
Packaging System for the Transport of Fresh LWR-MOX Fuel Assemblies

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INTRODUCTION

Siemens is manufacturing MOX fuel assemblies for use in LWR's. The assemblies have the same geometry as Uranium fuel assemblies. Typically the fuel composition is U-nat plus about 5 % Pu-tot. Radiation and decay heat is well above the level of Uranium fuel.

DESIGN REQUIREMENTS

It was the task to establish a packaging and transport system for such assemblies. In addition to the known regulatory requirements for type B packages the following design requirements had to be met:

- to make use of existing primary packagings for Uranium fuel
- to have maximum capacity within the dimensional and pay load limits of the given security vehicle
- to take into account specific loading/unloading procedures.

DESIGN FOR PWR FUEL

The system has been first developed, licensed and used for PWR fuel. It consists of an inner package identical with the Uranium fuel package surrounded by a rectangular overpack which itself is a steel/wood structure (see fig. 1 upper part).

Dimensions of the overpack:	1,350 x 1,050 x 6,000 mm
Overpack weight	: 2,900 kg
Total weight	: 6,650 kg

Capacity of the overpack is one inner package containing 2 assemblies. 2 overpacks can be loaded into the security vehicle.

An important function of the overpack is to protect the fuel rods - which form the "containment system" as defined by transport regulations - against the consequences of the punch test.

To demonstrate the positive performance a punch test with a simplified 1/2 scale package model has been performed: The overpack structure deformed but stopped the punch before it touched the rods.

The design has been licensed by PTB under license no. D/4174/B(M)F (Reason for the multilateral classification is the 27 bar He pressure in the rods).

DESIGN FOR BWR FUEL

The version for BWR fuel is presently in an advanced stage of design. The concept is to put 4 inner packages for BWR fuel into the overpack described above, with shockabsorbing spacers between the inner packages (see fig. 1, lower part).

The capacity will be 8 assemblies per overpack.

In view of criticality safety a minimum distance between the assemblies has to be maintained after the regulatory tests. For this purpose preliminary drop tests with a model have been performed to optimize the inner shock absorber/spacer arrangement. The model was a 1000 mm long full scale section of the package. Based on the test results the inner package structure has been slightly modified.

PWR SHIPPING EXPERIENCE

The PWR version of the packaging system has been licensed and 2 overpacks have been manufactured in 1985.

According to German physical protection regulations fresh MOX LWR fuel assemblies have to be shipped in a security vehicle (see figures 2 and 3).

Up to now, about 70 shipments with PWR fuel assemblies have been performed in this vehicle to six destinations in Germany and one in Switzerland.

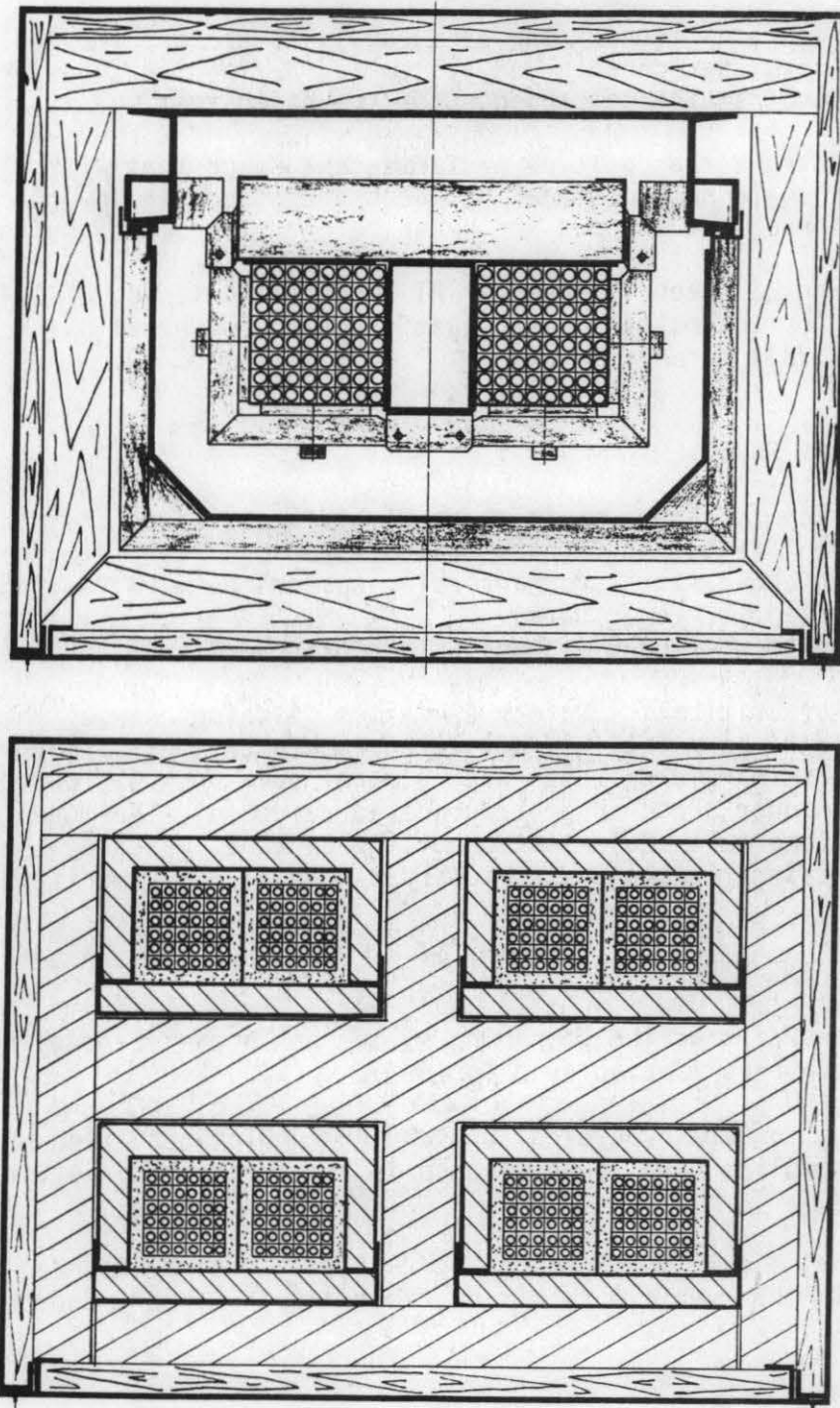


Figure 1. Cross section of MOX fuel packaging:
PWR version (upper part) für 2 assemblies
and BWR version (lower part) for 8 assemblies

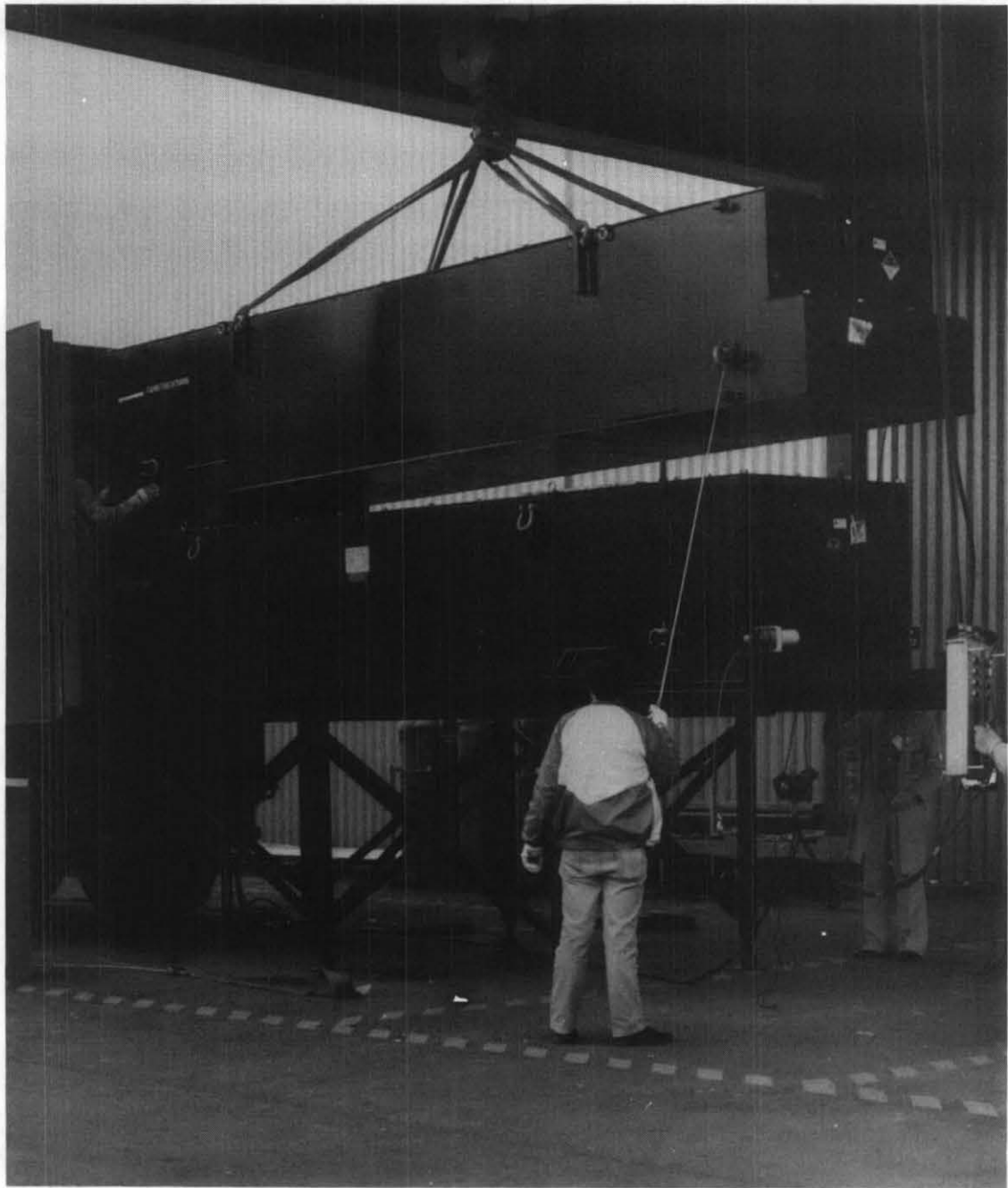


Figure 2.

Loading of 2 packages into the security vehicle



Figure 3. NCS security vehicle