

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 50-263  
License No: DPR-22

Report No: 50-263/97010(DRS)

Licensee: Northern States Power Company

Facility: Monticello Nuclear Generating Station

Location: 414 Nicollet Mall  
Minneapolis, MN 55401

Dates: June 23 - 27, 1997

Inspector: V. P. Lugheed, Reactor Engineer

Approved by: M. A. Ring, Chief, Lead Engineers Branch  
Division of Reactor Safety

## EXECUTIVE SUMMARY

### Monticello Nuclear Generating Station NRC Inspection Report 50-263/97010(DRS)

This was a special inspection to review the issues surrounding the licensee's discovery of an error in the head loss across the emergency core cooling system suction strainers. The NRC position regarding use of containment overpressure was also discussed with the licensee.

- The licensee identified an original design problem with the suction strainer head loss. This was identified due to a voluntary initiative and would not have been discovered through normal licensee efforts, including engineering reviews. The problem was not indicative of current engineering performance. The licensee took the conservative action to shut down the plant while larger strainers, which would meet the design requirement, were installed. Although this is an apparent violation of NRC requirements (10 CFR Part 50, Appendix B, Criterion III "Design Control"), it involved an old design issue in which licensee identification was a result of a good questioning attitude. The corrective actions were comprehensive to prevent recurrence. The design issue was not likely to be identified by routine licensee efforts such as normal surveillance or quality assurance activities. As a result of the good efforts to identify and correct this subtle violation, the violation was not cited in accordance with Section VII.B.3 of the NRC Enforcement Policy. (Section E1.1)
  
- The Office of Nuclear Reactor Regulation staff concluded that Monticello did not have credit for containment overpressure in its licensing basis and that any use of containment overpressure required prior NRC review and approval. This is considered an apparent violation of 10 CFR 50.59. (Section E1.2)

### III. Engineering

#### **E1 Conduct of Engineering**

##### **E1.1 Licensee Identification of Increased Head Loss Across Emergency Core Cooling System Suction Strainers**

###### **a. Inspection Scope (37551)**

The inspector reviewed the licensee's actions in regard to the emergency core cooling system (ECCS) net positive suction head (NPSH) requirements. Included in this review were licensee event report (LER) 97-007 "Inadequate NPSH for the ECCS Pumps for Certain Single Failures During Loss of Coolant Events;" Information Notice 97-27 "Effect of Incorrect Strainer Pressure Drop on Available Net Positive Suction Head;" and the Updated Safety Analysis Report (USAR), Section 6.2 "Emergency Core Cooling System (ECCS)," and Section 14.7 "Loss of Coolant Accident."

###### **b. Observations and Findings**

After reviewing an LER from another utility, the licensee undertook an independent initiative to verify that the problem did not also affect the Monticello plant. The licensee determined that the same type strainers were installed in Monticello and that a similar mistake was made when the head loss for the strainers was computed during construction of the plant. The original manufacturer specified in design specification NX-8291-51, "Design Requirement for the Suction Strainers," that the strainers, which were original plant equipment, produced a head loss of 1 foot per 10,000 gallons. However, when the licensee reperformed the strainer head loss calculations, the actual head loss across the strainer was 11.7 feet per 10,000 gallons. This reduced the NPSH available to the ECCS pumps by approximately 7 feet.

The other utility's LER also identified a more limiting single failure in regard to calculating the available NPSH. Monticello engineers had previously considered a loss of one emergency diesel generator to be most limiting single failure, in terms of the effect upon the containment and drywell temperature and pressure. While this affected the NPSH available, due to the temperature effect upon the vapor pressure component of the head loss, it also resulted in some containment overpressure being available. The licensee took credit for this containment overpressure in their NPSH calculations. However, the other utility mentioned that a more limiting single failure, in terms of NPSH, was a low pressure coolant injection (LPCI) loop select failure. This failure resulted in all four LPCI pumps injecting water through a broken loop, which rapidly decreased containment pressure. Although the licensee, in 1976, had analyzed this event for the LPCI pumps, neither they nor the NRC recognized at that time that the core spray pumps had a more limiting NPSH requirement and that the available NPSH was not sufficient. In 1997, the licensee recognized the potential for a core spray pump NPSH problem and analyzed the LPCI loop select event for the core spray pumps. The results indicated that containment pressure would decrease to less than three pounds within the first ten minutes following a large break loss of coolant accident with a LPCI loop select

failure and that this reduction in containment pressure resulted in a loss of another 17 feet to the available NPSH, for a total of 24 feet.

The licensee's calculations, prior to these issues being identified, showed the short-term (0 - 10 minutes) NPSH available for the core spray pumps to be 50.0 feet. This assumed credit for use of containment overpressure, although NRC had questioned the acceptability of the practice (see Section E1.2 below). Reducing the available overpressure by the 24 feet of additional head loss resulted in the core spray pumps having only 26.0 feet of available NPSH compared to the 33 feet required. The licensee's calculations used the licensing basis assumption that one strainer was completely blocked, with the other three strainers available. The licensee performed an operability evaluation and determined the core spray pumps to be operable, but degraded, based on testing done by the pump manufacturer which showed the pumps could withstand a NPSH deficit of up to 10 feet without damaging the pumps. For the long term situation, the licensee stated that the operators would recognize the situation and reduce flow or isolate pumps to increase the available NPSH.

Although the licensing basis only required assuming one strainer was clogged, the NRC questioned whether this was realistic. Monticello had large amounts of fibrous material insulation inside the drywell as well as having strainers with a small surface area along with high approach velocities. Specifically, the Office of Nuclear Reactor Regulation (NRR) questioned whether the core spray pumps would be capable of reflooding the core in the first three minutes of an accident. While the licensee believed that they could perform analyses to demonstrate that reflooding would occur; they determined it would be prudent to shut down the plant until larger strainers could be installed. At the time of the inspection, the licensee was in the process of installing larger strainers which would have a head loss below the 1 foot per 10,000 gallon design requirement.

10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be established to assure that the design basis is correctly translated into specifications, drawings, procedures, and instructions.

During initial plant construction, the head loss across the emergency core cooling system suction strainers, which was a design basis value, was incorrectly translated into the design specification NX-8291-51 "Design Requirement for the Suction Strainers." This apparent violation of NRC requirements will not be cited in accordance with Section VII.B.3 of the NRC Enforcement Policy since it was licensee identified, appropriate corrective actions are planned and have been taken to prevent recurrence, this deficiency was not likely to have been identified by routine surveillance or quality assurance activities and the violation is not reasonably linked to current performance (NCV 50-263/97010-01).

c. Conclusions

The inspectors concluded that the licensee had identified an original design problem with the suction strainer head loss. This was identified by the licensee due to a voluntary initiative and would not have been identified through normal licensee efforts, including engineering reviews. The problem was not indicative of current



engineering performance. The licensee took the conservative action to shut down the plant while larger strainers, which would meet the design requirement, were installed.

## E1.2 Use of Containment Overpressure When Performing NPSH Calculations

### a. Inspection Scope (C - 51 and 92001)

During a safety system operational performance inspection (SOPI), ending January 8, 1997, the inspectors identified a concern with the licensee's increasing dependence upon use of containment overpressure to ensure adequate NPSH for the ECCS pumps. Because the licensee asserted that Monticello had been given credit for use of containment overpressure during their initial licensing, the issue was left as unresolved during the SOPI exit and the question on overpressure was submitted to NRR on February 14, 1997. On May 28, 1997, NRR replied to the Region's question.

### b. Observations and Findings

In the response to the unresolved issue, NRR replied that Monticello's Safety Evaluation Report (SER) did not discuss NPSH to the core spray or LPCI pumps. However, NRR noted that the SER referenced the Dresden Unit 2 facility in the SER as follows:

"3.5 Emergency Core Cooling System (ECCS): The Monticello ECCS utilizes the same concept and same subsystem designs, except for the automatic pressure relief system, as those reviewed and approved for the Dresden Unit 2 facility, which was recently licensed for operation."

NRR concluded that, since Dresden was specifically excluded from use of containment overpressure, that exclusion also extended to Monticello, via reference.

NRR also noted that, in May 1976, the licensee was asked to evaluate the LPCI loop select failure for the LPCI pumps. The licensee documented in its reply, that the LPCI pumps would have adequate NPSH, assuming that no containment overpressure was available, in accordance with Safety Guide 1. The licensee noted that they believed that containment overpressure would be available; however, NRR did not approve its use. This evaluation was referenced in USAR Section 6.2.3.3.3. However, the NRC did not require, and Monticello did not perform, an NPSH calculation for the core spray pumps at that time.

The NRR staff did note that the Technical Specification Bases for Section 3.7 stated that containment pressure was not initially needed to maintain adequate NPSH for the core spray, high pressure coolant injection, and LPCI pumps. However, it implied that containment overpressure would be necessary for the long term situation ("However, during an approximately one-day period starting a few hours after a loss-of-coolant accident, should one RHR loop be inoperable and should containment pressure be reduced to atmospheric pressure through any means, adequate NPSH would not be available.") Although NRR acknowledged that

the bases statement implied that containment overpressure was needed for the long term, and that technical specifications were in place to limit the time when containment overpressure would not be available, NRR determined that the statement did not grant NRC approval of the use of containment overpressure.

NRR concluded that Monticello does not have credit for containment overpressure in the licensing basis. NRR noted that NRC's position was that any reliance upon containment overpressure needed to be reviewed and approved by the staff, and that any increase in reliance upon containment overpressure would also need to be reviewed and approved. This determination was relayed to the licensee in a telephone call on May 6, 1997, as part of a discussion on the containment strainers (see above).

10 CFR 50.59(a) states, in part, that a holder of a license may make changes in the facility as described in the safety analysis report, without prior Commission approval, unless the proposed change involves an unreviewed safety question. A proposed change shall be deemed to involve a unreviewed safety question if the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report may be increased, if the possibility for an accident or malfunctions of a different type than evaluated previously in the safety analysis report may be created, or if the margin of safety as defined in the bases for any Technical Specification is reduced.

Monticello USAR, Section 14.7.2 describes ECCS performance following a design basis loss of coolant accident. The accident analysis, to ensure the acceptance criteria of 10 CFR 50.46 are met, assumes that the core spray system will provide a minimum of 2700 gallons per minute inside the core shroud.

However, the inspectors determined that ECCS performance after an accident would be affected in that adequate NPSH was not available for the core spray pumps under certain scenarios unless containment overpressure was credited. Without adequate NPSH, the core spray pumps were not designed to be able to meet the flow requirements (2700 gpm) specified in the safety analysis report and used in the accident analysis. The use of containment overpressure was not previously reviewed and approved by the NRC staff and is considered a change from the licensing basis for the Monticello plant. Therefore, this created a possibility for a malfunction of a different type than evaluated in the USAR. This is considered an apparent violation (EEI 50-263/97010-02).

c. Conclusions

The NRR staff reviewed the licensing basis for the Monticello Nuclear Plant. The NRR staff concluded that Monticello did not have credit for containment overpressure in the licensing basis and that any use of containment overpressure required prior NRC review and approval.

## **E8 Miscellaneous Engineering Issues**

- E8.1 (Closed) Unresolved Item 50-263/96009-04: Credit for Containment Overpressure in Performing NPSH Calculations. This issue was reviewed by NRR, who determined that containment overpressure credit was not part of the licensing basis for Monticello. Further details are discussed in Section E1.2. The unresolved item is closed.
- E8.2 (Closed) Unresolved Item 50-263/96009-06: Use of GOTHIC Computer Code Without Prior NRC Approval. This issue was referred to NRR for resolution. In a response dated May 23, 1997 [Accession # 9705300225], NRR concluded that it was acceptable for the licensee to use the GOTHIC computer code for outside containment high energy line break analyses as long as a benchmarking to the previously approved outputs exists and an evaluation, in accordance with 10 CFR 50.59, determined that prior NRC approval was not required. The inspectors confirmed that benchmarking to the previously approved outputs had been performed. However, the licensee acknowledged that no safety evaluation had been performed under 10 CFR 50.59 prior to using the GOTHIC code. During this inspection, the licensee stated that they had reviewed the USAR and determined that no reference to the previously used computer code existed. In a broader review, the inspectors noted that the high energy line break analyses contained in Appendix I of the USAR did not provide any discussion of the methodology used to determine the high energy line breaks or the equipment affected by those breaks. Therefore, the inspectors agreed that no safety evaluation was required, since the code was not described in the USAR. The unresolved item is closed.
- E8.3 (Closed) Licensee Event Report (LER) (50-263/97007), Revision 0: Inadequate NPSH for the ECCS Pumps for Certain Single Failures During Loss of Coolant Events. This issue is discussed in Sections E1.1 and E1.2. The LER is closed.

## **V. Management Meetings**

### **X1 Exit Meeting Summary**

On June 27, 1997, the inspectors discussed the inspection results with the plant manager. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

## PARTIAL LIST OF PERSONS CONTACTED

### Licensee

J. Beres, Licensing  
S. Engleke, Superintendent, Electrical and Instrumentation System Engineering  
J. Grubb, Superintendent, Electrical Design Engineering  
S. Hammer, Superintendent, Turbine System Engineering  
W. Hill, Plant Manager  
C. Schibonski, General Superintendent, Engineering  
P. Tobin, Engineer, Containment Systems  
M. Voth, Licensing Project Manager  
A. Ward, Manager, Quality Services  
A. Wojchowski, Superintendent, Safety System Engineering

### INSPECTION PROCEDURES USED

IP 37551: Onsite Engineering  
IP 93701: Followup

### ITEMS OPENED, CLOSED, AND DISCUSSED

#### Opened

50-263/97010-01 NCV Original Design Deficiency Concerning Strainer Head Losses  
50-263/97010-02 EEI USQ Regarding Use of Containment Overpressure

#### Closed

50-263/96009-04 URI Credit for Containment Overpressure in NPSH Calculations  
50-263/96009-06 URI Use of GOTHIC Computer Code  
50-263/97007-00 LER Inadequate NPSH for the ECCS Pumps for Certain Single Failures During Loss of Coolant Events  
50-263/97010-01 NCV Original Design Deficiency Concerning Strainer Head Losses



## LIST OF ACRONYMS USED

ECCS	Emergency Core Cooling System
EEI	Escalated Enforcement Item
LER	Licensee Event Report
LPCI	Low Pressure Coolant Injection
NCV	Non-Cited Violation
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
PDR	Public Document Room
RHR	Residual Heat Removal
SER	Safety Evaluation Report
SOP	Safety System Operational Performance Inspection
URI	Unresolved Item
USAR	Updated Safety Analysis Report