

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

July 29, 2005

NRC INFORMATION NOTICE 2005-22: INADEQUATE CRITICALITY SAFETY ANALYSIS  
OF VENTILATION SYSTEMS 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 alert addressees to a safety concern arising from inadequate criticality safety analysis of ventilation systems at fuel cycle facilities. 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 IN are not new NRC requirements; therefore, no specific action nor written response is required.

**DESCRIPTION OF CIRCUMSTANCES**

Recently, two events occurred at NRC-licensed fuel cycle facilities involving the failure to implement criticality safety controls on process off-gas or ventilation systems when minor differences between otherwise similar systems, analyzed under a single broad criticality analysis, were not recognized by criticality safety analysts. The first instance was noted subsequent to a backflow event in an off-gas line from a uranium dissolver. The licensee used a single criticality safety analysis for ventilation systems in the facility. The ventilation analysis took credit for off-gas piping typically having either a siphon break and a drain, or two drains.

However, a concern about off-gas accumulation in an enclosed area led to a design modification for the off-gas line on the uranium dissolver such that only one drain was in the system. During preparation of the facility criticality safety analysis, criticality safety analysts failed to recognize that the design difference defeated the siphon break so that double contingency was not established.

The second instance was noted when a fuel cycle licensee observed an accumulation of uranium dioxide powder in a high-efficiency particulate air (HEPA) filter housing where no uranium was expected. The licensee determined that what criticality safety analysts thought was a breathing air-ventilation system was also connected to a process off-gas line from a hood on a uranium oxidation furnace. The licensee identified a design difference in the system in that ventilation and off-gas lines were connected differently, as they approached the HEPA filter, than was customary in the remainder of the plant. The licensee had several broad criticality safety analysis packages related to ventilation and process off-gas, grouping them as

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breathing air, dry off-gas, and wet off-gas. The criticality safety analyst's failure to recognize the design difference in duct connections in one part of the plant from other areas of the plant led to the incorrect determination that the system was breathing air and criticality was not credible. This incorrect determination resulted in the failure to implement criticality safety controls typical for off-gas ventilation in the plant.

## **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 and provide reliable controls to assure that inadvertent criticality events are highly unlikely. When processes, systems, equipment, or procedures are repeated in a facility, licensees frequently elect to combine similar processes, systems, equipment, or procedures into a single criticality analysis. The safety concern arises when modifications resulting in minor design differences between otherwise similar systems defeat the credited double-contingency arrangement or non-credibility determination.

In the two events described, the two licensees used a single criticality safety analysis to develop controls for groups of ventilation and process off-gas systems that were similar in form and function. While crafting the analyses, developing the criticality safety controls, and implementing the credited controls, licensee criticality safety analysts failed to recognize design differences between the systems that defeated some of the assumptions or credited controls used in some portion of the facility.

In the first instance, a design change occurred, during construction of the system, that involved placing an additional column into the system that effectively defeated the siphon break for the uranium dissolver. The criticality safety review for this design change looked at the analysis for the process, but did not consider the impact that the change would have on off-gas ventilation. In the second instance, contractors were constructing a new facility, and criticality safety analysts did not recognize design differences in the ventilation system.

Minor design changes during construction of new processes or facilities are common at fuel cycle licensees and may have a subtle effect on criticality controls. Licensees should consider actions, as appropriate, to mitigate this vulnerability. These actions could include reviewing all criticality safety analyses that group similar systems, to assure that all assumptions regarding the forms and functions of the systems are valid for all applications. Actions could also include verifying that the design change review process is adequate to trigger an in-depth criticality safety review for changes arising during construction.

The Part 70 integrated safety analysis (ISA) and the Part 76 safety analysis report (SAR) provide an integrated approach to assure that inter-relationships between accident scenarios and their controls are appropriately evaluated during related design and change activities. Licensees should consider whether their ISA/SAR provides an adequate integrated review of ventilation and related systems.

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](mailto:dcm@nrc.gov)

Attachment: "List of Recently Issued NMSS Generic Communications"

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**ADAMS ACCESSION #: ML051890406**

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<b>DATE</b>	07/ 08 /05	07/ 12 /05	07/ 20 /05	07/ 29 /05

**Recently Issued NMSS Generic Communications**

Date	GC No.	Subject	Addressees
07/13/05	RIS-05-13	NRC Incident Response and the National Response Plan	All licensees and certificate holders.
07/11/05	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.
06/10/05	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.
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.
6/23/05	IN-05-17	Manual Brachytherapy Source Jamming	All medical licensees authorized to possess a Mick applicator.
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.

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