

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9809240082 DOC.DATE: 98/09/17 NOTARIZED: NO
 FACIL:50-269 Oconee Nuclear Station, Unit 1, Duke Power Co.
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 BURCHFIELD, J.E. Duke Power Co.
 MCCOLLUM, W.R. Duke Power Co.
 RECIP.NAME RECIPIENT AFFILIATION

DOCKET #
05000269

SUBJECT: LER 98-011-00: on 980819, determined that available NPSH for RBS pumps were outside of design basis. Caused by incorrect interpretation of plant licensing basis. Operability assessment concluded RBS sys is operable. With 980917 ltr.

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 TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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W. R. McCollum, Jr.
Vice President

September 17, 1998

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 269/98-11, Revision 00
Problem Investigation Process No.: 98-3889

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 269/98-11, concerning a condition that resulted in the plants being operated outside their design basis.

This report is being submitted in accordance with 10 CFR 50.73 (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,

WR McCollum / JF Stokes

W. R. McCollum, Jr.

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Attachment

9809240082 980917
PDR ADOCK 05000269
S PDR

Document Control Desk

Date: September 17, 1998

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cc: Mr. Luis A. Reyes
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NRC Resident Inspector
Oconee Nuclear Station

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) Oconee Nuclear Station, Unit One	DOCKET NUMBER (2) 05000 269	PAGE (3) Page 1 of 11
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TITLE (4)
Available NPSH for RBS Pumps Outside Design Basis Due to Incorrect Interpretation

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)	
08	19	98	98	- 11	- 00	09	17	98	Oconee Unit Two	05000 270	
									Oconee Unit Three	05000 287	

OPERATING MODE (9) N THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (Check one or more of the following) (11)

POWER LEVEL (10) <input type="checkbox"/> 0	20.402(b)	20.405(a)(1)(i)	20.405(a)(1)(ii)	20.405(a)(1)(iii)	20.405(a)(1)(iv)	20.405(a)(1)(v)	20.405(c)	50.36(c)(1)	50.36(c)(2)	50.73(a)(2)(i)	50.73(a)(2)(ii)(B)	50.73(a)(2)(iii)	50.73(a)(2)(iv)	50.73(a)(2)(v)	50.73(a)(2)(vii)	50.73(a)(2)(viii)(A)	50.73(a)(2)(viii)(B)	50.73(a)(2)(x)	73.71(b)	73.71(c)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
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LICENSEE CONTACT FOR THIS LER (12)

NAME J.E. Burchfield, Regulatory Compliance Manager	TELEPHONE NUMBER AREA CODE (864) 885-3292
--	--

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)

YES (f yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> X	NO	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 August 11, 1998, the Nuclear Regulatory Commission staff issued a request for additional information (RAI) regarding Oconee's response to Generic Letter 97-04. This RAI implied that the licensing basis for the available net positive suction head (NPSHa) for the reactor building spray (RBS) pumps did not permit reactor building (RB) overpressure to be credited. On August 19, 1998, with Unit 1 in cold shutdown, and Units 2 and 3 operating at 100% full power, Duke concluded that utilizing RB overpressure to assure adequate NPSHa to the RBS pumps was not within the licensing basis. As a result, this condition was reported to the NRC in accordance with 10 CFR 50.72(b)(2)(i) for Unit 1 and 10 CFR 50.72(b)(1)(ii)(B) for Units 2 and 3. The root cause of this condition was an incorrect interpretation of the Oconee licensing basis. Opportunities to identify this condition were missed due to failure to update the UFSAR periodically in accordance with 10 CFR 50.71(e), and performance of an inadequate 10 CFR 50.59 evaluation. The corrective actions include an assessment of operability, submittal of a License Amendment Request, consideration of other means to provide additional NPSH margin, conducting a review of supporting 10 CFR 50.59 evaluations for past UFSAR changes, evaluating applicable processes against industry standards, and training.

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EVALUATION:

Background

On May 5, 1972, Duke filed Amendment No. 31 to its Application for License for the Oconee Nuclear Station. This submittal provided Revision 19 to the Oconee Final Safety Analysis Report which included a discussion of the evaluation used to establish minimum net positive suction head (NPSH) for the low pressure injection (LPI) [EIIS:BP] and reactor building spray (RBS) [EIIS: BE] pumps. The referenced analysis addressed two cases. One case took credit for reactor building (RB) pressure, and the other assumed the RB total pressure was equal to the saturation pressure of the sump water. The referenced analysis demonstrated that the available NPSH (NPSHa) was greater than the required NPSH (NPSHr) for the RBS and LPI pumps for both cases.

On July 6, 1973, the Nuclear Regulatory Commission (NRC) issued a Safety Evaluation for Oconee Nuclear Station, Units 2 and 3. This Safety Evaluation contained the original licensing basis for the NPSHa for the reactor building spray (RBS) pumps. The Safety Evaluation contained the following statements:

- 1) in Section 7.1.5, "... the applicant used the Oconee "as-built" configuration, sizes, layouts, etc., and made assumptions based on both credit for reactor building pressure and no credit for reactor building pressure (saturation pressure of sump water);"
- 2) in Section 7.1.5, "In all cases for the low pressure injection pumps, the available NPSH exceeded the required NPSH for the worst case assumptions of maximum sump temperature and no credit for building pressure;" and
- 3) in Section 7.2, "The staff requested that the applicant provide analysis in the FSAR to justify that the containment spray pumps have adequate net positive suction head. This analysis was performed with the analysis for the ECCS pumps described in Section 7.1.5 and the results were the same."

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The NRC Safety Evaluation for Oconee Nuclear Station, Unit 1, and its Supplements are silent regarding the assumptions that were utilized in the NPSH calculations for the LPI and RBS pumps.

Description of Event

To address potential non-conservatisms identified with the original net positive suction head (NPSH) calculations for the reactor building spray (RBS) pumps, a new NPSH calculation (OSC-4361) was developed in May 1991. This calculation credited a limited amount of reactor building (RB) overpressure to assure adequate available NPSH (NPSHa) for the RBS pumps. The calculation included the following statement: "The RB pressure is 2 psig or greater for sump temperatures below 212 F. Although Oconee did not take credit for RB pressure in its original NPSH analysis, Oconee is exempted from Regulatory Guide 1.1 and thus is allowed to do so." The calculation contained a reference to Section 7.1.5 of the NRC's Safety Evaluation for Units 2 and 3 dated July 6, 1973. The calculation contained assumptions and results which were different than those presented in the Updated Final Safety Analysis Report (UFSAR). This calculation was not incorporated into the UFSAR, as a result the changes made by this calculation were not reviewed against the criteria of 10 CFR 50.59.

In February 1992, another NPSH calculation (OSC-4467) was developed which determined the needed RB pressure for a range of expected post-accident sump temperatures. This calculation was not incorporated into the UFSAR, as a result the changes made by this calculation were not reviewed against the criteria of 10 CFR 50.59.

In April 1996, revision 1 to OSC-4467 was issued. The Oconee UFSAR was also revised at this time to remove outdated information. The 10CFR50.59 evaluation which supported the UFSAR change resulting from the revised NPSH analysis concluded that the change did not involve an unreviewed safety question. The evaluation did not specifically address crediting a limited amount of RB overpressure to assure adequate NPSH would be available for the RBS pumps.

Historically, Duke believed its licensing basis only required the ability to demonstrate that the NPSHa to the RBS pumps was greater than the NPSHr. Duke did not believe it was prohibited from crediting RB overpressure, as

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long as the RB overpressure required to assure adequate NPSH for the RBS pumps was less than the minimum predicted RB pressure based on conservative analysis. The rationale for this belief was:

1) Duke believed that the precedent had been set to utilize RB overpressure, if needed, to assure adequate NPSHa. This belief was based on the fact that the original UFSAR contained a summary of an NPSH analysis which addressed cases with RB overpressure assumed and without overpressure assumed. This analysis was referenced in the NRC's Safety Evaluation dated July 6, 1973; and

2) Oconee Units 1, 2, and 3 were not licensed to Regulatory Guide (RG) 1.1.

Generic Letter (GL) 97-04, "Assurance of Sufficient Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Pumps," requested licensees to submit information necessary to confirm the adequacy of the NPSHa for emergency core cooling and containment heat removal pumps.

Duke provided Oconee's response to GL 97-04 on January 5, 1998. In the response, Duke stated:

- 1) "the current design-basis NPSH analysis is different than that reviewed and approved by the NRC;"
- 2) "The original SER does acknowledge the crediting of overpressure, although the current analysis credits somewhat higher building pressure;"
- 3) "Containment overpressure was credited in the calculation of available NPSH;"
- 4) the RB overpressure required to assure adequate available NPSH was 2.28 psi for the RBS pumps, and 0 psi for the low pressure injection pumps; and
- 5) the RB overpressure available was 2.90 psi.

At the time Duke submitted the response to GL 97-04, the NPSH calculation of record was revision 2 to OSC-4467, "RB Pressure Needed for RBS

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Operation." Revision 2 of this calculation is no longer the calculation of record. Duke is in the process of revising OSC-4467. The calculation continues to credit RB overpressure to assure NPSHa is greater than the required NPSH for the RBS pumps.

On August 11, 1998, the NRC staff issued a request for additional information which implied that the licensing basis for the available NPSH for the RBS pumps did not permit RB overpressure to be credited. Following receipt of the NRC's letter dated August 11, 1998, Duke reviewed its position to determine if Oconee Nuclear Station Units 1, 2, and 3 were operating within their licensing basis regarding NPSH for the RBS and LPI pumps. On August 19, 1998, with Unit 1 in cold shutdown and Units 2 and 3 operating at 100% full power, Duke concluded that utilizing a limited RB overpressure to assure adequate NPSH available to the RBS pumps was not within the licensing basis. As a result, this condition was reported to the NRC in accordance with 10 CFR 50.72(b)(2)(i) for Unit 1 and 10 CFR 50.72 (b)(1)(ii)(B) for Units 2 and 3.

CONCLUSIONS:

This condition did not involve equipment failures, personnel injuries, or radioactive releases/exposures.

Root Cause

The root cause of this event was an incorrect interpretation of the Nuclear Regulatory Commission's (NRC) Safety Evaluation for Units 2 and 3 dated July 6, 1973. From May 1991, through August 1998, the responsible Duke personnel did not interpret the licensing basis to exclude the ability to credit reactor building (RB) overpressure to assure adequate available net positive suction head (NPSHa) for the reactor building spray (RBS) pumps.

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Missed Opportunities

On several occasions, Duke missed an opportunity to identify this issue. These missed opportunities were caused by:

- 1) Failure to revise the Updated Final Safety Analysis Report (UFSAR) in accordance with 10 CFR 50.71(e) to reflect the changes made as a result of calculation OSC-4361 and revision 0 of calculation OSC-4467.

Prior to 1996, literal maintenance of the UFSAR was not fully appreciated at Oconee Nuclear Station. Additionally, the responsible Duke personnel knew that the calculation methodology for determining NPSHa for the RBS pumps was being refined. Thus, they were concerned about updating the UFSAR with information that may be incomplete or incorrect. These two factors led to the failure to revise the UFSAR to reflect the revised NPSH analysis for the RBS pumps prior to 1996.

For the time period of concern (i.e., 1991 through 1996), the UFSAR maintenance process was managed via a Regulatory Compliance departmental procedure. Also, UFSAR ownership was assigned on a chapter basis at the management level. Specific ownership at the more detailed level of sections was not in place. Therefore, accountability for UFSAR accuracy at a detailed level was not in place prior to 1996.

Duke's process for UFSAR updates has been significantly enhanced over the last two years. Section owners were identified in 1996, and a special review was conducted in 1996-1997 as a short-term action to improve UFSAR quality. On March 12, 1997, Nuclear System Directive (NSD) 220, "UFSAR Revision Process," was issued. It clearly defines the roles and responsibilities for the UFSAR update process. The expectations for the section owners are identified in this NSD. Section owners are responsible for assuring that their UFSAR sections are accurate. The overall sensitivity to UFSAR accuracy is evident by the increase in UFSAR change packages from 54 change packages in the 1996 update to 220 change packages for the 1997 update.

Additionally, Duke is in the process of conducting a voluntary review of the accuracy and completeness of the entire UFSAR. The scope of this review was defined in a letter to the NRC dated June 16, 1997, and is

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being conducted to the industry accepted NEI methodology. However due to the methodology used to conduct this review, the responsible Duke personnel have stated that the project would not have identified this issue. This expectation was confirmed by reviewing the draft package regarding Chapter 6 of the UFSAR which did not identify crediting of containment overpressure to assure RBS NPSHa as an open item or deficiency.

- 2) Failure to perform an adequate 10 CFR 50.59 evaluation of the changes made to the UFSAR in 1996 in support of revision 1 of calculation OSC-4467. The applicable 10 CFR 50.59 evaluation did not contain a technical discussion of the changes, because the responsible Duke personnel believed they were simply updating the UFSAR to reflect the most recent calculation. They believed the technical justification resided in the calculation. Thus, even if the 10 CFR 50.59 evaluation had technically addressed the changes, the responsible Duke personnel would have concluded that the UFSAR changes did not involve an unreviewed safety question.

Information Notice 96-55 and Generic Letter 97-04 provided Duke with an opportunity to review events from other operating facilities regarding NPSH issues. The responsible Duke personnel involved in the review of Information Notice 96-55 and the preparation of the response to Generic Letter 97-04 firmly believed that Duke's interpretation of the NRC's Safety Evaluation dated July 6, 1973, was valid. While the information notice and generic letter provided Duke an opportunity to review past practices, the interpretation of the original FSAR and NRC Safety Evaluation made it difficult to identify that crediting containment overpressure was inappropriate. The reviews focused on the technical adequacy of the NPSH analysis.

Previous Events

A review of Licensee Event Reports from the past two years was conducted to determine if this event was considered recurring. The following events were identified; thus, the event is considered to be recurring.

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Incorrect Interpretation

LER 50-269/98-10 reported that a test method did not meet the Technical Specification Requirement due to inadequate wording of a licensing submittal. This LER concluded that the accountable Duke personnel did not interpret ANSI N510-1975 to require use of pitot tube traverses on those systems where installed instruments existed. The corrective actions provided in this LER address the actions necessary to correct this single deficiency. It does not contain any corrective actions to address the decision making process.

Inadequate Safety Evaluation

LER 50-269/98-06 reported that an inadequate safety evaluation resulted in the plants being operated outside their design basis. This LER committed to complete the UFSAR Accuracy Review Project to verify that the UFSAR is consistent with existing plant design, configuration, and operation.

CORRECTIVE ACTION:

Immediate:

1. Duke performed an operability assessment which concluded that Oconee possessed reasonable assurance that adequate net positive suction head (NPSH) would be provided to satisfy the requirements of the reactor building spray (RBS) pumps for all design basis loss of coolant accidents (LOCA). Thus, Duke concluded that the RBS System for all three units is operable.

Subsequent:

None

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Planned:

1. Duke will submit a License Amendment Request to the Nuclear Regulatory Commission to resolve this issue. It will request credit for reactor building (RB) overpressure to ensure adequate available NPSH (NPSHa) for the RBS pumps.
2. Duke will evaluate additional methods to improve NPSH margin for the RBS System.
3. Duke will conduct a sampling review of changes to the Updated Final Safety Analysis Report (UFSAR) to determine the adequacy of the supporting 10 CFR 50.59 evaluations for the subject UFSAR changes. This review will focus on UFSAR changes made to incorporate calculations or revisions to calculations.
4. Duke will evaluate the applicable directives against the industry standards for conducting 10 CFR 50.59 evaluations (e.g., NUREG 1606) to determine how to strengthen Duke's process or Oconee's implementation of the Duke process. This evaluation will focus on the recommendations regarding the performance of 10 CFR 50.59 evaluations associated with changes in design information.
5. Duke will prepare a training package regarding recently identified inadequate 10 CFR 50.59 evaluations and provide training to the engineering personnel involved in the conduct of 10 CFR 50.59 evaluations. This training will emphasize recent industry events associated with unacceptable 10 CFR 50.59 evaluations.
6. Duke will issue a memorandum describing recent industry events that resulted from incorrect interpretations of the licensing or design basis to the appropriate Duke management. This memorandum will stress the importance of conservative decision making regarding interpretations of the current licensing and design bases.

Planned corrective actions 1 through 6 are considered to be NRC Commitment Items. These are the only NRC Commitment items contained in this licensee event report.

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SAFETY ANALYSIS:

Duke's reactor building (RB) response analysis contains modeling assumptions and input parameters that tend to minimize the predicted RB pressure and maximize the RB sump temperature following a Loss of Coolant Accident (LOCA), thereby providing conservatism in how much overpressure can be credited for available net positive suction head (NPSHa).

A spectrum of scenarios were evaluated to ensure the worst case bounding conditions for the NPSH analysis were considered. In all cases, the NPSH analysis showed that the NPSHa exceeded the required NPSH (NPSHr) for all sump temperatures for the reactor building spray (RBS) pumps, given the available minimum RB overpressure.

Analysis of Failure to Achieve RB Overpressure

If the required RB overpressure is not available within the required time frame or a gross failure of the RB occurs, an NPSH deficiency for the RBS pumps could result due to the conditions in the RB during the post-LOCA sump recirculation mode of operation. The vendor for the RBS pumps has confirmed that the pumps would continue to function, although in a degraded manner. While the pumps would run rough under these conditions, mechanical failure would not be likely. The RBS pumps are ruggedly constructed and the cavitation effects would not be catastrophic. Under these conditions, the flow would be reduced to approximately 800 gpm.

Fission Product Scrubbing

For design basis accidents, fission product scrubbing by the RBS system is expected to occur if the RB conditions necessitate the use of the RBS. With the RB isolated, the post-accident RB pressure is seen to be greater than that needed for the NPSH margin. Gross failure of the RB integrity is needed to preclude the RB backpressure. Such a gross failure is very unlikely and is beyond the design basis.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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Impact on Severe Accident Risk

The RBS system performs no function related to maintaining reactor coolant system inventory or core heat removal. Therefore, the core damage frequency results are not affected by the potential failure modes of the RBS system.

Release mitigation following core damage accidents is accomplished by isolating the RB via the RB isolation system and by preventing RB failure from overpressurization by either the RB cooling system or the RBS system. For core damage sequences where the RBS system is available, the RBS system also plays a role in scrubbing the fission products in the reactor building atmosphere. In the current PRA (Rev. 2), the RBS system is seen to be failing for reasons other than the NPSH considerations (for example, loss of all power, containment bypass, etc.) for core damage sequences involving large early release. No sequences that contribute to the large early release are impacted by a loss of RBS during recirculation.

The reactor building cooling units (RBCUs) provide adequate heat removal to prevent RB failure as a result of overpressurization. As long as the RBCUs remain in operation no significant rise in RB pressure is expected on a loss of the RBS pumps. If the RB pressure is already so low that the RBS pumps may lose NPSH, then the driving force for a release from the RB is limited.

The potential for losing the RBS pumps as a result of loss of NPSH during the sump recirculation phase has essentially no impact on the probability and consequences of risk-significant accidents analyzed in the PRA. The core damage frequency is unaffected by the situation and the public health risk could only be impacted in an insignificant manner.

Conclusion

Based on the above, Duke concludes that the condition has no impact on public health and safety.