UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO NRC BULLETIN 95-02

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

1.0 INTRODUCTION

NRC Bulletin (BL) 95-02, "Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode," was issued on October 17, 1995. It requested all holders of boiling-water reactor (BWR) operating licenses or construction permits for nuclear power reactors to take five actions to ensure that unacceptable buildup of debris that could clog strainers does not occur during normal operation. By letters dated November 16, 1995, February 14, and May 24, 1996, Northern States Power Company (NSP or the licensee) submitted its response to BL 95-02 for Monticello. In its response, NSP stated that all actions required by BL 95-02 had been satisfied.

2.0 DISCUSSION

The following describes the requested actions of BL 95-02 and NSP's response to each requested action.

Action 1

Verify the operability of all pumps which draw suction from the suppression pool when performing their safety functions (e.g., ECCS [emergency core cooling system], containment spray, etc.), based on an evaluation of suppression pool and suction strainer cleanliness conditions. This evaluation should be based on the pool and strainer conditions during the last inspection or cleaning and an assessment of the potential for the introduction of debris or other materials that could clog the strainers since the pool was last cleaned.

Summary of Response

During the 1993 outage and several prior outages, the licensee drained and cleaned the suppression pool as part of a program to inspect and repair the interior coating. Since the suppression chamber internal coating repair was completed during the 1993 outage, the suppression chamber was not completely drained during the 1994 outage. The water level was lowered to the top of the ECCS suction strainers for an inspection of the strainers. A moss-like slime was observed below the water level which would dry out when exposed to the

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atmosphere. This slime was easily brushed off and NSP concluded that it would not contribute to strainer plugging. In addition, no materials capable of plugging the strainers were observed. No fibrous materials were observed. In the 18-month period between the 1993 and 1994 outages there was no buildup of any material on the strainers that would contribute to plugging. Prior to commencing operation following the 1994 outage a final inspection of the suppression chamber was performed to verify no foreign materials were left inside. Since Monticello has a Mark I containment which is closed and inerted during operation, no foreign materials can be introduced after containment is closed. Sources of water addition to the suppression chamber are of high purity, consistent with reactor coolant system water quality. No entries have been made into the suppression chamber subsequent to the final inspection and closure of the suppression chamber hatches. Additionally, a sample of suppression chamber water/sediment was taken in November 1995 and only a few isolated fibers were observed. These fibers were of such a small quantity and size, i.e., most being microscopic, that NSP did not consider them to represent fibrous material capable of contributing to plugging the 1/8-inch-diameter openings in the ECCS suction strainers. The fibers contained in the sample were of insufficient quantity for performance of analyses to determine the source. NSP believes they may be residual fibers from Chem-Wipes used during wipe-down of the internal surface during past suppression pool cleaning.

A review of core spray pump inlet pressure data from 1993, following suppression chamber cleaning, to date does not indicate any degradation that would be indicative of strainer plugging. No inlet pressure data is available for the residual heat removal (RHR) pumps. However, since the core spray and RHR pumps take suction from a common ring header, the suction strainers utilized for either set of pumps are common. An additional assurance that the strainers are not plugged is provided by the fact that quarterly American Society of Mechanical Engineers (ASME) Section XI tests of the ECCS pumps have been completed satisfactorily since the beginning of this cycle.

Based on the above, NSP concluded that the ECCS pumps are operable and will not be compromised by suction strainer cleanliness concerns, as noted in the licensee's November 16, 1995, letter.

Action 2

Confirm the operability evaluation in requested Action 1 above through appropriate test(s) and strainer inspection(s) within 120 days of the date of this bulletin.

Summary of Response

On February 9, 1996, four RHR pumps were run for 6 hours in a suppression pool cooling mode configuration (recirculation of suppression pool water with no cooling). The inlet pressure taps to two RHR pumps were provided with more accurate instruments and pressures were recorded at regular intervals throughout the test. Additionally, since a common ring header provides suction for all the ECCS pumps, the inlet pressures to the core spray pumps were also recorded at regular intervals to provide additional data. The results of this test showed no degradation of inlet pressure to either of the RHR pumps or the core spray pumps which indicates that no plugging of the ECCS suction strainers occurred. Adequate cleanliness of the suppression chamber was demonstrated and operability of all pumps that draw suction from the suppression pool when performing their safety functions was confirmed, as noted in NSP's February 14, 1996, letter.

As noted in NSP's May 24, 1996, letter, during the 1996 refueling outage, the suppression chamber water level was lowered to the bottom of the suction strainers. Ninety percent of surface area of the four suction strainers was above water and available for visual inspection. The suction strainers were found to be in good condition with only incidental accumulation of debris. The total debris found would have covered approximately 0.04 square feet of the 20.64 square feet of total surface area of the four suction strainers. The remaining suction strainer surface area was free of debris and unobstructed. The minor quantity of debris found on the suction strainers consisted of pieces of tape material, paint chips, wood chips, glass wool material, and string-like material. The amount of material found was considered to be insignificant since it covered only 0.2 percent of the total suction strainer surface area. Monticello has four suction strainers connected to a common ring header. ECCS pump suction lines draw suction from the ring header. The design NPSH [net positive suction head] analyses for the ECCS pumps assume a complete blockage of one suction strainer, i.e., 25 percent of the total suction strainer surface area.

In addition to the strainer inspection, water with materials suspended during the drain-down of the suppression chamber was collected, and the bottom of one bay of the suppression chamber was vacuumed to collect sediment and debris. Analysis of the water sample identified fibers, but all were microscopic in size and were not considered to represent fibrous material capable of contributing to plugging the 1/8-inch-diameter openings in the suction strainers. Vacuuming of one bay of the suppression chamber collected the sediment that has been accumulating since the last cleaning of the suppression chamber in 1993. Evaluation of the sediment collected determined that there were about 320 pounds (moist weight) of sediment in the entire suppression chamber, and the sediment was accumulating at a rate of about 110 pounds per year. In addition to the sediment, a piece of tape and a few paint chips were vacuumed up in the one bay. The accumulation rate for sediment was very close to that reported by other BWR units and is not a concern since significant quantities of fibrous material were not identified as present.

Evaluation of inspection, sampling, and vacuuming results determined that the suppression chamber cleanliness was acceptable and additional cleaning was not required. The quantity and type of materials identified in the suppression chamber would not be sufficient to block an appreciable portion of even one of the four suction strainers. Since the design basis for the ECCS pump NPSH analyses assumes a complete blockage of one suction strainer, the small amount of debris does not represent a challenge to any of the ECCS pumps drawing suction from the suppression chamber pool.

Action 3

Schedule a suppression pool (torus) cleaning. The schedule for cleaning the suppression pool should be consistent with the operability evaluation in requested Action 1 above. In addition, a program for periodic cleaning of the suppression pool should be established, including procedures for the cleaning of the pool, criteria for determining the appropriate cleaning frequency, and criteria for evaluating the adequacy of the pool cleanliness.

Summary of Response

Monticello scheduled a suppression chamber cleaning for the 1998 refueling outage, as noted in NSP's November 16, 1995, letter (subsequently, the suppression chamber was cleaned

during the 1997 outage to replace the ECCS suction strainers). Monticello drains and cleans the suppression chamber every third refueling outage for coating inspection. The last suppression chamber cleaning (prior to the 1997 outage) was performed in 1993. During the April 1996 outage, the strainers and suppression chamber were visually inspected and samples of the suppression chamber water and sediment were analyzed for fibers or other material that could contribute to ECCS strainer plugging, as noted in the response to Action 2 above.

Monticello's suppression chamber cleaning program will be evaluated when the ongoing BWR Owners' Group and NRC staff investigations on ECCS strainer plugging due to LOCA (loss-of-coolant accident)-generated debris are complete (NRC Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling Water Reactors"), as noted in NSP's November 16, 1995, letter.

Action 4

Review FME [foreign material exclusion] procedures and their implementation to determine whether adequate control of materials in the drywell, suppression pool, and systems that interface with the suppression pool exists. This review should determine if comprehensive FME controls have been established to prevent materials that could potentially impact ECCS operation from being introduced into the suppression pool, and that workers are sufficiently aware of their responsibilities regarding FME. Any identified weaknesses should be corrected. In addition, the effectiveness of the FME controls since the last time the suppression pool was cleaned and the ECCS strainers inspected, and the impact that any weaknesses noted may have on the operability of the ECCS should be assessed.

Summary of Response

FME is controlled by site work instructions and procedures. The following documents cover general plant housekeeping and cleanliness control for the drywell, suppression chamber, and open systems:

4AWI-4.2.1, "Housekeeping," establishes general housekeeping practices for the Monticello plant.

4AWI-4.5-9, "Foreign Material Control/Cleanliness Control," establishes open system cleanliness and inspection requirements for work on plant systems opened for maintenance, modification or repair, and new systems during installation. This includes opening of the suppression chamber and systems which communicate with the suppression chamber.

Procedure 1371, "Drywell Prestart Inspection," provides general instructions for inspecting the drywell to ensure all temporary outage materials and debris are removed from the drywell and vent system prior to reactor startup.

Procedure 1132, "Pressure-Suppression Chamber Internal Structural Visual Inspection," provides for a thorough visual inspection of the internal structural members of the suppression chamber. This procedure includes verification of the integrity and cleanliness of the ECCS suction strainers.

Procedure 80800, "Primary Containment Hatch Closure Procedure," includes verification that prior to the last hatch closure all foreign material has been removed from the suppression chamber.

Site personnel are maintained aware of FME controls through periodic training. The procedures listed above were satisfactorily completed and/or implemented during the last refueling outage, as noted in NSP's November 16, 1995, letter.

Action 5

Consider additional measures such as suppression pool water sampling and trending of pump suction pressure to detect clogging of ECCS suction strainers.

Summary of Response

In accordance with ASME Section XI, quarterly operability tests are conducted on the RHR and core spray pumps. These tests currently measure flow and pump differential pressure. The results of these tests are currently being trended. Trending of core spray pump inlet pressure was established to monitor the performance of the ECCS suction strainers that are common to both the RHR and core spray systems, as noted in NSP's May 24, 1996, letter. This action will be implemented for the remainder of the current operating cycle and for the subsequent operating cycle (cycle 18), or until resolution of the ECCS suction strainer/LOCA-generated debris concern, as noted in NSP's November 16, 1995, letter.

3.0 EVALUATION

The purpose of the requested actions in the bulletin is to ensure that ECCS and other pumps drawing suction from the suppression pool do not experience an unacceptable buildup of debris that could clog strainers during normal operation, preventing the strainers from performing their safety function. Action 1 requested licensees to evaluate the operability of their pumps based on the cleanliness of the suppression pool and strainers. Action 2 then requested a verification of the licensee's assessment through a pump test and strainer inspection. These two actions serve to ensure that the pumps are currently operable and not experiencing an unacceptable debris buildup. Actions 3, 4, and 5 serve to ensure that appropriate measures, such as cleaning of suppression pools and strengthening of FME practices, are taken in the long term to prevent debris accumulation in the pool.

The staff has concluded that the licensee's assessment of the ability of all pumps drawing suction from the suppression pool to perform their safety function provides a reasonable basis for concluding that all of the pumps evaluated are operable. The licensee conducted an inspection to confirm that the ECCS systems were not affected by an unacceptable buildup of debris that could clog the pump strainers. The licensee indicated initial strainer cleanliness was good. The staff has concluded that the licensee's response meets the intent of requested Actions 1 and 2 and is acceptable. The staff has also concluded that the licensee's evaluation of the FME program and suppression pool cleaning program meets the intent of requested Actions 3 and 4 and is acceptable. The licensee's programs for trending pump suction pressure data, sampling suppression pool water/sediment, and periodically inspecting the strainers and suppression chamber provide additional opportunity for early identification of potential strainer fouling. The staff has concluded that these additional actions meet the intent of requested Action 5 and are acceptable.

4.0 CONCLUSION

Based on the staff's evaluation of the licensee's submittals, the staff finds NSP's response to BL 95-02 acceptable.

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