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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report 50-313/95-001-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(ii)(B) and 10CFR50.46(a)(3)(ii), enclosed is the subject report concerning a condition involving the Loss-of-Coolant Accident evaluation model calculation.

Very truly yours,

for Dwight C. Mims
Director, Licensing

DCM/kjm

enclosure

010040

IE22

cc: Mr. Leonard J. Callan
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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Arkansas Nuclear One - Unit One	05000313	1 OF 5

TITLE (4) Increase in Calculated Peak Fuel Cladding Temperature Resulting From Loss of Coolant Accident Evaluation Model Errors Due to Human Error and Computer Code Data Handling

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	27	95	95	001	00	02	24	95	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)					
POWER LEVEL (10)	72.5	20.402(b)		20.405(c)		50.73(a)(2)(iv)	70.71(b)
		20.405(a)(1)(i)		50.36(c)(1)		50.73(a)(2)(v)	70.71(c)
		20.405(a)(1)(ii)		50.36(c)(2)		50.73(a)(2)(vii)	X OTHER
		20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)	Specify in Abstract Below and in Text
		20.405(a)(1)(iv)	X	50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Kimberly J. Miller, Nuclear Safety and Licensing Specialist	501-858-4605

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

In a letter dated January 27, 1995, B&W Nuclear Technologies (BWNT), notified ANO-1 of two conditions (nonconservative input of core flooding tank (CFT) initial conditions and nonconservative data handling by the computer code) related to the Large Break Loss-of-Coolant Accident (LBLOCA) evaluation model calculations. Either of these conditions, when corrected in the model, appears to result in a peak cladding temperature (PCT) change in excess of 50 degrees Fahrenheit to a value greater than 2200 degrees if the assumed LOCA linear heat rate (LHR) remains unchanged. A 1.3 kW/ft reduction of the LOCA limit at the 2 ft core elevation was found to envelop all analyses and ensure that PCTs would not exceed 2200 degrees. Although re-evaluated BWNT maneuvering analyses, with the 1.3 kW/ft reduction included, showed that no core operating limits were affected, ANO-1 immediately initiated steps to administratively reduce the LOCA LHR alarm limits on the plant computer. The root cause of the nonconservative input of CFT conditions was human error. The root cause of the nonconservative data handling was the use of a computer code that is unsophisticated by current standards. This event was reported pursuant to 10CFR50.72(b)(1)(ii) at 1120 hours on January 27, 1995, and the enclosed report is provided as required by 10CFR50.46(a)(3)(ii) and 10CFR50.73(a)(2)(ii)(B).

A. Plant Status

At the time this condition was identified, Arkansas Nuclear One, Unit One (ANO-1) was operating at 72.5 percent power. One reactor coolant pump was not operating due to motor bearing failure. Reactor Coolant System (RCS)[AB] average temperature was approximately 579 degrees Fahrenheit and RCS pressure was 2155 psig.

B. Event Description

In a letter dated January 27, 1995, B&W Nuclear Technologies (BWNT), the Nuclear Steam Supply System (NSSS) vendor, notified the NRC and ANO-1 of two conditions related to the Large Break Loss-of-Coolant Accident (LBLOCA) evaluation model calculations. Either of these conditions, when corrected in the model, appears to result in a peak clad temperature (PCT) change in excess of fifty degrees, to a value greater than 2200 degrees if the assumed LOCA linear heat rate (LHR) remains unchanged. The two concerns are nonconservative input of core flooding tank (CFT)[BP] initial conditions and nonconservative handling of data by the computer code used for the calculations.

While performing LOCA studies using RELAP5/MOD2 for Oconee, BWNT identified that the most limiting LHR limit for a ruptured-node limited case is produced by minimum CFT gas pressure and maximum liquid inventory. These observations were confirmed on November 15, 1994, by calculations which were performed using CRAFT2, and affect the Mk-B9 fuel used by ANO-1. The B&W Owners Group (BWOG) Analysis Committee was informed of the results via telephone conversation on November 16, 1994. At that time, it was decided to perform plant-specific analyses to attempt to resolve the concern. On November 28, 1994, BWNT issued a Preliminary Safety Concern (PSC) internally to address the issue. BWNT procedures, written to satisfy 10CFR21, allow 60 days (until January 27,1995) to determine whether or not the issue is reportable.

On December 15, 1994, the BWOG Analysis Committee was informed via telephone that the preliminary plant-specific analyses did not produce results that indicated that the PCT would be maintained below 2200 degrees Fahrenheit should a LBLOCA occur during a period when the CFT pressure was at its minimum and CFT inventory was at its maximum. During the same conversation, the committee was informed that BWNT also found that CRAFT2 handled some data nonconservatively; specifically that there was a nonconservative transfer of enthalpy from CRAFT2 to THETA. As with the RELAP5 findings, a 1.3 kW/ft reduction of the LOCA limit at the 2 ft core elevation was found to envelop all analyses and ensure that PCTs would not exceed 2200 degrees. Although the re-evaluated BWNT maneuvering analyses, with the 1.3 kW/ft reduction included, showed that no core operating limits are affected, ANO-1 immediately initiated steps to administratively reduce the LOCA LHR alarm limits on the plant computer.

The BWOG Steering and Analysis Committees were informed in separate telephone conversations on January 25, 1995, that BWNT would not be able to complete their analyses and determine reportability by the January 27 deadline and that there would be an interim report filed with the NRC per 10CFR21. BWNT confirmed that core operating limits remained bounding (would not change) and that a reduction of the LOCA LHR limit of 1.3 kW/ft at the 2 ft elevation ensures that PCTs would not exceed 2200 degrees in the event of a LBLOCA (actual analysis resul[illegible]ed reductions of 0.3 to 1.3 kW/ft were needed depending on the plant and fuel designs). The [illegible]im report, dated January 27, 1995, was transmitted to the NRC.

With regard to the nonconservative input of CFT conditions, it was believed that minimum CFT inventory would produce the worst case results. However, the revised analyses show that CFT injection could end before the downcomer is completely filled when CFT maximum inventory and minimum pressure is considered since maximum CFT liquid inventory results in minimum CFT gas volume. This condition then limits the core inlet flooding rate and results in the 2 ft elevation PCT exceeding 2200 degrees unless the LOCA LHR limit at that elevation is reduced. Until the time that the Oconee RELAP5 sensitivity studies were performed, it was believed that minimum CFT inventory would produce the limiting LBLOCA analysis results at all elevations.

While trying to resolve the concern of nonconservative input of CFT conditions, the nonconservative data handling was discovered. A variation in the CRAFT2 core path inlet enthalpy supplied to THETA1-B for the fuel pin thermal analysis was observed. The enthalpy was supplied to THETA1-B on a coarse data frequency of one point every 0.5 seconds, while the enthalpy is actually subject to high frequency oscillations that correspond to the changes in instantaneous flow direction. The calculated PCT was found to be sensitive to the enthalpy sampling because a large difference existed between the two nodes surrounding the 2 ft elevation. For the analysis of the fuel design used by ANO-1, the coarse data sampling frequency had resulted in a nonconservative enthalpy, which led to improved heat removal and a higher allowable 2 ft LOCA LHR limit.

In addition to the high frequency oscillations, it was determined that the enthalpy could also be skewed in the nonconservative direction by a nonhomogeneous treatment of the core following total dryout with a return to two-phase conditions. The blowdown model is constrained to homogeneous flows calculated by homogeneous conditions. As long as the nodes remain continuously two-phase, the homogeneous conditions are correctly calculated. However, after total dryout and return to two-phase conditions, the homogeneous condition is not met. CRAFT2 then separates the node into steam and liquid phases. Due to the flow path connections, the inlet flow path enthalpy, which is transferred to THETA1-B, would be artificially lower than the nodal homogeneous enthalpy. This nonhomogeneous behavior occurs at all core elevations, but its timing and duration are a function of the core height. The increase in PCT due to nonhomogeneous behavior appears to be less than 20 degrees, but adds to the already nonconservative results at the 2 ft elevation. Thus, the second problem, nonconservative data handling, consists of two

code problems. (CRAFT2/THETA is the approved code/model for ANO-1. RELAP5 is not yet reviewed and approved for use for LOCA calculations.)

The ANO-1 core also contains Mk-B8 fuel. The LOCA limits for this fuel were established by analysis using the TACO2 and TACO3 codes. Although the licensing basis for these codes utilized nominal CFT conditions as input, and is therefore not subject to CFT input changes, the analyses appear to be subject to the nonconservative enthalpy data transfer condition. However, the time-in-life LOCA analyses show a large margin to the acceptance criterion of 10CFR50.46 for PCT. Thus, the impact of the nonconservative handling of data by the computer code is not as great on the Mk-B8 fuel as it is on the Mk-B9 fuel and the 1.3 kW/ft administrative reduction of the LOCA LHR alarm limit at the 2 ft core elevation already completed on the plant computer is considered to envelop the Mk-B8 limits.

C. Root Cause

This event consists of two separate conditions. The root cause of the nonconservative input of CFT conditions was human error. The root cause of the nonconservative data handling was the use of a computer code (CRAFT2) that is unsophisticated by current standards.

These conditions occurred even though BWNT used NRC approved computer codes and LOCA models, performed sensitivity studies, operated under a 10CFR50, Appendix B, QA program with independent review of the code inputs and results, and utilized knowledgeable personnel to complete the analyses. The new BWNT modeling techniques and computer codes are current state-of-the-art, just as the original techniques/codes were in the mid-1970's.

D. Corrective Actions

The LOCA LHR alarm limits on the plant computer that are used to verify margin between actual core operating conditions and values for which core protection following LBLOCA can be ensured have been administratively reduced by 1.3 kW/ft for the 2 ft core elevation based on BWNT recommendations for fuel cycle 12.

ANO-1 will ensure that a Software Change Notice is issued by BWNT to administratively reduce the LOCA limit at the 2 ft elevation for use during fuel cycle 13 which follows the current refueling outage (1R12).

BWNT is continuing the evaluation of the effect of the two conditions. This evaluation is anticipated to be complete by August 1, 1995 and will include the consideration of all fuel loaded in the ANO-1 core. Any additional corrective actions that are indicated as being required by the final report documenting resolution of these concerns will be issued for ANO-1 by August 31, 1995.

E. Safety Significance

The operating limits for ANO-1, established by maneuvering analyses, were extremely conservative with respect to LOCA LHR limits. Reduction of the LOCA limits by 1.3 kW/ft had no effect upon the actual core operating limits since DNB limits are far more limiting for ANO-1 than are the LOCA LHR limits. Because of the margin between the operating limits and the LOCA analysis limits, ANO-1 never operated, and could not have operated, in a condition that would have placed the core at risk of exceeding a PCT of 2200 degrees due to this condition. In addition, BWNT provided technical justification in their PSC to the NRC that these conditions were not considered to be safety significant. For the reasons outlined above, this event is considered to be of low safety significance.

F. Basis for Reportability

10CFR50.46(a)(3)(ii) states, in part, "Any change or error correction that results in a calculated ECCS performance that does not conform to the criterion set forth in paragraph (b) of this section [PCT >2200 degrees] is a reportable event as described in § § 50.55(e), 50.72 and 50.73."

This event was reported pursuant to 10CFR50.72(b)(1)(ii) at 1120 hours on January 27, 1995.

This report is provided pursuant to 10CFR50.46(a)(3)(ii) and 10CFR50.73(a)(2)(ii)(B).

G. Additional Information

No previous similar events have been reported as Licensee Event Reports at ANO-1. This condition involves the LBLOCA analysis of ANO-1 only and does not affect ANO-2 since only BWNT uses CRAFT2 and BWNT was not the NSSS supplier for ANO-2.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].