

APPENDIX A

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-285/88-22

License: DPR-40

Docket: 50-235

Licensee: Omaha Public Power District (OPPD)
1623 Harney Street
Omaha, Nebraska 68102

Facility Name: Fort Calhoun Station (FCS)

Inspection At: Fort Calhoun Station, Blair, Nebraska

Inspection Conducted: June 29 through July 18, 1988

Inspectors:

T. F. Westerman for
P. H. Harrell, Senior Resident Reactor
Inspector

7/27/88
Date

T. F. Westerman for
T. Reis, Resident Reactor Inspector

7/27/88
Date

Approved:

T. F. Westerman
T. F. Westerman, Chief, Project Section B
Division of Reactor Projects

7/27/88
Date

Inspection SummaryInspection Conducted June 29 through July 18, 1988 (Report 50-285/88-22)

Areas Inspected: Special, unannounced inspection of the thermal margin/low pressure reactor protection system trip setpoint and the limiting condition for operation for excore monitoring of linear heat rate.

Results: Two potential violations (inoperability of the thermal margin/low pressure trip function of the reactor protection system, paragraph 3; and reporting of inaccurate information, paragraph 7) were identified.

DETAILS1. Persons ContactedOPPD

- *K. Morris, Division Manager, Nuclear Operations
- #W. Gates, Plant Manager
- *J. Fisicaro, Supervisor, Nuclear Regulatory and Industry Affairs
- J. Gasper, Manager, Administrative and Training Services
- *K. Holthaus, Manager, Nuclear Engineering
- R. Jaworski, Section Manager, Technical Services
- *J. Keczy, Reactor Engineer
- *L. Kusek, Manager, Nuclear Safety Review Group (Acting Plant Manager)
- D. Matthews, Supervisor, Nuclear Licensing
- R. DeMeulmeester, Shift Supervisor
- #*C. Simmons, Plant Licensing Engineer
- J. Spilker, Operations Support Engineer
- *W. Weber, Supervisor, Reactor Performance and Analysis

*Denotes attendance at the exit interview conducted on July 8, 1988.

#Denotes attendance at the exit interview conducted on July 18, 1988.

The NRC inspectors also contacted other plant personnel including operators, technicians, and administrative personnel.

2. Improper Limit on Excure Monitoring of Linear Heat Rate

On June 28, 1988, licensee engineers were performing setpoint analyses and developing reactor protection system trip setpoints for the upcoming twelfth fuel cycle. The analyses revealed that the data for the limiting condition for operation (LCO) for excure monitoring of linear heat rate (LHR) was incongruous with the results obtained for the previous eleventh fuel cycle. The plant is currently operating in the eleventh fuel cycle. The licensee alerted the core vendor, Combustion Engineering (CE), of the discrepancy. Together, they investigated and found the LCO for excure monitoring of LHR was nonconservative for Cycle 11.

During the current cycle, the licensee was not required to monitor the LHR with the excure detectors. The use of excure detectors is required only when the incore detectors are inoperable. Had the licensee monitored this parameter during the cycle with the excure detectors, the current Technical Specification (TS) LCO 2.10.4(1)(c) would have allowed power operation at a maximum level of 90 percent when the reanalysis demonstrated that the maximum level should have been 86 percent to prevent exceeding the required LHR margin.

The limitation on LHR ensures that, in the event of a loss-of-coolant accident, the peak temperature of the fuel cladding will not exceed 2200°. This limitation is normally monitored by the incore detection system which provides an alarm function. In the absence of incore monitoring, linear heat is evaluated by the excore detectors. However, in this mode, operation is limited by TS LCO 2.10.4(i)(c). This LCO requires operation within the bounds of TS Figure 2-6. In developing the limits of TS Figure 2-6, the licensee failed to incorporate the required overpower margin (ROPM) in the calculations. This resulted in an allowed operational power greater (i.e., 90 percent versus 86 percent) than that allowed had the ROPM been properly incorporated into the calculations.

The licensee contended that had the use of the excore monitoring LCO been necessary during Cycle 11, the required LHR margin would not have been exceeded since sufficient margin would have existed due to the margin between the actual total planar radial peaking factor and the TS limit of 1.85. The maximum total planar radial peaking factor recorded in the current cycle is 1.72.

3. Nonconservative Reactor Protection System Setpoint

After the licensee confirmed the error concerning the excore monitoring of the linear heat rate, the entire Cycle 11 setpoint analyses were independently verified. It was found that the thermal margin/low pressure (TM/LP) trip function of the reactor protection system was set in a nonconservative direction by 79 pound per square inch (psia). This nonconservatism rendered all four TM/LP channels inoperable. Continuous operation with inoperable reactor protection system channels is an apparent violation of TS 2.15. (285/822-01)

The TM/LP trip is provided to prevent operation when the departure from nucleate boiling ratio (DNBR) is less than 1.18. DNBR is a function of total integrated radial peaking factor, mass flow rate, average coolant temperature, total flow, and reactor coolant system pressure.

In calculating the TM/LP setpoint for Cycle 11, the licensee failed to incorporate a penalty factor involving the total integrated radial peaking factor into the calculation. This resulted in a TM/LP setpoint lower than would normally be allowed. The significance of this is that during a depressurization event, the reactor would not trip until pressure decreased by 79 psia below the desired setpoint. This reduced pressure would cause conditions which would put the core closer to DNB.

FCS has not experienced any depressurization events during Cycle 11. The licensee contends that had one occurred, the violation of the TM/LP limiting safety system setting would not have allowed the DNBR limit to be exceeded because of the conservatism of the total integrated radial peaking factor inherent in the Cycle 11 core. This conservatism is reported by the licensee to be 180 psia.

The total radial peaking factor used in the calculation of thermal margin reactor pressure (Pvar) was 1.80 as allowed by TS. Paragraph 3.4.5 of the Updated Safety Analysis Report states that the maximum expected total integrated radial peaking factor for Cycle 11 is 1.69. The actual maximum recorded to date has been 1.68. Using the smaller value of the total radial peaking factor in calculating Pvar would trend this pressure in the conservative direction. The licensee stated that a value of 1.80 was used because the engineers realized that the value was conservative. The licensee stated that this cognitive action was taken to conservatively establish core operating limits as the engineers routinely add as much conservatism as possible to the calculations. This was done to ensure that the plant is operated with as much conservatism as possible within the established plant limitations.

The licensee reported that the error resulting from the failure to incorporate the total integrated radial peaking factor penalty factor into the computations was 79 psia in the nonconservative direction. This results in the as-found TM/LP setpoint being conservative by (180-79) 101 psia as reported by the licensee.

NRR will review the licensee's calculations to verify the conservatism asserted by the licensee.

4. Root Cause

Prior to Cycle 11, the licensee performed its setpoint analyses manually using an NRR-approved methodology. The results were verified internally within the licensee's organization. Beginning with Cycle 11, the licensee employed a computer-aided technique of performing the setpoint analyses. Due to a misunderstanding between CE and the OPPD staff during training, the licensee wrongly assumed that the ROPM term and the total integrated radial peaking factor penalty factor had been incorporated into the computer program algorithm, while the CE instructor training licensee personnel or the use of the new software assumed that the licensee would incorporate these factors.

The NRC inspector determined that the computer program supplied by CE was purchased under the requirements of the licensee's quality assurance (QA) program and the computer program is maintained in accordance with QA requirements. However, the licensee stated that no instruction manual was supplied with the computer program to inform the user on how to properly input data into the program.

When the licensee changed from manual calculations to computer program calculations, NRR was not notified via a change to the Topical Report used to describe the method of setpoint analyses used by the licensee. The licensee stated that a change was not required because the same method was being used, but in a computer program format.

The licensee personnel that performed the calculations for Cycle 11 were somewhat inexperienced in performing the calculations because they had

only done the calculations one previous time. This fact may have contributed to the omission of the ROPM in the calculation. To ensure that errors are not inadvertently made by the plant staff during the performance of setpoint analyses in the future, the licensee stated that they will have CE independently review all analyses.

5. Generic Implications

The licensee stated that for CE analog plants only FCS and Maine Yankee perform their own setpoint analyses. CE provides this service for the remainder of the domestic units. CE has asserted to the licensee that Maine Yankee methodology is not applicable and that this error was not generic to CE analog plants.

On July 11, 1988, CE issued a letter to the licensee's supervisor of reactor performance analysis confirming that OPPD is the only utility organization utilizing their own personnel to generate plant setpoints by employing the CE setpoint methodology.

6. Sequence of Events and Corrective Action

The excore monitoring of linear heat rate was found to be nonconservative at approximately 5 p.m. on June 28, 1988. Engineers continued working that evening and discovered that the TM/LP setpoint had also been affected by the transition from manual to computer-aided calculations. At this time, neither of the errors had been quantified and it was not known whether the TM/LP was affected conservatively or nonconservatively. The TM/LP setpoint was found to be nonconservative and this fact reported to the reactor engineer at approximately 7:30 a.m. on June 29, 1988. At this time, the nonconservative error had not yet been quantified.

The NRC inspector became aware of the potential problem when reviewing the shift supervisor's log at approximately 7:30 a.m. on June 29, 1988. The reactor engineer had left instructions in the log to call him in the event the linear heat rate monitoring by incore detectors became inoperable during the night.

In addition, the reactor engineer advised the onshift operations staff via log entry that there may be some errors in the TM/LP calculation. The reactor engineer informed the staff that he had determined that if cold-leg temperature was maintained below 541°F, the margin would be acceptable. It was further conveyed to the operations staff that there appeared to be no reportability requirements on these items.

The NRC inspector also observed an additional log entry on June 29, 1988, in which it was reported that the reactor engineer called and stated that due to the TM/LP problem he did not want the operations staff to reset the variable high power trip on a power increase from the present 90 percent setting.

At 10 a.m. on June 29, 1988, the plant manager, reactor engineer, and technical assistants briefed the NRC inspector on the situation. They explained that they had declared the TM/LP channels inoperable and had entered LCO 2.15(3) of the TS at 9:20 a.m. This LCO requires that the reactor be placed in hot shutdown within 12 hours if the channels are not returned to service. Plant management stated that resetting the TM/LP trip setpoints had begun and that the situation would be reassessed in 4 hours and at that time, if it did not appear that the equipment could be returned to operability within a reasonable time, an orderly shutdown would commence. A reasonable time frame was defined as leaving 4 to 6 hours for a controlled shutdown.

It was further explained that administrative controls had been placed on monitoring linear heat rate with the excore detectors. The licensee had determined that the parameters of TS Figure 2-6 were nonconservative. Therefore, the shift supervisor was directed to reduce power to 80 percent in the event that incore monitoring of linear heat rate became inoperable.

Pursuant to 10 CFR Part 50.72(b)(2)(iii), the licensee made a 4-hour report on the inoperability of the TM/LP channels to NRC Headquarters. The report was made at 12:50 p.m.

Throughout the day, the NRC inspector observed I&C technicians resetting the TM/LP setpoints of the reactor protection system with the use of approved procedures. The reactor engineer monitored their progress and assisted almost continuously. At 4 p.m., three of the four channels had been reset. The NRC inspector met with the plant manager at 4:30 p.m. to discuss the situation. The plant manager felt at that time the situation was under control and he would not have to commence shutdown, although he was prepared to do so. At 5:30 p.m., on June 29, 1988, all four channels of TM/LP were declared operable.

In response to the errors identified in the Cycle 11 analyses, the licensee requested that CE perform an independent review for the analyses that were done for Cycle 10. No problems were identified during the review. A review of the analyses was not performed by CE for Cycles 8 and 9. Cycle 8 was selected by the licensee as the appropriate cycle to perform reverification on the analyses since the analyses method was changed by the licensee starting with Cycle 8. The licensee submitted a Topical Report change to NRR and the Topical Report was approved. The licensee felt that a reverification of the Cycle 8 analyses was not appropriate since CE independently reviewed the analyses at the time the calculations were performed. The licensee felt that reverification of the Cycle 9 analyses was not required since CE worked closely with licensee personnel during performance of the calculations.

In addition to the above actions, the licensee is also mobilizing the management investigative safety team (MIST) to provide an indepth, independent review of this event. The MIST was established by the licensee to identify the root causes of events and provide recommendations for the permanent corrective actions to be taken to prevent recurrence.

When the MIST completes a review of these events in the near future, the licensee will take actions to implement the MIST recommendations.

7. Reporting

In July 1, 1988, the licensee submitted a letter to the NRC summarizing a telephone discussion held between the licensee, Region IV, and NRR on June 30, 1988, regarding the nonconservative errors discovered in the cycle 11 setpoint analyses and the corrective actions taken. The NRC inspector reviewed this document and found some of the information to be inaccurate.

The letter states, in part, that on June 28, 1988, the reactor engineer contacted the shift supervisor and discussed with him the conservative actions to be taken until the errors could be quantified. The letter further states that the shift supervisor placed, in his log, instructions that if any situation arose that necessitated the use of the excore linear heat rate LCO, the unit would be brought to 80 percent power and not the 90 percent power level identified in TS Figure 2-6.

The NRC inspector reviewed the shift supervisors log entry and found the instructions did not state that power should be reduced to 30 percent if the affected LCO was entered. Instead, the instructions stated that the shift supervisor should call the reactor engineer if the incore detectors became inoperable. The NRC inspector interviewed the on-duty (3:30 p.m. to 11:30 p.m.) shift supervisor who initially received the instructions from the reactor engineer and the p.m. shift supervisor could not recall receiving instructions that if the excore monitoring LCO was invoked to reduce power to 80 percent. At that time, he only recalls discussing a nonconservative but nonquantified error existing with TS Figure 2-6.

In addition, the p.m. shift supervisor did not recall the 80 percent limit being presented to him until the following day. The NRC inspector interviewed other personnel associated with the information provided to the on-duty p.m. shift supervisor. The reactor engineer stated that he discussed the 80 percent limit with the on-duty p.m. shift supervisor on two occasions. The reactor engineer also stated that he discussed the 80 percent limit with the night (11:30 p.m. to 7:30 a.m.) shift supervisor and the plant manager. During an interview with the night shift supervisor, the NRC inspector determined that the night shift supervisor also could not recall the reactor engineer discussing the 80 percent power limit. However, the night shift supervisor stated that the on-duty p.m. shift supervisor notified him of the 80 percent power limit during shift turnover.

During an interview with the plant manager, the plant manager stated to the NRC inspector that he had called the on-duty p.m. shift supervisor and had stated that, should problems with the incore detectors occur, power should be reduced to 80 percent. Therefore, it appears, even though the

on-duty p.m. shift supervisor could not recall being provided with the information, approximately 10 days after the event, that the information had been provided to him.

However, the information submitted by the licensee in the letter dated July 1, 1988, provided inaccurate information. This is an apparent violation of 10 CFR Part 50.9. (285/8822-02)

8. Exit Interview

The NRC inspectors met with Mr. L. T. Kusek (Acting Plant Manager) and other members of the licensee staff on July 8, 1988. At this meeting, the NRC inspectors summarized the scope of the inspection and the findings. On July 18, 1988, the NRC inspector met with Mr. W. G. Gates (Plant Manager) to discuss additional information related to this inspection that was discovered after the initial exit interview had been given.

APPENDIX B

PROPOSED ENFORCEMENT CONFERENCE AGENDA

OMAHA PUBLIC POWER DISTRICT

August 1988

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| I. Introduction and Purpose of Meeting | L. J. Callan |
| II. Licensee Presentation | OPPD Staff |
| III. NRC Comments | L. J. Callan |
| IV. Licensee Response | OPPD Staff |
| V. Closing Comments | L. J. Callan |