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

October 14, 1994

NRC INFORMATION NOTICE 94-75: MINIMUM TEMPERATURE FOR CRITICALITY

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 potentially non-conservative initial conditions that were used in the analysis of some design-basis transients. As a result, some plant technical specifications for minimum temperature for criticality may not be adequately conservative. 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

Commonwealth Edison Company (Zion Nuclear Station Units 1 and 2) and New York Power Authority (Indian Point Nuclear Power Plant Unit 3) have informed the NRC that their technical specifications for minimum temperature for criticality were not supported by the safety analyses for their plants. The licensing analysis performed by Westinghouse for Zion assumed a nominal hot-zero-power (no-load) operating temperature of 286 °C [547 °F], but Zion's technical specifications allow criticality if the average reactor coolant system temperature is greater then 260 °C [500 °F]. The safety analysis for Indian Point 3 was also performed at 286 °C [547 °F], but its technical specifications allow criticality at 232 °C [450 °F], a limit which was set by reactor vessel material considerations. A review of Indian Point records indicated that the reactor was brought critical below 286 °C [547 °F] several times in the early life of plant operations (before 1988). The lowest temperature during these instances was 272 °C [521 °F].

After discovering a potential to operate the plant in a region outside that analyzed, both licensees instituted administrative controls to ensure that the minimum temperatures for criticality are bound by the safety analyses performed for their plants. In addition, both licensees submitted license amendments to NRC to revise the minimum temperature for criticality.

Further details concerning these events are in a 10 CFR Part 21 report to NRC prepared for the Zion plant, dated March 18, 1993, and in Indian Point 3 Licensee Event Report 93-046-00, dated December 1, 1993.

Discussion

For transient analysis performed for hot-zero-power cases, small changes (e.g., 3 °C [6 °F]) in initial conditions such as allowed by standard technical specifications would have a negligible impact on analysis results. However, if PWRs are allowed to achieve criticality significantly below the temperature that was previously analyzed at hot-zero-power, the following safety concerns would be raised:

(1) The transient analyses, such as "rod withdrawal from subcritical," "rod ejection," "zero power feedwater malfunction," and "boron dilution event" documented in the Final Safety Analysis Report, might not have been analyzed at temperatures below hot-zero-power and could be non-conservative. This could cause the analyses results with small margins to violate specified fuel design limits (i.e., centerline fuel melt or departure from nucleate boiling) for one or more of these postulated transients.

(2) The response of the power range ex-core nuclear instrumentation may be adversely effected by the increased density of the reactor coolant at lower temperatures. This could result in a higher power being reached before a power range reactor trip occurs which might violate specified fuel design limits for transients that rely on this trip.

(3) The moderator temperature coefficient will become more positive, perhaps causing a violation of existing technical specifications. Higher values of moderator temperature coefficient could exceed those used in some of the transient safety analyses. A more positive moderator temperature coefficient at power would result in reactivity insertion that could increase the consequences of an anticipated-transient-without-scram event.

New analyses may justify criticality at somewhat lower temperatures. For example, Commonwealth Edison Company performed the necessary safety analyses for the Zion station and the staff approved a technical specification amendment to change the minimum temperature for criticality to 277 °C [530 °F].

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 Project Support
Office of Nuclear Reactor Regulation

Technical contact: George A. Schwenk, NRR
(301) 504-2814

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-74	Facility Management Responsibilities for Purchased or Contracted Services for Radiation Therapy Programs	10/13/94	All U.S. Nuclear Regulatory Commission Medical Licensees.
94-73	Clarification of Criticality Reporting Criteria	10/12/94	All fuel fabrication facilities.
94-72	Increased Control Rod Drop Time from Crud Buildup	10/05/94	All holders of OLs or CPs for pressurized water reactors.
94-71	Degradation of Scram Solenoid Pilot Valve Pressure and Exhaust Diaphragms	10/04/94	All holders of OLs or CPs for boiling water reactors (BWRs).
94-70	Issues Associated with Use of Strontium-89 and Other Beta Emitting Radiopharmaceuticals	09/29/94	All U.S. Nuclear Regulatory Commission Medical Licensees.
94-69	Potential Inadequacies in the Prediction of Torque Requirements for and Torque Output of Motor-Operated Butterfly Valves	09/28/94	All holders of OLs or CPs for nuclear power reactors.
94-68	Safety-Related Equipment Failures Caused by Faulted Indicating Lamps	09/27/94	All holders of OLs or CPs for nuclear power reactors.
94-67	Problem with Henry Pratt Motor-Operated Butterfly Valves	09/26/94	All holders of OLs or CPs for nuclear power reactors.
94-66	Overspeed of Turbine-Driven Pumps Caused by Governor Valve Stem Binding	09/19/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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*SEE PREVIOUS CONCURRENCE

SRXB/DSSA	OGCB/DORS	Tech Ed	SC:SRXB/DSSA	C:SRXB/DSSA	D:DSSA
GSchwenk*	PCWen*	RFSanders*	LPhillips*	RCJones*	GMHolahan*
08/31/94	08/31/94	09/01/94	09/12/94	09/12/94	09/14/94

C:OTSB/DORS	AC:OGCB/DORS	D:DOPS
CIGrimes*	ELDoolittle*	BKGrimes
09/19/94	09/20/94	10/7/94

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