

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

January 8, 1997

**NRC INFORMATION NOTICE 97-01: IMPROPER ELECTRICAL GROUNDING RESULTS IN
SIMULTANEOUS FIRES IN THE CONTROL ROOM
AND THE SAFE-SHUTDOWN EQUIPMENT ROOM**

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to potential component grounding problems that could result in simultaneous fires. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

At approximately 5:00 p.m. on April 4, 1996, during a refueling outage, a licensee firewatch detected smoke in the back panel area of the control room at the Palo Verde Nuclear Generating Station, Unit 2. Licensee operators observed smoke emanating from the Train B emergency lighting uninterruptible power supply (ELUPS) panel in the control room.

The fire in the control room resulted in loss of power to Train B control room emergency lighting circuits, some general plant essential lighting and plant fire detection and alarm system panels. Lighting powered by the unaffected Train A lighting system was sufficient to operate the unit. The circuit breaker supplying power to the ELUPS panel tripped open when wiring insulation in the conduit supplying the power supply panel melted and caused various conductors to short circuit. The circuit breaker trip also deenergized power to the fire detection and alarm panels in the auxiliary building. When operators checked the control room fire alarm annunciator monitor, they noted that a large number of fire detector trouble alarms were alarming and that the alarms were scrolling on the monitor screen as a result of the deenergized fire detection and alarm panels.

The control room staff dispatched auxiliary operators to inspect their assigned areas to check for possible fire conditions and additional problems. An auxiliary operator discovered smoke and fire in the Train B dc equipment room on the 100-foot level of the auxiliary building. The fire was located in the 480/120-volt essential lighting isolation transformer. The trouble alarms resulting from the lost power supply masked the actual fire alarm in the Train B dc equipment room.

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The licensee's onsite fire department responded and all fires were extinguished within a short period of time. The licensee established the required compensatory firewatches in areas with disabled fire detectors. Actual equipment damage was limited to the components involved in the fires.

Discussion

The licensee's root-cause investigation indicated that the core of the regulating isolation transformer (located in the Train B dc equipment room) failed and made contact with the transformer coils, causing a short circuit fault to station ground through the transformer's panel ground. The purpose of the subject transformer is to isolate nonsafety-related portions of the circuit from the safety-related function of the circuit. The investigation also determined that the neutral leg of the transformer had not been grounded. An alternate source of power for the essential lighting uninterruptible power supply panel is provided by an inverter. The system had been designed with ground connections on the neutral leg of the inverter instead of grounding the neutral leg of the power supply (regulating transformer) in accordance with industry practice. The neutral wiring conductors within the inverter and from the inverter to the essential lighting distribution panel became the return fault path to the regulating transformer. These conductors were not designed to handle the high fault currents to which they were subjected. As a result, these wires ignited under these high fault currents. These components are depicted in Figure 1. The licensee also determined that the fires were related and were caused by a design error in the electrical grounding, which dated back to plant construction. The licensee found similar grounding arrangements in the other two Palo Verde units.


The final safety analysis report for the facility documented that grounding was accomplished in accordance with Institute of Electrical and Electronics Engineers (IEEE) Standard 142-1982, "Grounding of Industrial and Commercial Power Systems." The transformer and equipment supplied by the transformer was designed as a grounded system. IEEE 142-1982 defined a grounded system as a system of conductors in which at least one conductor or point (usually the middle wire or neutral point of the transformer or the generator windings) is intentionally grounded. The licensee also indicated that the grounding design for Palo Verde was in accordance with Bechtel Drawing 13-E-ZVG-007, "Grounding Notes, Symbols, and Details," Revision 20. The document did not require grounding of the transformer's neutral leg.

The licensee's corrective actions included grounding the neutral leg of the isolation transformer and fusing the output of the transformer to limit fault propagation. The licensee also removed the ground from the control room ELUPS panel. These modifications did not impact the isolation function of the transformer.

The event was of concern because a single electrical fault caused simultaneous fires in the control room and the Train B dc equipment room which supports alternative post-fire safe shutdown capability in the event of a control room fire. This electrical design error is important because it created a fire vulnerability in two separate areas of the plant. The fire could have resulted in operational challenges which are outside of the plant's design basis

and the scope of the NRC fire protection regulations (10 CFR 50.48). This vulnerability was caused by the inadequate design of the grounding circuitry from the electrical power supplies, which have been in service since the original construction.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

for 
Thomas T. Martin, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Chris Vandenburg, Region IV
(817) 860-8161
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Phil Qualls, Walnut Creek Field Office
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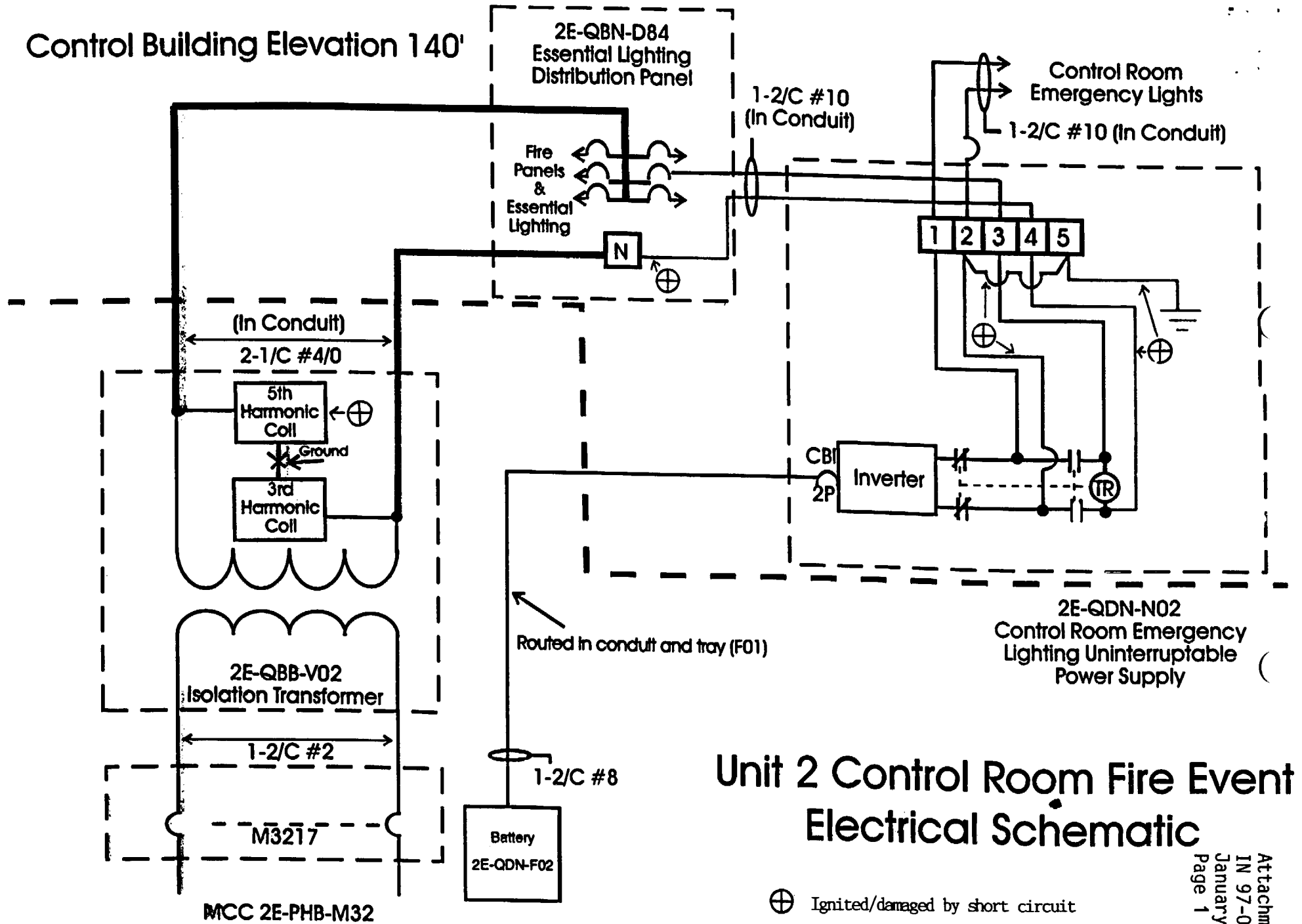
Ronaldo Jenkins, NRR
(301) 415-2985
E-mail: rvj@nrc.gov

Attachments:

1. Figure 1
2. List of Recently Issued NRC Information Notices

Attachment filed in Jacket

Control Building Elevation 140'



Unit 2 Control Room Fire Event Electrical Schematic

⊕ Ignited/damaged by short circuit

Control Building Elevation 100'

Figure 1

Attachment 1
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LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
96-72	Undetected Failure that May Occur During Patient Treatments with Teletherapy Devices	12/24/96	All teletherapy licensees
96-71	Licensee Response to Indications of Tampering, Vandalism, or Malicious Mischief	12/27/96	All holders of OLs or CPs for nuclear power reactors
96-70	Year 2000 Effect on Computer System Software	12/24/96	All U.S. Nuclear Regulatory Commission licensees, certificate holders, and registrants
96-69	Operator Actions Affecting Reactivity	12/20/96	All holders of OLs or CPs for nuclear power reactors
96-68	Incorrect Effective Diaphragm Area Values in Vendor Manual Result in Potential Failure of Pneumatic Diaphragm Actuators	12/19/96	All holders of OLs or CPs for nuclear power reactors
96-67	Vulnerability of Emergency Diesel Generators to Fuel Oil/Lubricating Oil Incompatibility	12/19/96	All holders of OLs or CPs for nuclear power reactors

OL = Operating License
CP = Construction Permit

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original signed by D.B. Matthews

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 Office of Nuclear Reactor Regulation

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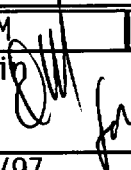
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DOCUMENT NAME: 97-01.IN

Tech Editor reviewed 10/11/96

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IN 96-xx
 December xx, 1996
 Page 3 of 3

potential to challenge the licensee's "Fire Protection Program," of 10 CFR Part 50, Appendix R. This vulnerability was caused by the inadequate design of the grounding circuitry from the electrical power supplies, which have been in service since the original construction.

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