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U.S. Nuclear Regulatory Commission
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DOCKET 50-255 – LICENSE DPR-20 – PALISADES PLANT
10 CFR 50.46 REPORT OF CHANGES AND ERRORS IN LBLOCA ECCS EVALUATION MODEL

In accordance with 10 CFR 50.46 (a)(3)(ii), a report of changes to or errors discovered in Emergency Core Cooling System (ECCS) evaluation models which are deemed to be significant must be submitted to the NRC within 30 days of discovery. As defined in 10 CFR 50.46(a)(3)(i), "*a significant change or error is one which results in a calculated peak 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.*" The purpose of this letter is to report a significant accumulation of changes and errors in the Palisades Large Break Loss of Coolant (LBLOCA) ECCS evaluation performed by Siemens Power Corporation.

As previously reported to NRC in Reference 1, the current LBLOCA ECCS evaluation for Palisades resulted in a peak cladding temperature (PCT) of 1832°F. This result was based on Siemens Power Corporation's (SPC) EXEM/PWR LBLOCA evaluation model.

On October 24, 2000, Palisades implemented Improved Technical Specifications (ITS). As part of the conversion to ITS, the Palisades LBLOCA analysis of record transitioned from methodology based on the SPC EXEM/PWR evaluation model to the SPC SEM/PWR-98 evaluation model. Due to this transition, the PCT for the Palisades LBLOCA ECCS evaluation has changed from 1832°F to 1878°F, which results in a net increase in calculated PCT of 46°F. Errors discovered during this transition result in an additional 11° F change in PCT. Therefore, the LBLOCA PCT including all error estimates to date is 1889 °F. The corresponding sum of the absolute magnitude of the changes in PCT is 85°F, which is considered significant.

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A description of each change or error associated with the transition to the SEM/PWR-98 evaluation model may be found in Attachment 1.

References

1. Letter, NLHaskell (Consumers Energy) to Document Control Desk (NRC), "Annual Report of Changes in ECCS Models per 10 CFR 50.46", dated June 30, 2000.

SUMMARY OF COMMITMENTS

This letter contains no new commitments and no revisions to existing commitments.

Robert A Vincent for

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Director, Licensing & Performance Assessment

CC Administrator, Region III, USNRC
Project Manager, NRR, USNRC
NRC Resident Inspector - Palisades

Attachment

ATTACHMENT

CONSUMERS ENERGY COMPANY

PALISADES PLANT
DOCKET 50-255

November 22, 2000

10 CFR 50.46 REPORT OF CHANGES AND ERRORS
IN LBLOCA ECCS EVALUATION MODEL

3 pages

10 CFR 50.46 REPORT OF CHANGES AND ERRORS IN LBLOCA ECCS EVALUATION MODEL

Transition from EXEM/PWR to SEM/PWR-98 Evaluation Model

The existing Palisades LBLOCA ECCS analysis of record, which was based on the SPC EXEM/PWR evaluation model for fuel cycle 14 (which concluded in October of 1999), was re-performed utilizing the SPC SEM/PWR-98 evaluation model. The peak cladding temperature (PCT) impact of this change in methodology for Palisades was determined to be +60°F.

Cycle 15 SEM/PWR-98 Analysis

The SEM/PWR-98 LBLOCA ECCS evaluation methodology was utilized to update the Palisades LBLOCA ECCS analysis for the current fuel cycle 15. The peak cladding temperature (PCT) impact of this change for Palisades was determined to be -14°F when compared with the results for Cycle 14.

RFPAC Fuel Temperature (Siemens Power Corporation Condition Report (SPC CR) #7462)

The SEM/PWR-98 methodology was intended to allow for non-uniform axial nodes in the RELAP4 model. However, coding considered only uniform nodes for transfer of data to RFPAC. The Palisades SEM/PWR-98 LBLOCA/ECCS evaluation model did not utilize variable length nodes. The peak cladding temperature (PCT) impact of this error was determined to be 0°F for Palisades.

SISPUNCH/ujun98 Code Error (SPC CR #7856)

An error in the SISPUNCH code version ujun98 can cause the accumulator flow rates written by SISPUNCH in the data transfer file for input to the RFPAC code to be incorrect. The SISPUNCH code creates data tables containing accumulator flows calculated by the RELAP4 accumulator-SIS transient calculation. Under certain conditions the accumulator flows placed in the data transfer file may extend beyond the time when the accumulator flows are shut off in the RELAP4 accumulator-SIS transient calculation. The peak cladding temperature (PCT) impact of this error was determined to be 0°F for Palisades.

Error in TOODEE2 Time Step Sensitivity Calculations (SPC CR #8748)

This error relates to the time steps utilized in the TOODEE2 base calculation and time step verification calculation. Siemens guidelines require that a different time step be used for the two calculations in order to ensure that convergence is adequately verified. The LBLOCA calculations use an extremely small time step which has been shown to result in an adequately converged solution. The peak cladding temperature (PCT) impact of this error was determined to be 0°F for Palisades.

PWR LBLOCA Split Modeling (SPC CR #8722)

This deviation in the modeling of the split break configuration for LBLOCA analyses results in a non-physical high pressure in the broken cold leg volume and the downcomer which could cause an early end of bypass time to be predicted for split breaks. Correction of the deviation in Palisades LBLOCA analyses resulted in the limiting break changing from a double-ended-cold-leg guillotine (DECLG) break with an EOC axial shape to a split break with an EOC axial shape. The PCT impact of the deviation was determined to be +10°F.

TEOBY Calculation Error (SPCR #8751)

The end of bypass time for the LBLOCA as determined by the TEOBY code was found to be in error. The code incorrectly chose the latest time that sustained flow reversal is achieved rather than the earliest time whenever multiple reversals have occurred by the end of the RELAP4 blowdown simulation. The PCT impact of this error was determined to be +1°F.

Change in Gadolinia-Bearing Fuel Rod Modeling

The modeling of gadolinia-bearing fuel rods was enhanced in several ways. Current analyses ensure that the limiting peak cladding temperature does not occur in a gadolinia-bearing rod. Therefore, the impact of the changes on the Palisades calculated PCT is 0°F as expected. The specific changes are:

- The pin-to-pin power distribution is taken from the 5x5 fuel rod array surrounding the highest power gadolinia-bearing rod at the exposure where the peak gadolinia-bearing rod to UO_2 rod power ration occurs. Previously, the pin distribution was taken at EOC conditions since this is conservative for UO_2 rods.

- The power of the eight fuel rods surrounding the gadolinia-bearing rod is calculated from their average power with the highest of the eight rods assumed to be at the Technical Specification power level. Guide tubes are not included in the average. Previously, all eight surrounding rods were assumed to be at the Technical Specification limit power level.

- The maximum decay heat is used in the TOODEE2 heatup calculation. The maximum product of the gadolinia-bearing rod to UO_2 rod power ratio and the gamma-smearing factor over the cycle is found and normalized to the peak power ratio to provide an effective gamma-smearing factor. This value results in a bounding decay heat. Previously, the maximum gamma-smearing factor and maximum power ratio were used rather than the maximum of their product. The maximum gamma smearing factor and maximum power ratio can occur at different burnups, thus using them independently is excessively conservative.

- The power history calculations assume an MOC axial shape for the purposes of finding the maximum stored energy. The previous calculations changed the spiked power shape from BOC to MOC, and then to EOC as the exposure increased rather than using a constant MOC shape throughout. This has negligible impact on the time of maximum stored energy. Using a constant axial shape simplified the power history calculation allowing it to be automated.