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April 4, 1990

Re: Indian Point Unit No. 2
Docket No. 50-247

Document Control Desk
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

SUBJECT: 10 CFR 50.46 Annual Notification of Modifications In The Indian Point 2 ECCS Evaluation Models

Pursuant to the October 17, 1988 revision to 10 CFR 50.46 regarding acceptance criteria for emergency core cooling systems for light-water nuclear power reactors, attached please find our annual report. If you have any questions, please contact Mr. Charles W. Jackson, Manager, Nuclear Safety and Licensing.

Very truly yours,

cc: Mr. William Russell
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ATTACHMENT

EFFECT OF WESTINGHOUSE ECCS EVALUATION MODEL MODIFICATIONS ON THE LOCA ANALYSIS RESULTS FOUND IN THE INDIAN POINT UNIT 2 LICENSING SUBMITTAL FOR TRANSITION TO 15 X 15 OFA FUEL

The October 17, 1988 revision to 10CFR50.46 required applicants and holders of operating licenses or construction permits to notify the Nuclear Regulatory Commission (NRC) of errors and changes in the ECCS Evaluation Models on an annual basis, when the errors and changes are not significant. Reference 1 defines a significant error or change as one which results in a calculated peak fuel cladding temperature different by more than 50°F from the temperature calculated for the limiting transient using the last acceptable model, or is a cumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50°F.

In Reference 2 & 3, information regarding modifications to the Westinghouse large break and small break LOCA ECCS Evaluation Models was submitted to the NRC. The following presents an assessment of the effect of the modifications to the Westinghouse ECCS Evaluation Models on the loss-of-coolant accident (LOCA) analysis results found in the Indian Point 2 Licensing Submittal for transition to 15 x 15 OFA fuel (March 1989).

Large Break LOCA

The large break LOCA analyses for Indian Point Unit 2 were examined to assess the effect of the applicable modifications to the Westinghouse large break LOCA ECCS Evaluation Model on peak cladding temperature (PCT) results reported in the Indian Point 2 Licensing Submittal for transition to 15 x 15 OFA fuel (March 1989). The large break LOCA analyses results were calculated using the 1981 version of the Westinghouse large break LOCA ECCS Evaluation Model incorporating the BART/BASH analysis technology. The analysis assumed the following information important to the large break LOCA analyses;

- Core Power Level of 3071.4 MWt
- 15 x 15 Optimized (OFA) fuel with nine fuel grids
- Total Peaking Factor (F_Q^T) of 2.32
- Hot Channel Enthalpy Rise Factor (FH) of 1.62
- 25% Uniform Steam Generator Tube Plugging
- Operating temperature band ($549^oF \leq T_{AV} \leq 579.7^oF$)

For Indian Point Unit 2, the limiting break resulted from the double ended guillotine rupture of the cold leg piping with a discharge coefficient of CD = 0.4 for the higher operating temperature case. The calculated peak cladding temperature was 2039°F.

The following modifications to the Westinghouse ECCS Evaluation Models discussed in Reference 2 would affect the large break LOCA analysis results found in the Indian Point 2 Licensing Submittal for transition to 15 x 15 OFA fuel (March 1989);

Several improvements were made to the BASH computer code to treat special analysis cases which are related to the tracking of fluid interfaces;

1) A modification, to prevent the code from aborting, was made to the heat transfer model for the special situation when the quench front region moves to the bottom of the BASH core channel. The quench heat supplied to the fluid node below the bottom of the active fuel was set to zero.

2) A modification, to prevent the code from aborting, was made to allow negative initial movement of the liquid/two-phase and liquid-vapor interfaces. The coding for these areas was generalized to prevent mass imbalance in the special case where the liquid/two-phase interface reaches the bottom of the BASH core channel.

3) Modifications, to prevent the code from aborting, were made to increase the dimensions of certain arrays for special applications.

4) A modification was made to write additional variables to the tape of information to be provided to LOCBART.

5) Typographical errors in the coding of some convective heat transfer terms were corrected, but the corrections have no effect on the BASH analysis results since the related terms are always set equal to zero.

6) A modification was made to the BASH coding to reset the cold leg conditions, in a conservative manner, when the accumulators empty. The BASH model is initialized at the bottom of core recovery with the intact cold legs, lower plenum full of liquid. Flow into the downcomer then equals the accumulator flow. The modification removed most of the intact cold leg water at the accumulator empty time by resetting the intact cold leg conditions to a high quality two phase mixture.

   In a typical BASH calculation, the downcomer is nearly full when the accumulators emptied. The delay time, prior to the intact cold leg water reaching saturation, is sufficient to allow the downcomer to fill from the addition of safety injection fluid before the water in the cold legs reaches saturation. When the intact cold leg water reached saturation it merely flowed out of the break. The cold leg water therefore, did not affect the reflood transient.

   However, in a special case, a substantial time was required to fill the downcomer after the accumulators emptied. The fluid in the intact cold legs reached saturation before the downcomer filled, which artificially perturbed the transient response by incorrectly altering the downcomer fluid conditions causing the code to abort.

For the Indian Point Unit 2 LOCA analysis, results could be affected by the modifications specified in items 1, 2, 3, 4, and 5 above. While there is no adverse effect on the PCT calculation for the majority of the changes which apply to Indian Point Unit 2 discussed above, a conservative estimate of 10°F will be assessed and tracked for use in determining the available margin to the limits of 10CFR50.46.

As discussed above, modifications to the Westinghouse large break LOCA ECCS Evaluation Model could affect the result by altering the PCT.

A.	Analysis calculated result	2039°F
B.	Modifications to Westinghouse ECCS Evaluation Model	+ 10°F
	ECCS Evaluation Model Modifications Resultant PCT	2049°F

Small Break LOCA

The small break LOCA analyses for Indian Point Unit 2 were also examined to assess the effect of the applicable modifications to the Westinghouse ECCS Evaluation Models on peak cladding temperature (PCT) results reported in the Indian Point 2 Licensing Submittal for transition to 15 x 15 OFA fuel (March 1989). The small break LOCA analyses results were calculated using the 1985 version of the Westinghouse small break LOCA ECCS Evaluation Model incorporating the NOTRUMP analysis technology. For Indian Point Unit 2, the limiting size small break resulted from a 6-inch equivalent diameter break in the cold leg at the higher end of the operating temperature band. The calculated peak cladding temperature was 1218.5°F. The analysis assumed the following information important to the small break LOCA analyses;

Core Power Level of 3071.4 MWt
15 x 15 Optimized (OFA) fuel
Total Peaking Factor (F_Q^T) envelope of 2.32
Hot Channel Enthalpy Rise Factor (FH) of 1.65
25% Uniform Steam Generator Tube Plugging
Operating temperature band (549°F $\leq T_{AV} \leq$ 579.7°F)
300 gpm total AFW flow

The following modifications to the Westinghouse ECCS Evaluation Models discussed in Reference 2 and 3 would affect the small break LOCA analysis results found in the Indian Point 2 Licensing Submittal for transition to 15 x 15 OFA fuel (March 1989);

The Westinghouse small break LOCA ECCS Evaluation Model analyses for Indian Point Unit 2 were performed with a version of the NOTRUMP computer code which incorporated all of the potentially significant modifications noted in References 2 & 3.

Since the small break LOCTA-IV code modifications could, at most, result in a very small benefit, the effect of modification to the small break LOCTA-IV code modifications do not need to be assessed or tracked.

Consequently, the effect of the potentially significant ECCS Evaluation Model modifications on the small break LOCA analyses for Indian Point Unit 2 are already taken into account and no additional margin utilization needs to be debited due to ECCS Evaluation Model changes when determining the available margin to the limits of 10CFR50.46.

As discussed above, modifications to the Westinghouse small break LOCA ECCS Evaluation Model could affect the small break LOCA analysis results by altering the PCT.

A.	Analysis calculated result	1218.5°F
B.	Modifications to Westinghouse ECCS Evaluation Model	+ 0.0°F
C.	ECCS Evaluation Model Modifications Resultant PCT	1218.5°F

Conclusions

An evaluation of the effect of modifications to the Westinghouse ECCS Evaluation Model, as reported in references 2 & 3, were performed for both the large break LOCA and small break LOCA analysis results found in the Indian Point 2 Licensing Submittal for transition to 15 x 15 OFA fuel (March 1989). The core power level used for the analysis was 3071.4 MWt. When the effects of the ECCS model changes were combined with the current plant analysis results, it was determined that compliance with the requirements of 10CFR50.46 would be maintained.

REFERENCES

1. "Emergency Core Cooling Systems; Revisions to Acceptance Criteria", Federal Register, Vol. 53, No. 180, pp. 35996-36005, dated September 16, 1988.

2. NS-NRC-89-3463, "10 CFR 50.46 Annual Notification for 1989 of Modifications in the Westinghouse ECCS Evaluation Models," Letter from W. J. Johnson (Westinghouse) to T. E. Murley (NRC), Dated October 5, 1989.

3. NS-NRC-89-3464, "Correction of Errors and Modifications to the NOTRUMP Code in the Westinghouse Small Break LOCA ECCS Evaluation Model Which Are Potentially Significant," Letter from W. J. Johnson (Westinghouse) to T. E. Murley (NRC), Dated October 5, 1989.