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January 8, 1990

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U. S. Nuclear Regulatory Commission
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SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report 50-313/89-043-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(ii), attached is the subject report concerning the boric acid corrosion of a control rod drive mechanism flange assembly caused by a deteriorated gasket which resulted in a Reactor Coolant System pressure boundary degradation.

Very truly yours,

E. C. Ewing
General Manager,
Technical Support
and Assessment

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U.S. Nuclear Regulatory Commission
Approved OMB No. 3150-0104
Expires: 8/31/85

# LICENSEE EVENT REPORT (LER)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Arkansas Nuclear One, Unit One | 0 5 0 0 0 3 1 3 | 1 OF 0 3 |

TITLE (4) Boric Acid Corrosion of a Control Rod Drive Mechanism Flange Fastening Assembly Caused by a Deteriorated Gasket Results in Reactor Coolant System Pressure Boundary Degredation

| 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 Names | Docket Number(s) |
| 1 2 | 0 8 | 8 9 | 8 9 | 0 4 3 | 0 0 | 0 1 | 0 8 | 9 0 | | 0 5 0 0 0 |
| | | | | | | | | | | 0 5 0 0 0 |

| 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 0 0 | 20.402(b) | | 20.405(c) | | 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 (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) | X | 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) |
|---|---|
| Larry A. Taylor, Nuclear Safety and Licensing Specialist | 5 0 1 9 6 4 - 3 1 0 0 |

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 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |

| SUPPLEMENT 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 December 6, 1989, while removing the nut ring from beneath the reactor vessel (RV) nozzle flange at Control Rod Drive Mechanism (CRDM) location L-2, plant maintenance personnel discovered that approximately 50 percent of one of the nut ring halves had corroded away and that two of the four bolt holes in the corroded nut ring half were degraded to the point where there was no bolt/thread engagement. A total of six CRDM flanges had been identified to be potentially leaking during a video camera inspection on November 28, 1989 while the plant was in hot shutdown. After the plant was taken to cold shutdown, maintenance personnel disassembled and inspected the six CRDM flanges which had been identified during this inspection. All of the gasket seating surfaces were found to be undamaged with the exception of L-2. The RV nozzle flange at L-2 was eroded and pitted. An inspection of the flanges and spiral wound gaskets which were removed from between the flanges revealed that the cause of the leaks was the gradual deterioration of the gaskets with age. An Engineering evaluation concluded that the L-2 nozzle flange was acceptable for use. A replacement CRDM was installed at location L-2. Additionally, the gaskets on the six CRDMs were replaced with new design graphite type gaskets.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

| FACILITY NAME (1) | DOCKET NUMBER (2) | LER NUMBER (6) | | | PAGE (3) |
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

A. Plant Status

At the time of discovery of this condition, Arkansas Nuclear One, Unit 1 (ANO-1) was in the cold shutdown condition. Midcycle outage 1489 was in progress.

B. Event Description

On December 8, 1989, while removing the nut ring from beneath the reactor vessel (RV) nozzle flange at Control Rod Drive Mechanism (CRDM) location L-2, plant maintenance personnel discovered that approximately 50 percent of one of the nut ring halves had corroded away and that two of the four bolt holes in the corroded nut ring half were degraded to the point where there was no bolt/thread engagement.

The CRDMs are attached to the RV by eight hold down bolts which pass through the CRDM flange and the RV nozzle flange and thread into a nut ring which is positioned below the RV nozzle flange. The nut ring is a two piece carbon steel ring with four threaded holes in each section.

The disassembly of the L-2 CRDM flange was being performed as a result of its being identified as leaking on November 28 while the plant was in the hot shutdown condition. At that time, a video camera inspection of a RV level monitoring instrumentation (Rad Cal) flange which had been repaired in May, 1989 was being conducted. During this inspection, a small amount of water was observed to be dripping from flange L-2. Upon discovery of this leak, a 100 percent inspection of the CRDM flanges was conducted with the video camera. Boron deposits were observed on five additional CRDM flanges which indicated that they could possibly have been leaking. The Rad Cal flange was also observed to be leaking.

After the plant was taken to cold shutdown, maintenance personnel disassembled and inspected the flanges of the six CRDMs which had been identified as potential leakers. The location numbers of these flanges are; E-5, D-8, G-9, H-8, N-8 and L-2. The RV nozzle flange at L-2 was eroded and pitted. All other inspected flanges were undamaged.

C. Safety Significance

An Engineering evaluation was conducted which determined that in its as-found condition, with two of the eight bolts carrying no load, the L-2 CRDM flange and nut ring assembly was within code allowable stress limits and would have withstood the worst case faulted condition loads. However, the ring nut assembly at L-2 was severely corroded and did represent a significant degradation of a Reactor Coolant System (RCS) [AB] pressure boundary. Had this condition gone undetected, the nut ring would have continued to corrode and could have resulted in a significant non-isolable RCS leak. It is unlikely, however, that the leak rate could have become significant without being detected due to the various RCS leakage detection methods/systems used at ANO. During power operation, RCS leakage is monitored by the Inventory Balance System, the Reactor Building (RB) Sump Monitoring System, and the RB Air Monitoring System. If the total RCS leakage exceeds 10 gallons per minute (gpm) or if unidentified RCS leakage exceeds 1 gpm, the plant's Technical Specifications require that the reactor be shut down.

In addition, prior to depressurizing in preparation for outages, and after repressurization before resuming power operation, the RCS is inspected for leaks. This inspection includes the RV head area. Any identified RCS leaks are evaluated for boric acid corrosion effects.

D. Root Cause

An inspection of the flanges and the spiral wound gaskets which were removed from between the flanges revealed that the cause of the leaks was the gradual deterioration of the gasket material with age. The gasket at L-2 had been in place since initial plant operation. The initial leakage flowpath at L-2 was across the face of the flange, down the hold down bolts and on to the carbon steel nut ring. This leakage flowpath had not been previously anticipated. Since the leakage did not travel to the outside edge of the flange and because the nut ring area is not easily viewed, it was not detected during previous routine inspections of the RV head area. The five other CRDM flange leaks were the result of minor gasket deterioration. The Rad Cal leak was caused by a defective seal.

E. Basis For Reportability

Since this condition represented a significant degradation of an RCS pressure boundary, it is considered reportable pursuant to 10CFR50.73 (a)(2)(ii).

This condition was also reported in accordance with 10CFR50.72 on December 12, 1989, via the Emergency Notification System.

F. Corrective Actions

An Engineering evaluation was performed by Babcock and Wilcox (B&W) which concluded that, although the L-2 RV nozzle flange was eroded and pitted, it was acceptable for use. B&W is presently developing a method by which the flange can be remachined. After development of this method, the L-2 flange will be remachined during the first outage of sufficient duration. The RV dome area and the RV head bolts were visually inspected for boric acid corrosion. This inspection revealed no significant corrosion or metal loss in this area.

A design change was implemented which installed new design graphite type gaskets, which were recommended by the vendor, in the six CRDM flanges and the Rad Cal flange.

A replacement CRDM was installed in location L-2. Additionally, the nut rings, bolts and washers were replaced on all six of the CRDM flanges and on the Rad Cal flange.

The defective Rad Cal seal design was modified to prevent leakage.

The "Inspection and Evaluation of Boric Acid Leaks" procedure will be revised by June 15, 1990, to require the inspection of the nut rings and associated hardware whenever a CRDM flange leak is identified. There are no RV head area inspections anticipated prior to this date.

The new design graphite gaskets which have been installed will be evaluated to determine if they are more reliable than the spiral wound gaskets which were originally installed. If the graphite gaskets prove to be more reliable, the spiral wound gaskets will be replaced, as necessary.

G. Additional Information

Similar events in which abnormal degradation of RCS pressure boundary components resulted from boric acid corrosion were reported in LERs 50-313/86-006-00 and 50-368/87-003-01.

Energy Industry Identification System (EIIS) codes are indicated in the text as [XX].