

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

September 14, 1993

NRC INFORMATION NOTICE 93-72: OBSERVATIONS FROM RECENT SHUTDOWN RISK AND  
OUTAGE MANAGEMENT PILOT TEAM INSPECTIONS

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 inform addressees of observations from recent shutdown risk and outage management pilot team inspections. 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.

Background

Events that occurred during the past several years have caused the NRC staff to be increasingly concerned about plant safety during shutdown operations. The Diablo Canyon event of April 10, 1987, in which boiling of the reactor coolant resulted from a loss of decay heat removal, highlighted the fact that operation of a pressurized-water reactor with a reduced reactor coolant system (RCS) inventory is a particularly sensitive condition. Based on its review of that event, the staff issued Generic Letter 88-17, "Loss of Decay Heat Removal," October 17, 1988, which requested that licensees address certain generic deficiencies to improve safety during operations with a reduced RCS inventory. More recently, Incident Investigation Team report, NUREG-1410, "Loss of Vital ac Power and the Residual Heat Removal System During Mid-Loop Operations at Plant Vogtle Unit 1 on March 20, 1990," emphasized the need for risk management of shutdown operations. Discussions with foreign regulatory organizations support NRC staff findings that the core-damage frequency for shutdown operations may be a substantial fraction of the total core-damage frequency.

Description of Circumstances

Between December 1991 and April 1993, the NRC staff conducted five pilot team inspections to assess the effectiveness of industry initiatives for improving shutdown safety. The inspections were performed at Oconee Nuclear Station, Unit 2 [NRC Inspection Report (IR) 50-270/91-202], Indian Point Nuclear

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Generating Station, Unit 3 (IR 50-286/92-901), Diablo Canyon Nuclear Station, Unit 1 (IR 50-275/92-201), Prairie Island Nuclear Generating Plant, Units 1 and 2 (IR 50-282/92-201; 50-306/92-201), and Cooper Nuclear Station (IR 50-298/93-201). Approximately one week of each inspection focused on licensee pre-outage planning and control processes and 8 to 10 days focused on licensee implementation of the outage.

In the pre-outage portion of the inspection, the inspectors evaluated the following: (1) management involvement in and oversight of the outage planning process, (2) planning and scheduling of outage activities, especially the relationships between significant work activities and the availability of electrical power supplies, decay heat removal systems, reactor coolant system RCS inventory and containment integrity, (3) the process for developing individual work packages to ensure coordination with other activities, and (4) operator response procedures, contingency plans and training for mitigation of loss of decay heat removal capability, loss of RCS inventory and loss of electrical power sources during shutdown conditions.

The inspectors walked through procedures related to shutdown safety to determine if the specified activities could be accomplished in the allotted time frames and to verify that the procedures could be implemented considering probable equipment availability. The inspectors reviewed training records on outage procedures to determine if the training was adequate and that, when appropriate, additional training was provided as the procedures were revised. The inspectors also evaluated the probable effects of environmental conditions such as temperature, steam and flooding on the performance of activities that would be required to mitigate adverse shutdown events.

In the implementation portion of the inspection, the inspectors evaluated: (1) the control of changes to the outage schedule, control of work activities, and control of system alignments, (2) the working relationships and communication channels between operations, maintenance and other plant support personnel, (3) the conduct of operations personnel both inside and outside of the control room regarding awareness of plant status, control of plant evolutions, response to alarms and other abnormal indications, (4) the completeness and effectiveness of shift turnovers, (5) whether maintenance and modification work was performed in accordance with current written and approved procedures and appropriate post-maintenance testing was required and performed, and (6) the adequacy of management involvement and oversight of the conduct of the outage as it progressed.

Other areas observed were, plant housekeeping, normal and emergency plant lighting, configuration control, radiological controls, equipment labeling and status tagging, vital area access control, use of overtime and licensee control of contractor work including contractor training and qualifications.

### Discussion

In general, the inspectors found that licensees had instituted programmatic changes developed from guidance contained in a Nuclear Management and Resources Council document, NUMARC 91-06, "Guidelines for Industry Actions to

Assess Shutdown Management." The team inspectors found individual examples of licensee failure to follow procedures but more importantly the inspectors identified two areas of more general concern: (1) risk assessment for pre-outage planning, emergent work and schedule changes, and (2) implementation of defense-in-depth methodologies for equipment availability. A general discussion of these areas is provided below. Specific details of the findings are contained in the inspection reports referenced above.

#### Risk Assessment for Pre-Outage Planning, Emergent Work and Schedule Changes

The inspectors found that licensees used various programmatic controls to assess shutdown risk factors during initial outage planning, emergent work and schedule changes. Assessment methodologies used for initial outage planning ranged from following minimum guidelines for equipment availability to performing a probabilistic risk assessment of scheduled outage activities. The inspection team found that the risk assessment aided the licensee in identifying activities that would be subject to high risk during the scheduled outage. However, as the outage progressed, the risk assessment became less valid because it was not updated as changes to the outage schedule occurred.

In the areas of emergent work and schedule changes, the inspectors found that three of the plants had a proceduralized process to assess the effect of emergent work or schedule changes on plant risk. The other two plants relied on a functional review by planners, schedulers, and operators to adjust the schedule appropriately to reduce risk.

The inspectors found that all of the plants maintained status boards or checklists in the control room to assist the operators in tracking the configuration status of plant systems and to help identify potential risk-significant activities.

#### Implementation of Defense-in-Depth for Equipment Availability

The inspection teams found that licensee implementation of defense-in-depth for equipment availability was inconsistent. Although industry guidelines for declaring equipment "available" exist, the inspectors found that the criteria for declaring equipment needed to ensure an appropriate margin of safety "available" varied from licensee to licensee. For example, declaring that equipment was "available" did not always include ensuring that support systems (e.g., cooling water and heating, ventilation and air conditioning) were also available. At times, after maintenance had been performed, equipment was listed as "available" without the benefit of a post-maintenance functional test. The inspectors also found that some equipment was considered to be "available" even though actions, such as removal of clearances or realignment of valves, would be required before the equipment could perform its function.

In addition to the above concerns, at most of the plants the team inspectors found examples of failures to comply with technical specification restrictions on overtime work in that management approval to exceed overtime limits was inadequately documented.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact 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: J.D. Wilcox, NRR  
(301) 504-1262

Attachment: List of Recently Issued NRC Information Notices

RSIB:DRIL:NRR JDWilcox 07/02/93	RSIB:DRIL:NRR SSanders 07/02/93	AC/RSIB:DRIL:NRR DNorkin 07/02/93	D/DRIL:NRR CERossi 07/10/93
RPB:ADM NBeeson 08/10/93	OGCB:DORS:NRR JLBirmingham 08/27/93	<sup>PCW</sup> C/OGCB:DORS:NRR for GHMarcus 09/27/93 08	D/DORS:NRR BKGrimes 09/ /93
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07/06/93

DOCUMENT NAME: OUTAGEIN.JLB

Based on the five pilot inspections, the NRC inspection teams concluded that NRC actions and industry initiatives have increased licensee awareness of the risk associated with shutdown and low power conditions. The inspection teams found that licensees were aware of the necessity for ensuring that required systems be available and of the need to maintain the capability of backup equipment during an outage. However, the inspection teams found that licensee interpretations of industry initiatives for addressing shutdown risk varied greatly. This was demonstrated by the various licensee interpretations of industry guidelines for declaring equipment "available."

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Original signed by  
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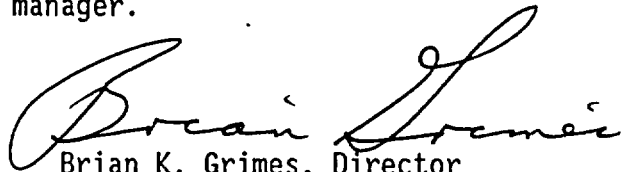
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LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-71	Fire at Chernobyl Unit 2	09/13/93	All holders of OLs or CPs for nuclear power reactors.
93-70	Degradation of Boraflex Neutron Absorber Coupons	09/10/93	All holders of OLs or CPs for nuclear power reactors.
93-69	Radiography Events at Operating Power Reactors	09/02/93	All holders of OLs or CPs for nuclear power reactors and all radiography licensees.
93-68	Failure of Pump Shaft Coupling Caused by Temper Embrittlement during Manufacture	09/01/93	All holders of OLs or CPs for nuclear power reactors.
92-16, Supp. 2	Loss of Flow from the Residual Heat Removal Pump during Refueling Cavity Draindown	08/23/93	All holders of OLs or CPs for nuclear power reactors.
93-67	Bursting of High Pressure Coolant Injection Steam Line Rupture Discs Injures Plant Personnel	08/16/93	All holders of OLs or CPs for nuclear power reactors.
93-66	Switchover to Hot-Leg Injection Following A Loss-of-Coolant Accident in Pressurized Water Reactors	08/16/93	All holders of OLs or CPs for pressurized water reactors.
93-65	Reactor Trips Caused by Breaker Testing with Fault Protection Bypassed	08/13/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit