10 CFR 50.73

DWIGHT C. MIMS
Senior Vice President, Nuclear
Regulatory & Oversight

Palo Verde
Nuclear Generating Station
P.O. Box 52034
Phoenix, AZ 85072
Mail Station 7605
Tel 623 393 5403

102-07054-DCM/DJH
June 5, 2015

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
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 2015-001-00

Enclosed please find Licensee Event Report (LER) 50-530/2015-001-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports a degraded principal safety barrier and a condition prohibited by Technical Specifications that resulted from reactor coolant system pressure boundary leakage on the Unit 3 reactor coolant pump 2A suction pipe instrument nozzle.

In accordance with 10 CFR 50.4, copies of this LER are being forwarded to the Nuclear Regulatory Commission (NRC) Regional Office, NRC Region IV, and the Senior Resident Inspector.

Arizona Public Service Company makes no commitments in this letter. If you have questions regarding this submittal, please contact Mark McGhee, Nuclear Regulatory Affairs Department Leader, at (623) 393-4972.

Sincerely,

FOR DC MIMS

DCM/DJH/hsc

Enclosure

cc: M. L. Dapas NRC Region IV Regional Administrator
M. M. Watford NRC NRR Project Manager
C. A. Peabody NRC Senior Resident Inspector PVNGS

IE22
NRR

Designate As Original Per
S. Vaidya 1/26/17

NRC FORM 366 (02-2014) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

Estimated burden per response to comply with this mandatory 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 FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@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 an 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 Page 2 for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Leakage from Reactor Coolant Pump 2A Suction Pipe Instrument Nozzle

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
04	07	2015	2015	- 001	- 00	06	05	2015	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
5	☐ 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)
10. POWER LEVEL	☐ 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)
0	☐ 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 below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Mark McGhee, Nuclear Regulatory Affairs Department Leader	623-393-4972

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	AB	NZL	C490	Y					

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

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

On April 7, 2015, at 0032, with Unit 3 in Mode 5, during a scheduled boric acid walk-down inspection of the Unit 3 reactor coolant system (RCS), engineering personnel at the Palo Verde Nuclear Generating Station (PVNGS) identified white residue on a one inch instrument nozzle on the reactor coolant pump 2A suction pipe. Isotopic analysis confirmed the white residue resulted from leakage of RCS coolant and, at 0330 on April 8, 2015, engineering personnel determined that RCS pressure boundary leakage had occurred resulting in a condition prohibited by Technical Specification 3.4.14, RCS Operational Leakage.

The cause of the event was determined to be primary water stress corrosion cracking of the Alloy 600 instrument nozzle. To correct the condition, the nozzle was repaired with an American Society of Mechanical Engineers (ASME) approved and NRC endorsed half-nozzle repair method.

PVNGS reported a similar problem in licensee event report number 50-530/2013-001-00 on December 6, 2013, when RCS pressure boundary leakage was identified on a Unit 3 reactor vessel bottom mounted instrument nozzle.

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NARRATIVE

All times are Mountain Standard Time and approximate unless otherwise indicated.

1. REPORTING REQUIREMENT(S):

This Licensee Event Report (LER) is being submitted pursuant to 10 CFR 50.73(a)(2)(ii)(A) as a degraded principal safety barrier and 10 CFR 50.73(a)(2)(i)(B) as a condition prohibited by Technical Specification (TS) Limiting Condition for Operation (LCO) 3.4.14, RCS Operational Leakage, due to reactor coolant system (RCS) pressure boundary leakage.

At approximately 0032 on April 7, 2015, with Unit 3 in Mode 5, during a scheduled boric acid walk-down inspection of the Unit 3 RCS, engineering personnel at the Palo Verde Nuclear Generating Station (PVNGS) identified white residue on a one inch instrument nozzle on the reactor coolant pump 2A suction pipe. Isotopic analysis confirmed the white residue resulted from leakage of RCS coolant and, at 0330 on April 8, 2015, engineering personnel determined that RCS pressure boundary leakage had occurred resulting in a condition prohibited by Technical Specification 3.4.14.

This condition was reported to the NRC pursuant to 10 CFR 50.72 (b)(3)(ii)(A) at 0840 on April 8, 2015, via the Emergency Notification System (ENS 50968).

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

A primary function of the RCS (EIIS: AB) is to provide a barrier against fission product release to the environment. In order to ensure integrity of the RCS, piping and component joints are made by welding, bolting, rolling, or pressure loading, and valves are provided to isolate connecting systems from the RCS. During plant life, the joint and valve interfaces can produce varying amounts of reactor coolant leakage, through normal operational wear or mechanical deterioration.

The RCS piping is arranged with two flow loops connected in parallel to the reactor vessel. Each of the two loops consists of one 42 inch outlet (hot leg) pipe, one steam generator, two 30-inch reactor coolant pump (RCP) inlet (cold leg) pipes, two RCPs, and two 30-inch RCP outlet (cold leg) pipes. The RCS piping is configured with various penetrations which serve to provide connections to interfacing systems and instrumentation. Each instrumentation penetration is provided with a nozzle which creates the interface between the pipe and the connected instrumentation. There are 47 instrument nozzles on RCS piping including 27 hot leg pipe nozzles and 20 cold leg pipe nozzles. Specific to this event, instrument nozzle 18 is

the loop 2A RCP suction pipe cold leg instrument nozzle. The cold leg instrument nozzles are fabricated from Alloy 600 and are connected to the RCS piping with J-groove welds made with Alloy 82/182 weld materials. Instrument nozzle 18 was welded using Alloy 182 weld material. These weld materials and Alloy 600 have been determined to be susceptible to primary water stress corrosion cracking (PWSCC). Three factors: susceptible material, a corrosive environment, and stress must be present for PWSCC to occur. Stresses that make Alloy 600 nozzles and their Alloy 82/182 J-groove attachment welds susceptible to cracking are inherent residual stresses induced by the welding of the nozzle to the inside surface of the pipe during fabrication.

To monitor the integrity of the RCS pressure boundary, the PVNGS In-Service Inspection (ISI) Program requires the conduct of bare metal visual examinations of RCS cold leg pressure retaining welds fabricated with Alloy 600 and Alloy 82/182 once per 10 year interval in accordance with American Society of Mechanical Engineers (ASME) Code Case N-722-1 as conditioned by 10 CFR 50.55a. In addition to the ISI Program inspections, the PVNGS Boric Acid Corrosion Control Program requires the performance of boric acid walk-down inspections of the RCS in each refueling outage to identify boric acid deposits which may be indicative of leakage. Because 16 of the 20 RCS cold leg instrument nozzles are readily accessible, the boric acid walk-down inspections conducted by engineering personnel in each refueling outage also inspect these nozzles.

PVNGS TS LCO 3.4.14, *RCS Operational Leakage*, is applicable in Modes 1 through 4 when the RCS is capable of being pressurized and provides limitations for RCS leakage. The LCO specifies the types of leakage and provides required actions when leakage rates exceed allowable values. The LCO specifies that no RCS pressure boundary leakage, defined as non-isolable leakage (except primary to secondary leakage) through a component body, pipe wall or vessel wall, is allowed because such leakage could cause further deterioration and result in higher leakage rates.

3. INITIAL PLANT CONDITIONS:

At approximately 0032 on April 7, 2015, PVNGS Unit 3 was stable in Mode 5 with RCS temperature at approximately 97 degrees Fahrenheit and RCS pressure at approximately 40 pounds per square inch absolute. Unit 3 had been shutdown at 0000 on April 4, 2015, to commence the 18th Unit 3 refueling outage (3R18). There were no structures, systems, or components inoperable that contributed to the event.

4. EVENT DESCRIPTION:

At approximately 0032 on April 7, 2015, during a scheduled boric acid walk-down inspection of the Unit 3 RCS, engineering personnel identified white residue on a one inch instrument

nozzle on the Unit 3 RCP 2A suction pipe (nozzle 18). This residue appeared to originate at the penetration for nozzle 18 and was in a pattern consistent with leakage of high pressure steam throttled through a very small opening. Visual inspections were performed in the immediate area and directly above nozzle 18, but no other evidence of leakage was found.

Isotopic analysis confirmed the white residue resulted from leakage of RCS coolant that was deposited within the previous six to ten months. At 0330 on April 8, 2015, engineering personnel notified operations personnel that the white residue on nozzle 18 resulted from RCS pressure boundary leakage. Based on the observed condition, engineering concluded the most likely source was leakage from a flaw in the J-groove weld that attached the nozzle to the RCS pipe. The degraded condition of a principle safety barrier was reported to the NRC pursuant to 10 CFR 50.72 (b)(3)(ii)(A) at 0840 on April 8, 2015, via the Emergency Notification System (ENS 50968).

An investigation was initiated to evaluate the condition and to establish necessary corrective actions. Scheduled refueling outage activities were continued and Unit 3 transitioned from Mode 6 to a Defueled condition on April 11, 2015, when all fuel was removed from the reactor vessel. The RCS piping was drained as necessary to allow repairs to the leaking nozzle. To characterize the problem, engineering personnel conducted additional inspections of the instrument nozzle and piping penetration. On April 13, 2015, straight beam ultrasonic testing (UT) of instrument nozzle 18 was performed and no indications of circumferential fatigue cracking were identified. Repairs were performed per an ASME code approved and NRC endorsed half-nozzle repair method which installed a new Alloy 690 nozzle with Alloy 52M weld material.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

This event did not result in a potential transient more severe than those analyzed in chapters 6 and 15 of the Updated Final Safety Analysis Report or result in the release of radioactive materials to the environment. There were no actual safety consequences as a result of this event and the event did not adversely affect the health and safety of the public.

The noted leakage from the instrument nozzle is bounded by the Probabilistic Risk Assessment (PRA) analysis for Very Small Loss of Coolant Accident or Leak events (NUREG/CR-5750 category G1) which is defined as pressure boundary leakage within the capacity of three charging pumps. These events are modeled as Miscellaneous Events in the PVNGS PRA model. The conditional probability of core damage given a Miscellaneous Event is 1.2E-7 in the PVNGS PRA. This risk impact is characterized as "very small" per NRC Regulatory Guide 1.174. Therefore, this condition had minimal safety significance.

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NARRATIVE

The condition would not have prevented the fulfillment of a safety function; and, the condition did not result in a safety system functional failure as defined by 10 CFR 50.73 (a)(2)(v).

6. CAUSE OF THE EVENT:

The cause of the event was determined to be primary water stress corrosion cracking of the Alloy 600 instrument nozzle.

7. CORRECTIVE ACTIONS:

To correct the instrument nozzle leakage an ASME code approved and NRC endorsed half-nozzle repair was performed on nozzle 18. In support of this repair, relief request number 53 was submitted and verbally approved by the NRC for one cycle of operation of Unit 3.

To address the extent of condition the following actions were performed or are planned:

- During 3R18, bare metal visual inspections were performed for the remaining 19 RCS cold leg instrument nozzles. No problems were identified during these inspections.
- Bare metal visual inspections will be performed on each of the 20 RCS cold leg instrument nozzles during the next refueling outage in Unit 1 and Unit 2.

No change to inspection activities was needed for the RCS hot leg instrument nozzles because all RCS hot leg instrument nozzles are inspected during each refueling outage in accordance with the PVNGS In-Service Inspection program.

8. PREVIOUS SIMILAR EVENTS:

A similar event occurred in October 2013 when RCS pressure boundary leakage was discovered on Unit 3 reactor vessel bottom mounted instrument (BMI) nozzle number three. PVNGS reported this problem in licensee event report number 50-530/2013-001-00 on December 6, 2013. The BMI nozzle leakage was corrected with an ASME code approved and NRC endorsed weld pad/half-nozzle repair method.