June 6, 2001

Mr. Robert P. Powers, Senior Vice President
Indiana Michigan Power Company
Nuclear Generation Group
500 Circle Drive
Buchanan, MI 49107

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2 - REQUEST FOR ADDITIONAL INFORMATION, “RESPONSES TO GENERIC LETTER (GL) 96-06 ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN-BASIS ACCIDENT CONDITIONS,” (TAC NOS. M96801 AND M96802)

Dear Mr. Powers:

On August 15, 2000, as supplemented November 7, 2000, Indiana Michigan Power Company (I&M) submitted responses to GL 96-06. The Nuclear Regulatory Commission (NRC) staff has reviewed your responses and concluded that they do not provide technical information in sufficient detail to enable the staff to make an independent assessment regarding the equipment operability and containment integrity during design-basis accident conditions in terms of regulatory requirements and the protection of public health and safety.

The NRC staff finds that the additional information identified in the enclosure is needed.

Draft questions were provided to your staff on March 5, 2001, and May 10, 2001, and were discussed with Ms. Laurie Lahti et al. of your staff on May 16, 2001. The questions in the enclosure to this letter are the same as the draft questions with minor modifications to provide clarification. A mutually agreeable target date of August 31, 2001, for your response was established. The NRC staff will continue review of your responses to GL 96-06 when your response to the enclosed questions is received.

If circumstances result in the need to revise the target date, please contact me at (301) 415-1345 at the earliest opportunity.

Sincerely,

/RA/
John F. Stang, Senior Project Manager, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosure: As stated

cc w/encl: See next page

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Nuclear Generation Group
500 Circle Drive
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cc:

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Attorney General
Department of Attorney General
525 West Ottawa Street
Lansing, MI 48913

Township Supervisor
Lake Township Hall
P.O. Box 818
Bridgman, MI 49106

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
7700 Red Arrow Highway
Stevensville, MI 49127

David W. Jenkins, Esquire
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Bridgman, MI 49106

Mayor, City of Bridgman
P.O. Box 366
Bridgman, MI 49106

Special Assistant to the Governor
Room 1 - State Capitol
Lansing, MI 48909

Drinking Water and Radiological
Protection Division
Michigan Department of
Environmental Quality
3423 N. Martin Luther King Jr Blvd
P.O. Box 30630, CPH Mailroom
Lansing, MI 48909-8130

Ronald Gaston
Director, Regulatory Affairs
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Bridgman, MI 49106

David A. Lochbaum
Union of Concerned Scientists
1616 P Street NW, Suite 310
Washington, DC 20036-1495

A. Christopher Bakken, Site Vice President
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Bridgman, MI 49106

Michael W. Rencheck
Vice President, Nuclear Engineering
Indiana Michigan Power Company
Nuclear Generation Group
500 Circle Drive
Buchanan, MI 49107

REQUEST FOR ADDITIONAL INFORMATION FOR

DONALD C. COOK, UNITS 1 AND 2

SUBMITTALS C0800-10 AND C1100-10 RESPONSES TO GENERIC LETTER 96-06,

DATED AUGUST 15, 2000, AND NOVEMBER 7, 2000

1. If a methodology other than that discussed in NUREG/CR-05220, "Diagnosis of Condensation-induced Waterhammer," was used in evaluating the effects of waterhammer, describe this alternate methodology in detail. Also, explain why this methodology is applicable and gives conservative results (typically accomplished though rigorous plant-specific modeling, testing, and analysis).

2. For both the waterhammer and two-phase flow analyses, provide the following information:

   Note: Licensees may find NUREG/CR-6031, "Cavitation Guide for Control Valves" helpful in addressing some aspects of the two-phase flow analyses. Also, 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.

   a. Identify any computer codes that were used in the waterhammer and two-phase flow analyses and describe the methods used to benchmark the codes for the specific loading conditions involved (see Standard Review Plan Section 3.9.1).

   b. Describe and justify all assumptions and input parameters (including those used in any computer codes) such as amplifications due to fluid structure interaction, speed of sound, force reductions, and mesh sizes, and explain why the values selected give conservative results. Also, provide justification for omitting any effects that may be relevant to the analysis (e.g, fluid structure interaction, flow induced-vibration, erosion).

   c. Provide a detailed description of the "worst case" scenarios for waterhammer and two-phase flow (i.e., scenarios that lead to most severe consequences when considering design-basis assumptions such as single-failure, loss of offsite power, etc.), taking into consideration the complete range of event possibilities, system configurations, and parameters. For example, all waterhammer types and water slug scenarios should be considered, as well as temperatures, pressures, flow rates, load combinations, and potential component failures. Additional examples include:

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

d. Please provide the limiting piping loads for the bounding waterhammer and provide comparisons to the allowable limits for these loads. Please include results demonstrating integrity of the non-essential service water (NESW) system inside containment and the results demonstrating the integrity of the system outside of the containment. Include consideration of containment isolation valves and penetrations.

e. Confirm that the 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 preformed.

f. Explain and justify all uses of “engineering judgement.”

3. Was condensation induced waterhammer (CIWH) analyzed? Are there any long horizontal piping runs in the NESW system where CIWH could occur during system drain down following a loss of offsite power or during the refill after power was reestablished?

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

5. Confirm that the waterhammer and two-phase flow loading conditions do not exceed any design specifications or recommended service conditions for the piping system and components, including those stated by equipment vendors; and confirm that the system will continue to perform its design-basis isolation functions as assumed in the safety analysis report for the facility.

6. With respect to the waterhammer and two-phase flow issue, provide a simplified diagram of the systems analyzed, showing major components, active components, relative elevations, lengths of piping runs, and the location of any orifices and flow restrictions.

7. Describe in detail any plant modifications or procedural changes that have been made or are planned to be made to resolve the waterhammer and two-phase flow issues. Consider the circumstance by which the NESW would be isolated following a loss-of-coolant accident or steamline break, voided within the containment as the result of internal steam formation and subsequent opening of the insolation valves by operators for post accident containment cooldown. Would waterhammer occur under such a scenario? What procedural safeguards are provided?

8. In the submittal of November 7, 2000, you identified 21 lines installed in Unit 1 that have no relief valves and are susceptible to thermally-induced pressurization. You classified three lines under category E1 and the remaining 18 lines under category E2 depending on the method you used for calculating peak pressure inside the affected line. You also stated that the 21 lines have been analyzed based on the inelastic analysis criteria in Appendix F to Section III of the American Society of Mechanical Engineers (ASME) Code.

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

b. Describe the applicable design criteria for the piping and the valves. Include the required load combinations and the methodology for calculating primary membrane stress intensity for combined loads. Identify the licensing basis code edition of Appendix F to Section III of the ASME Code. Provide the maximum calculated and allowable stress and strain in the carbon steel and/or stainless steel penetrations.

c. Based on the results of inelastic analysis of the 21 lines, provide the calculation for the line that has the maximum calculated stress/strain. The calculation should clearly indicate all design input parameters including material stress-strain curve and justification thereof, and the methodology for inelastic analysis including the analysis results. Provide the detailed calculation of maximum primary membrane stress intensity, membrane hoop strain, and the peak strain at local discontinuity. Acceptance criteria for stress and strain limits and its justification should also be provided along with the reference to specific articles of Appendix F to Section III of the ASME Code.

d. For piping in E2 category, you indicated that credit for the momentary lifting of diaphragm valves was taken in the calculation of peak pressure that are listed in the submittal. Describe the method used to estimate the valve lift off pressure. Discuss any source of uncertainty associated with the calculation of the valve lift off pressure.

9. In the submittal of August 15, 2000, you identified four lines installed in Unit 2 that have no relief valves and are susceptible to thermally-induced pressurization. You stated that the four lines were analyzed based on the inelastic analysis criteria in Appendix F to Section III of the ASME Code.

   a. Provide the maximum calculated temperature and pressure values for the pipe run. Describe in detail, the method to calculate temperature and pressure, if different from that provided in response to question 8(a).

   b. Provide the maximum calculated stress and strain in the carbon steel and/or stainless steel penetrations. Describe the design criteria, if different from that provided in response to question 8(b).

   c. Provide the calculation for the line with the maximum calculated stress/strain, if the maximum calculated stress/strain are not enveloped by and/or the calculation process is different from the sample calculation provided in response to question 8(c).