

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON, DC 20555

May 17, 2005

NRC INFORMATION NOTICE 2005-12:   EXCESSIVELY LARGE CRITICALITY SAFETY  
LIMITS FAIL TO PROVIDE DOUBLE  
CONTINGENCY AT FUEL CYCLE FACILITY

**ADDRESSEES**

All licensees authorized to possess a critical mass of special nuclear material.

**PURPOSE**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform addressees of a concern related to criticality safety at fuel fabrication and other facilities processing, storing, or handling critical masses of fissile material. It is expected that licensees will review this information and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this IN are not new NRC requirements; therefore, no specific action nor written response is required.

**DESCRIPTION OF CIRCUMSTANCES**

During a recent plant-wide review of criticality safety analysis at a fuel cycle licensee, a licensee criticality safety engineer questioned the utility of a control scheme that relied on mass and moderator controls for double contingency in a large uranium dioxide powder hopper. Experience and process knowledge caused the engineer to believe that the controls were too high and that exceeding one limit could lead to a critical configuration under credible circumstances, without requiring the other limit to be exceeded.

Licensee investigation revealed that the system had previously relied on a level limit and that during a revision of the safety basis, the controls had been changed to support new mass and moderator limits. The licensee determined that the new mass and moderator limits had been derived from the previous level limit (i.e., by determining how much mass was present at the maximum allowed level and then determining how much moderator was required to make the system critical in that configuration). There was no accompanying analysis to demonstrate that the new values were actually limiting. The licensee demonstrated that, in fact, increasing the amount of mass could make the system critical without exceeding the moderation limit.

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## DISCUSSION

Under 10 CFR Parts 70 and 76, certain licensees processing, storing, or handling critical masses of fissile material are required to analyze accident scenarios leading to criticality, establish subcritical limits, and provide reliable controls to provide an acceptable level of assurance that the subcritical limits are not exceeded. Dual, independent controls provide the basis for double contingency protection against inadvertent criticality. Fuel cycle licensees generally implement criticality safety controls on important process parameters that, when upset, may create a critical system.

NRC has several concerns about this issue. The first is that the practice of deconstructing an existing criticality safety limit was apparently the licensee's common practice, which many licensee criticality safety engineers used for years, resulting in a number of questionable control arrangements in the technical safety basis. This practice is associated with an expansion of an established limit. The second concern is the failure to perform needed analysis to assure that newly developed criticality safety limits would not lead to a critical system by their individual failure and would ensure double contingency. No explicit modeling was performed for this analysis, and such modeling is not normally performed for limits not based on computer analysis due to conservatism normally employed. The final concern is the failure of licensee technical reviewers and management to detect the excessively high limits during routine review and approval. Review of these new limits did not include thorough examination and questioning of existing technical analysis and assumptions.

Failure to establish and maintain fully independent nuclear criticality safety controls exposes fuel cycle licensees to the possibility of failure of double contingency. Licensees should consider actions, as appropriate, to identify and mitigate this vulnerability. Appropriate actions may include: (1) identification of double contingency arrangements based on tabulated values, hand calculations, or other related approximations, such as one-dimensional computer analysis, that may result in the questionable limits being identified, (2) analysis to establish the adequacy of the controls intended to support the limits identified in item (1), and (3) incorporation of appropriate requirements into routine review and approval protocol to assure implementation of suitably robust double contingency arrangements when new criticality safety limits are derived from previous limits.

## CONTACT

This IN requires no specific action nor written response. Questions about this matter may be referred to the technical contact listed below.

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Attachment: "List of Recently Issued NMSS Generic Communications"

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

**Recently Issued NMSS Generic Communications**

Date	GC No.	Subject	Addressees
04/18/05	RIS-05-06	Reporting Requirements for Gauges Damaged at Temporary Job Sites	All material licensees possessing portable gauges, regulated under 10 CFR Part 30.
04/14/05	RIS-05-04	Guidance on the Protection of Unattended Openings that Intersect a Security Boundary or Area	All holders of operating licenses or construction permits for nuclear power reactors, research and test reactors, decommissioning reactors with fuel on site, Category 1 fuel cycle facilities, critical mass facilities, uranium conversion facility, independent spent fuel storage installations, gaseous diffusion plants, and certain other material licensees.
02/28/05	RIS-05-003	10 CFR Part 40 Exemptions for Uranium Contained in Aircraft Counterweights - Storage and Repair	All persons possessing aircraft counterweights containing uranium under the exemption in 10 CFR 40.13(c)(5).
05/17/05	IN-05-013	Potential Non-conservative Error in Modeling Geometric Regions in the Keno-v.a Criticality Code	All licensees using the Keno-V.a criticality code module in Standardized Computer Analyses for Licensing Evaluation (SCALE) software developed by Oak Ridge National Laboratory (ORNL)
05/17/05	IN-05-012	Excessively Large Criticality Safety Limits Fail to Provide Double Contingency at Fuel Cycle Facility	All licensees authorized to possess a critical mass of special nuclear material.
04/07/05	IN-05-010	Changes to 10 CFR Part 71 Packages	All 10 CFR Part 71 licensees and certificate holders.

04/01/05	IN-05-007	Results of HEMYC Electrical Raceway Fire Barrier System Full Scale Fire Testing	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, and fuel facilities licensees.
03/10/05	IN-05-005	Improving Material Control and Accountability Interface with Criticality Safety Activities at Fuel Cycle Facilities	All licensees authorized to possess a critical mass of special nuclear material.

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