Omaha Public Power District
1623 Harney Omaha, Nebraska 68102-2247
402/536-4000

June 30, 1988
LIC-88-550

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, DC 20555

References:
1. Docket No. 50-285
2. Letter from the NRC (A. Bournia) to OPPD (R. L. Andrews) dated February 17, 1988
3. Letter from OPPD (R. L. Andrews) to NRC (Document Control Desk) dated May 27, 1988 (LIC-88-384)

Gentlemen:

SUBJECT: Response to Request for Additional Information concerning NUREG-0737, Item II.D.1

The Omaha Public Power District (OPPD) received Reference 1 which detailed the NRC staff and its consultant's review of NUREG-0737 Item II.D.1, Performance Testing of Relief and Safety Valves for Fort Calhoun Station.

Reference 3 was OPPD's response to the questions listed in Reference 2. In Reference 3, OPPD stated that the responses to items 5 and 6 would be submitted by June 30, 1988. Additionally, OPPD stated that the responses to items 9 and 11 would take approximately 8 weeks to prepare and were dependent upon the response to item 6. Attached please find OPPD's responses to items 5 and 6 and additional information for items 9 and 11. The responses to items 9 and 11 will be submitted by November 18, 1988.

Should you have any additional questions, please do not hesitate to contact us.

Sincerely,

W. Mary Yates

for R. L. Andrews
Division Manager
Nuclear Production

RLA/me

cc: LeBoeuf, Lamb, Leiby & MacRae
R. D. Martin, NRC Regional Administrator
R. D. Milano, NRC Project Manager
P. H. Harrell, NRC Senior Resident Inspector

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NRC Question 5:

Test information showing that the Crane block valves and their Limitorque SMB-00-7.5 operators will open and close under all possible conditions at Fort Calhoun was not provided. OPPD's response dated March 1, 1986 (Reference 15) to a request for additional information dated July 23, 1985 (Reference 14, question 8) was that (1) the probability of PORV failure is low (-10^{-3}/year), (2) that block valve operability is not a safety issue, and (3) that the Marshall Station block valve tests adequately show their operability.

The arguments presented by OPPD are not acceptable for the following reasons: (1) Based on the EPRI Dresser PORV cold loop seal test data, there is a very high probability that the Fort Calhoun PORVs will fail to close during a transient when the PORVs are required to operate, and (2) NUREG-0737 (Item II.D.1) requires the licensee to show block valve operability under all expected flow conditions.

The licensee response to question #8 in Reference 15 is considered to be unresponsive. The problems encountered with Westinghouse block valves failing to close against operating pressures which were identified during the block valve test (Reference 18) raised a safety concern for all untested block valves and their operators that must be addressed. OPPD must explain specifically how the Marshall Station block valve test data applied to the Fort Calhoun Crane block valves and their operators, or provide test data for the Fort Calhoun Crane block valves and their operators. It should be noted that manufacturer's calculations are not sufficient to show the block valve operators provide sufficient torque to close the valves.

OPPD's Response to Question #5:

Reference: 1. "EPRI Summary Report: Westinghouse Gate Valve Closure Testing Program." Prepared by Westinghouse Electro-Mechanical Division, dated March 31, 1982.

In order to confirm the original sizing of the PORV block valve operators, Crane Valve Division recalculated the thrust and torque requirements to operate the Model 797-U valve against 2500 psi differential pressure. The Crane calculation methodology was based on empirical data, and has been used by Crane for over twenty years to adequately size operators for gate valves. Using this methodology, Crane determined that a thrust of 3653 lbs would be required to seat the valve, corresponding to a torque requirement of 57 ft-lbs. These values agree with original sizing calculations.

The failure of Westinghouse gate valves to operate during the EPRI-sponsored Marshall Station test was addressed in Reference 1. Westinghouse demonstrated that closing thrust requirements increased at least 60% after 15 consecutive cycles at two minute intervals for each of three valves tested. In order to compensate for this phenomenon, Westinghouse recommended a change of the Valve Factor used to calculate the disc differential pressure load from 0.3 to 0.55. By substituting this more conservative valve factor into Crane's sizing formula, the closing thrust and torque requirement were predicted to be 6812 lbs and 106 ft-lbs, respectively.

OPPD's Response to Question #5: (Continued)

A torque of 106 ft-lbs exceeds that needed to operate three wedge gate valves similar to Fort Calhoun's block valves in the Marshall test. All Marshall tests were conducted with 3 inch valves, while Fort Calhoun uses 2½ inch valves. The torque requirement to operate 2½ inch valves is less than that for 3 inch valves due to reduced surface area exposed to system differential pressure.

OPPD proposes to reset the PORV block valve torque switches during the 1988 refueling outage to produce 106 ft-lbs, with the new setting verified using the MOVATS test method. If the existing torque switch spring packs cannot achieve this higher setpoint, new spring packs will be installed at the earliest outage of sufficient duration following receipt of the spring packs. The higher torque could be required if the valves are repeatedly cycled in quick succession. It is very likely that the PORV block valves would be cycled in this manner under any design basis transient/accident condition, thus OPPD has confidence in the original sizing calculations; however, the torque setting will be increased to provide a greater margin of safety and assurance that the valves would be operable at full design differential pressure. The PORV's are set to open at a pressure less than design differential pressure (2400 psia vs. 2500 psid). Further, an internal Feed and Bleed feasibility study (prepared by OPPD in October, 1986) indicates that the pressurizer pressure drops rapidly (3-4 psi/second) upon opening a single PORV. Thus, the differential pressure seen by the PORV block valves will be significantly less than design differential pressure. The greater torque capacity provided by the higher torque switch setting should provide far more closing thrust than will ever be needed. The higher setting will not damage the valves or their operators, and will provide a factor of safety of 1.9 over Crane's sizing methodology.

As outlined in OPPD's response to Question #4, the PORV loop seals have been modified to increase their temperature. Also, the ability of the PORVs to reseat after opening has been demonstrated during two loss-of-load events at Fort Calhoun. OPPD believes that the PORVs will adequately seat after being opened, and considers them to be operable. Since successful operation of the PORVs precludes the requirement of block valve operability, the probability that the block valves would be required to terminate flow through a stuck open PORV is extremely small.

NRC Question 6:

> The thermal-hydraulic analyses of the SV/PORV piping system, referred to in Reference 15, was done using the RELAP5/MOD1 code. Three cases were analyzed, 1, both PORVs opening at the same time (the PORVs have the same set pressure), 2, and 3, each SV opening alone (the SVs have staggered set pressures of 2485 psig and 2530 psig). No case was run where both safety valves lift simultaneously. During the loop seal test, the opening pressures for the valves ranged from +1.4 to +5.5% of set pressure, and during the steam tests and opening pressures ranged from -2.6 to +1.4% of set pressure. Since the set pressures of the two Fort Calhoun safety valves are only 1.8% apart, which is within the expected range of lift pressures for the safety valves, it is just as likely for the two valves to lift at the same pressure as for them to lift at different pressures. Therefore, a case with both safety valves lifting simultaneously must be run or OPPD must justify not running it because it is bounded by one of the other cases.

OPPD's Response to Question 6:

OPPD stated in Reference 3 that although simultaneous valve opening was considered an extremely unlikely event, a review of the analyses already performed would be made to determine if these analyses bounded this event. This review has recently been completed. It was determined that a portion of the analyzed piping could be considered bounded, however, there is a portion where the hanger loadings and pipe stresses may be affected in a way that cannot be adequately predicted without running another analysis. This effect is not expected to require any modifications to the piping or supports, but an exact statement of loadings and stresses from this event cannot be made from the existing analyses. In order to predict these loads and stresses OPPD will rerun the computer analysis with both safety valves opening simultaneously. This analysis is expected to be completed by November 18, 1988. At the completion of the analysis, the NRC will be informed of OPPD's plans regarding the results of the new analysis.

NRC Question 9:

The submittal states that RELAP5/MOD1 was used in the thermal-hydraulic analysis and FORCE was used to predict the piping loads that result. To allow for a complete evaluation of the methods used and the results obtained from the thermal-hydraulic analysis, a discussion that contains at least the following information should have been provided.

a. Identification of important parameters used in the analysis and rationale for their selection. These include peak pressure, peak pressurization rate, valve flow rate, valve opening time, loop seal temperature and other fluid conditions for the cases analyzed. Use of the ASME rated valve flow rate is acceptable because the measured flow rate was only 99-104% of rated flow at 3% accumulation.

b. Information on the model used is needed and how well it adheres to the guidelines in Reference 19. These include control volume length, calculation time step used, number of control volumes, and initial pipe conditions before the transient is run. Reference 4 recommends using control volume lengths between 0.5 and 1.0 ft and calculational time step size limited by the mass transport Courant limit for loop seal conditions. (The maximum time step used in the Reference 4 analyses was 2×10^{-4} sec.) If these recommendations were not adhered to, justification of what was used is required.

c. Provide a sketch of the thermal-hydraulic model used showing control volume sizes and locations. A copy of the thermal-hydraulic analysis report should also be provided.

OPPD's Response to Question 9:

As stated in Reference 3, the response to this question depended on the response to Question 6 above. Since the review required for Question 6 determined that a new analysis was needed, much of the information requested in this question will also be revised. Therefore, OPPD will delay submittal of this information until the additional analysis has been completed. Completion of the reanalysis has been projected to occur by November 18, 1988; a complete response to this question will follow at that time.

NRC Question 11:

The submittal states that a structural analysis of the SV/PORV piping system has been conducted using TPIPE, but did 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. Verification of TPIPE for use of dynamic piping structural analyses such as these.

b. How the FORCE calculation loads are applied.

c. A description of methods used to model supports, the pressurizer and relief tank connections, the safety valve bonnet assemblies, and the PORV actuator. Other code input information such as lumped mass spacing, calculation time step, damping factor, and cutoff frequency are also requested. Cutoff frequencies of less than 100 Hz need to be justified if used, and the lumped mass spacing and calculation time step should be consistent with the 100 Hz cutoff frequency or justification provided for the values used.

d. An evaluation of the results of the structural analysis, including a description of modifications made as a result of earlier stress analyses.

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.

OPPD's Response to Question 11:

OPPD's response to this question follows the same rationale as the response for Question 9 above.

As stated in Reference 3, the response to this question depended on the response to Question 6 above. Completion of the reanalysis for Question 6 has been projected to occur by November 18, 1988; a complete response to this question will follow at that time.