

ENCLOSURE 1

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-528/96-10
50-529/96-10
50-530/96-10

Licenses: NPF-41
NPF-51
NPF-74

Licensee: Arizona Public Service Company
P.O. Box 53999
Phoenix, Arizona

Facility Name: Palo Verde Nuclear Generating Station, Units 1, 2, and 3

Inspection At: Wintersburg, Arizona

Inspection Conducted: April 29 through May 30, and June 13, 1996

Inspector: Phillip M. Qualls, Reactor Inspector, Engineering Branch
Division of Reactor Safety

Approved:


Chris A. VanDenburgh, Chief, Engineering Branch
Division of Reactor Safety

7-10-96
Date

Inspection Summary

Areas Inspected (Units 1, 2, and 3): Special, announced inspection of the licensee's action and root-cause evaluation related to the fires in the Unit 2 control room and the Train B dc equipment room on April 4, 1996. NRC Inspection Procedure 64704 was used.

Results (Units 1, 2, and 3):

- An apparent violation concerning the failure to meet 10 CFR Part 50, Appendix R, safe shutdown requirements was identified. The violation involved the failure to ensure that both trains of equipment necessary to achieve and maintain the plant in a safe shutdown condition for a fire in the Train B dc equipment room were adequately protected (Section 1.2.6).

- An apparent violation concerning the failure to adequately translate licensee design commitments into construction requirements was identified. The violation involved a failure during plant construction to ensure that the 480/120 volt Regulating Transformer 2E-QBB-V02 in the Train B dc equipment room in Unit 2 was electrically grounded in accordance with the plant design (Section 1.2.6).

Summary of Inspection Findings:

- Violation 9610-01 was opened (Section 1.2.7).
- Violation 9610-02 was opened (Section 1.2.7).

Attachment:

Attachment - Persons Contacted and Exit Meeting



DETAILS

1 FIRE PROTECTION/PREVENTION PROGRAM (64704)

1.1 Palo Verde Nuclear Generating Station Fire Protection Requirements

Palo Verde Unit 1 Operating License, NPF-41, Section 2.C.7, issued June 1, 1985; Unit 2 Operating License, NPF-51, Section 2.C.6, issued April 24, 1986; and Unit 3 Operating License, NPF-74, Section 2.F, issued November 25, 1987, requires the licensee to implement and to maintain in effect all provisions of the NRC approved fire protection program as described in the Final Safety Analysis Report for the facility. Final Safety Analysis Report, Section 9.5.1.1.1.A, states, that the fire protection system shall be designed to minimize, consistent with other safety requirements, the effects of fires on structures, systems, and components important to safety in accordance with 10 CFR Part 50, Appendix R, Part III, Section G.

1.2 Followup of the April 4, 1996, Fires

The inspector reviewed the licensee's actions and root-cause evaluation related to the Unit 2 control room and Train B dc equipment room fires on April 4, 1996.

1.2.1 Electrical Distribution Background

Regulating Transformer 2E-QBB-V02 supplied power to the Train B Essential Lighting Uninterruptible Power Supply Panel 2E-QDN-N02. Panel 2E-QDN-N02, in turn, supplied power to Essential Lighting Distribution Panel 2E-QBN-D84. These panels provided power for some control room lighting and the auxiliary building fire detectors. These panels are located near the north wall of the control room.

1.2.2 Event Description

At approximately 5 p.m. on April 4, 1996, during a refueling outage, a licensee firewatch detected smoke in the back panel area of the Palo Verde, Unit 2, control room. Licensee's operators observed smoke emanating from the Train B Essential Lighting Uninterruptible Power Supply Panel 2E-QDN-N02 and Essential Lighting Distribution Panel 2E-QBN-D84 in the control room.

The fire in the control room resulted in loss of some control room lights, but the operators had sufficient lighting to operate the unit from lights on the unaffected Train A lighting system. The breaker supplying power to Essential Lighting Uninterruptible Power Supply Panel 2E-QDN-N02 tripped open when wiring in the conduit supplying the power supply panel melted and caused a short circuit. Opening the breaker resulted in Panel 2E-QDN-N02 deenergizing.



This action deenergized the fire detectors in the auxiliary building. A check of the control room fire alarm monitors by the operators indicated that a large number of fire detector trouble alarms were alarming and that the alarms were scrolling on the monitor screen due to the deenergized fire detectors. The trouble alarms masked the actual fire alarm in the Train B dc equipment room.

The control room dispatched auxiliary operators to walk down their assigned areas to check for additional problems. An auxiliary operator discovered smoke and fire in the Train B dc equipment room on the 100 ft level of the auxiliary building. The fire was located in the 480/120 volt Regulating Transformer 2E-QBB-V02.

1.2.3 Licensee Fire Response

The licensee's onsite fire department immediately responded and extinguished all fires. The licensee took actions to establish required compensatory firewatches in areas with disabled fire detectors.

1.2.4 Root-Cause Evaluation

The licensee initiated an extensive root-cause investigation under Condition Report/Disposition Request 2-6-0070. The licensee's root-cause investigation indicated that the core of Regulating Transformer 2E-QBB-V02 failed and contacted the transformer coils causing a short circuit fault to station ground through the transformer's panel ground. The investigation also determined that the neutral leg of the transformer was not grounded. Since the transformer's neutral leg was not grounded, the fault current propagated through the station ground into Panels 2E-QDN-N02 and 2E-QBN-D84 located in the control room. The overcurrent, resulting from the fault, caused the fires in the control room.

The licensee's root-cause investigation further indicated that the system was designed with ground connections on the neutral leg of the inverter instead of grounding the neutral leg of the power supply (Regulating Transformer 2E QBB-V02) in accordance with industry practice. The neutral wiring conductors within the inverter and from the inverter to Essential Lighting Distribution Panel 2E-QBN-D84 became the return fault path to the regulating transformer. These conductors were of an insufficient size to handle the high fault currents to which they were subjected. As a result, these wires ignited under these high fault currents. The licensee also determined that the fires were related and 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 units.

The licensee's root-cause investigation was expanded to include all similar transformers in all three units. The licensee identified similar deficiencies in Essential Lighting Regulating Transformers E-QBB-V01 and -V02; Control Room Emergency Lighting Inverters E-QDN-N01 and -N02; Instrument Power Supply Regulating Transformers E-NNN-V15, -V16, -V17, -V18; Heat Tracing Regulating



Transformers E-QMB-V30 and -V31; and, Control Room Emergency Lighting Inverter Battery Supplies E-QDN-F01 and -F02 in all three units.

1.2.5 Corrective Actions

To correct the original deficiency, the licensee modified the circuit by grounding the transformer's neutral leg and fusing the output of the transformer's secondary to protect the circuits supplied from the transformer from fault propagation. The licensee's modification also removed the ground in Panel 2E-QDN-N02. The modification was completed for Units 1 and 2 on April 27, 1996. At the conclusion of the inspection, the modification was scheduled for completion on Unit 3 before mid-July 1996.

The licensee took prompt actions to correct the other deficiencies identified during the root-cause investigation. At the conclusion of the inspection, all other corrective actions were complete except wiring modifications to install a fuse to protect Control Room Emergency Lighting Inverter Battery Supplies E-QDN-F01 and -F02. The fuse installation was scheduled to be completed by late June 1996 for Units 1 and 2. The modification required that the units be shutdown. Unit 3 modifications, requiring plant shutdown, were scheduled to be completed during the next refueling outage. The licensee determined that the circuits were already protected from overcurrent because of a shunt that was installed in the circuit path. Licensee's testing of the shunt overcurrent failure characteristics demonstrated that the shunt would melt prior to cable damage and fire propagation. The licensee also issued night orders to the operators describing the cause of the related fires and the actions needed to respond if a similar event occurred before corrective modifications could be implemented. In addition, the licensee placed compensatory fire watches in all areas as required by the fire protection program for degraded fire protection capabilities.

The licensee was also investigating a method to ensure that control room operators could rapidly monitor the control room fire alarm monitor screen and separate valid fire detector alarms from detector loss-of-power failure alarms.

1.2.6 Licensee Event Report 96-01

On May 6, 1996, the licensee issued Licensee Event Report 96-01. In the licensee event report, the licensee described the event as related above. The licensee also stated that:

"Contrary to 10 CFR Part 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 Train B DC Equipment Rooms (Fire Zones 7A and 7B, respectively, described in the PVNGS Pre-Fire Strategies Manual) could adversely affect the ability to achieve and maintain safe shutdown conditions."



As a result, the licensee concluded that the Unit 2 fire was a condition outside of the design basis of the plant.

Subsequent to receiving Licensee Event Report 96-01, the inspector reviewed the licensee's investigation of the event. Upon further review, the inspector agreed with the licensee's conclusion that a fire could, "... adversely affect the ability to achieve and maintain safe shutdown conditions." The inspector concluded that a single fire in the Train B dc equipment room could result in a control room fire and expose both trains of safe shutdown equipment to fire damage and was, thus, an apparent violation of the licensee's requirement to implement 10 CFR Part 50, Appendix R, Section III.G. The inspector conducted a telephonic exit meeting with the licensee on May 30, 1996, to discuss these conclusions with the licensee.

Subsequent to the meeting on May 30, 1996, the licensee revised Licensee Event Report 96-01. On June 11, 1996, the licensee issued Revision 1 to Licensee Event Report 96-01 providing additional details concerning the event and the circumstances in the control room and the Train B dc equipment room. The licensee concluded that the fire in the control room was "self-limiting" due to the low combustible loading and the location of the fire inside of an enclosed metal cabinet. Concerning the fire in the Train B dc equipment room, the licensee stated that, although operator actions were required to open a circuit breaker to terminate the fire, the fire was in the transformer enclosure; the amount of combustible material was limited; there were no exposed cables; and there were limited transient combustible materials in the area. Thus, the licensee concluded that the fire would not have progressed outside of the transformer enclosure. The licensee also concluded that, "It has been determined that there was no potential to adversely affect the ability to achieve and maintain safe shutdown prior to 1992." The licensee was continuing to evaluate a modification made in 1992, which was unrelated to the transformer grounding problem, and later informed the inspector that the subsequent evaluation identified no potential impact on the safe shutdown analysis.

The inspector reviewed additional information provided in Licensee Event Report 96-01, Revision 1. The inspector verified the licensee's statements concerning equipment configuration and combustible loading. However, the inspector did not agree with the licensee's conclusion that there was no potential to safely shutdown the plant.

The inspector conducted a second exit meeting with the licensee during a teleconference on June 18, 1996. The inspector discussed the observations concerning the plant configuration, and reiterated that, after additional inspection, that the inspector did not agree with the licensee's conclusion concerning the potential to adversely affect the ability to safely shutdown the plant and that an apparent violation of 10 CFR Part 50, Appendix R,



Section III.G, had occurred. The licensee did not agree that a violation had occurred. The licensee stated that the fires, which occurred, could not have spread to adjacent equipment. The licensee also stated that 10 CFR Part 50, Appendix R, requirements for electrical separation, were met and that the proper associated circuits analysis had been accomplished and implemented.

1.2.7 Inspection Activities and Conclusions

The inspector reviewed IEEE Standard 142-1982, the recommended practice for grounding of industrial and commercial power systems provides guidance for grounding electrical systems.

The inspector reviewed the licensee's Final Safety Analysis Report to determine the licensee's design requirements for establishing grounding for electrical systems. Section 8.3.1.1.9.G of the Final Safety Analysis Report documented that grounding was accomplished in accordance with IEEE Standard 142-1982. Licensee personnel informed the inspector that 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 transformer or generator windings) is intentionally grounded.

The licensee stated 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 NRC inspector reviewed the document to determine if transformer grounding was accomplished in accordance with the original design specifications. The document did not require grounding of the transformer's neutral leg.

The NRC inspector reviewed licensee's fire response activities and concluded that the licensee's response to the fire was excellent. The onsite fire department arrived on the scene within minutes of smoke identification. The proper extinguishing agents were used. The damaged equipment was promptly deenergized. The control room took prompt actions when the large number of detector alarms were received in the control room. Auxiliary operators were instructed to inspect the unit for additional fires and, as a result, promptly located the fire in the Train B dc equipment room.

The inspector observed the areas around the location of the two fires and verified that the statements in Licensee Event Report 96-01, Revision 1, were correct concerning low combustible loading and that there were no exposed electrical cables in the vicinity of the fires. The inspector concluded that the licensee's fire protection program was effective in limiting the potential for propagation of the fires which occurred. However, the inspector did not agree with the licensee's conclusion that for all plant conditions (such as maintenance activities with the cabinets open or "approved" transient combustible materials in the area) the fires could not propagate to other plant equipment.



Palo Verde Unit 1, Operating License NPF-41, Section 2.C.7, issued June 1, 1985; Unit 2, Operating License NPF-51, Section 2.C.6, issued April 24, 1986; and Unit 3, Operating License NPF-74, Section 2.F, issued November 25, 1987; required that the licensee implement and maintain in effect all provisions of the approved fire protection program as described in the Final Safety Analysis Report for the facility. Final Safety Analysis Report, Section 9.5.1.1.1.A, states that the fire protection system shall be designed to minimize, consistent with other safety requirements, the effects of fires on structures, systems, and components important to safety in accordance with 10 CFR Part 50, Appendix R, Section III.G.

Section III.G requires that fire protection features are provided for structures, systems, and components important to safe shutdown. This section also requires that the fire protection features limit fire damage so that one train of systems necessary to achieve and maintain hot shutdown from either the control room or emergency control station is free of fire damage. More specifically, Appendix R, Section III.G.2, requires that cables or equipment, including associated nonsafety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground of redundant trains of systems necessary to achieve and maintain hot shutdown conditions that are located within the same fire area outside of primary containment, include separation to ensure that one of the redundant trains remains free of fire damage. For areas where separation cannot be obtained, Appendix R, Section III.G.3, requires that alternative or dedicated shutdown capability and its associated circuits, independent of cable, systems, or components in the area, room, or zone under consideration, shall be provided.

The licensee did not meet the electrical separation requirements of Section III.G.2 for the control room, in that both Trains A and B of the safe shutdown capability are located inside of the control room. For a postulated control room fire, the licensee used an alternative safe shutdown method, which required actions and equipment installed in the Train B dc equipment room. The fire in the Train B dc equipment room resulted in a control room fire. Therefore, both trains of equipment relied upon to shut down the reactor during a postulated fire were exposed to the potential of receiving fire damage. Fire damage to both shutdown trains would have resulted in the inability of the operators to safely shutdown the plant. The failure to provide adequate grounding for the transformer, and the resulting related fires as described above, demonstrated that both trains of safe shutdown equipment were exposed to the potential of receiving fire damage. This is an apparent violation of License Condition 2.C.6, which required the licensee to implement the 10 CFR Part 50, Appendix R, Section III.G.1 requirement that one train remain "free of fire damage" (529/9610-01).

The failure to provide adequate transformer grounding is also an apparent violation of 10 CFR Part 50, Appendix B, Criterion III, which states that measures shall be established to assure that applicable regulatory requirements and the design bases are correctly translated into drawings, procedures, and instructions. The failure to incorporate IEEE 142 guidance into the drawings is a violation of 10 CFR Part 50, Appendix B, Criterion III, (529/9610-02).

2 REVIEW OF UPDATED FINAL SAFETY ANALYSIS REPORT (UFSAR) COMMITMENTS

A recent discovery of a licensee operating their facility in a manner contrary to the UFSAR description highlighted the need for a special focused review that compares plant practices, procedures, and/or parameters to the UFSAR descriptions. While performing the inspections discussed in this report, the inspector reviewed the applicable portions of the UFSAR that related to the inspection. The inspector determined that the plant design documented in the UFSAR was inconsistent with the as-built conditions of a portion of the electrical distribution system. Specifically, the UFSAR documented in Section 8.3.1.1.9.G that grounding was accomplished in accordance with IEEE 142. The transformer and panels discussed in this report were purchased 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 transformer or generator windings) is intentionally grounded. The actual as-built configuration did not have the transformer neutral point grounded.



ATTACHMENT

PERSONS CONTACTED AND EXIT MEETING

1 PERSONS CONTACTED

1.1 Licensee Personnel

- + J. Bailey, Vice President, Engineering
- ~ # S. Bauer, Section Leader, Licensing
- + S. Burns, Department Leader, Nuclear Electrical and Instrumentation & Control Design
- *#B. Eklund, Compliance Consultant
- ~+#*F. Garrett, Department Leader, Fire Protection
- + # B. Grabo, Section Leader, Compliance
- ~+# R. Guron, Fire Protection Engineer
- + M. Hodge, Section Leader, Mechanical and Auxiliary Systems
- + #*J. Holmes, Section Leader, Electrical Design
- ~+# A. Krainik, Department Leader, Nuclear Regulatory Affairs
- + J. Levine, Vice President, Production
- *E. O'Neill, Primary Plant Event Investigator
- ~+ *N. Turley, Licensing Engineer

1.2 NRC Personnel

- + # W. Ang, Senior Reactor Inspector, Engineering Branch, Division of Reactor Safety
- + D. Garcia, Resident Inspector
- ~ T. Gwynn, Director, Division of Reactor Safety
- *J. Kramer, Resident Inspector
- ~ P. Qualls, Reactor Inspector, Engineering, Division of Reactor Safety
- ~ G. Sanborn, Office of Enforcement
- + # T. Stetka, Senior Reactor Inspector, Engineering Branch, Division of Reactor Safety
- ~+# C. VanDenburgh, Chief, Engineering Branch, Division of Reactor Safety

In addition to the personnel listed above, the inspector contacted other personnel during this inspection period.

*Denotes personnel that attended the exit meeting on May 3, 1996.

#Denotes personnel that attended the telephonic exit meeting on June 18, 1996.

+Denotes personnel that attended the telephonic exit meeting on May 30, 1996.

~Denotes personnel that attended the telephonic exit meeting on July 10, 1996.

2 EXIT MEETING

An exit meeting was conducted on May 3, 1996. During this meeting, the inspector reviewed the scope and findings of the report. The licensee did not express a position on the inspection findings documented in this report. The licensee identified that Bechtel Drawing 13-E-ZVG-007 was labelled proprietary. The licensee did not identify as proprietary any other information provided to, or reviewed by, the inspector. A second exit was telephonically conducted on May 30, 1996, with Ms. A. Krainik and others of

the licensee's staff. The apparent violation identified, as a result of the review of Licensee Event Report 96-01, was discussed at that time. The licensee stated that a revision to Licensee Event Report 96-01 was being evaluated to more accurately quantify and to better understand the potential safety significance of the event. A third exit meeting was conducted with Mr. J. Levine and others of the licensee's staff on June 18, 1996. The final inspection findings were also discussed in a fourth exit meeting on July 10, 1996.



V. PREDECISIONAL ENFORCEMENT CONFERENCES

Whenever the NRC has learned of the existence of a potential violation for which escalated enforcement action appears to be warranted, or recurring nonconformance on the part of a vendor, the NRC may provide an opportunity for a predecisional enforcement conference with the licensee, vendor, or other person before taking enforcement action. The purpose of the conference is to obtain information that will assist the NRC in determining the appropriate enforcement action, such as: (1) a common understanding of facts, root causes and missed opportunities associated with the apparent violations, (2) a common understanding of corrective action taken or planned, and (3) a common understanding of the significance of issues and the need for lasting comprehensive corrective action.

If the NRC concludes that it has sufficient information to make an informed enforcement decision, a conference will not normally be held unless the licensee requests it. However, an opportunity for a conference will normally be provided before issuing an order based on a violation of the rule on Deliberate Misconduct or a civil penalty to an unlicensed person. If a conference is not held, the licensee will normally be requested to provide a written response to an inspection report, if issued, as to the licensee's views on the apparent violations and their root causes and a description of planned or implemented corrective action.

During the predecisional enforcement conference, the licensee, vendor, or other persons will be given an opportunity to provide information consistent with the purpose of the conference, including an explanation to the NRC of the immediate corrective actions (if any) that were taken following identification of the potential violation or nonconformance and the long-term comprehensive actions that were taken or will be taken to prevent recurrence. Licensees, vendors, or other persons will be told when a meeting is a predecisional enforcement conference.

A predecisional enforcement conference is a meeting between the NRC and the licensee. Conferences are normally held in the regional offices and are not normally open to public observation. However, a trial program is being conducted to open approximately 25 percent of all eligible conferences for public observation, i.e., every fourth eligible conference involving one of three categories of licensees (reactor, hospital, and other materials licensees) will be open to the public. Conferences will not normally be open to the public if the enforcement action being contemplated:

(1) Would be taken against an individual, or if the action, though not taken against an individual, turns on whether an individual has committed wrongdoing;



(2) Involves significant personnel failures where the NRC has requested that the individual(s) involved be present at the conference;

(3) Is based on the findings of an NRC Office of Investigations report; or

(4) Involves safeguards information, Privacy Act information, or information which could be considered proprietary;

In addition, conferences will not normally be open to the public if:

(5) The conference involves medical misadministrations or overexposures and the conference cannot be conducted without disclosing the exposed individual's name; or

(6) The conference will be conducted by telephone or the conference will be conducted at a relatively small licensee's facility.

Notwithstanding meeting any of these criteria, a conference may still be open if the conference involves issues related to an ongoing adjudicatory proceeding with one or more intervenors or where the evidentiary basis for the conference is a matter of public record, such as an adjudicatory decision by the Department of Labor. In addition, with the approval of the Executive Director for Operations, conferences will not be open to the public where good cause has been shown after balancing the benefit of the public observation against the potential impact on the agency's enforcement action in a particular case.

As soon as it is determined that a conference will be open to public observation, the NRC will notify the licensee that the conference will be open to public observation as part of the agency's trial program. Consistent with the agency's policy on open meetings, "Staff Meetings Open to Public," published September 20, 1994 (59 FR 48340), the NRC intends to announce open conferences normally at least 10 working days in advance of conferences through (1) notices posted in the Public Document Room, (2) a toll-free telephone recording at 800-952-9674, and (3) a toll-free electronic bulletin board at 800-952-9676. In addition, the NRC will also issue a press release and notify appropriate State liaison officers that a predecisional enforcement conference has been scheduled and that it is open to public observation.

The public attending open conferences under the trial program may observe but not participate in the conference. It is noted that the purpose of conducting open conferences under the trial program is not to maximize public attendance, but rather to determine whether providing the public with opportunities to be informed of NRC activities is compatible with the NRC's ability to exercise its regulatory and safety responsibilities. Therefore, members of the public will be allowed access to the NRC regional offices to attend open enforcement conferences in accordance with the "Standard Operating Procedures For Providing Security Support For NRC Hearings And Meetings," published November 1, 1991 (56 FR 56251). These procedures provide that visitors may be subject to personnel screening, that signs, banners, posters, etc., not larger than 18" be permitted, and that disruptive persons may be removed.

Members of the public attending open conferences will be reminded that (1) the apparent violations discussed at predecisional enforcement conferences are subject to further review and may be subject to change prior to any resulting enforcement action and (2) the statements of views or expressions of opinion made by NRC employees at predecisional enforcement conferences, or the lack thereof, are not intended to represent final determinations or beliefs. Persons attending open conferences will be provided an opportunity to submit written comments concerning the trial program anonymously to the regional office. These comments will be subsequently forwarded to the Director of the Office of Enforcement for review and consideration.

When needed to protect the public health and safety or common defense and security, escalated enforcement action, such as the issuance of an immediately effective order, will be taken before the conference. In these cases, a conference may be held after the escalated enforcement action is taken.

