July 17, 2002

MEMORANDUM TO: Jacob I. Zimmerman, Acting Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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

SUBJECT: MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2, FACSIMILE TRANSMISSION, ISSUES TO BE DISCUSSED IN AN UPCOMING CONFERENCE CALL (TAC NO. M96833)

The attached information was transmitted by facsimile on July 11, 2002, to Mr. Ravi Joshi of Dominion Nuclear Connecticut, Inc. (the licensee). This information was transmitted to facilitate a upcoming conference call in order to determine an appropriate response time for the attached set of questions associated with the licensee's submittals in response to Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions" for Millstone Nuclear Power Station, Unit No. 2. This memorandum and the attachment do not convey a formal request for information or represent an NRC staff position regarding the licensee's request.

Docket No. 50-336

Attachment: As stated

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REQUEST FOR ADDITIONAL INFORMATION

REGARDING RESOLUTION OF GENERIC LETTER 96-06

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

DOCKET NO 50-336

By letters dated October 30, 1996, January 28, 1997, January 12, 1999, and July 11, 2001, responses to the requested actions of Generic Letter (GL) 96-06 were provided for Millstone Nuclear Power Station, Unit No. 2 (MP2). The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing the MP2 responses to the GL and has determined that additional information is required to complete the review.

1. As discussed in a letter from the NRC to the Electric Power Research Institute (EPRI) Waterhammer Project Utility Advisory Group dated April 3, 2002 (reference ADAMS Accession No. ML020940132), the NRC staff has approved EPRI Report TR-113594 as an acceptable method for performing evaluations to address the GL 96-06 waterhammer concerns. NUREG/CR-5220 also provides an acceptable method for evaluating waterhammer events. As discussed in your submittals dated January 12, 1999, and July 11, 2001, the RELAP5 computer code was used to evaluate waterhammer in the Reactor Building Closed Cooling Water (RBCCW) system for MP2. The NRC staff does not believe that the RELAP5 computer code is an appropriate method for evaluating waterhammer. This is because the code uses a nodal solution that is incapable of tracking individual water slugs in horizontal pipes. The collision of these water slugs produced by the rapid condensation of steam is the process that can cause waterhammer to occur. In reaching this decision concerning RELAP5, the NRC staff had discussions with the RELAP5 developers and performed sample RELAP5 waterhammer calculations comparing the results with other methodologies. In a letter dated October 23, 2001 (ADAMS Accession No. ML013020519), the Advisory Committee for Reactor Safeguards (ACRS) stated that a code such as RELAP may have trouble modeling waterhammer events because it does not have a good representation of direct contact condensation, the mixing and stratification processes in the main pipes, nor the phase separation that may occur in the coolers (reference page 7 of the enclosure to the letter).

   Since the MP2 RBCCW system evaluations for GL 96-06 were done with a methodology which the staff does not believe is appropriate for waterhammer analysis (i.e., RELAP5), please provide the results of waterhammer calculations using appropriate methodology. If you choose to use a methodology that has not been previously approved, please provide documentation including all equations. Provide justification by comparison to experimental waterhammer data that is applicable to the conditions in the Millstone 2 RBCCW system.

2. Your response dated July 11, 2001, indicates that following a loss of offsite power and either a loss-of-coolant accident (LOCA) or a main steam line break (MSLB) inside the containment, if the RBCCW pumps are not automatically restarted within 26 seconds, emergency procedures instruct operators to wait until the containment pressure has decreased to 20 psia before restarting the RBCCW pumps. Please provide the results of analyses for the automatic pump restart and the delayed pump restart for the peak waterhammer pulse. Provide the results of the structural analysis for the RBCCW piping,

supports, valves and penetrations. Based on a telephone conversation on July 9, 2002, we understand that flow orifices have recently been provided in the RBCCW system. What would the loads on the flow orifices be as a result of waterhammer from restarting the RBCCW pumps? For the most severe case of waterhammer, please provide the margin to failure for each component.

3. Provide the following information as a function of time for the most severe condition of waterhammer following the restart of the RBCCW pumps into a partially voided system:

   a. pressure in the gas phase between the water columns;

   b. liquid velocity in the water column;

   c. liquid temperature at the closing face of the water column; and

   d. saturation temperature in the water column.

4. GL 96-06 suggested that licensees may find the information contained in Volumes 1 and 2 of NUREG/CR-5220, "Diagnosis of Condensation-Induced Waterhammer," to be informative and useful in evaluating potential waterhammer conditions. Condensation-induced waterhammer (CIWH) might occur as containment cooling systems are drained during a loss of offsite power (LOOP) condition, or during initiation of cooling water flow. CIWH typically occurs in horizontal pipe segments partially filled with cold water overlaid by steam that is supplied by a steam source. Condensation of steam on the surface of the water can cause tongues of water to be whipped up in a wave like manner. If steam condensation is vigorous enough, a water tongue can extend to the top of the pipe forming a plug. The steam bubble trapped between two plugs of cold water would experience a drop in pressure from continued condensation. The pressure difference then causes the two plugs to be driven together. CIWH occurs when the trapped steam bubble condenses and the plugs of water converge. Please provide evaluations of CIWH for MP2 in the RBCCW piping.

5. In lieu of detailed waterhammer analyses, an alternative approach that may be acceptable is to manage how the RBCCW pumps are restarted so as to prevent system failure due to waterhammer. If this option is pursued, describe specifically how pump restart will be managed and what procedural changes will be made to assure that system failure will not occur. Note that this approach would not be appropriate if immediate response by the RBCCW system is required for accident mitigation.