July 13, 1998

Mr. James W. Langenbach, Vice President
and Director - TMI
GPU Nuclear, Inc.
P.O. Box 480
Middletown, PA 17057

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING GPU NUCLEAR RESPONSE TO GENERIC LETTER (GL) 96-06 FOR THE THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)(TAC NO. M96877)

Dear Mr. Langenbach:

The staff has reviewed your letters dated February 14, and June 2, 1997, and February 13, 1998, regarding GL 96-06, "Assurance of Equipment Operability and Containment Integrity During Design Basis Accident Conditions." The February 14, 1997, submittal addresses the issues of waterhammer, two-phase flow, and thermally-induced pressurization of piping runs penetrating the containment for TMI Unit 1. The June 2, 1997, submittal contained a description of your planned corrective actions. The February 13, 1998, submittal provided a summary of your evaluations. The staff has determined that it will need the additional information identified in the enclosure to complete its review of your responses. Please respond to this request for additional information by September 30, 1998, in order for the staff to remain on schedule with its review.

Sincerely,

Original signed by

Timothy G. Colburn, Senior Project Manager
Project Directorate I-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosure: Request for Additional Information

cc w/encl: See next page

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J. Langenbach
Three Mile Island Nuclear Station, Unit No. 1

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REQUEST FOR ADDITIONAL INFORMATION
THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)
RESPONSE TO GENERIC LETTER (GL) 96-06 (TAC NO. M96877)

In its submittal of June 2, 1997, the licensee identified eleven piping segments that are susceptible to thermally-induced over pressure. The licensee indicated that the Reactor Coolant Pump Seal Return Line was demonstrated to be acceptable by analysis. The licensee also committed to install pressure protection for the remaining ten piping segments. In order to complete its review of the licensee's response to the GL, the staff needs additional information regarding the Reactor Coolant Pump Seal Return Line piping segment which was found acceptable by analysis. Please provide the following information:

1. Provide the applicable design criteria for the piping and the valves. Include the required load combinations;

2. Provide a drawing of the piping run between the isolation valves. Include the lengths and thicknesses of the piping segments and the type and thickness of the insulation;

3. Provide the maximum-calculated temperature and pressure for the pipe run. Describe in detail the method used to calculate these pressure and temperature values. This should include a discussion of the heat transfer model used in the analysis and the basis for the heat transfer coefficients used in the analysis.

GL 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," dated September 30, 1996, included a request for licensees to evaluate cooling water systems that serve containment air coolers to assure that they are not vulnerable to waterhammer and two-phase flow conditions. The licensee provided its assessment of the waterhammer and two-phase flow issues for TMI-1 in letters dated February 14, 1997, and February 13, 1998. The licensee has determined that since a minimal amount of voiding will occur (<1%) in the reactor building emergency cooling (RBEC) system during the worst-case scenario, waterhammer and two-phase flow do not present a concern for TMI-1. The RBEC system provides cooling water for the containment air cooling units. In order to assess the licensee's resolution of these issues, the following additional information is requested:

4. Provide a detailed description of the "worst case" scenarios for waterhammer and two-phase flow, taking into consideration the complete range of event possibilities, system configurations, and parameters. For example, all temperatures, pressures, flow rates, load combinations, and potential component failures should be considered. Additional two-phase flow considerations include:

   - the effects of void fraction on flow balance and heat transfer;
   - the consequences of steam formation, transport, and accumulation;
   - cavitation, resonance, and fatigue effects; and
   - erosion considerations.

Enclosure

It is important for licensees to realize that in addition to heat transfer considerations, two-phase flow also involves structural and system integrity concerns that must be addressed. Licensees may find NUREG/CR-6031, "Cavitation Guide for Control Valves," helpful in addressing some aspects of the two-phase flow analyses.

5. Describe and justify all assumptions and input parameters (including those used in any computer codes) that were used in the waterhammer and two-phase flow analyses. Confirm that these assumptions and input parameters are conservative and are consistent with the existing design and licensing basis of the plant. Any exceptions should be explained and justified.

6. Confirm that the waterhammer and two-phase flow analyses included a complete failure modes and effects analysis (FMEA) for all components (including electrical and pneumatic failures) that could impact performance of the cooling water system and confirm that the FMEA is documented and available for review, or explain why a complete and fully documented FMEA was not performed.

7. Determine the uncertainty in the waterhammer and two-phase flow analyses that have been completed, explain how the uncertainty was determined, and how it was accounted for in the analyses to assure conservative results.

8. Provide a complete description of any limitations and non-conservatisms that exist in the fan cooler model that was developed, including use of the GOTHIC computer code in this particular application. Explain how the fan cooler model and use of the GOTHIC code were validated such that conservative results are assured.

9. Depending on the context, 1% voiding can be a substantial amount. Clarify what was meant by the characterization that was made (e.g., <1% mass fraction of vapor in the fluid stream; <1% vapor formed when compared to the total fluid mass of the system). Explain why this amount of voiding does not constitute a waterhammer or two-phase flow concern.

10. Discuss specific system operating parameters and other operating restrictions that must be maintained to assure that the waterhammer and two-phase flow analyses remain valid (e.g., pressures, temperatures, surge tank level, system alignment), and explain why it would not be appropriate to establish technical specification requirements to acknowledge the importance of these parameters and operating restrictions. Also, describe and justify use of any non-safety related instrumentation and controls in maintaining these parameters and operating restrictions.

11. Implementing measures to assure that waterhammer and two-phase flow will not occur, such as maintaining system alignment requirements and surge tank parameters, is an acceptable approach for addressing these concerns. However, all scenarios must be considered to assure that the vulnerability to waterhammer and two-phase flow has been eliminated. Confirm that all scenarios have been considered, including those where the affected containment penetrations are not isolated (if this is a possibility), such that the measures that have been established are adequate to prevent the occurrence of waterhammer and two-phase flow during (and following) all applicable accident scenarios.

12. Explain and justify all uses of "engineering judgement" that were credited.

13. Provide a simplified diagram of the system, showing major components, active components, relative elevations, lengths of piping runs, and the location of any orifices and flow restrictions.

14. Describe in detail any plant modifications or procedure changes that have been made or are planned to be made to resolve the waterhammer and two-phase flow issues.