



Palo Verde Nuclear
Generating Station

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10CFR50.73
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192-01096-WEI/SAB/DJS
December 4, 2001

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 1, 2, and 3
Docket No. STN 50-528, 50-529 and 50-530
License No. NPF-41, NPF-51 and NPF-74
Licensee Event Report 2001-003-00**

Attached please find Licensee Event Report (LER) 50-528/2001-003-00 that has been prepared and submitted pursuant to 10CFR50.73. This LER reports a plant shutdown of PVNGS Unit 2 based upon the discovery of Control Element Assembly (CEA) degradation in PVNGS Unit 3.

The Unit 3 CEA degradation was observed during the ninth refueling outage and was assumed to be transportable to Unit 2. Technical Specifications require all full length CEAs to be operable and therefore Unit 2 entered LCO 3.0.3 and shutdown to inspect the CEAs. This CEA degradation LER reports APS' activities for Units 1, 2, and 3. 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 10CFR50.73(d), a copy of this LER is 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,

WEI/SAB/DJS/kg
Attachment

cc: E. W. Merschoff (all with attachment)
J. H. Moorman
L. R. Wharton

IE22

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

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 bis1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOF-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.

1. FACILITY NAME Palo Verde Nuclear Generating Station Unit 1	2. DOCKET NUMBER 05000528	3. PAGE 1 OF 6
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4. TITLE
Technical Specification Required Shutdown Due to Degraded Control Element Assemblies

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
10	10	2001	2001	0003	00	12	04	2001	Palo Verde Unit 2	05000529
									FACILITY NAME	DOCKET NUMBER
									Palo Verde Unit 3	05000530

9. OPERATING MODE	1	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)		
10. POWER LEVEL	100	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)	X	50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)				
		20.2203(a)(2)(v)	X	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)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)						

12. LICENSEE CONTACT FOR THIS LER

NAME Daniel G. Marks, Section Leader, Regulatory Affairs	TELEPHONE NUMBER (Include Area Code) 623-393-6492
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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
X	AA		C490	Y					

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

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

On October 10, 2001, at approximately 0430 MST, Palo Verde Unit 2 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power when Control Room personnel were advised of a potentially transportable condition affecting the integrity of Control Element Assemblies (CEAs). Preliminary inspection of Unit 3 CEAs during refueling revealed one CEA with cracks. Due to the similar design and operating history of CEAs, similar cracks were assumed to also be present in Unit 2. Based upon the Unit 3 discovery, Unit 2 plant operators initiated a plant shutdown and at approximately 0937 MST, Palo Verde Unit 2 entered Mode 3 (HOT STANDBY). Unit shutdown occurred normally and following the manually inserted reactor trip per the unit shutdown procedure, all CEAs fully inserted into the core. Unit 2 was taken to Mode 6 (REFUELING) to inspect and replace the CEAs. The event did not adversely affect the health and safety of the public. In the past three years, there have been no previous similar events reported pursuant to 10CFR50.73 for CEA degradation at Palo Verde Nuclear Generating Station. This CEA degradation LER reports APS' activities for Units 1, 2, and 3.

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

1. REPORTING REQUIREMENT(S):

This LER (50-528/2001-004-00) is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(A), to report the completion of a plant shut down required in Unit 2 (Docket Number 05000529 – License Number NPF-41) by Technical Specification 3.0.3 on October 10, 2001 at approximately 0937 Mountain Standard Time (MST). Also, this LER is being submitted pursuant to 10 CFR 50.73(a)(2)(i)(B), to report a condition prohibited by Technical Specifications where entry into Technical Specification 3.0.3 was performed for the suspected Control Element Assembly (CEA) degradation, and the condition was not corrected within one hour in Unit 2.

The degradation was also discovered in Unit 1 and Unit 3. The LCO was not applicable at the times of discovery for Units 1 and 3's CEA degradation. The time of discovery for Units 1 and 3 occurred during refueling activities (MODE 6) where the operability of the CEAs is not required. Also, during the Unit shutdowns prior to the Unit 1 and Unit 3 refueling outages, the CEAs performed their design functions. Due to the conservative decision to declare the Unit 2 CEAs inoperable, it is considered that the same condition prohibited by Technical Specifications existed in Unit 1 and Unit 3.

On October 10, 2001 at 0823 MST, APS made notification of the event to the Nuclear Regulatory Commission (NRC) via the emergency notification system (ENS# 38373).

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

The paragraphs in this section provide brief descriptions of the major equipment and systems that were relied upon, influenced, or had a significant function in this event.

Control Element Assemblies & Support Systems (CEAs) (EIS: AA)

Palo Verde Unit 1, 2, and 3 are a Combustion Engineering (now Westinghouse), System-80 Nuclear Steam Supply System. The System-80 design uses full length Control Element Assemblies (CEAs) (EIS: AA) consisting of assemblies of 4 or 12 fingers. Each CEA finger consists of an Inconel (Alloy 625) tube filled with boron carbide pellets. Within the tube, above the pellets, is a plenum that allows for expansion of the

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internal parts. This plenum contains a spacer and spring. The spring applies a compressive force on the pellets to restrain them inside the tube and prevent them from rising into the plenum. The lower 12 inches of each finger contains reduced diameter boron carbide pellets that are wrapped with stainless steel feltmetal material. The reduced diameter pellets and surrounding feltmetal provide space for the swelling of the pellets brought on by neutron interaction during operation in the reactor. Irradiation Assisted Stress Corrosion Cracking (IASCC) is predicted to be a life limiting factor for fingers using this design.

3. INITIAL PLANT CONDITIONS:

On October 10, 2001, at approximately 0430 MST, Palo Verde Unit 2 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power. There were no major structures, systems, or components that were inoperable or otherwise contributed to the event.

4. EVENT DESCRIPTION:

During the ninth refueling outage of Palo Verde Unit 3 (Docket Number 05000530 – License Number NPF-74), an inspection of the Control Element Assemblies (CEAs) removed from the reactor was performed during planned CEA replacement activities. During initial inspections, several fingers of one CEA were observed to contain crack-like indications near the lower end of the finger. One of the fingers was also observed to emit a small stream of bubbles from the top of a crack-like indication. Due to the similarity of design and operating history of the CEAs in Unit 2, notification of the condition was immediately made to the Unit 2 Control Room.

Limiting Condition for Operation (LCO) 3.1.5 states: "All full length CEAs shall be OPERABLE . . ." No associated action in Technical Specification (TS) 3.1.5 applied to the suspected degradation in CEA integrity, therefore, Unit 2 entered TS LCO 3.0.3. On October 10, 2001, at approximately 0430 MST, Palo Verde Unit 2 entered TS LCO 3.0.3 and initiated actions to place the unit in Mode 3. Following an uncomplicated shutdown and a manual reactor trip from approximately 22 percent power per the unit shutdown procedure, all CEAs fully inserted into the core. Unit 2 entered Mode 3 at 0937 MST.

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On October 11, 2001, at 1345 MST, Unit 2 entered Mode 5. After the shutdown, Unit 2 was taken to Mode 6 for a mid-cycle outage. Preliminary inspections of the Unit 2 CEAs during replacement activities found several CEA fingers with evidence of cracking near their lower ends. The nose cap of one finger of one CEA was also observed to have separated from the finger. All full length CEAs were replaced during the ensuing mid-cycle outage.

There were no safety system actuations and none were required.

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The basic function of the Control Element Assemblies (CEAs) is to provide for reactivity control under all normal and adverse conditions during reactor operations and accident conditions. Cracks in CEA fingers can lead to loss of boron carbide, which would reduce the reactivity of the CEAs. Loss of CEA reactivity is outside the design requirements for CEAs. Loss of CEA reactivity may produce unacceptable power peaking factors, Departure from Nucleate Boiling Ratio (DNBR), Linear Heat Rates (LHRs), or Shut Down Margin (SDM). These factors could lead to reactor conditions inconsistent with the safety analysis. There were no CEA failures found sufficient to impact any Safety Margins, therefore the CEAs could continue to shut down the reactor, maintain the reactor in a safe shutdown condition and mitigate the consequences of an accident. Replacement of all full length CEAs in all three units at Palo Verde has returned the CEAs to their conforming condition. Part length CEAs are not relied upon for accident mitigation and are different in design such that the possibility of cracking is not a concern.

The event did not result in any challenges to the fission product barriers or result in any release of radioactive materials. Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or health and safety of the public.

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

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6. CAUSE OF THE EVENT:

CEA failures were first detected in Unit 1(Docket Number 05000528 – License Number NPF-41) during the ninth refueling outage in the Spring of 2001. All of the full-length CEAs in Unit 1 were replaced during the refueling outage. The design of the Unit 1 CEAs was considered to be more limiting than the design of the CEAs in Units 2 and 3.

The failures found in Unit 3 were not consistent with design expectations, which resulted in APS' decision to immediately replace CEAs in Unit 2 and Unit 3. This was the first replacement of CEAs in all three units at Palo Verde and the first time CEA integrity issues have caused a plant shutdown. No previous shutdowns have occurred at Palo Verde for this cause.

An equipment root cause of failure analysis is being conducted in accordance with the APS Corrective Action Program. Preliminary findings suggest the CEA degradation is due to age related mechanisms exhibiting their effects at a rate faster than expected. Examinations of suspect CEAs will be performed as part of the ongoing investigation.

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

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.

7. CORRECTIVE ACTIONS:

APS replaced all Unit 1, Unit 2 and Unit 3 full length CEAs.

Actions to prevent recurrence include adjustment to the projected service life for Palo Verde CEAs in consideration of the observed failures and to reflect the findings of the equipment root cause failure analysis when it is complete.

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8. PREVIOUS SIMILAR EVENTS:

In the past three years, there have been no previous similar events reported pursuant to 10CFR50.73 for CEA degradation at Palo Verde Nuclear Generating Station. This CEA degradation LER reports APS' activities for Units 1, 2, and 3.

9. ADDITIONAL INFORMATION:

The reactor shut down (Unplanned Power Changes greater than 20 percent) was a single actual initiating event that affected only the initiating event cornerstone in the regulatory oversight and assessment process. The event was tabulated as part of the Unplanned Power Changes per 7,000 critical hours, in the performance indicator cornerstone of initiating events.