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**Palisades Nuclear Plant**
Operated by Nuclear Management Company, LLC

December 27, 2001

10 CFR 50.46

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

**DOCKET 50-255 - LICENSE DPR-20 - PALISADES NUCLEAR PLANT**
ANNUAL REPORT OF CHANGES IN ECCS MODELS PER 10 CFR 50.46

Nuclear Management Company, LLC is submitting the annual report of changes in Emergency Core Cooling System (ECCS) models for the Palisades Plant. The report is submitted in accordance with 10 CFR 50.46(a)(3)(ii). The report contains both the Westinghouse Electric Company small break loss-of-coolant accident (SBLOCA) ECCS evaluation summary and the Framatome ANP Richland SEM/PWR-98 large break loss-of-coolant accident (LBLOCA) evaluation summary. This report covers the period from November 2000 through November 2001.

SUMMARY OF COMMITMENTS

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

for
Laurie A. Lahti
Manager, Licensing

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

Attachment

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Rec'd 01/30/02

ATTACHMENT

NUCLEAR MANAGEMENT COMPANY
PALISADES NUCLEAR PLANT
DOCKET 50-255

December 27, 2001

# ANNUAL REPORT OF CHANGES IN ECCS MODELS PER 10 CFR 50.46

6 Pages

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

Westinghouse Electric Company LLC (formerly Asea Brown Boveri-Combustion Engineering Nuclear Power) performed the Palisades small break loss-of-coolant accident (SBLOCA) analysis for Fuel Cycle 14. This analysis also applies for Cycle 15 operation. The peak cladding temperature (PCT) was determined to be 2026°F and was reported in Reference 1. Since this report, Palisades Nuclear Engineering has determined that the SBLOCA analysis applies to the current Fuel Cycle 16, which began in May 2001. The following error, as reported by Westinghouse Electric Company, has also been addressed for Fuel Cycle 16.

CEFLASH-4AS Code Error (Westinghouse Electric Company NSAL-01-002)

An error in the break flow calculation subroutine in CEFLASH-4AS contained coding that performed operations which exceeded the range of arrays in the subroutine, resulting in the over-writing of code data used by other code calculations. The PCT impact of this error was determined to be +37°F.

**The resulting PCT, as applicable for the current Fuel Cycle 16, is 2063°F.**

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

Framatome ANP Richland, Inc. (formerly Siemens Power Corporation) evaluates the Palisades large break loss-of-coolant accident (LBLOCA) with the SEM/PWR-98 methodology. The PCT was determined to be 1889°F for Fuel Cycle 15 and was reported in Reference 2. Since this report, the LBLOCA analysis was updated for the current Fuel Cycle 16. The following errors were also addressed in this current analysis.

RDX2LSE Fast Flux Input Error (Framatome ANP Condition Report #9429)

The fast flux was not specified in the first input block of the RDX2LSE hot rod input, causing the code to ignore the fast flux input for the remainder of the calculation and to use fast flux values calculated by the code. Therefore, the fast flux used by the code was incorrect by the difference between the calculated values and the input values. The PWR LBLOCA methodology requires that the fast flux be input rather than calculated by the code. The PCT impact of this error was determined to be +4°F.

Break Loop Steam Generator Tube Exit Junction Inertia (Framatome ANP Condition Report #9266)

The inertia for the steam generator tube-to-outlet plenum junction was not calculated correctly for the Palisades Cycle 16 LBLOCA analysis. The number of nodes in the steam generator tube region was increased in the SEM/PWER-98 LBLOCA evaluation model relative to the number of nodes in the previous EXEM/PWR LBLCOA evaluation model. This increased nodalization resulted in a decrease in the steam generator tube exit volume. The analysis incorrectly used a junction inertia consistent with the earlier EXEM/PWR evaluation model nodalization. The PCT impact of this error was determined to be +1°F.

End of Bypass Calculation Error (Framatome ANP Condition Report #9054)

The end of bypass time for the LBLOCA was found to be in error. Under certain circumstances, when a flow reversal occurs at the junction between the upper downcomer and the broken cold leg, a sustained flow reversal may begin between the upper and lower downcomer that may cause a momentary positive flow from the upper downcomer to the broken cold leg. As a result, the end-of-bypass time is based on the flow reversal time for upper to lower downcomer junction instead of earlier reversal at the junction between the upper downcomer and the broken cold leg. The short period of positive flow is an artifact of the one-dimensional homogenous equilibrium model used in the SEM/PWR-98 methodology and does not represent the resumption of bypass flow. The methodology was modified to choose the earlier flow reversal at the break to define end-of-bypass time. The PCT impact of this error was determined to be 0°F.

TOODEE2 Radiation Heat Transfer (Framatome ANP Condition Report #9024)

The radiation heat transfer coefficient calculated by TOODEE2 for use during the refill period was found to be incorrectly applied. After core reflood begins, the radiation heat transfer coefficient at each node is used until the reflood heat transfer becomes greater than the radiation heat transfer. If at any point in the calculation, the radiation heat transfer coefficient becomes larger than the reflood value, the radiation heat transfer coefficient is used. However, once a convective heat transfer coefficient is used in the calculation for an individual node, assumptions used in the radiation heat transfer model are no longer valid. The result is erroneous calculation of radiation sink temperatures and radiation heat transfer coefficients. The code TOODEE2 was modified to turn off the radiation model at each node once the convective heat transfer at the node exceeds the radiation value. The PCT impact of this error was determined to be 0°F.

RDX2LSE and RODEX2-2A V&V (Framatome ANP Condition Report #8266)

Framatome ANP maintained three approved versions of RODEX2 (RODEX2, RODEX2-2A and RDX2LSE). Documentation for RODEX2 had stated that 75 percent of the pellet dish volume was assumed to be available to accommodate gaseous swelling. However, the version of RODEX2 used for mechanical analyses actually used a value of 57 percent. The error in the RODEX2 documentation was corrected. RDX2LSE is used for safety analysis, and the error was not corrected in it, causing the model to become overly sensitive to the number of radial nodes (NRD) used to model the central dished part of the pellet. Correcting the error and merging RODEX2 and RDX2LSE had negligible effect on the safety and mechanical analyses. The PCT impact of this error was determined to be 0°F.

SEM/PWR-98 Accumulator/SIT Line Losses (Framatome ANP Condition Report #8586)

A conservative PCT was calculated using safety injection tank (SIT) line losses that were conservatively high in the FRA-ANP LBLOCA methodology used prior to SEM/PWR-98 when the ruptured node was also the PCT node. The PCT for SEM/PWR-98 calculations occurs much later in time and typically does not occur on the ruptured node, increasing the reflood period and sensitivity to reflood parameters. The effect of using conservatively high SIT line losses has offsetting effects. The SIT injection flow rate would be less, which would adversely increase the beginning of core reflood time and result in increased PCT. However, it also results in more total injection water going to the intact loops, which would tend to reduce the PCT. Slowing the SIT injection results in less SIT mass being dumped to containment prior to the end of bypass time, which results in higher containment pressures during reflood and decreases PCT. Since this parameter has offsetting effects, the FRA-ANP is to use average SIT line loss values. The PCT impact of this error was determined to be +1°F.

Cycle 16 SEM/PWR-98 Analysis

The SEM/PWR-98 LBLOCA ECCS evaluation methodology was used to update the Palisades LBLOCA ECCS analysis for the current fuel cycle 16. The PCT impact of this change for Palisades was determined to be +39°F.

**The sum of these errors is +45°F and results in the LBLOCA PCT for the current Fuel Cycle 16 to be 1934°F.**

**References:**


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

2. Letter, N. L. Haskell (Consumers Energy Company) to Document Control Desk (NRC), "10 CFR 50.46 Report of Changes and Errors in LBLOCA ECCS Evaluation Model," dated November 22, 2000.