NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Palo Verde Unit 1	0 5 0 0 0 5 2 8	1 OF 0 5

TITLE (4)

Spurious ESF Actuations Caused by Overheated ESF Sequencer Module

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 NUMBER(S)
											0 5 0 0 0
1 2	1 6	8 5	8 5	–	0 8 3	– 0 0	0 1	1 5	8 6		0 5 0 0 0

OPERATING MODE (9)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
1	20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10) 0 5 2	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)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	Special Report 1-SR-85-033
	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
William F. Quinn, Manager - Nuclear Licensing (Extension 4087)	AREA CODE 6 0 2 9 4 3 - 7 2 0 0

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
X	J I E	C P U	G 0 6 3	N							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE)	NO		0 3	1 5	8 6

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

This LER also contains a Special Report (1-SR-85-033) on the failure of the Train "A" emergency diesel generator to load.

At 1811 MST on December 16, 1985, Unit 1 was operating at 52% reactor power in Mode 1, POWER OPERATION, when an electronics failure in a Train "A" Engineered Safety Feature (ESF) cabinet resulted in the spurious actuation of several ESF signals.

A spurious auto-start of the Train "A" emergency diesel generator, operation of the ESF load sequencer, and a Train "A" load shed signal also occurred as a result of the electronics failure. The load shed signal did not clear as required, and did not allow the automatic or manual loading of the electrical loads onto the diesel generator.

The cause of the event has been traced to failure of a fan in the ESF cabinet. Failure of the fan allowed the ESF load sequencer module to overheat and malfunction.

As a corrective action, the ESF load sequencer was replaced, the ESF cabinet door was temporarily removed, and the fan was repaired. Hourly verification of fan operation was performed until a control room alarm, which annunciates on high cabinet exit air temperature, could be installed.

Numerous actions requiring the attention of the licensed operators during this event prevented the initiation of action required under Technical Specification 3.0.3 within 1 hour as required.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

This LER also contains a special report (1-SR-85-033) on the failure of the Train "A" emergency diesel generator to load, which occurred during this event.

At 1811 MST on December 16, 1985, Palo Verde Unit 1 was operating at 52% reactor power in Mode 1, POWER OPERATION, when failure of an electronic component in the sequencer module for the Train "A" Engineered Safety Features (ESF) (JE) cabinet resulted in several spurious ESF actuations, an inadvertent operation of the ESF load sequencer (JE), and an automatic start of the Train "A" emergency diesel generator (EK). The ESF load sequencer, which experienced the failure of the electronic component, was supplied by General Atomics; Model No. 0342-5200.

The event occurred following the scheduled daily performance of automatic tests on the circuitry in the Train "A" Balance of Plant Engineered Safety Feature Actuation System (BOP-ESFAS) cabinet. A popping noise was heard, and the smell of burning electronic components was detected by a control room operator (licensed). The source of the smell was determined to be the Train "A" BOP-ESFAS cabinet. It was also noted that all of the lights in the ESF load sequencer module were illuminated and that the cooling fan for the ESF load sequencer module was not operating. All of these conditions are abnormal. Investigation into the abnormal conditions was initiated immediately by Instrument and Control Technicians.

During the investigation, the ESF load sequencer spuriously caused the Train "A" emergency diesel generator to start in the "test" mode, and initiated an invalid load shed and loss of power condition for the Class 1E loads supplied from the Train "A" 4160V AC bus. The normal and alternate bus supply breakers opened and all bus loads were stripped from the Train "A" bus. As a result of the failure in the BOP-ESFAS cabinet, a spurious BOP-ESFAS actuation of the following ESF signals also occurred: Fuel Building Essential Ventilation Actuation Signal (FBEVAS), Containment Purge Initiation Actuation Signal (CPIAS), and Control Room Essential Filtration Actuation Signal (CREFAS).

Following the stripping of the bus loads, the diesel generator supply breaker did not automatically close, and the stripped loads were not automatically loaded onto the emergency diesel generator. In an effort to restore power to the Train "A" electrical loads, an operator (licensed) unsuccessfully attempted to manually close the normal supply breaker. The normal supply breaker and ESF service transformer connect the 4160V AC, Class 1E bus to the 13.8kV, Class 1E bus, and to offsite power sources.

The failure of the diesel generator output breaker to automatically close and load the Train "A" electrical loads occurred as a result of the component failure in the BOP-ESFAS cabinet. More specifically, the BOP-ESFAS component failure prevented the diesel generator from operating as designed and transferring to the "emergency" mode, from the "test" mode, following the Train "A" load shed. Automatic closure of the diesel generator output breaker on a loss of power signal is only expected when the diesel generator is operating in the "emergency" mode.

Because the load shed signal was initiated by a failure of the BOP-ESFAS circuitry, and not initiated as a result of an actual loss of offsite power condition, the load shed signal which was actuated did not clear after the electrical loads had been shed. Usually, the load shed signal duration is approximately 1 second. An active load shed signal will not allow the closure of breakers onto the bus. As a result, the presence of the active load shed signal prevented the manual closure of the normal supply breaker.

Following the attempt to align the normal supply breaker to the bus, an attempt to manually align the diesel generator supply breaker was made. This attempt ultimately resulted in a trip of the diesel generator and opening of the diesel generator output breaker at 1818. The indicated cause of the diesel generator trip was reverse power.

The diesel generator trip on reverse power that resulted when the operator (licensed) attempted to close the diesel generator supply breaker remains unexplained since neither of the predicted initiating causes for a reverse power trip appear to have initiated the diesel generator trip. The predicted initiating causes for a reverse power trip of the diesel generators are: bus voltage greater than the diesel generator output voltage and/or a manual trip of the diesel generator with the output breaker aligned to parallel the diesel generator with an offsite source. The results of further investigation into the cause of the reverse power diesel generator trip will be included in a supplemental LER.

A work request was written to check the calibration of the reverse power trip relay. Although the calibration check found some foreign material within the reverse power trip relay, it is not believed that it could have caused the diesel generator trip. Additionally, the diesel generator was functionally tested following the trip to demonstrate that it would not trip on reverse power when operating in the "emergency" mode. This test was performed by simulating a loss of power signal and simultaneously actuating the reverse power trip relay manually. The diesel generator continued to run following this test, as designed.

Following the emergency diesel generator trip on reverse power, the diesel generator continued to run on starting air, at low speed, until it tripped on low lube oil pressure. Continued operation of the diesel generator at low speed on starting air is not an expected mode of operation, and can only occur when the diesel generator is started and subsequently tripped from the diesel generator start signal module portion of BOP-ESFAS, also an unexpected mode of operation. This occurrence is attributable to the failure of the diesel generator test circuitry in the BOP-ESFAS cabinet.

Another attempt was made to restore power to the shed Train "A" loads. By removing the control power fuses to the normal supply breaker, it was possible to close the normal supply breaker. However, the load center feeder breakers which connect the Class 1E, 4160V AC bus to the Class 1E, 480V AC motor control centers could not be closed because of the still active load shed signal.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

In order to clear the load shed signal and restore power to the shed Train "A" loads, the Train "A" BOP-ESFAS cabinet was downpowered. The load center feeder breakers automatically closed after the load shed signal was cleared. Downpowering the BOP-ESFAS cabinet allowed the load center feeder breakers to close, and reenergizing the BOP-ESFAS panel resulted in a Train "A" loss of power signal and load shed signal. As a result, the normal supply breaker reopened, as designed.

The BOP-ESFAS panel was downpowered again, and power was successfully returned to the bus by manually reclosing the normal supply breaker. To prevent another loss of power signal and load shed actuation, the Train "A" undervoltage relays were jumpered, and the leads on the load shed relay were lifted. The BOP-ESFAS functions were reset, and the system was returned to normal operating status. The ESF load sequencer was placed in the manual mode.

To prevent the ESF load sequencer from automatically starting the Train "A" high pressure safety injection pump (HPSI), low pressure safety injection pump (LPSI) and containment spray pumps upon restoration of power to the bus, the control power fuses to these pumps were removed prior to downpowering the BOP-ESFAS cabinet.

Removal of the control power fuses from the Train "A" HPSI, LPSI and containment spray pumps prior to downpowering the BOP-ESFAS panel rendered the equipment inoperable. Concurrently, the Train "B" essential chiller tripped at 1812 and rendered the corresponding Train "B" equipment inoperable as well.

It was recognized by the control room operators that the loss of both trains of HPSI, LPSI, and containment spray at 1812 required entry into Technical Specification 3.0.3. However, because of the amount of activity which required the attention of licensed shift personnel during this event, actions could not be initiated within 1 hour to bring the plant to HOT SHUTDOWN, as required. Required actions were initiated at 1950, 38 minutes late. Technical Specification 3.0.3 was exited at 0046.

Since the failure of the emergency diesel generator to load following a spurious start was caused by the malfunction of the BOP-ESFAS sequencer module, which is not a part of the defined diesel generator unit design, the failure of the diesel generator to load has been classified as an invalid start, in accordance with Regulatory Guide 1.108. Prior to this event, 2 diesel generator failures had occurred in the 100 previous valid tests (on a per nuclear unit basis). The surveillance testing interval of 14 days was not altered as a result of this event, and was being implemented in accordance with Regulatory Guide 1.108, Position C.2.d.

All Train "A" equipment which was designed to start following the restoration of power to the bus performed as designed, with satisfactory results. Other safety related equipment which failed to perform as expected includes the failed BOP-ESFAS cabinet, the diesel generator reverse power trip relay, and the Train "B" essential chiller, which tripped on low refrigerant level, as noted previously.

Testing of the ESF load sequencer on the following day, after it had been allowed to cool, revealed proper operation of all sequencer functions, with the exception of the auto-test function test point for the emergency diesel generator. The load sequencer locked-up when it attempted to perform the auto-test.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

The cause of this event has been traced to failure of a fan in the ESF cabinet. Failure of the fan allowed the ESF load sequencer module to overheat and malfunction. As a corrective action, the ESF load sequencer was replaced, the ESF cabinet door was temporarily removed, and the failed fan was replaced with two larger capacity fans. Hourly verification of fan operation was performed until a control room alarm, which annunciates on high cabinet exit air temperature, could be installed.

An assessment of the safety consequences of this event will be included in a supplement to this LER.

No previous occurrences of this type have been reported.

Arizona Nuclear Power Project
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January 15, 1986
ANPP-34654-EEVB/PGN/98.07

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

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 1
Docket No. STN 50-529 (License NPF-41)
Licensee Event Report - 85-083-00;
Special Report - Unsucessful Diesel
Generator Load Attempt (Invalid Failure)
File: 86-020-404

Dear Sirs:

Attached please find Licensee Event Report (LER) No. 85-083-00 prepared and submitted pursuant to 10 CFR 50.73. This LER also satisfies the requirement for a Special Report (1-SR-85-033) pursuant to Technical Specifications 4.8.1.1.3 and 6.9.2. The Special Report discusses the invalid failure of the train "A" emergency diesel generator to load. In accordance with 10 CFR 50.73(d), we are herewith forwarding a copy of the LER and the Special Report to the Regional Administrator of the Region V Office.

If you have any questions, please contact me.

Very truly yours,

EE Van Brunt Jr/JKT

E. E. Van Brunt, Jr.
Executive Vice President
Project Director

EEVB/PGN/rw
Attachment

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