

# ETMF: A NEW PACKAGE DESIGN FOR THE TRANSPORT OF FISSILE MATERIAL

T. DELON, J. DANAN

Email: [thierry.delon@cea.fr](mailto:thierry.delon@cea.fr)

French Alternative Energies and Atomic Energy Commission, CEA Cadarache, 13108 Saint-Paul-lez-Durance, France

## Introduction

The CEA (French Alternative Energies and Atomic Energy Commission) is responsible for the transportation of radioactive materials from its facilities and manages a fleet of IP2-F type and B(U)F packages used in France or abroad.

The CEA is currently designing a new transport package called "ETMF" that can be classified as either IP2-F type or B(U)F, which will be used to transport fissile material between research reactors and laboratories. This package will be transported by road, sea and air, in France or abroad.

## Design the "ETMF" new package

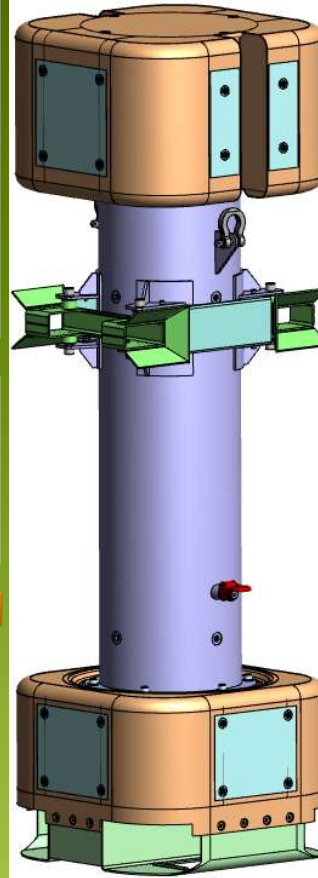
The ETMF package consists of a cylindrical body and two shock absorbers at its ends. Handling devices are also attached to the body of the package.

### Dimensions of the package:

- Height: 1949 mm
- Diameter (cylindrical body): 330 mm
- Cross section of shock absorber: 600 x 600 mm<sup>2</sup>
- Maximum weight: 600 kg

This package is mainly transported in a vertical position, but horizontal transport is being studied, in particular for air transport.

## Overview of ETMF



## Types of contents and related risks

### Dimensions of the package cavity:

- Height: 1475 mm
- Diameter of the main part: 140 mm
- Diameter at the top: 152 mm
- Transportable maximum weight: 100 kg

### Characteristics of the contents:

- Type: non-irradiated nuclear fuel
- Physical forms: powders, pellets, sections of elements (rods, plates), liquids, partial or complete fuel elements, ingots
- Chemical forms: uranium, plutonium, mixed oxides, alloys or uranyl nitrate.

### Risks related for the contents:

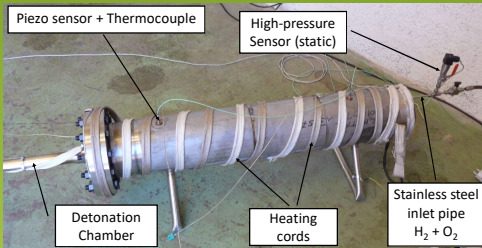
- Safety-criticality: The resistance (including explosion) of the cavity and the new DK-TF resin will ensure that the contents are kept in sub-critical conditions
- Radiation protection: The stainless steel inner and outer shells, as well as the DK-TF neutron-absorbing resin, will contribute to dose rate attenuation
- Thermal power for plutoniferous contents
- Thermolysis, radiolysis or pyrophoricity: The inerting and the explosion resistance of the cavity will ensure the safety of the package model. In addition, content resident times will be shorter.

## The cavity is resistant to explosion

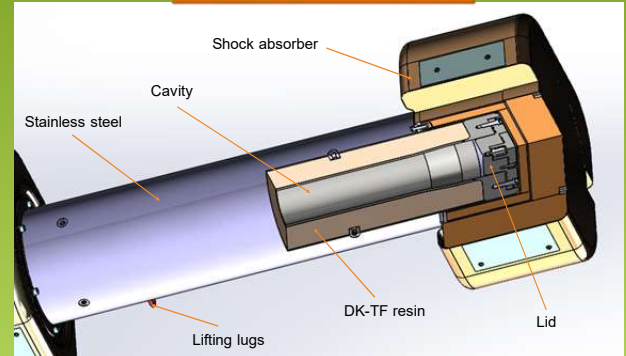
The ETMF package will transport contents with subsidiary risks. The package is also designed to withstand the explosion of gas produced by radiolysis and thermolysis of organic materials.

The safety case will be based on finite-element calculations and representative tests (see below).

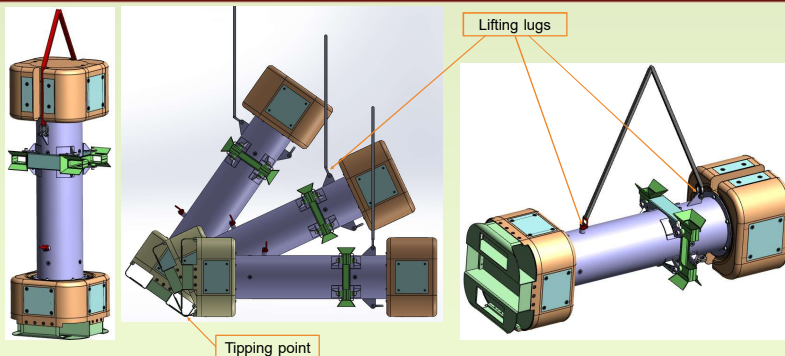
## Explosion tests on a mockup of internal cavity



## 3D sectional view of ETMF



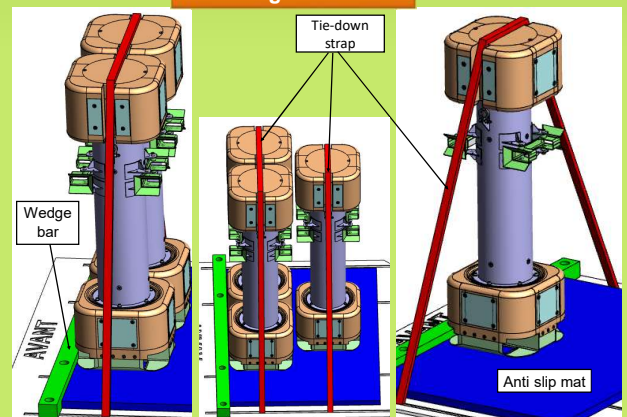
## This package is designed for vertical or horizontal handling by travelling crane



## Stowage

This new package may be stowed alone or with other packages. An example of stowage on a trailer is given below. Stowage is carried out with an anti-slip mat, a wedge bar and a strap.

## Stowage of ETMF



## Package handling with a forklift truck or manual pallet stacker

