

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

April 30, 1990

NRC INFORMATION NOTICE NO. 90-27: CLARIFICATION OF THE RECENT REVISIONS TO THE REGULATORY REQUIREMENTS FOR PACKAGING OF URANIUM HEXAFLUORIDE (UF₆) FOR TRANSPORTATION

Addressees:

All Uranium Fuel Fabrication and Conversion Facilities.

Purpose:

This notice is being issued to review and clarify the significant features of two recent rulemaking actions which were completed by the U.S. Department of Transportation (DOT), relating to the regulatory requirements for the packaging of UF₆ for transportation. It is suggested that recipients review the information here, and consider actions, if appropriate, to preclude possible problems in the transport of UF₆. However, this information does not constitute new U.S. Nuclear Regulatory Commission (NRC) requirements, therefore no specific action or written response is required.

Background:

The routine transportation of UF₆, both as a non-fissile radioactive material (depleted and natural uranium, a "low specific activity" [LSA] material) and as a fissile radioactive material (when containing "greater than" 1.0 weight percent U-235), constitutes a very significant volume of radioactive materials transportation in the nuclear fuel cycle, both within the USA and worldwide. UF₆ is packaged for transport in cylinders which must meet certain inspection, testing and in-service requirements which are found in the 49 CFR DOT regulations and certain physical standards which are adopted by reference in those regulations. The primary type of packaging used are cylinders of steel, nickel, or monel in various diameters ranging from 1 inch to 48 inches.

For shipments of the unenriched UF₆ as an LSA, non-fissile radioactive material, the cylinders are normally shipped bare, without protective overpacks. Overpacks are used, however, for the shipment of enriched UF₆, as a fissile material, when the U-235 content exceeds 1.0 weight percent. The overpacks used are either of the DOT Specifications 20PF or 21PF Series as prescribed in 49 CFR 178.120 and 178.121 of DOT regulations, or as authorized in several NRC Certificates of Compliance. (See Attachment 1.) Most shipments of UF₆ are made in exclusive-use highway or rail vehicles, and in equivalent defined stowage areas or inter-modal freight containers aboard seagoing vessels.

Before November 1986, the DOT regulations were not specific on the standards for the cylinders, but rather, referenced the need to use a "strong tight package" for exclusive-use shipments. For non-exclusive-use shipments, the cylinders were required to meet the requirements for DOT Specification 7A, Type A packaging. [The cylinders actually used, however, were in accordance with industry standards that exist in ANSI N14.1 and/or a Department of Energy (DOE) document, ORO-651]. On November 17, 1986, DOT issued a new regulation (49 CFR 173.420) specifying cylinder standards and other requirements for all shipments of UF₆. Several supplemental notices and amendments were subsequently issued in the Docket HM-166V, with the last revision of the final rule having been issued on August 29, 1989.

As for the protective overpacks for the cylinders, DOT originally issued its regulatory specifications for the DOT Specifications 20PF and 21PF series in 1974. Over the years, during the use of these overpacks, increasing difficulties have been experienced in their use, maintenance and quality control. The primary difficulty has been with the tendency of the packagings to collect and retain water within the phenolic foam insulating medium within the walls of the overpack. Although the presence of this water is not an immediate safety problem, the water does increase the gross weight of the packages significantly, and also accelerates corrosion of the metal and rotting of the wood components of the overpacks. It often tends to "slosh" out from the drain holes, and sometimes creates considerable alarm to the public and to carriers, when water (albeit non-radioactive water) is observed to be leaking from a package marked "RADIOACTIVE" in commerce. Accordingly, DOE petitioned DOT for rulemaking to amend the DOT 21PF series protective overpack specification, so as to authorize the use of an improved design that would correct the deficiencies. A notice of proposed rulemaking was issued in August 1984, with the final rule issued on September 20, 1988 (Docket HM-190). During the interim period, between the notice and final rule, several NRC-licensed shippers of UF₆ in protective overpacks applied for and received NRC certificates of compliance authorizing use of non-DOT specification, improved overpacks.

Discussion:

Attachments 2 and 3 are chronological summaries of the two recently completed DOT rulemaking dockets relating to UF₆ packaging and transportation. Attachment 2 summarizes the Docket HM-166V on cylinder requirements, and Attachment 3 summarizes the Docket HM-190 rule changes on the DOT Specification 21PF series of protective overpacks. Attachment 1 is a summary of the present status of several NRC certificates of compliance for overpacks that are similar to the DOT Specification 21PF overpacks. Discussion of each of these areas follows:

CYLINDERS

The net effect of the cylinder rulemaking imposed by the new 49 CFR 173.420 in Docket HM-166V has been to formalize, as regulatory requirements, the use of cylinders which have already been in use for many years, pursuant to certain industry standards, as well as other requirements (e.g., requirements for UF₆

to be in solid form and specified volumetric fill limits). In carrying out the rulemaking, however, several difficulties were observed (e.g., the method of cleaning for other than new cylinders, provisions for use of existing cylinders, etc.), as evidenced by the series of eight notices and amendments between April 1986 and April 1989. It is noted that the final rule also formalizes the use of the DOT Class 106A multiunit tank car tank (which is actually referred to in the industry as the Model 30A cylinder). However, both of the published industry standards -- ANSI N14.1-1987 and ORO-651, Rev. 5 -- have taken the position that the Model 30A cylinder is obsolete, and will be replaced by the Model 30B. In effect, therefore, DOE has stated that it will no longer fill Model 30A cylinders at its gaseous diffusion facilities after December 31, 1992.

For any existing cylinder constructed before the new rules, continued use is authorized, provided that it was designed, inspected, tested, and marked in accordance with the 1987, 1982 or 1971 version of ANSI N14.1, in effect at the time of construction; or for cylinders manufactured before June 30, 1987, Section III, Div. I of the ASME Code.

PROTECTIVE OVERPACKS

The net result of the rulemaking in Docket HM-190 has been to upgrade the regulatory requirements for the fabrication, maintenance, and use of the DOT Specification 21PF-1 protective overpacks. The key dates for compliance with these new rules are:

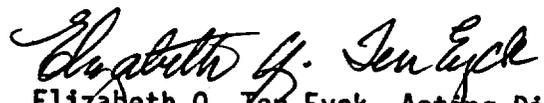
April 1, 1989--Construction of all new overpacks must be in accordance with DOT Specification 21PF-1B after this date, and these overpacks marked as such; and

April 1, 1991--Refurbishment and conversion of all existing overpacks to the requirements of DOT Specification 21PF-1A must be accomplished and these overpacks marked as such.

During the period between April 1, 1989 and April 1, 1991, therefore, the use of unmodified DOT Specification 21PF-1 overpacks continues to be authorized. However, both the owners of unmodified overpacks and the U.S. enrichment plants which fill the cylinders for subsequent loading into the overpacks are taking steps to perform quality control inspections of the overpacks to correct deficiencies, such as containing excessive water. (See Attachment 4). If such inspections reveal excessive water, measures are being taken to remove the overpack from service for drying, resealing, gasket replacement, or other necessary refurbishment, or if necessary, for disposal. The U.S. enrichment plants are also requesting the owners of unmodified overpacks to supply them with acceptance certifications stating that the quality control inspections and other maintenance procedures have been accomplished.

NRC CERTIFICATES OF COMPLIANCE

During the period of the Docket HM-190 rulemaking, several U.S. owners of protective overpacks for 30" cylinders obtained certificates of compliance from the NRC to authorize the use of overpacks of improved design. These are summarized in Attachment 1. A comparison of the specifics of the DOT Specification 21PF-1A and 1B requirements with these certificates indicates that there will still remain a need for the certificates, in that there are substantial differences between, for example, the Model UX-30 (USA/9234/AF) and the NCI-21-PF-1 (USA/9196/AF) and the DOT specifications.



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Attachments:

1. NRC Certificates of Compliance for UF₆ Overpacks
2. Chronology of UF₆ Cylinder Rulemaking⁶ (HM-166V)
3. Chronology of UF₆ Overpack Rulemaking (HM-190)
4. "Interim Inspection and Sealing Procedures for DOT-21PF-1 Overpacks"
5. List of Recently Issued NMSS Information Notices
6. List of Recently Issued NRC Information Notices

U.S. NUCLEAR REGULATORY COMMISSION (NRC)
CERTIFICATES OF COMPLIANCE ISSUED FOR UF₆ PROTECTIVE OVERPACKS

<u>CERT #</u>	<u>REV #</u>	<u>MODEL #</u>	<u>REGISTERED USERS</u>	<u>COMMENTS</u>
USA/4909/AF	8	GE-21-PF-1 W-21-PF-1	General Electric Westinghouse	May be equivalent to Spec 21-PF-1A or 1B. Authorized gross weight: 8000 lbs.
USA/9196/AF	2	UX-30	Nuclear Packaging U.S. Department of Energy (DOE)	Not equivalent to Specs. 21-PF-1A or 1B: uses different insulating media and has other physical features which differ. Authorized gross weight: 8000 lbs.
USA/9234/AF	0	NCI-21-PF-1	Nuclear Containers Inc. Advanced Nuclear Fuels	Similar, but not equivalent to Spec. 21-PF-1B; auth. gross weight: 8700 lbs.
USA/6553/AF	3	Paducah Tiger	DOE	Overpack for model 48A and 48X 10-ton cylinders. Authorized gross weight: 37,500 lbs.

CHRONOLOGY OF UF₆ RULE-MAKING (DOCKET HM-166V)

<u>Date</u>	<u>NUMBER</u>	<u>MAJOR ACTIONS INVOLVED</u>
April 11, 1986	Notice 86-2	Proposes adding specific requirements, as a new paragraph 173.420, for all UF ₆ cylinders, referencing ANSI N14.1-1982 standards; also would require UF ₆ to be in solid form; and would impose a volumetric fill limit of 61 percent at 70°F; and would require internal pressure to be less than 14.7 psia at 70°F.
Nov. 18, 1986	Amdts. 172-107 and 173-198	Adopts the changes as proposed in Notice 86-2, and adds requirement for cleaning of cylinders per App. A of ANSI N14.1-1982. <u>Eff. Date:</u> January 1, 1987.
Dec. 24, 1986	Amdt. 173-198	Delays effective required date for applicability of ANSI standards to new cylinders to June 30, 1987 and references additional applicability of above changes to previous editions of ANSI N14.1. Also provides notice of public meeting to be held on March 2, 1987 to discuss UF ₆ rule-making. <u>Eff. Date:</u> January 1, 1987.
March 12, 1986	Amdt. 173-199	An emergency final rule which amends Nov. 18, 1986 final rule by <u>removing</u> the requirement for <u>other than new cylinders</u> or those undergoing periodic retesting to be cleaned in accordance with App. A of ANSI N14.1-1982. <u>Eff. Date:</u> March 12, 1987.
July 6, 1987	Amdt. 173-198	Revises final rule of Nov. 18 and Dec. 24, 1986, so as to reference an alternative to use cylinders manufactured to U.S. Department of Transportation (DOT) Class 106A multiunit tank car tanks. (Model 30A cylinders), in addition to those conforming to ANSI N14.1-1982 (for cylinders manufactured after May 30, 1987). <u>Eff. Date:</u> June 30, 1987.
July 6, 1987	Notice 87-7	Proposes to authorize the indefinite continued use of cylinders which were not made in accordance with ANSI N14.1-1987 or DOT Class 106A tanks.

- April 6, 1988 Notice 88-2 Proposes to amend the earlier rule-making to permit use of cylinders manufactured in accordance with ANSI N14-1-1987; and to permit loading of depleted UF₆ to a fill limit of 62 percent by volume rather than 61 percent at 70°F.
- April 29, 1989 Amdts 171-103 and 173-214 Amends previous final rules by authorizing continued use of cylinders manufactured before June 30, 1987, in accordance with Section VIII, Div. I of the ASME Code in effect at time of manufacture; and also authorizes a fill limit of 62 percent by volume for depleted UF₆ at 20°C.
Eff. date: September 28, 1989.

CHRONOLOGY OF UFG PROTECTIVE OVERPACK RULEMAKING (HM-190)

<u>Date</u>	<u>NUMBER</u>	<u>ACTION INVOLVED</u>
Aug. 16, 1984	Notice # 84-7	Proposal to modify design of Spec. 21-PF-1 overpacks to alleviate problems resulting from water in-leakage, retention and subsequent leaking out. Based on U.S. Department of Energy (DOE) petition. Contained proposals for required physical modifications to existing overpacks and requirements for newly constructed overpacks. Major changes would be the use of stainless rather than carbon steel and reversal of steps joints on shell closure interfaces.
Sept. 20, 1988	Amdts. 171-96, 173-206, and 178-90	Final rule based on earlier notice. Revisions essentially as proposed. Modified overpacks to be designated as Spec. 21-PF-1A and newly constructed overpacks as Spec. 21-PF-1B. <u>Eff. date:</u> April 1, 1991 for required modifications as Spec. 21-PF-1A; and April 1, 1989, for new construction as Spec. 21-PF-1B.

[This procedure was sent by the U.S. Department of Energy (DOE), Oak Ridge Operations Office on January 18, 1990, to the owners of U.S. Department of Transportation (DOT) Spec. 21PF-1 Overpacks. It has currently been implemented by DOE enrichment plants. This procedure is quoted below.]

"INTERIM INSPECTION AND SEALING
PROCEDURES FOR DOT-21PF-1 OVERPACKS"

21PF- Overpack Conference

The U.S. Department of Energy and Martin Marietta Energy Systems, Inc., hosted the first conference on the DOT-21PF-1 Overpack at the DOE Gaseous Diffusion Plant in Piketon, Ohio on November 14-15, 1989. The conference was attended by representatives from the DOT, NRC, DOE, U.S. and non-U.S. industrial firms. One of the primary concerns of conference attendees was the establishment of criteria for acceptance of overpacks in the interim between now and the deadline (April 1991) for the full implementation of the provisions of 49CFR278.121. Accordingly, a working group was formed to recommend procedures that could be adopted by industry prior to April 1991.

The procedures described in this report were recommended to the conference at the end of the morning session.

Introduction

It has been known for a long time that the foam insulation in the 21PF-1 Overpack will pick up water due to its open cell structure, and that the water may subsequently leak out of the foam through the vent holes in the outer shell. Although numerous studies have shown that the water does not adversely affect the thermal and impact protection capabilities of the foam, the public perceives a leaking overpack as hazardous. This public perception is reason enough to take whatever steps are necessary to preclude leaking overpacks.

49CFR178.121 requires that all existing overpacks be dried and modified to meet the 21PF-1A standards by April 1991.

The 21PF-1A standards required that neither the top half nor the bottom half of the overpack contain more than 25 pounds of water. This amount of water will be absorbed by the foam and will not leak out even when the foam is subjected to the compressive loading imposed by a full UF₆ cylinder. The problem with this requirement is that accurate initial tare weights were not obtained when the existing overpacks were manufactured, such that water pickup cannot be determined by simply weighing the overpacks. This will not be a problem in the future because the packages will be accurately weighed when they are dried and modified, and the new dry tare weight will be engraved on the modified overpack's stainless steel nameplates.

Between now and April 1991, there is a need for some method for satisfactorily determining that no leaking overpack will be used in public transportation without prematurely implementing 49CFR178.121. The following procedures were developed by the working group and recommended to the conference as one workable answer to this problem.

Procedure

Prior to shipping an overpack to a USDOE enrichment facility, the overpack will be prepared and inspected as follows to ensure that water leakage will not be a problem when the overpack is loaded with a full UF₆ cylinder:

1. Drill out the four bottommost vent holes in the overpack using a 1/4" drill.
2. Load the overpack with a full weight cylinder; use either a loaded UF₆ cylinder or a dummy cylinder which is the same diameter and weight as a loaded UF₆ cylinder.
3. Maintain the load test for a minimum of 48 hours at temperatures above freezing.
4. Inspect for leakage while under load.
5. If any leakage is found; remove the overpack from service to be dried and refurbished, or to be discarded.
6. If no leakage is found:
 - (a) Use Silicone RTV Caulking to seal the metal/wood interface at the closure plane step joint.
 - (b) Use Silicone RTV Caulking to seal the spaces between skip welds on all external reinforcements.
 - (c) Reseal the bottom vent holes using 1/4" plastic capplugs set in Silicone RTV Caulking.

- (d) Inspect to ensure that the overpack is in sound condition and the gaskets are acceptable and in place.
- (e) Use matching paint to touch up old indications of water leakage so that enrichment facility inspectors will not treat them as indications of fresh new leaks.
- (f) Accompany each overpack shipment with a certification that the overpack has been inspected, sealed, and painted as described above and that the overpack is in sound condition and free of water leaks when loaded.

Enrichment Facility Acceptance

The purpose of providing overpacks with the above described certification to the enrichment facilities is to provide the means for the overpack to be loaded and shipped from the enrichment facility with no more than the routine inspection for soundness and for absence of water leakage. With such user provided certification and with physical evidence that the overpacks have been sealed as described above and are not leaking, a DOE enrichment facility would permit shipment of UF₆ in such an overpack without accurate water weight data on the overpack. This provision will not apply to overpacks which have been modified and certified as meeting DOT-21PF-1A specifications and will not apply to any overpacks after April 1991.

LIST OF RECENTLY ISSUED
NMSS INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to:
90-24	Transportation of Model SPEC 2-T Radiographic Exposure Device	04/10/90	All NRC licensees authorized to use, transport, or operate radiographic exposure devices and source changers.
90-20	Personnel Injuries Resulting from Improper Operation of Radwaste Incinerators	03/22/90	All U.S. NRC licensees who process or incinerate radioactive waste.
90-16	Compliance with New Decommissioning Rule	03/07/90	All materials licensees.
90-15	Reciprocity: Notification of Agreement State Radiation Control Directors before Beginning Work in Agreement States	03/07/90	All holders of NRC materials licenses that authorize use of radioactive material at temporary job sites.
90-14	Accidental Disposal of Radioactive Materials	03/06/90	All NRC byproduct materials licensees.
90-09	Extended Interim Storage of Low-Level Radioactive Waste by Fuel Cycle and Materials Licensees	02/05/90	All holders of NRC materials licenses.
90-01*	Importance of Proper Response to Self-Identified Violations by Licensees	01/12/90	All holders of NRC materials licenses.

*Correct Number for 90-01 should be 90010145.

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-70, Supp. 1	Possible Indications of Misrepresented Vendor Products	4/26/90	All holders of OLs or CPs for nuclear power reactors.
90-26	Inadequate Flow of Essential Service Water to Room Coolers and Heat Exchangers for Engineered Safety-Feature Systems	4/24/90	All holders of OLs or CPs for nuclear power reactors.
90-25	Loss of Vital AC Power with Subsequent Reactor Coolant System Heat-Up	4/16/90	All holders of OLs or CPs for nuclear power reactors.
90-24	Transportation of Model Spec 2-T Radiographic Exposure Device	4/10/90	All NRC licensees authorized to use, transport, or operate radiographic exposure devices and source changers.
90-23	Improper Installation of Patel Conduit Seals	4/4/90	All holders of OLs or CPs for nuclear power reactors.
90-22	Unanticipated Equipment Actuations Following Restoration of Power to Rosemount Transmitter Trip Units	3/23/90	All holders of OLs or CPs for nuclear power reactors.
90-21	Potential Failure of Motor-Operated Butterfly Valves to Operate Because Valve Seat Friction was Under-estimated	3/22/90	All holders of OLs or CPs for nuclear power reactors.
90-20	Personnel Injuries Resulting from Improper Operation of Radwaste Incinerators	3/22/90	All NRC licensees who process or incinerate radioactive waste.

OL = Operating License
CP = Construction Permit