

January 11, 2005

Mr. Daniel J. Malone  
Site Vice President  
Palisades Nuclear Plant  
Nuclear Management Company, LLC  
27780 Blue Star Memorial Highway  
Covert, MI 49043-9530

SUBJECT: PALISADES PLANT - GENERIC LETTER 96-06 REGARDING PIPING THERMAL OVERPRESSURIZATION, WATERHAMMER, AND TWO-PHASE FLOW ISSUES (TAC NO. M96844)

Dear Mr. Malone:

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," (Accession No. 9609250096). In GL 96-06, the NRC staff expressed concerns that cooling water systems serving the containment air coolers may (1) be exposed to the hydrodynamic effects of waterhammer during either a loss-of-coolant accident or a main steamline break, or (2) experience two-phase flow conditions during these postulated accidents. The NRC staff also expressed concern that (3) thermally-induced overpressurization 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. The NRC staff requested that addressees assess these concerns, take certain actions as appropriate, and provide certain information to the NRC staff within specified times.

Consumers Power Company (CPCo, the previous name of Consumers Energy Company, CECo, the former licensee of the Palisades Plant) submitted an initial 30-day response by letter dated October 21, 1996 (Accession No. 9610290148), indicating that a written summary report would be submitted within 120 days of the date of GL 96-06 that would provide the requested information. By letter dated January 27, 1997 (Accession Nos. 9702030038 and 9704160135), CPCo submitted its 120-day response that forwarded a summary report of actions taken, specific responses to the information requested by GL 96-06, an operability assessment for transient conditions and an operability evaluation for two-phase flow conditions. CECo and Nuclear Management Company, LLC (NMC, the current licensee of the Palisades Plant) subsequently submitted a number of letters to the NRC staff addressing changes in schedular commitments regarding GL 96-06.

#### Thermally-Induced Pressurization of Piping

By letters dated January 27 and March 21, 1997 (Accession No. 9703270234), CPCo responded to GL 96-06 with respect to the concern for thermally-induced pressurization of piping that penetrates containment. In its letter of January 27, 1997, CPCo identified three penetrations potentially vulnerable to a water solid volume subjected to an increase in pressure

due to heating of trapped fluid. The affected three lines are: Clean Waste Receiver Tank Fill and Drain lines; and Reactor Cavity Drain Line. CPCo determined that the affected penetrations were operable based upon its review of the functions and configurations of the affected lines and concluded that the containment integrity would be maintained.

In Licensee Event Report (LER) 97-003, "Potential For Steam Voiding And Waterhammer In Containment Air Cooler System, And For Overpressurization Of Closed Piping Systems," dated March 21, 1997 (Accession No. 9703270234), CPCo reported an additional susceptible penetration associated with the Reactor Cavity Fill Line. CPCo states in the LER that it took corrective actions prior to the plant startup from the 1996 refueling outage by installing surge pots on the Clean Waste Receiver Tank Fill and Drain Lines, and revising administrative procedures controlling the Reactor Cavity Drain and Fill Lines to insure that the lines are drained during operation.

The NRC staff finds that these assessments and corrective actions provide an acceptable resolution for the issue of thermally-induced pressurization of piping runs penetrating the containment.

#### Waterhammer and Two-Phase Flow

After issuance of GL 96-06, the Electric Power Research Institute (EPRI) developed an analytical methodology for evaluating the GL 96-06 waterhammer issue that was documented in EPRI Technical Reports 1003098 and 1006456, dated April 30, 2002 (Accession Nos. ML021750063, ML021750141, and ML021750025), previously known as EPRI Report TR-113594, "Resolution of Generic Letter 96-06 Waterhammer issues, Volumes 1 and 2," dated December 31, 2000, (Accession Nos. ML003779585 and ML003781044), and approved by the NRC by letter and safety evaluation dated April 3, 2002 (Accession Nos. ML020940132 and ML021140065). Section 3.3 of the NRC staff's safety evaluation requested that licensees who chose to use the EPRI methodology provide additional information to confirm that the EPRI methodology was properly applied and that plant-specific risk considerations were consistent with the EPRI risk perspective; to justify any proposed exceptions to the EPRI methodology; and to provide any additional information that is required to address the GL 96-06 two-phase flow issue.

By letter dated January 27, 1997, CPCo provided its initial response addressing the waterhammer and two-phase flow aspects of GL 96-06. CECO supplemented its response by letter dated January 29, 1998 (Accession No. ML9802040242). In response to questions by the NRC (Accession No. ML9806250212), CECO provided additional information in a letter dated August 26, 1998 (Accession No. ML9808310289), indicating that it would be participating in the EPRI initiative and that answers to the NRC staff's questions would be deferred pending the completion of this initiative. CECO subsequently updated the status of its response to GL 96-06 in a letter dated January 16, 2001 (Accession No. ML010230062). Upon completion of the EPRI initiative, NMC submitted the information that was required by Section 3.3 of the NRC staff's safety evaluation by letters dated February 28, July 24, November 12, 2003 (Accession Nos. ML030770736, ML032170125, and ML033250345) and August 18, 2004 (Accession No. ML042370019).

Based on our review of the information that was provided, we are satisfied with NMC's evaluation of the GL 96-06 waterhammer and two-phase flow issues. Although the licensee used computer codes that have not been reviewed and approved by the NRC to facilitate its application of the EPRI methodology, the results were shown to be conservative through comparative analysis using the EPRI rigid body method approach. No exceptions to the EPRI methodology were proposed, and plant-specific risk considerations are consistent with the EPRI risk perspective. For a few pipe supports, the licensee found that the waterhammer loads exceeded the safe shutdown earthquake loads. The licensee performed a specific evaluation of the calculations for these particular supports and concluded that the design-basis allowable stresses would not be exceeded and that no modifications were necessary. With respect to two-phase flow, the licensee has determined that boiling will not take place in the service water piping downstream of the containment fan coolers after cooling water flow has been reestablished following event initiation and therefore, two-phase flow will not occur.

#### Conclusion

On the basis of the above, the NRC staff concludes that NMC and its predecessor licensee have performed evaluations and taken actions that satisfy the concerns stated in GL 96-06. This completes the NRC staff's review of the licensee's response to GL 96-06 and TAC No. M96844 is being closed.

If you have questions regarding this letter, please contact me at (301) 415-1439.

Sincerely,

*/RA/*

David H. Jaffe, Senior Project Manager, Section 1  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-255

cc: See next page

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David H. Jaffe, Senior Project Manager, Section 1  
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