



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C. 20555-0001

DEC 14 1993

MEMORANDUM FOR: Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

FROM: Gary M. Holahan, Director
Division of Safety Programs
Office for Analysis and Evaluation
of Operations Data

SUBJECT: POTTER & BRUMFIELD MODEL MDR ROTARY RELAY FAILURES

AEOD has recently completed a study of the operating experience associated with Potter & Brumfield (P&B) model MDR rotary relay failures and their potential safety implications. This Special Study Report, S93-06, is enclosed for your information and use, and should be of particular interest to staff and licensee personnel who are involved with Information Notice (IN) 92-04, "Potter & Brumfield Model MDR Rotary Relay Failures." The study found that over 124 P&B MDR relay failures, due to specific failure mechanisms, have occurred in various nuclear power plants (NPPs) between 1984 and 1992 in reactor protection, emergency core cooling, and engineered safety feature systems and caused a wide range of results. About 1/3 of these relay failures occurred in 10, multiple-relay, simultaneous-failure events. Five of these events involved simultaneous failures of redundant components, which defeated the single failure assumption relied on in nuclear power plant design. Failures were often not detected until relay operation was tested or demanded and some MDR relays failed to reset after testing leaving a believed operable system inoperable. A number of failures were nonrecoverable, because of specific relay function.

All MDR relays were constructed of the same materials, making each subject to the same failure mechanisms. Similar failures occurred in ac, dc, latching, and non-latching relays. Most of the failures occurred in normally energized relays, but about 30 percent occurred in normally de-energized relays. While the timing of the relay failures is affected by a number of variables, the failure mechanisms are caused by several specific material or application problems. P&B has instituted a series of design improvements which address these problems. However, P&B has taken exception to 10 CFR 21 reporting, has not issued a Part 21 report, or made any recommendations to MDR users. The NRC issued a violation to P&B in 1992 for failing to evaluate deviations or informing licensees of the deviations, as required by 10 CFR 21.

This study suggests that a supplement to NRC IN 92-04 be issued to inform all commercial NPP licensees of the additional MDR relay common-cause failure mechanisms identified since the IN was initially issued. It also notes that an increase in reliability and a reduction in challenges to safety-related systems could be effected by replacing MDR relays, subject to the dependent failure mechanisms identified in this study, that are relied upon to actuate or operate safety-related systems.

02M-7 (AEOD)
X-05R-5-1 (Operating Experience)
X-05R-5 (Support/Structure/Filters)
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Brian Grimes

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If you have any questions regarding the enclosed study, please contact Bob Spence on 492-8609. Please contact me if AEOD can provide any additional assistance.

Original signed by

Jack E. Rosenthal for:

Gary M. Holahan, Director
Division of Safety Programs
Office for Analysis and Evaluation
of Operational Data

Enclosure: As stated

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