

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

September 6, 1991

NRC INFORMATION NOTICE 91-54: FOREIGN EXPERIENCE REGARDING BORON DILUTION

Addressees

All holders of operating licenses or construction permits for pressurized water reactors (PWRs).

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a potential sequence of events that may result in a rapid injection of unborated reactor coolant water into the reactor core. 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.

Description of Circumstances

The NRC has learned of analyses, performed by a foreign program, of certain events and event sequences which indicate that there is a potential for a rapid injection into a PWR reactor core of unborated reactor coolant whose effects would be more severe than similar events considered in the safety analyses of most U.S. plants.

The adverse events involve the accumulation of a significant volume of unborated water in a part of the primary coolant system during plant shutdown. Various actions performed during plant shutdown could result in such an accumulation. Once the unborated water is accumulated, the startup of an idle reactor coolant pump could send the unborated water into the reactor core causing a significant and unplanned reactivity insertion.

The following sequence of events is evaluated in the foreign study.

The sequence is initiated by the loss of one of two offsite electrical power sources. This loss of power occurs while the reactor coolant water is being diluted for reactor startup. At this time, decay heat is insufficient to cause natural circulation of the reactor coolant. It is assumed that the operating reactor coolant pump(s) are powered from the failed offsite power source and cease running. However, the charging pumps, powered from the alternate power source, continue to operate and a significant volume of unborated water is accumulated in the reactor coolant system. If, at this

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point, an idle reactor coolant pump is started, the accumulated volume of weakly borated or unborated water would be injected into the reactor core.

### Discussion of Safety Significance

The safety analyses for most U.S. nuclear plants do not address this explicit sequence of events. However, the staff is aware of one representative analysis of a similar sequence for a U.S. PWR. In that analysis, the results indicate that such an accident could cause some core damage but that breach of the reactor coolant system would be unlikely. The NRC is continuing to study other possible sequences that could cause a similar unplanned injection of unborated water. The above postulated sequence of events would occur as a result of actions performed during plant restart from a shutdown condition and as such is being considered as part of the NRC's review of shutdown risk.

This accident sequence involves several assumptions regarding plant conditions and equipment configuration and, therefore, may not apply to a particular U.S. plant. Training and procedures that emphasize the need to ensure uniform boron concentration in the reactor coolant system at all times and the implementation of appropriate caution in starting an idle reactor coolant loop can reduce the probability of occurrence of such an event.

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 Office of Nuclear Reactor Regulation project manager.

*Charles E. Rossi*  
Charles E. Rossi, Director  
Division of Operational Events Assessment  
Office of Nuclear Reactor Regulation

Technical contacts: N. Prasad Kadambi, NRR  
(301) 492-0841

M. Caruso, NRR  
(301) 492-3235

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-90, Supp. 2	Pressurizer Safety Valve Lift Setpoint Shift	09/05/91	All holders of OLs or CPs for nuclear power reactors.
91-53	Failure of Remote Shutdown System Instrumentation Because of Incorrectly Installed Components	09/04/91	All holders of OLs or CPs for nuclear power reactors.
91-52	Nonconservative Errors In Overtemperature Delta- Temperature (OTΔT) Set- point Caused by Improper Gain Settings	08/29/91	All holders of OLs or CPs for Westinghouse (W)-designed nuclear power reactors.
86-14, Supp. 2	Overspeed Trips of AFW, HPCI and RCIC Turbines	08/26/91	All holders of OLs or CPs for nuclear power reactors.
91-51	Inadequate Fuse Control Programs	08/20/91	All holders of OLs or CPs for nuclear power reactors.
91-50	A Review of Water Hammer Events After 1985	08/20/91	All holders of OLs or CPs for nuclear power reactors.
91-49	Enforcement of Safety Requirements for Radiog- raphers	08/15/91	All Nuclear Regulatory Com- mission (NRC) licensees authorized to use sealed sources for industrial radiography.
91-48	False Certificates of Con- formance Provided by West- inghouse Electric Supply Company for Refurbished Com- mercial-Grade Circuit Breakers	08/09/91	All holders of OLs or CPs for nuclear power reactors.
91-47	Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test	08/06/91	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit

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Original Signed by  
 Charles E. Rossi

Charles E. Rossi, Director  
 Division of Operational Events Assessment  
 Office of Nuclear Reactor Regulation

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\*See previous concurrence.

SRXB:DST:NRR	C:SRXB:DST:NRR	D:DST
*MCaruso	*RJones	*ATHadani
08/21/91	08/21/91	08/24/91

OFC	:OGCB:DOEA:NRR:C:OGCB:DOEA:NRR:IP	:TechEd	:D:DOEA:NRR	:
NAME	:*Pkadambi	:*CHBerlinger	:HJFaulkner:*JMain	: <i>CE Rossi</i>
DATE	:08/08/91	:08/28/91	:08/21/91*	:08/09/91 :08/3/91

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NAME	:*Pkadambi	:CHBerlinger	:HJFaulkner:*JMain	:CERossi	:
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