October 6, 2003

Mr. David A. Christian
Sr. Vice President and Chief Nuclear Officer
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Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: CLOSEOUT OF RESPONSES TO GENERIC LETTER 96-06 FOR MILLSTONE POWER STATION, UNIT NO. 2 (TAC NO. M96833)

Dear Mr. Christian:

On September 30, 1996, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions." The GL requested licensees to determine: (1) if containment air cooler cooling water systems are susceptible to either water-hammer or two-phase flow conditions during postulated accident conditions; and (2) if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that over-pressurization of piping could occur. On November 13, 1997, the NRC issued Supplement 1 to GL 96-06, to inform licensees about ongoing efforts and new developments associated with the GL, and to provide additional guidance for completing corrective actions.

By letters dated October 30, 1996; January 28, 1997; January 12, 1999; July 11, 2001; September 6, 2002; and June 10 and August 21, 2003; responses to the requested actions of GL 96-06 were provided for Millstone Power Station, Unit No. 2 (MP2). The results of the NRC's review of your responses to GL 96-06 follow.

Water-Hammer and Two-Phase Flow

As discussed in the background section of GL 96-06, cooling water systems serving the containment air coolers may be exposed to the hydrodynamic effects of water-hammer during either a loss-of-coolant accident (LOCA) or a main steamline break (MSLB). These cooling water systems were not designed to withstand the hydrodynamic effects of water-hammer. In addition, cooling water systems serving the containment air coolers may experience two-phase flow conditions during postulated LOCA and MSLB scenarios. The heat removal assumptions for design-basis accident scenarios were based on single-phase flow conditions. Therefore, based on these two issues of concern, these cooling water systems may need corrective actions to satisfy system design and operability requirements if they are vulnerable to water-hammer and two-phase flow conditions.

Subsequent to issuance of GL 96-06, the Electric Power Research Institute (EPRI) developed an analytical methodology for evaluating the GL 96-06 water-hammer issue that was documented in EPRI Technical Reports 1003098 and 1006456 (previously known as EPRI Report TR-113594), and was approved by the NRC in a safety evaluation (SE) dated April 3, 2002 (included as Appendix A in EPRI Report 1003098, and as Appendix B in EPRI Report 1006456). Section 3.3 of the staff's SE requested that licensees who chose to use the

EPRI methodology provide additional information to confirm that the methodology was properly applied for the plant-specific application. The licensee's submittals dated June 10 and August 21, 2003, provided the information requested by the NRC staff's SE approving use of the EPRI methodology.

The licensee's initial water-hammer analysis, in response to GL 96-06, was performed using the RELAP5 computer code. While the analysis appeared to be reasonable, this specific application of the RELAP5 computer code has not been reviewed and approved by the NRC. Therefore, in order to resolve concerns associated with use of the RELAP5 computer code, the licensee performed additional analyses using the EPRI methodology referred to in the preceding paragraph.

In order to resolve the water-hammer concerns discussed in GL 96-06 for MP2, the licensee determined that modifications to the reactor building closed cooling water (RBCCW) system were required. In particular, four pipe supports were modified and another one was added to the RBCCW system, and flow restriction orifices were added in the RBCCW pump supply lines from the surge tank in order to assure that design-basis margins for the RBCCW system are maintained during GL 96-06 water-hammer events. Additionally, emergency procedures were established to assure that delayed restart of the RBCCW pumps will not occur during a LOCA or a MSLB accident unless containment pressure is below 20 psig, thereby further minimizing the likelihood and consequences of a potential water-hammer transient. Based on our review of the information that was submitted, we consider the licensee's evaluation of the GL 96-06 water-hammer issue to be consistent with the EPRI methodology as approved by the staff, and we find the licensee's response and corrective actions to address the GL 96-06 water-hammer issue to be acceptable.

With regard to the two-phase flow issue, we are satisfied with the licensee's response dated January 12, 1999. As discussed in Attachment 1, page 7, of the January 12, 1999, submittal, the licensee stated that based on the pressure, temperature, and flow conditions calculated, it was concluded that no flashing will develop in the system and no two-phase flow occurs when the RBCCW pumps are in operation.

While we are satisfied with the licensee's response and consider the water-hammer and two-phase flow elements of GL 96-06 to be closed, we have not performed a detailed review of the licensee's water-hammer analysis or of the modifications that were made, and they could be the subject of a future NRC audit or inspection activity.

Thermally-Induced Over-Pressurization

Thermally-induced over-pressurization of isolated water-filled piping sections in containment could jeopardize the ability of accident-mitigating systems to perform their safety functions and could also lead to a breach of containment integrity via bypass leakage. Corrective actions may be needed to satisfy system operability requirements.

In the submittal dated January 28, 1997, the licensee summarized its review of fluid system piping segments that had the potential to over-pressurize due to thermal expansion of internal fluid. The licensee identified nine containment penetrations which were potentially susceptible

to thermally-induced pressurization. Some of the penetrations contained more than one piping segment, for a total of 16 segments. The licensee determined that a review of all of these penetrations would be performed and corrective actions would be taken prior to plant startup. In the July 11, 2001, submittal, the licensee provided the results of its evaluation and a description of the corrective actions taken. For these nine penetrations, the licensee provided the following information:

- For Penetration No. 2, which contains two piping segments, it was determined that very hot water was trapped in the piping such that the water would not be thermally pressurized.

- For Penetration No. 10, which contains one piping segment, the water which could be trapped will be procedurally controlled to be above a minimum temperature, and additional insulation was added such that additional temperature rise and thermally-induced pressurization is prevented.

- For Penetration No. 14, a relief valve was added to one piping segment, and in another piping segment, it was determined that a globe valve disk would lift with pressure under the seat, which prevents excessive pressurization.

- For Penetration No. 21, there are four interconnected piping segments, one which could trap only very hot water and three which could trap cold water. For these, it was determined that the cooling of the very hot fluid segment would adequately relieve the pressure buildup due to possible heating in the cold fluid segments, since they are interconnected.

- For Penetration No. 35, which contains one piping segment, it was determined that a globe valve disk will lift with pressure under the seat, preventing excessive pressurization.

- For Penetration No. 43, which contains two piping segments, it was determined that only a small part of the piping can be heated such that the resulting pressurization that could occur is acceptable.

- For Penetration No. 49, which contains one piping segment, it was determined that one valve, which is not a containment isolation valve, will be procedurally left open to prevent pressurization.

- For Penetration Nos. 67 and 68, which contain three piping segments, the piping will be partially drained by procedure to prevent pressurization.

The NRC staff finds the licensee's evaluations and corrective actions for the identified nine penetrations to be acceptable. Therefore, the staff concludes that the licensee's response adequately addresses the issue of thermally-induced over-pressurization concern identified in GL 96-06.

Summary

Based on the above discussion, the NRC staff concludes that the issues identified in GL 96-06 have been adequately addressed for MP2. Therefore, this letter closes out the staff's actions for TAC No. M96833.

If you have any questions, please contact me at 301-415-1420.

Sincerely,

/RA/

Richard B. Ennis, Senior Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-336

cc: See next page

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