

# The R83 Package: A new Type B(U) Fissile Package for Research Reactor Spent Fuels Transportation in the Netherlands

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## 1. ABSTRACT

### Background

To cover the need of Nuclear Research and Consultancy Group (NRG) to transport used LEU fuel from the High Flux Reactor (HFR) in Petten and Hoger Onderwijs Reactor (HOR) in Delft to the inter-mediate storage facility HABOG at COVRA, Nieuwdorp, as well as waste from the Mo-99 production from its facilities in Petten, ROBATEL Industries has been selected to design, license and manufacture a new type B(U) fissile cask model, the R83.

ROBATEL Industries is a worldwide nuclear turnkey services provider, especially regarding bespoke radioactive material transportation casks. For decades it has designed numerous package models, type B ones especially which require regulators approvals. Based on such a broad experience, the company acquired a comprehensive knowledge of the technical issues related to safety and to inter-national regulations.

### R83: a new versatile spent fuels type B cask

ROBATEL Industries delivered two R83 packages and their ancillary equipment early 2019. This package has been specifically thought from the beginning to complies with all the site constraints im-posed by the fact that the R83 replaces an old existing cask for which original interfaces had been designed for, and it allows an optimized shielding for current spent fuels to be transported and it was made future proof to be able to transport the future PALLAS reactor spent fuels.

Dedicated proprietary materials developed by ROBATEL Industries (phenolic foams FENOSOL™, and PNT7™) have been implemented, with an innovation in that the impact limiters have been filled with FENOSOL™ with two different foam densities per impact limiters to ensure high overall performance level, especially regarding suitable shock absorbing feature, efficient fire protection, while keeping the dimensions within limits.

The aim of this paper is to present this new R83 type B Fissile package design dedicated to the Research Reactor spent fuels transportation, describing the challenges and focusing on its specificities, mainly in terms of innovative implementation of materials and technical solutions.

## 2. INTRODUCTION

This paper aims to present one of the last type B(U) fissile package called “R83” designed by ROBATEL Industries. This model was designed for the Nuclear Research and Consultancy Group (NRG) to transport used LEU fuel from the High Flux Reactor (HFR) in Petten and Hoger Onderwijs Reactor (HOR) in Delft to the inter-mediate storage facility HABOG at COVRA, Nieuwdorp, as well as waste from the Mo-99 production from its facilities in Petten. The development of this cask from the early design to the safety authority approval and the manufacturing in less than 4 years only (2016-2019) was made possible thanks to the wide experience of ROBATEL Industries in the package transportation design and manufacturing. Indeed, from more than 60 years, ROBATEL Industries has managed the whole process of cask delivery: from the customer technical specification it designs the cask and the operating tools, builds the safety studies, obtains the approval certificate for type B packages, manufactures the casks and tools, performs the qualification tests.

The R83 designed has necessitate the full range of engineer skills encountered in the package transportation field : detailed safety shielding and criticality analysis using Monte-Carlos codes, crash simulations using explicit finite element codes, thermal calculation by finite element analysis taking into account specific materials like PNT7™ thermal shield and shock absorbing FENOSOL™ foam, drop tests on a specifically designed scale model, etc.

## 3. PRESENTATION OF THE R83 PACKAGE

### R83 loading capabilities

The R83 package has been developed in order to transport Low Enriched Uranium (LEU with an initial  $^{235}\text{U}$  enrichment  $\leq 19.95\%$ ) spent fuels. They mainly consists in fuel and control assemblies or in Uranium Collecting Waste (UCW) filters wherein uranium residues has been collected.

For their loading into the cask's cavity (whose useful dimensions are  $\varnothing 743 \text{ mm} \times \text{H } 950 \text{ mm}$ ), suitable metallic baskets are used. Currently, 2 kinds of baskets have been developed to fit with the various transport needs (see Table 1 ), but other types of internals may also be developed to address any other specific issues.

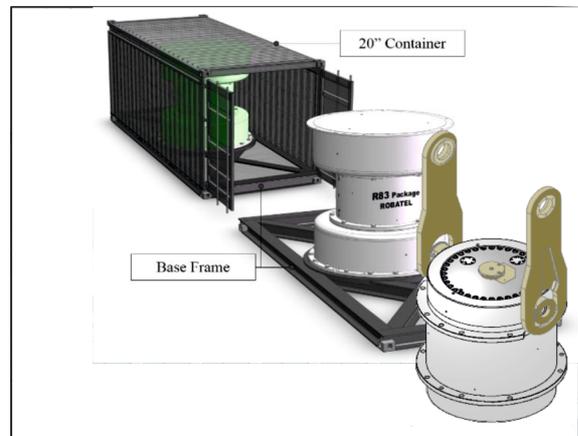


Figure 1. R83 –Transport & handling configurations

### R83 operation overview

The R83 package is dedicated to road transportation. Specific container including dedicated transport frame has been thereby designed to ensure safe use.

The cask is operated vertically using its 2 trunnions, either regarding its loading and unloading operation, but depending on facilities constraints, its design allows both wet loading (by immersing the cask's body in pond) and dry unloading (by interfacing the cask to hot cells for instance).

To this purpose, the package is equipped with dedicated interfaces and connections so as it enables to flood, drain and dry its cavity in safe and convenient way. Moreover, these devices and ports also make possible to fill the cask's cavity with an inert gas as needed (helium for instance for addressing heat dissipation or radiolysis issues if any).

#### 4. CONCLUSION

The R83 package is a typical turnkeys' project where ROBATEL Industries excels. This project, which began by addressing the customer transportation issues regarding to the spent fuel and fissile waste to finally end with the design and delivery of a manufactured cask (see Figure 2 ) with its certificate of approval, was achieved in less than 4 years.

This cask, designed to transport fissile materials like spent fuels or fissile waste, has been fully optimized to the customer need: particularly, it may be loaded/unloaded under water or dry by docking it to a hot cell.

All the safety analysis and tests were carried out in house by the design engineers' team. The type B(U) certificate of approval was obtained in 3 years only from the contract signature. The R83 design takes indeed advantage of the materials commonly used by ROBATEL Industries (lead, PNT7™ concrete and FENSOL™ foams especially: see Figure 3).



**Figure 2.** Picture of a R83's body



**Figure 3.** R83's impact limiter manufacturing (FENSOL™ foams)