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U.S. Nuclear Regulatory Commission ATTN: Document Control Desk Washington, DC 20555

DOCKET <u>50-255</u> - LICENSE <u>DPR-20</u> - PALISADES PLANT 10 CFR 50.46 REPORT OF CHANGES AND ERRORS IN LBLOCA ECCS EVALUATION MODEL

Per 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 is due 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 cumulation of changes and errors in the Palisades fuel cycle 14 Large Break Loss of Coolant Accident (LBLOCA) ECCS evaluation performed by Siemens Power Corporation (SPC). Further, this letter outlines the current schedule for re-analysis of the Palisades LBLOCA transient by SPC.

As previously reported to NRC in Reference 1, the current (fuel cycle 14) LBLOCA ECCS evaluation for Palisades resulted in a peak cladding temperature (PCT) of 1869°F. This result was based on the currently approved EXEM/PWR LBLOCA evaluation model, as modified by the interim fuel cooling testing facility (FCTF) correlation. Also as reported in Reference 1, a significant "excessive variability" error existed, which when corrected resulted in a reduction in PCT of 70°F.

Ten additional errors associated with the SPC EXEM/PWR LBLOCA evaluation model have been identified by SPC. The impact of each individual error on the PCT has been evaluated for Palisades fuel cycle 14 using the SPC EXEM/PWR evaluation model with the "excessive variability" error corrected. A description of each error along with its individual evaluation of the change in PCT may be found in Attachment 1. The sum of the absolute magnitudes of delta PCT introduced by these ten errors is 63°F, which is considered significant per 10 CFR 50.46. However, the licensing basis LBLOCA PCT of 1869°F continues to be conservative relative to the SPC EXEM/PWR evaluation model results corrected for "excessive variability" and the ten errors detailed in Attachment 1.

SPC currently plans to perform a complete re-analysis of the LBLOCA event for Palisades upon completion of the SEM/PWR-98 ECCS evaluation model review currently ongoing by NRC. The current schedule is for completion of an updated Palisades licensing basis calculation utilizing the SEM/PWR-98 ECCS evaluation model by the end of the second quarter of 1999. Until such time as this new LBLOCA evaluation is in place, SPC will continue to use the EXEM/PWR LBLOCA model, modified by the interim FCTF correlation, to perform plant analyses for Palisades.

References

- 1. Letter, NLHaskell (Consumers Energy) to Document Control Desk (NRC), "Evaluation of 10 CFR Part 21 Report Regarding Impact of RELAP4 Excessive Variability on Palisades Large Break LOCA ECCS Results", dated June 1, 1998.
- 2. Letter, JFMallay (SPC) to Document Control Desk (NRC), "Interim Report of Evaluation of a Deviation Pursuant to 10 CFR 21.21(a)(2)", SPC Letter Number NRC:98:063, dated September 21, 1998.

SUMMARY OF COMMITMENTS

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

Nathan L. Haskell Director, Licensing

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

Attachment

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ATTACHMENT 1

CONSUMERS ENERGY COMPANY PALISADES PLANT DOCKET 50-255

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RELAP4 Decay Heat Re-normalization (SPC CR#6578)

An error was discovered in the re-normalization of the decay heat in RELAP4 at the initiation of the transient. The re-normalization incorrectly adjusted the fission product decay heat by slightly less than the required 1.2 multiplier on the RELAP4 decay heat equations. The actinides are still conservatively estimated but not by a factor as great as 1.2. The peak cladding temperature (PCT) impact of this deviation was determined to be +18°F for Palisades.

RELAP4 Average Temperature (SPC CR#6581)

An error was discovered in the calculation of the fuel average temperature in RELAP4. The fuel average temperature in RELAP4 is incorrectly computed because one-half of the volume of the first gap node is used in calculating the fuel volume. The PCT impact of this deviation was determined to be -3°F for Palisades.

TOODEE2 Cold Gap Width (SPC CR#6574)

An error was discovered in the calculation of the gap dimensions in RODEX2. The deviation was that the gap dimension TOODEE2 input was calculated at zero power hot standby conditions rather than at cold conditions. The PCT impact of this deviation was determined to be +2°F for Palisades.

RDX2LSE Gadolinia Conductivity (SPC CR#6419)

An error was discovered in the RDX2LSE (RODEX2) code used to provide fuel rod input for the PWR LOCA analyses. The error was that the gadolinia-bearing fuel conductivity equation described in XN-NF-85-92(P)(A), and approved by the NRC, was not incorporated in the code. The previous gadolinia-bearing fuel conductivity equation, described in XN-NF-79-56(P)(A), was not replaced upon the approval of the gadolinia-bearing fuel conductivity equation described in XN-NF-79-56(P)(A). The impact of incorporating the currently approved gadolinia-bearing fuel conductivity equation in the RDX2LSE code is to significantly reduce the calculated PCT for the gadolinia-bearing fuel rods during the LBLOCA. Since the gadolinia fuel rods are not limiting, this reduction in gadolinia-bearing fuel rod PCT has no impact on the limiting PCT. Thus, the PCT impact of this deviation was determined to be 0°F for Palisades.

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RDX2LSE Fuel Density (SPC CR#6655)

An error was discovered in the asymptotic fuel density (SWMDEN) used in the RDX2LSE (RODEX2) code. The SWMDEN value was not reflective of the current manufacturing process. SWMDEN is a RODEX2 input defined as the asymptotic fuel density that occurs after full densification and full accommodation of the solid swelling by the as-fabricated fuel porosity. The value of SWMDEN is determined by the processes employed during fuel manufacturing. The PCT impact of this deviation was determined to be +4°F for Palisades.

PREFILL Negative SI Flow Rates (SPC CR#6809)

An error was discovered in the PREFILL sub-code of the RFPAC calculation. The RFPAC code calculated negative values of LPSI and HPSI combined flow rates when there was a time gap between termination of accumulator flow and initiation of LPSI flow. The error has only been found to occur when the time gap is sufficient for the cold leg liquid to fall below 10% full. The PCT impact of this deviation was determined to be 0°F for Palisades.

TOODEE2 Axial Nodalization (SPC CR#6580)

An error was discovered regarding the calculation of an unrealistically high PCT in the region at the upper extremity of the core when 3-inch axial nodes are modeled in TOODEE2 in the upper extremity of the core (Reference 2). The current Palisades licensing analyses use greater than 3-inch nodes to model the upper extremity of the core. The unrealistically high PCT is caused by the fact that the FCTF heat transfer correlation predicts unrealistically low heat transfer coefficient above the 10.5-foot elevation. This behavior is phenomenologically unrealistic, however, the additional testing required to correct this deviation is not feasible within a reasonable time period. Therefore, to assure that a bounding PCT is calculated, an increased nodalization will be used at the top of the core. The PCT impact of this deviation was determined to be +25°F for Palisades.

RDX2LSE Incorrect Gadolinia Density (SPC CR#6442)

An error was discovered in the RDX2LSE (RODEX2) code used to provide fuel rod input for the PWR LOCA analyses. The error was that the gadolinia-bearing fuel rod fuel density correlation has been incorrect. Calculations with a developmental version of RDX2LSE indicate that the initial stored energy for the gadolinia fuel rods is a few degrees lower with the corrected density correlation. Thus, the calculated PCT for gadolinia fuel rods will be slightly lower than that previously calculated. Since the PCT for gadolinia fuel rods is significantly less

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than the limiting PCT for UO_2 fuel rods, the PCT impact of this deviation was determined to be 0°F for Palisades.

RELAP4 Transient Gap (SPC CR#6805)

An error was discovered in the gap conductance being too low at the start of the transient because RELAP4 incorrectly converted the DELFI input from inches to feet a second time. It was converted correctly for the initial, steady-state calculation. Consequently, the gap conductance decreased at the start of the transient causing a slight, unexpected increase in the fuel average temperature and resulting in conservative peak cladding temperatures. This error exists only in the RELAP4 version corrected for excessive variability and does not exist in the RELAP4 versions used in prior licensing calculations. The PCT impact of this deviation on the RELAP4 code corrected for excessive variability (Reference 1) was determined to be -11°F for Palisades.

RELAP4 Pressure Dependent Fill Junction (SPC CR#6877)

An error was discovered when an incorrect flow rate was produced for the pressure dependent fill junction by the SIS model. The iterative solution method used a non-converged pressure to determine the fill flow rate. This error exists only in the RELAP4 version corrected for excessive variability and does not exist in the RELAP4 versions used in prior licensing calculations. The PCT impact of this deviation on the RELAP4 code corrected for excessive variability (Reference 1) was determined to be 0°F for Palisades.

LICENSING CORRESPONDENCE SUMMARY

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

DATE: January 7, 1999

 FILE NAME:
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 SYS/EQUP NO:
 NA

 PRC NO.:
 NA

 NPAD NO.:
 NA

 RELATED CORRECTIVE ACTION DOCUMENTS:
 None

 DATES OF PREVIOUS NRC CORRESPONDENCE: None
 None

 DATES OF PREVIOUS CONSUMERS ENERGY CORRESPONDENCE:
 6/1/98

REVIEW & CONCURRENCE RECORD

The attached document requires your review as described below. Your concurrence is requested by 1/7/99. The Licensing contact is Phil Flenner, phone extension 2544. This letter is not required to be submitted under oath.

REVIEWER	REVIEW CODES*	CONCURRENCE SIGNATURE (✓) after signature if you want a copy of submittal.		COMMENTS
Lead Manager, GABaustian	1	On file - Rec'd 1/7/99		Comments incorporated
GFPratt	1	On file - Rec'd 1/7/99	1	Comments incorporated
				-
Licensing Peer	Peer	DEEngler Reprid 1/7/99		Comments incorporated
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*2. Reviewer is familiar with the subject matter and should review the entire document, or appropriate sections of the document, to verify the information is accurate and complete.

*3. Reviewer is assigned an NRC commitment contained within the correspondence and summarized on the attached sheet(s). The commitment wording and completion date should be verified to be proper, and concurrence provided by initials of assigned person or their supervisor.