Palo Verde Nuclear Generating Station

William E. Ide
Vice President
Nuclear Production

TEL (623) 393-6116
FAX (623) 393-6077

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

192-01061-WEI/DGM/RAS
November 18, 1999

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
Docket No. STN 50-528
License No. NPF-41
Licensee Event Report 99-007-00

Attached please find Licensee Event Report (LER) 50-528/99-007-00 that has been prepared and submitted pursuant to 10 CFR 50.73. This LER reports an ESFAS actuation due to a loose power supply jumper. No commitments are made to the NRC in this submittal.

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,

FOR WE IDE

WEI/DGM/RAS/ras

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

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.

LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Palo Verde Nuclear Generating Station-Unit 1	05000528	1 OF 6

TITLE (4)

Half-Leg ESFAS Actuation Due To Loose Power Supply Jumper

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	19	1999	1999	- 007 -	00	11	18	1999	N/A	
									FACILITY NAME: N/A	DOCKET NUMBER

OPERATING MODE (9)	6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)	000		20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
			20.2203(a)(1)		20.2203(a)(3)(i)		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)	X	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
A	JE	JX	L045	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 19, 1999, at approximately 0049 mountain standard time (MST), Unit 1 was in the eighth refueling outage, in Mode 6 with the core off-loaded to the spent fuel pool, when a momentary loss of power to a portion of the train A engineered safety feature actuation system (ESFAS) auxiliary relay cabinet occurred. The momentary loss of ESFAS power caused the train A emergency diesel generator (EDG) to start and actuated many train "A" components to a post safety injection actuation.

The train A ESFAS actuations reset within one second of initiation and the effected equipment had been restored by approximately 0128 MST on October 19, 1999. Preliminary investigation results indicate that a loose input power selection jumper on an ESFAS power supply was the cause of the event and the faulty power supply was replaced.

A previous similar event was reported in LER 50-529/97-005-00.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 1	05000528	1999	- 007 -	00	2 OF 6

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

I. REPORTING REQUIREMENT(S):

This LER 528/99-007-00 is being submitted pursuant to 10 CFR 50.73(a)(2)(iv) to report an event that resulted in the automatic actuation of Engineered Safety Features (ESF) (EIIS:JE).

Specifically, on October 19, 1999, the Unit 1 train A engineered safety features actuation system (ESFAS)(EIIS:JE) actuated after a momentary loss of power occurred due to a loose power supply input selection jumper. The momentary loss of ESFAS power caused the train A emergency diesel generator (EDG)(EIIS:EK) to start and actuated many train A components to a post safety injection actuation condition. This event has also been reported to the NRC via the emergency notification system (ENS# 36309).

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

The ESFAS is a subsystem of the plant protection system (PPS)(EIIS:JC) which initiates necessary safety systems, based upon the values of selected unit parameters, to protect against violating core design limits and the reactor coolant system pressure boundary during anticipated operational occurrences and ensures acceptable consequences during accidents.

The ESFAS contains devices and circuitry that generate the following signals when monitored variables reach levels that are indicative of conditions requiring protective action: Safety injection actuation signal (SIAS)(EIIS:BP/BQ); containment spray actuation signal (CSAS)(EIIS:BE); containment isolation actuation signal (CIAS)(EIIS:BD); main steam isolation signal (MSIS)(EIIS:SB); recirculation actuation signal (RAS); and auxiliary feedwater actuation signal (AFAS)(EIIS:BA).

ESFAS initiation relay contacts are arranged into two trip legs (leg 1-3, leg 2-4) for each train actuation trip path. Initiation relay (EIIS: RLY) contacts are configured such that "one-out-of-two twice" logic is employed that (typically) requires one contact in each leg to open in order to initiate a full ESFAS actuation. Initiation relay contact opening causes the group actuation relays to de-energize, thereby effecting actuation in the individual pump and valve circuits. A half-leg ESFAS actuation can occur upon a complete loss of power to any one initiation circuit.

Two Lambda model LRS-58-48-43054 power supplies (EIIS:JX) provide auctioneered power to each of the ESFAS trip leg initiation circuits. The 1-3 and 2-4 trip leg initiation circuits manipulate group and subgroup actuation relays. These power supplies can be configured to operate on either 120 volt alternating current (VAC) or 220 VAC input voltage, and supply (as output) approximately 36 volts direct current (VDC) to ESFAS relays. When configured to operate on

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 1	05000528	1999	- 007 -	00	3 OF 6

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

120 VAC, an input selection jumper is required to be placed between two points on a terminal board mounted on the exterior of the power supply, adjacent to input power terminations.

Two independent, 100% capacity diesel generators provide a dependable onsite power source capable of starting and supplying the essential loads necessary to shut down the plant safely and to maintain it in a safe shutdown condition under loss of offsite power (LOP) conditions (voltage degradation to the 4.16 kV ESF bus). Load sequencers are provided to sequentially load the diesel generators and are a part of the engineered safety features (ESF) system actuation. The diesel generators are started automatically by a LOP, AFAS, SIAS, or CSAS. A LOP also initiates automatic ESF load sequencing onto the diesel generators.

III. INITIAL PLANT CONDITIONS:

At the time of the event, October 19, 1999, at approximately 0049 mountain standard time (MST), Unit 1 was defueled, at zero percent power on the seventeenth day of the eighth refueling outage. The Reactor Coolant System (RCS) (EIIS: AB) was at approximately 88 degrees Fahrenheit (F) and at atmospheric pressure.

At the time of the event, ESFAS auxiliary relay cabinets were out of service, with bypass jumpers installed in support of refueling outage testing and maintenance. The ESFAS jumpers effectively bypassed PPS initiated actuations. In addition, both Train B auctioneered power supplies within this ESFAS auxiliary relay cabinet were deenergized to allow testing and maintenance. ESFAS trip leg 2-4 was being powered by a single Lambda power supply (1-J-SAA-EY-0049) which receives power from the train A 120 VAC class 1E vital instrument and control distribution panel (1E-PNA-D25)(EIIS: EJ). As stated, the normally redundant ESFAS trip leg 2-4 power supply (1-J-SAA-EY-0050) was unavailable due to an outage of the train B 120 VAC vital instrument and control distribution panel (1E-PNB-D26). The train B distribution panel had been de-energized at approximately 2125 MST on October 18, 1999, as part of pre-planned outage testing and maintenance.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 1	05000528	1999	- 007 -	00	4 OF 6

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

IV. EVENT DESCRIPTION:

On October 19, 1999, at approximately 0049 mountain standard time, Unit 1 was in Mode 6 defueled, with the core off-loaded to the spent fuel pool when a momentary actuation of the train A Engineered Safety Feature Actuation System (ESFAS) occurred. At 0049:00 MST, the 2-4 leg of the ESFAS actuated and plant monitoring equipment recorded train A leg 2-4 trips for MSIS, CSAS, AFAS-1, CIAS, RAS AFAS-2 and SIAS. By 0049:01 MST, plant monitoring equipment recorded that these trips had reset.

Although the ESFAS trip circuitry had reset from a trip condition in less than one second, the 2-4 leg ESFAS actuation:

- Started the train A EDG
- Started the train A condensate transfer and storage pump
- Tripped the non-class chilled water system evaporator
- Tripped the train A containment HVAC system air handler
- Tripped non-class 480 VAC motor control center M19 (SIAS)
- Tripped non-class 480 VAC motor control center M71 (SIAS)
- Closed the non-class chilled water system valve 62

In addition, the water reclamation facility (WRF) lost power due to the SIAS load shed, which subsequently caused a loss of domestic water cooling to the instrument air compressors and the breathing air compressor.

Instrument air compressor 1C tripped on high interstage temperature, and instrument air compressor 1A started, but was stopped by control room staff due to the loss of compressor cooling.

At approximately 0110 MST, on October 19, 1999, non-class 13.8 kV power supply NAN-S05G was closed, restoring power to the WRF. At 0123 MST, the train A EDG was placed in "off" and after a five minute cool down the train A EDG was stopped.

Because there was no loss of offsite power (LOP) signal, the load sequencer did not connect train A EDG to the Class 1E 4160 V bus (EIIS:EB). The Class 1E 4160 bus electrical power supply and spent fuel pool (EIIS:ND) cooling were not interrupted as a result of the event. The ESFAS equipment was restored in accordance with applicable procedures. There were no other

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 1	05000528	1999	- 007 -	00	5 OF 6

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

safety system actuations and none were required. All systems actuated as designed considering that the half-leg actuation was the result of a component failure and not a valid actuation signal.

V. SAFETY CONSEQUENCES:

The inadvertent actuation of the train A ESFAS 2-4 leg equipment and train A EDG presented an unnecessary challenge to safety systems. However, the available ESFAS 2-4 leg equipment and train A EDG actuated as designed and as assumed by the safety analysis. 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.

VI. CAUSE OF THE EVENT:

An investigation of this event is being conducted in accordance with the PVNGS Condition Reporting program. Preliminary results indicate the event was caused by a loose input selection jumper on a Lambda model LRS-58-48-43054 power supply, which at the time of the event, was the sole source of power for ESFAS trip leg 2-4 initiation circuit. The input selection jumper was the point of failure for the power supply.

The loose jumper caused a momentary (< 1 second) loss of input power to the power supply, which when coupled with the train B vital bus outage resulted in the train A ESFAS leg 2-4 actuation. As a result of the train B distribution panel being de-energized, an increase in the current though the loose jumper increased the temperature of the loose, high resistance, connection and causes increased temperature, localized melting and the momentary loss of connection.

It is not known at this time why the power supply jumper was loose. Investigation has revealed that it is not necessary to loosen the jumper during power supply refurbishment or power supply replacement. The jumpers were installed during the initial installation of the power supply in 1990.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Nuclear Generating Station Unit 1	05000528	1999	- 007 -	00	6 OF 6

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

VII. CORRECTIVE ACTIONS:

The failed power supply (1-J-SAA-EY-0049) was replaced at 0300 MST on October 21, 1999.

The remaining Unit 1 train A and B ESFAS power supplies were inspected and the tightness of the jumpers was verified. Similarly, spare power supplies jumpers have been verified to be tight.

The importance of verifying the tightness of external jumpers prior to installing equipment was re-emphasized to PVNGS maintenance groups.

Work orders have been developed to verify that the jumpers are tight on the ESFAS power supplies in Units 2 and 3.

VIII. PREVIOUS SIMILAR EVENTS:

A previous similar event was reported in LER 50-529/97-005-00, when a failed Lambda power supply initiated a similar ESFAS half-leg trip. Investigation of the earlier event revealed that an electrolytic capacitor in the voltage regulator circuit failed, causing the half-leg actuation.

One of the corrective actions developed as a result of the earlier event was to ensure the redundant power supplies are available and operating properly prior to de-energizing the supply power to the ESFAS cabinets. This corrective action had been implemented prior to this event. However, during the current event, the power supply failed after the redundant supply voltage had been verified to acceptable. Therefore, the previous corrective actions could not have prevented this event.