June 3, 1985

DMB016

Dockets Nos. 50-269, 50-270
and 50-287

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Mr. Hal B. Tucker
Vice President - Nuclear Production
Duke Power Company
P. O. Box 33189
422 South Church Street
Charlotte, North Carolina 28242

Dear Mr. Tucker:

SUBJECT: PERFORMANCE TESTING OF RELIEF AND SAFETY VALVES - REQUEST FOR ADDITIONAL INFORMATION

Re: Oconee Nuclear Station, Units 1, 2 and 3

We, along with our consultant EG&G Idaho, have reviewed your letters dated March 23, and July 1, 1982, and January 21, 1983 associated with NUREG-0737, Item II.D.1, "Performance Testing of Relief and Safety Valves." To complete our review, we need the additional information identifed in the enclosure.

We request that you respond to this request for additional information within 90 days of the date of this letter.

The reporing and/or recordkeeping requirements contained in this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,

"ORIGINAL SIGNED BY
JOHN F. STOLZ"
John F. Stolz, Chief
Operating Reactors Branch #4
Division of Licensing

Enclosure:
Request for Additional
Information

cc w/enclosure:
See next page

ORB#4:DL
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ORB#4:DL
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Mr. H. B. Tucker
Duke Power Company

Oconee Nuclear Station, Units
Nos. 1, 2 and 3

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Honorable James M. Phinney
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REQUEST FOR ADDITIONAL INFORMATION

TMI ACTION NUREG-0737 (II.D.1)

FOR

OCONEE

UNITS 1, 2 AND 3

DOCKET NOS.: 50-269, 50-270 AND 50-287

MAY 1985

SAFETY EVALUATION QUESTIONS

TMI ACTION NUREG-0737 II.D.1

FOR OCONEE 1, 2, and 3

QUESTIONS RELATED TO THE SELECTION OF TRANSIENTS AND VALVE INLET AND DOWNSTREAM CONDITIONS:

1. The B&W valve inlet fluid conditions report indicated tne SRV and PORV could pass water for extended HPI events. The report indicated water relief would continue until the steam generators were able to remove decay heat with auxiliary feedwater and operator action was taken to secure HPI, but it did not state how long this might be. The EPRI valve test program included water tests of the SRV and PORV but the test report did not state the test duration for the SRV and the test duration for the PORV was short. Provide the following information because long periods of water flow has the potential to damage valve guides, seats, etc. and thus affect valve operability. Make a comparison between the expected duration of water flow conditions through the SRV and PORV in Oconee and the duration of the EPRI water tests to demonstrate operability of the SRV and PORV will not be impaired. If the duration of the water flow conditions expected in Oconee exceed the test times, provide evidence showing the extended water flow conditions will not impair valve operability.

2. EPRI tests of Dresser safety valve 31739A showed valve blowdown generally exceeded the design blowdown of 5% regardless of the valve ring settings. B&W report 77-1135671-00 (August 1982), Pressurizer Safety Valve Maximum Allowable Blowdown, indicated that blowdowns of up to 20% are acceptable because natural circulation was not impeded with blowdowns of that magnitude. The report showed, however, that with the larger valve blowdown the pressurizer did fill and liquid was discharged from the SRV. The report recommended safety valve blowdown be limited to less than 20%. Discuss what will be done at Oconee 1, 2, and 3 to assure that safety valve blowdown will be less than 20%. Provide test data to demonstrate Oconee SRVs will have less than 20%

blowdown. Also, since the report indicated the pressurizer will fill due to the larger blowdown, include liquid discharge due to excessive blowdown in the discussion of question 1.

QUESTIONS RELATED TO VALVE OPERABILITY:

3. The B&W valve inlet fluid condition report identified Oconee 1, 2, and 3 as being covered by the cold overpressure protection section of the report. The B&W report identified the conditions at the PORV inlet as low pressure steam because operator action could be used to mitigate the transient at 10 min and longer than 10 min was required to fill the pressurizer. Water solid operation of the system never occurs. Since no low pressure steam tests were performed for the PORVs, confirm that the high pressure steam tests demonstrate operability for the low pressure steam case for both opening and closing of PORVs.

4. The backpressures expected for the SRVs and PORVs in Oconee 1, 2, and 3 were not discussed in the plant submittal. Since the backpressure could affect valve operability, discuss the expected backpressures for the SRVs and PORVs and demonstrate that the expected backpressures in Oconee were enveloped by the EPRI tests.

5. Bending moments are induced on the safety valves and PORV during the time they are required to operate because of discharge loads and thermal expansion of the pressurizer tank and inlet piping. Predicted plant moments were not identified in the plant submittal. Make a comparison between the predicted plant moments with the moments applied to the test valve to demonstrate that the operability of the plant valves will not be impaired.

6. The Oconee 1, 2, and 3 plant safety valves are Dresser 31739A spring loaded valves which was one of the valves EPRI chose for testing. EPRI testing of the Dresser 31739A valve was performed at various ring settings. The submittal did not identify clearly the applicable EPRI tests which demonstrate operability of the plant safety valves by referencing the appropriate test numbers or providing the current plant ring settings. The submittal mentioned that, "with the 'reference' ring settings selected for the later tests, the valve exceeded rated flow for all tests except one." The reference ring

settings referred to in the submittal are identified in the EPRI Test Condition Justification Report as upper, -48, middle, -40, and lower, +11. However, it is not clear from the submittal that these reference ring settings are the same as the current plant ring settings. If the current plant rings settings were not used in the EPRI tests, the results may not be directly applicable to the Oconee 1, 2, and 3 safety valves. Identify the Oconee 1, 2, and 3 safety valve ring settings. If the plant specific ring settings were not tested by EPRI, explain how the expected values for flow capacity, blowdown, and the resulting back pressure corresponding to the plant specific ring settings were extrapolated or calculated from the EPRI test data. Identify these values and evaluate the effect of these values on safety valve behavior.

7. The submittal stated Duke Power Co. was working with valve vendors/consultants to determine optimum safety valve ring settings for Oconee 1, 2, and 3. When the optimum ring settings are identified, provide the settings to be used. If the identified ring settings are different than current ring settings, demonstrate valve operability based on EPRI testing or by providing information similar to that requested in Question 6 if current ring settings differ from those used in EPRI testing.

8. EPRI testing of the Dresser 31739A safety valve with reference ring settings using 400°F water (Test 1114) indicated the valve was not able to relieve the system pressure during the test. In addition the valve only opened to a partial lift position. The B&W valve inlet fluid condition report indicated that 400°F water is a possible safety valve inlet condition for B&W 177-FA plants which include Oconee 1, 2, and 3. The Oconee submittal stated that preliminary system analyses indicated the amount of flow passed in each subcooled water test was sufficient to prevent an overpressure condition in Oconee. Discuss the details of these analyses and/or otherwise demonstrate the ability of the Dresser 31739A safety valve to relieve the system pressure at

Oconee 1, 2, and 3 if it must pass 400°F water. Otherwise, discuss what pressure relief system modifications will be implemented to assure an overpressure condition will not arise if the safety valve must pass 400°F water.

9. The B&W valve inlet fluid condition report identified a pressurization range of 0-65 psi/sec was possible from extended HPI events which include steam, transition, and water conditions at the valve inlet. EPRI testing for transition and water conditions, however, included pressurization rates of less then 3 psi/sec. This bounds the lower end of the pressurization range, but not the upper range. If the upper range of the pressurization rates occurs only for steam flow, then the 65 psi/sec rate would be bounded by steam testing conducted by EPRI. Demonstrate for Oconee 1, 2, and 3 that the upper range of the pressurization rates associated with extended HPI events only occurs for steam flow, otherwise, demonstrate the operability of the Dresser 31739A safety valve for transition and water flow with pressurizations rates of approximately 65 psi/sec.

10. The submittal stated the PORV open setpoint was 2450 psia. The PORV close setpoint was not identified. EPRI testing of the Dresser PORV used in Oconee 1, 2, and 3 had the valve closing at pressures no greater than 2335 psia for steam conditions and 2360 psia for water conditions at the valve inlet. Identify the PORV close setpoint. If the close setpoint for the PORVs in Oconee 1, 2, and 3 is greater than 2360 psia, demonstrate the ability of the Dresser PORV to close at pressures greater than 2360 psia.

11. NUREG-0737 Item II.D.1 required the plant-specific PORV control circuitry be qualified for design-basis transients and accidents. Please provide information which demonstrates this requirement has been fulfilled.

12. For many of the steam tests with the short inlet configuration the Dresser 31739A valve failed to achieve rated lift and/or flow. Even with the reference ring settings, the valve failed to achieve rated

lift and/or flow during three tests (Nos. 320, 322, and 1104a). Address this problem and discuss what measures will be taken in Oconee 1, 2, and 3 to assure the valves operate as designed.

13. The B&W valve inlet fluid condition report indicated that transition and liquid flow could exist for the PORV for extended HPI events (steam line and feedwater line breaks). The same flow conditions will also exist for the block valve. The EPRI block valve test program, however, did not test the block valve with fluid media other than steam. The Westinghouse Gate Valve Closure Testing Program did include water tests but the test program report did not provide specific test results. Since it is conceivable the EMOV would have to operate with liquid flows, discuss EMOV block valve operability with Oconee expected liquid flow conditions and provide specific test data.

14. Block valve testing by EPRI was only performed in the horizontal position. The EPRI block valve test report indicated that B&W plants generally have the block valve installed in a vertical configuration. The submittal did not state the plant specific installation of the block valves in Oconee 1, 2, and 3. Identify the plant specific installation configuration of the block valves. If different than horizontal, discuss the effect of installation configuration on the operability of the Oconee valves.

15. Dresser Industries, the manufacturer of the Oconee PORV, wrote a letter to Metropolitan Edison Co. in March 1976 warning that the PORV block valve should be kept closed when reactor coolant system pressure is below 1000 psig to avoid damaging the PORV disk and seat by steam wirecutting. The EPRI program data indicates that the Dresser PORV was successfully tested on water at pressures in the 500-900 psig range. Steam testing at lower pressures was not performed. Each EPRI test sequence was initiated with a valve where disk and seat were in excellent condition, which may not be representative of the condition of the Dresser PORV as routinely placed in service at Oconee. The

15. (cont.) recommendation made by Dresser that the PORV be isolated at pressures lower than 1000 psi would seem to preclude the use of the PORV for low temperatures overpressure protection of the reactor vessel. Explain whether the Dresser recommendation or a modification of it will be followed to prevent damage to the disk and seat from steam wirecutting or provide details of tests performed since the March 1976 letter that demonstrate that such precautions are unnecessary.

QUESTIONS RELATED TO THE THERMAL HYDRAULIC ANALYSIS OF THE INLET AND DISCHARGE PIPING:

16. The submittal did not discuss the thermal hydraulic analysis of the safety/relief valve piping system. To allow for a complete evaluation of the methods used and the results obtained from the thermal hydraulic analysis, provide a discussion on the thermal hydraulic analysis that contains at least the following information:

   a. Evidence that the analysis was performed on the fluid transient cases producing the maximum loading on the safety/PORV piping system. The cases should bound all steam, steam to water, and water flow transient conditions for the safety and PORV valves.

   b. A detailed description of the methods used to perform this analysis. This includes a description of methods used to generate fluid pressures and momenta as a function of time and methods used to calculate the resulting fluid forces on the system. Identify the computer programs used for the analysis and how these programs were verified.

   c. Identification of important parameters used in the thermal hydraulic analysis and rationale for their selection. These include peak pressure and pressurization rate, valve opening time, and fluid conditions at valve opening.

   d. An explanation of the method used to treat valve resistances in the analysis. Report the valve flow rates that correspond to the resistances used. Because the ASME Code requires derating of the safety valves to 90% of actual flow capacity, the safety valve analysis should be based on flows equal to 111% of the valve flow rating, unless another flow rate can be justified. Provide information explaining how derating of the safety valves was handled and describe methods used to establish flow rates for the safety valves and PORVs in the analysis.

e. A discussion of the sequence of opening of the safety valves that was used to produce worst case loading conditions.

f. A sketch of the thermal hydraulic model showing the size and number of fluid control volumes.

g. A copy of the thermal hydraulic analysis report as well as a copy of the EPRI report referenced in the submittal, <u>Dynamic Loading on Pressurizer Safety and Relief Valve Discharge Line Due to Valve Actuation</u>, September 22, 1982.

QUESTIONS RELATED TO THE STRUCTURAL ANALYSIS OF THE INLET AND DISCHARGE PIPING:

17. The submittal indicated that a structural analysis of the safety/PORV valve piping system has been conducted, but does not present details of the analysis. To allow for a complete evaluation of the methods used and results obtained from the structural analysis, please provide reports containing at least the following information:

a. Identify the computer programs used for the analysis and how these programs were verified.

b. An identification of the load combinations performed in the analysis together with the allowable stress limits for each load combination. Differentiate between load combinations used in the piping upstream and downstream of the valve. Explain the mathematical methods used to perform the load combinations. It is not clear from the submittal whether the 1967 USAS B31.1 Code or the 1980 ASME Code was used to define acceptable piping stress levels. Identify the piping stress criteria used in the analysis. If the ASME Code was used, state which class was used.

c. Provide a table comparing the calculated stress with the allowable stress for the most highly loaded pipes.

d. An evaluation of the results of the structural analysis. The submittal stated an evaluation of the piping, in accordance with the 1967 USAS B31.1 code with loading conditions that include the new transients, found piping stresses slightly exceeding B31.1 allowable stresses. It also stated modifications are planned in order to reduce the piping system stresses. Identify the overstressed locations and describe the planned modifications.

e. A sketch of the structural model showing lumped mass locations, pipe sizes, and application points of fluid forces.

f. A copy of the structural analysis report as well as a copy of the EPRI report referenced in the submittal, <u>Determination of As-Tested Bending Moments Acting on Test Valve Discharge Flanges</u>, July 9, 1982.