10CFR50.73

Palo Verde Nuclear
Generating Station

Gregg R. Overbeck
Senior Vice President
Nuclear

TEL (623) 393-5148
FAX (623) 393-6077

Mail Station 7602
P.O. Box 52034
Phoenix, AZ 85072-2034

192-01121-GRO/SAB/REB
May 27, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Docket No. STN 50-530
License No. NPF-74
Licensee Event Report 2003-002-00

Attached please find Licensee Event Report (LER) 50-530/2003-002-00 that has been prepared and submitted pursuant to 10CFR50.73. This LER reports the discovery and corrective actions taken as a result of reactor coolant system pressure boundary leakage caused by a degraded inconel alloy 600 hot leg instrument nozzle and a degraded inconel alloy 600 pressurizer heater sleeve. The degraded nozzle and pressurizer heater sleeve were discovered prior to the Unit 3 tenth refueling outage and were repaired prior to Unit 3 resuming power operation.

The corrective actions described in this LER are not necessary to maintain compliance with regulations. Arizona Public Service Company makes no commitments in this letter.

In accordance with 10 CFR 50.73(d), copies of this LER are being forwarded to the NRC Regional Office, NRC Region IV and the Senior Resident Inspector. If you have questions regarding this submittal, please contact Daniel G. Marks, Section Leader, Regulatory Affairs, at (623) 393-6492.

Sincerely,

Gregg R. Overbeck

GRO/SAB/DJS/kg

Attachment

cc: Regional Administrator – NRC Region IV (all with attachment)
N. L. Salgado
J. N. Donohew

IE22

NRC FORM 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 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

RCS Pressure Boundary Leakage Caused by Degraded Inconel Alloy 600 Components

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
										05000
03	29	2003	2003	– 002	– 00	05	27	2003	FACILITY NAME	DOCKET NUMBER
										05000

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

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Daniel G. Marks, Section Leader, Regulatory Affairs	623-393-6492

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	NZL	C490	Y	B	AB	EHTR	C490	Y

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

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

On March 29, 2003 with Unit 3 operating in Mode 4, Hot Shutdown, and cooling down to Mode 5, Cold Shutdown, for a refueling outage, engineering personnel discovered boric acid on a reactor coolant system hot leg instrument nozzle and a pressurizer heater sleeve. The cause of the boric acid leakage was attributed to primary water stress corrosion cracking of alloy 600 Inconel material in the instrument nozzle and the pressurizer heater sleeve. The amount of boric acid found was small.

A second pressurizer heater sleeve was initially suspected to be leaking, but a subsequent VT-2 examination revealed no indication of leakage.

The instrument nozzle was replaced with an Alloy 690 nozzle and the pressurizer heater sleeve was repaired using a mechanical nozzle seal assembly (MNSA). As a conservative measure, the second suspected heater sleeve was repaired with a MNSA clamp.

Similar previous conditions were reported in LER 50-530/2001-003-00, LER 50-528/2001-001-00 and LER 50-528/1999-006-00.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

1. REPORTING REQUIREMENT(S):

This LER is being submitted pursuant to 10CFR50.73(a)(2)(ii).

Specifically, on March 29, 2003, engineering personnel, in accordance with the PVNGS boric acid walkdown procedure discovered boric acid residue on a reactor coolant system (RCS) (EIIS:AB) hot leg instrument nozzle (EIIS:NZL) and a pressurizer heater sleeve (EIIS:EHTR). Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.4.14 permits no RCS pressure boundary leakage. Therefore, the discovery of leakage (boric acid residue) from the nozzle and heater sleeve was considered to be a serious degradation of a principal safety barrier. Upon notification of the discovery, Operations personnel entered LCO 3.4.14 Condition B at 1150 Mountain Standard Time (MST). The TS Condition B was exited on March 30, 2003 at 0845 MST when the plant entered Mode 5, Cold Shutdown, and the LCO was no longer applicable.

On March 29, 2003 at 11:40 MST, APS made prompt notification of the event to the Nuclear Regulatory Commission (NRC) via the emergency notification system (ENS# 39714).

2. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

The degraded hot leg instrument nozzle (EIIS: TW) (2JRCCTW0112HC) penetrates the RCS Loop 1 hot leg piping and was fabricated from NiCrFe Alloy 600 (Inconel 600). The degraded pressurizer heater sleeve (EIIS: EHTR) (3MRCEA01) is the location for pressurizer back-up heater "A01" and was fabricated from Inconel 600. Heater sleeve "A15" (EIIS: EHTR) (3MRCEA15) was initially suspected to be leaking, but a subsequent VT-2 examination revealed no indication of leakage.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

3. INITIAL PLANT CONDITIONS:

On March 29, 2003, Unit 3 was in Mode 4, Hot Shutdown. The RCS was being cooled down in preparation for Unit 3's tenth refueling outage. There were no structures, systems, or components that were inoperable at the time of discovery that contributed to this condition.

4. EVENT DESCRIPTION:

On March 29, 2003, APS engineering personnel were performing pre-planned boric acid walkdowns of RCS components in accordance with the Boric Acid Corrosion Prevention Program procedure (70TI-9CZ01). This procedure incorporated NRC Bulletins 2002-01 and 2002-02, which address RCS pressure boundary integrity.

The purpose of the boric acid walkdowns is to identify boric acid leakage for corrective maintenance during the refueling outage. The walkdowns are part of APS' systematic measures to ensure that boric acid corrosion does not lead to degradation of the reactor coolant pressure boundary and that there is an extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture.

During the walkdown of the RCS, a detectable amount of boric acid residue was observed around an instrument nozzle that penetrates the Loop 1 hot leg. The boric acid had accumulated on the exterior of the hot leg piping around the outer perimeter of the instrument nozzle. In addition, a detectable amount of boric acid residue was observed around the penetration for pressurizer back-up heater A01.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The cracking of Alloy 600 hot leg piping instrument nozzles at Palo Verde has been attributed to primary water stress corrosion cracking (PWSCC), and has not considered an immediate significant threat to the structural integrity of the RCS boundary or instrument nozzles, due to the orientation of the cracks and the low leakage rates.

The bases for this conclusion is that when PWSCC has occurred at Palo Verde, the cracks have been axial in orientation and have resulted in detectable (albeit insignificant) leakage. Past examinations of hot leg piping instrument nozzles have confirmed this conclusion (reference LERs: 50-530/2001-003-00, 50-528/2001-001-00 and 50-528/1999-006-00). At Palo Verde, the boric acid leakage has been identified during visual examinations prior to any significant degradation of the reactor coolant boundary. Eddy Current examination at heater sleeve A01 confirmed the presence of axial orientated PWSCC.

There were no failures that rendered a train of a safety system inoperable and no failures of components with multiple functions were involved.

The condition would not have prevented the fulfillment of the safety function, and the condition did not result in a safety system functional failure as defined by 10CFR50.73(a)(2)(v).

6. CAUSE OF THE EVENT:

An investigation of this event was conducted in accordance with the PVNGS Condition Reporting program. PWSCC was determined to be the mechanistic cause of the instrument nozzle and heater sleeve leakage, resulting from axial cracking of the Inconel 600 material. This type of cracking is known to be affected by high temperatures and time of service.

Alloy 600 nozzles show significant variability with respect to PWSCC. Forgings and hot worked bar stock may be more susceptible to this form of degradation than cold drawn and annealed pipe material. Nozzles with a wide variety of yield strength levels, from near the specification minimum to very high yield strength, have cracked. Nozzles fabricated from Alloy 600 with a variety of microstructures, including some that steam generator experience indicated should have been resistant to PWSCC, have cracked, as have nozzles fabricated from material with high and low final mill-anneal temperatures.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

Industry and Palo Verde specific data demonstrates that PWSCC cracks will become evident through small leaks prior to significant degradation of the pressure boundary.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. No personnel or procedural errors contributed to this event.

7. CORRECTIVE ACTIONS:

The degraded Alloy 600 instrument nozzle that penetrates the RCS Loop 1 hot leg piping was repaired with a more corrosion resistant Alloy 690 nozzle.

The degraded heater sleeve was repaired using a NRC-approved mechanical nozzle seal assembly (MNSA.) The MNSA is a mechanical device consisting of a split gasket/flange assembly that is placed around the leaking penetration. The gasket is made of Grafoil packing, a graphite compound that is compressed within the assembly to prevent RCS leakage past the penetration. The assembly is bolted into holes drilled and threaded on the outer surface of the pressurizer. Another assembly is bolted to the flanges, which serves as the structural attachment of the sleeve to the wall. This assembly serves to carry the loads in lieu of the "J" welds on the Alloy 600 penetrations. Post installation testing of the MNSA at normal operating pressure and temperature has demonstrated the acceptability of the installation.

Any additional corrective actions taken as a result of this event will be implemented in accordance with the PVNGS corrective action program. If information is subsequently developed that would significantly affect a reader's understanding or perception of this event, a supplement to this LER will be submitted.

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17. NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)*

8. PREVIOUS SIMILAR EVENTS:

Similar previous conditions were reported in LER 50-530/2001-003-00, LER 50-528/2001-001-00 and LER 50-528/1999-006-00, in which different hot leg instrument nozzles were found to have evidence of leakage (boric acid residue). Similarly, these conditions have been attributed to PWSCC and the nozzles were repaired using Alloy 690 instrument nozzles. The corrective actions to prevent recurrence from the previous conditions are the same as for the conditions reported in this LER.