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

October 3, 1990

NRC INFORMATION NOTICE NO. 90-63: MANAGEMENT ATTENTION TO THE ESTABLISHMENT AND MAINTENANCE OF A NUCLEAR CRITICALITY SAFETY PROGRAM

Addressees:

All fuel cycle licensees and other licensees possessing more than critical mass quantities of special nuclear material.

Purpose:

This information notice is provided to alert addressees to an incident resulting from inadequate management attention to the establishment and maintenance of a nuclear criticality safety program. The licensee's inattention to Information Notice No. 89-24, Nuclear Criticality Safety, dated March 6, 1989, may have been a contributing factor in the incident. It is expected that licensees will review this information and the 1989 Information Notice for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this Information Notice do not constitute U.S. Nuclear Regulatory Commission (NRC) requirements; therefore, no specific action or written response is required.

Description of Circumstances:

In March 1990, a licensee's routine sample analysis for a Raschig-ring filled waste collection tank (a non-favorable geometry vessel) yielded a concentration of approximately 2 grams of highly enriched uranium per liter of solution. Contents of the tank are normally transferred to a second larger tank (a non-favorable geometry vessel without Raschig rings) at a release limit of 0.01 grams uranium per liter. The analysis of a second sample confirmed that a major upset had occurred in the waste collection system. Consequently, the waste processing area was shutdown, and the waste collection tank was isolated. Corrective actions were taken to recover the uranium (in excess of 4 kilograms).

The licensee's investigation team concluded that the contents of two favorable diameter 11-liter cylinders, one or both containing high concentration solution, had been dumped into a sump used to pump solution to the waste collection tank. By procedure, operators were allowed to dump low concentration uranium solutions into the sump after receiving authorization and key access from supervisors. Findings which supported the team's conclusion are: (1) the quantity of uranium in the tank, (2) an operator's statement that two 11-liter cylinders of process

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Encl: As stated

solution were poured into the sump, (3) traces of yellow uranium solids in the sump and filter, and (4) ineffective isolation of the sump caused by failure to perform maintenance and to conduct access control. The investigation team also speculated that one or both of the 11-liter cylinders had been mislabelled based on an operator's statement that 11-liter cylinders were mislabelled in the past and the team's observation of an 11-liter cylinder of high concentration solution that was improperly labelled.

The failure of the licensee's management control systems resulted in an unsafe transfer of the uranium solution through the sump into the collection tank. Both the sump and the collection tank had risks of a criticality event and no controls remained. Even though the administrative control led to the detection of the high concentration of uranium and precluded its transfer to the second larger tank, an additional unsafe transfer could have occurred with only one unlikely, independent, and concurrent change in process conditions (viz., recording the wrong analysis or using the wrong sample analysis, etc.). In both the actual incident and the postulated case of transfer of concentrated solution to the second larger tank, controls to satisfy the double contingency principle were not implemented.

Discussion:

This event and those events described in the 1989 Information Notice emphasize the need for continuing vigilance in providing a sound nuclear safety program. Although the licensee had a copy of the 1989 Information Notice on file, no action was taken to avoid similar events. Some of the recommendations made by the licensee's investigation team are listed below. Licensees are encouraged to review these recommendations, the 1989 Information Notice, and their own programs to ensure nuclear criticality safety.

- Eliminate sumps and install piping to transfer waste solutions, thereby, eliminating the use of the 11-liter cylinders in this application.

- Evaluate the procedures and practices for affixing labels to 11-liter cylinders in all process areas.

- Install in-line detectors and totalizers on all streams to waste collection tanks containing Raschig rings. Consider automatic shutoff of the flow when a detected uranium concentration exceeds an acceptable nuclear criticality control limit.

- Install additional controls on all streams to the collection tank without Raschig rings. This should include an evaluation of interlocked valves, as well as valves controlled by in-line detectors or conductivity meters connected to an alarm system.

- Develop training material for, and train, first responders to unusual events.

- Retrain supervisory personnel on issues important to safety, labor relations, training, and emergency response.

- Evaluate the existing training program to ensure that personnel are trained and knowledgeable of assigned tasks in waste processing areas and of nuclear criticality safety issues, including selected criticality accident histories.

- Reevaluate all nuclear criticality safety analyses to ensure proper application of the double contingency principle, with emphasis on unsafe geometry vessels.

- Reevaluate the audit and inspection programs to ensure that management control systems are being properly implemented.

- Review operating procedures for accuracy and completeness.

- Retrain personnel with procedural requirements with emphasis on mandatory compliance.

No specific action or written response is required by this Information Notice. If you have any questions, please contact the technical contacts listed below or the Regional Administrator of the appropriate regional office.

Glen L Sjoblom for

Richard E. Cunningham, Director
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

Technical Contacts: Edward McAlpine, Region II
(404) 331-5547

W. Scott Pennington, NMSS
(301) 492-0693

Attachments:
1. Information Notice No. 89-24,
Nuclear Criticality Safety,
dtd March 6, 1989
2. List of Recently Issued
NMSS Information Notices
3. List of Recently Issued
NRC Information Notices

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

March 6, 1989

NRC INFORMATION NOTICE NO. 89-24: NUCLEAR CRITICALITY SAFETY

Addressees:

All fuel cycle licensees and other licensees possessing more than critical mass quantities of special nuclear material.

Purpose:

This information notice is being provided to alert addressees to potential problems resulting from inadequate administration and application of the double contingency principle in establishing nuclear criticality safety limits and controls. It is expected that licensees will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute U.S. Nuclear Regulatory Commission (NRC) requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The double contingency principle, as used in ANSI/ANS-8.1-1983*, states that "Process designs should, in general, incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible." Proper application of the double contingency principle provides assurance that no single error or loss of a control will lead to the possibility of a criticality accident.

In March 1988, an NRC licensee was authorized to operate a new pilot plant operation involving highly enriched uranium solution. Provisions were made to remove liquid scrap in 2.5 liter bottles from the operations area (Area 1). Because of increased quantities of scrap solution and lack of temporary storage, an alternate liquid-handling process was established. The alternate method allowed both dilute and concentrated scrap solution to be stored in 11-liter bottles in the same area. After an analysis of a single sample, the 11-liter bottles of dilute scrap solution were to be transferred to an adjacent area (Area 2) and emptied into mass-limited 55-gallon drums.

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*American National Standard For Nuclear Criticality Safety in Operations With Fissionable Materials Outside Reactors, ANSI/ANS-8.1-1983.

 3pp.

During an inspection in July 1988, NRC personnel recognized that an operator could inadvertently transfer an unsafe quantity of scrap solution into a drum by either selecting the wrong bottle of solution or as a result of an erroneous sample analysis. Such an unsafe transfer could have been effected with only one unlikely, independent, and concurrent change in process conditions (viz., selecting the wrong bottle, recording the wrong analysis or using the wrong sample analysis, etc.) and hence, the double contingency principle was not satisfactorily implemented. Because this method of handling 11-liter bottles was somewhat similar to the handling method contributing to the Wood River Junction accident in 1964, the NRC inspectors expressed concern. The licensee immediately ceased all scrap handling and subsequently shutdown the entire process area to review the safety limits and controls.

Further review disclosed that the nuclear criticality safety analyst who had analyzed the process before startup was not familiar with the alternate scrap-solution-handling procedure. Administrators within the licensee's safety group had approved the change because a safe mass limit had been imposed on each drum in Area 2. The licensee claimed that the alternate method of solution-handling, permitted by procedure, had not been used because the material control and accounting restrictions made the method inefficient.

NRC personnel also noted that Area 2 contained several open 55-gallon drums. Area 2 was used to remove solids from Raschig ring filled drums which were used in Area 3 (scrap recovery). Raschig ring filled drums and drums of chemicals were taken from Area 2 into Area 3. Because a 55-gallon drum was involved in the Oak Ridge Y-12 accident, NRC personnel expressed concern with the lack of controls on open drums. The licensee immediately shutdown Areas 2 and 3 so that the nuclear criticality safety limits and controls could be re-examined.

Discussion:

These events highlight the need for continuing vigilance in providing a sound nuclear safety program. Some of the licensee's actions taken after the inspection are discussed here. Licensees are encouraged to review these actions and their own vigilance in assuring nuclear criticality safety.

A team led by a safety director from another of the licensee's nuclear facilities conducted an immediate audit of the three areas. The team consisted of safety and production personnel. The audit team confirmed NRC's findings and identified other safety items.

All nuclear criticality safety analyses were reviewed to ensure proper application of the double contingency principle. Documentation of analyses has been revised to provide explicit consideration of the double contingency principle.

The nuclear criticality safety analysis group now reviews all changes to nuclear criticality limits and controls. The administrative group can no longer approve seemingly simple changes such as authorizing new mass limits for work stations, based on established safe mass limits.

Production personnel were not involved in establishing nuclear safety limits and were not familiar with the above-mentioned nuclear criticality accidents. The safety training program has been revised to include selected accident histories.

All involved personnel, including production operators, have reviewed all procedures. Before startup of Areas 1, 2, and 3, procedures were revised to include nuclear safety limits and controls. Procedures in other plant areas will be revised to include safety limits.

Liquid scrap from Area 1 is now collected in favorable geometry containers. After analysis, the solution is transferred to a favorable geometry quarantine tank for a second analysis. Then the solution is transferred to uniquely identified favorable geometry containers, for transfer to the drums in Area 2.

Most 55-gallon drums in Area 2 have been eliminated by engineering redesign. Barriers and other controls are in place to prevent unauthorized transfer of drums into Area 3. Engineering studies are underway to eliminate or reduce the use of all unfavorable geometry containers in Area 3.

No specific action or written response is required by this information notice. If you have questions about this matter, please contact the technical contacts listed below or the Regional Administrator of the appropriate regional office.

Richard E Cunningham

Richard E. Cunningham, Director
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Medical Nuclear Safety
Office of Nuclear Material Safety
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Technical Contacts: Gerald Troup, Region II
(404) 331-5566

George Bidinger, NMSS
(301) 492-0683

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NMSS INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to:
90-62	Requirements for Import and Distribution of Neutron-Irradiated Gems	09/25/90	All irradiated gemstone importers and distributors, and all non-power reactor licensees
90-59	Errors in the use of Radioactive Iodine-131	09/17/90	All medical licensees
90-58	Improper Handling of Ophthalmic Strontium-90 Beta Radiation Applicators	09/11/90	All Nuclear Regulatory Commission (NRC) medical
90-56	Inadvertent Shipment of a Radioactive Source in a Container Thought to be Empty	09/04/90	All U.S. Nuclear Regulatory Commission (NRC) licensees
90-50	Minimization of Methane Gas in Plant Systems and Radwaste Shipping Containers	08/08/90	All holders of operating licenses or construction permits for nuclear power reactors
90-44	Dose-Rate Instruments Underresponding to the True Radiation Fields	06/29/90	All NRC licensees
90-38	Requirements for Processing Financial Assurance Submittals for Decommissioning	05/29/90	All fuel facility and materials licensees
90-35	Transportation of Type A Quantities of Non-Fissile Radioactive Materials	05/24/90	All U.S. Nuclear Regulatory Commission (NRC) Licensees

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90-61	Potential for Residual Heat Removal Pump Pump Damage Caused By Parallel Pump Interaction	9/20/90	All holders of OLs or CPs for nuclear power reactors.
90-60	Availability of Failure Data In the Government-Industry Data Exchange Program	9/20/90	All holders of OLs or CPs for nuclear power reactors.
90-59	Errors In the Use of Radioactive Iodine-131	9/17/90	All medical licensees.
90-58	Improper Handling of Ophthalmic Strontium-90 Beta Radiation Applicators	9/11/90	All NRC medical licensees.
90-57	Substandard, Refurbished Potter & Brumfield Relays Misrepresented As New	9/5/90	All holders of OLs or CPs for nuclear power reactors.
90-56	Inadvertent Shipment of A Radioactive Source In A Container Thought To Be Empty	9/4/90	All U.S. Nuclear Regulatory Commission (NRC) licensees.
90-55	Recent Operating Experience on Loss of Reactor Coolant Inventory While In A Shutdown Condition	8/31/90	All holders of OLs or CPs for nuclear power reactors.
83-44 Supp. 1	Potential Damage to Redundant Safety Equipment As A Result of Backflow Through the Equipment and Floor Drain System	8/30/90	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

- Develop training material for, and train, first responders to unusual events.

- Retrain supervisory personnel on issues important to safety, labor relations, training, and emergency response.

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Technical Contacts: Edward McAlpine, Region II
(404) 331-5547

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NAME:WSPennington:mh	RWilson:VLTharpe	GHBidinger	CHaughney	GSjoblom	RECunningham:
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- Development and implementation of training material for first responders to unusual events.

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