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TO:
Dr. Peter A. Morris

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Reactor Isolation from 90% Power and Subsequent Events on 7-14-71.....

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NSP

NORTHERN STATES POWER COMPANY

Minneapolis, Minnesota 55401

July 23, 1971

Dr. Peter A. Morris, Director
Division of Reactor Licensing
United States Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Morris:

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Reactor Isolation from 90% Power
and Subsequent Events

A condition occurred at the Monticello Nuclear Generating Plant on July 14, 1971, which we are reporting in accordance with the reporting requirements of Section 6.6.B3 of Appendix A, Technical Specifications, of the Provisional Operating License DPR-22. The Region III Compliance Office has been notified in accordance with the reporting requirements of 6.6.A of the Technical Specifications.

The attached report, "Reactor Isolation from 90% Power and Subsequent Events" describes the details of the occurrence and the corrective actions taken as a result of the occurrence.

Yours very truly,

R. O. Duncanson/CEL

R. O. Duncanson, Jr., P.E.
Gen. Supt. of Power Plants - Mechanical
Chairman - Monticello Safety Audit Committee

ROD/CEL/mmm

3382

MONTICELLO NUCLEAR GENERATING PLANT

July 23, 1971

Subject: Reactor Isolation from 90% Power and Subsequent Events

1. Summary Description of Occurrence

At approximately 1348, Wednesday, July 14th, a reactor isolation occurred while operating at approximately 90% of rated power. The isolation was initiated by noise spiking on the main steam line flow sensors while completing scheduled surveillance testing. After clearing the isolation condition, condenser vacuum was re-established. Shortly thereafter, the gaseous activity in the reactor building vent stack and the off-gas stack increased and airborne contamination was detected in the turbine building. Maximum activity levels of approximately 35,000 uc/sec at the off-gas stack and 20,000 uc/sec at the reactor building vent stack existed for approximately 30 minutes.

Concurrent with the reactor building vent stack release, an increase in the discharge canal activity was measured. The measured liquid activity of approximately 2.5×10^{-6} uc/cc has been determined to be the result of cooling tower scrubbing of the reactor building vent stack discharge which was blown from the plant toward the towers.

2. Detailed Description of the Occurrence

a. Summary of Conditions

At the time of the occurrence the reactor was operating at a steady power level of approximately 90%.

b. Account and Analysis of the Occurrence

(Note: Where times are listed to the second, they were taken from the computer alarm printer; all other times are according to the control room log, correlation with recording charts, or from personnel observations).

134801 A reactor scram from 90% power occurred due to a high flow isolation of the Main Steam Isolation Valves. The isolation was caused by a spike introduced in the high steam flow differential pressure switches while valving one of the switches into service following surveillance testing.

134804 The normal low reactor water level transient which followed the scram initiated a group 2 and 3 isolation and started the Standby Gas Treatment System. Initiation of the Standby Gas Treatment System isolated the reactor building ventilation system.

1348 to 1411 The reactor pressure was controlled automatically by the relief valves. The relief valves opened 9 times during this period maintaining the reactor pressure below 1100 psig.

134835 The reactor water level increased to the high level setpoint causing a turbine lockout. The turbine lockout initiated an automatic closed transfer

of auxiliary power from the #11 main auxiliary transformer to the 1R reserve auxiliary transformer and started both diesel generators. The Turbine Lockout also tripped both reactor recirculation pumps. All of these interlocks operated properly.

134843 No. 12 Reactor Feedwater Pump was manually tripped.

1350 An attempt was made to re-establish steam flow to the condenser after it had been determined that the isolation was a result of the surveillance test. It was discovered that the outboard main steam line drain isolation valve (MO-2374) could not be opened to pressurize the steam line prior to opening the MSIV's.

135140 Due to the failure of MO-2374, which prevented normal pressurization of the main steam line, the operator attempted to use the test pushbutton to slowly open one of the MSIV's; however, because of the large differential pressure existing across the MSIV's, another high flow isolation occurred immediately after the valve started to open.

135514 The reactor water level was approximately 90 inches. The reactor water cleanup system was placed back in service with dump flow established to reduce the reactor water level.

1356 A second attempt was made to pressurize the main steam lines by opening a MSIV using the test pushbutton. A high flow isolation immediately reclosed the MSIV.

1400 Both reactor recirculation pumps were restarted.

1401 Reactor Cleanup System isolated due to high outlet temperature from the non-regenerative heat exchanger. The high temperature isolation of the cleanup system has occurred on several previous occasions when the dump flow is increased to reduce the reactor water level. The increased dump flow reduces the flow through the regenerative heat exchangers and results in higher temperatures to the cleanup demineralizers. When the high temperature isolation occurred, an operator was dispatched to the cleanup system area to manually increase the service water flow.

1403 No. 11 Reactor Feedwater Pump was manually tripped.

1405 Reactor Water Cleanup System was returned to service and dump flow re-established to decrease reactor water level. The condenser vacuum was decreasing due to loss of the air ejector and turbine gland seal steam supply. In order to maintain condenser vacuum, the mechanical vacuum pump was placed in service discharging through the 1.75 minute off-gas line.

1407 MO-2374, Main Steam Drain Isolation Valve, was opened by manually operating the breaker contacts until the valve was fully open and then pulling the breaker. This established steam supply to the air ejector and the turbine steam seal system. The steam flow was sufficient to prevent further relief valve openings.

(It was subsequently determined that the flow switch trip relay fuse which was pulled to complete the high steam flow differential pressure switch surveillance test prevented the opening of MO-2374).

1407 The stack gas radiation monitor began to show an increase as annormal result of the high off-gas flow.

The No. 12 air ejector steam supply pressure went to full scale (200 psig) and remained there for approximately 5 minutes indicating that air ejector steam supply pressure control system was not operating properly.

The air ejector off-gas flow recorder also went to full scale (200 CFM), and remained there for approximately 30 minutes. Although this condition is normal while establishing condenser vacuum, the high steam supply pressure to No. 12 air ejector further increased the off-gas flow.

1409 The turbine building Continuous Air Monitor (CAM) which monitors the activity of the turbine building equipment drain sump area began to increase. The increase in activity was the result of losing the air ejector off-gas loop seal when the air ejectors were returned to service at 1407. The loop seal drains condensation from the 30 minute off-gas holdup line to the turbine building equipment drain sump. With the water lost from the loop seal, a direct path was established to vent off-gas from the 30 minute holdup line into the sump.

1411 The main steam line pressure had increased to approximately 450 psig. The MSIV's were opened and the line pressure immediately increased to 925 psig.

Difficulty was experienced controlling the steam packing exhauster suction pressure. It is postulated that the steam seal regulator did not respond fast enough to the sudden re-pressurization of the steam lines and may have resulted in leakage of steam to the turbine building through the turbine shaft seals.

1412 The mechanical vacuum pump, which is located in the same room as the turbine building equipment drain sump, was shutdown. As the operator was leaving the sump room area, a portable radiation detector located outside the sump room area alarmed. A CAM located in the same general area also alarmed. The Radiation Protection Engineer and assistant who were also in the area and the operator proceeded to the access control area for checkout. The three personnel required washing of exposed areas.

The Radiation Protection Engineer informed the Shift Supervisor of the airborne activity in the turbine building. Subsequent entries into the turbine building and the reactor building were made wearing full face masks and protective clothing.

The Radiation Protection Engineer requested that an air sample in the area of the turbine building CAM be obtained for analysis. The sample, taken at 1423, showed an airborne concentration of 4.4×10^{-8} μci/cc. A spectrum of the sample indicated the activity to be Rb^{88} and Cs^{138}.

Subsequent urinalysis (gamma and beta) for the three personnel showed no above normal activity.

1414 The stack gas radiation monitor reached the high alarm setpoint (8000 uci/sec.).

1415 The activity released in the lower areas of the turbine building was carried into the reactor building exhaust plenum through the normal ventilation system causing an increase in the indication of the reactor building vent CAM.

1417 The off-gas stack release rate leveled off at 35,000 uci/sec.

141745 The reactor building exhaust plenum high radiation alarm was received. The alarm setpoint of 1.25 mr/hr is equivalent to a reactor building vent stack release of approximately 10,000 uci/sec.

1419 to 1459 The discharge canal radiation monitor showed an increase in activity. The measured liquid activity of approximately 2.5×10^{-6} uci/cc has been determined to be the result of cooling tower scrubbing of a very small portion of the reactor building vent stack discharge which was blown from the plant toward the tower by a 10 mph wind. A gamma spectrum of a sample taken from the canal monitor discharge showed that the activity was Rb^{88} and Cs^{138}. The analysis confirmed the concentration indicated by the discharge canal monitor.

From approximately 1430 to 1445, the reactor building plenum exhaust fans were shutdown to stop the release of activity from the reactor building vent stack. Except for this fifteen minute period, the reactor building vent stack release was approximately 20,000 uci/sec.

1430 The charcoal and particulate filters in the reactor building vent sampling system were changed. Immediate count of the particulate filter indicated a release rate of approximately 1.37 uci/sec, and a gamma spectrum of the filter showed the activity to be Rb^{88} and Cs^{138}. An analysis of the charcoal filter showed no I^{131}.

1430 to 1440 CAMs located on the reactor building refueling floor and ground level floor started to increase.

A smoke bomb test performed on July 22, 1971, revealed that with the reactor building isolated and the plenum fans shut down, leakage into the reactor building occurs around the reactor building exhaust fan ventilation ducts which penetrate the plenum wall. A small amount of leakage was also detected through a set of double interlocked doors located between the turbine building and the reactor building.

1441 The condenser vacuum had returned to normal with an off-gas flow of approximately 10 cfm. With the reduced flow, the stack gas activity release rate decreased by approximately one decade.

1444 An air sample taken from the reactor building exhaust plenum showed a concentration of 4.6×10^{-6} uci/sec. A spectrum analysis showed the activity to be Rb^{88} and Cs^{138}.

1445 The charcoal and particulate filters in the off-gas stack sampling system were changed. An immediate count of the particulate filter indicated a release rate of 1.99 uci/sec and a gamma spectrum of the filter showed the activity to be Rb^{88} and Cs^{138}. A 48 hour analysis of the particulate filter showed that a long lived activity release rate of 8.7×10^{-4} uci/sec occurred. Analysis of the charcoal filter indicated an I^{131} release rate of 4.09×10^{-2} uci/sec.

Airborne activity was detected in the access control area of the administration building. An air sample showed the concentration to be 1.0×10^{-7} uci/sec. A spectrum of the sample showed the activity to be Rb^{88} and Cs^{138}. With the exhaust plenum fans shutdown, a strong draft exists between the turbine building and the administration building. This draft held the access control area door to the turbine building open and carried airborne activity into the access control area. The door was immediately closed.

An air sample at 1510 showed a concentration in the access control area of 6.7×10^{-9} uci/cc. A sample at 1535 showed a concentration of 1.1×10^{-8} uci/cc.

The reactor building plenum exhaust fans were restarted. Normal turbine building ventilation flow was established.

1500 An air sample was taken on the turbine building operating floor. A count of the sample showed the activity to be 3.5×10^{-6} uci/cc. A spectrum of the sample showed the activity to be Rb^{88} and Cs^{138}.

The reactor building exhaust plenum monitor indication began to decrease.

1505 The Standby Gas Treatment System was shutdown and the reactor building ventilation system was returned to normal.

1509 The reactor building exhaust radiation monitor indication decreased below the 1.25 mr/hr high level trip point.

1530 An air sample was taken on the turbine building operating floor. A count of the sample showed the activity to be 1.1×10^{-7} uci/cc.

The CAM located on the reactor building refueling floor peaked at 1.0×10^{-8} uci/cc.

1545 The CAM located on the ground level of the reactor building peaked at 1.96×10^{-8} uci/cc.

1548 An air sample taken on the ground level of the reactor building showed a concentration of 7.6×10^{-8} uci/cc.

1630 The reactor building vent CAM returned to normal indication.

1706 The airborne activity on the turbine operating floor was measured as 1.24×10^{-9} uci/cc.

1727 The airborne activity in the turbine building equipment drain sump area was measured as 1.24×10^{-9} uci/cc.

1745 The charcoal and particulate filters in the reactor building vent sampling system were changed. A 48 hour analysis of the particulate filter showed a long lived activity release rate of 1.63×10^{-4} uci/sec. and the release rate of I^{131} to be less than 6.1×10^{-4} uci/sec.

1800 All indications showed that plant airborne activities had returned to normal.

c. Account of Additional Activities

1700 July 14 An NSP consultant was contacted to discuss cooling tower scrubbing of airborne activity. Discussions strongly supported our determination that the discharge canal activity was the result of cooling tower scrubbing of gaseous activity.

1900 to 2130 July 14 The Operations Committee met to review the occurrence and determine what actions were required prior to restarting the plant.

2300 July 14 The off-gas HEPA filter was DOP tested and found to be 99.9 percent efficient. The filter was tested because of possible damage due to high off-gas flows which had occurred while re-establishing condenser vacuum.

July 15 AM The Region III Compliance Office was advised of the occurrence. The occurrence was reported on the basis of an unplanned release.

July 15 Noon It was determined to remain shutdown and go into a turbine screen removal outage. The outage was anticipated to last nine days.

July 15 PM The Minnesota Department of Health was requested to analyze the on-site and off-site thermoluminescent dosimeters. The TLDs (12), which had been placed on location four days earlier, were analyzed and showed no indications above background.

July 16 Grass, mud and soil samples taken near the cooling towers showed no above normal activity.

July 21 Grass, mud and soil samples taken three miles east (downwind) of the plant showed no above normal activity.

3. Corrective Actions

To prevent a recurrence of the unplanned gaseous release, the operating procedures for the recovery from an isolation scram have been reviewed

and supplemented with a temporary memo (Volume F) to the Operations Manual. The detailed supplemental procedure addresses itself to the re-establishment of normal operation of the air ejector system and the turbine steam seal system during the recovery from an isolated condition.

In addition to the procedural changes, the following system control changes have been completed to assure proper recovery from an isolated condition.

a. A new control switch has been provided in the control room which will allow the operators to isolate the off-gas line loop seal during high off-gas flow periods. The isolation will be removed when off-gas flows return to normal.

b. The control switch, which is used to isolate the off-gas flow to the air ejectors, has been interlocked to also isolate the steam supply to the air ejectors when the switch is in the CLOSED position. This interlock will provide the operator with isolation capability from the control room and facilitate recovery from an isolated condition.

Testing will be performed during the next reactor startup to verify proper operation of the control system changes.

Also, the duct penetration seals from the reactor building exhaust plenum to the reactor building have been repaired to prevent the possibility of airborne in leakage to the reactor building if the plenum exhaust fans are shutdown.

Analysis of the occurrence is continuing and further actions may be initiated to prevent similar occurrences.