

Paper No. 1021

Development of a New 48-Inch UF₆ Cylinder Overpack

Andy Langston

DAHER-TLI

Philip Sewell

DAHER-TLI

Norman Kent

DAHER-TLI

Tanya Sloma

DAHER-TLI

Abstract

The Kevil Kougar overpack is new generation Type H(U) packaging designed to transport ANSI N14.1 and ISO-7195 compliant 48-inch UF₆ cylinders. The Kevil Kougar is designed specifically to transport the thin-wall 48G cylinders, but will also accommodate other 48-inch cylinder types. The Kevil Kougar design provides thermal and impact protection for the cylinder under conditions required for a Type H(U) package capable of transporting UF₆ via road, rail, and ocean. The packaging design is a smooth octagonal shape designed to carry one 48-inch UF₆ cylinder. It consists of an upper subassembly and lower subassembly, which are fastened together with ten toggle bolts, five per side. Each subassembly consists of an outer and inner steel shell secured to a frame assembly, with wood and polyurethane foam filling the space between. The only protruding components are for ease of operation and consist of four lifting lugs and fork pockets on the upper body and the base and fork pockets on the lower body. The design incorporates interior rubber pads for cylinder cushioning, support, and alignment, steel stabilizing beams fore and aft to prevent cylinder movement, closure mechanisms, a tamper indicating device, and tie-down features. Currently, the Kevil Kougar is designed to transport contents of depleted uranium and natural uranium. Future activities include licensing the package as Type AF to facilitate transport of historic USA Department of Energy fissile material packages.

Introduction

ANSI N14.1^[1] and ISO-7195^[2] cylinders are typically used for the storage and transport of larger quantities of Uranium Hexafluoride (UF₆). US and international transport regulations^{[3][4]} allow for shipments of full “thick-walled” 48-inch UF₆ cylinders (most commonly 48X and 48Y) with added

thermal protection, such as thermal blankets. However, there is no allowance for shipments of full “thin-walled” 48-inch cylinders (most commonly 48G) and other less common cylinders, without the addition of a protective overpack. An overpack is required for these thin-walled cylinders to provide protection to the cylinder, so that it meets the regulatory thermal and impact requirements for a UF₆ package. The Kevil Kougar packaging is designed to meet this need and provide a protective overpack that can be used to allow shipments of any ANSI N14.1 and ISO-7195 compliant 48-inch UF₆ cylinders. The Kevil Kougar overpack, shown in Figure 1, is a licensed Type H(U) package capable of transporting any full ANSI N14.1 and ISO-7195 compliant 48-inch cylinder via road, rail, or ocean while meeting all relevant US or international regulatory requirements. The current contents licensed for the Kevil Kougar package include natural and depleted uranium.



Figure 1 – The Kevil Kougar Package

Kevil Kougar Design

The Kevil Kougar overpack provides thermal and impact protection for the 48-inch cylinder, such that containment of the contents is maintained through testing required for the UF₆ packaging in 49CFR173 [3] and SSR-6 [4].

Thermal protection for the 48-inch cylinder and UF₆ contents is provided by low-density polyurethane foam and wood blocks. The components are layered in the upper and lower

assemblies of the Kevil Kougar packaging. The outer shell of the overpack shields the foam and wood from direct exposure to flame in the event of a fire accident. Vents in the outer shell prevent internal pressure buildup in the overpack due to off-gassing of the foam that could occur. However, these vents do not relieve pressure in the 48-inch cylinder. The Kevil Kougar packaging design provides adequate thermal protection of the 48-inch cylinder and UF₆ contents.

Impact protection is provided by the shock limiting properties of the same components that provide thermal protection. The foam and wood blocks act together to absorb impact energy and provide efficient thermal insulation. Figure 2 is cutaway of the end view of the Kevil Kougar design showing a sample arrangement of the impact limiting materials. The structural design with minimum dimensions and material properties provides adequate impact protection of the 48-inch cylinder and valve.

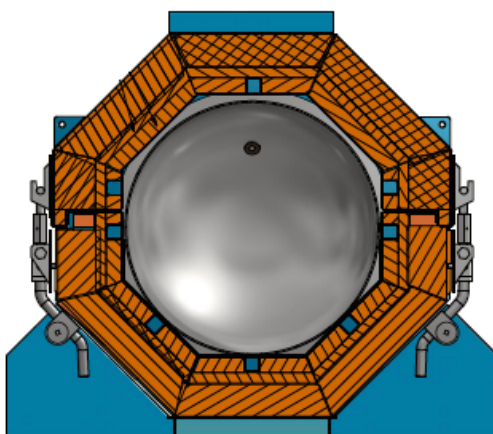


Figure 2 – Kevil Kougar Impact Limiting Components Sample Arrangement

Kevil Kougar Transport Features

The focus of the Kevil Kougar packaging design process was to create a package that facilitates the safe transport of 48-inch UF₆ cylinders, but incorporates features that are simple to use and convenient for package operations. The transport features incorporated in the Kevil Kougar design provide a secure and robust packaging system, that offer straightforward handling during loading, transport, and unloading.

Internal Supporting/Positioning Features

The Kevil Kougar is designed to allow the 48-inch cylinder to be loaded in either direction, with or without a valve protector assembly. Twelve rubber support pads (six each in the upper and lower subassemblies) provide internal cushioning support, cradling the cylinder during transport.

Channels and channel pockets cut into the interior cavity of the upper and lower subassemblies to

provide positioning support. These channels and channel pockets accommodate the majority of historic and current 48-inch cylinder types. The channel pockets prevent cylinder rotation during normal transport, and in the event of a drop incident, the channels hold the stiffening rings, and therefore the cylinder, in place axially.

Finally, vertical stabilizing beams are installed at each end when transporting the shorter 48X or 48G cylinder. The support pads, channels, channel pockets, and stabilizing beam in the lower subassembly are shown in Figure 3.

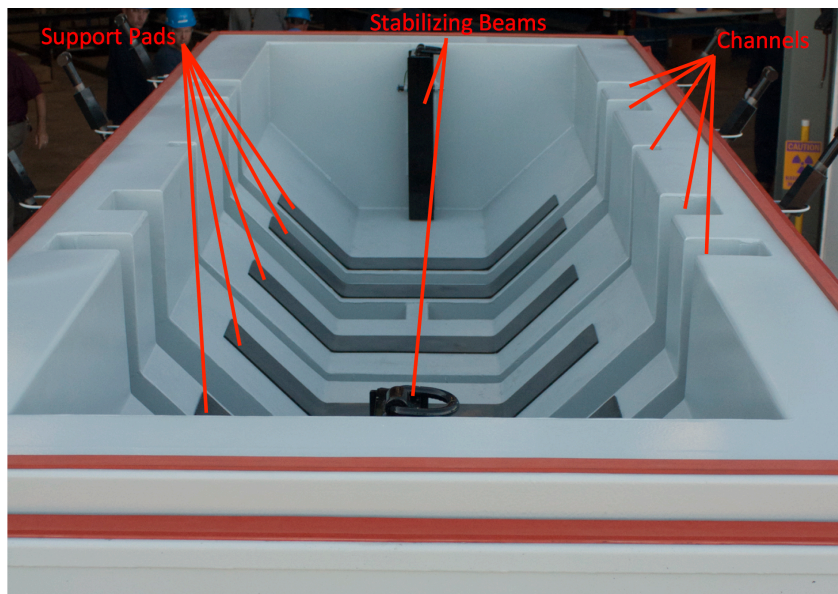


Figure 3 – Kevil Kougar Lower Subassembly Interior

Closure

The closure system for the Kevil Kougar secured by positive closure toggle swing bolts, equally spaced on either side. The toggle bolts are mounted on the lower toggle assembly. For closure of the overpack, the T-bolt head seats in the upper assembly bracket. The toggle arm is swung down and locked in place with a lock-pin. The toggle bolt assembly is designed such that under conditions normally incident to transport it will remain closed, protecting the cylinder. Toggle bolt assembly is shown closed in Figure 1 and open in Figure 4.



Figure 4 – Kevil Kougar Closure Toggle System

Lifting

The Kevil Kougar has top and bottom fork pockets and four lifting lugs. The upper subassembly can be installed or removed using the top fork pockets or the four lifting lugs. The bottom fork pockets are used for lifting the lower subassembly and the assembled package.

Figures 5 and 6 show the upper subassembly lifting features in use. The forklift pockets are operated with the use of an appropriate forklift and the lifting lugs are operated with the addition of lifting eyes and hooks and the use of a crane. When the upper and lower subassemblies are joined together the top fork pockets and the lifting lugs are rendered inoperable, as only the bottom fork lift pockets may be used to lift the entire package. The top fork pockets and lifting lugs are rendered inoperable once the top subassembly is installed with the insertion of pins through the pocket holes and the removal of the lifting eyes from the lugs and a cover that falls over the holes in the lug.



Figure 5 – Lifting the Kevil Kougar Upper Subassembly with Fork Lift Pockets



Figure 6 – Lifting the Kevil Kougar Upper Subassembly with Lifting Lugs

Tie-Down

The Kevil Kougar package is properly secured to the conveyance using ISO locks. The Kevil Kougar design includes four ISO lock receivers welded to the outside corners of the base to facilitate secure mounting to a conveyance.

Conclusions

The Kevil Kougar overpack is currently licensed to ship depleted and natural uranium in any full ANSI N14.1 and ISO-7195 compliant 48-inch cylinder via road, rail, or ocean. The packaging is designed for safe transport of all contents with simple and convenient requirements operationally.

Future activities for the Kevlar Kougat include licensing the package as Type AF to facilitate transport of historic USA Department of Energy fissile material packages.

Acknowledgments

Put acknowledgments here.

References

1. American National Standards Institute, "American National Standard for Nuclear Materials - Uranium Hexafluoride - Packagings for Transport," ANSI N14.1-2012.
2. International Organization for Standardization, "Nuclear Energy - Packagings of Uranium Hexafluoride (UF₆) for Transport," ISO 7195, 2005.
3. United States Department of Transportation (USDOT), Title 49, Code of Federal Regulations Part 173, Subpart I - Class 7 (Radioactive) Materials, 2016.
4. International Atomic Energy Agency, (IAEA), "Regulations for the Safe Transport of Radioactive Material," IAEA Safety Standard SSR-6, 2012.