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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Davis-Besse Nuclear Power Station
Report of Changes to the Emergency Core Cooling System Evaluation Model In Accordance With 10 CFR 50.46(a)(3)

Ladies and Gentlemen:

In accordance with 10 CFR 50.46(a)(3), the FirstEnergy Nuclear Operating Company (FENOC) hereby submits the annual report for changes and errors to the Emergency Core Cooling System (ECCS) Evaluation Model (EM) used at the Davis-Besse Nuclear Power Station (DBNPS). This report covers the period of January 1, 2005 to December 31, 2005.

In addition, final calculations for the current operating cycle, beginning in April 2006, have resulted in a calculated Peak Cladding Temperature (PCT) increase of 50°F. FENOC is reporting this change pursuant to 10 CFR 50.46 which requires 30-day reporting of significant changes in the calculated PCT. The analysis results continue to meet the performance criteria in paragraph (b) of §50.46. No reanalysis or other action is needed to show compliance.

The annual report, including discussion of the PCT increase described above, is included as Attachment 1. Attachment 2, Commitment List, identifies that there are no commitments contained in this letter.

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If there are any questions or if additional information is required, please contact Mr. Gregory A. Dunn, Manager – FENOC Fleet Licensing, at (330) 315-7243.

Very truly yours,

Mark B. Bezilla, Vice President-Nuclear

MSH

Attachments

cc: Regional Administrator, NRC Region III
DB-1 NRC/NRR Project Manager
DB-1 NRC Senior Resident Inspector
Utility Radiological Safety Board

Annual Report of Changes to the 10 CFR 50.46 Emergency Core Cooling System Evaluation Model for the Davis Besse Nuclear Power Station

10 CFR 50.46 (a)(3) states that each holder of an operating license shall report to the Nuclear Regulatory Commission (NRC) at least annually each change or error in an acceptable Emergency Core Cooling System (ECCS) Evaluation Model (EM) or in the application of such a model that affects the calculation of Peak Cladding Temperature (PCT).

General Description

The BWNT evaluation model (EM) is applicable to all Babcock & Wilcox (B&W) designed pressurized water reactors for large and small-break loss-of-coolant accident (LOCA) analyses for Zircaloy or M5 cladding. The NRC-approved topical report for this EM is BAW-10192P-A, Rev 0 (Document 1).

The large-break LOCA EM consists of four computer codes:

1. BAW-10164P-A, RELAP5/MOD2-B&W: computes the system, core, and hot rod response during blowdown (Document 2),
2. BAW-10171P-A, REFLOD3B: calculates the time for refill of the lower plenum and core reflood rate (Document 3),
3. BAW-10095-A, CONTEMPT: computes the Containment Vessel's pressure response (Document 4) and,
4. BAW-10166P-A, BEACH (the RELAP5/MOD2-B&W reflood heat transfer package): determines the hot pin thermal response during refill and reflood phases (Document 5).

The small-break LOCA EM consists of two codes:

1. BAW-10164P-A, RELAP5/MOD2-B&W: computes the system, core, and hot rod response during the transient (Document 2) and,
2. BAW-10095-A, CONTEMPT: computes the Containment Vessel's pressure response (Document 4), if needed.

An NRC-approved fuel performance code (currently BAW-10162P-A, TACO3 (Document 6) or BAW-10184P-A, GDTACO (Document 7)) is used to supply the fuel rod steady-state conditions at the beginning of the small or large-break LOCA. These codes are approved for use with M5 cladding as discussed in BAW-10227P-A (Document 8).

BWNT LOCA Evaluation Model Error Correction and Changes

EM Change for BHTP CHF Correlation Implementation for SBLOCA

The BHTP critical heat flux correlation (CHF) was conservatively implemented in the RELAP5/MOD2-B&W code as dictated by Section 4.3.4.8 of Volume 1 of the EM for use in LOCA applications. This EM change was previously reported via 10 CFR 50.46 as part of the 2003 annual report (Document 9). As originally implemented, the flow-direction dependent terms of the BHTP correlation were excluded from the calculation of the CHF for large-break LOCA (LBLOCA) applications. This causes a conservative reduction in the BHTP CHF prediction, which was specifically intended only for LBLOCA applications. The EM is changed such that for small-break LOCA (SBLOCA) applications, the BHTP CHF correlation is adjusted to specifically account for these flow-dependent terms since the flow direction does not change for these smaller break sizes and the conservatism in the implementation is not necessary. The SBLOCA EM has been generically modified to include the impact of these terms for analysis and evaluation of the Mark-B-HTP fuel assembly.

The effect of this SBLOCA EM change on the plant-specific evaluations and analyses related to the Mark-B-HTP fuel is reported herein. The maximum break size for the SBLOCA spectrum is defined in the BWNT LOCA EM based on the CHF performance. Specifically, the heat flux should not exceed the CHF during the first several seconds of the SBLOCA transient. The extent of this EM change is to confirm that the correct EM (transition LBLOCA versus SBLOCA) is utilized to analyze the transient. However, this change does not affect the limiting SBLOCA PCT. Therefore, the PCT change associated with this SBLOCA EM change is 0 °F.

- Generic EM Change – Implementation of BHTP CHF Correlation for SBLOCA
- The PCT change is 0 °F for the Mark-B-HTP SBLOCA applications.

BWNT LOCA Evaluation Model Generic Analyses

One generic B&W evaluation was completed in 2005, a generic evaluation of the FUELGUARD™ inlet debris filter utilized for the Mark-B-HTP fuel assembly design. Since the implementation of the Mark-B-HTP fuel assembly design is being included herein as a 30-day report, this generic study is being reported.

AREVA offers the FUELGUARD™ inlet debris filters on the Mark-B-HTP fuel assemblies to help reduce fuel assembly fretting problems. The purpose of the filter is to catch debris before it enters the core. Document 10 establishes the LOCA and safety analysis design basis requirements for these filtering devices. Of primary importance is demonstrating that using a fuel filter results in a net positive impact on the risk to public health and safety.

It was concluded that the Mark-B-HTP fuel assemblies used in B&W designed plants are no more nor no less subject to adverse consequences due to trapping debris as a result of incorporating the FUELGUARD™ inlet debris filters into their design. Additionally, there is no safety significance in that long-term cooling is provided for both cold-leg and hot-leg breaks.

- Other – Generic evaluation of debris filter versus no debris filter
- There are no PCT changes associated with this topic.

EM Application Changes and Errors

A summary of the changes for the reporting period and the corresponding PCTs is provided in Table 1.

Low Pressure Reactor Trip

It was identified that the analyzed value used for the Reactor Protection System's (RPS) low pressure reactor trip was nonconservative (i.e., too high). The error was applicable to the LOCA analysis of the Mark-B10K and Mark-B12 fuel assembly designs.

An evaluation of the lower analytical value with respect to the LOCA analyses was performed by AREVA. Results of the evaluation are documented in Document 11. The RPS low pressure trip is not utilized during the analysis of the LBLOCA transient. The SBLOCA utilized a nonconservative value.

The SBLOCA analysis was evaluated based on an analytical value decrease of 15 psi (i.e., 1,900 psia to 1,885 psia). It was concluded that the changes to the results were negligible and the existing analyses remained valid. The estimated PCT change associated with this input change for the SBLOCA licensing basis case is 0 °F.

- Error Correction – Update of analytical value for RPS low pressure trip.
- This analytical value is not utilized in the LBLOCA transient analyses.
- The estimated PCT change associated with this input change for the SBLOCA is 0 °F.

Evaluation of Plant Parameter Changes

The plant boundary conditions for use in LOCA analyses were redeveloped based on a review performed by FENOC. The final conditions to be utilized for the new Mark-B-HTP fuel assembly LOCA analyses (i.e., fuel cycle 15) are summarized in Document 12. Several small differences between these new plant boundary conditions and those utilized by the cycle 14 analysis for the Mark-B12 and Mark-B10K fuel assembly designs were identified (i.e., initial feedwater temperature, turbine header pressure, main feedwater flow, more detailed modeling of the Emergency Diesel Generator sequencer, etc.).

An evaluation of the plant parameter changes was performed by AREVA to assess the effect, if any, on PCT, maximum local oxidation, and whole-core hydrogen generation. This evaluation is documented in Document 13.

The evaluation concluded that the results of the analysis for the large-break and small-break LOCA limiting cases remain applicable with no change in PCT.

- Plant Change – Update of plant boundary conditions.
- The previous analyses were determined to be bounding for this plant change.
- There is a 0 °F PCT change.

EM Application Change for BHTP CHF Correlation Implementation for SBLOCA

The maximum break size for the SBLOCA spectrum is defined in the BWNT LOCA EM based on the heat flux performance. Specifically, the heat flux should not exceed the critical heat flux (CHF) during the first several seconds of the SBLOCA transient. For the Mark-B12, Mark-B10K, and Mark-B10M assemblies (Mark-B grid design) that are analyzed with the BWC CHF correlation, the maximum break size for the SBLOCA spectrum is 0.75 ft^2. As discussed previously, the SBLOCA EM has been changed to account for the flow-dependent terms in the BHTP CHF correlation. With this EM change (discussed in detail in Document 14), the BHTP CHF correlation has shown that the 0.75-ft^2 break size remains the maximum SBLOCA break size for the Mark-B-HTP fuel assembly design. The extent of this EM change is to confirm that the correct EM (transition LBLOCA versus SBLOCA) is utilized to analyze the transient. The SBLOCAs with the least margin to CHF are those with break sizes exceeding 0.3 ft^2, and with respect to PCT, these break sizes are not limiting for the Davis-Besse SBLOCA. Therefore, there is a 0 °F PCT change associated with this EM change.

When the SBLOCA cases do not exceed the CHF during the first several seconds of the transient, there are no differences in the transient results for each fuel assembly type due to the CHF correlation selected. Therefore, the same SBLOCA cases represent the results for all fuel designs considered. The break sizes greater than the maximum SBLOCA break size are part of the transition LOCA methodology, which is bounded by the results of the LBLOCA analyses.

- EM Change – Implementation of BHTP Correlation to SBLOCA.
- There is a 0 °F PCT change.

Mixed-Core Mark-B-HTP LOCA Analysis for Cycle 15 (30 day Report)

Mixed-core Mark-B-HTP LBLOCA and SBLOCA analyses were performed to support licensing of the new Mark-B-HTP fuel assembly design at Davis-Besse beginning with fuel cycle 15. These analyses consisted of LBLOCA and SBLOCA analyses that considered the Mark-B-HTP fuel assembly surrounded by Mark-B10K, Mark-B12 or Mark-B10M fuel assemblies.

The LBLOCA and SBLOCA analyses utilized EM R0.9, which includes the BHTP CHF correlation necessary for analysis of the Mark-B-HTP design, the approved hot pin modeling for LBLOCA (Document 2), and the approved void-dependent cross-flow model for SBLOCA (Document 2).

The following documents were prepared to develop the LOCA models used for licensing calculations:

Document 12, Analytical input summary that outlines plant boundary conditions for use in the LOCA analyses.
Document 15, Development of the LBLOCA base model with the boundary conditions from Document 12.
Document 16, Evaluation to confirm the method utilized to analyze the mixed-core LBLOCA configuration.

The LOCA analyses are presented in the following documents:

Document 17, Mixed-core Mark-B-HTP and Mark-B10K/B12 analyses and evaluations.
Document 18, Analysis to support operation at end-of-cycle with reduced T_{AVE}.
Document 19, Sensitivity studies to determine the linear heat rate (LHR) reduction to be applied at power levels less that 3,025 MWt (analyzed) to ensure that the analyses performed at 3,025 MWt represented the most severe calculational consequences.
Document 20, SBLOCA analyses covering the Mark-B-HTP, Mark-B12, Mark-B10K and Mark-B10M fuel assembly designs.
Document 21, Text for inclusion in the Mark-B-HTP fuel design report for Davis-Besse.

A complete description of the results of the LBLOCA and SBLOCA analyses for the Mark-B-HTP, Mark-B12, Mark-B10K and Mark-B10M fuel assemblies, along with the results of each 10 CFR 50.46 criterion, is provided in Document 14.

The LBLOCA PCTs for the Mark-B10M, Mark-B10K and Mark-B12 assembly designs in a mixed core with Mark-B-HTP fuel were determined to be bounded by previous analyses. Therefore, the change in PCTs for these fuel assembly designs is 0 °F.

The initial application of the Mark-B-HTP fuel in a mixed core resulted in a PCT of 2,095 °F for the LBLOCA for the Mark-B-HTP fuel.

The SBLOCA analysis performed for the Mark-B-HTP fuel has been determined to be applicable to all fuel assembly types. The PCT for the SBLOCA increased from 1,505 °F to 1,555 °F.

- Plant Change – Cycle 15, Mixed-core of Mark-B-HTP fuel assemblies.
- The change in LBLOCA PCTs for the Mark-B10M, Mark-B10K and Mark-B12 assembly designs in a mixed-core of Mark-B-HTP fuel is 0 °F. The Mark-B-HTP PCT for a LBLOCA in a mixed-core was determined to be 2,095 °F.
- The PCT for the SBLOCA increased from 1,505 °F to 1,555 °F.

Documents

1. AREVA/FANP Proprietary Topical Report BAW-10192P-A, Rev. 0, "BWNT LOCA – BWNT Loss-of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998.
2. AREVA/FANP Proprietary Topical Report BAW-10164P-A, Rev. 4, "RELAP5/MOD2-B&W – An Advanced Computer Program for Light Water Reactor LOCA and Non-LOCA Transient Analysis," November 2002.
3. AREVA/FANP Proprietary Topical Report BAW-10171P-A, Rev. 3, "REFLOD3B – Model for Multinode Core Reflooding Analysis", December 1995.
4. AREVA/FANP Proprietary Topical Report BAW-10095-A, Rev. 1, "CONTEMPT – Computer Program for Predicting Containment Pressure-Temperature Response to a LOCA", April 1978.
5. AREVA/FANP Proprietary Topical BAW-10166P-A, Rev. 5, "BEACH – A Computer Program for Reflood Heat Transfer During LOCA", November 2003.
6. AREVA/FANP Proprietary Topical Report BAW-10162P-A, Rev. 0, "TACO3 Fuel Pin Thermal Analysis Code", October 1989.
7. AREVA/FANP Proprietary Topical Report BAW-10184P-A, Rev. 0, "GDTACO Urania – Gadolinia Fuel Pin Thermal Analysis Code", February 1995.
8. AREVA/FANP Proprietary Topical Report BAW-10227P-A, Rev. 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel", June 2003.
9. Letter, M. B. Bezilla to USNRC Document Control Desk, "Annual Report of Changes to the Emergency Core Cooling System Evaluation Model in Accordance With 10 CFR 50.46(a)(3)," Davis-Besse Serial Number 3081, August 7, 2004.
10. AREVA/FANP Document 51-9004825-000, "FUELGUARD™ Debris Filter Evaluation for BWOG Plants", 12/05.
11. AREVA/FANP Proprietary Document 51-5057725-00, "DB-1 Low Pressure Reactor Trip Setpoint Evaluation", 1/05.
12. AREVA/FANP Document 51-5053743-01, "DB-1 LOCA AIS for Mk-B-HTP Fuel", 12/05.
13. AREVA/FANP Proprietary Document 51-5071318-00, "DB-1 Mk-B10K/B12 Evaluation for Mk-B-HTP AIS Changes", 9/05.
14. Davis-Besse calculation number, C-NSA-064.02-036, R00, "DB-1 LOCA Summary Report," 3-24-06.
15. AREVA/FANP Proprietary Document 32-5057047-00, "DB-1 Mk-B-HTP LBLOCA Model Development", 5/05.
16. AREVA/FANP Proprietary Document 32-5062361-01, "DB-1 Mixed-Core LOCA LHR Method", 1/06.
17. AREVA/FANP Proprietary Document 32-9004260-000, "DB-1 Mk-B-HTP Mixed-Core LOCA", 1/06.
18. AREVA/FANP Proprietary Document 32-5071714-00, "Davis-Besse Mark-B-HTP T_{AVE} Reduction", 1/06.
19. AREVA/FANP Proprietary Document 32-5069012-00, "DB-1 Mark-B-HTP Partial Power Study", 1/06.

Documents (cont'd)

20. AREVA/FANP Proprietary Document 32-5064828-00, "DB-1 Mk-B-HTP SBLOCA Analyses", 1/06.
21. AREVA/FANP Document 51-9006350-000, "LOCA Inputs to DB-1 Mk-B-HTP Design Report", 1/06.
22. AREVA/FANP Proprietary Document 51-9000998-001, "DB-1 CY15 LOCA LHR Limits", 1/06.

Table 1

Evaluation Model Application Summary

Utility Name:		FirstEnergy Corporation, FirstEnergy Nuclear Operating Company	*LOCA Spectrum*				
Plant Name:		Davis-Besse	*Mk-B10M LBLOCA*	*Mk-B10K LBLOCA*	*Mk-B12 LBLOCA*	*Mk-B-HTP LBLOCA*	*SBLOCA*
Item #	*Reporting Category*	*Description*	*Peak Clad Temperature*				
Licensing Basis at End of 2004			**<2,102 °F Estimate EM R0.6**	**2,102 °F Analyzed EM R0.6**	**2,099 °F Analyzed EM R0.6**	**N/A**	**1,505 °F Analyzed EM R0.6**
2005/2006 Licensing Activity							
1	Plant Change	Reactor Protection System Low Pressure Setpoint Update	N/A	N/A	N/A	N/A	0 °F
2	Plant Change	Evaluation of Cycle 14 Plant Parameter Changes	0 °F	0 °F	0 °F	N/A	0 °F
3	EM Change	Implementation of BHTP CHF Correlation for SBLOCA Applications	N/A	N/A	N/A	N/A	0 °F
4	Plant Change	Cycle 15: Mixed-Core Mark-B12, Mark-B10K, Mark-B10M and Mark-B-HTP (30 day report)	Previously Bounding	Previously Bounding	Previously Bounding	2,095 °F Analyzed EM R0.9	1,555 °F Analyzed EM R0.9
Licensing Basis at Beginning of Cycle 15 (April 2006)			**<2,102 °F Estimate EM R0.6**	**2,102 °F Analyzed EM R0.6**	**2,099 °F Analyzed EM R0.6**	**2,095 °F Analyzed EM R0.9**	**1,555 °F Analyzed EM R0.9**

COMMITMENT LIST

The following list identifies those actions committed to by the Davis-Besse Nuclear Power Station, Unit Number 1, (DBNPS) in this document. Any other actions discussed in the submittal represent intended or planned actions by the DBNPS. They are described only for information and are not regulatory commitments. Please notify Gregory A. Dunn, Manager – FENOC Fleet Licensing (330-315-7243) of any questions regarding this document or associated regulatory commitments.

COMMITMENTS	DUE DATE
None	Not applicable