APS

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear
Generating Station

10 CFR 50.73

David M. Smith
Plant Manager
Nuclear Production

Tel. 623-393-6116
Fax. 623-393-6077
e-mail: DSMITH10@apsc.com

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

192-01152-DMS/SAB/DLK
September 10, 2004

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
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 2004-002-00

Attached please find Licensee Event Report (LER) 50-529/2004-002-00 prepared and submitted pursuant to 10 CFR 50.73. This LER reports an automatic reactor trip on low DNBR following a large load reject reactor power cutback.

In accordance with 10 CFR 50.4, a copy of this LER is being forwarded to the NRC Region IV Office 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.

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.

Sincerely,

DMS/SAB/DLK

Attachment

cc:	B. S. Mallett	NRC Region IV Regional Administrator
	M. B. Fields	NRC NRR Project Manager
	N. L. Salgado	NRC Senior Resident Inspector for PVNGS

IE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory 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 and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Palo Verde Nuclear Generating Station Unit 2	05000529	1 OF 5

4. TITLE
Reactor Trip on Low DNBR

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
									None	05000
07	14	2004	2004	- 002 -	00	09	10	2004	FACILITY NAME None	DOCKET NUMBER 05000

9. OPERATING MODE: 1

10. POWER LEVEL: 100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 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)
☐ 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 below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Daniel 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
C	TL	EXC	G084	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 July 14, 2004 at approximately 0134 Mountain Standard Time (MST) Unit 2 was operating at 100 percent power, Mode 1 (Power Operations), when the Unit experienced a reactor power cutback followed by an automatic reactor trip. At the time of the event, Palo Verde was in a severe thunderstorm in which several lightning strikes had landed in the vicinity of the Palo Verde switchyard. Approximately five seconds after the series of lightning strikes, the main generator tripped which in turn initiated a reactor power cutback. Approximately 11 seconds after the reactor power cutback, a low departure from nucleate boiling ratio (DNBR) reactor trip was initiated by the core protection calculators (CPCs) in response to a conservative calculation of update DNBR for plant conditions.

The main generator tripped on a loss of generator field signal which was induced by the effects of the multiple lightning strikes in the vicinity of the Palo Verde switchyard. The cause of the reactor trip is attributed to overly conservative addressable constants for planar radial peaking factor in the CPCs which are used to calculate update DNBR.

A similar reactor trip occurred in Unit 3 on June 7, 2004 (LER 50-530/2004-002)

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 2	05000529	2004	-- 002	-- 00	2 OF 5

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

1. REPORTING REQUIREMENT(S):

This LER (50-529/2004-002-00) is being submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A), to report a reactor protection system (RPS) (EIIS: JC) initiated reactor trip, while critical on July 14, 2004 at approximately 0134 MST.

On July 14, 2004 at 0435 MST, APS made notification of the event to the Nuclear Regulatory Commission (NRC) via the emergency notification system (ENS# 40870).

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

The main generator excitation and voltage regulation system (Generrex) (EIIS: TL) is a static excitation and control system. The Generrex excitation system controls the terminal voltage or reactive volt-amperes of the main generator by controlling the field excitation. The system maintains voltage at the generator terminals based on the requirements of the power grid or commands by the operator. The major components of the system include: the excitation power source, the exciter cubicle containing the power rectifiers and related control equipment, the regulator cubicle, the generator brush-holder rigging and slip rings, and the control station with a mimic bus.

The reactor power cutback system (RPCS) (EIIS: JD) is a control system designed to accommodate loss of load or loss of one main feed pump events by providing a "step" reduction in reactor power. The step reduction in reactor power is accomplished by the simultaneous dropping of one or more pre-selected groups of full length regulating control element assemblies (CEAs) (EIIS: AA) into the core.

The RPS portion of the plant protection system (PPS) (EIIS: JC) provides a rapid and reliable shutdown of the reactor to protect the core and the reactor coolant system pressure boundary from potentially hazardous operating conditions. Shutdown is accomplished by the generation of reactor trip signals. The trip signals open the reactor trip switchgear breakers, de-energizing the control element drive mechanism coils, allowing all CEAs to drop into the core by the force of gravity.

The core protection calculator / control element assembly calculator (CPC/CEAC) (EIIS: JC) system monitors pertinent reactor core conditions and provides an accurate, reliable means of initiating a reactor trip. The CPC system is an integral part of the PPS in that it provides two trips to the RPS. Trip signals are provided to the RPS whenever the minimum departure from nucleate boiling ratio (DNBR) or fuel design limit local power density (LPD) is approached during reactor operation. The CPCs incorporate a reactor cutback "flag" feature that activates when the Unit experiences a reactor power cutback.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 2	05000529	2004	-- 002	-- 00	3 OF 5

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

The CPCs will not generate an out of sequence or subgroup CEA deviation penalty factor during the time the reactor power cutback flag is generated. The reactor power cutback flag permits out of sequence or subgroup CEA deviation for a short period of time (currently 10.35 seconds) to allow the reactor power cutback to rapidly step down power without initiating an automatic reactor scram as a result of the out of sequence or subgroup CEA deviation.

3. INITIAL PLANT CONDITIONS:

On July 14, 2004 at approximately 0134 MST Palo Verde Unit 2 was in Mode 1 (Power Operations), operating at approximately 100 percent power. There were no major structures, systems, or components that were inoperable at the start of the event that contributed to the event.

4. EVENT DESCRIPTION:

On July 14, 2004 at approximately 0134 MST Unit 2 was operating in Mode 1 at 100 percent power when the Unit experienced a reactor power cutback followed by an automatic reactor trip. At the time of the event, Palo Verde was in a severe thunderstorm. Six lightning strikes had landed in the vicinity of the Palo Verde switchyard in a 300 millisecond period. Approximately five seconds after the series of lightning strikes, the main generator tripped on a loss of field which in turn tripped the main turbine. The steam bypass control valves quick opened diverting main steam directly to the main condenser and a reactor power cutback initiated as designed for a large load reject event. CEAs for regulating groups 4 and 5 fully inserted into the core. Reactor power decreased as expected to approximately 68 percent. Approximately 11 seconds after the reactor power cutback, two channels (A and B) of the core protection calculators generated a low DNBR reactor trip. All CEAs automatically inserted into the core as designed. Heat removal was maintained to the main condenser by way of the steam bypass control system.

At 0147 MST, with Unit 2 in Mode 3 (Hot Standby), control room personnel (utility, licensed) classified the reactor trip as uncomplicated and entered the standard post trip procedure. There were no engineered safety feature actuations and none were required. There was no loss of heat removal capability or loss of safety features associated with the event. Off site power remained available throughout the event. The NRC operations center was notified of the event at 0435 MST (re: ENS 40870).

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 2	05000529	2004 --	002 --	00	4 OF 5

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

5. ASSESSMENT OF SAFETY CONSEQUENCES:

The reactor trip did not result in a transient more severe than those already analyzed in the Updated Final Safety Evaluation Report chapters 6 and 15. The primary system and secondary pressure boundary limits were not approached and no violations of the specified acceptable fuel design limits occurred.

The event did not result in any challenges to the fission product barriers or result in the release of radioactive materials. Therefore, there were no adverse safety consequences or implications as a result of this event and the 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 any safety feature and 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 event initiator (main generator loss of field trip) was attributed to a failure of the Generrex signal override circuit board induced by an electrical transient from a series of lightning strikes in the vicinity of the Palo Verde switchyard.

The cause of the reportable event (automatic reactor trip on low DNBR) was attributed to the application of an overly conservative planar radial peaking factor in the CPCs which resulted in an overly conservative DNBR calculation. The overly conservative DNBR value was greater than the trip setpoint that existed once the reactor power cutback flag cleared.

If APS determines that the cause of the reportable event is something other than conservative addressable constants for calculation of update DNBR, then a supplement to this report will be submitted.

7. CORRECTIVE ACTIONS:

The main generator and the Generrex system were evaluated in accordance with Palo Verde corrective action program. Failed components, including the Generrex signal override circuit board were replaced.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 2	05000529	2004	-- 002	-- 00	5 OF 5

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

Calculation TA-13-C00-2004-004, "Determination of a new ARM5 value for Units 1 and 2 Cycle 12 & Unit 3 Cycle 11," was revised to establish ARM5 values that would minimize the possibility of an automatic reactor trip following a reactor power cutback while at the same time not inhibit the required trip protection should the integrated system response following a reactor power cutback fall outside the design basis. (ARM5 is one of the CPC addressable constants for planar radial peaking factor.) The new ARM5 values have been incorporated into all three Unit's CPCs.

8. PREVIOUS SIMILAR EVENTS:

On June 7, 2004 Unit 3 experienced a main turbine control system malfunction that resulted in a reactor power cutback followed by an automatic reactor trip on low DNBR (LER 50-530/2004-002-00). The investigation and corrective actions associated with the June 7 event had not been completed at the time the event discussed in this LER occurred.