# CATEGORY 1

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FACIL:50-270 Oconee Nuclear Station, Unit 2, Duke Power Co. 05000270
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SUBJECT: LER 96-005-01:on 961030,potential uncontrolled release Via Main Steam relief valves occurred due to inadequate work practices.Cotter pins were properly attached.W/970130 ltr.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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DUKE POWER

January 30, 1997

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

Subject: Oconee Nuclear Station Unit
Docket Nos. 50-269, -270, -287
Licensee Event Report 270/96-05
Problem Investigation Process No.: 2-096-2031

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a) (1) and (d), attached is Licensee Event Report 270/96-05, concerning the technical inoperability of the Main Steam Safety Valves.

This report is being submitted in accordance with 10 CFR 50.73 (a) (2) (v) (C). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

J. W. Hampton

/fts

Attachment

070033

IE22

Document Control Desk
January 30, 1997

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NRC 366 (4-95) U.S. REGULATORY COMMISSION

APPROVED OMD NO. 3150-0104
EXPIRES: 04/30/98
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)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Oconee Nuclear Station, Unit Two | 05000 270 | 1 Of 8 |

TITLE (4)
Potential Uncontrolled Release Via Main Steam Relief Valves Due To Inadequate Work Practices

| 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(S) |
| | | | | | | | | | Oconee, Unit Three | 05000 287 |
| 10 | 30 | 96 | 96 | - 05 | - 01 | 01 | 30 | 97 | | 05000 |

| OPERATING MODE (9) | N | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (Check one or more of the following) (11) | | | | | |
|---|---|---|---|---|---|---|---|
| POWER LEVEL (10) | 0 | 20.402(b) | 20.405(c) | 50.73(a)(2)(iv) | 73.71(b) | | |
| | | 20.405(a)(1)(i) | 50.36(c)(1) | X 50.73(a)(2)(v) (C) | 73.71(c) | | |
| | | 20.405(a)(1)(ii) | 50.36(c)(2) | 50.73(a)(2)(vii) | OTHER (Specify in Abstract below and in Text, NRC Form 366A) | | |
| | | 20.405(a)(1)(iii) | 50.73(a)(2)(i) | 50.73(a)(2)(viii)(A) | | | |
| | | 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 |
|---|---|
| | AREA CODE |
| W. W. Gibson Safety Review | (864) 885-3413 |

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 | |
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| 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 fifteen single-space typewritten lines) (16)

On October 14, 1996, Units 1 and 2 were at cold shutdown and Unit 3 was in a refueling outage. As a result of industry events, an inspection of the Unit 2 Main Steam Safety Valves (MSSV) was conducted. This inspection indicated that the spindle nut cotter pins were not properly installed on four of the sixteen valves. On October 24, 1996, an inspection of the Unit 3 MSSVs revealed that the spindle nut cotter pins were missing from two of the sixteen valves. The Unit 1 MSSV spindle nut cotter pins were found to be properly installed. On October 29, 1996, at 1000 hours, an engineering review concluded that a reasonable doubt existed as to whether the MSSVs could have mitigated the consequences of certain accidents. The root cause of this event is Inadequate Work Practices. Corrective action includes implementation of a modification, revising procedures and additional training.

BACKGROUND

Two Main Steam (MS) [EIIS:SB] lines exit each Reactor Building [EIIS:NH] and run outside before entering the Turbine Building (TB) [EIIS:NM]. Prior to entering the TB each line has eight relief valves installed. These sixteen relief valves provide the ASME code required overpressure protection for the MS system.

A spindle nut is threaded on the exposed portion of the spindle at the top of each valve and is secured with a cotter pin. The spindle nut provides a bearing surface for the lift device to transfer force that can be used for manually opening the valve.

EVENT DESCRIPTION

An industry event, that occurred in May 1996, resulted in a Main Steam Safety Valve (MSSV) failing to reseat due to problems associated with cotter pins and the spindle nut connection. There have been several other similar events over the past ten or fifteen years. As a result of the May 1996 event, an inspection of the cotter pin to nut configuration of each MSSV was planned.

On August 14, 1996, a meeting was held between Duke Power and the NRC to discuss the inspection of the cotter pin/spindle nut configuration. The differences in the Oconee valves and the valves associated with the May 1996 industry event, were discussed. Engineering concluded that the valve design differences justified an expectation that the Oconee valves' spindle nuts were acceptably locked to the spindles. Due to safety concerns with personnel near the valves, if the unit were to trip while at power, a decision was made to inspect the MSSV cotter pins at the next refueling outage on each unit. A Problem Investigation Process (PIP) report was initiated to track these inspections on all three units.

On September 24, 1996, Unit 2 was manually tripped due to a heater drain pipe rupture. Subsequently, Units 1 and 3 were shut down in a controlled sequence due to safety concerns and inspection of piping.

A decision was made to inspect the spindle nut cotter pins while the units were shut down.

On October 14, 1996, an inspection of the Unit 2 MSSVs found that the spindle nut cotter pins were not properly installed on four of the sixteen valves (2MS-1, 2MS-5, 2MS-13, and 2MS-14). The pins were not bent in a sufficient manner to prevent them from possibly vibrating out of the spindle nut. A PIP was initiated to document the findings and Engineering was assigned to evaluate the consequences of the improperly installed pins.

On October 15, 1996, an inspection of the Unit 1 MSSVs found that all sixteen valves had their spindle nut cotter pins properly installed.

On October 24, 1996, an inspection of the Unit 3 MSSVs found that on two of the sixteen valves (3MS-1 and 3MS-10) the spindle nut cotter pins were missing. Another PIP was initiated to document the findings and Engineering was assigned to evaluate the consequences of the missing pins.

On October 29, 1996, component engineering completed a preliminary analysis of the missing pins on the Unit 3 valves. The spindle nuts had actually been found in their proper position. However, the possibility existed that, once opened during a unit trip, flow-induced vibration might cause one or both of the unsecured spindle nuts to rotate down the spindle toward the valve body. As a result, the MSSVs with the missing pins could have been prevented from properly closing when required. It was concluded that a reasonable doubt existed as to whether the MSSVs could have mitigated the consequences of certain accidents which result in a reactor trip. At 1148 hours, the condition was conservatively reported to the NRC.

On October 30, 1996, component engineering completed a preliminary analysis of the improperly installed cotter pins on Unit 2. The possibility existed that, if a MSSV was opened during an event, flow-induced vibration might cause the cotter pins, which were not properly installed, to vibrate out of the spindle nut. With no cotter pin in

the spindle nut, the unsecured spindle nut might also rotate down the spindle toward the valve body. As a result, the MSSVs which had the improperly installed cotter pins could have been prevented from properly closing when required. At 1414 hours, the condition was conservatively reported to the NRC.

Engineering continued the evaluation for the past operability of the system for accident situations. An investigation was initiated to determine the cause of the missing and improperly installed cotter pins.

Procedures were reviewed for the maintenance and testing of the MSSVs. The most recent setpoint testing had been performed on Unit 1 in June 1994, on Unit 2 in May 1996, and on Unit 3 in June 1995. The setpoint testing procedure, step 11.5, requires verifying the spindle nut cotter pin is installed and in good mechanical condition. It requires replacement, if damaged, and documentation on the data sheet of each valve. To perform the test, the procedure requires removal of the cotter pin and spindle nut. Step 12.3 of the restoration portion of the setpoint testing procedure requires the spindle nut cotter pins to be in place and in good mechanical condition. This is a single sign-off step for verification of all sixteen MSSVs.

Nuclear Maintenance Specialists (NMS), who performed the MSSV testing for each unit, were interviewed. NMSs who worked on Unit 1 indicated that individual valves were restored prior to testing the next valve. NMSs who worked on Unit 2 indicated that, following the testing of a line (8 valves), the restoration was performed on all valves in the line. NMSs who worked on Unit 3 indicated that all sixteen valves were tested before the restoration step and was performed by the entire crew which is composed of three or four NMSs and possibly the supervisor.

During the inspection of the cotter pins, it was noted that some of the Unit 2 pins were shorter than others. The cotter pins that were improperly bent were two inches long and the properly bent pins were three inches long. There is no length specified on the drawings or in the procedures for the cotter pins. The two inch cotter pins are too short to adequately bend.

On December 5, 1996, engineering concluded in a past operability evaluation for Unit 3 that, for a Steam Generator Tube Rupture scenario, post accident releases could be greater than current UFSAR values but would remain less than 10 CFR 100 limits.

CONCLUSIONS

The root cause of this event is Inadequate Work Practices. If the maintenance technicians performing the setpoint test on the Main Steam Safety Valves (MSSV) had properly secured the cotter pins, this condition would not have occurred. Installation of cotter pins is considered skill of the craft and should not require detailed procedure steps. The improperly installed cotter pins could be partially attributed to the length of the cotter pins and the lack of attention to detail. The pins should have been of sufficient length to allow for proper installation. Management expectations are that technicians are to use their skill in properly installing cotter pins and stop the activity if the task cannot be performed adequately.

A historical search of events and problem reports over the last two years indicates that there have been no similar events with a root cause of inadequate work practices. However, there have been less significant problem reports which could be attributed to inadequate work practice.

There were no equipment failures associated with this event.

There were no personnel injuries, radiation exposures, or releases of radioactive materials associated with this event.

CORRECTIVE ACTIONS

Immediate

1. The cotter pins were properly attached.

Subsequent

1. An analysis was performed that verified the valves would properly operate if the spindle nuts and cotter pins were removed. Modifications were implemented to remove the lift lever assembly, spindle nuts, and cotter pins on all three units Main Steam Safety Valves.

2. The Pressurizer (PZR) [EIIS:PZR] code safety valves on all three units were inspected for similar deficiencies and none were found.

3. Maintenance reviewed all 551 safety related valve maintenance procedures for removal and restoration steps with a special emphasis on fasteners. A list of weaknesses was generated.

Planned

1. Prioritize and resolve the list of weaknesses generated by the review of safety related valve maintenance procedures.

2. Strengthen field validation process for maintenance procedures.

3. Train all appropriate Maintenance field personnel in practical factors to focus on work standards and practices for each functional area in Maintenance.

4. Implement modifications to remove the lift lever assembly, spindle nuts, and cotter pins on PZR code safety valves on all three units.

5. Train appropriate personnel on this incident as well as industry events concerning cotter pin installation and use.

SAFETY ANALYSIS

For this report, the potential existed that one or more Main Steam Safety Valves (MSSV) could have failed to reseat due to the improper cotter pin installation, following an initiating event. The licensing basis events which result in MSSVs lifting were analyzed. These are 1) unit trip and 2) Steam Generator Tube Rupture.

Scenario 1, Unit Trip:

The MSSVs lift following a reactor or turbine trip from greater than approximately 20% full power. The primary system transient would vary depending upon which valves are postulated to fail to reseat. Key aspects of the postulated transient include: the uncontrolled depressurization of one or both Steam Generators (SG), overcooling and depressurization of the Reactor Coolant System (RCS) [EIIS:AB], additional High Pressure Injection [EIIS:BG] would actuate on the low RCS pressure, and Feedwater [EIIS:SJ] would be automatically and manually controlled and isolated to stop the overcooling and stabilize the RCS conditions. The Emergency Operations Procedure provides guidance to respond to transients with failed open MSSVs. Any failed open MSSV could be readily identified and appropriate actions taken to mitigate further consequences.

The overcooling rate from four failed open MSSVs is bounded by the UFSAR steam line break accident. The main steam line break bounds SG tube loads due to SG blowdown and tube to shell delta T stresses.

The conditional core damage probability as a result of a stuck open MSSV following a reactor trip has been evaluated. For the assumed conditions, the conditional probability of core damage is calculated to be approximately 8.6E-07. The importance of a stuck open MSSV that may result from an improperly placed or missing cotter pin has been examined and results indicate that the situation does not represent an accident sequence precursor.

Scenario 2, Steam Generator Tube Rupture:

Two cases were examined: (1) A Steam Generator Tube Rupture (SGTR) accident with initial, steady-state Reactor Coolant System (RCS) activity levels, with a concurrent spike in the iodine release rate from the fuel. (2) A SGTR with a pre-existing spike in the RCS activity. The current licensing basis for the SGTR accident is 1% failed fuel (i.e. 368 leaking rods), with no concurrent iodine spiking. However, Unit 3 operated with up to 21 leaking rods before October 8, 1996, and iodine spiking was observed during Unit 3 transients during this period. Thus, the investigation of the consequences of concurrent iodine spiking is a reasonable boundary condition, yet outside of the current Unit 3 licensing basis. The resulting 0-2 hour Exclusion Area Boundary (EAB) thyroid and whole body doses (9.8 rem thyroid and 1.4E-2 rem whole body) are above the current UFSAR values (1.11 rem thyroid and 7E-3 rem whole body), but remain well below the 10 CFR 100 criteria (300 rem thyroid and 25 rem whole body), for the 0-2 hour EAB doses. The 0-30 day low-population zone (LPZ) thyroid and whole body doses (28.5 rem thyroid and 4E-2 rem whole body) are below the 10 CFR 100 criteria (300 rem thyroid and 25 rem whole body), for the 0-30 day LPZ doses.

The Unit 2 SGTR offsite dose results are: The 0-2 hour EAB thyroid and whole body doses (1.0 rem thyroid and 1.82E-3 rem whole body), are below the Updated Final Safety Analysis Report (UFSAR) and well below the 10 CFR 100 criteria. The 0-30 day LPZ thyroid and whole body doses (4.61 rem thyroid and 5.44E-3 rem whole body), are below the 10 CFR 100 criteria.

The overall impact, of this postulated event, on the health and safety of the public is very low. There were no personnel injuries or releases of radioactive material associated with this event.