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A NEW WAY FOR THE DUAL PURPOSE CASK TN™24: A GLOBAL SOLUTION OFFER

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Abstract

For more than 20 years now, TN International (AREVA group) has proposed the TN™24 family of metallic casks for both the transport and storage of used fuel elements. For instance since 1996, more than 50 TN24 casks have been delivered to the Doel storage facility in Belgium. Today the main issue for some customers is the return of the compacted nuclear wastes induced by the reprocessing of used fuel performed by AREVA NC at La Hague facility. To perform such transportations, some specific packaging may have to be designed. But, as an alternative to the design and the manufacture of new casks, the existing dual purpose casks may be adapted to new contents. Therefore TN International has decided to investigate the possibility of using TN24 casks for the transportation of compacted wastes.
After technical analyses it appears that the TN24DH, one of the 5 cask versions in operation at Doel storage facility, could be compliant with the characteristics of the compacted wastes. The originality of the proposed solution is not only to allow a new content to be transported by the TN24DH but also to propose a global solution to the customer: these casks will be used first for the transport of compacted wastes, and in a couple of years, will be used for their primary purposes, i.e. the transport and storage of used fuel elements coming from Doel NPP.
The purpose of this paper is to present our experience, to describe the way to manage this kind of project and furthermore to underline the main advantages of the TN24 dual purpose transport cask for customer. Hence this paper focuses on the following topics: - A technical solution for the return of the compacted wastes,
- A solution in line with the sustainable development, reduction of final wastes,
- An economical solution in terms of manufacturing, licensing
- A dedicated project organisation for a global solution management.

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Context

At the end of the 70's, SYNATOM, in charge of fuel management on behalf of the Belgian Utility ELECTRABEL, signed Reprocessing Contracts with AREVA NC, providing returns of residues to its country of origin where they will be managed in a safe storage facility. Therefore a part of Belgian Used Fuel has been reprocessed in La Hague facility.

Fuel reprocessing consists of using chemical and mechanical processes to separate recyclable materials (uranium and plutonium) from the used fuel of the nuclear power plants (NPP) and research reactors. The proportion of used fuel which is recyclable is 96%. The ultimate wastes separated, sorted out and then safely conditioned are mainly:

- Fission products (and minor actinides) are calcined, incorporated into a chemically stable glass matrix and conditioned in universal canisters (CSD-V),
- Fuel's metallic structures are compacted and conditioned in universal canisters (CSD-C).

The return of the Belgian vitrified wastes to Belgium has been performed by means of rail using the TN28VT transport cask which has been designed by TN International. At its arrival in the Mol station in Belgium, the transport cask is transferred onto a truck and transported to a storage building on the Belgoprocess site where the canisters are unloaded and stored.

The industrial production of compacted wastes started in 2002 and is the result of indepth R&D studies performed by AREVA NC in order to reduce the volume of materials considered to be radioactive waste. The discussion for the return of the compacted wastes to Belgium resulted in a contract in 2007 between TN International and SYNATOM: all the Belgian canisters produced at La Hague facility will be transported to the storage building on Belgoprocess site from 2009 to 2013.

In the 1990's, SYNATOM decided to have an additional way of managing its used fuel and chose to store the used fuel without prior treatment in a specially design cask. Thus, since 1996, TN International has delivered to the Doel interim storage facility more than 50 TN™24 metallic casks used both for the transport and storage of used fuel from the Doel NPP.

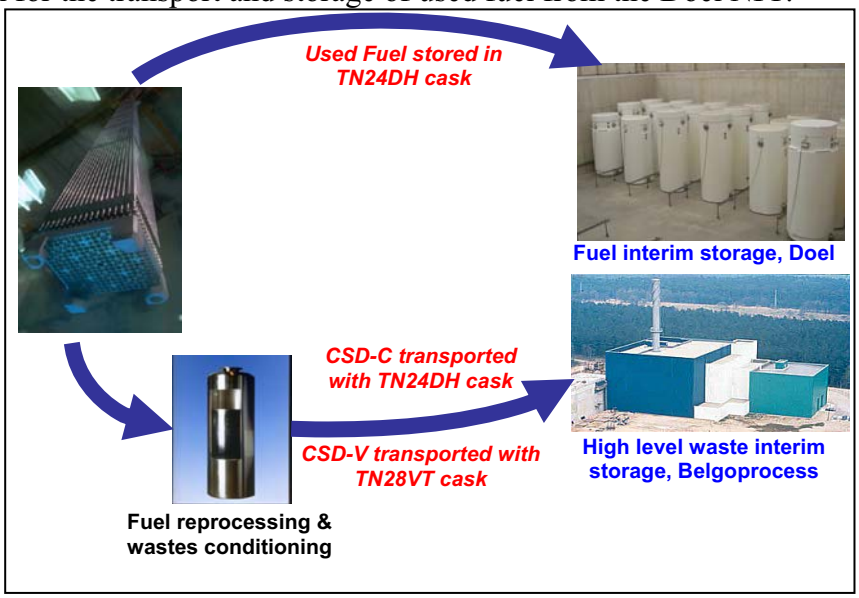

Figure 1: Management of the Belgium used fuel

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Within the framework of the contract for the return of Belgian compacted wastes, TN International offers a global solution to its customer allowing the transportation of the CSD-C using the TN™24 casks before the storage of used fuel. Thus, this global solution combines transportation management and regulation as well as services related to the licensing and manufacturing of cask.

Strategy

The compacted wastes are a new type of waste which have not been transported to date.. In the Belgian case, as SYNATOM has many TN™24 casks under construction at its disposal, TN International proposed to investigate the possibility of transporting compacted wastes using existing casks.

The analyses focussed on the following topics:

- Design and licensing activities
  The adaptation of an existing cask for a new content leads to a reduction in the amount of studies for the justification of the behaviour of the package regarding the transport regulations. It was a great challenge for our engineers to find solutions suited to the new content and the existing cask. Furthermore another implication is the limitation of time required for the granting of an extension of an existing certificate of approval compared to the submission of a new certificate of approval.

- Economical solution
  The adaptation of an existing cask is a good deal for the customer: the investments are reduced to light equipment (over 50 % of costs are saved compared to a new cask) and, the management of the cask fleet is improved due to a new utilisation (costs are shared between interim storage and wastes transportation).

- Schedule
  One constraint of the customer is to manage the compacted wastes return program, to optimise the schedule in order to finish the transportation in 2013. The adaptation of an existing cask is then a good solution because the time needed to have a cask available and licensed for transportation is only about 2 years compared to 4 or 5 years needed to license and manufacture a new cask.

- Sustainable development
  The reuse of existing casks for an additional purpose complies with the sustainable development approach through the economic, social and environmental dimensions. For example, this approach allows the reduction of final wastes due to manufacturing and decommissioning and it has a sensible impact in terms of cost and preservation of natural resources.

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The different topics studied for the selection of the strategy are presented in the table 1.

	New cask	**Existing cask**
Design and Licensing	- Design of the cask, the basket with the new content - Performance of SAR (Safety Analysis Report) - New certificate of approval	- Design of the new basket with the new content - Updating of SAR - Extension of the certificate of approval
Cost	- Studies and licensing - Cask manufacturing (including the basket)	- Studies and licensing - Basket manufacturing
Schedule	4 – 5 years	< 2 years
Sustainable development	One-shot use	- Optimisation of use - Reduction of material volume

Table 1: Selection of the cask fitted to compacted wastes

The analyses demonstrate the main advantages of adapting an existing cask for the transportation of compacted wastes in terms of costs, customer satisfaction and schedule.

The TN™24DH cask as a solution for the transport of compacted wastes

In addition to the strategic and economical analysis concerning the use of an existing cask, technical analyses have been performed which deal with the 5 versions of TN™24 casks in operation at Doel storage facility. The analyses focussed on the TN24DH cask due to its main characteristics (dimension, weight).

The TN24DH cask has been designed for the transport and the storage of used fuel from the unit 3 of Doel NPP. The first certificate of approval was granted the 24th of December 1999. To this day SYNATOM has ordered 25 TN24DH casks, and 13 casks have been delivered and loaded at the Doel interim storage facility.

The TN24DH cask is part of the TN™24 family which is a line of dual-purpose casks. The TN™24 concept is composed of a forged steel body providing the main gamma shielding, a layer of resin between the forged and the external shell providing the neutron shielding and an inner basket providing compact spacing of used fuel assemblies. Figure 2 presents the TN24DH cask.

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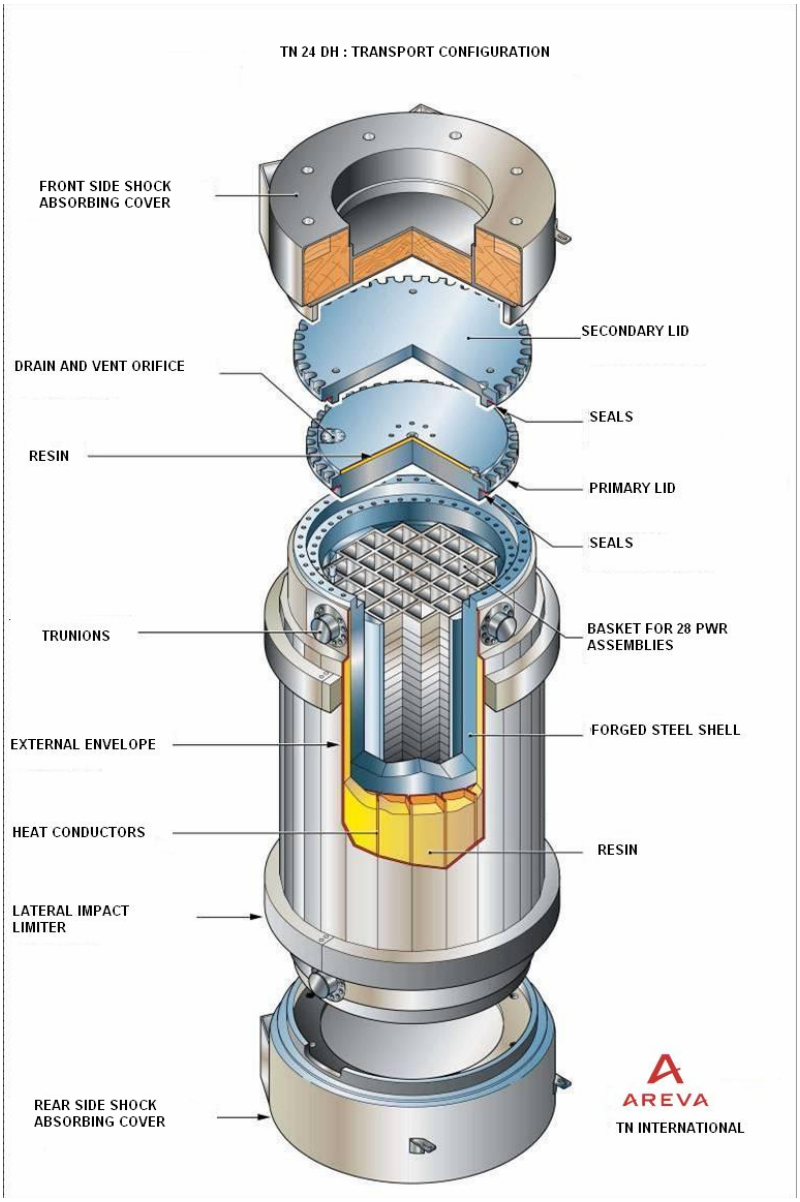

Figure 2: TN™24DH

The analyses demonstrate that the TN24DH cask can be used for the transport of compacted wastes providing mainly the change of the internal arrangement. With a new basket, the cask can be loaded with 24 compacted wastes instead of 28 PWR assemblies for the basic version. Table 2 presents the main characteristics of the TN24DH cask adapted to the specific used fuel from Doel NPP unit 3 and the compacted wastes to be returned to Belgium.

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	Basic version: TN™24DH cask with used fuel	CSD-C version: TN™24DH cask with compacted wastes
Cask characteristics: ▪ transport weight ▪ handling weight ▪ overall height ▪ outer diameter (body) ▪ cavity	 ▪ 126 t ▪ 120 t ▪ 6362 mm ▪ 2520 mm ▪ Dia 1758 mm / length 4144 mm	 ▪ 118 t ▪ 112 t ▪ 6362 mm ▪ 2520 mm ▪ Dia 1758 mm / length 4144 mm
Fuel Design basis: ▪ type of fuel ▪ burnup ▪ cooling time ▪ enrichment (U5) ▪ dimension ▪ weight	 ▪ PWR ▪ 55,000 MWd/tU ▪ 7 years ▪ 4.5 % ▪ 214 x 214 x 4060 mm^3 ▪ 680 kg	 ▪ CSD-C ▪ Dia 440 mm / length 1335 mm ▪ 850 kg
Cask content: ▪ capacity	 ▪ 28 PWR	 ▪ 24 CSD-C ▪ 3 stacking of 8 CSD-C

Table 2: TN™24DH characteristics

Another criteria for the selection of the TN24DH cask for the transport of compacted wastes is its acceptance in the loading and unloading sites. The TN24DH cask can be received at La Hague facility and at the storage building on Belgoprocess site.

The innovation of this project is to propose a new way to use a TN™24 cask in compliance with the customers needs.

A specific project organisation

One specificity of the project is the organisation of the different phases in connection with the storage of used fuel at the Doel interim storage facility. The transport program of compacted wastes is to begin in 2009 using two TN24DH casks. At the end of the program, in 2013, these two casks will then be stored and loaded with 28 used fuel assemblies. These two casks were ordered in 2005 within the framework of the contract for the delivery of 25 casks at Doel interim storage facility. The first challenge for the CSD-C transport program was to anticipate the manufacturing of the casks compared to the initial need to store the used fuel.

The different phases of the project are scheduled as below:

- Design process: studies of the new internal arrangement adapted to the compacted wastes,
- Licensing process: updating of the safety analysis report and submittal of application for the extension of the certificate of approval in France and Belgium,
- Manufacturing process: manufacture of the baskets and dedicated auxiliaries for the CSD-C version,
- Cask preparation process: the TN24DH casks are equipped with the dedicated equipment for CSD-C transportation,

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- Transport program: transportation of compacted wastes from France to Belgium from 2009 to 2013,
- Cask conversion process: the TN24DH casks are converted from CSD-C transportation configuration to used fuel storage configuration.

A dedicated project organisation has been put in place in order to offer a global solution to SYNATOM. All the services of TN International are involved in the project: the design and licensing section, the manufacturing section, the transport section, the maintenance section and the program division. The program division provides the connection between the different sections of the company but also between the customer and the other stakeholders like La Hague facility, Belgoprocess site and competent authorities.

A global solution

TN International offers a global solution to the customer adapted to its needs. Basically TN International provides two interrelated services: the design of casks which are adapted to the specific needs of a variety of transport and storage conditions and of a variety of fuels, and the safe and secure transportation. For the specific need of SYNATOM, TN International has been innovative, proposing another use of dedicated casks and ensuring the management of the wastes return and the storage of used fuel. Two TN24DH casks will be used first for the transport of compacted wastes, and in a couple of years, will be used for their primary purposes, i.e. the transport and storage of used fuel from Doel NPP.

TN International exhibits its wide and proven experience within the framework of the transportation of nuclear materials and the development of casks for transport and storage.

Today TN International has discussions with several customers proposing TN24DH in his two ways:

- used fuel storage and transportations,
- waste transportations.

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