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1CAN051002

May 26, 2010

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Licensee Event Report 50-313/2010-002-00
Arkansas Nuclear One – Unit 1
Docket No. 50-313
License No. DPR-51

Dear Sir or Madam:

In accordance with 10 CFR 50.73(a)(2)(ii)(A), attached is the subject report concerning leakage through the Reactor Coolant System pressure boundary.

There are no new commitments contained in this correspondence.

Sincerely,

Original signed by Stephenie Pyle for D. B. Bice

DBB/fpv

Enclosure

cc: Elmo Collins
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NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 8/31/2010

Estimated burden per response to comply with this mandatory information collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Reactor Coolant System Pressure Boundary Leakage Due to Primary Water Stress Corrosion Cracking of Pressurizer Level Instrument Tap Resulted in Degradation of a Principal Safety Barrier

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
03	27	2010	2010	- 002	- 00	05	26	2010	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

6

10. POWER LEVEL

000

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☒ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER- Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
David Bice, Acting Manager, Licensing	479-858-5338

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

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	AB	PZR	B015	Y						

14. SUPPLEMENTAL REPORT EXPECTED

☐ **YES (If yes, complete 15. EXPECTED SUBMISSION DATE)**

☒ **NO**

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

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

On March 27, 2010, with Arkansas Nuclear One - Unit 1 (ANO-1) in Mode 6 for a refueling shutdown, visual examinations discovered indications of through wall leakage on an ANO-1 Reactor Coolant System (RCS) pressurizer level instrument tap nozzle. Leakage was indicated by a small amount of dry boron on the lower portion of the nozzle bore with rust stains on the Alloy 600 nozzle and in the vicinity surrounding the nozzle outlet. Subsequent inspections and evaluation revealed minor corrosion of the nozzle bore and concluded that the failure mechanism for the degradation was Primary Water Stress Corrosion Cracking (PWSCC) of Alloy 600 material. A planned mitigation repair method for the affected nozzle was implemented to resolve this condition. Also, in accordance with Arkansas Nuclear One's Inservice Inspection program, the remaining 8 pressurizer nozzles were visually inspected and exhibited no indications of leakage or degradation. During the refueling outage, all 9 pressurizer instrument nozzles were replaced with materials that are resistant to PWSCC. The pressurizer nozzles with dissimilar metal butt welds (surge, spray, and safety valve nozzles) had previously been mitigated by a full structural weld overlay.

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NARRATIVE

A. Plant Status

At the time this condition was discovered, Arkansas Nuclear One, Unit 1 (ANO-1) was shutdown in Mode 6 for a scheduled refueling outage.

B. Event Description

On March 27, 2010, during a scheduled visual examination, an Entergy examiner noted conditions indicative of corrosion and a through wall leak on an ANO-1 Reactor Coolant System (RCS) [AB] pressurizer [PZR] level tap nozzle. This is 1 of 9 pressurizer instrument penetrations that contained Alloy 600 materials. The leakage was indicated by a small trail of what appeared to be dry boron on the lower portion of the nozzle bore accompanied by rust stains on the Alloy 600 nozzle and the insulation cut-out around the nozzle. The affected nozzle is located in the upper section (steam space) of the pressurizer.

On March 31, 2010, upon completion of initial machining to remove a portion of the original nozzle to a depth of 2 1/8 inches from the outside diameter (OD) of the pressurizer shell, a visual inspection was performed. This depth is the design boring depth for the installation of a new half nozzle. The inspection revealed minor wastage of the pressurizer carbon steel at the 270 degree position (with zero degrees at top dead center, increasing in a clockwise direction when looking from the outside of the pressurizer) and evidence of general corrosion in the annulus between the bore and the nozzle remnant. A decision was made to bore an additional 1/2 inch, which was the maximum capable depth allowed by the installed Foreign Material Exclusion (FME) plug. A visual and boroscopic examination of the bore revealed similar corrosion and wastage. Accordingly, additional nozzle removal was performed to determine the extent of this corrosion. A shorter length FME plug was installed that allowed removal of the original nozzle to a depth of 5 inches. This permitted further inspections (on April 3 and April 4, 2010) confirming that there is no structurally significant wastage.

The assessment of the extent of corrosion in the affected nozzle conservatively estimated the total volume of material loss is 0.43 cubic inches. This value assumes a nominal 0.06 inch depth of material loss over 30 percent of the surface area of the bore. The diameter of the bore is 1.455 inches and the depth is 5 inches. The maximum depth of corrosion in the radial direction with respect to the bore/penetration axis was estimated to be 0.10 inches, which was at the original 270 degree location at the 2 inch bore depth.

There was no evidence of leakage identified in the remaining 8 pressurizer nozzles.

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C. Cause

The original installed pressurizer nozzle materials are comprised of Inconel Alloy 600 and weld material 82/182. These Inconel materials are susceptible to Primary Water Stress Corrosion Cracking (PWSCC). The type of leakage noted (boron trails and rust stains) is indicative of this type of degradation. Further examination and evaluation of the affected nozzle determined that the cause was due to through wall PWSCC of either the nozzle material or the J-weld material.

The wastage present in the bore of the pressurizer penetration was due to the corrosive environment that developed as a result of the leakage. The wastage consists of general area corrosion with local areas of pitting. Most of the corrosion identified is limited to the bottom half of the bore. The localized pitting is random and does not appear to be a result of damage mechanisms amplified by high velocity flow rates, such as flow accelerated corrosion or jet impingement erosion. The primary damage mechanism appears to be oxidation of the carbon steel base metal due to the presence of moisture and air, with localized pitting of small areas.

D. Corrective Actions

The affected nozzle was replaced along with the remaining 8 other small bore nozzles on the pressurizer. As part of the Alloy 600 mitigation program, all 9 pressurizer nozzles had been scheduled for replacement during this refueling outage and were replaced with materials that are resistant to PWSCC (Inconel materials Alloy 690 and weld metal 52/152).

An engineering evaluation of the nozzle bore corrosion where the leakage occurred was performed with regard to the structural qualification of the pressurizer vessel. The modified geometry of the replacement nozzle, the OD pad, and the associated welds were evaluated to determine if the corrosion must be repaired or to determine if the condition was acceptable for continued service as-is. The modified geometry was the result of excavating the existing nozzle deeper than originally designed and a slightly increased nozzle diameter. The evaluation report calculated an ASME Code allowable bore diameter in the pressurizer of 3.34 inches. With a maximum corrosion depth of approximately 0.10 inches, the corrosion is well within the Code allowable. Additionally, the half-nozzle repair meets the primary stress requirements of the ASME Code, Section III.

E. Safety Significance Evaluation

Examinations and evaluation of the affected nozzle have characterized the corrosion as minor. There was minimal base material wastage to the pressurizer nozzle area. Additionally, a nozzle repair method has been qualified and accepted which leaves the flaw contained in the original ID weld and the nozzle remnant in place.

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E. Safety Significance Evaluation - continued

During the previous operating cycle, there were no indications of degradation. RCS total leakage prior to shutdown for the refueling outage was stable, with a maximum RCS total leak rate for the month of March 2010 of 0.285 gallons per minute (gpm). The unidentified leak rate measured on March 21, 2010 immediately prior to shutdown for refueling was 0.028 gpm. These values are well within the Technical Specification RCS leak rate limits. While the contribution from the nozzle flaw cannot be specifically quantified, the unidentified leak rate measurement above provides a bounding value.

For these reasons, the overall safety significance of this condition was determined to be minimal.

F. Basis for Reportability

Using the guidance from NUREG-1022, “Event Reporting Guidelines – 10 CFR 50.72 and 50.73”, Section 3.2.4, the discovered condition was considered a serious degradation of a principal safety barrier. Accordingly, on March 27, 2010, an immediate notification was made to the NRC Operations Center in accordance with 10 CFR 50.72(b)(3)(ii)(A). The report herein is submitted pursuant to 10 CFR 50.73(a)(2)(ii)(A).

G. Additional Information

Arkansas Nuclear One, Unit 1 has previously reported as Licensee Event Reports (LERs), 5 conditions involving degradation of a principal safety barrier attributed to PWSCC of Alloy 600 material. In LER 50-313/90-021-00 (letter 1CAN019112 dated January 21, 1991), ANO-1 reported leakage from an Alloy 600 pressurizer level sensing nozzle. In LER 50-313/2000-003-00 (letter 1CAN030001 dated March 16, 2000), ANO-1 reported leaking welds for RCS hot leg level instrumentation nozzles. In LER 50-313/2001-002-00 (letter 1CAN050101 dated May 8, 2001), ANO-1 reported a leaking control rod drive mechanism (CRDM) nozzle. In LER 50-313/2002-003-00 (letter 1CAN120201 dated December 4, 2002), ANO-1 reported a cracked CRDM nozzle reactor vessel head weld. In LER 50-313/2004-002-00 (letter 1CAN060403 dated June 29, 2004), ANO-1 reported a cracked CRDM nozzle reactor vessel weld.

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