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 8

TITLE (4)
Inappropriate Grounding Of Equipment Results In A Condition That Does Not Meet 10CFR Appendix R Requirements

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 4	0 4	9 6	9 6	- 0 0 1	- 0 0	0 5	0 6	9 6	Palo Verde Unit 2	0 5 0 0 0 5 2 9
									Palo Verde Unit 3	0 5 0 0 0 5 3 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)					
POWER LEVEL(10)	1 0 0	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)	X	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)	X	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)		Tech Spec 6.9.3	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Burton A. Grabo, Section Leader, Nuclear Regulatory Affairs	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 NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	F G	X F M R	S 2 5 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 April 6, 1996, at approximately 1725 MST, it was determined that the fire in Unit 2 on April 4, 1996, was associated with a condition outside the design basis of the plant that could adversely affect the ability to achieve and maintain safe shutdown. The condition exists in all three units where a fire in the Train A or B Direct Current Equipment Room could adversely affect the ability to achieve and maintain safe shutdown conditions.

The apparent cause of the fire was a short/failure of the hot lead to ground at the 100 foot Control Building transformer winding between terminals one and two of transformer (2E-QBB-V02). The existing design for this power circuit does not utilize a ground at this point or any point within the transformer; therefore, the fault propagated through the circuit until terminated by opening the power supply breaker to the transformer.

Hourly roving fire watches were established and a night order for heighten awareness of the situation was issued. An investigation for inappropriate grounding of low voltage power distribution systems was initiated and to date has identified twelve components (per unit) requiring modifications. The equipment root cause of failure is still under investigation.

There have been five previous similar events reported pursuant to 10CFR50.73.

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1. REPORTING REQUIREMENT:

This LER 528/96-001-00 is being written to report an event that resulted in the nuclear power plant being in a condition that was outside the design basis of the plant, as specified in 10 CFR 50.73(a)(2)(ii)(B). Technical Specification 6.9.3 requires that a violation of the requirements of the Fire Protection Program which would have adversely affected the ability to achieve and maintain safe shutdown in the event of a fire shall be reported in accordance with 10 CFR 50.73.

Palo Verde Nuclear Generating Station (PVNGS) Fire Hazards Analysis credits Train B Safe Shutdown equipment, including equipment contained within the Train B Direct Current (DC) Equipment Room, to safely shutdown the plant and maintain safe shutdown in the event of a fire in the control room. The fire scenarios also credit manual actions in the Train A DC Equipment Room to prevent various Train A components from spurious actuation. Although the actual fire did not involve safe shutdown circuits or equipment, the fire demonstrated that the potential exists for the Train B area to become untenable to operators and cause damage to Train B equipment.

Per 10CFR50 Appendix R, Section III.G "Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that: a. one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free from fire damage." Contrary to 10 CFR 50 Appendix R and the requirements of the Fire Protection Program as described in the PVNGS Updated Final Safety Analysis Report (UFSAR), a design basis Appendix R fire in Train A or B DC Equipment Rooms (Fire Zones 7A and 7B respectively, described in the PVNGS Pre-Fire Strategies Manual) could result in a secondary fire in the control room area. This situation could adversely affect the ability to achieve and maintain safe shutdown conditions.

On April 6, 1996, PVNGS Unit 1 was in Mode 1 (POWER OPERATION) at approximately 100 percent power, Unit 2 was in Mode 6 (REFUELING) with the Reactor Coolant System (RCS, AB) at approximately 87 degrees Fahrenheit (F) and at atmospheric pressure and Unit 3 was in Mode 1 (POWER

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OPERATIONS) at approximately 100 percent power when the design basis condition was identified.

2. EVENT DESCRIPTION:

On April 6, 1996, at approximately 1725 MST, the incident investigation team (other utility personnel) concluded that the Unit 2 fire on April 4, 1996, was associated with a condition outside the design basis of the plant that could adversely affect the ability to achieve and maintain safe shutdown conditions and a one hour 10 CFR 50.72 notification was made. The investigation conducted subsequent to the fire revealed that the design engineering performed during the design phase of the plant resulted in an improperly grounded circuit.

On April 4, 1996, at approximately 1700 hours MST, Unit 2 was in Mode 6 for its sixth refueling outage, and reactor core offload was in process, when smoke was discovered in the back boards area of the control room by a security officer (other utility personnel) who was performing an hourly fire watch tour. Smoke was emanating from the Essential Lighting Uninterruptible Power Supply (ELUPS, 2E-QDN-N02) and the Essential Lighting Distribution Panel (ELDP, 2E-QBN-D84) which are located near and on the north wall of the control room. The security officer immediately notified the Operations Shift Supervisor and the Security Central Alarm Station, requesting emergency response from the fire department and support from security. Subsequently, an Auxiliary Operator (AO, utility nonlicensed operator), who had been dispatched by control room personnel to survey his duty area, discovered smoke and fire in the Train B DC Equipment Room on the 100 foot level of the Control Building. The fire in the DC Equipment Room was contained within the Essential Lighting Isolation Transformer (ELIT, 2E-QBB-V02).

At approximately 1714 MST, the control room staff evaluated the condition, noted the potential degradation to safety related equipment, and classified the event as an ALERT. At approximately 1725 MST, the control room was informed that the fire at both the 100 and 140 foot levels of the Control Building were extinguished. At approximately 1805 MST, the ALERT classification was terminated.

On April 5, 1996, qualified personnel with electrical and equipment expertise performed a walkdown of the fire damage and adjacent equipment. The conduits attached to the damaged equipment were traced and the next in

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succession junction box/equipment inspected to ensure that smoke migration did not deposit products of combustion or cause damage. Other equipment in the vicinity was also inspected for any signs of smoke or damage. Damage was determined to be confined to the ELUPS (2E-QDN-N02), ELDP (2E-QBN-D84), junction box (2EZ3ANKKJ15), ELIT (2E-QBB-V02) and adjoining cables. No other damage was identified. No smoke related residue was identified which eliminates any long term issues associated with cable degradation.

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

The April 4, 1996, event did not require control room evacuation. The fire on the 140 foot level of the control building was extinguished in approximately nine minutes, and the fire on the 100 foot level of the control building was extinguished in approximately twenty-five minutes. Damage was restricted to the ELUPS (2E-QDN-N02), ELDP (2E-QBN-D84), junction box (2EZ3ANKKJ15), ELIT (2E-QBB-V02) and adjoining cables. No other damage was identified and no Safe Shutdown equipment was affected by the fire.

The actual combustible fire loading for the DC equipment room is classified as low. A low fire loading is defined as fire areas where quantity and/or combustibility of content is low with relatively low rates of heat release expected (BTU rating less than 60,000 BTU per square foot).

Additionally, the DC equipment rooms are provided with the following fire detection/protection equipment:

- Ionization smoke detectors
- Three-hour fire rated barrier walls and two-hour fire rated doors
- Primary fire protection is fire hose stations
- Backup fire protection is portable fire extinguishers

All of the rooms surrounding the DC equipment rooms are protected by a carbon dioxide or halon suppression systems. Based on the above fire detection/protection equipment, it is unlikely a fire would impact the ability to safely shutdown the plant and maintain it in safe shutdown condition. Additionally, equipment within these rooms is contained within metal cabinets and conduit. Therefore, direct flame impingement is

unlikely, and the buildup of combustible gases from the fire would be minimal. The most likely condition would be that the smoke from the fire in the DC Equipment Room would cause a delay in personnel being able to perform their duties until donning self-contained breathing apparatus.

However, per the PVNGS Fire Hazards Analysis, it is assumed that all equipment within the Train B DC Equipment Room is damaged due to fire. As demonstrated by the April 4, 1996 fire, the possibility of a control room fire (Train A safe shutdown equipment) concurrent with a Train B DC equipment room fire is a credible event.

This event did not result in any challenges to the fission product barriers or result in any releases 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 the health and safety of the public.

4. CAUSE OF THE EVENT:

On April 6, 1996, at approximately 1725 MST, the incident investigation team (other utility personnel) concluded that the Unit 2 fire on April 4, 1996, was associated with a condition outside the design basis of the plant that could adversely affect the ability to achieve and maintain safe shutdown conditions and a one hour 10 CFR 50.72 notification was made. The investigation conducted subsequent to the fire revealed that the design engineering performed during the design phase of the plant resulted in an improperly grounded circuit.

To date, a root cause of failure for the ELIT has not been determined; however, a short/failure of the hot lead to ground at the voltage regulator within the ELIT occurred. Visual examinations performed suggest that a short to ground occurred at the transformer winding between terminals one and two. The existing design for this power circuit does not utilize a ground on this point or any point within the ELIT (E-QBB-V02) (SALP Cause Code B: Design). Since there is no protective device on the neutral line in this circuit, the fault propagated from the shorted transformer winding through the plant grounding system to the ground at the ELUPS (E-QDN-N02), through the neutral wiring within the ELUPS, then through transfer relay neutral contacts, and back through the neutral wiring to the ELUPS AC terminal board, then on through the neutral wiring to the ELIT. This

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condition existed until the circuit was deenergized by manually opening the power supply breaker to the ELIT.

No unusual characteristics of the work location (e.g., noise, heat, or poor lighting) directly contributed to this event. There were no procedural errors which contributed to this event.

If the evaluation results differ from this determination or if information is developed which would affect the reader's understanding or perception of this event, a supplement to this report will be submitted.

5. STRUCTURE, SYSTEM, OR COMPONENT INFORMATION:

ELIT is manufactured by Solidstate Controls Inc., model number TL74025014XMXXX; the transformer steps down 480 VAC to 120 VAC and has a volt-ampere rating of 25 KVA.

The Emergency Lighting System is designed to provide sufficient illumination to allow safe personnel access/egress throughout the plant in the event of a loss of normal lighting or for the local manual operation of safe shutdown equipment in the event of a fire.

In the normal configuration the Essential Lighting System provides power to the Emergency Lighting System components, to the battery charger to maintain the battery at fully charged state and to the power supply transferring circuit to place the back-up DC power source as a standby power source. In the emergency configuration the Emergency Lighting System back-up DC power provides power to the assigned emergency lighting.

ELDP (2E-QBN-D84) is the normal AC supply for forty fire panels throughout the power block. As a result of the fire the ELDP was deenergized resulting in thirty-seven fire protection related panels and six water fire suppression system pressure switches losing power. Twenty-eight fire protection panels associated with safety related areas swapped to their battery back-up power supply. Since, the AC power outage was going to be greater than the four hours credited for battery operation, fire watches were established as required.

No 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

safety system inoperable were involved. There were no safety system actuations and none were required.

6. CORRECTIVE ACTIONS TO PREVENT RECURRENCE:

Investigation into the equipment root cause of failure continues and is expected to be concluded on or about June 15, 1996. As part of the investigation a broadness review for appropriate grounding is being conducted. To date, twelve components (limited to regulating transformers, battery supplies and inverters) per unit have been identified that require modifications for electrical circuit protection. Four of these components are located within the same fire zone, and compensatory measures are already in place. Roving fire watches have been established in all of the affected areas as compensatory measures. A "vertical slice" review of 125 VDC and 480 VAC and above power distribution systems is expected to be completed on or about May 10, 1996.

On April 4, 1996, fire watches were established as required for affected areas, and affected equipment was quarantined.

On April 5, 1996, the inspection of fire damage was completed, and a temporary modification was developed to restore power to ELDP (2E-QBN-D84).

On April 6, 1996, the installation to temporary power to ELDP was completed, and the forty fire panels affected were verified to be operable. Compensatory measures were established as required in all three units.

Repairs to fire damaged equipment in Unit 2 has been completed. Modifications, in Units 1 and 2, to ensure circuitry protection have been completed on the two ELITs and two instrument power supply regulating transformers.

On April 25, 1996, testing was conducted on the shunts currently installed in the 125 VDC power circuit from the Emergency Lighting Batteries (E-QDN-F01 and F02) to the control room ELUPS. These tests proved conclusively that the shunts will interrupt relatively high levels of fault current; therefore, these devices are an adequate interim means of isolating faults in these cables that could potentially initiate fires outside of the battery rooms. Modifications are being designed to

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permanently install fuses near the batteries that will provide proper protection for these cables.

Actions to prevent recurrence are being developed based on the results of the investigation and will be tracked by APS' Commitment Action Tracking System (CATS). If the evaluation results differ from this determination or if information is developed which would affect the reader's understanding or perception of this event, a supplement to this report will be submitted.

7. PREVIOUS SIMILAR EVENTS:

Previous similar events were prepared and submitted pursuant to Technical Specification 6.9.3 and 10CFR50.73 in LER 528/91-008-01, LER 528/91-011-00, LER 528/92-010-00, LER 528/92-015-00 and LER 528/93-002-00. All of these events have been discovered during the Appendix R Reconstitution Project. The corrective actions taken for these events are specific to the postulated scenarios and would not be expected to prevent subsequent events.