Nebraska Public Power District

COOPER NUCLEAR STATION
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NLS940112

November 14, 1994

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

Cooper Nuclear Station Licensee Event Report 94-010, Supplement 1 is forwarded as an attachment to this letter.

Sincerely,

J. T. Herron
Plant Manager

JTH/nr

Attachment

cc: L. J. Callan
G. R. Horn
J. H. Mueller
R. G. Jones
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INPO Records Center
NRC Resident Inspector
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JE22

NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| COOPER NUCLEAR STATION | 05000298 | 1 OF 5 |

TITLE (4) Closure of Shutdown Cooling Suction Isolation Valves While Warming the Residual Heat Removal System Due to Leakage Through the Minimum Flow Valve.

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| 05 | 26 | 94 | 94 | --010-- | 01 | 11 | 14 | 94 | FACILITY NAME | DOCKET NUMBER |

| OPERATING MODE (9) | N | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| POWER LEVEL (10) | | | 20.402(b) | | 20.405(c) | X | 50.73(a)(2)(iv) | | 73.71(b) |
| | | | 20.405(a)(1)(i) | | 50.36(c)(1) | | 50.73(a)(2)(v) | | 73.71(c) |
| | | | 20.405(a)(1)(ii) | | 50.36(c)(2) | | 50.73(a)(2)(vii) | | OTHER |
| | | | 20.405(a)(1)(iii) | | 50.73(a)(2)(i) | | 50.73(a)(2)(viii)(A) | | (Specify in Abstract below and in Text, NRC Form 366A) |
| | | | 20.405(a)(1)(iv) | | 50.73(a)(2)(ii) | | 50.73(a)(2)(viii)(B) | | |
| | | | 20.405(a)(1)(v) | | 50.73(a)(2)(iii) | | 50.73(a)(2)(x) | | |

LICENSEE CONTACT FOR THIS LER (12)

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Gautam Sen, Senior Staff Nuclear Licensing & Safety Engineer | (402) 825-3811 |

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPRDS | | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPRDS |
|---|---|---|---|---|---|---|---|---|---|---|
| X | BO | V | A395 | Y | | | | | | |
| | | | | | | | | | | |

| SUPPLEMENTAL REPORT EXPECTED (14) | | | EXPECTED SUBMISSION DATE (15) | MONTH | DAY | YEAR |
|---|---|---|---|---|---|---|
| YES (If yes, complete EXPECTED SUBMISSION DATE). | X | NO | | | | |


ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On May 26, 1994, at 09:44 am, and again at 11:57 am and 12:06 pm, Residual Heat Removal (RHR) shutdown cooling isolation valves RHR-MOV-M017 and RHR-MOV-M018 closed as a result of actuation of one or both of the shutdown cooling suction high pressure switches RHR-PS-128A and RHR-PS-128B. These isolations occurred during heatup and flushing of RHR subsystem B loop piping which was being conducted in order to place the subsystem in the Shutdown Cooling mode of operation. At the time when these isolations occured, reactor pressure and temperature was approximately 40 psig and 280 degrees F, respectively. The turbine bypass valves were controlling RPV pressure, rejecting decay heat to the main condenser.

Subsequent to these isolations, leakage was audibly detected through RHR-MOV-M016B (RHR pump B minimum flow valve) to the suppression pool (torus). At 12:30 pm, RHR-MOV-M016B was closed manually with less than one hand wheel turn of the motor operator. Leakage through the valve was determined to have caused the rapid depressurization of the shutdown cooling suction line, creating steam voids in that section of piping, which led to hydraulic instability (pressure spiking) upon admittance of fluid to the suction piping. Per NUREG-1022, the root cause of this event is "Other," attributed to the lack of a Foreign Material Exclusion (FME) program at CNS.

A. Plant Status

The plant was shutdown and preparations were being made to place the RHR System in the Shutdown Cooling mode of operation. Reactor pressure and temperature was approximately 40 psig and 280 degrees F, respectively, throughout the duration of this event. The turbine bypass valves were controlling RPV pressure, rejecting decay heat to the main condenser.

B. Event Description

On May 26, 1994, at 09:44 am, and again at 11:57 am and 12:06 pm, Residual Heat Removal (RHR) shutdown cooling isolation valves RHR-MOV-M017 and RHR-MOV-M018 closed as a result of actuation of one or both of the shutdown cooling suction high pressure switches RHR-PS-128A and RHR-PS-128B. Prior to receipt of the first isolation, heatup and flushing of RHR subsystem B loop piping was in progress in preparation for placing the subsystem in the Shutdown Cooling mode of operation. When RHR-MOV-M015B and RHR-MOV-M015D (RHR pump shutdown cooling suction valves) were opened, RHR-MOV-M017 and RHR-MOV-M018 closed. Indications of a pressure perturbation were observed and RPV level dropped approximately 4.5 inches (minimum level for the event was approximately 210 inches above TAF). Other indications included annunciation of both the RHR SDC suction header pressure high alarm and the Automatic Depressurization System (ADS) auxiliary cooling interlock alarm.

A preliminary evaluation of the data on the isolation indicated that a steam void had formed and subsequently collapsed in the RHR suction piping downstream of RHR-MOV-M015B & D causing a pressure perturbation which actuated one or both of the shutdown cooling suction high pressure switches RHR-PS-128A and 128B. A walkdown of accessible RHR piping was performed and no damage to system piping or components was found. No evidence of system leakage was observed during the system walkdown. Prior to attempting to re-open RHR-MOV-M017 and 18, it was noted that because the heated water (approximately 250 degrees F) had been static in the suction piping for more than two hours, a void could be present. As such, it was understood that there was a potential for a second isolation, and that in this event, the valves should be re-opened as soon as possible afterward to prevent a void from reforming. At 11:00 am the intermediate elevation RHR suction pressure gauge was indicating 28 psig.

At 11:57 am, the group 2 logic was reset and RHR-MOV-M017 and 18 were opened. The isolation was again received with indications of a pressure perturbation and an RPV level decrease of approximately 13.5 inches (minimum level for the event was approximately 200 inches above TAF). However, the actual setpoint of 72.5 psig (shutdown cooling high suction pressure interlock), which provides overpressure protection for the shutdown system piping, was not reached.

B. Event Description (continued)

At 12:06 pm, the Group 2 logic was reset and RHR-MOV-M017 and 18 were re-opened. The isolation was again received with indications of a pressure perturbation and RPV level decrease of approximately 16.5 inches (minimum level for the event was approximately 200 inches above TAF). Subsequent to the event, the system engineer, who was in the vicinity of RHR pumps B and D, audibly detected leakage through RHR-MOV-M016B (RHR pump B minimum flow valve) to the suppression pool (torus). In a parallel investigation, it had been noted that suppression pool level had been increasing slowly since approximately 5:00 am, which corresponded with the commencement of subsystem flushing operation. At 12:30 pm, with less than one hand wheel turn, RHR-MOV-M016B was manually closed and was subsequently declared inoperable.

Over the time period of flushing and heatup operations (seven hours), RHR pump B minimum flow valve RHR-MOV-M016B had been leaking into the torus. The leakage through RHR-MOV-M016B was the cause of both the torus level increase and the rapid depressurization of the shutdown cooling suction line. The multiple isolations of RHR shutdown cooling isolation valves RHR-MOV-M017 and M018 were caused by pressure perturbations (water hammer) in the RHR shutdown cooling suction line.

At 1:10 pm, the intermediate level RHR suction pressure gauge, which was indicating 28 psig prior to closing M016B, was found to be indicating 38 psig.

At 3:30 pm, based on pump suction pressures and gauge elevations, it was determined that no void could exist in the suction piping. In addition, it was noted that the increase in torus level had ceased since RHR-MOV-M016B was closed. A systematic walkdown of accessible piping was again performed and no damage to system piping or components was found. At 5:25 pm, RHR-MPOV-M017 and 18 were opened and Procedure 2.2.69.2 was re-initiated. Shutdown cooling was established at 9:35 pm without further incident.

C. Cause

Leakage through RHR-MOV-MO16B caused depressurization and flashing of hot fluid (approximately 250°F) in the suction line and led to steam void formation in the line. The rapid repressurization of the suction line, when RHR-MOV-MO15B and 15D (first attempt) and RHR-MOV-MO17 and MO18 (second and third attempts) were opened, collapsed the steam voids which resulted in a water hammer. The engineering and operations personnel did not develop pre-planned actions to eliminate the steam void. This resulted in multiple unsuccessful attempts to establish shutdown cooling.

The failure of RHR-MOV-MO16B to fully close was caused by foreign particles on one of the two torque switch contacts. When the control switch for the valve was taken to CLOSED, the limit switch (LS8) bypassed the torque switch and allowed the motor operator to operate up to 97% fully closed position.

The root cause of this event is lack of a Foreign Material Exclusion (FME) program at CNS.

D. Safety Significance

The failure of RHR pump B minimum flow valve, RHR-MOV-MO16B, to fully close was caused by foreign particles on one of the two torque switch closed contacts. The leakage path past the seat of RHR-MOV-MO16B valve provides a source of vessel inventory loss into the torus. Based on the estimate of total leakage to the torus (8000 gallons) over the time frame of flushing and heat up operations (seven hours), the leakage rate would have been approximately 50 gpm through RHR-MOV-MO16B valve during shutdown cooling. It is not a significant impact on available system flow from either the main condensate system during normal operations, or low pressure ECCS pumps during faulted conditions. Shutdown cooling is the only mode of concern during which the leak path is isolable (either by RHR-MOV-MO17 and MO18 or RHR-MOV-MO15B and 15D from the suction side, and by MO27B and pump discharge check valve form the discharge side). The effects of this leak would raise the torus water level and it is well monitored in the Control Room via high level alarm annunciators. If RHR-MOV-MO16B valve failure would have occurred coincident with a LOCA, then it would be considered as the single failure and the redundant A-train of RHR system would provide the required cooling. Also, containment integrity is assured because this is a closed system outside containment.

Based on the probable impact of the leakage of RHR-MOV-MO16B valve on the plant during operation, shutdown and LOCA conditions, it can be concluded that the safety significance of this event is minimal.

E. Corrective Action

As part of the short-term corrective action for eliminating the root cause of this event, appropriate safety related motor operated valves (MOV) will be checked for torque-in current during MOV operability surveillances.

In order to prevent recurrence of this type of event, a Foreign Material Exclusion (FME) program will be developed and implemented at CNS and a motor operated valve compartment cleanliness program will be incorporated into the MOV surveillance procedures.

Also, throughout flushing and heatup evolutions, per RHR System Operations Procedure 2.2.69.2, it will be ensured that RHR suction and discharge piping is filled and pressurized.

F. Similar Events

LER 92-007 Actuation of shutdown cooling isolation valves due to low reactor pressure while warming the Residual Heat Removal System.

LER 94-005 Actuation of shutdown cooling isolation valves due to a pressure perturbation caused by void collapse in the Residual Heat Removal System.