

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555-0001

May 6, 2005

NRC INFORMATION NOTICE 2005-11: INTERNAL FLOODING/SPRAY-DOWN OF  
SAFETY-RELATED EQUIPMENT DUE TO  
UNSEALED EQUIPMENT HATCH FLOOR PLUGS  
AND/OR BLOCKED FLOOR DRAINS

**ADDRESSEES**

All holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

**PURPOSE**

The U.S. Nuclear Regulatory commission (NRC) is issuing this information notice (IN) to inform addressees of the possibility of flooding safety-related equipment as a result of (1) equipment hatch floor plugs that are not water tight and (2) blockage of the equipment floor drain systems that are credited to mitigate the effects of flooding in the final safety analysis report (FSAR) and plant design basis calculations.

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 in this IN are not NRC requirements; therefore, no specific action or written response is required.

**DESCRIPTION OF CIRCUMSTANCES**

On August 18, 2004, during an extended backwash evolution on the reactor water cleanup demineralizer at Susquehanna Unit 1, approximately 1,500 gallons of contaminated water from the backwash-receiving tank overflowed into the reactor building equipment floor drain system. The drain header became blocked by the resin from the receiving tank and rust displaced from inside the drain pipes. The water flowed up and out of the blocked drains on a lower elevation, across the floor, and down into the Division II core spray and the high-pressure coolant injection system compartments. The water entered these compartments by flowing through unsealed spaces between the equipment hatch floor plugs and the floor. The equipment floor drains in the emergency core cooling system (ECCS) compartments were isolated, as per design, and the water accumulated on the floor. Approximately 2 inches of water accumulated on the floor of the Division II core spray and high-pressure injection system compartments.

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The licensee disabled the automatic start feature of the Division II core spray pumps and declared the pumps inoperable but functional for approximately 2 hours until an assessment was completed to verify operability. The licensee's immediate actions were to perform system walkdowns and determine the effect of the flooding on the Division II core spray and high-pressure coolant injection systems. The walkdowns determined that the water leakage into the room did not significantly impact the systems and that the systems remained operable. The walkdowns also confirmed that the other ECCS compartments were not affected.

## **DISCUSSION**

The licensee's FSAR flooding analysis stated that the ECCS compartments were water tight. However, the equipment hatch floor plugs were not sealed and therefore did not constitute a water-tight barrier. The plant-specific design calculations did not address leakage around these plugs. Water leaked through the ceiling into the Division II core spray and high-pressure coolant injection compartments through gaps between the equipment hatch floor plug and the floor. The licensee did not scope the equipment floor drain system function (mitigating internal flooding) into the Maintenance Rule. The FSAR and flooding design calculations credited the equipment floor drain system to assist in removal of water from internally flooded areas. Part of the licensee's corrective actions were to place the floor and equipment drain functions within the scope of the Maintenance Rule and to revise the plant calculations to reconcile the plant design analysis and the FSAR. The licensee has also developed and installed a modification to seal the equipment hatch floor plugs above the ECCS compartments.

## **CONCLUSION**

The event described above illustrates the potential for degradation of multiple trains of ECCS as a consequence of potential flooding of safety-related equipment outside containment. All holders of reactor operating licenses should be aware of the effect of unsealed equipment hatch floor plugs and malfunctioning drains on their plant-specific FSARs and plant design analyses for flooding. Unsealed reactor building equipment hatch floor plugs and less than optimal maintenance monitoring of the equipment floor drain systems can result in additional internal flooding vulnerabilities. Licensees should consider several actions to mitigate these vulnerabilities:

- (1) Verify that the actual plant configuration and design of the equipment hatch floor plugs meet the FSAR description and design basis calculations for water-tight compartments. Consider appropriate actions to achieve floor plug water tightness, such as the use of gaskets and sealers. Additionally, if the analysis allows for leakage through the equipment hatch floor plugs, the qualification of equipment below these plugs should consider water spray as well as submergence.
- (2) In addition, if the drain system is required for water removal, periodically verify that the floor drain system performs as intended and perform maintenance to assure that the system can perform the water removal function assumed in the FSAR and design calculations.

## GENERIC IMPLICATIONS

Flooding due to internal causes has been shown to be a significant contributor to risk at some facilities. Flooding also has the potential to make multiple trains of equipment and support equipment inoperable, significantly increasing plant risk. Flooding also has the significant consequence of preventing or limiting operator mitigation and recovery actions. As a result, semiannually, NRC inspectors select one or two plant areas and inspect internal flood protection features for risk-significant structures, systems, and components in accordance with Inspection Procedure Attachment [71111.06](#) "Flood Protection Measures."

Multiple previous NRC generic communications have addressed flood protection issues:

1. [Circular CR 78-06](#) POTENTIAL COMMON MODE FLOODING OF ECCS EQUIPMENT ROOMS AT BWR FACILITIES
2. [IN 83-44](#) POTENTIAL DAMAGE TO REDUNDANT SAFETY EQUIPMENT AS A RESULT OF BACKFLOW THROUGH THE EQUIPMENT AND FLOOR DRAIN SYSTEM
3. [IN 83-44 S1](#) POTENTIAL DAMAGE TO REDUNDANT SAFETY EQUIPMENT AS A RESULT OF BACKFLOW THROUGH THE EQUIPMENT AND FLOOR DRAIN SYSTEM
4. [IN 87-49](#) DEFICIENCIES IN OUTSIDE CONTAINMENT FLOODING PROTECTION
5. [IN 92-69](#) WATER LEAKAGE FROM YARD AREA THROUGH CONDUITS INTO BUILDINGS
6. [IN 94-27](#) FACILITY OPERATING CONCERNS RESULTING FROM LOCAL AREA FLOODING
7. [IN 98-31](#) FIRE PROTECTION SYSTEM DESIGN DEFICIENCIES AND COMMON-MODE FLOODING OF EMERGENCY CORE COOLING SYSTEM ROOMS AT WASHINGTON NUCLEAR PROJECT UNIT 2

## CONTACTS

This IN requires no specific action or written response. Please direct any questions about this matter to the technical contact(s) listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Note: NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.