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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

April 8, 1992

MEMORANDUM FOR: Leif J. Norrholm, Chief
Vendor Inspection Branch

THRU: Gregory C. Cwalina, Chief *GC*
Special Projects Section

FROM: Kamalakar W. Naidu
Senior Reactor Engineer

SUBJECT: TRIP REPORT TO PALO VERDE NUCLEAR GENERATING STATION TO
OBTAIN INFORMATION ON ARD RELAY FAILURES AND P&B RELAY
FAILURES

On March 20, 1992, I visited the Arizona Public Service Company's (APSC's) Palo Verde Nuclear Generating Station to discuss with its quality engineers the status of the actions taken to preclude the repetition of failures of ARD type relays manufactured by Westinghouse Electric Corporation (W) and rotary relays manufactured by Potter & Brumfield (P&B).

APSC made a presentation (Enclosure 1) on the failures of P&B and ARD relays and outlined the actions taken to ensure that the manufacturers corrected the problems.

APSC also provided me a copy of "Equipment Root Cause of Failure Analysis" on ARD relays (Enclosure 2) which was prepared by APSC engineers. In this analysis, APSC documented its conclusion that W's ARD relays failed because the potting compound softened at higher temperatures, flowed into the operating mechanism (plunger mechanism) and prevented the relay contacts from changing position. W used "Amicon System" (Amicon) as the potting compound to manufacture ARD relays. Amicon (System T-663) is a mixture of T-663A (resin) and T-663B (hardener). A consultant to APSC investigated the ARD relay failures and determined that if the resin and hardener are not mixed together properly they will separate at elevated temperatures. APSC's report stated that W contracted its Space and Technology Center (WSTC) to investigate the epoxy cure characteristics. WSTC confirmed that inefficient mixing of the resin and the hardener in the potting compound caused the epoxy to flow. APSC engineers stated that the W Nuclear Safety Division (NSD), located in Pittsburgh, Pennsylvania, which supplies safety-related components, performed an audit at its facility in Coamo, Puerto Rico, where the relays are manufactured as commercial grade items, and determined that the resin was being inefficiently mixed with the hardener.

APSC engineers provided a copy of their purchase order (PO) No. 33700531 of March 4, 1992, to W for 300 ARD660UR type relays to demonstrate the quality requirements incorporated therein. The relays are manufactured at the W facility in Coamo, Puerto Rico, as commercial grade items without the benefit of a quality assurance program that meets the requirements of 10 CFR 50,

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Appendix B. W NSD dedicates the commercial grade relays and upgrades them to safety-grade. The APSC PO to W NSD contains the following requirements:

- The manufacturer of the relays must comply with quality assurance requirements.
- NSD must perform a nitrogen test on the relays to confirm that the resin and hardener have been adequately mixed. The test consists of heating the relays to 250 °F for 2.5 hours and using nitrogen to determine the concentration of the hardener in the epoxy.
- All requirements specified in the PO extend to subtier suppliers.
- Part 21 applies and requires W to provide a copy of the notification to APS if the items are related to the PO.

APSC appears to be the only licensee aware that the nitrogen test is the only test to positively determine the adequacy of mixing the resin and hardener. Other licensees may not know of this test and therefore may not specify this test on the relays as a requirement in their PO. W failed to include the nitrogen test as an attribute for the dedication, and this failure is reflected in the abnormal price for the test.

I recommend that the NRC staff conduct an inspection at W's Coama facility in Puerto Rico to determine the adequacy of the manufacturing practices. The staff already set a precedent for inspecting a commercial grade manufacturer. In 1984, the Vendor Inspection Branch (VIB) inspected ICO de Puerto Rico, Incorporated, located in Cobo Rojo, Puerto Rico where DS- and DB-type circuit breakers are manufactured as commercial grade items as a follow-up to the 1983 inspection regarding the reactor trip breaker failure at Salem. Also, in 1991, VIB inspected W's facility in Beaver, Pa, at which it manufactures commercial grade moulded case circuit breakers.

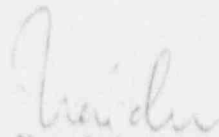
Although the NRC can not "inspect" quality into a component, it can use the inspection process to prompt suppliers to manufacture components of adequate quality.

Mr. Leif Norrholm

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I met the following persons at Palo Verde:

R. N. Prabhakar, Manager, Quality Engineering
D. F. Hautala, Senior Quality Engineer
J. I. Davis, Senior Component Engineer
D. Wheeler, Vendor Quality Technical Specialist
W. M. Seary, Senior QA Technical Specialist
B. P. Fisher, I & C System Engineer
J. Hebison, I & C System Engineer
J. Baxter, Senior Engineer, Compliance
M. Ferguson, Supervisor, Vendor Quality Assurance
S. G. Penick, Supervisor, Operations Quality Assurance
D. Sachs, Materials Engineer



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Enclosures:

1. Potter & Brumfield - MDR relay and Westinghouse - ARD Relay
2. Equipment Root Cause of Failure Analysis

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VIB/DRIS Reading

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Central Files/Docket File: 50-528; -529; -530

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