

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

March 10, 2005

NRC INFORMATION NOTICE 2005-05: IMPROVING MATERIAL CONTROL AND
ACCOUNTABILITY INTERFACE WITH
CRITICALITY SAFETY ACTIVITIES AT FUEL
CYCLE FACILITIES

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 safety concern related to criticality safety at fuel fabrication and other facilities processing, storing, or handling critical masses of fissile material. The safety concern arises when licensees fail to establish and maintain a communication process between criticality safety staff and material control and accountability (MC&A) staff, in order to support timely identification of fissile material-related process upsets that challenge the criticality safety basis for the facility. 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 Parts 70 and 76, certain licensees processing, storing, or handling critical masses of fissile material are required to analyze accident scenarios leading to criticality and provide reliable controls to assure that inadvertent criticality events are highly unlikely. Recently, a licensee reported an event, to the NRC, concerning operation of an incinerator outside of the approved safety basis. The licensee had performed a criticality safety evaluation of the incinerator approximately 8 years previously and had concluded that criticality was not credible outside of the primary combustion chamber.

The licensee nuclear criticality safety (NCS) analysis focused on accumulation of sufficient mass in the incinerator system to support criticality. Licensee NCS engineers concluded that very limited amounts of ash would carry over from the incinerator primary combustion chamber to the remainder of the incinerator system and that mass controls on the primary combustion chamber would limit uranium concentration in the ash to less than 21.6 percent throughout the incinerator system. This led the licensee's NCS engineers to conclude that criticality outside the primary combustion chamber was not credible due to normal operations and expected upsets.

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At the time that this NCS analysis was approved, licensee MC&A staff possessed sampling data showing concentration levels above 21.6 percent uranium in some parts of the incinerator system. In addition, licensee MC&A staff were aware, from approximately 15 years of operational experience, that substantial amounts of fissile material routinely accumulated in parts of the incinerator system where criticality analysis assumed minimal accumulation.

The material accumulation event was identified initially when a licensee criticality safety engineer reviewed MC&A sampling data. Subsequent investigation of the event by the licensee revealed that ash deposits at various locations in the incinerator routinely exceeded the 21.6 percent uranium concentration assumed to be bounding for ash and that the mass of ash deposited also exceeded expectations. Licensee review of MC&A sampling records confirmed that both concentration and deposit information were known prior to approval of the original NCS analysis.

The amount of fissile material that accumulated in the uncontrolled parts of the incinerator system exceeded a critical mass. Extensive investigation by the licensee and the NRC revealed a poor interface between licensee criticality safety and MC&A staff. This poor interface, resulting from failing to require routine interaction, apparently was a factor in the failure to identify the process upset before the event occurred.

Discussion

Two issues from this event are of concern to the NRC. The first issue is that licensee NCS staff had not ensured that MC&A staff were familiar with the criticality safety basis for the incinerator system. Specifically, MC&A staff were not aware of the basic assumption that fissile material would not accumulate in the upper chamber or flue. Had MC&A staff been made aware of this assumption, they would likely have identified the reality of incinerator ash deposition and caused the NCS staff to place additional criticality controls on at least those two sections of the incinerator system.

The second issue is that the MC&A sampling data routinely reported mass and concentration values that challenged the criticality safety basis, and this fact was not recognized by criticality safety engineers because the data were not routinely provided to them.

Licensee NCS staff are familiar with the criticality safety basis and underlying assumptions. MC&A staff have a general knowledge of where material is currently located and where process hold-up is likely to occur. Communication between these two organizations is necessary to assure that the criticality safety basis is not violated.

Failure to establish appropriate interactions between criticality safety and MC&A staff exposes fuel cycle licensees to this type of programmatic failure. Licensees should consider actions, as appropriate, to mitigate this vulnerability. NCS staff should be familiar with MC&A sampling methodology and data reporting and should routinely review MC&A reports for location of material in relation to the criticality safety basis. MC&A staff should be trained on the criticality

safety basis, particularly bounding assumptions about fissile material accumulation, and should routinely review new or changed NCS analyses.

This IN requires no specific action nor written response. If you have any questions about the information in this notice, please contact the technical contact listed below.

/RA/

Robert C. Pierson, Director
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Technical Contact: Dennis Morey, NMSS
301-415-6107
e-mail: dcm@nrc.gov

Attachment: List of Recently Issued NMSS Generic Communications

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|-------------|-----------|--------------|----------------|-----------|-----------|
| OFC | TSG | FCFB | Tech ED | TSG | NSIR |
| NAME | DMorey:dw | JMuszkiewicz | Ekraus: by fax | MGalloway | MWilliams |
| DATE | 2/ 22 /05 | 3/ 01 /05 | 2/ 28 /05 | 2/ 28 /05 | 3/ 09 /05 |

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|-------------|-----------|--|
| OFC | FCSS | |
| NAME | RPierson | |
| DATE | 3/ 10 /05 | |

Recently Issued NMSS Generic Communications

| Date | GC No. | Subject | Addressees |
|------------|------------|--|---|
| 12/16/2004 | RIS-04-020 | NRC Regulatory issue Summary 2004-20: Lessons Learned from Review of 10 CFR Parts 71 and 72 Applications | All holders of, and applicants for, a (1) 10 CFR Part 71 certificate of compliance for a radioactive material transportation package; (2) 10 CFR Part 72 certificate of compliance for a spent fuel storage cask; and (3) 10 CFR Part 72 specific license for an independent spent fuel storage installation (ISFSI). |
| 12/01/2004 | RIS-04-018 | NRC Regulatory Issue Summary 2004-18: Expiration Date for 10 CFR Part 71 Quality Assurance Program Approvals | All holders of U.S. Nuclear Regulatory Commission (NRC)-approved 10 CFR Part 71 Quality Assurance Programs (QAPs). |
| 11/23/2004 | RIS-04-017 | NRC Regulatory Issue Summary 2004-17: Revised Decay-in-Storage Provisions for the Storage of Radioactive Waste Containing Byproduct Material | All licensees regulated under 10 CFR Parts 30, 32, 33, and 50. |
| 10/26/2004 | IN-04-018 | Recent Safety-Related Event at Panoramic Wet-source-Storage Irradiator | All licensees authorized to possess and use sealed sources in panoramic wet-source-storage irradiators, and irradiator vendors. |
| 07/19/2004 | IN-04-014 | Use of less than Optimal Bounding Assumptions in Criticality Safety Analysis 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.