

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

May 31, 1989

NRC INFORMATION NOTICE NO. 89-51: POTENTIAL LOSS OF REQUIRED SHUTDOWN
MARGIN DURING REFUELING OPERATIONS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is being provided to alert addressees to the potential loss of required shutdown margin during the movement and placement of highly reactive fuel during refueling operations. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Baltimore Gas and Electric Company (BG&E) submitted a 10 CFR Part 21 report to the NRC on March 15, 1989, regarding the potential loss of shutdown margin during refueling operations at its Calvert Cliffs Nuclear Power Plant, Units 1 and 2. BG&E reported that it had increased the fuel enrichment during the last several fuel cycles. In the current cycle, 4.3 weight percent U-235 fuel was loaded into the core. During a review of NRC Information Notice No. 88-21, "Inadvertent Criticality Events at Oskarshamn and U.S. Nuclear Power Plants," BG&E discovered that the Calvert Cliffs refueling procedures allowed the placement of fuel assemblies in intermediate positions during core alterations. In addition, BG&E determined that the potential existed for placing several fresh 4.3 weight percent reload assemblies together and losing some of the required 5 percent shutdown margin. Calculations also showed that under extreme conditions an inadvertent criticality could occur if a number of highly reactive assemblies were grouped together and no credit was taken for control rods or burnable poisons.

BG&E has revised the Calvert Cliffs refueling procedures to ensure that fuel assemblies will not be placed in intermediate positions during core alterations without first verifying their potential reactivity. The revised procedures allow fuel to be positioned only in intermediate core locations that will contain fuel of equal or greater reactivity in the final core configuration.

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Discussion:

As a result of longer fuel operating cycles, utilities have been increasing the enrichment of reload fuel. Some of these fresh reload assemblies may be highly reactive under refueling conditions. Although analyses are performed to confirm that the refueling boron concentration is sufficient to maintain the required shutdown margin (subcriticality) for the final core configuration, these analyses may not be sufficient to assure that the shutdown margin will be maintained for all intermediate fuel assembly positions. In addition, explicit procedural controls may not exist to control the location and movement of highly reactive fuel assemblies during refueling. Because a significant amount of reactivity can be added to subcritical configurations by the addition of a single highly reactive assembly, it is possible that an inadvertent criticality could occur if a number of such assemblies are grouped together. With this highly reactive fuel, subcritical multiplication (inverse count rate) may not provide adequate warning of an approach to criticality.

Combustion Engineering, Inc. (CE), the nuclear fuel design consultant for Calvert Cliffs, recognized this potential problem and recently issued an information bulletin regarding shutdown margin during refueling to all utilities with CE-designed plants. These utilities have been advised to review their fuel shuffle procedures that control the location of highly reactive fuel and to be aware that the refueling boron concentration necessary to maintain the required shutdown margin, which is based on the final core configuration, may not be sufficient to assure that their required shutdown margin will be maintained for all intermediate fuel assembly positions. In circumstances in which explicit analyses are not available for each intermediate fuel assembly position, CE recommends positioning fuel only in intermediate core locations that will contain fuel of equal or greater reactivity in the final core configuration.

No specific action or written response is required by this information notice. If you have any questions regarding this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi

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

Technical Contact: Laurence I. Kopp, NRR
(301) 492-0879

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-88, Supp. 1	Degradation of Westinghouse ARD Relays	5/31/89	All holders of OLs or CPs for nuclear power reactors.
89-50	Inadequate Emergency Diesel Generator Fuel Supply	5/30/89	All holders of OLs or CPs for nuclear power reactors.
89-49	Failure to Close Service Water Cross-Connect Isolation Valves	5/22/89	All holders of OLs or CPs for nuclear power reactors.
89-48	Design Deficiency in the Turbine-Driven Auxiliary Feedwater Pump Cooling Water System	5/22/89	All holders of OLs or CPs for nuclear power reactors.
89-47	Potential Problems With Worn or Distorted Hose Clamps on Self-Contained Breathing Apparatus	5/18/89	All holders of OLs or CPs for nuclear power reactors and fuel facilities.
89-46	Confidentiality of Exercise Scenarios	5/11/89	All holders of licenses for fuel cycle facilities and byproduct material licensees having an approved emergency response plan.
89-45	Metalclad, Low-Voltage Power Circuit Breakers Refurbished with Sub-standard Parts	5/8/89	All holders of OLs or CPs for nuclear power reactors.
89-44	Hydrogen Storage on the Roof of the Control Room	4/27/89	All holders of OLs or CPs for nuclear power reactors.
88-82, Supp. 1	Torus Shells with Corrosion and Degraded Coatings in BWR Containments	5/2/89	All holders of OLs or CPs for BWRs.

OL = Operating License
 CP = Construction Permit

Discussion:

As a result of longer fuel operating cycles, utilities have been increasing the enrichment of reload fuel. Some of these fresh reload assemblies may be highly reactive under refueling conditions. Although analyses are performed to confirm that the refueling boron concentration is sufficient to maintain the required shutdown margin (subcriticality) for the final core configuration, these analyses may not be sufficient to assure that the shutdown margin will be maintained for all intermediate fuel assembly positions. In addition, explicit procedural controls may not exist to control the location and movement of highly reactive fuel assemblies during refueling. Because a significant amount of reactivity can be added to subcritical configurations by the addition of a single highly reactive assembly, it is possible that an inadvertent criticality could occur if a number of such assemblies are grouped together. With this highly reactive fuel, subcritical multiplication (inverse count rate) may not provide adequate warning of an approach to criticality.

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Changes to final draft were discussed with J. Beuller, C. Berlinger, L. Kopp, T. Collins (acting for Hodges) and H. Richardson 5/25/89 C.E. Rossi

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*SEE PREVIOUS PAGE FOR CONCURRENCE

D/DOEA:NRR CERoss1 05/25/89	*C/SRXB:DEST:NRR WHodges 05/19/89	*C/OGCB:DOEA:NRR*RPB:ARM CHBerlinger 05/23/89	TechEd 05/17/89
*OGCB:DOEA:NRR JGuillen 05/17/89	*SRXB:DEST:NRR LKopp 05/18/89	*SAD/DEST:NRR ATHadani 05/17/89	*D/DEST:NRR LCShao 05/22/89

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