May 21, 2003

Mr. R. T. Ridenoure
Division Manager - Nuclear Operations
Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION – FT. CALHOUN STATION PRESSURE-TEMPERATURE LIMIT REPORT SUBMITTAL (TAC NO. MB6468)

Dear Mr. Ridenoure**:**

By letter dated October 8, 2002, Omaha Public Power District (OPPD), submitted for NRC staff review a license amendment request which would permit the implementation of a pressure-temperature limit report (PTLR) for the Fort Calhoun Station, Unit 1 (FCS). OPPD stated that the submittal was consistent with the guidance provided in Generic Letter 96-03, "Relocation of the Pressure Temperature Limit Curves and Low Pressure Overpressure Protection System Limits."

The staff has reviewed OPPD's submittal. A teleconference with OPPD was conducted on April 23, 2003. The staff has determined that additional information is needed to complete our review. A request for additional information is enclosed. This request was discussed with Richard Jaworski of your staff on May 8, 2003, and it was agreed that a response would be provided within 30 days of receipt of this letter.

If you have any questions, please contact me at (301) 415-1445.

Sincerely,

/RA/
Alan B. Wang, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure: Request for Additional Information

cc w/encl: See next page

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REQUEST FOR ADDITIONAL INFORMATION

PRESSURE TEMPERATURE LIMIT REPORT

OMAHA PUBLIC POWER DISTRICT

FT. CALHOUN STATION, UNIT 1

DOCKET NO. 50-285

Omaha Public Power District (OPPD/the licensee) requested the approval of their revised low-temperature overpressure protection (LTOP) methodology based on RELAP5/MOD 3.2 computer code. This methodology would be incorporated into the pressure temperature limit report (PTLR) and would allow OPPD to change the LTOP system setpoints without prior NRC approval. The staff has reviewed your request and the following additional information regarding the analysis is required for the staff to complete its review.

1. The LTOP analysis employed RELAP5/MOD3.2 which is not the latest version. RELAP5/MOD3.3 contains improved water property data at low pressure. Why wasn't RELAP5/MOD3.3 used? What would have been the impact on the LTOP transients?

2. Did ITS Corporation perform the LTOP analysis using the same version RELAP5 as that used by OPPD? If not, what were the differences and do they impact the analysis?

3. Code benchmarking and validation is presented in the attachment to the October 8, 2002, submittal named NEPTUNUS. Did INEEL use the same version as that used by OPPD in the LTOP analysis? (The INEEL RELAP5/3-D version differs from the ISL version used by OPPD). Did OPPD benchmark the version obtained from ISL? Please provide the validation results justifying the use of RELAP5/MOD3.2D for the LTOP analysis.

4. NEPTUNUS simulated pressurization (and subsequent depressurization) with sprays and an initial void in the pressurizer. Many of the LTOP analyses were run in a water solid condition. What data were used to validate the use of RELAP5 for water solid conditions? In addition:

    The NEPTUNUS pressurizer nodalization employed 12 cells while the LTOP FCS analysis utilized 6 cells. Please provide the sensitivity study justifying the FCS study.

    What sensitivity studies were performed for time-steps and number-of-cells that justify the time steps and number of cells in the FCS model?

    The MIT pressurization test series showed that for pressurizer insurge, the peak pressure was controlled by wall heat transfer rather the water-steam interfacial heat transfer. Please show the wall nodalization justifying the OPPD modeling approach.

5. The power operated relief valve (PORV) discharge coefficient was based on high pressure steam conditions. Was the coefficient also used for liquid conditions at low pressure? If so, justify the use of the discharge coefficient.

6. The benchmarking is insufficient for overpressurization events. There are relevant data from Shippingport, Connecticut Yankee, and Millstone 2. Also a series of insurge non-equilibrium experiments at the Massachusetts Institute of Technology (MIT) were performed by Griffith that covers low pressure. Please justify the adequacy of the benchmarking or show the results with the above data. Also, provide a comparison of RELAP5 with data in a water solid condition. Please discuss the data in the literature and the reasons for your choice of separate effects and integral experiments.

7. Once residual heat removal conditions are met, the reactor coolant system can develop a bubble in the top of the vessel. Please discuss the effect of the bubble in the reactor vessel. It is anticipated that a bubble in the upper head would not affect the peak pressure, but only the timing of pressure increase. Please discuss whether a bubble in the upper head impacts the results and the conclusions of the analysis.

8. In many of the LTOP events, collapse of the bubble in the pressurizer will occur. Please explain how the bubble collapses during the insurge prior to opening of the PORV. It appears that the nodalization in the pressurizer is too coarse so that artificial mixing of the fluid during the insurge when there is a bubble in the pressurizer will reduce the magnitude of the pressurization. During such an insurge, the increase in the liquid is expected to compress and superheat the upper steam region. Some heat transfer between the liquid and steam region will occur initially, however, the liquid surface will saturate and a thermal layer will form insulating the steam from the lower cooler liquid region. Under these conditions, the upper steam region would not be expected to totally collapse as the RELAP5 code can predict. Please discuss the above. A comparison with the MIT pressurization tests will show these non-equilibrium effects.

9. Please explain why the events with injection from a liquid-solid condition do not result in an immediate and faster pressurization.

10. Which critical flow model was used in the RELAP5 model and what is the basis for this choice?

11. Non-condensables collect in the pressurizer and the upper vessel head. Please describe the impact of non-condensables on the LTOP analysis. Are there any scenarios where non-condensables can affect the calculated peak pressure and the development of the LTOP limits.

12. Was inadvertent actuation of emergency sprays evaluated for the cases where the pressurizer is water solid?

13. What assumptions are made regarding the quench tank? Once the quench tank ruptures, would this result in higher pressurizer pressure due to the additional quench tank resistance? What is the relief area from the quench tank compared to the PORV? Please show that the analysis without a quench tank model is bounding.

14. For each case, show the PORV mass flow rates as compared to the injection rate. Also, show the void fraction in the top cell and the temperature distribution in the pressurizer for each case.

15. How were the quality assurance findings identified in the ITS Corporation letter dated September 9, 2002, addressed relative to their impact on the LTOP analysis? Please discuss each of the findings and their impact on the analysis.

16. Discuss the pertinence of the INEEL validation presented for the SCDAP/RELAP5 simulation of the TMI-2 accident in view of the fact that the SCDAP/RELAP5 code differs from RELAP5/MOD3.2 used in the OPPD analysis, the nodalization is very different from the OPPD model, and TMI-2 is a different design compared to the CE-designed FCS. The SCDAP/RELAP5 simulation does not validate nor justify the application of a different version RELAP5/MOD3.2d for use in simulating LTOP events in a CE-designed plant. As such, the benchmarking is weak. Additional benchmarking using the same version of RELAP5 that was used in the LTOP analysis by OPPD needs to be employed in the analysis. Please consider the MIT pressurization test data, as well as RELAP5 simulations of overpressurization events in CE-designed plants. Benchmarking of the code against water solid relief is also needed.

17. Please explain why the pressure does not cycle open and close the PORV as steam is initially vented and then remains at the PORV setpoint when the discharge transitions to a pure liquid condition, stabilizing at the condition where injection into the RCS equals the PORV discharge flow. Please show the injection rates as compared to PORV mass flow rates and the quality of the steam exiting the pressurizer for those cases.

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