

Fleet of Type B packaging for low level radioactive waste shipments

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ABSTRACT

The United States have already announced around 20 reactor shutdown and many more in the next 10 year. Financial constraints on plant operators and the low cost of fossil energy contribute to accelerate the shutdown of additional reactors. To improve the cost efficiency of the upcoming projects, larger and more capacitive transport casks are needed to transport increasing volume of Low Level Waste (LLW) at a more attractive cost. Waste disposal is also a major cost element in a dismantling project. Consequently, the capacity to segment, package and transport the waste in the most optimized configuration will result in significant cost savings. The key element to succeed is the availability on the market of a licensed type B transport packaging with a larger payload that allows at the same time an optimization of the waste segmentation operations.

Orano TN has developed and licensed a fleet of diverse casks to support the increase in waste packaging and transportation. This fleet includes the MP197HB designed and licensed as versatile high capacity type B casks for the transport of spent fuel canisters as part of the NUHOMS® system that can also be used to transport radioactive waste. While it will take a few more years to transport spent fuel to a consolidated interim storage facility and even more to a repository, the MP197HB can be used to transport activated LLW from dismantled reactors to disposal sites.

Larger transport capacities are going to be put in service for customers as early as in 2019 thanks to the new MP197HB transport cask to support large decommissioning projects..

This paper will present the main characteristics of the packaging, provide an update of the overall project schedule, and explain Orano's innovations that contribute to simpler and more cost effective transport and operations solutions.

INTRODUCTION

The development of transport casks adapted to the customer needs with a high level of safety is ORANO TN routine. The increase in the needs for transport of LLRW requires the adaptation of the fleet of casks with an increase in size and the development of innovative type of services to the customers. ORANO TN continues developing its large fleet of casks and new services, in particular in the field of the LLRW transport.

DISCUSSIONS

New Low Level Radioactive Waste (LLRW) Paradigm in the United States

An increasing number of nuclear reactors in the United States are shut down or are considering shutting down in a near future. This trend along with the willingness of utilities and local authorities to accelerate the decommissioning of commercial reactors is driving the need for more transports of LLRW to disposal sites. The amount of wastes of all classes (A, B and C) is expected to increase in the next few years, mostly to support the sites decommissioning. In the meantime, shutting down sites are loading into dry storage systems Greater Than Class C (GTCC) wastes on their Independent spent fuel storage installation (ISFSI). The GTCC wastes will also have to be transported to disposal sites or other interim storage sites in the future and therefore will require suitable transport packages.

A reactor dismantling project consists of five main phases:

- Planning
- Decontamination
- Dismantling and decommissioning
- Used fuel and waste management and transportation
- Site restoration

The dismantling and decommissioning phase which consists of disassembly of plant and equipment, including cutting away piping systems, deconstructing heavy reactor components and demolishing buildings, treatment, conditioning and packaging is one of the most costly phases along with waste disposal. Optimization of the dismantling to allow more efficient waste packaging will allow cost reduction as well as a better environmental approach to reduce waste disposal footprint.

To do so, availability of flexible and optimized pay-load transport package is a key component of a reactor dismantling project

The needs to be addressed are:

- Increase the transport capacities with limited capital investments
- Optimize the number of shipments in the public domain with higher pay-load transport casks
- Be compatible:
 - o with the existing transport infrastructures
 - o with the shutdown sites, in particular sites with tight lifting capabilities, and with the D&D operations
- Reduce the number of Reactor Vessel and Reactor Vessel Internal cutting operations and optimize the decommissioning costs
- Increase waste disposal / processors receipt capacities
- Optimize the waste disposal costs and the loading of the waste liners
- Limit the workers and public dose exposure during the operations

To address this needs and better optimize waste management thru flexible and higher packaging capacity, ORANO TN has designed, licensed and fabricated a family of casks with new additions such as the TN-MW triple purpose package and the high capacity MP197HB package

ORANO TN Transport Casks Fleet Licensed For Wastes

TN has been developing a flexible fleet of transport packages adapted to the different needs of the industry.

The first non-fissile model considered in the TN®MW family is a Type B(U) cask (in accordance with 2012 IAEA regulations) to be licensed for transportation and interim storage for at least 50 years. The TN®MW is compatible with a variety of waste types such as legacy waste, orphan waste, waste produced during plant life (maintenance and operation), and during dismantling operations.

The TN®MW cask can be transported by road, rail or vessel, inside a standard 20' ISO container. A few of the major features of the TN®MW are provided below:

- Underwater Loading/Unloading
- Openings to facilitate draining/drying of the package cavity
- On-site transfer and interim storage of the package without shock absorbers in vertical position
- Interim storage for up to 40/50 years on-site without maintenance (no gasket replacement, possibility of leak-tightness monitoring if needed)
- Compatible with final disposal (Triple purpose)
- Cavity internal maximum dimensions are: Diameter 740mm and height 1140 mm. The total weight in transport configuration is 12 metric tons. The first TN-MW has been delivered with success in Europe in 2017.

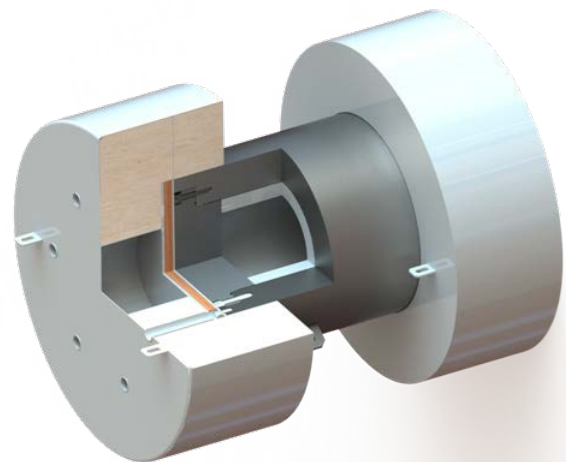


Fig. 1: TN®MW transport cask

For more than 30 years, the TN-RAM has been the “workhorse” for transporting irradiated waste. The

TN-RAM is providing a reference solution to the pool clean outs and transport of non-fuel bearing LLRW from reactor pools to waste disposal sites. A second TN-RAM transport package will be put in service in 2018. The TN-RAM is a proven robust 80,000 lbs package that is offering a pay-load of 9,500 lbs (4,309 kg) of content into a 60ft³ (1.5 m³) liner containing up to 30,000 Ci or equivalent of Co-60.



Fig. 2: TN-RAM transport cask

The MP197HB, which is part of the TN NUHOMS technology offered by ORANO TN for transport of spent fuel stored into dry shielded canister. It is a multi-purpose package already licensed by the US NRC for the transport of Spent Nuclear Fuel Canisters (DSC) but also Rad Waste Canisters (RWC) loaded with Low Level Radioactive Wastes. It is today licensed for transportation of RWC containing up to 70,000 Ci of Co-60 or equivalent. The RWC dimensions are the same size as the DSC.



Fig. 3: MP197HB transport cask

Zoom on The TN Americas MP197HB High Pay-load transport package

The MP197HB is an NRC approved Type B(U) transport package. The MP197HB transport cask allows the transport of LLRW thanks to its different designs of Rad Waste Canisters (RWC). New developments are currently focusing on adapting the RWC to the LLRW coming from the decommissioning of commercial reactors and adapted to the new and very specific loading operations that are planned to support the Reactor Vessel and Reactor Vessel Internal decommissioning. The MP197HB is part of a larger logistics architecture that can mobilize additional equipment to fit the new transport needs:

- The Radioactive Waste Canisters (RWC) that can be adapted to add radial and axial shielding whenever necessary and can be designed to be fully adapted to the transfer and disposal operations. Welded or bolted lid designs can be proposed. In transport, the RWC is a part of the transport cask design and allows the loading of wastes directly into its cavity with or without baskets. It allows the loading of multiple liners that can be loaded and stored in the Spent Fuel Pool in advance, inside of the RWC cavity. The RWC or the liners can be used as final disposal containment depending on the waste processors capabilities. The maximum weight of the loaded RWC is 56 tons.
- A fleet of Transfer casks that can be used when the site lifting capacities or the pools are not suitable for direct loading into the transport cask. A light transfer casks such as the OS-197L or larger transfer casks like the OS-200 or OS-197 can be mobilized to transfer the wastes from reactor building to Horizontal Transfer Systems or Horizontal Storage Modules in the case of Greater Than Class C wastes.
- Shielding Horizontal Transfer Systems (HTS) based on the proven TN HSM designs can be mobilized onsite to provide a temporary buffer of LLRW between the transfer cask and the transport cask. As many HTS as needed can be provided to make the size of the buffer adapted to support the logistics and depending on the number of transport casks available. This type of equipment provides significant schedule buffer and flexibility in the operations (loading and transport operations)

- Ancillary equipment such as lifting equipment, vacuum drying system, leak test equipment, transport skids, transfer skids can also be adapted to multiple sites and operations.

Future Developments

The approach of ORANO TN is to integrate the entire waste cycle constraints into the waste packaging and transport cask, starting from the waste characterization and conditioning up to the final disposal. The transport casks should not be seen as a bottleneck for the decommissioning activities but a source of inspiration and improvement to make the decommissioning operations and waste disposal costs effective while minimizing the impact on environment.

ORANO TN is working on building more cost effective packaging and transport equipment of various sizes to meet the different industry needs worldwide.

In the USA, one large capacity MP197HB cask in addition of two TN-RAM casks will be available to the Industry in the 2018-2019 timeframe.

In Europe, ORANO TN is developing the TN-MW family. The next models currently under development to expand the TN@MW family are:

- A Type B(U) “wet” version with penetrations when wet loading/unloading is required (version describe here above)
- A Type B(U) “dry” version with no penetrations and reduced package cost when only dry loading/unloading is required (no drain orifice)
- A Type B(U) “transportation only” version with elastomer gaskets to reduce costs when no storage is needed
- An “IP-2 version” for Low Specific Activity (LSA) or Surface Contaminated Objects (SCO) material and “type A version” without shock absorbers and with elastomer gaskets
- An “on-site transfer” specific version adapted to 400L drums without shock absorbers
- A version for the transport and the interim storage of residues issued from the Research Reactor Spent Fuel reprocessing plant
- A Type B(U) “large version” adapted to special waste or equipment (such as dismantled parts that cannot be segmented on site) with the objective of staying below a mass of 60 MT (without shock absorbers).

ORANO TN is also working on new innovations and development that will improve the operational interface with the decommissioning and disposal sites to reduce the turnaround time, to optimize the loading while keeping the high level of safety provided by ORANO TN technologies.

ORANO TN strong licensing experience and proven onsite pool to pad services capabilities are also contributing to the new developments. This type of services is also an area that may be of interest to utilities that are in the process of shutting down and loosing skilled resources and know-how.

ORANO TN Services

ORANO TN has been developing a wide range of services to support the customer needs such as the pool to pad operations or other on site specific operations. The development of sites decommissioning requires a lot of flexibility to adapt to very different sites and operations. ORANO TN provides onsite support to the customers appropriately dimensioned for the type of operations needed.

ORANO TN also maintains a strong expertise in transport services, design engineering, licensing of cask, onsite technical support or fabrication of new casks and equipment (thanks to CHT). ORANO TN offers turnkey solutions supporting the logistics of radioactive materials.

CONCLUSIONS

With respect to the various waste generated during a facility's life time, such as legacy waste, operational and maintenance waste, and dismantling waste with different forms such as activated metallic waste, sludge, resins, and orphan waste, optimization of waste stream management is a key factor in controlling and reducing waste management costs. In addition of the multiple characteristics of waste, interfaces at point of origin and disposal sites has to be smoothly integrated.

Using its extensive design, licensing fabrication and operational expertise, ORANO TN is continuing to develop innovative packaging and transport solutions understanding the key role of the package into the overall process.

REFERENCES

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