

1) PID controller modified (derivative time constant set to off)
2) Setpoint change on PORV interlock bistable (to 2335 psig)
3) Safety valve position/flow indication installed.
4) PORV position-indication limit switches replaced with environmentally qualified switches.
5) Circuitry modified to provide control room annunication from the PORV limit switch on PORV opening.

References:

1) WCAP 9804 - "Probabilistic Analysis and Operational Data in Response to NUREG-0737, Item II.K.3.2 for Westinghouse NSS Plans," Westinghouse Electric Corporation, February, 1981.

2) T. M. Novak (USNRC) to H. B. Tucker (Duke), "TMI Action Item Plan II.K.3.2 Report on PORV Failures (McGuire Nuclear Station, Units 1 and 2 Docket #50-369, 50-370 July 25, 1983.

3) W. O. Parker (Duke) to J. P. O'Reilly (USNRC) McGuire Nuclear Station Units 1 and 2 Docket Nos. 50-369 and 50-370; File MC 801.02, 815.03, April 13, 1979

4) "Report of Pressurizer PORV Operability Tests - McGuire Unit 1 Final Test Dates February 5 & 6, 1980 - Marshall Steam Station - Power Operated Relief Valve," March 15, 1981.

5) "EPRI PWR Safety and Relief Valve Test Program - Safety and Relief Valve Test Report." EPRI NP-2628-SR Special Report December, 1982.