U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-263/84-13(DRS)

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

Licensee: Northern States Power Company
414 Nicollet Mall
Minneapolis, MN 55401

Facility Name: Monticello Nuclear Generating Plant

Inspection At: Monticello Site, Monticello, MN

Inspection Conducted: May 29-31, July 2-3, and August 31, 1984.

Inspector: D. H. Danielson for K. D. Ward — Date: 9/7/84

Approved By: D. H. Danielson, Chief
Materials and Processes Section — Date: 9/7/84

Inspection Summary

Inspection on May 29-31, July 2-3, and August 31, 1984 (Report No. 50-263/84-13(DRS))
Areas Inspected: Announced special safety inspection of inservice inspection (ISI) activities, recirculation system piping replacement, and licensee action on IE Bulletins and a 10 CFR Part 21 Reports. This inspection involved a total of 56 inspection-hours by one NRC inspector including 14 inspector-hours during off-shifts.
Results: No items of noncompliance or deviations were identified.

DETAILS

1. Persons Contacted

Northern States Power Company (NSP)

*W. Shamla, Plant Manager
*B. Day, Superintendent Operations Engineering
*M. Clarity, Assistant to the Plant Manager
*J. Schanen, Materials and Special Processes Specialist
L. Dahlman, Materials and Special Processes Specialist
D. Netzer, QA Engineer
J. Ricker, QA Specialist
G. Crosby, Lead QA Engineer
T. Gillman, Assistant Project Engineer
G. Crosby, QA

Lambert - MacGill - Thomas Incorporated (LMT)

B. Thomas, Level III Examiner

General Electric Company (GE)

R. Price, QC Supervisor

Hartford Steam Boiler Engineering and Insurance Company

M. Rudek, Authorized Nuclear Inservice Inspector (ANII)

The inspector also contacted and interviewed other licensee and contractor employees.

*Denotes the individuals present at the final exit interview on August 31, 1984.

2. Licensee Action on IE Bulletins

(Closed) IE Bulletin 83-05 (263/83-05-BB) ASME Nuclear Code pumps and spare parts manufacturing by the Hayward Tyler Pump Company. The inspector reviewed the final response dated August 8, 1983; Monticello neither has nor intends to purchase pumps or spare parts manufactured by the Hayward Tyler Pump Company. This IE Bulletin is considered closed.

3. Licensee Action on 10 CFR 21 Items

(Open) 10 CFR 21 Report (SS.H-17-84/01): Report of defective components. This item is still being worked and may be completed in the near future.

4. Inservice Inspection (ISI)

a. General

Reference Report No. 50-263/84-06

NSP contracted Lambert, MacGill, Thomas, Inc. (LMT) to perform the ISI in accordance with ASME Section XI, 1977 Edition, Summer 1978 Addenda, and General Electric (GE) to perform the visual examination on the reactor vessel. Westinghouse and NSP jointly performed a visual examination of the internal and external surfaces and the nozzles on the four feedwater spargers.

Ultrasonic examinations (UT) were performed on the following systems:

. Jet Pumps Instrumentation Nozzle and Canisters

Results: On the "A" loop, weld W-1 on the canister was cracked. Weld W-2 was acceptable and weld W-3 was not ultrasonically examined. Liquid penetrant examinations (PT) were also performed on welds W-1, W-2, and W-3 and were acceptable. On the "B" Loop weld JPAD-1 on the jet pump instrumentation nozzle N8A was acceptable. The "A" and "B" Loops will be replaced from the nozzle/safe end welds through the canister welds.

. Residual Heat Removal, "A" and "B" Loops

Results: On the "A" Loop weld #RHCF-20 and weld #RHCJ-21 were cracked. On the "B" Loop weld #RHBF-20 and weld #RHBJ-21 were cracked. "A" and "B" Loop piping were removed and are to be replaced.

. Feedwater Sparger

Results: Sparger #N4C, one crack from center of reactor vessel looking at vessel-nozzle #5 from T-box connection, left side. Sparger #N4D, three cracks from center of reactor vessel looking at vessel nozzles #6, 7, 8 from T-box connection, left side. Sparger #N4B, one crack, counting to the right from the tee nozzle #5. The feedwater spargers were removed for further inspection and the cracked nozzles were removed by GE for analysis. The following nozzles were PT'd, found cracked and removed:

. "D" Sparger - 8th nozzle to left of T-box.
. "B" Sparger - 5th nozzle to left of T-box.
. "C" Sparger - 7th and 10th nozzle to right of T-box.

The above nozzles were shipped to GE San Jose, California, for analysis. The conclusions of the analysis was that the most probable cause of the sparger nozzle fracture was high cycle fatigue, with initiation at the geometric discontinuity at the weld root in a region of high weld residual stresses.

General Electric will provide four new Monticello spargers. The new spargers will be (1) designed to eliminate a weld on each of the top-mounted nozzles, (2) fabricated using 316NG steel for the adapters and elbows and consumable inserts for welding, and (3) solution-heat-treated after final welding of the top-mounted nozzles. The program includes design and fabrication of a template to facilitate installation of the new spargers.

b. Procedure Review (Field Changes)

- NSP, Liquid Penetrant Examination, PT-1, Revision 3
- NSP, Ultrasonic Examination of Pipe Welds, UT-1, Revision 2
- NSP, Ultrasonic Examination of Pipe Welds, UT-16, Revision 2

No items of noncompliance or deviations were identified.

5. Recirculation System Piping Replacement

Reference Report No. 50-263/84-06

During the course of routine in-service inspection on September 28, 1982, crack-like indications were identified in the end cap of one of the recirculation system riser manifolds. Subsequent investigation confirmed the existence of four linear indications extending from the weld root into the adjacent heat-affected zone (HAZ), although no through-wall cracking was noted. The NRC was notified and advised that remedial measures were under investigation.

Upon further investigation, indications were found at five additional locations. Three indications were noted in the 12" riser to nozzle safe end welds and two were located in a riser pipe elbow. While preparing the recirculation safe-ends for repair, through-wall cracks were found in each of the three safe-ends. One elbow crack was found by leakage during hydro-static testing. The cracks were determined to be due to inter-granular stress corrosion cracking (IGSCC). (Cracks were equally distributed between both recirculation loops.)

As a result of these findings, Northern States Power (NSP) performed repairs (DC 82M087) and then entered into contracts with General Electric Company (GE) and Bechtel Power Corporation (Bechtel) for the replacement of ten inlet safe-ends and transition pieces, ten recirculation riser pipes using bent pipe instead of elbows, semi-circular manifolds using 22" x 12" reducers and 12" elbows on each manifold end, pump suction and discharge piping including a new flow element and suction safe-ends at the reactor vessel. This configuration eliminates the manifold end caps and the equalizer crosstie between loops A and B as well as 4" bypass line around the discharge valves. Two RHR valves (RHR 6-1 and 6-2) were replaced with new valves. The inspector observed machining on one of the new valves welded to the RHR pipe.

New pipe whip restraints were added on the horizontal run of the 12" ring header. The inspector also observed welding on the new pipe whip restraints.

Existing snubbers and hangers were modified as required. New pipe stops were added and the new RHR piping is being installed between the recirculation connections and RHR valves 6-1, 6-2 and 9. The three 4" MO valves and associated piping were installed during this outage, but was administratively controlled by NSP until a license amendment was processed and approved by the NRC.

Consistent with 10 CFR 50.55a for a plant whose construction permit was issued prior to January 1, 1971, the original recirculation system piping for Monticello was designed and fabricated in accordance with ASME Boiler and Pressure Vessel Code Section 1 and B31.1 Code for Pressure Piping. The recirculation pump casings were designed in accordance with ASME Section III, Class A.

Requirements for repairs were governed by ASME Code Section XI, IWA 4000.

NSP adopted to use later editions of the Code to replace the recirculation piping, consistent with IWA 7210 (c) of Section XI and NCA-1170 of Section III which allows the use of later editions of the Code. The replacements are consistent with the guidance contained in Regulatory Guide 1.84, 1.85 and 1.147.

The inspector reviewed a GE Audit of GE #MRC5.14.4 and a NSP Audit of GE #NQGEC-0129-84 B 200.

The safe end and all internal components in the nozzle are stainless steel type 304 materials except for the flat plate spring, which is Inconel X-750 material.

The recirculation piping was redesigned to eliminate as many fittings as possible and utilized bent pipe in order to reduce the number of welds. A material was specified that has a low carbon, high nitrogen chemistry to minimize the possibility of IGSCC. To further minimize this problem, the specification required solution annealing of the shop welds after fabrication.

The crossover piping and valves that connected the two 22" manifolds were eliminated. Operational experience has shown this connection to be without significant utility. Technical specification precludes operation of the reactor with the crossover line open. Four-inch equalizing lines were installed on the RHR suction and discharge lines. Since the loop crossover piping was eliminated, use of these new equalizing lines will facilitate cool down during any anticipated system condition.

The physical location of the field welds was improved to allow easier access for ISI equipment.

After the weld joints were tack welded, remotely controlled and operated automatic welding equipment was used to improve weld consistency and minimize welder radiation exposures. All field welds are completed and each weld will be stress relieved using the Induction Heating Stress Improvement (IHSI) method. The IHSI process modifies the through wall

stress distribution of welded pipe. The weld heat affected zones I.D. tensile stresses are forced into compression. This redistribution of stress is accomplished by heating the outside of the pipe over 1000°F by controlled induction heating while holding the inside under 300°F by flowing water in the pipe. The O.D. is yielded in tension during heating and pulls the I.D. into compression as it cools. This stress redistribution eliminates the main source of stress leading to IGSCC.

Consistent with the requirements of ASME Section XI, installation is being performed in accordance with the requirements of ASME Section III, Article NB-4000, as specified in installation specifications developed by GE and Bechtel.

GE had a tool and material accountability procedure that went to great lengths to control where what tools, and what materials went. GE inspection procedures for system closure were detailed in requirements to assure that nothing was left where it was not supposed to be. Quality Control verified that opened systems were free of foreign materials prior to closure.

All work was performed in accordance with procedures developed for NSP by GE, Bechtel, or Quadrex and approved by NSP management.

Fabrication and installation was in accordance with Section X-1977, augmented by the ASME Section III - 1980 Quality and NDE requirements. Longitudinal and girth weld in tubular products and fittings were 100% radiographed after final heat treatment. All field welds were 100% radiographed in accordance with ASME Section III, NB-5222 prior to hydrotesting.

Preservice ISI examination of 100% of the pressure retaining welds is being performed in accordance with Section XI, IWB 2000, 1977 Edition through Summer 1978 Addenda upon completion of Section III work but prior to system hydro as provided by IWB 2200. This is being performed prior to and will be performed after IHSI of all field welds including safe end welds to reactor vessel nozzles.

Replacements performed in accordance with ASME Section XI, Article IWA-7000, will be subjected to a System Hydrostatic Test in accordance with Article IWB-5000.

The recirculation flow was not measurably changed as a result of the repairs. Nevertheless, since the repair required installation of a new flow nozzle, recalibration of the recirculation flow instrumentation system will be performed prior to plant startup.

The hydrotest of the system will be performed in accordance with ASME Section XI.

No items of noncompliance or deviations were identified.

6. Exit Interview

The inspector met with representatives (denoted in Persons Contacted Pargraph 1) at the conclusion of the inspection. The inspector summarized the scope and findings of the inspections noted in this report.