

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

October 31, 2005

NRC INFORMATION NOTICE 2005-28: INADEQUATE TEST PROCEDURE FAILS TO  
DETECT INOPERABLE CRITICALITY ACCIDENT  
ALARM HORNS

**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 alarms at fuel fabrication facilities, nuclear power plants, 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. Suggestions contained in this IN are not NRC requirements; therefore, no specific action nor written response is required.

**DESCRIPTION OF CIRCUMSTANCES**

Under 10 CFR 70.24 and 10 CFR 76.89, certain licensees possessing, storing, or handling critical masses of fissile material are required to maintain a criticality accident alarm system that is capable of detecting the minimum accident of concern in fissile material operations and annunciating a clearly audible signal that will cause the immediate evacuation of affected persons to a safe location. All areas of fuel cycle facilities licensed under these regulations are required to be covered by event detection and alarm signaling devices. In addition, certain 10 CFR Part 50 licensees are required, as part of their licensing basis for new and spent fuel storage, to maintain a criticality accident alarm system in accordance with the 10 CFR Part 70 regulations.

A fuel cycle licensee conducted monthly tests of the site criticality accident alarm system by sounding the horns while designated employees listened for the alarm. The licensee relied on all employees to report questionable alarm audibility. Subsequent to a recent routine criticality alarm system test at the facility, a licensee maintenance manager questioned audibility and directed maintenance staff to check all criticality accident alarm horns in the system. The horn operability check resulted in the discovery that eight horns were inoperable and that the criticality alarm system was inaudible at several exterior locations.

The fuel cycle licensee in this situation used multiple, independent criticality accident alarm detector/annunciator systems to accomplish coverage of the facility. The licensee facility was physically large, and used several independent criticality alarm systems. Multiple, independent

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criticality alarm systems were used because the licensee desired that employees only evacuate if they would be affected by the criticality event detected as defined by horn audibility. Detector and annunciator (horn) coverage of exterior areas was not fully redundant, resulting in the necessity for individual systems to be able to annunciate events in their area of coverage without the assistance of other systems. Four out of five horns on one exterior system became inoperable over time so that an alarm from that system could not be heard in a large portion of its area of coverage, including locations with high ambient noise levels and the interior of two buildings containing non-fissile operations.

## **DISCUSSION**

The criticality alarm concern arises when licensees fail to detect inoperable criticality alarm system annunciators (horns) during routine testing, and an inaudible criticality alarm situation is not corrected. Two factors contributed to the problem. First, the test procedure sounded horns in groups and did not routinely check individual horns for operability. Inoperable horns were not always detected during the criticality alarm routine tests and, in fact, could go undetected until many horns were inaudible and a large part of the facility was not receiving an audible alarm. Second, the licensee relied on all employees to report inaudibility, but employees did not fully understand requirements for criticality alarm horn response during system audibility testing. In fact, employees were trained to react only to audible alarms. The affected buildings involved intermittent work operations so that, even though the criticality alarm system horns involved were rated at approximately 100 decibels, employees working in the area did not recognize that the horns never sounded.

The NRC concern about this issue is that failure to adequately test a criticality alarm system for audibility may cause an inaudible condition to go undetected for an indefinite amount of time. This event likely occurred because licensee training did not result in employees understanding that inoperable horns in a work area were required to be reported and testing procedures did not result in detection and correction of inoperable horns.

Failure to maintain audibility of the criticality alarm system exposes licensees to the possibility that affected employees will not evacuate during an actual criticality event. NRC inspections of criticality alarm systems typically include review of criticality accident alarm audibility test procedures, employee emergency response training, criticality accident alarm detector/annunciator coverage, and criticality accident alarm outage procedures.

## CONTACT

This information notice does not require any specific action or written response. Please direct any questions about this matter to the technical contact below, or the appropriate regional office.

**/RA/**

Patrick L. Hiland, Chief  
Reactor Operations Branch  
Division of Inspection Program Management  
Office of Nuclear Reactor Regulation

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Attachment: List of Recently Issued NMSS Generic Communications

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### ADAMS ACCESSION #: ML052720579

OFC	FCSS/TSG	Tech ED	FCSS/TSG	NRR	NRR
<b>NAME</b>	DMorey:dw	Ekraus: by fax	MGalloway	VHodge	JWermiel
<b>DATE</b>	9/ 30 /05	10/ 04 /05	10/ 06 /05	10/ 24 /05	10/ 24 /05
OFC	NRR	NRR	NRR	FCSS	
<b>NAME</b>	IJung	MJRoss-Lee	PHiland	RPierson	
<b>DATE</b>	10/ 27 /05	10/ 27 /05	10/ 28 /05	10/ 31 /05	

**Recently Issued NMSS Generic Communications**

Date	GC No.	Subject	Addressees
2/11/05	BL-05-01	Material Control and Accounting at Reactors and Wet Spent Fuel Storage Facilities	All holders of operating licenses for nuclear power reactors, decommissioning nuclear power reactor sites storing spent fuel in a pool, and wet spent fuel storage sites.
8/25/05	RIS-05-18	Guidance for Establishing and Maintaining a Safety Conscious Work Environment	All licensees, applicants for licenses, holders of certificates of compliance, and their contractors subject to NRC authority
8/10/05	RIS-05-16	Issuance of NRC Management Directive 8.17, "Licensee Complaints Against NRC Employees"	All licensees and certificate holders.
8/3/05	RIS-05-15	Reporting Requirements for Damaged Industrial Radiographic Equipment	All material licensees possessing industrial radiographic equipment, regulated under 10 CFR Part 34.
7/13/05	RIS-05-13	NRC Incident Response and the National Response Plan	All licensees and certificate holders.
7/11/05	RIS-05-12	Transportation of Radioactive Material Quantities of Concern NRC Threat Advisory and Protective Measures System	Licensees authorized to possess radioactive material that equals or exceeds the threshold values in the Additional Security Measures (ASM) for transportation of Radioactive Material Quantities of Concern (RAMQC) under their 10 CFR Part 30, 32, 50, 70, and 71 licenses and Agreement State licensees similarly authorized to possess such material in such quantities under their Agreement State licenses.
7/11/05	RIS-05-11	Requirements for Power Reactor Licensees in Possession of Devices Subject to the General License Requirements of 10 CFR 31.5	All holders of operating licenses for nuclear power reactors and generally licensed device vendors.

**Recently Issued NMSS Generic Communications**

Date	GC No.	Subject	Addressees
6/10/05	RIS-05-10	Performance-Based Approach for Associated Equipment in 10 CFR 34.20	All industrial radiography licensees and manufacturers and distributors of industrial radiography equipment.
4/18/05	RIS-05-06	Reporting Requirements for Gauges Damaged at Temporary Job Sites	All material licensees possessing portable gauges, regulated under 10 CFR Part 30.
4/14/05	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.
2/28/05	RIS-05-03	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).
10/07/05	IN-05-27	Low Dose-Rate Manual Brachytherapy Equipment Related Medical Events	All medical licensees.
7/29/05	IN-05-22	Inadequate Criticality Safety Analysis of Ventilation Systems at Fuel Cycle Facilities	All licensees authorized to possess a critical mass of special nuclear material.
6/23/05	IN-05-17	Manual Brachytherapy Source Jamming	All medical licensees authorized to possess a Mick applicator.

**Recently Issued NMSS Generic Communications**

Date	GC No.	Subject	Addressees
5/17/05	IN-05-13	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)
5/17/05	IN-05-12	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.
4/7/05	IN-05-10	Changes to 10 CFR Part 71 Packages	All 10 CFR Part 71 licensees and certificate holders.
4/1/05	IN-05-07	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.
3/10/05	IN-05-05	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.

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