

DUKE POWER COMPANY

POWER BUILDING

422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

February 16, 1982

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

02 FEB 22 1982
TELEPHONE AREA 704
373-4083

Mr. J. P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Re: McGuire Nuclear Station Unit 1
Docket No. 50-369



Dear Mr. O'Reilly:

Please find attached Reportable Occurrence Report RO-369/82-07. This report concerns T.S.3.3.2, "The Engineered Safety Feature Actuation System (ESFAS) instrumentation channels and interlocks shown in Table 3.3-3 shall be operable...". This incident was considered to be of no significance with respect to the health and safety of the public.

A report will be submitted pursuant to T.S.6.9.2 in fulfillment of the special report provision of T.S.3.5.2(action b) concerning the inadvertent safety injection, by April 9, 1982.

Very truly yours,

William O. Parker, Jr.

PBN/jfw
Attachments

cc: Director
Office of Management and Program Analysis
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Records Center
Institute of Nuclear Power Operations
1820 Water Place
Atlanta, Georgia 30339

Mr. P. R. Bemis
Senior Resident Inspector-NRC
McGuire Nuclear Station

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DUKE POWER COMPANY
McGUIRE NUCLEAR STATION
REPORTABLE OCCURRENCE REPORT NO. 82-07

REPORT DATE: February 16, 1982

FACILITY: McGuire Unit 1, Cornelius, NC

IDENTIFICATION: Engineered Safety Features Actuation and Reactor Trip
Resulting from Extreme Cold Weather

DISCUSSION: On January 11, 1982, while at 75% reactor power, Unit 1 experienced an inadvertent actuation of Engineered Safety Features (ESF) causing safety injection (SI), steamline isolation, and reactor and turbine trips. ESF was automatically actuated as a result of a two-out-of-three low pressure coincidence trip of steam generator (S/G) "A" pressure instrumentation channels. Both channels tripped when pressure was released from their impulse lines through manually cracked open test connections.

In the progress of this event, abnormal efforts were employed to maintain power production. Extremely cold weather was being experienced throughout the Southeast, and record peak power demands were predicted for Monday morning, January 11. With several major power units off-line, it was considered essential to keep McGuire Unit 1 operating.

Exposure to the cold conditions began to cause errors in Unit 1 parameter measurement on January 10. When frozen impulse lines disabled automatic feedwater control, efforts to prevent instrument lines from freezing were initiated by installing portable heaters in the exterior doghouse. During the day the effects of the cold escalated (see "Sequence of Events"). By about 2200, when safety related instrument lines began to freeze, there were ten to twelve technicians continuously working to thaw instrument lines and warm the doghouse. Propane burners were used on the instrument lines, and a variety of heat producing devices including smudge pots were brought in to warm the area. Workers attempted to place a plastic covering over the open-topped doghouse to retain heat; however, the material shattered due to the cold before it could be installed.

At approximately 0900 on January 11, test connections on S/G pressure transmitter serving S/G's "A" and "D" (a total of six) in the penetration room were manually cracked open to provide flow in the associated impulse lines. This measure was intended to prevent further freezing by drawing warm steam line condensate through the lines. This method appeared successful for nearly three hours; so, personnel, who had been involved in heating instrument lines, abandoned the effort. At 1155 the impulse line to SMPT-5080, S/G "A" pressure transmitter (Channel I) either emptied of condensate, or froze providing a freeze seal line on the line. Pressure bled from the transmitter through the test connection and the channel tripped. A technician was dispatched to shut the test connection on the instrument line, but before pressure could be recovered and the channel reset, a second channel tripped by the same mechanism.

The recovery from inadvertent SI and reactor trip was accomplished without incident and the unit was soon stabilized at normal hot standby conditions.

SEQUENCE OF EVENTS: The sequence of events presents the major consequences of the cold weather experienced at the station.

1/10/82

- 0724 "S/G A flow mismatch lo, CF flow alert", CF (Main Feedwater) flow on Channel I failed low.
- 0830 S/G in manual (feedwater control) due to CF flow instruments freezing. Technicians installing heaters (in the doghouse area where the impulse lines are located).
- 1035 EMF-33 (Process Radiation Monitoring System) declared inoperable due to loss of sample flow. Sample line frozen.
- 1135 The CF flow detectors experienced fluctuations due to freezing of the instrument lines. Outside temperature ~19°F. FWST (Refueling Water Storage Tank) temperature had reached the lo lo setpoint. All heaters on; FW pump was on recirculate.
- 1345 EMF-31 declared inoperable due to loss of flow.
- 1514 An RF (Fire Protection System) sprinkler head burst on the turbine building mezzanine floor. The leak was isolated by shutting RF 135.
- 1535 All steam generator level control (feedwater flow) returned to the automatic mode.
- 1656 An RF sprinkler header on the southeast corner of Unit 1 Turbine Building was frozen and burst. The header was isolated.
- 1930 "Low Condensate Booster Pump Suction Pressure" alarm. The pressure switches on the impulse line had been blown off. The pump did not trip (as designated). Suspect the pressure switches had frozen. The impulse line was reinstalled.
- 1958 The RF header ruptured in the area around "G" feedwater heaters.
- 2034 An RF line of the turbine floor ruptured. It was isolated by shutting RF-421.
- 2056 S/G "D" auxiliary feedwater flow instrument, CAP 5120 frozen; declared inoperable.
- 2148 Main steam pressure decreasing rapidly. Computer point for "A" S/G indicating 1500 lbs. (actual ~1000 lbs). Found SV-19, power operated relief valve for S/G "A" open. Isolated the valve.
- 2152 CFPT-5680, S/G "A" feedwater pressure transmitter, is off scale high; suspected frozen.

- 2159 CAFT-5090, S/G "A" auxiliary feedwater flow, failed high; declared inoperable.
- 2205 SMPT-5080 and -5100, S/G "A" pressure transmitters, failing high; suspected frozen; declared inoperable.
- 2235 CFPT-565, S/G "D" feedwater pressure failed high. Isolated SV-1, PORV for S/G "D".
- 2300 Commenced unit shutdown, reducing the load.

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- 0054 CFPT-5000 and -5010, Channel I and Channel II, S/G "A" feedflow transmitters failed low; S/G "A" feedwater flow control valve in manual.
- 0130 SMPT-5090, S/G "A" pressure transmitter failing high.
- 0145 SMPT-5080 operating properly; declared operable.
- 0220 SMPT-5180, S/G "D" pressure transmitter, failing high; declared inoperable, and placed the channel (I) in the tripped condition.
- 0300 SMPT-5100 frozen; declared inoperable, and placed the channel (III) in the tripped condition.
- 0302 SMPT-5090 operating properly; declared the instrument operable, and secured the load reduction.
- 0318 SMPT-5180 operating properly; declared operable, and returned to operation.
- 0320 Commenced increasing reactor power to 75%; only Channel III of S/G "A" pressure instrumentation remains in the tripped condition.
- 0330 Returned S/G "A" feedwater control to the automatic mode.
- 0531 SMPT-5100 operating properly; declared operable and returned to operation.
- 0723 SMPT-5180 failing high; declared inoperable, and placed the channel (I) in the tripped condition.
- 0820 SMPT-5100 declared inoperable; placed the channel (III) in the tripped condition.
- 0825 SMPT-5100 operating properly; declared operable, and returned to operation.
- 0830 SMPT-5180 operating properly; declared operable and returned to operation.
- SMPT-5090 declared inoperable; placed the channel (II) in the tripped condition.

- 0900 Flow was established in S/G pressure transmitter impulse lines by bleeding test connections.
- 0930 SMPT-5090 operating properly; declared operable and returned to operation.
- 1155 SMPT-5080 failed low, tripping channel (I); the instrument was declared inoperable.
- 1206 Pressure at SMPT-5100 dropped below the trip setpoint due to instrument line bleed. S/G "A" pressure channel III subsequently tripped in coincidence with the already present channel I trip. ESF actuation and subsequent reactor and turbine trips ensued.

EVALUATION: All instrument lines affected by the cold were associated with S/G's "A" and "D". The unit 1 exterior doghouse serves as a containment penetration room for "A" and "D" secondary systems, while the interior doghouse provides for S/G's "B" and "C". Impulse line systems taps are made in the piping runs through the doghouses.

The doghouses are concrete structures providing physical security and support for the secondary systems piping. Their atmospheres are uncontrolled and they are mostly open at the top for natural ventilation, and to provide for the release of steam should a steam line break occur. Because of the relative location of those structures, the wind has a greater effect on the dissipation of heat from the exterior doghouse due to its exposure.

Inspection of site environmental data showed that, prior to the SI event, the temperature had remained below freezing for a 41 hour period. The most critical cold times were at approximately 1000 on January 10 and at 0700 on January 11 when the chill factored equivalent temperature was -28°F. It is considered significant that the wind direction during the period was from the northwestern and southwestern quadrants, providing maximum ventilation of the exterior doghouse.

In this event the instrument lines in the exterior doghouse proved to be the more susceptible to the consequences of cold environmental conditions. However, more severe conditions might produce similar results in the interior doghouse. The instrument lines in neither structure are insulated and some lengths are anchored to and are in direct contact with the structural concrete walls.

At 2205 on January 10, two S/G "A" pressure channels began to freeze, and were declared inoperable. Since both channels could not be tripped (results in SI actuation), technicians attempted to restore the channels by clearing the instrument lines of ice. At 2300 control room operators began shutting down the plant by reducing power. The conditions, for continuing plant operation, of Technical Specification 3.3.2 could not be met.

The only remaining operable S/G "A" pressure channel exhibited signs of freezing (fluctuating high indication) at 0130, January 11. However, by 0302 two channels were cleared, the third channel was manually tripped, and the load reduction was stopped. Having satisfied the conditions of Technical Specification 3.3.2, power escalation was initiated at 0320.

During the period from 2205, January 10 until 0302, January 11 the automatic ESF actuation capability of S/G "A" pressure channels was completely lost. The freeze seals on the impulse lines caused the instruments to fail high (in the unconservative direction). Except for the first hour in this condition, during which efforts to clear the known problem were ongoing, progress toward reactor shutdown was continual.

Under normal circumstances conservative operating practice would have dictated initiation of shutdown procedures at the time of the failure of the first two S/G pressure channels. Although continued operation was challenging to the allowable limits of Technical Specifications, the action taken is considered justified and no violation occurred.

At approximately 0900, the test connections on the S/G pressure transmitter impulse lines were cracked open. This action could have allowed the lines to void of fluid; but, through interview, it was assured that only a drip was established at all the test connections. Therefore, it can reasonably be assumed that freeze seals were established on the impulse lines of the channels that tripped. The freeze seals allowed depressurization of the lines at the pressure transmitters through the test connections.

Several technicians had worked throughout the night thawing instrument lines; so, when the test connection flow appeared to solve the problem, they were assured that continued effort was no longer necessary. After the doghouse was left unmanned the lines froze again.

SAFETY ANALYSIS: The purpose of the pressure instrumentation involved is to initiate ESF actuation and reactor trip in the event of a steam line break. The reactor trip is anticipatory to degraded primary system parameters which would follow a steam line break incident. Had a steam line break occurred in the S/G "A" associated subsystem while the instrumentation was disabled, a slightly delayed trip would have occurred when primary system parameters were affected. A steam line break in itself present no radiation hazard to the public.

CORRECTIVE ACTION: As immediate corrective action, heat tracing has been applied to instrument lines in the doghouse. The doghouse-enclosed equipment has been covered to prevent loss of heat until freezing is no longer a potential problem.

Luke Power Company is currently analyzing several potential permanent solutions, including permanent heat tracing; a comprehensive cold weather procedure; or providing adjustable dampers on the doghouses.

The interim measures now in effect are expected to be effective for the remainder of the season. The event, however, took place under unusual conditions. Permanent solutions will be analyzed for conditions as severe with an appropriate margin for safety.