

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Palo Verde Unit 1	DOCKET NUMBER (2) 0 5 0 0 0 5 2 8	PAGE (3) 1 OF 0 5
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TITLE (4)
Reactor trip on low steam generator level due to insufficient feedwater flow followed by AFAS-2

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											
0	2	2	9	8	9	8	-	0	0	2	-	0	0	0	3	1	2	9	8	N/A	0 5 0 0 0 0
										N/A	0 5 0 0 0 0										

OPERATING MODE (9) 1		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.73 (Check one or more of the following) (11)											
POWER LEVEL (10) 1 0 0		20.402(b)				20.405(c)				<input checked="" type="checkbox"/> 50.73(a)(2)(iv)		73.71(b)	
		20.405(a)(1)(i)				50.36(c)(1)				<input type="checkbox"/> 50.73(a)(2)(v)		73.71(c)	
		20.405(a)(1)(ii)				50.36(c)(2)				<input type="checkbox"/> 50.73(a)(2)(vi)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)	
		20.405(a)(1)(iii)				50.73(a)(2)(i)				<input type="checkbox"/> 50.73(a)(2)(vii)(A)			
		20.405(a)(1)(iv)				50.73(a)(2)(ii)				<input type="checkbox"/> 50.73(a)(2)(vii)(B)			
		20.405(a)(1)(v)				50.73(a)(2)(iii)				<input type="checkbox"/> 50.73(a)(2)(x)			

LICENSEE CONTACT FOR THIS LER (12)							
NAME Daniel G. Marks, Section Leader, Nuclear Regulatory Affairs							
TELEPHONE NUMBER AREA CODE 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	MANUFACTURER	REPORTABLE TO NPDOS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPDOS		
X	S	J	C	O	M	P	F	1	8	0	N

SUPPLEMENTAL REPORT EXPECTED (14)						EXPECTED SUBMISSION DATE (15)		MONTH	DAY	YEAR
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)						<input checked="" type="checkbox"/> NO				

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

On February 22, 1998, at approximately 2221 MST, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power when an automatic reactor trip occurred on low steam generator number 2 (SG-2) water level due to a decrease in main feedwater flow. In addition to the reactor trip, the unit received an Engineered Safety Feature Actuation System actuation of the auxiliary feedwater system 2 (AFAS-2) on low SG-2 water level. On receipt of the AFAS-2, both emergency diesel generators started and ran unloaded as designed. By approximately 2259 MST, the unit was stabilized in Mode 3 (HOT STANDBY) and the Shift Manager classified the event as an uncomplicated reactor trip. All safety systems functioned as designed. There were no other safety system actuations and none were required.

The reactor tripped on low SG-2 water level following the spurious closing of the economizer regulating valve by approximately 25 percent. A preliminary evaluation has determined that the apparent root cause of the economizer regulating valve closure is attributed to a failure of the dynamic compensator card in the compensated level signal circuitry which is an input to the feedwater control system 2 (FWCS-2) master controller. As corrective action, the FWCS-2 was quarantined. Following troubleshooting, the card was replaced and the unit restarted.

No previous similar events have been reported pursuant to 10CFR50.73.

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1. REPORTING REQUIREMENT:

This LER 528/98-002-00 is being written to report an event that resulted in the automatic actuation of an Engineered Safety Feature (ESF) (JE), including the Reactor Protection System (RPS) (JC) as specified in 10 CFR 50.73(a) (2) (iv).

Specifically, at approximately 2221 MST on February 22, 1997, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION) operating at approximately 100 percent power when an automatic reactor (AC) trip occurred on low Steam Generator Number 2 (SG-2) (AB) water level due to a decrease 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 Auxiliary Feedwater Actuation System 2 (AFAS-2) (JE) (BA) on low steam generator water level for SG-2. On receipt of the AFAS-2, both emergency diesel generators (EK) started and ran unloaded as designed.

2. EVENT DESCRIPTION:

Prior to the automatic reactor trip, at approximately 2220 MST on February 22, 1998, Control Room personnel observed a drop in secondary calorimetric power from 99.99 percent to 97.43 percent. Control Room personnel also observed that SG-2 water level was decreasing rapidly, took manual control of the feedwater control system 2 (FWCS-2) (SJ) master controller, and attempted to restore feed flow to greater than steam flow on SG-2. The economizer regulating valve responded to manual control and reopened to restore flow, however the SG-2 water level decreased to the reactor trip setpoint of 44.2 percent wide range. At approximately 2221 MST, the reactor automatically tripped on low SG-2 water level. SG-2 water level continued to decrease following the reactor trip and an actuation of AFAS-2 occurred at the setpoint of 25.8 percent wide range. The minimum indicated SG-2 water level reached 22.4 percent wide range. All control element assemblies (CEA) (AA) inserted as designed. The reactor trip initiated a main turbine/main generator trip (TA/TB). On receipt of the AFAS-2, both emergency diesel generators started and ran unloaded as designed. The steam bypass control system (JI) responded as designed to control the secondary system pressure.

By approximately 2259 MST, the unit was stabilized in Mode 3 (HOT STANDBY) and the Shift Manager classified the event as an uncomplicated reactor trip. There were no other safety system actuations and none were required. Required safety systems responded to the event as designed. FWCS-2 was quarantined due to the master controller output decreasing without an apparent cause.

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

A safety limit evaluation was performed as part of the APS investigation. 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 reactor trip did not result in a transient more severe than those already analyzed in Chapter 15 of the Updated Final Safety Evaluation Report. Scenarios concerning a decrease in heat removal by the secondary system or loss of normal feedwater flow remain bounding for this event. This event did not challenge shutdown margin criteria. All CEAs inserted as designed. Both primary and secondary pressures remained well below 110 percent of the design pressures. No pressurizer (AB) or main steam safety valves (SB) lifted as a consequence of this event. The specified acceptable fuel design limits (SAFDL) were not exceeded during this event. The plant response was normal for the situation that occurred.

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.

4. CAUSE OF THE EVENT:

An independent investigation of this event is being conducted in accordance with the APS Corrective Action Program. The investigation has determined that the reactor tripped on low SG-2 water level following the spurious closing of the economizer regulating valve by approximately 25 percent. A preliminary evaluation has determined that the apparent root cause of the economizer regulating valve closure is attributed to a failure of the dynamic compensator card in the compensated level signal circuitry which is an input to the FWCS-2 master controller (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. No personnel errors or procedural errors contributed to this event.

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5. STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION:

An independent investigation of this event is being conducted in accordance with the APS Corrective Action Program. The investigation has determined that the reactor automatically tripped on low SG-2 water level following the spurious closing of the economizer regulating valve by approximately 25 percent. A preliminary root cause of failure analysis (ERCFA) has determined that the apparent root cause of the economizer regulating valve closure is attributed to a failed electronics card in the compensated level signal circuitry which is an input to the FWCS-2 master controller. The failed dynamic compensator card output voltage was high (10 VDC) while the input voltage was within expected range (approximately 5 VDC). The 10 VDC output would cause the economizer valve to go closed. A new compensator card was installed, the output voltage returned to normal, and the FWCS voltages returned to expected values. The failed compensator card is currently at the instrumentation and control rework facility to determine the specific failure mode of the card. If the final evaluation results differ from this determination, a supplement to this report will be submitted to describe the final root cause determination.

The investigation also included a transportability review which revealed that of the 84 dynamic compensator cards installed across multiple systems in all three units, only one other card failure has occurred. Since no abnormal failure modes or repetitive problems exist, there are no further transportability issues.

The dynamic compensator card in the compensated level signal circuitry is manufactured by Foxboro and is part number 2AX-DYC-L.

There were 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:

An independent investigation of this event is being conducted in accordance with the APS Corrective Action Program. Actions to prevent recurrence are being developed based upon the results of the investigation and will be tracked to completion under the PVNGS Commitment Action Tracking System. As immediate corrective action, the dynamic compensator card was replaced and the feedwater control system checked satisfactory.

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7. PREVIOUS SIMILAR EVENTS:

Although previous events have been reported pursuant to 10 CFR 50.73 in the past three years for automatic actuation of an ESF, including the RPS, the causes discussed in the previous events have not been similar to this event. Therefore, the corrective actions of the previous events would not have prevented this event.

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 0250 MST on February 24, 1998, Unit 1 entered Mode 2 (STARTUP), at approximately 1112 MST on February 24, 1998; Unit 1 entered Mode 1, and at approximately 0902 MST on February 25, 1998, Unit 1 was synchronized on the grid.

