

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, DC 20555-0001

November 24, 2004

NRC INFORMATION NOTICE 2004-21:     ADDITIONAL ADVERSE EFFECT OF BORIC  
  ACID LEAKAGE: POTENTIAL IMPACT ON POST-  
  ACCIDENT COOLANT pH

**ADDRESSEES**

All holders of operating licenses or construction permits for pressurized water reactors (PWRs), except those who have 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 potential adverse effects of boric acid leakage that may not have been previously considered and to reemphasize concerns regarding boric acid accumulations on reactor plant equipment inside containment. The primary concern regarding boric acid leakage is corrosion of ferritic steel components. However, if boric acid deposits of sufficient magnitude are present in containment, dissolution of these deposits may also affect the pH of the reactor coolant in the containment sump. The NRC anticipates that recipients will review the information for applicability to their facilities and consider appropriate actions. However, suggestions contained in this IN do not constitute NRC requirements; therefore, no specific action or written response is required.

**DESCRIPTION OF CIRCUMSTANCES**

During refueling outages throughout the 1990s, personnel at the Davis-Besse nuclear power plant performed visual inspections of the reactor pressure vessel (RPV) head surface that was accessible through the service structure weep holes. Visual inspections performed below the RPV head insulation found some accumulation of boric acid deposits on the RPV head. The boric acid buildup was due to leaking control rod drive mechanism flanges and reactor coolant pressure boundary leakage. Many areas of the RPV head were not visible because of persistent boric acid deposits that the licensee did not clean. In addition to the significant buildup of boric acid on the reactor pressure vessel head, a substantial amount of boric acid built up inside the containment at Davis-Besse.

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After a loss-of-coolant accident (LOCA) at a pressurized water reactor, chemical agents would be used to ensure that the reactor coolant pH is kept neutral or slightly basic. At the Davis-Besse plant, trisodium phosphate (TSP) is used. The TSP is kept in designated storage baskets in the containment building. However, large deposits of boric acid in containment may adversely affect the pH of the reactor coolant in the containment sump.

## **DISCUSSION**

Boric acid deposits can occur inside a pressurized water reactor containment as a result of reactor coolant system leakage. The deposits typically accumulate at any point where moisture condenses inside containment (e.g., cooling water pipes, ventilation systems, containment liner surfaces). If these deposits are not promptly identified and routinely removed, they could accumulate and impact the sump pH. Therefore, it is important to have procedures and programs to routinely identify and remove boric acid deposits.

After a LOCA, the iodine released from the damaged core is removed from the containment atmosphere by spraying borated water accumulated in the containment sump. To keep iodine in solution, the pH of the sump water should be at least 7. Maintaining a pH of 7 or slightly greater is also necessary to minimize chloride stress corrosion cracking in austenitic stainless steel components exposed to the sump water. The amount of TSP depends on how much boric acid from all sources has accumulated in the containment. Failure to control and remove accumulations of boric acid deposits inside containment may challenge whether the reactor coolant in the containment sump is chemically neutral or slightly basic.

Boron concentration in the reactor coolant and the impact on containment sump pH are discussed in NRC Bulletin 77-04, "Calculational Error Affecting the Design Performance of a System for Controlling pH of Containment Sump Following a LOCA," available at ADAMS Accession No. ML031200570 and on the NRC Web site at <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/bulletins/1977/bl77004.html>.

During recent years, the nuclear power industry has become more sensitive to leakage of borated water from the reactor coolant system or auxiliary systems. The NRC issued several generic communications to inform the industry of the serious consequences of such leakage and took other actions to ensure that such leakage is addressed if and when it occurs. Several actions to address boric acid leakage are described in Attachment 1 of Regulatory Issue Summary (RIS) 2003-13, "NRC Review of Responses to Bulletin 2002-01, 'Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity.'" This RIS is available at ADAMS Accession No. ML032100653 and the NRC Web site at <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/reg-issues/2003/ri200313.pdf>.

## CONTACT

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

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LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
2004-20	Recent Issues Associated with NRC Medical Requirements for Licensed Operators	11/24/2004	All holders of operating licenses for nuclear power reactors and research and test reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.
2004-19	Problems Associated with Back-up Power Supplies to Emergency Response Facilities and Equipment	11/04/2004	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.
2004-18	Recent Safety-related Event at Panoramic Wet-source-storage Irradiator	10/26/2004	All licensees authorized to possess and use sealed sources in panoramic wet-source-storage irradiators, and irradiator vendors.
2004-17	Loose Part Detection and Computerized Eddy Current Data Analysis in Steam Generators	08/25/2004	All holders of operating licenses for pressurized-water reactors (PWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.
2004-16	Tube Leakage Due to a Fabrication Flaw in a Replacement Steam Generator	08/03/2004	All holders of operating licenses for pressurized-water reactors (PWRs), except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor.

**Note:** NRC generic communications may be received in electronic format shortly after they are issued by subscribing to the NRC listserver as follows:

To subscribe send an e-mail to [listproc@nrc.gov](mailto:listproc@nrc.gov), no subject, and the following command in the message portion:

subscribe gc-nrr firstname lastname