
Regulations and Standards Improve UF₆ Handling and Transportation Practices

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INTRODUCTION

No fatalities or injuries have ever occurred due to accidents involving the transportation of UF₆. However, we must not become complacent or rest on this record. Safely transporting uranium hexafluoride for over 40 years has caused many to feel confident because of the many levels of safety intended to protect the public and the environment. The intent of this paper is to emphasize several safety related concerns that we at the Portsmouth Gaseous Diffusion Plant have as a result of our experience in shipping enriched UF₆, and to review the impact of recent regulations and standards.

DISCUSSION

The most important level of UF₆ cylinder protection is the packaging itself. All shipments of enriched UF₆ are made with the product cylinders encased in protective structural packages (PSPs) commonly referred to as "overpacks" which are the property of the licensed UF₆ user. The purpose of this overpack is to ensure that the cylinder will withstand not only normal wear and tear but also the wide range of transportation insults that it might receive and still maintain its integrity.

Each overpack design is required to pass a series of tests before being accepted for routine use. The first tests are those associated with normal conditions of transport, whereas the second tests involve hypothetical accidents. Testing for normal conditions of transport requires exposure of the packaging to heat, cold, pressure, vibration, water spray, free drop within 2 hours of the water spray, corner drop, penetration, and compression. Testing for hypothetical accident conditions of transport involve a drop of 30 feet onto an unyielding surface; a drop of 40 inches onto an upright 5-inch by 8-inch bar;

exposure to an environment of 1475°F for 30 minutes; and submersion in water for not less than 8 hours.

To ensure the continued reliability of the overpack, owners are required to provide certification accompanying each overpack, which states that they have been inspected and that the overpack meets regulatory requirements. A signed statement from the owner is usually sent with each overpack; however, some overpacks are received that have been erroneously certified or have no certification and are not in an acceptable condition to transport cylinders of UF₆ product.

UF₆ shippers are required to inspect overpacks as specified in USDOE ORO-651 Revision 5, "Uranium Hexafluoride: Handling Procedures and Container Criteria". Section 6.4 states: "Protective overpacks shall be visually inspected by the shipper prior to each use. The following shall be cause for further investigation or removal from service until the defective condition is satisfactorily corrected: excessive warping, distortion or other damage of liner or shell, which prevents a tight closure of the package; excessive clearances for inner container within the liner; fastener damage; reduction in thermal insulation thickness in any area; or any other damage or condition which would otherwise make the integrity of the protective overpack questionable as a fire-and shock-resistant housing. The vent holes should be inspected and resealed with an epoxy, if necessary, and the gaskets replaced or resealed, as required. The 30-inch protective overpack should be weighed periodically to determine if water has leaked into the overpack causing a weight gain. Overpack tie-downs should be inspected to assure that they are not damaged and are adequate for their intended use."

The "American National Standard for Packaging of Uranium Hexafluoride for Transport," ANSI N14.1-1987, Section 7.4.1 also specifies a routine operational inspection. Besides including the foregoing from USDOE ORO-651, it states:

"The outer protective packaging shall also be inspected for evidence of the inleakage of water into the packaging. Any evidence of inleakage of water shall require an investigation of the packaging to determine the amount of water present in the packaging. The packaging may be required to have the weight recertified if found necessary by the investigation. The water shall be removed prior to repair of the outer protective packaging. Any nonconforming conditions found by the inspector shall be referred to personnel designated by the shipper to evaluate for the use, repair, or condemnation of protective packaging. The representative of the shipper shall contact the owner and user of the protective packaging for recommendations concerning any repair or modification of the packaging."

Inspection at Portsmouth indicates that many 30-inch cylinder overpacks no longer meet design criteria due to extended usage and normal wear

and tear. Some owners have become lax in performing periodic preventative maintenance to the extent that an inordinate number of overpacks do not now meet design specifications. While it is the owner's responsibility to assure maintenance and repair of their own overpacks, the Portsmouth Gaseous Diffusion Plant occasionally performs some maintenance, which is billed to the owner, by repairing or replacing bad gaskets or stripped nuts and bolts, repairing minor welds, and repairing seal rings. We must reject overpacks when the repairs are extensive or exceed our repair capabilities. In that case, loading, and shipping schedules have been changed and the owner notified to send a replacement overpack. An example of an overpack out of specification is shown in Figure 1.

The RSPA ruling, "Modifications to DOT Specification 21PF-1 Overpacks" (HM190) changed the requirements for the fabrication, modification, maintenance and use of the DOT 21 PF-1, and must be complied with by April 1, 1991. Under this ruling, existing overpacks must be inspected for corrosion of the outer shell and deterioration of wooden components. After passing the review, overpacks must be dried, stiffener braces drain holes drilled, joints sealed, and a new joint cover and gasket installed. The lowerhalf step joint must be covered with carbon steel, and a Silastic E RTV rubber or silicone sponge gasket installed. Outer shells, inner liners, and support framing must meet specifications of 21 PF-1A as described in CAPE 1662, Revision 1 and Supplement 1, and K/SS-471. Any overpack under construction must also incorporate these modifications, and new overpacks must be built to 21 PF-1B specifications. New 21 PF-1 overpacks must use stainless steel for the metal shell, the overpack closure must be a step-up joint, and specific welding requirements and welder qualifications followed.

In addition to our concern with overpacks discussed above, the receipt of cylinders and overpacks for international shipments has presented two other areas of concern -- tie-down methods and the condition of trailers. The first involves the various tie-down methods encountered for securing the overpacks to the shipping trailer beds. The design method for securing the overpack during shipment is to bolt its base to the trailer bed. Since most domestic shipping trailers are dedicated to UF₆ cylinder transportation, the overpacks remain bolted to the trailer beds and these overpacks are transported in the designed manner. However, numerous trailers for international shipment have been received with improperly and potentially dangerously secured overpacks. Examples of non-standard tie-down methods employed on incoming shipments are shown in Figures 2 and 3. In order that these shipments meet design specifications, holes will have to be drilled in the trailer bed and the overpacks properly secured for the return shipment.

The American National Standard Institute, is in the process of drafting Standard N14.2, "Tie-down for Truck Transport of Radioactive Materials," but is awaiting completion of ANSI standard N14.30 before continuing its work.

The International Atomic Energy Agency (IAEA) has issued for comment TECDOC-423, "Recommendations for Providing Protection During the Transport of Uranium Hexafluoride" which recognizes this problem area, but final review and implementation are yet to be determined.

Another major concern to have arisen with international shipments is the condition of the trailers themselves. Many trailers have not been loaded at Portsmouth due to mechanical problems, rotten flooring, bald tires, no brakes or brake lights, or broken springs. An example of defects which have resulted in trailers being rejected for use is shown in Figure 4. A recent DOE directive states that questionable shipping practices are to be documented for DOE who will advise the DOT and appropriate state agencies.

RECOMMENDATIONS

As a result of HM 190 and the proposed standards ANSI N14.2 and ANSI N14.30, we at Portsmouth expect to experience receipt of fewer nonspecification overpacks and eventually better carrier equipment using industry approved tie down methods. However, we recommend that the regulations should be further amended by:

- (1) DOT 21PF-1A and 1B overpacks should be recertified every 5 years beginning after modification or initial fabrication, as applicable;
- (2) Persons modifying, fabricating, recertifying or making repairs to DOT 21PF-1, 21PF-1A or 1B overpacks, should be required to have an approved quality assurance program;
- (3) Any facility which has an approved quality assurance program, should be audited intermittently to ensure it continues to meet standards;
- (4) The regulatory references to the USDOE report ORO-651 entitled, "Uranium Hexafluoride Handling Procedures and Container Criteria," should be updated to Revision 5, 1987 edition; and
- (5) The securing of international radioactive material shipments should be reviewed and international standards adopted.

CONCLUSION

The Department of Transportation Research and Special Programs Administration (RSPA) has issued "HM-190, Modifications to DOT specification 21 PF-1 Overpacks" to enhance safety in the transport and use of the overpacks, and must be complied with by April 1, 1991. It requires owners to modify existing overpacks to ensure that all existing 21 PF-1

overpacks meet design specifications. As a result of this legislation, fewer overpacks will be rejected as owners have overpacks refurbished to HM-190 specifications.

ANSI N14.30 will provide guidance for semi-trailers used for UF_6 . However, the optimum transportation method will be special trailers dedicated to the transport of UF_6 , nationally as well as internationally. Currently there are no regulations for the method of securing overpacks, and this should be formally addressed. Engineered tie-downs should be developed on a low center of gravity trailer whose maintenance can be monitored and whose owners would be held accountable for trailers meeting DOT standards.

Our industry has compiled an enviable transportation safety record due to the basic design integrity of the packaging. By developing dedicated trailers we will further demonstrate our continued commitment to safety and control of all facets of the transportation cycle. Together we must continue to fulfill our transportation and logistics responsibilities, and maintain our enviable safety record in the handling and transportation of UF_6 .

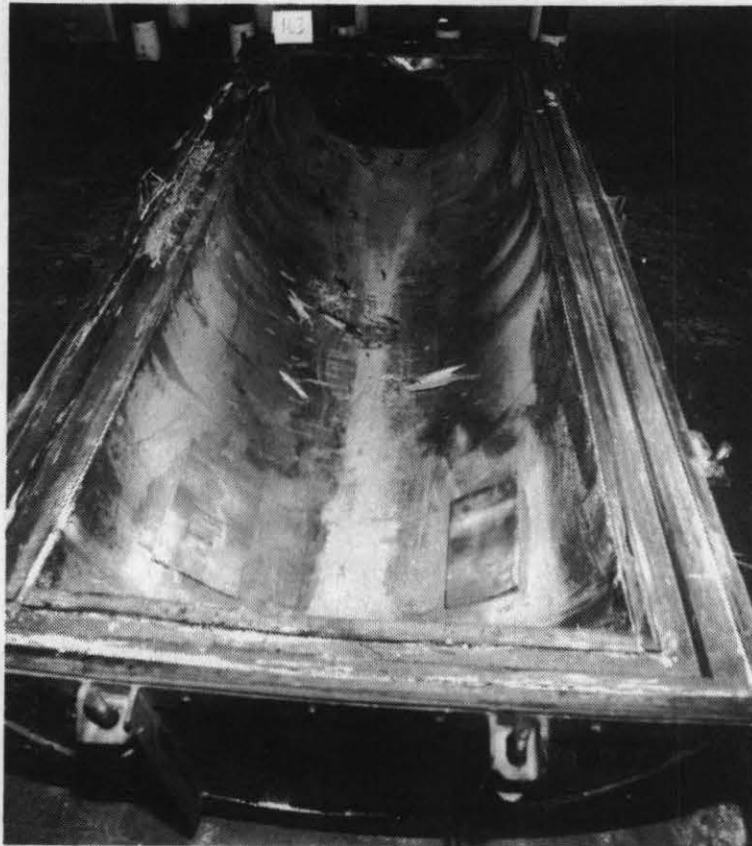


Figure 1. Overpack Base Out of Specification Having Bad Gasket, Rotted Step Joint, Rusted and Missing Liner, Evidence of Water Inleakage.

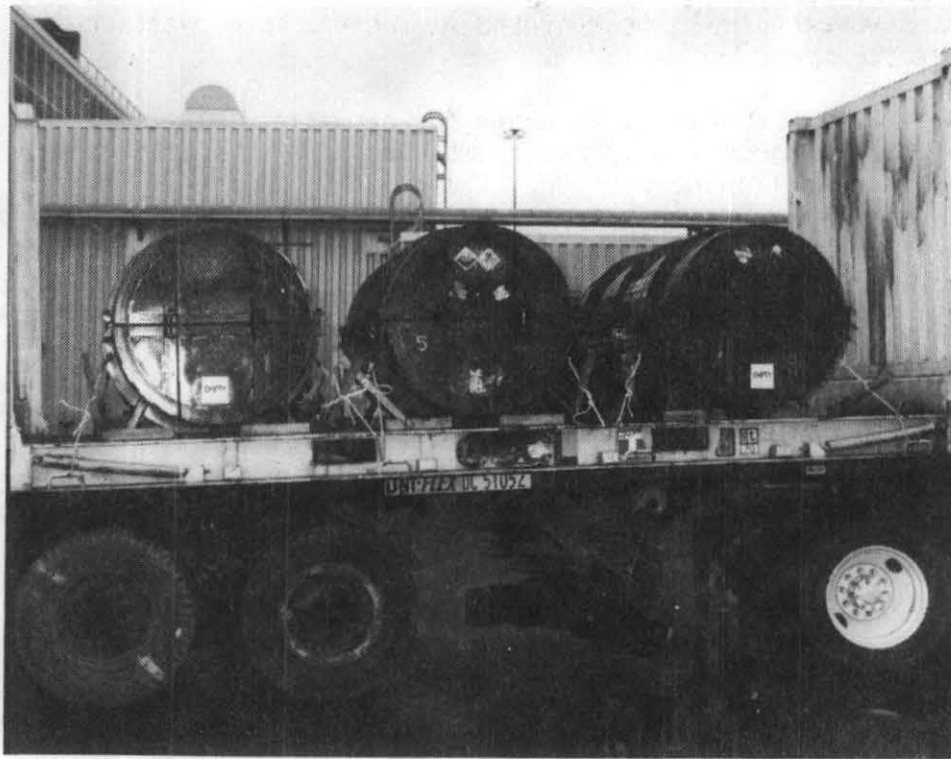


Figure 2. Non-Standard "Boy Scout" Tie Down.

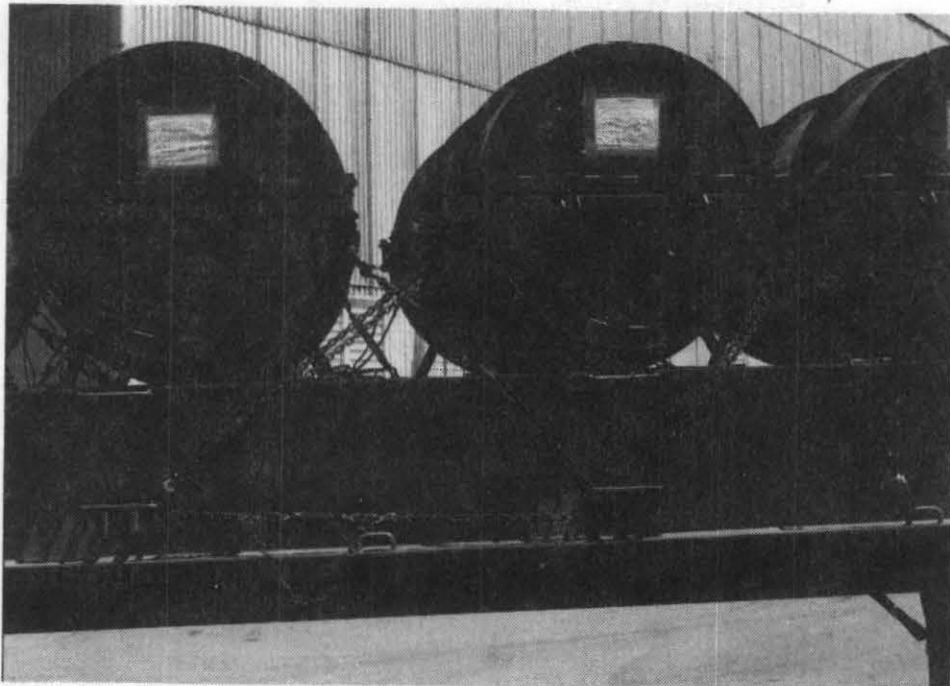


Figure 3. Non-Standard Tie Down Method Using Shackles Secured by Chains, Snap Binders, Cable, and Toggle Bolt.



Figure 4. Leaking Wheel Seal of Equipment Rejected from Loading.



Figure 5. Refurbished USA-DOT 21PF-1A Overpack.

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