

November 4, 1991

Docket Nos. 50-282
and 50-306

Mr. T. M. Parker, Manager
Nuclear Support Services
Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Dear Mr. Parker:

SUBJECT: NRC BULLETIN 88-08, "THERMAL STRESSES IN PIPING CONNECTED TO REACTOR COOLANT SYSTEMS" (TAC NOS. 69673 AND 69674)

By letters dated September 30, 1988, and June 2, 1989, Northern States Power Company responded to NRC Bulletin 88-08. Your response stated that a review was performed of piping connected to the reactor coolant system (RCS). However, your response to Action 3 of the Bulletin does not provide sufficient assurance that unisolable portions of all piping connected to the RCS will not be subjected to combined cyclic and static thermal stresses and other stresses that could cause fatigue failure during the remaining life of the units. Because the fundamental precept of the actions of the Bulletin is to prevent the initiation of cracks in piping, inservice inspection is not an acceptable technique identified in the Bulletin for preventing such cracks. A program must be implemented to provide such assurance by means of either redesign or modification, or temperature and pressure monitoring. If you plan to provide such assurance for certain lines by inspection alone, such as by an inservice inspection program, further justification must be provided. Criteria contained in the enclosure (Evaluation Criteria) should help you in preparing an acceptable response. Your response is expected within 90 days.

Although no response was required relative to Supplement 3 of the Bulletin, some licensees have addressed Supplement 3 in their response to the Bulletin. Those who have not will not be required to provide a specific response to Supplement 3. However, you are reminded that having been informed of the phenomenon identified in that supplement, you are responsible for adequate review of both its applicability to your plant and any considered actions. NRC staff may audit or inspect the implementation of Bulletin 88-08 and its supplements at a future date.

Sincerely,
Original Signed By:
Armando Masciantonio, Project Manager
Project Directorate III-1
Division of Reactor Project III/IV/V
Office of Nuclear Reactor Regulation

Enclosure:
As stated
cc w/ enclosure:
See next page

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Prairie Island Nuclear Generating
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EVALUATION CRITERIA FOR RESPONSES
TO NRC BULLETIN 88-08, ACTION 3 AND SUPPLEMENT 3

1.0 OBJECTIVE

To provide continuing assurance for the life of the plant that unisolable sections of piping connected to the reactor coolant system (RCS) will not be subjected to thermal stratification and thermal cycling that could cause fatigue failure of the piping.

2.0 PURPOSE

To provide guidelines for evaluation of licensee responses, including acceptable procedures and criteria to prevent crack initiation in susceptible unisolable piping.

3.0 IDENTIFICATION OF POTENTIALLY SUSCEPTIBLE PIPING

- (1) Sections of injection piping systems, regardless of pipe size, which are normally stagnant and have the following characteristics:
 - A. The pressure is higher than the RCS pressure during reactor power operation.
 - B. The piping sections contain long horizontal runs.
 - C. The piping systems are isolated by one or more check valves and a closed isolation valve in series.
 - D. For sections connected to the RCS:
 - a. Water injection is top or side entry.
 - b. The first upstream check valve is located less than 25 pipe diameters from the RCS nozzle.

Examples of such sections in PWRs are the safety injection lines and charging lines between the reactor coolant loop and the first upstream check valve, and the auxiliary pressurizer spray line between the charging line and the main pressurizer spray line.

- (2) Sections of other piping systems connected to the RCS, regardless of pipe size, which are normally stagnant and have the following characteristics:
 - A. The downstream pressure is lower than RCS pressure during reactor power operation.
 - B. The piping systems are isolated by a closed isolation valve, or a check valve in series with a closed isolation valve.
 - C. There is a potential for external leakage from the isolation valve.

Examples of piping containing such unisolable sections in PWRs are the residual heat removal (RHR) lines. Examples of such piping for BWRs are the RHR lines and the core spray injection lines.

4.0 ACCEPTABLE ACTIONS

The following actions are considered as acceptable responses to Bulletin 88-08, Action 3 and Supplement 3, as applicable, provided that the requirements of Bulletin 88-08, Action 2 have been satisfied.

- (1) Revision of system operating conditions to reduce the pressure of the water upstream of the isolation valve below the RCS pressure during power operation.
- (2) Relocation of the check valves closest to the RCS to be at a distance greater than 25 pipe diameters from the nozzle.
- (3) Installation of temperature monitoring instrumentation for detection of piping thermal cycling due to valve leakage.
 - A. Type and location of sensors.
 - a. Temperature sensors should preferably be resistance temperature detectors (RTDs).
 - b. RTDs should be located between the first elbow (elbow closest to the RCS), and the first check valve (check valve closest to the RCS).
 - c. For the auxiliary pressurizer spray line, RTDs should be installed near the "tee" connection to the main pressurizer spray line or on the cold portion (ambient temperature) of the line.
 - d. RTDs should be located within six inches of the welds.
 - e. At each pipe cross section, one RTD should be positioned on the top of the pipe and another RTD on the bottom of the pipe.

B. Determination of baseline temperature histories.

After RTD installation, temperature should be recorded during normal plant operation at every location over a period of 24

hours. The resulting temperature versus time records represent the baseline temperature histories at these locations. Baseline temperature histories should meet the following criteria:

- a. The maximum top-to-bottom temperature difference should not exceed 50°F.
 - b. Top and bottom temperature time histories should be in-phase.
 - c. Peak-to-peak temperature fluctuations should not exceed 60°F.
- C. Monitoring time intervals.
- a. Monitoring should be performed at the following times:
 1. At the beginning of power operation, after startup from a refueling shutdown
 2. At least at six-month intervals thereafter, between refueling outages
 - b. During each monitoring period, temperature readings should be recorded continuously for a 24-hour period.
- D. Exceedance Criteria.

Actions should be taken to modify piping sections or to correct valve leakage if the following conditions occur:

- a. The maximum temperature difference between the top and the bottom of the pipe exceeds 50°F.
- b. Top and bottom temperature histories are in-phase but the peak-to-peak fluctuations of the top or bottom temperatures exceed 60°F.
- c. Top and bottom temperature histories are out-of-phase and the bottom peak-to-peak temperature fluctuations exceed 50°F.
- d. Temperature histories do not correspond to the initially recorded baseline histories.

- (4) Installation of pressure monitoring instrumentation for leakage detection in injection lines.

(Pressure monitoring is not the preferred method since pressure measurements cannot provide a measurement of thermal cycling in the unisolable pipe sections.)

A. Type and location of sensors.

- a. Pressure sensors should preferably be pressure transducers.
- b. Pressure transducers should be installed upstream and downstream of the first check valve.
- c. For systems having a pressure higher than the RCS pressure, pressure transducers may be installed upstream and downstream of the first closed isolation valve. (The downstream section is the pipe segment between the isolation valve and the check valve.)

B. Monitoring time intervals.

- a. Monitoring should be performed at the following times:
 1. At the beginning of power operation, after startup from a refueling shutdown
 2. At least at six-month intervals thereafter, between refueling outages
- b. Pressure readings should be recorded continuously for a 24-hour period.

C. Exceedance criteria.

Actions should be taken to modify piping sections or to correct valve leakage if the following conditions occur:

- a. For pressure measurements across a check valve, the downstream pressure (RCS pressure) is equal to or less than the upstream pressure at any time during power operation.
- b. For pressure measurements across a closed isolation valve, the downstream pressure is equal to or greater than the upstream pressure at any time during power operation.