

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

May 12, 1993

NRC INFORMATION NOTICE 93-35: INSIGHTS FROM COMMON-CAUSE FAILURE EVENTS

Addressees

All holders of operating licenses or construction permits for nuclear power plants (NPPs).

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to inform addressees about the publication of an NRC report on common-mode and common-cause failure events that could occur at nuclear power plants. 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.

Discussion

The Office for Analysis and Evaluation of Operational Data (AEOD) published a report, "Insights from Common-Mode Failure Events," AEOD/E92-02, in June 1992 and issued Supplement 1 in February 1993.* The staff reviewed 62 selected licensee event reports that discussed actual or potential common-cause failures. Of the 62 events reviewed, 16 also were identified as precursors in the accident sequence precursor program (ASP). Common-cause failures may significantly degrade safety since they can defeat the additional benefit normally provided by redundant systems. Furthermore, common-cause failure has been cited as a major uncertainty in probabilistic risk assessments of nuclear power plants.

Most of the reports used in the AEOD study were prompted by events that occurred in 1990. In the study, the staff used reports of events where the failed equipment was considered neither "recoverable" nor "self-revealing." A failure that is recoverable is one in which the plant condition could be restored by taking a corrective action during the event. However, failure in a location inaccessible during an accident, such as inside the containment; a failure of equipment needed for a rapidly developing event such as a loss-of-coolant accident; a challenge to pressure vessel integrity; or a backwards installation of a necessary valve are considered failures that are not recoverable. For a self-revealing condition, the licensee would presumably

*Copies of this report and its supplement are available for inspection and copying in the NRC Public Document Room, 2120 L Street N.W., Washington, D.C. 20037

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correct the situation before the event occurred that required the equipment. The staff excluded such conditions from this study.

The AEOD report attempted to identify the actions that would be most effective in precluding or reducing the likelihood of common-cause failures at operating nuclear power plants. Each of the events was reviewed against a set of eight potential actions: comprehensive testing, staggered testing, post-maintenance testing, using equipment from different manufacturers in redundant trains (diverse equipment), using equipment with larger design margin, increasing frequency of testing, providing adequate separation of trains, and using different maintenance personnel on separate trains. No single action would have alleviated all the common-cause failures in the study. Considering all the events, the action that had the highest potential benefit was using equipment with larger design margins. This action alone would have corrected about 56 percent of the situations examined in the AEOD study. Performing comprehensive systems tests, ensuring adequate train separation, and using diverse equipment each had a potential benefit in about 27 percent of the cases. The use of staggered surveillance testing would have benefited 20 percent of the events.

The staff noted that about two-thirds of the events were related to design, fabrication, and installation errors that may be undetected for long periods of time. The remaining events were associated with maintenance deficiencies, either preventive or corrective. The major alleviating action identified for these maintenance-related events was staggered surveillance testing, which is assumed to result in a shorter time during which the common-mode failure is undetected.

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



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

Technical contact: S. Israel, AEOD
(301) 492-4437

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-34, Supp. 1	Potential for Loss of Emergency Cooling Function Due to A Combination of Operational and Post-Loca Debris in Containment	04/06/93	All holders of OLs or CPs for nuclear power reactors.
93-34	Potential for Loss of Emergency Cooling Function Due to A Combination of Operational and Post-Loca Debris in Containment	04/26/93	All holders of OLs or CPs for nuclear power reactors.
93-33	Potential Deficiency of Certain Class 1E Instrumentation and Control Cables	04/28/93	All holders of OLs or CPs for nuclear power reactors.
93-32	Nonconservative Inputs for Boron Dilution Event Analysis	04/21/93	All holders of OLs or CPs for pressurized water reactors (PWRs).
93-31	Training of Nurses Responsible for the Care of Patients with Brachytherapy Implants	04/13/93	All U.S. Nuclear Regulatory Commission medical licensees.
93-30	NRC Requirements for Evaluation of Wipe Test Results; Calibration of Count Rate Survey Instruments	04/12/93	All U.S. Nuclear Regulatory Commission medical licensees.
93-29	Problems with the Use of Unshielded Test Leads in Reactor Protection System Circuitry	04/12/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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The staff noted that about two-thirds of the events were related to design, fabrication, and installation errors that may be undetected for long periods of time. The remaining events were associated with maintenance deficiencies, either preventive or corrective. The major alleviating action identified for these maintenance-related events was staggered surveillance testing, which is assumed to result in a shorter time during which the common mode failure is undetected.

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the licensee would presumably correct the situation before the event occurred that required the equipment. The staff excluded such events from this study.

The AEOD report was prepared to identify the corrective actions that would be most effective in precluding or reducing the likelihood of common-cause failures at operating nuclear power plants. Each of the events was reviewed against a set of eight corrective actions. No single corrective action can minimize all the potential causes of common-cause failures. Considering all the events, the corrective action that had the highest potential impact was using equipment with larger design margins. This action alone corrected about 56 percent of the situations examined in the AEOD study. Performing comprehensive systems tests, ensuring adequate train separation, and using diverse equipment each had a potential impact on about 27 percent of the cases. The use of staggered surveillance testing impacted 20 percent of the events.

The staff noted that about two-thirds of the events were related to design, fabrication, and installation errors that may be undetected for long periods of time. The AEOD study also showed that the major corrective action for these situations was using equipment with larger design margins. The remaining one-third of the events was associated with maintenance deficiencies, either preventive or corrective. The major corrective action for these maintenance-related events was staggered surveillance testing.

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cause a failure event, the licensee would presumably correct the situation before the failure event occurred. The staff excluded such events from this study.

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