APS

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10 CFR 50.73

192-01073-WEI/DGM/REB
November 1, 2000

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 2
Docket No. STN 50-529
License No. NPF-51
Licensee Event Report 2000-004-00

Attached please find Licensee Event Report (LER) 50-529/2000-004-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports the findings and corrective actions taken upon discovery of a leak in an Inconel Alloy 600 pressurizer heater sleeve. APS has repaired the degraded sleeve and will test the repair during start-up (Mode 3) at normal operating pressure and temperature. No commitments are being made to the NRC by this letter.

In accordance with 10CFR50.73(d), a copy of this LER is being forwarded to the Regional Administrator, NRC Region IV and to the Resident Inspector. If you have questions regarding this submittal, please contact Daniel G. Marks, Section Leader, Regulatory Affairs, at (623) 393-6492.

Sincerely,

WEI/DGM/REB/kg

Attachment

cc: E. W. Merschoff (all with attachment)
J. H. Moorman
M. B. Fields
INPO Records Center

IE22

NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If 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.

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TITLE (4)

Reactor Coolant System Pressure Boundary Leakage Due to Degraded Alloy 600 Pressurizer Heater Sleeve

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 NAME	DOCKET NUMBER
10	04	2000	2000	- 004 -	00	11	01	2000	N/A	
									FACILITY NAME	DOCKET NUMBER
									N/A	

OPERATING MODE (9)	4
POWER LEVEL (10)	000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

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

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	AB	PZR	C490	Y					

SUPPLEMENTAL 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 15 single-spaced typewritten lines) (16)

On October 4, 2000, at approximately 2300 mountain standard time (MST), Unit 2 was in Mode 4, Hot Shutdown, cooling down for a refueling outage when engineering personnel discovered a small accumulation of boric acid residue on a reactor coolant system pressurizer heater sleeve. The condition was identified during a routine boric acid walkdown of the reactor coolant system hot legs. Subsequent eddy current testing confirmed a linear indication in the sleeve. Visual inspections of other RCS Alloy 600 hot leg components did not identify other degraded components. An ENS notification was made on October 5, at 1248 MST to report the condition.

The sleeve has been repaired and testing will be completed during startup (Mode 3) at normal operating pressure and temperature.

A previous similar event was reported in LER 50-528/1999-006-00.

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

I. REPORTING REQUIREMENT(S):

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

Specifically, on October 4, 2000, at approximately 2300 mountain standard time (MST) engineering personnel discovered boric acid residue on a pressurizer heater (EIIS:AB) sleeve. Technical Specifications (TS) Limiting Condition for Operation (LCO) 3.4.14 permits no reactor coolant system (RCS) (EIIS:AB) pressure boundary leakage and therefore, the discovery of leakage (boric acid residue) from the heater sleeve was a degradation of a principal safety barrier. Notification of the event (ENS# 37411) was made in accordance with 10CFR50.72(b)(2)(i) at 1248 MST on October 5, 2000. The timing of this ENS report was based on the determination at 1030 MST on October 5, 2000 that the boron accumulation represented a serious degradation of a prinicipal safety barrier.

This condition did not result in a safety system functional failure as defined in 50.73(a)(2)(v).

II. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) OR COMPONENT(S):

The heater sleeve was fabricated from NiCrFe Alloy 600 (Inconel 600), penetrates the pressurizer from the bottom and provided a connection for a pressurizer backup heater. This heater sleeve had previously been repaired in 1988 when the heater element failed. That failure resulted in additional stresses, caused by swelling, being placed on the heater sleeve and the sleeve was plugged at that time.

III. INITIAL PLANT CONDITIONS:

On October 4, 2000 at approximately 2300 MST Unit 2 was in Mode 4, Hot Shutdown. The RCS was being cooled down in preparation for Unit 2's ninth refueling outage. There were no structures, systems, or components that were inoperable at the time of discovery that contributed to this condition. There were no failures that rendered a train of a safety system inoperable and no failures of components with multiple functions were involved.

IV. EVENT DESCRIPTION:

On October 4, 2000, at approximately 2300 MST, APS engineering personnel were performing preplanned visual examinations of RCS piping in accordance with procedure requirements. The purpose of the visual examinations was to identify leakage from pressure retaining components. The examinations are part of APS' systematic measures to ensure that boric acid corrosion does

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not lead to degradation of the RCS pressure boundary and assure a low probability of abnormal leakage, rapidly propagating failure, or gross rupture.

During the visual examinations of the pressurizer, a small amount of boric acid residue was observed around a heater sleeve (2MRCEA06) that penetrates the pressurizer. The boric acid had accumulated on the exterior of the sleeve. Eddy current testing conducted on October 17, 2000, identified a linear indication, which appeared to be axially orientated, in the heater sleeve.

Unit 2 entered Mode 5, Cold Shutdown, at 0150 MST on October 5, 2000 at which time the LCO for RCS operational leakage was no longer applicable.

V. SAFETY CONSEQUENCES:

The cracking of Alloy 600 components both at Palo Verde and industry-wide has been attributed to axially oriented, primary water stress corrosion cracking (PWSCC). PWSCC is not considered a significant threat to the structural integrity of the RCS boundary or the heater sleeve, as this type of cracking typically results only in small leaks.The bases for this conclusion is that if PWSCC occurred at Palo Verde, the cracks would be predominately axial in orientation. The cracks would result in visibly detectable leakage that would be apparent during visual examinations, performed as part of walkdown inspections, before significant damage to the reactor coolant boundary occurred.

VI. CAUSE OF THE EVENT:

An investigation of this event is being conducted in accordance with the PVNGS condition-reporting program. Primary water stress corrosion cracking is believed to be the mechanistic cause of the heater sleeve cracking, resulting in axial cracking of the Inconel 600 material. This type of cracking is known to be affected by high temperatures and time duration. Industry and Palo Verde specific data demonstrates that these PWSCC cracks will not result in a complete failure of the pressure boundary but will become evident through small leaks.

Alloy 600 components 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. Components with a wide variety of yield strength levels from near the specification minimum to very high have cracked. Components 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 components fabricated from material with high and low final mill-anneal temperatures.

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.

VII. CORRECTIVE ACTIONS:

The degraded heater sleeve has been repaired and testing will be completed during startup (Mode 3) at normal operating pressure and temperature. The repair consisted of cutting the degraded pressurizer heater sleeve as close as possible to the bottom head of the pressurizer. The degraded sleeve was then counter bored and a reinforcing pad and plug were welded to seal the sleeve location. This repair resulted in the relocation of the ASME Pressure boundary weld from the inside diameter to the outside diameter of the pressurizer shell. The repairs were made using Alloy 690 material.

Another pressurizer heater sleeve (2MRCEB18) was repaired during the refueling outage. This heater location had experienced a heater element failure (similar to 2MRCEA06) and resultant swelling in 1991. Engineering personnel performed eddy current testing on this sleeve on October 17, 2000 and discovered a linear indication, which appeared to be axially orientated. No boric acid was observed at this location and no leakage is believed to have occurred. The sleeve was repaired similarly to A06. No other heaters in Units 1,2, and 3 have experienced this condition.

Any additional corrective actions taken as a result of the investigation 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.

VIII. PREVIOUS SIMILAR EVENTS:

LER 50-528/1999-006-00 reported a similar condition that occurred in Unit 1. In that event, an instrument nozzle was discovered during a boric acid walkdown to be leaking. The nozzle was also an Inconel 600 component that experienced PWSCC.

XIV. OTHER INFORMATION:

PVNGS has replaced all Alloy 600 pressurizer instrumentation nozzles (seven per unit) with corrosion resistant Alloy 690 nozzles and has replaced the Alloy 600 RCS hot leg pressure instrumentation and sampling nozzles in Unit 2 with Alloy 690 nozzles. In addition, all hot leg Alloy 600 instrument nozzles in Units 1, 2, 3 are scheduled to be modified in future outages.