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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 94-007-00:on 940830,reactor trip occurred when steam generator 2 water level reached RPS trip setpoint.Caused by component failure.FWCS-2 master controller was replaced. W/940924 ltr.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:Standardized plant. 05000530

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Arizona Public Service Company
PALO VERDE NUCLEAR GENERATING STATION
P.O. BOX 52034 • PHOENIX, ARIZONA 85072-2034

JAMES M. LEVINE
VICE PRESIDENT
NUCLEAR PRODUCTION

192-00908-JML/BAG/KR
September 24, 1994

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Washington, D.C. 20555

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Unit 3
Docket No. STN 50-530 (License No. NPF-74)
Licensee Event Report 94-007-00
File: 94-020-404

Attached please find Licensee Event Report (LER) 94-007-00 prepared and submitted pursuant to 10CFR50.73. This LER reports an August 30, 1994 reactor trip on high steam generator water level caused by an increase in feedwater flow. The unit also received an Engineered Safety Feature Actuation System (ESFAS) actuation of the Main Steam Isolation System on high steam generator water level. In accordance with 10CFR50.73(d), a copy of this LER is being forwarded to the Regional Administrator, NRC Region IV. If you have any questions, please contact Burton A. Grabo, Section Leader, Nuclear Regulatory Affairs, at (602) 393-6492.

Sincerely,

James M. Levine

JML/BAG/KR/pv

Attachment

cc: L. J. Callan (all with attachment)
K. E. Perkins
K. E. Johnston
INPO Records Center

JE22

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Palo Verde Unit 3	0 5 0 0 0 5 3 0	1 OF 0 6

TITLE (4)

Reactor Trip Caused by an Increase in Main Feedwater Flow

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 NAMES	DOCKET NUMBERS
									N/A	0 5 0 0 0
0 8	3 0	9 4	9 4	- 0 0 7 -	0 0	0 9	2 4	9 4	N/A	0 5 0 0 0

OPERATING MODE (9)	1
POWER LEVEL (10)	1 0 0

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

[ ] 20.402(b)	[ ] 20.405(c)	[X] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
Burton A. Grabo, Section Leader, Nuclear Regulatory Affairs	6 0 2 3 9 3 - 6 4 9 2

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
X	S J	M C B D	F 1 8 0	N					

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 fifteen single-space typewritten lines) (16)

On August 30, 1994, at approximately 1500 MST, Palo Verde Unit 3 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power when a reactor trip occurred when Steam Generator Number 2 (SG-2) water level reached the Reactor Protection System (RPS) trip setpoint for high steam generator water level caused by an increase in main feedwater (MFW) flow. In addition to the reactor trip, the unit received an Engineered Safety Feature Actuation System (ESFAS) actuation of the Main Steam Isolation System (MSIS A and MSIS B) on high steam generator water level for SG-2. The MSIS necessitated the use by Control Room personnel of the auxiliary feedwater pump (AFWP-B) and the atmospheric dump valves (ADVs) to control secondary heat removal (AFWP-B was used to feed the steam generators and the ADVs were used to stabilize secondary temperature and pressure). Required plant equipment and safety systems responded to the event as designed. No other ESF actuations occurred and none were required. The Shift Supervisor diagnosed the event as an uncomplicated reactor trip. By approximately 1530 MST on August 30, 1994, the plant was stabilized in Mode 3 (HOT STANDBY).

The reactor trip on high SG-2 water level was initiated by a malfunction in the Feedwater Control System (FWCS-2) which was attributed to a failed FWCS-2 master controller power fuse. As corrective action, the master controller was replaced.

TEXT

1. REPORTING REQUIREMENT:

This LER 530/94-007-00 is being written to report an event that resulted in the automatic actuation of an Engineered Safety Feature, including the Reactor Protection System (RPS) as specified in 10 CFR 50.73(a)(2)(iv).

Specifically, at approximately 1500 MST on August 30, 1994, Palo Verde Unit 3 was in Mode 1 (POWER OPERATION) operating at approximately 100 percent power when a reactor (AC) trip occurred when Steam Generator Number 2 (SG-2) (AB) water level reached the RPS trip setpoint for high steam generator water level caused by an increase in main feedwater (MFW) (SJ) flow. In addition to the reactor trip, the unit received an Engineered Safety Feature Actuation System (ESFAS) actuation of the Main Steam Isolation System (MSIS A and MSIS B) (JE)(SG) on high steam generator water level for SG-2.

2. EVENT DESCRIPTION:

On August 30, 1994, prior to the reactor trip and the MSIS actuation reported in this LER, at approximately 1500 MST, Unit 3 Control Room (NA) personnel (utility, licensed) received several feedwater control system (FWCS) (SJ) alarms indicating low suction pressure for the main feedwater pumps (MFWP A and MFWP B). The low suction pressure trip signals were initiated by an unwarranted speed increase of both MFWPs A and B. The secondary reactor operator recognized the symptoms of a FWCS malfunction (see 7. PREVIOUS SIMILAR EVENTS) and was able to take manual control of the FWCS-1 master controller. The Control Room Supervisor (CRS) took manual control of the FWCS-2 master controller. However, the attempt to manually reduce the FWCS-2 master controller's 100 percent output signal failed (i.e., the controller did not respond to the CLOSE signal).

Control Room personnel observed that SG-2 water level was increasing rapidly. Following an evaluation of plant conditions (i.e., SG-2 level was at 88 percent narrow range), the CRS directed Control Room personnel to manually trip the reactor. However, before Control Room personnel could complete the manual reactor trip directive, at approximately 1500 MST, an automatic reactor trip occurred when SG-2 water level reached the RPS trip setpoint for high steam generator water level (i.e., 91 percent narrow range). All control element assemblies (CEA) (AA) inserted as designed.

In addition to the reactor trip, an ESFAS actuation of the MSIS on high steam generator water level for SG-2 was initiated at 91 percent narrow range. One SG-1 main steam safety valve (MSSV) (SB) SGE-PSV-0572 lifted, mitigating further increase in secondary pressure. (By lifting in the lower end of the allowable band, SGE-PSV-0572 relieved enough

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pressure to prevent its counterpart MSSV (SGE-PSV-579) from reaching its lift setpoint.) The MSIS necessitated the use by Control Room personnel of the auxiliary feedwater pump (AFWP-B) (BA) and the atmospheric dump valves (ADVs) (SB) to control secondary heat removal (AFWP-B was used to feed the steam generators and the ADVs were used to release steam and stabilize secondary temperature and pressure). The MSSV seated after remaining open for approximately one minute and remained closed with no signs of residual leakage.

The reactor trip was followed by a Main Turbine/Main Generator (TA/TG) trip and the subsequent deenergization of the unit auxiliary transformer (MAN-X02). The startup transformer (NAN-X01) was out-of-service for maintenance and therefore, by procedure, the fast bus transfer was disabled between the non-Class 1E 13.8 kV switchgear buses (NAN-S04 and NAN-S02) (EA). This resulted in the deenergization of NAN-S02 on the loss of the unit auxiliary transformer which resulted in the loss of two of four reactor coolant pumps (RCPs 1B and 2B) (AB)(P), two of four circulating water pumps (CWPs) (NN)(P), and non-essential load centers. RCPs 1A and 2A maintained forced circulation of the reactor coolant system (RCS) throughout the event. The loss of non-Class 1E loads under these circumstances was as expected.

The Shift Supervisor diagnosed the event as an uncomplicated reactor trip. By approximately 1530 MST on August 30, 1994, the plant was stabilized in Mode 3 (HOT STANDBY). At approximately 1531 MST, NAN-S02 was reenergized. By approximately 1632 MST, MSIS A and B were reset. No other ESF actuations occurred and none were required.

Required plant equipment and safety systems responded to the event as designed. As part of the automatic safety system response, the MSIS isolated the main steam, main feedwater, sample, and blowdown lines on both steam generators. For this event, the MSIS actuation prevented moisture carryover from the steam generators from reaching the main turbine and causing equipment damage.

3. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

A safety limit evaluation was performed as part of the APS Incident Investigation Program. The evaluation determined that the plant responded as designed, that no safety limits were exceeded, and that the event was bounded by current safety analyses. The event reported by this LER is bounded by the Palo Verde Updated Final Safety Analysis Report (FSAR) Chapter 15 accident scenarios concerning increases in heat removal by the secondary system or an increase in normal feedwater flow event. In addition, the Updated FSAR Chapter 6 scenarios concerning loss of coolant accidents were not challenged by this event.

TEXT

The event did not result in a transient more severe than those already analyzed. The primary system pressure boundary limit was not approached, and the transient did not cause any violation of the Specified Acceptable Fuel Design Limits (SAFDL). Therefore, there were no 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.

4. CAUSE OF THE EVENT:

The reactor trip on high SG-2 water level was initiated by an unwarranted speed increase of both MFWPs caused by a failure of the FWCS-2 master controller power fuse (SALP Cause Code E: Component Failure). The cause of the component failure and the failure mode, mechanism, and effect of the failed component is discussed in Section 5.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. There were no procedural errors or personnel errors which contributed to this event. The investigation determined that the action taken by Control Room personnel within the 40 second span between initiation of the event and the reactor trip were prompt and appropriate.

5. STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION:

The malfunction in FWCS-2 (i.e., unwarranted speed increase of both MFWPs A and B and the opening of the SG-2 economizer valve) was immediately recognized as the cause of the reactor trip. The rapid increase in SG-2 water level was due to the increased MFWP flow to SG-2 following the SG-1 economizer valve closure (manual control by Control Room personnel of FWCS-1). The reactor trip and the MSIS actuations were generated from a valid high level SG-2 signal of approximately 91 percent narrow range level. A high output signal from the FWCS-2 master controller would have caused the increase in both MFWP speeds and the above described scenario.

An independent investigation of this event is being conducted in accordance with the APS Incident Investigation Program. Following the reactor trip, the FWCS (i.e., MFWPs, SG-2 economizer valve, and FWCS master controller) was quarantined. A troubleshooting plan was developed and implemented to determine the cause of the malfunction of the FWCS-2. As part of the investigation, an equipment root cause of failure analysis (ERCFA) of the FWCS-2 master controller is being performed by APS Engineering personnel. APS Engineering personnel determined that a FWCS master controller power fuse failed and that the high output signal from the FWCS-2 master controller was the expected component response to the fuse failure. The failed component, FWCS master proportional integral controller, where the fuse is located, is

manufactured by Foxboro, Inc. The model number of the card is 2AX+T4. Foxboro was contacted regarding the fuse failure and specifically, for information related to their experience with fuse failures. The ERCFA is continuing to determine the specific root cause for the master controller power fuse failure.

A Combustion Engineering (ABB/CE) systems design engineer was consulted to support the troubleshooting effort and to evaluate both feedwater malfunction events (August 19, 1994 and August 30, 1994 reactor trips) for similarities or common cause failures. It was determined that the cause of two events were not related.

The maintenance history of the failed card is being researched by APS personnel. Following a completion of the ERCFA, the evaluation will include transportability issues and additional corrective actions, if any. The investigation determined that no maintenance or troubleshooting activities in progress could have contributed to this event.

There are no indications that any structures, systems, or components were inoperable at the start of the event which contributed to this event. No failures of components with multiple functions were involved. No failures that rendered a train of a safety system inoperable were involved.

6. CORRECTIVE ACTIONS TO PREVENT RECURRENCE:

The FWCS-2 master controller was replaced.

As part of the investigation, an ERCFA of the FWCS-2 master controller is being performed by APS Engineering personnel. The preliminary evaluation identified a FWCS-2 master controller power fuse failure which caused the high output. The ERCFA is continuing to determine the specific root cause for the master controller power fuse failure. Following a completion of the ERCFA, the evaluation will include transportability issues and additional corrective actions, if any. If information is developed which would significantly affect the readers' understanding or perception of this event, a supplement will be submitted.

7. PREVIOUS SIMILAR EVENTS:

Reactor trips attributed to an FWCS malfunction have been previously reported in LERs 529/92-001, 530/93-001, and 530/94-005. Eleven days prior to the event reported in this LER, a feedwater malfunction also occurred in Unit 3. On August 19, 1994, Unit 3 was in Mode 1 operating at approximately 100 percent power when a reactor trip occurred on low steam generator water level following the degradation of main feedwater

TEXT

flow. This event was reported in LER 530/94-005-00. The reactor trip was initiated by an unexplained and unwarranted closing of the economizer valve on SG-1 which was later determined to be caused by an intermittent component failure of the main feedwater control system (FWCS-1). In addition to installing recorders to monitor the FWCS-1 and to help determine the cause of the malfunction should it recur, Control Room personnel were briefed on the possibility of another FWCS-1 component failure and on actions required to mitigate a FWCS malfunction event. Based on the information available at this time, the cause and specific scenario of the event reported by this LER does not appear to be related to the previous FWCS malfunctions.

8. ADDITIONAL INFORMATION:

Based on the contingency action plan and on reviews by the Plant Review Board, the Management Response Team, and the Incident Investigation Team, unit restart was authorized by the Operations Director in accordance with approved procedures. At approximately 1822 MST on August 31, 1994, Unit 3 entered Mode 2 (STARTUP), at approximately 2154 MST on August 31, 1994, Unit 3 entered Mode 1, and at approximately 0112 MST on September 1, 1994, Unit 3 was synchronized on the grid.