

## **TN Hi-MW®: An Innovative Solution for Transportation and Storage of Long Activated Waste**

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### **Abstract**

Since 2013 AREVA TN has been working on a transport and storage solution, the TN Hi-MW®, to enlarge the scope of the La Hague treatment facility so that it may treat long-activated waste with a specific optimized supply chain for equipment to be replaced in the Nuclear Power Plants (NPPs), thus extending their duration of life. For example, the control rod guide tube assemblies (CRGT) are to be replaced and transported from NPPs in the near future.

CRGTs are located not far from the fuel in the nuclear reactor and are consequently contaminated, but mainly in the lower 30-cm section. Therefore, special containers are required for their transportation and storage operations: Areva TN's TN Hi-MW® solution offers many advantages and is innovative compared to other containers used in the past. For example, load rupture can be avoided during the entire operation cycle from the Reactor Building to an off-site treatment or storage facility. Moreover, the TN Hi-MW® takes into account operational constraints and practices, dimensions and weights, making it simple, safe, and quick to operate.

The TN Hi-MW® is a dual purpose Type B(U)-F container designed for activated waste storage and transportation in conformity with the Safety Authority Rules and Requirements. The TN Hi-MW®, composed of a thick carbon-steel forged body and closure system, is simple and robust, using proven fabrication processes and materials.

This paper will present the characteristics of the new TN Hi-MW® solution and present how this innovative container meets the future needs for CRGT transportation and its storage in a new treatment center at the La Hague recycling plant.

## **Introduction**

AREVA TN and AREVA engineering teams have often worked together on treatment solutions for activated waste. Thanks to this AREVA task force, AREVA TN can now offer an innovative and competitive B(U) container for the transportation and storage of ACTIVATED LONG WASTE, for example CRGTs. This container meets mid-term needs with high performance during operations and logistics. The AREVA TN solution enhances productivity, significantly reduces operation costs, and gives more flexibility in use.

## **Context**

As the program to extend the life of NPPs is currently underway, CRGTs and other long activated waste will be massively replaced. This equipment, situated not far from the fuel, is highly contaminated and activated.

### **AREVA TN SOLUTION: TN Hi-MW®**

- One sustainable container for any operation and requirement for long activated waste evacuation
- A “dual purpose” container for transportation and storage optimized to be used from the Reactor Building to public roads without load rupture
- A flexible container for operations with multiple loading/unloading configurations (underwater, dry, vertical or horizontal)
- A container to increase productivity for onsite operations and to reduce costs through the logistics process (onsite transportation, temporary storage and transportation on public road)
- A container design which can be used for other kinds of activated waste (basket modification)
- A container developed on proven technologies, based on existing container and transportation licenses

## **HIGH CAPACITY DUAL PURPOSE CONTAINER DEVELOPMENT**

With the TN Hi-MW® solution, load rupture is avoided throughout the operation cycle, from the Reactor Building to an off-site treatment or storage facility. This container takes into account operational constraints and practices, dimensions and weights as specified. Moreover, the loaded maximum weight of the TN Hi-MW® meets the Reactor Building acceptable loaded maximum in “storage” configuration without the shock absorbers. The current maximum load capacity regarding a weight constraint of 60 T without shock absorbers is 21 CRGT, for example. It includes a basket adapted to the content to be transported and stored.

The TN Hi-MW® is a dual purpose Type B(U) container designed for activated waste storage and transportation in conformity with the Safety Authority Rules and Requirements for Transportation. The TN Hi-MW® design, mainly composed of a thick stainless-steel forged body and closure system, was made to be simple and robust

using proven fabrication processes and materials. The closure system consists of a lid closed by screws and 2 joints to assure containment of the radioactive contents under any conditions.

Operating the TN Hi-MW<sup>®</sup> is simple, safe and quick. Equipped with 4 welded trunnions, the container is handled with a lifting beam to move from horizontal to vertical position.

For transportation, the 2 shock absorber covers are added to the top and bottom of the container to ensure its performance under ACT (Accidental Conditions of Transport). The TN Hi-MW<sup>®</sup> container is designed to ensure the following safety functions in all loading, transfer, storage and transport conditions:

- Containment of the radioactive contents in any conditions
- The maximum radiological protection for workers and the public.

The design of the TN Hi-MW<sup>®</sup> is based on the standard technologies used by AREVA TN for other B(U) containers. Every component had previously been approved by the French authorities for other currently licensed B(U) type containers. The main components are:

- The body and lid design are in the same material and originate from the same manufacturing technology as the TN<sup>®</sup>12, TN<sup>®</sup>13 and TN<sup>®</sup>24 bodies, all licensed in France and Switzerland as type B(U) fissile. This material is thus well known by French and Swiss authorities and mastered by AREVA TN.
- The shock absorbers are in wood which is the most common technology implemented in type B(U) AREVA TN packages.
- The shock absorber design is also tested through numerical calculations, based on drop test capitalization, simulation extrapolation and close exchange with the Safety Authorities.

The use of these previously approved components:

- Avoids the necessity of the drop test and complex analyses
- Reduces the time needed to obtain a transport license

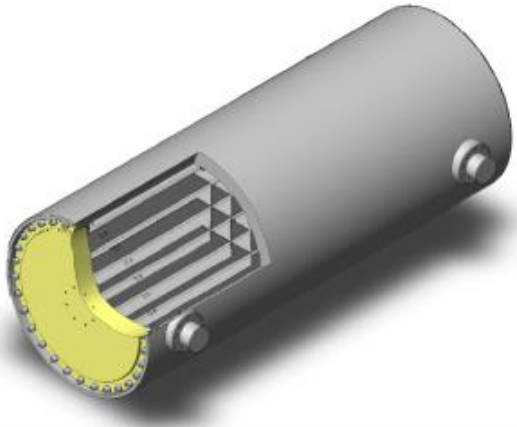
The TN Hi-MW<sup>®</sup> container is designed based on previously existing safety assessments and justifications used as demonstrations for the licensing process. In particular the following points:

- Mechanical behavior justification in ACT through numerical simulation.
- Well-known overall hypotheses regarding the content design for the radioprotection and containment studies thanks to return of experience from others casks licensing process

The TN Hi-MW<sup>®</sup> container is robust providing that:

- it is made of stainless steel,
- the contents are mechanically immobilized in the basket,
- the baskets are drilled in their bottom part in order to drain the cavity.

**Main design features of the TN-Hi MW<sup>®</sup> cask are summarized below:**

<b>Main design features</b>		
 <p>TN Hi-MW<sup>®</sup> container in storage configuration</p>	Cavity for basket	Up to 21 CRGT
	Maximum charge mass	<60 T

NB: given masses and dimensions are nominal values

**Figure 1 Main design features of the TN-Hi MW<sup>®</sup>**

**Conclusions**

The TN Hi-MW<sup>®</sup> solution enables the unloading of long activated waste from NPPs directly into the container for temporary storage before transportation.

As soon as the container obtains its transportation license and some treatment solutions are available, the container will be able to be directly transported from the storage area to the treatment facility. No off-site transfer activities are needed for evacuation of the long activated waste. All containers can be loaded and unloaded with only one opening and closure.

These containers can transport and store up to 21 CRGTs, for example, significantly reducing the number of casks, handling activities and shipments.

To accept any kind of activated contents, AREVA TN has developed different types of baskets depending on the required shielding. Some studies shall be made in the near future for different constraints and customer requirements.