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AUTH.NAME AUTHOR AFFILIATION
BURCHFIELD,J.E. Duke Power Co.
MCCOLLUM,W.R. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 99-003-00:on 990512,LTOP was noted inoperable.Caused by misapplication of design input.Revised setpoints & limits of ACs to assure operators have at least 10 minutes to mitigate potential LTOP events.With 990607 ltr.

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Duke Power
A Duke Energy Company

W. R. McCollum, Jr.
Vice President

Duke Power
Oconee Nuclear Site
7800 Rochester Highway
Seneca, SC 29672
(864) 885-3107 OFFICE
(864) 885-3564 FAX

June 7, 1999

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
Licensee Event Report 269/99-03, Revision 0
Problem Investigation Process No. 0-O-99-1225

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 269/99-03, concerning the effects of nitrogen in the reactor coolant system pressurizer on the Operability of the Low Temperature Overpressure Protection System.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(i)(B) and (a)(2)(ii)(B). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

W. R. McCollum, Jr.

Attachment

cc: Mr. Luis A. Reyes
Administrator, Region II
U.S. Nuclear Regulatory Commission
61 Forsyth Street, S. W., Suite 23T85
Atlanta, GA 30303

Mr. D. E. LaBarge
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

INPO Records Center
700 Galleria Parkway, NW
Atlanta, GA 30339-5957

Mr. M. A. Scott
NRC Resident Inspector
Oconee Nuclear Station

NRC FORM 366 (4-95) | U.S. NUCLEAR REGULATORY COMMISSION | APPROVED OMD NO. 3150-0104 EXPIRES: 04/30/98

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)
Oconee Nuclear Station, Unit 1	05000 269	1 of 8

TITLE (4)

Low Temperature Overpressure Protection Inoperable: Misapplication of Design Input

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(S)
									Unit 2	05000 270
05	12	1999	1999	- 03	- 00	06	07	99	Unit 3	05000 287

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (Check one or more of the following) (11)					
POWER LEVEL (10)	100	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)		
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)		
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)		
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)			
		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	
	AREA CODE	
J.E. Burchfield, Regulatory Compliance Manager	(864)	885-3292

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

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SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e. approximately fifteen single-space typewritten lines) (16)

On May 12, 1999, with Oconee Units 1, 2 and 3 in Mode 1 at approximately 100 percent power, it was determined that one train of Low Temperature Overpressure Protection (LTOP) Administrative Controls (ACs) required by Technical Specification 3.4.12 were deficient. These ACs are intended to assure operators have at least 10 minutes to mitigate a LTOP event. The deficient ACs would not have allowed 10 minutes for operator action if all pressurizer heaters were actuated with nitrogen (N2) in the pressurizer. This condition could have previously existed for more than the four hour Completion Time of TS 3.4.12, Required Action F.1, to implement compensatory measures. At 1329 hours, the NRC was notified via the Emergency Notification System.

The presence of N2 in the pressurizer had not been adequately considered in prior LTOP analyses that established limits and setpoints for the LTOP ACs. The cause of this error was a misapplication of design input. After concluding that the effects of N2 in the pressurizer had not been analyzed, Operations was conservatively notified to implement the required compensatory measures. Following reanalyzes of the LTOP scenarios, the setpoints and limits of the ACs were revised to assure operators have at least 10 minutes to mitigate potential LTOP events. This event was of no safety significance.

EVALUATION:

BACKGROUND

The Low Temperature Overpressure Protection (LTOP) system is designed to protect the Reactor Coolant System (RCS) [EIIS:AB] from overpressurization at temperatures less than 325 degrees F by providing a relief path. The requirements are outlined in Technical Specification (TS) 3.4.12 and the associated Bases. Two trains of LTOP are required. The first train is an active train which consists of a Power Operated Relief Valve set to relieve at a low pressure setpoint. The second train consists of Administrative Controls necessary to assure that operator action can be taken within 10 minutes during a LTOP event to prevent overpressurization of the RCS. The requirements of the second train consist of a combination of limits and controls as follows:

1) Limits on RCS pressure and pressurizer level.

2) Isolation or depressurization of both Core Flood [EIIS:BP] Tanks.

3) Deactivation of both High Pressure Injection (HPI) [EIIS:BG] trains.

4) Restrictions on RCS makeup flow.

5) Operability requirements for audible pressurizer level and RCS pressure alarms.

6) Controls on the high pressure nitrogen system [EIIS:LK].

7) TS Amendment 302 added limits on the number of available RCS pressurizer heater [EIIS:HTR] banks.

Except where indicated, all further discussion is based on the TSs as they existed prior to implementation TS Amendment 302. This amendment revised the reactor pressure vessel (RPV) P-T and LTOP limits for usage through 26 EFPY. TS Amendment 302 was implemented at the rate of one unit per day on May 11 through May 13, 1999. The issue described in this report was addressed in the TS amendment implementation process.

TS 3.4.12, Condition F, requires implementation of compensatory measures to monitor for initiation of an LTOP event within four hours when the Administrative Controls train of LTOP protection is not implemented. The compensatory measures are designation of an Operator dedicated to monitoring for initiation of a LTOP event.

The above limits and administrative controls provide protection from non-ductile failure of the RCS for the following LTOP design basis events:

1) Erroneous actuation of the HPI system.

2) Erroneous opening of the Core Flood Tank discharge valve.

3) Erroneous addition of nitrogen to the pressurizer.

4) Makeup control valve fails full open.

5) Pressurizer heaters erroneously energized.

6) Temporary loss of the decay heat removal system's capability to remove decay heat from the RCS.

7) Thermal expansion of the RCS after starting a reactor coolant pump as a result of the stored energy in the steam generators.

This report concerns brief periods of operation when the requirements of TS 3.4.12, Required Action F.1 were not met. During those periods, the Oconee units were in a condition outside the design bases of the plant.

EVENT DESCRIPTION

By letter dated March 16, 1999, Framatome Technologies (FTI) informed the B&W Owners Group, which includes Duke Energy Corporation (Duke), of a Preliminary Safety Concern (PSC). The PSC involved analysis of the peak RCS pressure response to a LTOP event initiated due to inadvertent opening of the High Pressure Injection RCS makeup flow control valve when there is nitrogen in the pressurizer as opposed to steam.

On receipt of the FTI PSC, Duke recognized that the Oconee LTOP analyses did not specifically analyze nitrogen in the pressurizer or RCS. On March 31, 1999, Duke started developing appropriate analytical tools with a conservative RCS model needed to evaluate the LTOP design bases events with nitrogen in the pressurizer.

By April 5,1999, preliminary evaluations indicated that nitrogen in the pressurizer may reduce the operator response time to less than 10 minutes. Consequently, Operations was informed that the compensatory measures required by TS 3.4.12, Required Action F.1, were to be implemented as a conservative measure when nitrogen was present in the pressurizer and TS 3.4.12 was applicable.

On May 12, 1999, analysis of the applicable LTOP design bases was completed with the newly developed analytical tools. The analysis concluded the LTOP Administrative Controls were inadequate if any of the units were placed in a condition where nitrogen was present in the pressurizer and all pressurizer heater banks were functional. Approximately 7.5 minutes were available for operator response from the first RCS pressure alarm for events involving energization of all pressurizer heaters. This time is less than the operator response time required by LCO 3.4.12. This condition could have existed for more than the four hour Completion Time to implement compensatory measures allowed by TS 3.4.12, Required Action F.1 during unit startup. For all other LTOP scenarios, the Administrative Controls provided the required 10 minutes mitigation time.

On May 12, 1999, at approximately 1329 hours, with Oconee Units 1, 2 and 3 in Mode 1 at approximately 100% power, the NRC was notified via the Emergency Notification System that the Oconee units would have been outside of the design bases of the plant anytime the above described circumstances existed.

CAUSAL FACTORS

The engineering calculations Duke used to determine LTOP protective limits and controls were initially developed between 1987 and 1989. During this period, a detailed evaluation was performed to determine all

potential LTOP initiators and the limiting conditions of operation from which the identified events could occur. It was determined during the evaluation that nitrogen gas could be present in the pressurizer for certain LTOP events. Due to the lack of analytical tools then available at Duke that could specifically address a non-condensable gas such as nitrogen, engineering judgment was used. It was judged that the conservatism included in the LTOP analyses that modeled a steam bubble would adequately account for any transient response differences resulting from the use of nitrogen rather than steam. This approach to dispositioning the presence of nitrogen was not documented as an assumption in the original LTOP evaluation. The effect of nitrogen was raised again when FTI issued the PSC on March 16, 1999.

The magnitude of the impact of a nitrogen bubble rather than a steam bubble in the LTOP analysis is not large. Many other initial and boundary conditions in this analysis are selected to be very conservative in order to provide a conservative overall result. In terms of time, the operator would have had 7.5 minutes to respond with a nitrogen bubble, rather than 10 minutes with a steam bubble. Although the nitrogen bubble does affect the analysis results, the safety margin in the LTOP analysis assumptions and model, and the vessel stress analysis, support the conclusion that the impact of a nitrogen bubble is not large.

Therefore, the root cause of this condition is misapplication of design input due to a failure to quantify the impact of the above described assumption in 1987 through 1989. This failure resulted from an unavailability of analytical tools and an inaccurate assumption. This deficiency was not recognized in subsequent LTOP analyses revisions performed in 1991, 1994 and 1998. These analyses revisions used the same methodology to revise the existing LTOP limits to meet revised RPV P-T limits. The failure to subsequently consider the presence of nitrogen in the pressurizer occurred because the: 1) the original assumption regarding nitrogen was not documented, and 2) analyses revisions were performed by different engineers who were unaware of the original assumption.

Since 1991, procedures for engineering calculations and analysis contain more detailed documentation requirements including documentation of

assumptions/engineering judgments. Had the above assumption been documented in the calculation, the procedure existing since 1991 would have required re-validation of the assumption for each revision. Since the assumption was not documented, there was no opportunity for revalidation.

CORRECTIVE ACTIONS

Immediate:

Duke reviewed the Oconee LTOP analyses to determine applicability of the FTI PSC to the current Oconee LTOP limits and controls. Duke initially determined the existing LTOP Administrative Controls may not provide operators with >/= 10 minutes needed to mitigate an LTOP event when nitrogen was present in the pressurizer. As a conservative measure, on April 5, 1999, Operations was instructed to enter TS 3.4.12, Required Action F.1, whenever there was nitrogen in the pressurizer.

Subsequent:

1. Duke initiated a thorough review of the LTOP analyses supporting the: 1) existing LTOP TS limits and controls, and 2) revised P-T and LTOP limits and controls approved by the NRC on March 31, 1999, as TS Amendment 302. Duke revised these analyses to identify the limits and administrative controls needed to provide adequate protection to the RPV during LTOP operations.

2. As part of the TS Amendment 302 implementation, Duke revised the LTOP Administrative Controls described in the LCO section of the TS 3.4.12 Bases to address the issue. These revisions reduced RCS pressure alarm setpoints to provide >/= 10 minutes response time to mitigate an LTOP event when nitrogen was present in the pressurizer. On May 13, 1999, implementation of TS Amendment 302 was completed with the revised Administrative Controls.

3. On May 11, 1999, Duke submitted a TS Amendment Application to the NRC which would extend P-T and LTOP limits to 33 EFPY. This application is based on analyses using recently approved ASME Code

Cases which provide considerably higher P-T and LTOP limits. The LTOP Administrative Controls described in this Amendment Application were revised prior to submittal to provide the needed >/= 10 minutes response time with nitrogen in the pressurizer.

Planned:

None. The present procedural controls for calculations and analyses implemented in 1991 described in the above Causal Factors discussion are adequate to prevent recurrence. No further corrective action relative to the cause of this event is planned.

SAFETY ANALYSIS

This condition was of little safety significance for several reasons.

The LTOP scenario where all pressurizer heaters are erroneously energized credits use of an audible alarm at a RCS pressure of 345 psig to alert the Operators to mitigate a LTOP event. Pressurizer heater use is manually controlled during LTOP operations utilizing procedures to maintain the desired RCS pressure. There is no single equipment failure that could energize all pressurizer heaters while in the manual mode of control. Indicating lights in the control room illuminate when any pressurizer heater bank is energized. It is unlikely that this condition would continue unnoticed to the point of exceeding LTOP conditions since an operator is controlling them in manual. There is also another audible RCS pressure alarm at 450 psig available to the operator to aid in detection and termination of a LTOP event. The 0-2500 psig (wide range) pressure transmitter(s) are not utilized for LTOP events but would be available to the operator. They could be utilized to determine if the RCS pressure was unexpectedly increasing.

The operational evolutions involved with filling the RCS and creating a pressurizer steam bubble and the subsequent nitrogen venting is an involved process with very restrictive procedural limits. During this process, operators pay close attention to operational parameters needed to maintain the RCS within these limits. Although the operator mitigation response time, from the first LTOP alarm at 345 psig to exceeding the P-T limits, had been reduced to approximately 7.5 minutes,

it is highly unlikely the alarm point would be reached before detection and de-energization of the pressurizer heaters. Should the RCS pressure increase to the 345 psig alarm point without detection, it is likely that operators would determine the cause of the alarm and de-energize pressurizer heaters within 7.5 minutes before reaching the PORV opening setpoint of 480 psig. Additionally, operators would be alerted to increasing pressure by the 450 psig RCS pressure alarm. The 450 psig alarm provides sufficient time to mitigate the event if all pressurizer heaters are promptly de-energized. In the event that operators do not de-energize pressurizer heaters, the PORV would automatically open and maintain RCS pressure at </= 480 psig.

In the remote event that operators responded to the first LTOP alarm and the PORV failed to open or its block was closed, the RCS would reach approximately 550 psi 10 minutes after the alarm. Analyses performed in support of the TS amendment application submitted on May 11, 1999, show that the most limiting P-T for all three units is 555 psi at 60 degrees F. It is therefore concluded that operator action within 10 minutes would have been adequate to protect the RPV against non-ductile failure for the LTOP limits and restrictions prior to implementation of TS Amendment 302.

ADDITIONAL INFORMATION

A review of LERS for misapplication of design inputs over the last four years was conducted. There were no LERs associated with misapplication of design input. The condition described in LER 269/98-09 involved the LTOP system but had a different root cause. Therefore, this event is considered non-recurring.

This condition did not result in personnel injuries, radiation overexposures, or releases of radioactive materials. There were no equipment failures associated with this event.