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NL-14-040

March 18, 2014

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: 30-Day 10CFR50.46 Report of Change in Emergency Core Cooling System Model
Indian Point Unit Nos. 2 and 3
Docket Nos. 50-247 & 50-286
License Nos. DPR-26 & DPR-64

Reference:
1. Entergy letter NL-13-029; 2012 Annual 10 CFR 50.46 Emergency Core Cooling System Evaluation Changes Report, dated May 29, 2013.
2. Entergy letter NL-12-083; 30-Day 10 CFR 50.46 Report of Change in Emergency Core Cooling System Model, dated June 14, 2012.

Dear Sir or Madam:

Entergy Nuclear Operations, Inc. (Entergy) is submitting this 30-day report of changes in the emergency core cooling system (ECCS) models for Indian Point Units 2 (IP2) and 3 (IP3). This report is in lieu of the annual report and is submitted in accordance with 10 CFR 50.46(a)(3)(ii) as a significant change in peak cladding temperature (PCT) due to accumulation of changes and errors such that the sum of the absolute magnitudes of the respective temperature changes is greater than 50°F.

Two separate changes were reported by Westinghouse Electric Company LLC (Westinghouse), concerning the Indian Point Units 2 and 3 Best-Estimate (BE) Large-Break Loss-of Coolant Accident (LBLOCA) analyses. The first change reported in 2013 was for Revised Heat Transfer Multiplier Distributions resulting in an estimated PCT effect of -32°F for IP2 and -35°F for IP3. The second change reported in 2014 was for the HOTSPOT Burst Strain error correction resulting in an estimated PCT impact of +38°F for IP2 and +25°F for IP3. The net effect of these changes are +6°F for IP2 (-32°F+38°F=6°F) and -10°F for IP3 (-35°F+25°F=-10°F). Attachments 1 and 2 provide details of the issues.

There are no new PCT adjustments required for the IP2 or the IP3 small break loss-of-coolant accident (LOCA) analyses of record (AOR) for calendar year 2013. The previously reported large break LOCA PCT for IP2 and IP3 (Reference 1) was 2113°F and 2056°F respectively. Adjusting these values for the changes discussed above, the adjusted PCT for IP2 is 2119°F (2113°F+6°F=2119°F) and for IP3 is 2046°F (2056°F-10°F=2046°F).

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A proposed schedule for providing a reanalysis was previously provided in Reference 2. The re-analysis was for addressing the thermal conductivity degradation issue and will also address the issues identified in this letter. The schedule for the re-analysis provided in Reference 2 was "on or before December 15, 2016." There are no new commitments contained in this letter. If you have any questions or require additional information, please contact me.

Sincerely,

RW/ai

Attachments:
1. Indian Point Unit 2 Background for Estimated Effect of Revised Heat Transfer Multiplier Distributions and HOTSPOT Burst Strain Error Correction
2. Indian Point Unit 3 Background for Estimated Effect of Revised Heat Transfer Multiplier Distributions and HOTSPOT Burst Strain Error Correction

cc: Mr. William Dean, Regional Administrator, NRC Region 1
Mr. Douglas Pickett, Senior Project Manager, NRC NRR DORL
IPEC NRC Resident Inspector's Office
Mr. Francis J. Murray, President and CEO, NYSERDA
Ms. Bridget Frymire, New York State Department of Public Service

Attachment 1

Indian Point Unit 2 Background for Estimated Effect of Revised Heat Transfer Multiplier Distributions and for HOTSPOT Burst Strain Error Correction

Revised Heat Transfer Multiplier Distributions

Background

Several changes and error corrections were made to WCOBRA/TRAC and the impacts of these changes on the heat transfer multiplier uncertainty distributions were investigated. During this investigation, errors were discovered in the development of the original multiplier distributions, including errors in the grid locations specified in the WCOBRA/TRAC models for the G2 Refill and G2 Reflood tests, and errors in processing test data used to develop the reflood heat transfer multiplier distribution. Therefore, the blowdown heatup, blowdown cooling, refill, and reflood heat transfer multiplier distributions were redeveloped. For the reflood heat transfer multiplier development, the evaluation time windows for each set of test experimental data and each test simulation were separately defined based on the time at which the test or simulation exhibited dispersed flow film boiling heat transfer conditions characteristic of the reflood time period. The revised heat transfer multiplier distributions have been evaluated for impact on existing analyses. Resolution of these issues represents a closely related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

Estimated Effect

A plant transient calculation representative of Indian Point Unit 2 transient behavior was performed with the latest version of WCOBRA/TRAC. Using this transient, a matrix of HOTSPOT calculations was performed to estimate the effect of the heat transfer multiplier distribution changes. Using these results and considering the heat transfer multiplier uncertainty attributes from limiting cases for Indian Point Unit 2, an estimated PCT effect of -32°F has been established for 10 CFR 50.46 reporting purposes for Indian Point Unit 2.

Error in Burst Strain Application

Background

An error in the application of the burst strain was discovered in HOTSPOT. The equation for the application of the burst strain is given as Equation 7-69 in WCAP-16009-P-A and in WCAP-12945-P-A. The outer radius of the cladding after burst occurs should be calculated based on the burst strain, and the inner radius of the cladding should be calculated based on the outer radius. In HOTSPOT, the burst strain is applied to the calculation of the cladding inner radius. The cladding outer radius is then calculated based on the inner radius. As such, the burst strain is incorrectly applied to the inner radius rather than the outer radius, which impacts the resulting cladding geometry at the burst elevation after burst occurs. Correction of the erroneous calculation results in thinner cladding at the burst node and more fuel relocating into the burst node, leading to an increase in the Peak Cladding Temperature (PCT) at the burst node. This issue has been evaluated to estimate the impact on existing Best-Estimate (BE) Large-Break Loss-of-Coolant Accident (LBLOCA) analysis results. The resolution of this issue represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model
2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

Estimated Effect

The issue described above was evaluated by executing the most limiting plant-specific HOTSPOT runs with a HOTSPOT version that includes the correction of this error. This plant-specific sensitivity study resulted in an estimated PCT impact of 38°F for Indian Point Unit 2.

Attachment 2

Indian Point Unit 3 Background for Estimated Effect of Revised Heat Transfer Multiplier Distributions and for HOTSPOT Burst Strain Error Correction

Revised Heat Transfer Multiplier Distributions

Background

Several changes and error corrections were made to WCOBRA/TRAC and the impacts of these changes on the heat transfer multiplier uncertainty distributions were investigated. During this investigation, errors were discovered in the development of the original multiplier distributions, including errors in the grid locations specified in the WCOBRA/TRAC models for the G2 Refill and G2 Reflood tests, and errors in processing test data used to develop the reflood heat transfer multiplier distribution. Therefore, the blowdown heatup, blowdown cooling, refill, and reflood heat transfer multiplier distributions were redeveloped. For the reflood heat transfer multiplier development, the evaluation time windows for each set of test experimental data and each test simulation were separately defined based on the time at which the test or simulation exhibited dispersed flow film boiling heat transfer conditions characteristic of the reflood time period. The revised heat transfer multiplier distributions have been evaluated for impact on existing analyses. Resolution of these issues represents a closely related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model
1999 Westinghouse Best Estimate Large Break LOCA Evaluation Model, Application to PWRs with Upper Plenum Injection

Estimated Effect

A plant transient calculation representative of Indian Point Unit 3 transient behavior was performed with the latest version of WCOBRA/TRAC. Using this transient, HOTSPOT calculations were performed with both the original and revised heat transfer multiplier distributions. Based on the change in the 95th percentile results, estimated PCT effects of 5°F for Reflood 1, and -35°F for Reflood 2 have been established for 10 CFR 50.46 reporting purposes for Indian Point Unit 3.

Error in Burst Strain Application

Background

An error in the application of the burst strain was discovered in HOTSPOT. The equation for the application of the burst strain is given as Equation 7-69 in WCAP-16009-P-A and in WCAP-12945-P-A. The outer radius of the cladding after burst occurs should be calculated based on the burst strain, and the inner radius of the cladding should be calculated based on the outer radius. In HOTSPOT, the burst strain is applied to the calculation of the cladding inner radius. The cladding outer radius is then calculated based on the inner radius. As such, the burst strain is incorrectly applied to the inner radius rather than the outer radius, which impacts the resulting cladding geometry at the burst elevation after burst occurs. Correction of the erroneous calculation results in thinner cladding at the burst node and more fuel relocating into the burst node, leading to an increase in the Peak Cladding Temperature (PCT) at the burst node. This issue has been evaluated to estimate the impact on existing Best-Estimate (BE) Large-Break Loss-of-Coolant Accident (LBLOCA) analysis results. The resolution of this issue represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1996 Westinghouse Best Estimate Large Break LOCA Evaluation Model
2004 Westinghouse Realistic Large Break LOCA Evaluation Model Using ASTRUM

Estimated Effect

The issue described above was evaluated by executing the most limiting plant-specific HOTSPOT runs with a HOTSPOT version that includes the correction of this error. A representative Indian Point Unit 3 case was run using HOTSPOT versions which only differ in the burst strain application. Based on the change in the 95th percentile results, estimated PCT effects of 20°F for Reflood 1 and 25°F for Reflood 2 have been established for 10 CFR 50.46 reporting purposes for Indian Point Unit 3.