Stephen B. Bram
Vice President

Consolidated Edison Company of New York, Inc.
Indian Point Station
Broadway & Bleakley Avenue
Buchanan, NY 10511
Telephone (914) 737-8116

March 3, 1993

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 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 a 30 day report. This will also serve as our annual report. We have determined that Indian Point 2 remains in full compliance with all the requirements of 50.46, and no further action is required.

Westinghouse Electrical Corporation provides the Emergency Core Cooling System (ECCS) and Loss of Coolant Accident (LOCA) calculations for Con Edison's Indian Point 2. The attached information was provided to us by Westinghouse and contains a summary of the ECCS Evaluation Model changes for 1992. Included are the specific mode changes, the affected evaluation models and the effect on the peak clad temperature (PCT) calculation for Indian Point 2.

If you have any questions, please contact Mr. Charles W. Jackson, Manager, Nuclear Safety and Licensing.

Very truly yours,

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cc: Mr. Thomas T. Martin
Regional Administrator - Region I
US Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Francis J. Williams, Jr., Project Manager
Project Directorate I-1
Division of Reactor Projects I/II
US Nuclear Regulatory Commission
Mail Stop 14B-2
Washington, DC 20555

Senior Resident Inspector
US Nuclear Regulatory Commission
PO Box 38
Buchanan, NY 10511

LOCA Evaluation Model Changes for 1992

Bessel Function Error

Background

An error was discovered in SUBROUTINE BESSJ0 which led to calculation of incorrect values for the zeroth order Bessel function of the first kind. This calculation is used in the algorithm designed to limit heat transfer out of a quenching fuel rod to the theoretical conduction limit. This error existed only in one cycle of the NOTRUMP computer code (Cycle 23) and therefore only affects analyses performed with that version. Cycle 23 of NOTRUMP was in use from February of 1991 until the error was corrected in February of 1992. This error correction returned the NOTRUMP code to consistency with the applicable section of WCAP-10079-P-A and therefore is not a change to the Evaluation Model.

This was determined to be a Non-discretionary Change in accordance with Section 4.1.2 of WCAP-13451 and was corrected in accordance with Section 4.1.3 of WCAP-13451.

Affected Evaluation Models

1985 Small Break LOCA Evaluation Model

Estimated Effect

Plant specific PCT effects were determined by reanalysis of the limiting break size transient with the corrected NOTRUMP version. The result is a 3.6°F PCT benefit.

Auxiliary Feedwater Flow Table Error

Background

The Steam Generator Auxiliary Feedwater (AFW) flowrate is governed by the timing variable TIMESG(I). A minor logic error associated with this variable was discovered which led to a step change in the AFW flowrate once the transient time passed the value of TIMESG(7). Typically, this value is set equal to 11000 seconds and so this error would only affect very long transient calculations. In addition, the nature of the error is to allow the AFW flowrate to immediately revert to the full value of the Main Feedwater flowrate. This enormous step change has led to code aborts in the cases where it has occurred.

This logic was corrected as a Discretionary Change as described in Section 4.1.1 of WCAP-13451. This determination is based on the fact that SBLOCA transients are generally terminated before the logic error can have an effect coupled with the codes lack of capability to handle the step change if it does occur. Therefore, it was reasoned that the logic could not affect LOCA results.

Affected Evaluation Models

1985 Small Break LOCA Evaluation Model

Estimated Effect

This error correction has no effect on any current or prior applications of the Evaluation Model.

Steam Generator Secondary Side Modelling Enhancements

Background

A set of related changes which make steam generator secondary side modelling more convenient for the user were implemented into NOTRUMP. This model improvement involved several facets of feedwater flow modelling. First, the common donor boundary node for the standard Evaluation Model nodalization has been separated into two identical boundary nodes. These donor nodes are used to set the feedwater enthalpy. The common donor node configuration did not allow for loop specific enthalpy changeover times in cases where asymmetric AFW flowrates or purge volumes were being modeled for plant specific sensitivities.

The second improvement is the additional capability to initiate main feedwater isolation on either loss of offsite power coincident with reactor trip (low pressurizer pressure) or alternatively on safety injection signal (low-low pressurizer pressure). The previous model allowed this function only on loss of offsite power coincident with reactor trip. The auxiliary feedwater pumps are still assumed to start after a loss of offsite power with an appropriate delay time to model diesel generator start-up and buss loading times.

The final improvement is in the area of modelling the purging of high enthalpy main feedwater after auxiliary feedwater is calculated to start. This was previously modelled through an approximate time delay necessary to purge the lines of the high enthalpy main feedwater before credit could be taken for the much lower enthalpy auxiliary feedwater reaching the steam generator secondary. This time delay was a function of the plant specific purge volume and the auxiliary feedwater flowrate. The new modelling allows the user to input the purge volume directly. This then is used together with the code calculated integrated feedwater flow to determine the appropriate time at which the feedwater enthalpy can be assumed to change.

These improvements are considered to be a Discretionary Change as described in Section 4.1.1 of WCAP-13451. Since they involve only enhancements to the capabilities and useability of the Evaluation Model, and not changes to results calculated consistently with the previous model, these changes were implemented without prior review as discussed in Section 4.1.1 of WCAP-13451.

Affected Evaluation Models

1985 Small Break LOCA Evaluation Model

Estimated Effects

Because these enhancements only allow greater ease in modelling plant specific steam generator secondary side behavior over the previous model, it is estimated that no effect will be seen in Evaluation Model calculations.

Structural Metal Heat Modeling

Background

A discrepancy was discovered during review of the finite element heat conduction model used in the WREFLOOD-INTERIM code to calculate heat transfer from structural metal in the vessel during the reflood phase. It was noted that the material properties available in the code corresponded to those of stainless steel. While this is correct for the internal structures, it is inappropriate for the vessel wall which consists of carbon steel with a thin stainless internal clad. This was defined as a non-discretionary change per Section 4.1.2 of WCAP-13451, since there was thought to be potential for increased PCT with a more sophisticated composite model. The model was revised by replacing it with a more flexible one that allows detailed specification of structures.

Affected Evaluation Models

1981 ECCS Evaluation Model with BART
1981 ECCS Evaluation Model with BASH

Affected Codes

WREFLOOD-INTERIM

Estimated Effects

The estimated effect of this correction is a 25°F PCT benefit.

Spacer Grid Heat Transfer Error in BART

Background

During investigations into anomolous wetting and dryout behavior demonstrated by the BART grid model a programming logic error was discovered in the grid heat transfer model. The error caused the solution to be performed twice for each timestep. The error was traced back to the original coding used in all of the BART and LOCBART codes. This was defined as a non-discretionary change per Section 4.1.2 of WCAP-13451. The error was corrected, and a complete reverification of the grid model was conducted and transmitted to the NRC (WCAP-10484, Addendum 1).

Affected Evaluation Models

1981 ECCS Evaluation Model with BART
1981 ECCS Evaluation Model with BASH

Affected Codes

BART
LOCBART

Estimated Effects

Calculations performed with the affected code have consistently demonstrated significantly better grid wetting and lower clad temperatures. A conservative estimate of zero degrees PCT penalty has been assigned for this issue.

POWER SHAPE SENSITIVITY MODEL (PSSM)

Background

Historically, chopped cosine power shapes have been assumed to produce limiting results in Westinghouse large break LOCA analyses. However, with the advent of more advanced models (BART and BASH) it was discovered that under certain circumstances, top skewed power shapes could potentially be more limiting. The PSSM was developed to allow the assessment of shape specific Peak Cladding Temperature (PCT) trends in large break LOCA. As described in WCAP-12909-P and further clarified in ET-NRC-91-3633 (currently under NRC review), the methodology was developed from a large database of large break LOCA analysis results which used a wide variety of full power power shapes in typical twelve foot core for Westinghouse supplied fuel.

This methodology change is considered to be a Non-discretionary Change as described in Section 4.1.2 of WCAP-13451 and has been implemented prior to final NRC review in accordance with Section 4.1.3 of WCAP-13451.

Affected Evaluation Models

1981 ECCS Evaluation Model with BART
1981 ECCS Evaluation Model with BASH

Estimated Effect

The implementation of this methodology reasonably assures that cycle specific power distributions will not lead to results more limiting than those of the analysis of record. Therefore, there is no PCT effect for this methodology.

15x15 Optimized Fuel Assembly (OFA) Core Pressure Drop Increase

Background

Hydraulic tests performed on the 15x15 Optimized Fuel Assembly (OFA) indicated that the design values for the grid loss coefficients were previously underestimated. This results in the core pressure drop in safety analysis being underestimated by approximately 10%. The effects of this on LOCA analysis has been calculated on a plant specific basis.

This was determined to be a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451 and was corrected in accordance with Section 4.1.3 of WCAP-13451. As such, affected plants have been notified previously of the impact of this error in NSAL-92-002.

Affected Evaluation Models

All Large Break and Small Break LOCA Evaluation Models used on the affected plants.

Estimated Effect

The effect is a 40°F PCT penalty.