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Gentlemen:

DOCKETS 50-266 AND 50-301
EVALUATION OF STEADY-STATE
SERVICE WATER SYSTEM HYDRAULIC CHARACTERISTICS
DURING A DESIGN BASIS ACCIDENT
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

In our letter to the NRC, VPNPD-96-046, dated July 23, 1996, we described the basis for continued operability of the Service Water (SW) System and Containment Fan Coolers (CFCs) during a design basis Loss Of Coolant Accident (LOCA). That letter described the SW System hydraulic response at the stage when the CFC has started and the containment heat removal systems are operating in a steady-state condition. The SW System hydraulic response to a potential LOCA with a CFC start-up transient has been evaluated separately, and has been described to the NRC in our September 9, 1996, letter VPNPD-96-065. The subject of this letter is the steady-state service water system hydraulic characteristics during a design basis accident.

As discussed in VPNPD-96-046, we have discovered a potential for two-phase conditions in the SW lines downstream of the CFCs and the consequent potential for a reduction in SW flow to the CFCs during a LOCA. To evaluate the effects, we used the most accurate and readily-available engineering tools available to us. These tools included the WATER™ model (Reference 1) of the Point Beach Nuclear Plant (PBNP) SW System, and the AIRCOOL™ model (Reference 2) of the PBNP CFCs. Since WATER™ does not model two-phase flow, we applied our best engineering judgment to predict the pressure effects of the two-phase conditions at the expected locations. These pressure effects were then modeled in the WATER™ program to predict the SW flow rate through the CFCs. As a result, we determined that the SW flow rate might be reduced, but would not reduce CFC performance below that which is necessary to keep containment pressure below the design value.

As we committed to do in VPNPD-96-046, we have conducted two independent analyses to validate the approach used in the WATER™ flow model calculations. These independent analyses simulate two-phase flow effects due to high temperatures in the containment fan cooler (CFC) discharge piping and low pressures in the service water return header. One analysis used the RELAP5/MOD3.1 computer program (Reference 3) to directly evaluate two-phase flow in the CFC return lines and the service water return header. Another independent analysis used experimental data and analytical methodologies to validate the WATER™ results.

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The system configuration and boundary conditions of the analyses are based upon PBNP drawings and the existing WATER™ flow model and system temperature calculations.

Sargent & Lundy (S&L) used RELAP5 to analyze a representative portion of the service water system including the CFC return lines downstream of the CFC return manifolds, the service water return header, and the overboard lines all the way to the overboard boundaries as specified in existing WATER™ flow calculations. The boundary conditions for the RELAP5 run include the pressures at the accident unit CFC return manifolds, the pressures at the service water overboard boundaries, and the flow rates through other components of the system. These boundary conditions are derived from calculation 96-0117 Revision 0 (Reference 7). The S&L analysis is documented in Reference 5.

Fauske & Associates Incorporated (FAI) analyzed a representative portion of the service water system including the CFC supply and return piping and the 20-inch service water return header to the entry point into the circulating water system. The boundary condition for this analysis is based on the service water supply pressure derived from calculation 96-0117 Revision 1 (Reference 4). The analysis determined that the pressure in the 20-inch service water return piping would not change significantly from the normal operating conditions. The FAI analysis is documented in Reference 6.

Conclusion:

For the range of fouling factors considered in the WATER™ flow model calculations (References 4 and 7), the results of both analyses show that the service water flow rate to each of the four CFCs exceeds the minimum required flow rate and correlates with those calculated using the WATER™ flow model. Therefore, there is adequate assurance that the WATER™ flow model will provide acceptable results for routine engineering evaluations of the service water system over the range of fouling factors considered.

These analyses are available for your review upon request. If you have any questions or require additional information, please contact us.

Sincerely,

Bob Link
Vice President
Nuclear Power

GDA
Attachment
cc: NRC Resident Inspector
NRC Regional Administrator, Region III

References:

1. WATER™ - The WATER™ program was produced by Municipal Hydraulics Inc. This program simulates water distribution systems and predicts steady-state flow in pipes. Validation of PBNP service water flow by comparison of the computer program results with the actual plant data and specifications demonstrates that the WATER™ computer program can be used to accurately predict flows in the service water system.

2. AIRCOOL™ - The AIRCOOL™ program was produced by Holtec International Corporation. This program uses methods described in Compact Heat Exchangers by Kays and London for predicting heat exchanger performance and Process Heat Exchangers by Kern for predicting dehumidification heat transfer coefficients. Validation analyses and benchmark data comparison has been performed by Holtec for this computer code.

3. RELAP5 is the NRC's state-of-the-art transient flow and accident analysis program. RELAP5 is based on a non-homogeneous and non-equilibrium model for the two-phase system that is solved by a partially implicit numerical scheme to permit calculation of system transients.

4. WE Calculation 96-0117 Revision 1, dated 9/19/96

5. S&L Report M-09334-195.SW, Revision 0, dated 9/27/96, "RELAP Modeling of Component Fan Cooler Service Water Return Lines".

6. Fauske & Associates Incorporated (FAI) Report FAI/96-88 dated September 1996, "Assessment of One-Component Two-Phase Flow in the Point Beach Fan Cooler Service Water Flow".

7. WE Calculation 96-0117 Revision 0, dated 6/6/96