October 18, 1988

Docket Nos.: 50-413
and 50-414

Mr. H. B. Tucker, Vice President
Nuclear Production Department
Duke Power Company
422 South Church Street
Charlotte, North Carolina 28242

Dear Mr. Tucker:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION CONCERNING THE REVIEW OF NUREG-0737, ITEM II.D.1, PERFORMANCE TESTING OF RELIEF AND SAFETY VALVES - CATAWBA NUCLEAR STATION, UNITS 1 AND 2 (TACS 65753/65754)

The NRC staff, with the assistance of EG&G Idaho, Inc., has reviewed your submittals dated April 29, May 31, and June 14, 1988, concerning Performance Testing of Relief and Safety Valves, TMI Item II.D.1 of NUREG-0737. These submittals were in response to our request for additional information dated July 31, 1987. Based on this review, we find that additional information, as identified in the enclosure, is required before we can complete our review.

Your response to the enclosure is requested within 60 days from the date of this letter. Please contact me at (301) 492-1496 if you have any questions.

The reporting 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:
Kahtan N. Jabbour, Project Manager
Project Directorate II-3
Division of Reactor Projects I/II

Enclosure:
As stated

cc: w/enclosure
See next page

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ENCLOSURE

ADDITIONAL QUESTIONS ON THE DUKE POWER CO.
NUREG-0737, ITEM II.D.1, SUBMITTAL
FOR
CATAWBA, UNITS 1 AND 2

1. In Reference 1, Duke Power Co. (DPC) responded to question 1 of the NRC request for additional information by stating that the plant specific valve closing pressure rise was 9 psi. The value of 9 psi appears to be too low even for the short inlet pipe used with the Catawba safety valves. Verify this value includes both frictional and acoustic wave components of the pressure rise calculation as provided in Reference 4. For valve closing, if the plant specific pressure rise exceeds the test pressure rise, justify the plant valves will operate stably.

2. DPC's response to question 6 in Reference 1 stated that the bending moments calculated for the safety valves and PORVs did not include a seismic load because the probability of a peak seismic load coinciding with a peak blowdown load was extremely small. This response is not considered acceptable because the NRC request specifically asked that the loads due to a safe shutdown earthquake (SSE) be included in the bending moment calculation. Therefore, provide a comparison of the bending moment calculated for Catawba 1 and 2 including the loads due to deadweight, thermal expansion, SSE, and valve actuation. Compare the calculated bending moment to those applied to the valves in the EPRI test program. If the calculated bending moment is higher than the applied moment, justify the valves will operate satisfactorily with the higher bending moment.

3. DPC's response to question 8, provided in Reference 2, stated that a PORV block valve operator torque output of 51 ft-lb was considered adequate based on calculations by the operator manufacturer, and, although MOVATS testing of the block valve was to be performed, no further justification of the current block valve setting was needed. This response is not considered acceptable. The intent of NUREG-0737, Item II.D.1, was to verify valve operability by test. Manufacturer

calculations are not considered adequate to verify block valve/operator operability. DPC's response also mentioned the block valve/operator combination would be tested by MOVATS as part of the IE Bulletin 85-03 program. For the purposes of meeting the requirements of Item II.D.1, MOVATS testing is considered a good diagnostic tool, but it does not necessarily demonstrate the valve/operator combination will function properly under full differential pressure conditions. To verify the operability of the block valve/operator, provide test data to support DPC's assertion that 51 ft-lb provides adequate torque to close the block valve under full differential pressure conditions. Note: DPC mentioned two EPRI block valve tests where the torque switch on operator was set to 1.5 and 1.6. In these tests, the valve closed to within 3 and 2%, respectively, of full closure but closed off all flow. These results were compared to tests with the 1.9 torque switch setting that produced 95 ft-lb of torque and full closure of the test valve. Closing off all flow, but not necessarily achieving full closure, is considered adequate to demonstrate valve operability. If DPC can show that the 51 ft-lb of torque produced by the plant valve operators is greater than or equal to the torque produced by the operator in the EPRI tests with a torque switch setting of 1.5 or 1.6, then operability of the plant valve/operator combination will be adequately demonstrated. If plant torque is less than that produced by the EPRI operator at a setting of 1.5 or 1.6, then supply test data to justify operability at the current plant setting.

4. The following items request additional information on DPC's response in Reference 1 to question 9.

   a. In answer 9b, DPC stated a maximum time step size of 10^{-3} s was used in the RELAP5/MOD1 thermal hydraulic analysis. This time step appears to be too large for the node size used to ensure piping forces due to the valve discharge were conservatively calculated. The maximum time step used in the EPRI study verifying RELAP5/MOD1 with a similar nodalization was 2×10^{-4} s (Reference 5). This time step size was determined so that no front (pressure or fluid) could traverse the length of a control volume in one time step. Justify the time step used in the analysis or redo the analysis with a smaller time step.

b. The PORV opening time used in the thermal hydraulic analysis was stated to be 1.5 s compared to a 1.6 s opening time based on the EPRI test data. However, the 1.6 s opening time referred to is the total valve opening time. This is the time measured from the time of energizing the solonoid until the valve reaches a full open position. The correct time to use in the thermal hydraulic analysis is the main disk opening time which was also provided in the EPRI test data for the Control Components PORV. The main disk opened as quickly as 0.302 s in Test 49-CC-2S. In order for the thermal hydraulic analysis for PORV discharge to be considered acceptable, DPC must justify that conservative piping forces were calculated with the slower opening time or redo the analysis with the correct PORV opening time.

c. The fluid inlet conditions used in the thermal hydraulic analysis were provided in the response to question 9d. Conditions analyzed included steam discharge and extended HPI. Conditions representative of a low temperature overpressure (LTOP) transient were not considered and it is not clear the conditions analyzed will bound the LTOP transient for the PORV piping. To complete the review of this matter, a comparison should be made between the most highly loaded locations for a LTOP transient and the valve discharge conditions already analyzed, including all the applicable loads, and the results provided for review to verify the LTOP condition was adequately considered by the conditions analyzed.

d. DPC statedin response to question 9c that a simultaneous discharge of the safety valves and PORVs was the only valve discharge case considered. DPC noted that current analysis techniques do not consider this the most conservative approach as was the case in 1982 when the Catawba analysis was preformed. The NRC staff agrees with this assessment and does not consider the Catawba analysis using the simultaneous discharge of the safety valves and PORVs adequate. Therefore, unless DPC can justify that the forces calculated by the simultaneous opening of the safety valves and PORVs bounds that which would be calculated by the separate actuation case, DPC needs to redo the analysis assuming the safety valve and PORV actuations as separate cases.

5. The following items request additional information on DPC's response in Reference 3 to question 12.

   a. Provide the dates for the editions and any addenda of the ASME and ANSI Codes used in the structural analysis.

   b. Because Table 1.2 only discusses the ASME and AISC Codes, clarify the relationship between Tables 1.2 and 1.3 provided in DPC's response to question 12c.

   c. For the load combinations provided in Table 1.0 (question 12c), clarify whether the allowable used for equation 9 (faulted) also considered the constraint that the stress be not greater than 2.0 S_y. If not, justify not using this constraint provided in the ASME Code. Also, equation 13 should have included the OBE seismic anchor movements. Justify not including this load or redo the analysis including it.

   d. For the load combinations provided in Table 1.2 (question 12c), clarify why the faulted load combination allowable was 1.5 times the AISC normal allowable stress when the AISC code only allows a normal allowable increase of 1.33 for any seismic load. Also, provide the allowables used for the Class 1 piping supports that were stated in note 1 of Table 1.2 to be based on Subsection NF of the ASME Code.

   e. In several of the tables that compared the maximum calculated stresses to the allowable stresses (question 12d), there were points where the equation 10 calculated stresses exceeded the allowable stress. This was stated to be acceptable because equations 12 and 13 or equation 11 were satisfied. However, the tables did not provide a comparison of the calculated stresses and the equation 12 and 13 or equation 11 allowables for these points. Provide this comparison for review.

f. In its response to question 12b, DPC stated the time step used in the structural analysis was 0.002 s and the lumped mass spacing was based on a frequency of 30 Hz. A time step of 0.002 s is able to accurately calculate frequency responses up to about 62 Hz. Based on EG&G Idaho experience, a frequency of at least 100 Hz needs to be considered in the structural analysis because the forcing functions from the valve discharge could excite the higher frequencies in the piping. If less than 100 Hz was used, significant dynamic responses in the system could be missed in the analysis and the piping stresses underpredicted. DPC must justify that the analysis with a lumped mass spacing based on 30 Hz and 0.002 s time step conservatively calculated the piping stresses or redo the analysis accounting for the higher frequencies.

References

1. H. B. Tucker, Jr., Duke Power Co. letter to USNRC Document Cpontrol Desk, "Catawba Nuclear Station, Units 1 and 2, Docket Nos. 50-413 and 50-414, NRC Request for Additional Information on Performance Testing of Relief and Safety Valves," April 29, 1988.

2. H. B. Tucker, Jr., Duke Power Co. letter to USNRC Document Cpontrol Desk, "Catawba Nuclear Station, Units 1 and 2, Docket Nos. 50-413 and 50-414, NRC Request for Additional Information on Performance Testing of Relief and Safety Valves," May 31, 1988.

3. H. B. Tucker, Jr., Duke Power Co. letter to USNRC Document Cpontrol Desk, "Catawba Nuclear Station, Units 1 and 2, Docket Nos. 50-413 and 50-414, NRC Request for Additional Information on Performance Testing of Relief and Safety Valves," June 14, 1988.

4. <u>EPRI PWR Safety and Relief Valve Test Program Guide for Application of Valve Test Program Results to Plant-Specific Evaluations, Revision 2, Interim Report</u>, July 1982.

5. <u>Application of RELAP5/MOD1 for Calculation of Safety and Relief Valve Discharge Piping Hydrodynamic Loads</u>, EPRI-2479, December 1982.