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U. S. Nuclear Regulatory Commission
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Subject: Licensee Event Report 50-313/2004-002-00
Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51

Dear Sir or Madam:

In accordance with 10CFR50.73(a)(2)(ii)(A), enclosed is the subject report concerning degradation of a principal safety barrier.

There are no new commitments contained in this submittal.

Sincerely,

Richard H. Scheide for
Dale E. James
Manager, Licensing

DEJ/dh

enclosure

IE22

cc: **Dr. Bruce S. Mallett**
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LICENSEE EVENT REPORT (LER)

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503.

FACILITY NAME (1) Arkansas Nuclear One - Unit 1	DOCKET NUMBER (2) 05000313	PAGE (3) 1 OF 3
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TITLE (4) Operation Prohibited by Technical Specifications due to Degradation of a Principal Safety Barrier Caused by Primary Water Stress Corrosion Cracking of a Control Rod Drive Mechanism Nozzle

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	30	2004	2004	002	00	06	29	2004	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9) 6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (Check one or more) (11)									
POWER LEVEL (10) 000	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)	X 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						
20.2203(a)(2)(vi)	50.73(a)(2)(i)(B)	50.73(a)(2)(v)(D)	Specify in Abstract or NRC Form 366A							

LICENSEE CONTACT FOR THIS LER (12)

NAME Dee Hawkins, Nuclear Safety and Licensing Specialist	TELEPHONE NUMBER (include Area Code) 479-858-5589
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	NO X	EXPECTED SUBMISSION DATE (15)	MO	DAY	YEAR
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ABSTRACT (16)

On April 30, 2004, following shutdown for a scheduled refueling outage, inspections of the reactor vessel head and associated penetration nozzles revealed two axial indications on the outside diameter of Control Rod Drive Mechanism Nozzle 61. The cause of the cracks was determined to have been primary water stress corrosion cracking. The penetration was repaired before the unit was returned to service. No evidence of a leak path was identified. A safety assessment concluded that the cracks did not pose any risk for catastrophic failure of the nozzle.

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NARRATIVE (17)

A. Plant Status

At the time this condition was discovered, Arkansas Nuclear One, Unit 1 (ANO-1) was in refueling shutdown conditions with the reactor vessel (RV) [AB] head on the storage stand.

B. Event Description

On April 30, 2004, following shutdown for a scheduled refueling outage, inspections of the RV head and associated penetration nozzles were performed in accordance with NRC Order EA-03-009, *Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors*, and relaxation granted by the NRC in a letter dated April 29, 2004. An ultrasonic (UT) examination performed on Control Rod Drive Mechanism (CRDM) [AA] Nozzle 61 revealed two axial indications on the outside diameter (OD) of the nozzle on the lower side. One indication was at the toe of the fillet weld and extended below the fillet weld cap. The second indication extended the full length of the weld and just beyond the toe of the fillet cap. No evidence of a leak path was detected during the UT or observed in the bare metal visual examination. The carbon steel interface around the annulus did not show any signs of degradation or loss of metal.

C. Root Cause

Both nozzle flaws were caused by primary water stress corrosion cracking (PWSCC). The CRDM nozzles were fabricated from Alloy 600, which is known to be susceptible to PWSCC. Industry experience with PWSCC in Alloy 600 components was evaluated in MRP-110, *Materials Reliability Program Reactor Vessel Closure Head Penetration Safety Assessment of U.S. PWR Plants*. Inspections of penetration nozzles in pressurized water RV closure heads have shown that these Alloy 600 components are susceptible to aging degradation due to PWSCC, a failure mechanism that is dependent on time of operation as well as on temperature, stress and material condition.

Additionally, during the RV head fabrication process, the CRDM nozzle OD was ground in order to achieve an interference fit between the nozzle and penetration. Residual grinding stresses during fabrication are contributing causes to PWSCC.

D. Corrective Actions

CRDM Nozzle 61 was repaired using an inside diameter temper bead (IDTB) half-nozzle weld repair process, performed in accordance with the ASME (American Society of Mechanical Engineers) Section XI program and relief granted by the NRC via a telephone conference on May 6, 2004. The IDTB weld repair method meets the stress and fatigue requirements of the design code. A final weld inspection was performed using liquid penetrant and UT examination methods.

The life expectancy of the IDTB weld repair, relative to PWSCC, was evaluated for one operating cycle. Since the RV head will be replaced during the next refueling outage in October 2005, this repair will remain in service for only one operating cycle.

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E. Safety Significance

The safety assessment documented in MRP-110 demonstrates that the typical case of axial nozzle cracking is not a credible mechanism leading to nozzle rupture because the critical axial crack length is much greater than the height of the nozzle region subject to welding residual stresses. The safety assessment also demonstrates that periodic bare metal visual examination of the head top surface performed at appropriate intervals provides assurance against significant wastage of the low-alloy steel head material, even given the assumption of a leaking nozzle.

Therefore, the overall safety significance of this condition was determined to be minimal. There was no actual impact on the public health and safety due to this condition.

F. Basis for Reportability

The cracks in CRDM Nozzle 61 constituted a degradation of one of the plant's principal safety barriers. This condition is being reported pursuant to 10CFR50.73(a)(2)(ii)(A). This condition was determined to be reportable at 0840 CDT on May 3, 2004, and was reported to the NRC Operations Center pursuant to 10CFR50.72 (b)(3)(ii)(A) at 1429 CDT.

G. Additional Information

ANO has previously reported, as Licensee Event Reports (LERs), seven 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 a cracked pressurizer level sensing nozzle. In LER 50-313/2000-003-00 (letter 1CAN030001 dated March 16, 2000), ANO-1 reported cracked welds in Reactor Coolant System (RCS) hot leg level instrumentation nozzles. In LER 50-313/2001-002-00 (letter 1CAN050101 dated May 8, 2001), ANO-1 reported a crack in a CRDM nozzle. In LER 50-368/87-003-01 (letter 2CAN088801 dated August 12, 1988), ANO-2 reported cracked pressurizer heater sheaths. In LER 50-368/2000-001-00 (letter 2CAN080011 dated August 29, 2000), ANO-2 reported cracking of pressurizer heater sleeves and an RCS hot leg resistance temperature detector. In LER 50-368/2002-001-00 (letter 2CAN060201 dated June 12, 2002), ANO-2 reported cracked pressurizer heater sleeves. In LER 50-313/2002-003-00 (letter 1CAN120201 dated December 4, 2002), ANO-1 reported a cracked CRDM nozzle RV head weld. Corrective actions for these conditions were not intended to prevent recurrence of PWSCC in Alloy 600 material that is subject to this failure mechanism.

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