

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

February 22, 2000

NRC INFORMATION NOTICE 2000-02: FAILURE OF CRITICALITY SAFETY CONTROL TO  
PREVENT URANIUM DIOXIDE (UO<sub>2</sub>) POWDER  
ACCUMULATION

Addressees:

All Nuclear Regulatory Commission (NRC) licensed fuel-cycle conversion, enrichment, and fabrication facilities.

Purpose:

The NRC is issuing this information notice to alert addressees to a problem recently noted with safety-significant level probes that are not self-checking. A level probe in a uranium dioxide (UO<sub>2</sub>) powder hopper failed without indicating a failed condition due to a broken connector in the level-probe circuit. This allowed UO<sub>2</sub> powder to accumulate in a hopper and approach the criticality safety mass limit before discovery. Recipients are expected to review this information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. Suggestions contained in this information notice are not NRC requirements. Therefore, no specific action nor written response is required.

Description of Circumstances:

On August 5, 1999, a fuel cycle facility operator noticed that dry UO<sub>2</sub> powder was not coming out of a granulator while the granulator was operating. Powder was being automatically fed to the equipment at the time and a level probe was monitoring the powder level in the feed hopper as a primary nuclear criticality safety control. The licensee determined that powder had blocked the compaction section of the granulator and an unusual amount of dry UO<sub>2</sub> powder had accumulated in the powder hopper. The powder accumulation was not detected by the level-probe on the feed hopper because the probe had failed due to a broken connector in the level-probe circuit.

Discussion:

A fuel cycle licensee achieves uniform fuel particle size with equipment that compacts UO<sub>2</sub> powder into a ribbon and then grinds up the compacted powder. Powder is added to the equipment from safe-geometry containers called polypacks. A known difficulty with this

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equipment is that the ribbon of compacted  $\text{UO}_2$  can jam and block the material flow. The safety of the operation was assured by limiting mass and moderator in the equipment. Primary criticality safety controls on mass included operator monitoring of the equipment, an interlock system limiting the number of polypacks that can be added, and a level-probe in the powder hopper that feeds the compactor.

An operator assigned to the compactor/granulator equipment observed that powder was not coming out of the granulator while the equipment was in operation and powder was being automatically fed to the compactor. The operator subsequently discovered that an unusual amount of dry  $\text{UO}_2$  powder had accumulated in the hopper that feeds the compactor. Licensee investigation revealed that the powder hopper level-probe, which was intended to detect this type of failure, did not work due to a broken connector in the level-probe circuit. Additionally, the licensee determined that the limit on the number of polypacks that could be added to the powder hopper was set too high to prevent the mass limit in the hopper from being reached. Also the licensee determined that required visual checks for powder accumulation were set at twice per shift without specific instructions on the required interval. Operators were allowed to perform the checks at the beginning and end of a shift which was too long an interval to ensure that the mass of  $\text{UO}_2$  powder did not exceed the mass limit in the hopper.

The primary contributing factor to the event was that the level-probe on the compactor/granulator powder hopper did not self-indicate failure and alert the licensee to a lost control. A properly functioning level probe would have indicated the powder accumulation in the hopper before the powder approached safety limits. A self-indicating circuit would have informed the licensee of probe failure so that corrective actions could be taken to restore the control.

Additional contributing factors were that the limit on the number of polypacks automatically added to the hopper was set too high to protect against exceeding the mass limit and that the interval between required visual checks was allowed to be too long to assure that accumulations would be seen before the mass limit was exceeded.

This event highlights the need to establish the availability and reliability of safety-significant controls involving nuclear criticality safety under all credible upsets. Licensees should evaluate the need for safety-significant electronic equipment to be self-checking. Licensees should also establish that supporting criticality safety controls will actually perform their intended function.

It is expected that addressees will evaluate the above information for applicability to licensed activities. This information notice requires no specific actions nor written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate regional office.

Michael F. Weber, Director  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Nuclear Material Safety  
and Safeguards

Technical Contact: Sheryl A. Burrows, NMSS  
301-415-6667  
E-mail: [sab2@nrc.gov](mailto:sab2@nrc.gov)

Attachments:

1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices

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\*See previous concurrences

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LIST OF RECENTLY ISSUED  
NMSS INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
99-33	Management of Wastes Contaminated With Radioactive Materials	12/28/99	All medical licensees
99-32	The Effect of the Year 2000 Issues on Medical Licensees	12/17/99	All NRC medical licensees
99-31	Operational Controls to Guard Against Inadvertent Nuclear Criticality	11/17/99	All NRC licensed fuel cycle conversion, enrichment and fabrication facilities
99-30	Failure of Double Contingency Based on Administrative Controls Involving Laboratory Sampling and Spectroscopic Analysis of Wet Uranium Waste	11/8/99	All fuel cycle licensees and certificates performing laboratory analysis to determine uranium content, in support of administrative criticality safety controls
99-29	Authorized Contents of Spent Fuel Casks	10/28/99	All power reactor licensees and spent fuel storage licensees and applicants
99-28	Recall of Star Brand Fire Protection Sprinkler Heads	9/30/99	All holders of licenses for nuclear power, research and test reactors, and fuel cycle facilities
99-27	Malfunction of Source Retraction Mechanism in Cobalt-60 Teletherapy Treatment Units	9/2/99	All medical licensees authorized to conduct teletherapy treatments
99-26	Safety and Economic Consequences of Misleading Marketing Information	8/24/99	All Distributors and/or Manufacturers of Generally Licensed Products
99-24	Broad-Scope Licensees' Responsibilities for Reviewing and Approving Unregistered Sealed Sources and Devices	7/12/99	All medical licensees' of broad-scope and master materials licensees

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
2000-01	Operational Issues Identified in Boiling Water Reactor Trip and Transient	2/11/2000	All holders of licenses for nuclear power reactors
99-34	Potential Fire Hazard in the use of Polyalphaolefin in Testing of Air Filters	12/28/99	All holders of licenses for nuclear reactors and fuel cycle facilities
99-33	Management of Wastes Contaminated With Radioactive Materials	12/28/99	All medical licensees
99-32	The Effect of the Year 2000 Issues on Medical Licensees	12/17	All NRC medical licensees
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99-29	Authorized Contents of Spent Fuel Casks	10/28/99	All power reactor licensees and spent fuel storage licensees and applicants
99-01, Rev. 1	Degradation of Prestressing Tendon Systems in Prestressed Concrete Constrainments	10/7/99	All holders of operating licensees for nuclear power reactors
99-28	Recall of Star Brand Fire Protection Sprinkler Heads	9/30/99	All holders of licenses for nuclear power, research and test reactors, and fuel cycle facilities