U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No.: 50-263/91013

Docket No.: 50-263 License No.: DRP-22

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

Facility Name: Monticello Nuclear Generating Station

Inspection at: Monticello, MN 55362

Inspection Conducted: June 26 and 27, 1991

Inspectors: S. P. Ray

H. Peterson

Approved By: R W DeFayette
R. W. DeFayette, Chief
Reactor Projects Section 2B

JUL 09 1991
Date

Inspection Summary

Inspection on June 26 and 27, 1991, (Report No. 50-263/91013(DRP))
Areas Inspected: A reactive, announced inspection by the senior resident inspector and a regional reactor engineer of onsite follow up (92701) of the June 6, 1991, unexpected reactor scram during a shutdown.
Results:
The inspectors determined that although the event itself including the reactor scram was relatively insignificant from a safety standpoint, and that the decision to shut the reactor down was conservative, the actual performance of the shift operating crew was less than adequate. Several concerns were identified relating to inattention by members of the licensed staff; lack of awareness of plant status; lack of supervision by control room supervisors for plant reactivity changes; and lack of understanding by the crew of the effect of low decay heat on the reactor shutdown. One apparent violation was identified relating to inadequate supervision by control room supervisors in directing reactor reactivity changes, and lack of awareness and inattention to plant status by licensed personnel (section 5).

DETAILS

1. Persons Contacted

Facility

*D. Antony, NSP General Manager, Monticello Site
+*D. Nevinski, NSP General Superintendent, Operations
+*M. Brant, Site Superintendent
B. McGillic, Operations Training Supervisor, Monticello

Interviewees

B. Steckelberg, SRO, Lead NPEO
R. Voigt, RO, NPEO (BOP)
H. Paustian, Nuclear Engineer
C. Banyai, SRO, Shift Supervisor
M. Lechner, SRO, Shift Manager
C. Schwarzkopf, RO, NPEO (RO)

U. S. Nuclear Regulatory Commission (NRC)

+*S. Ray, Senior Resident Inspector, Monticello
R. Mendez, Reactor Engineer
D. Schrum, Reactor Engineer

+Denotes those present at the management entrance meeting on June 26, 1991.

*Denotes those present at the management exit meeting on June 27, 1991.

2. Summary

On June 6, 1991, the Northern States Power Company Monticello Nuclear Generating Station experienced a reactivity anomaly during a reactor shutdown when an unanticipated cooldown occurred in conjunction with the rod insertion for reactor shutdown. The reactor did not have sufficient decay heat to maintain reactor pressure and temperature during shutdown. As a result, the positive reactivity from cooldown overcame the control rod negative reactivity and resulted in a high high IRM flux reactor scram.

3. Event Description

On June 6, 1991, at approximately 1500 hours, the afternoon shift assumed the control room duties. The afternoon shift consisted of the Nuclear Lead Plant Equipment Operator (NLPEO) who is SRO licensed, and two licensed Reactor Operators (RO). The two supervisors (Shift Manager (SM) and Shift Supervisor (SS)), who also are SRO licensed, were already on watch because they were on 12 hour shifts while the operators were on normal 8 hour shifts. The crew assumed its duties and continued with the normal reactor startup to raise reactor power and pressure to open 1 1/2 turbine bypass valves. The reactor had just been taken critical that morning and thus had little or no decay heat. The reactor mode switch was in the "Startup" position.

During the course of the power increase, the maintenance supervisor entered the control room to monitor the status of the "H" SRV tail pipe temperature because of previous problems associated with that SRV. Its tail pipe temperature was approximately 160 deg F (higher than anticipated) and increasing. Plant management met with the SM and SS in the control room to assess the course of action. It was decided to shut the plant down to repair the leaking SRV, even though its temperature (200 deg F) was less than that required for reactor shutdown (230 deg F).

At 1619 hours the SS ordered one RO to start inserting control rods and shut down the reactor. The SS apparently used words such as "don't dawdle," to request the shutdown as quickly as possible, which may have created a false sense of urgency. The RO commenced rod insertion in reverse sequence of the startup rod pull, inserting three groups of rods totaling approximately 178 notches. After giving the order the SS exited the control room to obtain the shutdown checklist and deinerting procedures from the third floor of the administration building (one floor above the control room). The SM and the NLPEO were in the control room preoccupied in identifying where to originate the transition between the startup (C.1) and shutdown (C.3) procedures. The second RO was in the back area of the control room taking a break, apparently reviewing procedures for the shutdown in respect to the balance of plant. He was not cognizant of the plant status and did not render assistance to the lone RO performing the shutdown.

A Nuclear Engineer was also in the control room completing paperwork associated with the IRM heat balance which was performed and completed earlier at 1614 hours. The IRM heat balance is required by procedure for reactor startup and shutdown.

During the course of 20 minutes (1619 to 1639) of this shutdown evolution, a steady decrease in reactor pressure and temperature was occurring due to the low decay heat generation rate. Subsequently, the turbine bypass valves closed and with the auxiliary steam loads still present (off-gas recombiners, steam jet air ejectors (SJAE), etc.), an unanticipated cooldown was also occurring.

At 1633, the main steam line (MSL) low pressure alarms (A, B, C, and D) were received as indicated on the computer alarm printout. Additionally, as the RO inserted control rods, notch by notch, the IRM recorders indicated an initial subcritical condition with power decreasing. But, when rod insertion would stop, the IRMs indicated a critical condition with power increasing. This effect was repeated throughout the course of the shutdown. The continued steam load and minor reactor water level fluctuations of 1 to 2 inches substantially contributed to the cooldown conditions which added positive reactivity to negate, then overcome, the negative reactivity added by the control rod insertions. None of the operators in the control room recognized the reactor pressure decrease, the bypass valves closing, the reactivity anomaly, nor recall the MSL low pressure alarms. Therefore, no actions were taken pertaining to these abnormal plant conditions prior to the reactor scram.

Based on computer printouts, at 1638:22 the RO inserted rod 14-23 from position 08 to 06. Progressively within the 37 seconds after the rod insertion, the fast speed IRM channel 13 recorder unmistakenly indicated a

power rise, an indication of a reactivity anomaly. Apparently, the SM noticed a problem after hearing an alarm associated with the IRMs (IRM high alarm, half scram alarm) and questioned it. At 1638:59 an IRM flux upscale high alarm annunciated and within two seconds a full reactor scram occurred from high high flux on IRM channels 12 and 16. During this short transient period (the reactor period was estimated to be about 50 seconds) the SM stated that he observed the high IRM and attempted to upscale the IRM recorders. He upscaled two IRM recorders from range 7 to 8, but his actions were insufficient and too late to prevent the reactor scram. The RO stated that within the short transient period he was observing other plant parameters and that the IRM problem was a surprise. He could not respond fast enough to affect any mitigating actions by inserting more rods or attempt to upscale the IRM recorders.

Subsequent actions pertaining to the reactor scram were adequate and all immediate and required actions were sufficiently performed. Following the scram the operators identified that the turbine bypass valves had closed and that the reactor pressure was still rapidly decreasing. They identified the uncontrolled cooldown and secured the recombiners and SJAEs. They also isolated the MSIVs at time 1720 hours. At approximately 1755 hours, actions were taken to reopen the MSIVs to initiate a controlled reactor cooldown. Control of the reactor and plant was successfully completed following the reactor scram. By 2222 the reactor was less than 212 deg F and the drywell deinerted for initiating repairs to the "H" SRV.

4. Significance of Event

This event, by itself, had minimal safety significance in that the reactor was at a low power level within the IRM range 7, the plant activities were to shut down the reactor with rod insertion, and the reactor protection system more than adequately ensured safety of the plant. Even if the IRM high high scram had not functioned correctly, the APRM low power scram set point would have initiated a reactor scram. Additionally, there were no violations of safety limits, no major threat of radioactivity release, nor any failures of safety related equipment or systems. However, the conduct of control room operations and operator training/knowledge were of NRC concern as follows:

(1) The shift supervisor failed to brief the crew prior to the start of this evolution which was a special plant condition, that dramatically changed the scope of operations (e.g. from reactor startup to reactor shutdown with no decay heat). This also was a violation of licensee procedures.

(2) The crew failed to recognize and understand the significance of the lack of decay heat and its effect on reactor shutdown.

(3) There was little direct supervision of the reactor operator, and, in fact, for 20 minutes he was "on his own" while the shift supervisor left the control room to find another procedure, and the shift manager had his back to the control panels while he tried to determine where they should be in the procedures. In general, there was a lack of awareness by the Shift Supervisor, Shift Manager, NLPEO, and the reactor operator of control room activities and plant conditions during this significant plant evolution.

(4) The reactor operator failed to recognize and understand IRM indications of this event.

The causes of this event appear to be the lack of management oversight of control room operations and supervisor responsibilities; lack of training pertaining to reactivity anomalies and shutdown with lack of decay heat; and personnel error. It appeared that control room atmosphere and "command and control" was informal, and suggested, given the number of supervisor management personnel who missed the warnings, that crew performance and interaction may be "loose" and undisciplined. It also appeared that training for this type of event is either lacking or at least inadequate.

5. Apparent Violation

10 CFR 50 Appendix B Criterion V states in part that activities affecting quality shall be prescribed by documented instructions and procedures of the type appropriate to the circumstances and shall be accomplished in accordance with these instructions and procedures.

Monticello Technical Specification section 6.5 requires that detailed written procedures, including the applicable check-off lists and instructions, covering areas of plant operations shall be prepared and followed.

On June 6, 1991, the licensee apparently failed to adhere to the following procedure requirements.

a. Monticello Nuclear Generating Plant Administrative Work Instruction (AWI) 04.07.05, General Plant Operating Activities, revision 1, section 4.2.4.A, Performance of Operators While On-Duty, requires all on-duty operators and the Shift Supervisor to be aware of and responsible for the plant status at all times. They must be alert to ensure that the plant is operating safely and must be capable of taking action to prevent any condition that might be unsafe. The Shift Supervisor's authority and responsibility must apply to all personnel assigned to his shift and whose actions could affect plant safety. During this event, the Shift Supervisor, Shift Manager, NLPEO, and reactor operator failed to monitor, recognize and understand the significance of the lack of decay heat which subsequently affected the normal conduct of reactor shutdown. They also failed to effectively monitor the reactor shutdown including the reactivity transients associated with the turbine bypass valves and the decreasing reactor pressure. In general, they were not aware of plant conditions nor attentive to the plant evolution in progress. Furthermore, the SS left the control room after giving instructions to the RO.

b. Section 4.2.4.B, of the same procedure requires that operators be particularly attentive to the instrumentation and controls at all times. During this event, the reactor operator failed to correctly monitor the fast speed IRM channel 13 recorder and subsequently did not identify nor understand the reactivity anomaly during the reactor shutdown (specifically, the cycling between subcritical and

critical during rod insertion), which resulted in a reactor scram. Additionally as the lone reactor operator at the controls, he failed to identify the abnormal conditions of unexpected reactor pressure decrease, unexpected closure of the turbine bypass valves, and failed to recognize/acknowledge the Main Steam Line Low Pressure alarms.

c. Section 4.2.4.H of the same procedure requires in part, that all operations personnel must communicate effectively during normal and abnormal operational activities. Instructions are to be given with sufficient information to ensure that the desired operational activity occurs. The use of slang expressions should be avoided. In this event, the Shift Supervisor gave inadequate shutdown orders to the reactor operator and did not specify the transition steps between the startup and shutdown procedures and checklists (Monticello Nuclear Generating Plant procedures C.1, Startup, procedure C.3, Shutdown, procedure 2167, Startup Checklist, and procedure 2204, Shutdown Checklist).

d. Section 4.7, of the same procedure, Shift and Relief Turnover, item 4.7.5.J requires the Shift Supervisor to periodically conduct shift briefings to discuss items such as major evolutions planned, pertinent night orders/standing orders, unusual conditions, and general shift routine. During this event the Shift Supervisor failed to conduct a crew briefing concerning the major change in the course of plant operation (from startup to shutdown) due to the abnormal condition of the SRV tail pipe temperature increase. Additionally, the Shift Supervisor failed to brief the crew concerning the unusual plant condition of low decay heat affecting the reactor shutdown operations.

The above four examples of violations are indicative of a lack of attention or carelessness towards license responsibility and the breakdown in the control of licensed activities during this event. (50-263/91013-01(DRP))

6. Corrective Actions Taken by the Facility

The licensee short term corrective actions (including immediate corrective actions) consisted of management discussions with the operating crew, proposed procedural change to add a "NOTE" in step 24 of procedure C.3, Shutdown, and Operations Department management initiation of a memorandum, dated June 21, 1991, addressing this event.

As of June 27, 1991, the licensee was still involved in identifying and documenting the long term corrective actions and root cause analysis associated with this event. These issues will be addressed in the licensee's Licensee Event Report (LER) and Human Performance Evaluation System (HPES) report and evaluated by the NRC.

7. Exit Meeting

An exit meeting with the facility management was conducted at the Monticello Site on June 27, 1991. Those attending the meeting are listed in Section 1 of this report.

The following items were discussed during the exit meeting:

a. Overall activities conducted during this follow up inspection.

b. Heightened concern towards this event by Region III management.

c. The potential escalated enforcement of this event.

Monticello management relayed its concern towards this event and assured that corrective actions would be expeditiously performed.