U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-282/89031(DRP); 50-306/89031(DRP)

Docket Nos. 50-282; 50-306 Licenses No. DPR-42; DPR-60

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

Facility Name: Prairie Island Nuclear Generating Plant

Inspection At: Prairie Island Site, Red Wing, Minnesota

Inspection Conducted: December 12, 1989 through January 16, 1990

Inspectors: P. L. Hartmann
T. J. O'Connor
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Approved By: B. L. Burgess, Chief
Reactor Projects Section 2A

1/31/90
Date

Inspection Summary

Inspection on December 12, 1989 through January 16, 1990 (Reports No. 50-282/89031(DRP); No. 50-306/89031(DRP))
Areas Inspected: Routine unannounced inspection by resident inspectors of plant operational safety, maintenance, surveillance, radiological protection and industrial safety.
Results: Unit 1 entered the inspection period at 81% power, coasting down to the cycle 13 to 14 refueling outage. At 10:13 p.m. on January 16, 1990, Unit 1 came off line. Planned outage activities include steam generator eddy current testing, tube plugging and sleeving and the installation of the digital feedwater control system. Associated activity levels remain less than 1% of Technical Specification (TS) limits. No additional degradation in the pressurizer manway steam leak has occurred. In preparation for the refueling outage, the licensee has taken steps to minimize activity levels in the reactor coolant system and inside containment. Unit 1 has operated continuously for 179 days.

Unit 2 experienced a reactor trip on December 21, 1989 from a negative flux rate. Trouble shooting activities were completed and the unit returned to service on December 22, 1989. On December 26, 1989, Unit 2 again tripped from a negative flux rate. Both reactor trips were complicated by an accompanying loss of power to the Unit 2 reserve station transformers. An NRC Augmented

Inspection Team (AIT) was dispatched to the site to monitor the licensee's investigative and corrective actions. Details of these reactor trips and AIT inspection results can be found in Inspection Reports No. 50-282/89032(DRP); No. 50-306/89032(DRP). Unit 2 was returned to service on January 10, 1990.

Of the six areas inspected, one violation of NRC requirements was identified. This violation involved the failure to comply with Technical Specification requirements concerning the chlorine detection system. The root cause has been identified as inadequate training and miscommunication between operations personnel.

DETAILS

1. Persons Contacted

#E. Watzl, Plant Manager
#D. Mendele, General Superintendent, Engineering and Radiation Protection
#M. Sellman, General Superintendent, Operations
G. Lenertz, General Superintendent, Maintenance
A. Smith, General Superintendent, Planning and Services
#R. Lindsey, Assistant to the Plant Manager
D. Schuelke, Superintendent, Radiation Protection
#G. Miller, Superintendent, Operations Engineering
K. Beadell, Superintendent, Technical Engineering
S. Schaefer, Superintendent, Technical Engineering
M. Klee, Superintendent, Quality Engineering
R. Conklin, Supervisor, Security and Services
#M. Wadley, Shift Manager
#P. Valtakis, Shift Manager
#J. Sorensen, Shift Manager
#L. Dahlman, Senior Materials & Special Process Engineer
#J. Leveille, Nuclear Support Services
#A. Hunstad, Staff Engineer

#Denotes those present at the exit interview of January 19, 1990.

2. Licensee Action on Previous Inspection Findings (92701)

(Closed) Unresolved Item (282/89028-01; 306/89028-01(DRP)): The inspectors questioned the method and frequency, calibration, and surveillance of the Hot Shutdown Panel's equipment. As a result, the licensee determined that the source range detector indication was not part of a calibration surveillance program. However, the licensee promptly incorporated the source range detector into the Instrumentation and Calibration Surveillance Test Procedure numbered SP1734[2734], Neutron Flux Monitor Calibration. The inspectors confirmed at the Train A and B Hot Shutdown Panels that the gamma-metric instrumentation meters numbered 1[2]NI51 C/B and 1[2]NI52 C/B are identified in the procedure as NI-51B and NI-51C for each train and have been placed on an outage frequency surveillance schedule. The inspectors also questioned the licensee's testing program of the other remote controls in the Hot Shutdown Panels. Consequently, the licensee informed the inspectors that the other Hot Shutdown Panel remote controls are in the surveillance program. Based on the above information, this item is considered closed.

3. Operational Safety Verification (71707, 93702, 60705)

a. Routine Inspection

The inspector observed control room operations, reviewed applicable logs, conducted discussions with control room operators and observed

shift turnovers. The inspector verified operability of selected emergency systems, reviewed equipment control records, and verified the proper return to service of affected components, conducted tours of the auxiliary building, turbine building and external areas of the plant to observe plant equipment conditions, including potential fire hazards, and to verify that maintenance work requests had been initiated for the equipment in need of maintenance.

b. Unit Operation

Unit 1 coasted down to a level of 50% power until its removal from service on January 16, 1990. The inspectors verified the Unit 1 coastdown to be in accordance with the restrictions imposed by Figure C1-29, Tave Restrictions During End of Life Coastdown, Revision 2. Other than the shutdown for refueling, Unit 1 operated uneventfully during the inspection period.

The Unit 2 reactor tripped from 100% power on December 21, 1989. The suspected cause was the dropping of two shutdown bank rods which caused a negative flux rate trip. When the generator output breakers (8H-13 and 8H-14) opened, 8H-13 opened slowly (<10 cycles). This slow opening is treated as a breaker fault and results in a Bus 1 (345kv substation bus) lockout. The lockout removed normal and alternate power to the nonessential buses (21, 22, 23 and 24). The plant was stabilized using natural circulation. Following testing and repairs to the reactor protection motor generator sets, the unit was restarted on December 22 with the turbine placed back on the grid at 12:09 a.m. December 23, 1989.

Unit 2 operated until 12:32 p.m. on December 26, 1989, when the unit tripped again as a result of a negative flux rate. The sequence of events was nearly identical to the December 21, 1989 event, and the plant was promptly stabilized using natural circulation. In response to the December 26 event, an NRC Augmented Inspection Team (AIT) was formed and dispatched to the site. The AIT report discusses these two events, equipment failures and root cause investigation in detail (ref. Inspection Reports No. 282/89032; No. 306/89032).

Following regional administrator concurrence (ref. CAL RIII-89-027), unit restart commenced at 3:55 p.m. on January 9, 1990. At 5:30 p.m., step 220 on control bank D was reached without criticality being achieved. The control rods were reinserted and recalculation of the estimated critical position (ECP) was commenced. The inspector was present during this criticality attempt and considers the actions taken by the licensee to be conservative.

The licensee determined several factors, which resulted in more negative reactivity (which keeps the reactor shutdown), were present than what the original ECP had taken into account. These factors included: reactivity curves which were not fuel cycle specific; the unaccounting of negative reactivity associated with samarium after

14 days following a trip from 100% power, and; a more accurate calculation for preshutdown boron calculation. The unit was restarted at 12:37 a.m. on January 10, 1990 and criticality was achieved within 150 percent millirho (pcm) of the revised ECP. The licensee is investigating the cause of the ECP being calculated with less actual negative reactivity than what was actually present in the reactor. The original ECP calculation missed criticality by 638 pcm. The licensee's procedural limit is 750 pcm. The ECP calculation procedure will be revised to improve accuracy pending the outcome of the licensee's investigation. The inspectors were satisfied with the explanation of the ECP calculation prior to the restart of Unit 1.

c. Scaffolding

During the inspectors' plant tours, scaffolding erected for the Unit 1 refueling outage was observed utilizing portions of the containment spray piping for support. This situation was immediately corrected. Subsequent discussions with the licensee revealed an absence of a procedure to govern the erection of scaffolding. The licensee stated the intention to establish a plant procedure to govern the erection of scaffolding. The inspector expressed concerns that such a procedure should include provisions for access to safety related components, attachment to related components and the accompanying 50.59 review and fire protection considerations. The inspectors will continue to monitor the licensee's use of scaffolding.

d. Emergency Lighting

During the inspectors' plant tours, a walkdown of the emergency lighting was conducted. All inspected batteries had proper electrolyte levels, appropriate voltage and working lights. However, Emergency Light No. 63 located in the Unit 2 "porkchop area" was identified as being 75% discharged with low electrolyte levels. Review of the work requests (WR) associated with this emergency light revealed WRs being written on a monthly basis to correct deficient electrolyte levels. This item will be further pursued by the maintenance team inspection under Inspection Reports No. 50-282/90001; No. 50-306/90001(DRS). It should be noted that two "Work Requested" tags, dated November 30, 1989 and December 26, 1989 were affixed to the emergency light. No work request form was generated in conjunction with the tag dated November 30, 1989. The inspector will continue to monitor the initiation of work requests and the use of "Work Requested" tags.

e. Chlorine Monitor Inoperability

On December 11, 1989, with chlorine detector 121 in bypass, a computer alarm indicated a problem with chlorine detector 122. At 7:00 p.m., the operators placed the 122 chlorine detector in bypass which placed the plant into Technical Specification (TS) 3.13.E.2.

TS 3.13.E.2 requires the licensee, within 6 hours, to restore either the 121 or 122 chlorine detector to service or operate the redundant ventilation system in the normal (non-recirculation) mode and close the outside air supply dampers for the affected train of ventilation. After monitoring the 122 chlorine detector for approximately one hour, the decision was made to return this detector to service. Due to miscommunication between the licensed operator and the outplant operator, the licensed operator thought that the 122 chlorine detector had been returned to service when in fact it had not. Approximately 11 hours later, (6:15 a.m., December 12, 1989) it was discovered that both chlorine monitors were in bypass. The 122 chlorine monitor was then returned to normal.

Technical Specification (TS) 3.13.E.2.15 states "if both chlorine detection channels for one train of ventilation are inoperable then within six hours: (1) restore at least one channel to operable status, or (b) operate the redundant ventilation system in the normal (non-recirculation) mode and close the outside air supply dampers for the affected train of ventilation." Contrary to the above, both chlorine detection channels for the 122 Control Room Ventilation train were placed in bypass for approximately 11 hours, without the outside air supply dampers being placed in the closed position. This is identified as Violation 50-282/89031-01.

10 CFR 2, Appendix C., G.1., states that violations may not be issued if the violation:

(1) was identified by the licensee

(2) is normally classified as a severity Level IV or V.

(3) was reported, if required

(4) was or will be corrected, including measures to prevent recurrence, within a reasonable time; and

(5) was not a willful violation or a violation that could reasonably be expected to have been prevented by the licensee's corrective action for a previous violation.

The inspector concluded, based on item five above, this violation warrants issuance of a Notice of Violation when viewed in conjunction with previous instances of inattention to detail documented in recent inspection reports (ref. Inspection Reports No. 50-282/89-026; No. 50-306/89-026).

Licensee Event Report (LER) 282/89021 has been received by the NRC which discusses this event. Following review, the inspectors requested further information to determine the chlorine detector setpoint for automatic actuation of the control room ventilation system, and consideration of the setpoint necessary to allow an

operator adequate time to manually initiate isolation of the control room ventilation system. This question has been brought to the attention of the licensee.

f. Chlorine Monitor System Modification

In response to the large number spurious actuations of the control room ventilation system, the licensee has implemented a plant modification and revised the ventilation system lineup. Previously, a spike on a chlorine monitor completed the necessary one out of one logic and caused the automatic actuation of the appropriate portion of control room ventilation.

As an interim measure, the licensee has placed the outside air intake dampers associated with the 121 control room ventilation system in the closed position and the chlorine detectors in bypass. The licensee has added additional chlorine detectors to the No. 122 control room ventilation system so that a two out of two actuation logic is required for automatic actuation. The licensee is currently investigating the availability of qualified chlorine detectors with higher reliability than those presently installed.

4. Maintenance Observation (71707, 37700, 62703)

a. Routine Inspection

Routine, preventive, and corrective maintenance activities were observed to ascertain that they were conducted in accordance with approved procedures, regulatory guides, industry codes or standards, and in conformance with Technical Specifications. The following items were considered during this review: adherence to limiting conditions for operation while components or systems were removed from service, approvals were obtained prior to initiating the work, activities were accomplished using approved procedures and were inspected as applicable, functional testing and/or calibrations were performed prior to returning components or systems to service, quality control records were maintained, activities were accomplished by qualified personnel, radiological controls were implemented, and fire prevention controls were implemented.

b. Charging Pump Maintenance

During the inspection period, the licensee experienced trouble with the 21 and 22 charging pumps. Initial problems with the 22 charging pump were associated with control of the pump's speed which required replacement of the pulley sheaves, and belts and recalibration of the speed controller. These items masked an additional problem which prevented proper flow. The remaining problem was attributed a cracked "O" ring valve seat. The cracks, internal to the outer surface of the seat, were discovered only upon pump manifold

disassembly. Typical indication of a cracked "O" ring valve seat is visual leakage, because the crack generally penetrates the outer surface. A crack which penetrated the outer surface of the "O" ring valve seat was the cause of flow problems on the 21 charging pump. The licensee is examining the replacement of the "O" ring valve seats as part of yearly preventive maintenance. The inspectors confirmed minimum pump operability requirements and compliance with TS.

c. In Service Inspection

During the Unit 1 outage, approximately 437 In Service Inspection (ISI) examinations will be performed. During implementation of the ISI program, hangar RHR H-32, a dead load pipe clamp, was discovered to have a loose bolt.

This hangar was identified for inspection this outage due to drawing discrepancies discovered during the previous outage. The ISI program requires components with discrepancies to be inspected during the next outage. The bolt was tightened and reinspected. No discrepancies were identified during this reinspection.

The inspector asked the licensee if this bolt became loose as a result of excessive pump or flow vibration. In response, the licensee examined the hangar while the pump was operating under full flow conditions. This examination confirmed that no abnormal vibration conditions exist during system operation.

d. Turbine Driven Auxiliary Feedwater System

At approximately 2100 hours on December 22, 1989, Unit 2 had commenced reactor start up and reached the point of adding heat. At approximately 2106 hours, while shutting down the 22 turbine driven auxiliary feedwater pump (22 TDAFWP), the turbine tripped on overspeed. TDAFWP procedures require the operator to close the flow control valves and then stop the pump. Plant operators reset the trip mechanism and restarted the pump. Full pump flow was verified and the pump was shut down at approximately 2139 hours. The system engineer was notified of the overspeed trip.

On December 26, 1989, Unit 2 had reached plant conditions which allowed the 22 TDAFWP to be shut down. At approximately 1354 hours while shutting down the 22 TDAFWP down, the turbine again tripped on overspeed. Plant operators reset the trip mechanism and restarted the pump. Full pump flow was verified and the pump shut down. The system engineer initiated a work request to investigate and repair the 22 TDAFWP.

On December 27, 1989, the 22 TDAFWP was removed from service for troubleshooting. Troubleshooting included closing the flow control valves from various flow rates (200, 150, 100 and 50 gpm) and monitor the maximum rpm's after closure. The overspeed trip setpoint and governor linkage were also checked. Although the

22 TDAFWP was able to deliver various flows, the pump was unable to maintain a steady speed, constantly "hunting." The 22 TDAFWP was returned to service at approximately 1754 hours. The system engineer concluded that the governor was responsible for the pump's inability to maintain steady speed.

On December 28, 1989, the 22 TDAFWP was removed from service for replacement of the governor and additional trouble shooting. After the governor was replaced, the pump was still unable to maintain steady speed. The 22 TDAFWP was declared inoperable when it tripped on overspeed during startup for the operability surveillance, SP 2102, 22 Turbine Driven Auxiliary Feedwater Pump Test, Revision 34.

On December 29, 1989, the pump's operating speed was lowered, the speed at which the overspeed trip occurs was increased and additional adjustments to the governor linkage were made. Although these adjustments enabled the pump to start without tripping and deliver the required flows, the pump was still unable to maintain a steady speed. The 22 TDAFWP was returned to service at approximately 6:33 p.m.

On December 30, 1989, the 22 TDAFWP was taken out of service to work on the governor linkage and for internal examination of the governor valve. The results of this effort revealed a bent governor valve stem, galled surfaces on the valve stem and plug, and a bent section of horizontal governor linkage. These anomalies prevented proper governor valve motion. Correction of these anomalies improved the governor valve operation; however, the pump was still unable to maintain a steady speed. During overspeed testing, the pump failed to trip at the required setpoint.

On December 31, 1989, the licensee replaced the overspeed trigger and then verified the proper trip setpoint. The 22 TDAFWP remained out of service.

On January 1, 1990, with the assistance of the governor manufacturer's representative, the old governor was reinstalled and the pump restarted. The 22 TDAFWP tested satisfactory and the pump was returned to service at approximately 1942 hours. The root cause was determined to be the bent governor valve stem and linkage and the galled surfaces on the governor valve plug and valve stem. The manufacturer's representative recommended modifying the governor in order to test the overspeed trip mechanism rather than the licensee's current practice of using a crowbar to override the governor. The defective spare governor which was installed will be returned to the vendor for examination.

Although the pump was operable between the overspeed trips on December 22, 1989, and December 26, 1989, the inspector considers the lack of trouble shooting efforts during this time period to be non conservative. The inspector also considers the adjustments to the pump speed and the overspeed trip setpoint on December 29, 1989

to be non conservative. These actions only compensated for the "hunting" and did not rectify the problem. Additionally, these actions delayed the examination of the governor valve as the source of the hunting.

No violations or deviations were identified.

5. Surveillance (61726, 71707)

The inspector witnessed portions of surveillance testing of safety-related systems and components. The inspection included verifying that the tests were scheduled and performed within Technical Specification requirements, by observing that procedures were being followed by qualified operators, that Limiting Conditions for Operation (LCOs) were not violated, that system and equipment restoration was completed, and that test results were acceptable to test and Technical Specification requirements.

Portions of the following surveillances were observed/reviewed during the inspection period:

- SP 1089 Residual Heat Removal Pumps and Suction Valves from Refueling Water Storage Tank, Revision 25
- SP 1102 11 Turbine-Driven Auxiliary Feedwater Pump Test, Revision 25
- SP 2102 22 Turbine Driven Auxiliary Feedwater Pump Test
- SP 2016 RCP Breakers Test, Revision 10

No violations or deviations were identified.

6. Cold Weather Preparations (71714)

In conjunction with the requirements NRC Inspection Procedure 71714, Cold Weather Preparations, the inspectors reviewed the licensee's surveillance procedure, SP-1637, Winter Plant Operation, Revision 7 and performed tours during extreme cold temperatures (-20 degrees F.) to determine the adequacy of the licensee's program. Tours of the turbine building, auxiliary building, and radiation waste buildings and screenhouse revealed temperatures well above freezing with safety related fluid systems appearing properly heat traced or contained within heated structures.

7. Fitness-for-Duty Training

(Closed) Temporary Instruction 2515/104

Following a discussion with Regional management, the inspectors chose to attend a portion of the Prairie Island Fitness of Duty (FFD) training. This decision was based on higher priority inspection activities of the resident inspectors and the full FFD training that was attended by

inspectors at the Monticello Nuclear Generating Plant, (ref. Inspection Report 263/89031(DRP)), and the training is generic for both Prairie Island and Monticello. The training was developed in the licensee corporate security group. Based on attending the escort training, the inspectors have closed this effort. The questionnaire associated with escort FFD training was forwarded to P. H. McKee, NRR and J. R. Creed, Region III.

8. Offsite Meetings with Local and Corporate Officials

The inspectors met with several offsite groups during the inspection period. A discussion of each is contained below.

a. The inspectors visited the State of Minnesota Emergency Operations Center on December 20, 1989. The inspectors toured the facilities and discussed matters of mutual interest regarding emergency preparedness, with L. Lund, Deputy Director, Division of Emergency Management.

b. The inspectors toured the licensee's corporate facilities on December 20, 1989. Specifically the corporate emergency operations center was visited. Its functions and purpose were discussed with M. Offerdahl, Corporate Emergency Planning.

c. The inspectors met with the Goodhue County Commissioners on December 17, 1989. The inspectors briefly discussed; the function and purpose of the resident inspector program, current activities at Prairie Island, NRC inspection responsibilities for emergency planning. The inspectors answered several questions regarding nuclear power in general.

9. Exit (30703)

The inspectors met with the licensee representatives denoted in Paragraph 1 at the conclusion of the report period on January 19, 1990. The inspectors discussed the purpose and scope of the inspection and the findings. The inspectors also discussed the likely information content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any documents or processes as proprietary.