

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

June 19, 2007

NRC INFORMATION NOTICE 2007-22: RECENT HYDROGEN FLUORIDE EXPOSURES
AT FUEL CYCLE FACILITIES

ADDRESSEES

All fuel cycle licensees and certificate holders.

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees about recent hydrogen fluoride (HF) exposures. 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 occupational exposures to accidental releases of HF. These events highlight the need for fuel cycle facilities and their workers to be alert about the dangers of accidental releases of HF into the workplace, and for offsite medical facilities to be properly equipped and trained to handle medical incidents involving HF. If left untreated, or improperly treated, severe HF exposures may be fatal. Thus, immediate and continuous first-aid care and medical treatment are critical.

In the first event, a worker was hospitalized for the treatment of an HF chemical burn to the right forearm. Because the nitrogen reduction system was inoperable, a cylinder containing uranium hexafluoride (UF_6) had to be disconnected. A ventilation tent was placed over the cylinder so that a worker could disconnect and reconnect the pigtail. While removing the valve cap from the cylinder, the worker was exposed to a release of UF_6 and HF. The worker was wearing a supplied-air respirator; chemically resistant, wrist-length gloves; and long-sleeved coveralls. Within a short time, the worker noticed a blister forming on his arm in an area that was not covered by chemically resistant material. He was treated onsite with topical applications of calcium gluconate and taken to the hospital. Treatment at the hospital was initially delayed because personnel were unfamiliar with the specialized treatment for HF chemical burns and the hospital did not have a supply of calcium gluconate. This event illustrates the need to (1) ensure employees are provided appropriate personal protective clothing and equipment, and (2) for facilities to coordinate with their local hospitals, before an HF exposure occurs, to ensure prompt treatment.

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The second event involved HF vapor and resulted in the hospitalization of a worker for inhalation exposure. Two workers noted an unusual odor and immediately evacuated the process area. The workers obtained respiratory protection equipment and returned to the location to collect air samples, to determine the source of the leak. Air sample results showed that HF levels were elevated. The physical condition of both workers was evaluated by a supervisor. Because of latent symptoms, one worker later went to the hospital for further evaluation. Facilities and first-aid providers need to be aware that the onset of symptoms of an HF exposure may be delayed, especially in the case of exposure at low concentrations, and that treatment must be immediate.

DISCUSSION

Under 10 CFR Part 70, licensees are required to establish and maintain a safety program to protect workers, the public, and the environment from releases of hazardous chemicals resulting from the processing of licensed special nuclear material. In addition, certain Part 70 licensees are required to conduct an integrated safety analysis (ISA), to identify and evaluate hazards and potential accident sequences, including hazardous chemicals. Also, 10 CFR 70.22 requires certain licensees to prepare an emergency plan for responding to radiological and chemical hazards. For hazardous chemicals, the emergency plan must certify that the licensee has met its responsibilities under the Emergency Planning and Community Right-to-Know Act.

HF presents a hazard in different stages of the nuclear fuel cycle. During conversion, HF is used in the production of UF_6 . During fuel fabrication, UF_6 is sublimed and hydrolyzed. The hydrolysis products include uranyl fluoride and HF. In addition, when UF_6 is exposed to moist air, HF is produced.

HF is a colorless, fuming liquid or gas, with a strong, irritating odor. HF's unique properties make it much more hazardous than many other acids. Fluoride ions can penetrate the skin, causing deep-tissue destruction and possible acute fluoride toxicity. Thus, HF exposure requires immediate and specialized first-aid care and medical treatment.

Most HF exposures occur by dermal contact with an aqueous solution. Because of its volatility, HF also poses an inhalation hazard. On contact, HF produces immediate tissue destruction and pain at high concentrations, but effects are delayed at low concentrations. HF is readily absorbed into the skin. Once absorbed, it forms toxic, soluble salts. Absorption of substantial amounts of HF by any route may be fatal.

The NRC concern is that fuel cycle facilities be aware of the hazards of HF releases and protect workers against adverse effects from exposure to accidental releases of HF. Appropriate personal protective clothing and equipment must be carefully selected, used, and maintained. Recommendations for appropriate personal protective equipment (PPE) can be found in the manufacturers' Material Safety Data Sheets (MSDS's) and other references, such as the Hydrogen Fluoride Industry Practices Institute's "Personal Protective Equipment Guideline for Anhydrous Hydrogen Fluoride and Hydrofluoric Acid." Workers should be trained in the hazards of HF and understand the PPE requirements.

In conducting the ISA, licensees should identify items relied on for safety to prevent potential accidents that could exceed the performance requirements of 10 CFR 70.61. In evaluating potential accident sequences in their ISAs, licensees should consider both catastrophic releases, such as the rupture of a cylinder, and smaller releases, such as materials handling mishaps, that could lead to HF exposure to a worker. Licensees should also consider all routes of exposure that could lead to health effects.

In addition, fuel cycle facilities should consider mitigation of accidental releases through emergency response planning as well as protective measures such as adequate PPE. The Occupational Safety and Health Administration's regulations in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," address the selection, use, and maintenance of PPE for emergency response to chemical hazards. Also, Appendix B to this regulation provides guidance on PPE protection levels.

In case of an HF exposure in the workplace, first-aid care must be applied immediately. To facilitate appropriate first-aid care, fuel cycle facilities should provide information and training, including first-aid procedures, to employees before they begin working with HF. First-aid information can be found in the MSDS's and in other references, such as the Agency for Toxic Substances and Disease Registry (ATSDR) "Medical Management Guidelines for HF." Calcium-containing gels, solutions, and medications, such as calcium gluconate gel, should be readily accessible in areas where a potential for HF exposure exists. Depending on the route of exposure, first-aid providers and onsite medical personnel should ensure timely and appropriate administration of gel or nebulized solution.

Because the treatment of an HF exposure is specialized and differs from the treatment of other strong acid exposures, fuel cycle facilities should coordinate their emergency plans with their local hospitals and appropriate emergency responders. This coordination is necessary to ensure that local hospitals are capable of promptly administering the appropriate emergency treatment. In addition, fuel cycle facilities should consider other actions they can take to ensure that local hospitals have the appropriate information and initial treatment materials when an employee is sent to the hospital for an HF exposure. Additional information about emergency medical treatment can be found in various references, including the ATSDR "Medical Management Guidelines for HF" and the Honeywell Speciality Materials' "Recommended Medical Treatment for Hydrofluoric Acid Exposure."

CONTACT

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

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

Technical Contact: Breeda Reilly, NMSS
Phone: (301) 415-8103
E-mail: bmr@nrc.gov

Enclosures:

1. List of Useful Chemical Safety Information
for Hydrogen Fluoride
2. Recently Issued FSME/NMSS Generic
Communications

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

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NAME	BReilly	EKraus	AMcIntosh	PHabighorst	GJanosko	DCollins	RPierson
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List of Useful Chemical Safety Information for Hydrogen Fluoride

Agency for Toxic Substances and Disease Registry, "Medical Management Guidelines for Hydrogen Fluoride (HF)," 2006, <http://www.atsdr.cdc.gov/MHMI/mmg11.html>.

Honeywell Specialty Materials, "Recommended Medical Treatment for Hydrofluoric Acid Exposure," 2006, <http://www.honeywell.com>.

Hydrogen Fluoride Industry Practices Institute, "Personal Protective Equipment Guideline for Anhydrous Hydrogen Fluoride and Hydrofluoric Acid," 2005, <http://www.hfipi.org/guides.asp>.

Occupational Safety and Health Administration, "Hazard Information Bulletin: Use of Hydrofluoric Acid in the Petroleum Refining Alkylation Process," 1993, <http://www.osha.gov>.

Recently Issued FSME/NMSS Generic Communications

Date	GC No.	Subject	Addressees
02/02/07	IN-07-03	Reportable Medical Events Involving Patients Receiving Dosages of Sodium Iodide Iodine-131 less than the Prescribed Dosage Because of Capsules Remaining in Vials after Administration	All U.S. Nuclear Regulatory Commission medical use licensees and NRC Master Materials Licensees. All Agreement State Radiation Control Program Directors and State Liaison Officers.
02/28/07	IN-07-08	Potential Vulnerabilities of Time-reliant Computer-based Systems Due to Change in Daylight Saving Time Dates	All U. S. Nuclear Regulatory Commission licensees and all Agreement State Radiation Control Program Directors and State Liaison Officers.
03/15/07	IN-07-10	Yttrium-90 Theraspheres® and Sirspheres® Impurities	All U.S. Nuclear Regulatory Commission (NRC) Medical Licensees and NRC Master Materials Licensees. All Agreement State Radiation Control Program Directors and State Liaison Officers.
04/04/07	IN-07-13	Use of As-Found Conditions to Evaluate Criticality-related Process Upsets at Fuel Cycle Facilities	All licensees authorized to possess a critical mass of special nuclear material.
05/02/07	IN-07-16	Common Violations of the Increased Controls Requirements and Related Guidance Documents	All licensees who are implementing the U.S. Nuclear Regulatory Commission (NRC) Order Imposing Increased Controls (EA-05-090), issued November 14, 2005 and December 22, 2005.
03/01/07	RIS-07-03	Ionizing Radiation Warning Symbol	All U.S. Nuclear Regulatory Commission licensees and certificate holders. All Radiation Control Program Directors and State Liaison Officers
03/09/07	RIS-07-04	Personally Identifiable Information Submitted to the U.S. Nuclear Regulatory Commission	All holders of operating licenses for nuclear power reactors and holders of and applicants for certificates for reactor designs. All licensees, certificate holders, applicants, and other entities subject to regulation by the U.S. Nuclear Regulatory Commission of the use of source, byproduct, and special nuclear material
03/20/07	RIS-07-05	Status and Plans for Implementation of NRC Regulatory Authority for Certain Naturally-occurring and Accelerator-produced Radioactive Material	All NRC materials licensees, Radiation Control Program Directors, State Liaison Officers, and NRC's Advisory Committee on the Medical Uses of Isotopes
04/05/07	RIS-07-07	Clarification of Increased Controls for Licensees That Possess Collocated Radioactive Material During Transportation Activities	All U.S. Nuclear Regulatory Commission (NRC) licensees issued NRC's Order Imposing Increased Controls and all Radiation Control Program Directors and State Liaison Officers

Note: A full listing of generic communications may be viewed at the NRC public website at the following address:
<http://www.nrc.gov/Electronic Reading Room/Document Collections/Generic Communications>.