REGULAT[redacted] INFORMATION DISTRIBUTION [redacted]YSTEM (RIDS)

ACCESSION NBR: 8706160395 DOC. DATE: 87/06/08 NOTARIZED: NO DOCKET #
FACIL: STN-50-529 Palo Verde Nuclear Station, Unit 2, Arizona Publi 05000529
AUTH. NAME AUTHOR AFFILIATION
BRADISH, T. R. Arizona Nuclear Power Project (formerly Arizona Public Serv
HAYNES, J. G. Arizona Nuclear Power Project (formerly Arizona Public Serv
RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 87-013-00: on 870510, shutdown commenced per Tech Spec 3.8.3.1 due to inoperable inverter. Caused by loose silicon controlled rectifier (SCR). Loose SCR replaced & other SCRs retorqued. W/870608 ltr.

DISTRIBUTION CODE: IE22D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 4
TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

NOTES: Standardized plant. M. Davis, NRR: 1Cy. 05000529

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD5 LA	1	1	PD5 PD	1	1
	LICITRA, E	1	1	DAVIS, M	1	1
INTERNAL:	ACRS MICHELSON	1	1	ACRS MOELLER	2	2
	AEOD/DOA	1	1	AEOD/DSP/ROAB	2	2
	AEOD/DSP/TPAB	1	1	DEDRO	1	1
	NRR/DEST/ADE	1	0	NRR/DEST/ADS	1	0
	NRR/DEST/CEB	1	1	NRR/DEST/ELB	1	1
	NRR/DEST/ICSB	1	1	NRR/DEST/MEB	1	1
	NRR/DEST/MTB	1	1	NRR/DEST/PSB	1	1
	NRR/DEST/RSB	1	1	NRR/DEST/SGB	1	1
	NRR/DLPQ/HFB	1	1	NRR/DLPQ/QAB	1	1
	NRR/DOEA/EAB	1	1	NRR/DREP/RAB	1	1
	NRR/DREP/RPB	2	2	NRR/PMAS/ILRB	1	1
	NRR/PMAS/PTSB	1	1	REG FILE 02	1	1
	RES DEPY GI	1	1	RGN5 FILE 01	1	1
EXTERNAL:	EG&G GROH, M	5	5	H ST LOBBY WARD	1	1
	LPDR	1	1	NRC PDR	1	1
	NSIC HARRIS, J	1	1	NSIC MAYS, G	1	1
NOTES:		1	1			

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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 2	0 5 0 0 0 5 2 9	1 OF 0 3

TITLE (4)
Loose Silicon Controlled Rectifier In Inverter Forces Unit Shutdown

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)
									N/A	0 5 0 0 0
0 5	1 0	8 7	8 7	— 0 1 3	— 0 0	0 6	0 8	8 7	N/A	0 5 0 0 0

OPERATING MODE (9)	1
POWER LEVEL (10)	0 2 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)	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)	X 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
T. R. Bradish, Compliance Supervisor (Ext. 6936)	AREA CODE 6 0 2 — 9 3 2 - 5 3 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
B	E J	I N V T	E 2 0 9	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 fifteen single space typewritten lines) (16)

At 1532 on May 10, 1987 Palo Verde Unit 2 was in Mode 1 (POWER OPERATION) at 20 percent power when a shutdown was commenced in accordance with Technical Specification 3.8.3.1 due to an inoperable inverter. The inverter powers a 400 amp bus which supplies power to portions of the Plant Protection System (PPS), the Engineered Safety Features (ESF) Actuation System, and various plant instrumentation.

At 1532 on May 9, 1987, a fuse had blown on the "C" train inverter. The control room operators declared the inverter inoperable and entered the ACTION for Technical Specification 3.8.3.1.

During troubleshooting the inverter fuse blew again, and its associated static transfer switch did not switch power to the bus from a backup 120 volt alternating current supply. This caused the bus to lose power, which resulted in several single channel ESF and PPS trips being generated which is per design. No ESF or PPS actuations occurred.

The root cause of the inoperable inverter was determined to be a loose Silicon Controlled Rectifier (SCR). As corrective action the loose SCR was replaced and several other SCRs were retorqued.

No similar events have been reported previously.

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NRC Form 366

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Palo Verde Unit 2	0 5 0 0 0 5 2 9	8 7	— 0 1 3	— 0 0	0 2 OF 0 3

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

At approximately 1532 on May 10, 1987 Palo Verde Unit 2 was in Mode 1 (POWER OPERATION) at 20 percent power when the control room operators (utility-licensed) commenced a Unit shutdown in accordance with Technical Specification 3.8.3.1 due to an inoperable inverter (EF). The inverter converts class 1E 125 Volt direct current (d.c.) power to alternating current (a.c.). The inverter powers a 400 amp bus which supplies power to portions of the Plant Protection System (JC), the Engineered Safety Features (ESF) Actuation System (JE), and various plant instrumentation. The inverter (model #INV 253-1-101) is manufactured by ELGAR.

At 1532 on May 9, 1987 a fuse had blown on the "C" train inverter. The control room operators declared the inverter inoperable and entered the ACTION Statement for Technical Specification (T.S.) 3.8.3.1. T.S. 3.8.3.1 requires that the associated inverter be reconnected to the Vital bus within 24 hours or that the Unit be in HOT STANDBY in the next 6 hours and COLD SHUTDOWN within the following 30 hours. The inverter could not be reconnected within 24 hours and at 1532 on May 10, 1987 a Unit shutdown and subsequent cooldown was commenced.

As immediate corrective action the blown fuse was replaced and attempts were made to restart the inverter. The fuse blew again, and its associated static transfer switch did not switch power to the bus from a backup 120 volt alternating current supply. This caused the bus to lose power, which resulted in several single channel PPS and ESF trips being generated which is per design. No ESF or PPS actuations occurred.

Troubleshooting of the inverter was conducted in accordance with approved plant procedures, and revealed that 9 Silicon Controlled Rectifiers (SCRs) were found shorted. The SCRs were replaced. Attempts to reenergize the inverter caused the fuse to blow again. A retest of the SCRs was conducted and inspection of all a.c. output circuitry components was performed. The a.c. output circuitry components checked satisfactorily. Shorted SCRs were replaced along with SCRs that exhibited current leakage from cathode to gate to ensure that the best matched manufactured SCRs were installed in the inverter.

The SCR connections and mountings were checked. Several SCRs were found loose and were retightened. The cause of the loose SCRs could not be determined. The SCRs could have been torqued improperly during manufacturing or installation at the plant.

The inverter was restarted and the SCR firing waveforms were verified to be in accordance with the waveforms depicted in the inverter technical manual. After inverter startup, approximately 15 transfers from the inverter to regulator and back to the inverter were initiated at various load conditions to demonstrate operability. Both manual and simulated inverter fault condition transfers

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

were initiated to verify inverter performance to specifications. The inverter was placed back in service at 0115 on May 14, 1987. The inverter was inoperable for approximately 4 days and 10 hours.

The root cause of the fuse failure has been isolated to one SCR mounted loosely in the heatsink on the middle bridge and SCRs that were not mounted in accordance with specifications. This caused misfiring and overheating of the SCRs which accounted for the premature failures. A misfiring SCR on the middle bridge can cause fuse failure on the upper or middle bridges. All Unit 2 fuse failures have occurred on the upper and middle bridge of the "C" inverter. Based on the fact that fuse failures were only occurring on the "C" train inverter it is believed that the loose SCRs are isolated to the "C" inverter. The problems experienced in Unit 2 were evaluated for applicability to Units 1 and 3. This is an ongoing effort and corrective actions will be instituted as necessary.

Testing was conducted on the static transfer switch associated with the inverter. The loss of power to the 400 amp bus as a result of trying to make a power transfer from the regulator to the inverter could not be repeated. Numerous attempts to recreate the loss of power were unsuccessful.

During troubleshooting it was also discovered that a wire had a resistance from termination to termination of 2.56 ohms. Since the jumper was for a common circuit it is possible that the resistance may have caused all of the static switch SCRs to turn off at once. This can result when the logic board, control board, and drive board do not communicate with each other. This can also happen when these boards are not referenced to the same common circuit.

The jumper was replaced and resistance measurements taken to ensure that all boards were referenced to the same common circuit.

When the PPS bus lost power single channel trips occurred as designed. The other 3 channels of PPS were still operable and were able to perform their intended function as needed. Therefore this event had no impact on the safe operation of the plant.

There were no structures, components, or systems inoperable at the start of the event other than as described above that contributed to the event. No failed components other than those described above affected the event.

No previous similar events have been reported. Should other concerns or information pertinent to this event be discovered, a supplement to this report will be issued.

Arizona Nuclear Power Project
P.O. BOX 52034 • PHOENIX, ARIZONA 85072-2034

192-00225-JGH/TRB/JHT
June 8, 1987

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

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. 50-529
Licensee Event Report 2-87-013
File: 87-020-404

Dear Sirs:

Attached please find Licensee Event Report (LER) No. 2-87-013 prepared and submitted pursuant to 10CFR 50.73. In accordance with 10CFR 50.73(d), we are herewith forwarding a copy of the LER to the Regional Administrator of the Region V Office.

If you have any questions, please contact T. R. Bradish, Compliance Supervisor at (602) 932-5300, Ext. 6936.

Very truly yours,

J. G. Haynes
Vice President
Nuclear Production

JGH/JHT/cld

Attachment

cc: O. M. DeMichele (all w/a)
E. E. Van Brunt, Jr.
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R. P. Zimmerman
R. C. Sorenson
E. A. Licitra
A. C. Gehr
INPO Records Center

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