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10CFR50.46(a)(3)(ii)

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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
Errors or Changes in the Emergency Core Cooling
System Evaluation Model; Annual Report for 2001

Dear Sir or Madam:

10CFR50.46(a)(3)(ii) requires licensees to report annually each change to or error discovered in an acceptable evaluation model (EM) or in the application of such model for the emergency core cooling system (ECCS) that affects the peak cladding temperature (PCT). Included in the submittal is the estimated effect these changes or errors have on the limiting ECCS analysis. The purpose of this submittal is to provide that required information for Arkansas Nuclear One (ANO) for the reporting period January 1, 2001, through December 31, 2001.

ANO-1: The ANO-1 licensing basis for the year 2001 was the CRAFT2-based EM. For ANO-1, there were no errors or changes to the CRAFT2-based Babcock and Wilcox Nuclear Technology (BWNT) ECCS EM or the application of this model that resulted in a change in the PCT or non-conformance to additional criteria set forth in 10CFR50.46(b). Also, during 2001, there were no input errors detected that changed the results of completed loss-of-coolant accident (LOCA) analyses. In addition, for information only, Attachment 1 provides a description of the analyses and evaluations that have been completed during the reporting period for ANO-1.

ANO-2: For ANO-2, there was an error in the ABB-CE ECCS small-break LOCA (SBLOCA) EM that resulted in an increase in the PCT. There were no other errors or changes in the Westinghouse (formerly ABB-CE) ECCS models or the application of these models that resulted in a change in the PCT or non-conformance to additional criteria set forth in 10CFR50.46(b). The SBLOCA EM error is discussed in section 2.5 of Attachment 2. Attachment 2 provides a description of the analyses and evaluations that have been completed during the reporting period for ANO-2.

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This submittal contains no commitments. Should you have any questions regarding this submittal, please contact me.

Sincerely,

R. Fuller for J. R. Cotton

Sherrie R. Cotton
Director, Nuclear Safety Assurance

SRC/nbm
Attachments

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Attachment 1

Each of the 2001 licensing analyses or evaluations applicable to ANO-1 is described below, with the inclusion of the reporting category and applicable PCT change. Limiting ECCS analyses are tracked for the Mark-B9 fuel rod design for both the CRAFT2-based and RELAP5-based EMs.

1.1 CRAFT2-Based EMs

The current licensing basis for ANO-1 is based on the CRAFT2 EM described in References 1.13 and 1.14. The CRAFT2 analyses applicable to ANO-1 are described in References 1.10 and 1.11. No new analyses have been performed in 2001 based on this EM.

1.1.1 Preliminary Safety Concern (PSC) 2-00, CRAFT2-Based EMs

PSC 2-00 (Reference 1.1) evaluated the EM assumption that SBLOCA analyses with loss-of-offsite power (LOOP) (which results in immediate reactor coolant pump (RCP) trip) predict more severe consequences than analyses that model the availability of the RCPs until the operators manually trip them according to procedures. Analyses of large SBLOCAs based on the RELAP5-based BWNT LOCA EM (Reference 1.12) for some Babcock and Wilcox (B&W) plants with the incorporation of the RCP Two-Phase Degradation Model for SBLOCA error correction have shown that more severe consequences may be obtained when modeling an RCP trip at two minutes after the loss of subcooling margin (LSCM).

No CRAFT2 analyses or evaluations have been performed to determine the impact of PSC 2-00 on the current CRAFT2 evaluations for ANO-1. However, based on the RELAP5 evaluations that credited the low-pressure injection (LPI) cross-tie for the core flood tank (CFT) line break analysis, it can be estimated that the PCT change associated with PSC 2-00 is 0°F. This is a new application and the first estimate of the effect of two minute RCP trip on the limiting PCT.

1.1.2 LHR Reduction for Cycle 17, CRAFT2-Based EMs

Evaluations have determined that the CRAFT2-based EM analyses are valid up to approximately 8.4% steam generator (SG) tube plugging (Reference 1.7). In order to accommodate the potential of the cumulative SG tube plugging exceeding this limit during the cycle 17 refueling outage, the LOCA linear heat rate (LHR) limits applied to ANO-1 were reduced such that they would remain valid considering the RELAP5-based BWNT LOCA EM (Reference 1.12). With the reduction (References 1.8 and 1.9), the core power distribution analyses and subsequent core operational limits would remain valid in the event that the CRAFT2-based EM was no longer applicable because of high SG tube plugging.

A partial set of RELAP5-based BWNT LOCA EM large-break LOCA (LBLOCA) cases were performed to support the LHR limits utilized in the cycle 17 core power distribution analyses. The CRAFT2 LHR limits were conservatively adjusted with the results of these analyses to be applicable to a change to the RELAP5-based methodology if it had been necessary. However, since the ANO-1 SG tube plugging did not exceed the CRAFT2 allowed plugging limit during the cycle 17 refueling outage, it was not

necessary to implement a change in the ECCS licensing basis at that time. Therefore, the PCT change associated with reducing the LHR limits for ANO-1 Cycle 17 is 0°F. This is a new application and the first application of results for reduced LHR limits.

1.2 RELAP5-Based EM

RELAP5-MOD2B&W was not the licensing basis EM for ANO-1 for 2001. However, Entergy is in the process of changing the ANO-1 licensing basis to analyses performed based on the BWNT LOCA EM (Reference 1.12), which uses the RELAP5-MOD2B&W and associated computer codes. Information relating to the RELAP5-based analyses has been reported in previous years' ECCS reports (References 1.2 and 1.3). For information only, the following is presented regarding changes to the RELAP5-based EM that have occurred in 2001 which could affect the ANO-1 application once it becomes the ANO-1 licensing basis.

1.2.1 BEACH Topical Report Error Correction, RELAP5-Based EM

No analyses were required to support the BEACH Topical Report error correction of the initial cladding temperature at the onset of reflood. The error correction simply increases the range of initial cladding temperatures allowed at the onset of reflooding and supports the EM analyses that have already been performed.

1.2.2 PSC 2-00, RELAP5-Based EM

Preliminary Safety Concern 2-00 (Reference 1.1) evaluated the EM assumption that SBLOCA analyses with LOOP (which results in immediate RCP trip) predict more severe consequences than analyses that model the availability of the RCPs until the operators manually trip them according to procedures. Analysis of large SBLOCAs (0.4 ft² CFT line break, 0.3ft², 0.5ft², and 0.75ft² cold leg pump discharge (CLPD)) for some B&W plants with the incorporation of the RCP Two-Phase Degradation Model for SBLOCA error correction have shown that more severe consequences may be obtained when modeling RCP trip at two minutes after the LSCM.

For the resolution of PSC 2-00, the larger SBLOCAs were analyzed for ANO-1 at 2772 megawatts (thermal) (MW(t)) with manual RCP trip at two minutes following LSCM (Reference 1.1). For the CFT line break analysis, credit for the availability of the LPI cross-tie line was taken. The ANO-1 LPI system has the LPI cross-connect line open, and the cavitating venturis in the individual LPI lines passively balance LPI flow to both CFT nozzles. This configuration assures that some LPI flow is obtained even for a CFT line break with only one creditable LPI pump. The assurance of some LPI flow reaching the core for the CFT line break transient allows acceptable consequences to be obtained for ANO-1 with a manual RCP trip at two minutes following LSCM.

1.2.3 LBLOCA at Current CFT Tech Specs, RELAP5-Based EM

In early 2001, a partial spectrum of LBLOCA cases was completed to support the potential of exceeding the CRAFT2 steam generator tube plugging limit of 8.4% (Reference 1.7). The partial spectrum of LBLOCA cases for Mark-B9 fuel (Reference 1.5) for ANO-1 assumed current technical specification CFT

conditions and modeled the ANO-1-specific Byron-Jackson RCP type. The previous generic analyses (Reference 1.4) had assumed different CFT parameters and had modeled the Westinghouse RCP type, which was found to be limiting with respect to PSC 1-99 (Reference 1.6). Since the ANO-1 steam generator tube plugging has not exceeded the limit, it was not necessary to complete the spectrum of LBLOCA cases in 2001.

1.2.4 References

- 1.1 FRA-ANP Document 51-5009856-00, "Summary of PSC 2-00 Analyses," 4/13/01
- 1.2 FRA-ANP Document 47-5007106-00, "1999 DRAFT ECCS Annual Letter," 2/16/00
- 1.3 FRA-ANP Document 47-5011843-00, "2000 DRAFT ECCS Annual Letter," 4/19/01
- 1.4 FRA-ANP Document 86-5002073-02, "Summary Report for BWOG 20% TP LOCA", 7/28/99
- 1.5 FRA-ANP Document 86-5010462-00, "ANO-1 R5 LHR Limits Summary Report," 4/2/01
- 1.6 FRA-ANP Document 51-5006132-00, "PSC 1-99 Resolution," 1/18/00
- 1.7 FRA-ANP Document 51-1258105-00, "SA Review of SG Tube Plugging Limits," 9/17/96
- 1.8 FRA-ANP Document 51-5010524-00, "ANO-1 Cycle 17 Task 4 RR Input," 1/29/01
- 1.9 FRA-ANP Document 51-5010524-01, "ANO-1 Cycle 17 Task 4 RR Input," 4/4/01
- 1.10 FRA-ANP Document 86-1244489-00, "SBLOCA ECCS Evaluation for CR-3," 5/31/96
- 1.11 FRA-ANP Proprietary Document 32-1202149-04, "Mk-B9 LL Spectrum LOCA Study," 3/29/95
- 1.12 FRA-ANP Document BAW-10192-PA, "BWNT Loss-Of-Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," June 1998
- 1.13 FTI Topical Report BAW-10104P-A, Rev. 5, "B&W's ECCS Evaluation Model," November 1988
- 1.14 FTI Topical Report BAW-10154-A, Rev. 0, "B&W's Small-Break LOCA ECCS Evaluation Model," July 1985

Attachment 2

ECCS performance evaluations for ANO-2 are performed using NRC-approved EMs based on the 1985 EM for LBLOCA and the S2M model for SBLOCA. For the calendar year 2001, Westinghouse (formerly ABB-CE) made the following changes and error corrections to the EMs or application of the models (CENPD-279, Supplement 13, Revision 1, Attachment 1 to LTR-OA-02-36, Revision 1, dated April 16, 2002). The impacts of the changes or error corrections on the peak cladding temperature (PCT) for ANO-2 are described below.

2.1 1999 EM for LBLOCA

The 1999 EM was added as an option to the existing codes that support the 1985 EM for LBLOCA and the SBLOCA models. These changes have no effect on the results produced for the 1985 EM or the S2M models. Although the 1999 EM was introduced for licensing analysis in the year 2001, ANO-2 ECCS performance analyses are based on the 1985 EM and S2M models for the calendar year 2001. The power uprate submittal that was approved by the NRC in 2002 included results from the 1999 EM.

2.2 Integrated STRIKIN-II Rod Temperature Code

The integrated STRIKIN-II code combines the codes HCROSS, PARCH, and STRIKIN-II and is used in the various EMs for the large and small break LOCA licensing analyses. This change has no effect on the results of the ECCS performance analysis.

2.3 ZIRLO Cladding Properties

An option for selecting ZIRLO properties was added to various codes. This has no impact on results produced for Zircaloy-4 cladding. ANO-2 uses Zircaloy-4 and not ZIRLO.

2.4 Change in Computer System State

The change in the computer system state involved changes to the compiler and loader options and implementation of a new version of the operating system. These changes did not impact the PCT for the 1985 EM. The impact to the PCT for the S2M model is <0.1°F (included in the change reported in the next section).

2.5 Code Error in CEFLASH-4AS

The CEFLASH-4AS code is used to simulate the blowdown phase of the SBLOCA event. A coding error resulted in exceeding array dimensions in CEFLASH-4AS. This error was corrected in 2001. The correction resulted in the PCT based on the S2M ECCS EM to increase by 21°F. The impact of this error on the PCT to support power uprate was 24°F and was reported to NRC by letter dated June 27, 2001 (2CAN060109).

2.6 Error in the PARCH Module of the Integrated STRIKIN-II code

Errors were found in the PARCH module of the integrated STRIKIN-II code in 2001. The errors were corrected, and the impact of these corrections on the LBLOCA results is

negligible. There is no impact to the SBLOCA results. There was no impact on the PCT.

2.7 Summary

The sum of the absolute magnitude of the PCT changes for the 1985 EM to date is less than 1°F. The accumulated change in cladding temperature for the small break LOCA S2M EM is 21°F. For ANO-2, in the calendar year 2001, the changes or error corrections to the ECCS EMs, or the application of these models, did not result in a significant increase (greater than 50°F) in the PCT or non-conformance to the additional criteria set forth in 10CFR50.46(b).