UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 22, 2009

Mr. Joseph N. Jensen
Senior Vice President and
Chief Nuclear Officer
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 2 – REQUEST FOR ADDITIONAL INFORMATION REGARDING THE SMALL-BREAK LOSS-OF-COOLANT ACCIDENT EVALUATION MODEL REANALYSIS (TAC NO. ME1147)

Dear Mr. Jensen:

By letter dated March 30, 2009 (Agencywide Documents Access and Management System Accession No. ML091100153), Indiana Michigan Power Company (the licensee) submitted a small-break loss-of-coolant accident (SBLOCA) evaluation model reanalysis for the Donald C. Cook Nuclear Plant, Unit 2.

The U.S. Nuclear Regulatory Commission staff in the Nuclear Performance and Code Review Branch of the Office of Nuclear Reactor Regulation has reviewed the licensee's submittal and determined that additional information is required to complete the review. The requested information is provided as an enclosure.

In a telephone conversation on September 16, 2009, Mr. Michael Scarpello committed to provide the requested information 60 days from the date of this letter. Please contact me immediately if it is subsequently determined that the submittal date cannot be met.

If you have any questions, please call me at (301) 415-3049.

Sincerely,

Terry A. Beltz, Senior Project Manager
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-316

Enclosure:
As stated

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REQUEST FOR ADDITIONAL INFORMATION

SMALL-BREAK LOSS-OF-COOLANT ACCIDENT EVALUATION MODEL REANALYSIS

DONALD C. COOK NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-316

TAC NO. ME1147

The U.S. Nuclear Regulatory Commission (NRC) staff in the Nuclear Performance and Code Review Branch of the Office of Nuclear Reactor Regulation has reviewed the small-break loss-of-coolant accident (SBLOCA) evaluation model reanalysis for the Donald C. Cook Nuclear Plant, Unit 2 (CNP-2) and identified the following information is required to complete an evaluation.

1. Please provide the following:

    a. The elevation of the bottom of the horizontal section of the suction legs;

    b. The elevation of the bottom of the discharge leg; and

    c. The elevation of the top of the core.

2. When the low pressure injection is terminated for 5 minutes during switchover to recirculation,

    a. Is the remaining pumped injection greater than boil-off?

    b. Please justify the 5 minute switch-over time.

    c. Does this injection delay include operator error?

    d. What is the impact of the delay on the limiting small-break LOCA?

3. The NOTRUMP version employed in the evaluation utilized the COSI steam condensation model. While the staff has previously approved this model, there have been no integral experiments validating of this modification.

    Has any benchmarking been performed since this question was asked regarding previous SBLOCA submittals? If so, please provide the results of the COSI condensation model to integral SBLOCA experiments with long-term core uncovery.

    If such benchmarks have not yet been performed, please explain why this model has not been validated against integral experimental data.

ENCLOSURE

4. a. The two-inch break in Figure 65 shows that the core is uncovered in excess of 5000 seconds. The two-phase level behavior from 1800 to 3000 seconds is erratic and does not display the typical smooth decrease in level as a result of boil-off exceeding injection until the reactor coolant system pressure has decreased sufficiently to match the steaming rate in the core.

   Please explain the cause of the level spiking from 2000 to 3000 seconds.

   b. The core appears to remain uncovered at 7000 seconds.

   Please show the remainder of the event until the core two-phase level recovers to above the top of the core.

   Please demonstrate that temperatures in the upper portion of the core do not produce oxidation levels that are not limiting.

   c. Baker-Just oxidation produces oxidation rates that are not applicable to low temperature oxidation processes.

   Please show that the oxidation with correlations applicable to clad temperatures less than 1500°F for extended periods of time result in acceptable levels of oxidation.

5. The 3-inch break remains uncovered at 5000 seconds.

   a. Please present the results of this break showing that the core two-phase level eventually recovers and the oxidation is not limiting for this case.

   b. Please verify that the most limiting top-skewed power shape has been employed in these analyses.

6. The spectrum analyses at 3600 megawatt thermal (MWt) is very coarse. NRC staff calculations for break sizes between 0.06 and 0.07 ft^2 are in excess of 2100°F for the analyses at 3600 MWt. Preliminary calculations for the 0.0625 ft^2 cold-leg break show temperatures in excess of 2200°F.

   Please demonstrate that a more detailed spectral analysis for breaks between 2 and 4 inches are not more limiting than those presented for 3600 MWt.

7. The 9-inch break presented in Figure 78 shows instability spikes at 3800 seconds and continuously for the exposed portion of the core from 4500 to 5000 seconds.

   a. Please demonstrate that a stable solution will not produce a higher peak cladding temperature or clad oxidation percentage.

   b. What causes the rapid increase in level after 4800 seconds?

   c. Please demonstrate that a smaller or larger break is not more limiting.

d. What is the behavior of the loop seals? Do they refill later in time and affect the long-term core level? Please explain.

8. Regarding the limiting break sizes,

   a. Please identify the timing for and the location of the loops seals that clear of liquid.

   b. Please provide plots of the liquid levels in the vertical sections of the loops seals for the limiting breaks.

9. Were time step studies performed on the limiting small break? Many of the breaks appear to display unstable solutions. Was the effect of time step evaluated for the cases where the two-phase level experienced erratic behavior and spiking?

   Please explain.

10. Were any modifications made to the emergency core cooling system licensing models subsequent to the latest NRC approval and applied to the CNP-2 SBLOCA analyses?

    Please identify any changes.

11. Please confirm that the hot-leg nozzle gap and barrel alignment key leakages were not modeled in the analyses presented in the CNP-2 SBLOCA evaluations.

12. The 9-inch break shows that core is uncovered even at 5000 seconds.

    a. What is the boric acid concentration in the core versus time for this break, especially from 2 to 4 hours post-LOCA?

    b. Since the two-phase level is very low in the vessel, boric acid concentrations will be very high.

       Please demonstrate that the boric acid concentration in the core for this break size (or breaks near this size) do not build-up excessive boric acid concentrations before the switch to simultaneous injection.

    c. What is the largest break size that simultaneous injection will not flush the core and has this condition been evaluated?

       Please explain.

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