

# **The TN-GEMINI: A PRAGMATIC APPROACH TO ALPHA WASTE TRANSPORT OPERATION MANAGEMENT**

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## **INTRODUCTION**

Alpha wastes are generated in fuel cycle facilities such as those involved in reprocessing, manufacturing of MOX fuel, as well as by research laboratories. If a significant amount of waste has to be transported, then a Type B packaging is required. Developed by Transnucléaire, the TN GEMINI container enables nuclear facility operators to further optimize their alpha waste transport management.

The TN GEMINI container is a rectangular packaging similar to an ISO 20 foot container in terms of total weight, size, handling devices and tie-down capability. It provides a large internal usable volume available for a 5.8 tons payload and enables the transport of alpha wastes conditioned in drums or big contaminated boxes.

TN GEMINI has been licensed in France since 1997 and two packages are currently operated in Europe.

After a general description of the TN GEMINI container, the paper will describe its capabilities, the process for the transport licensing, the main operational feed back from the existing units already in operation in Europe and the latest developments.



Picture 1

## **DESCRIPTION**

The TN GEMINI packaging has been mainly developed for the transport of alpha waste which can have a very wide range of characteristics especially in terms of shapes and sizes. Logically, the most

convenient internal cavity shape of packaging is rectangular. This rectangular cavity allows for easy operation during the loading, transport and unloading of the package.

The TN GEMINI has handling characteristics similar to an ISO 20 foot container in terms of size, handling devices and tie-down capability. The main characteristics are:

- Overall dimensions:           Length: 6058 mm  
  Width: 2500 mm  
  Height: 2650 mm
  
- Internal cavity:                Length: 4510 mm  
  Width: 1840 mm  
  Height: 2000 mm
  
- Maximum weights:            Empty: 24.2 tons  
  Loaded: 30 tons  
  Payload: 5.8 tons

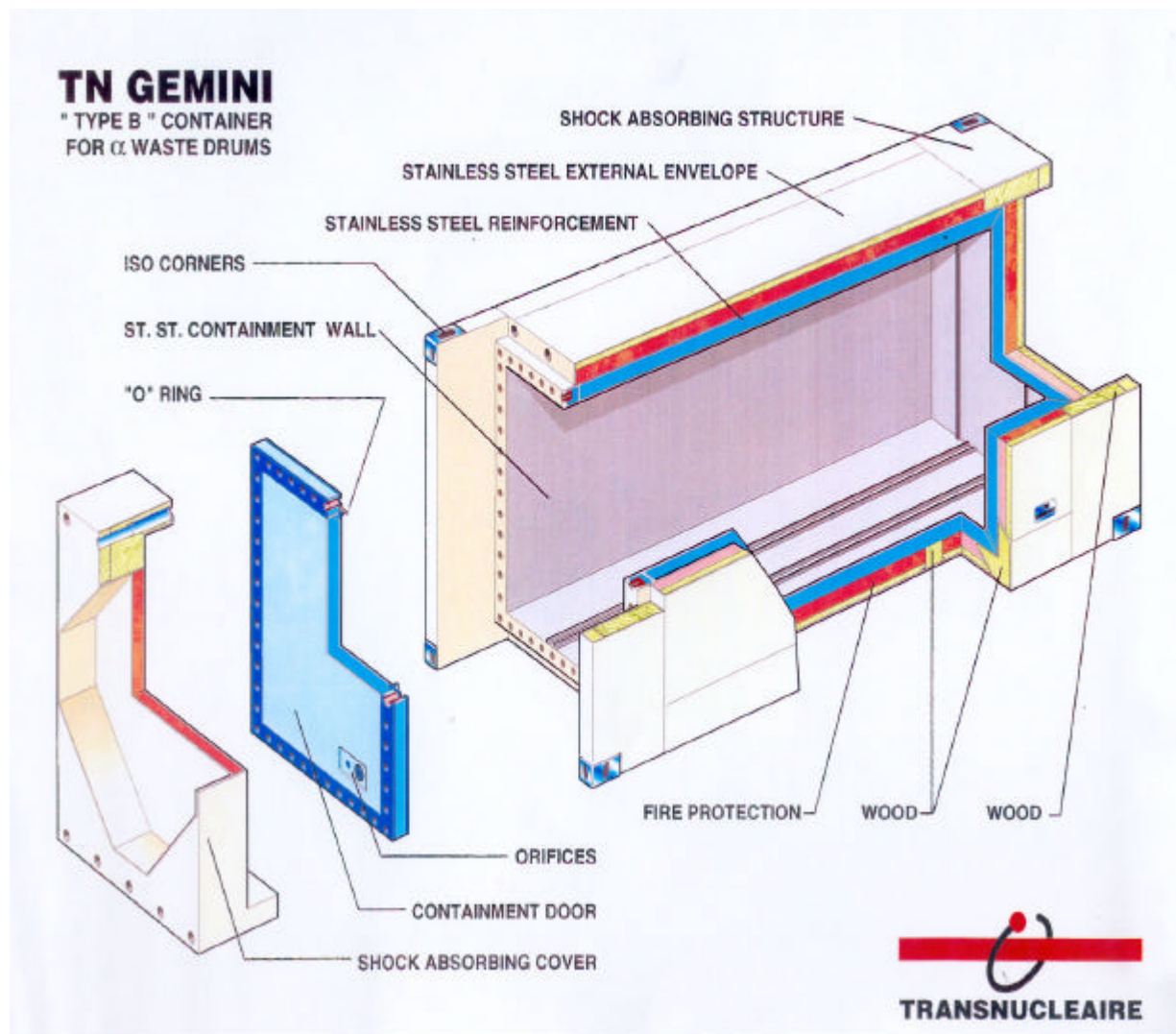


Figure 1

With such dimensional characteristics, the TN GEMINI can be easily transported on road with a maximum total weight below 40 tons including the trailer and tractor. Therefore, it is not necessary to be in an exceptional transport configuration and the package can be moved routinely, without additional constraint.

The TN GEMINI is mainly composed of:

- A rectangular body made of stainless steel, shock absorbing material and fire protection. The internal cavity is covered by stainless steel plates which allows for easy decontamination. The external part is painted. For handling and transport, the package is equipped with eight standard ISO corners.
- A lid equipped with two elastomer gaskets and with an orifice also equipped with two elastomer gaskets. The lid is fixed on the body with screws type M36.
- A shock absorber cover screwed on the body of the packaging.

Depending on the type of content, the packaging could be equipped with various internal devices for loading and tying down the content.

### **LICENSING PROCESS**

The TN GEMINI packaging is a type B(U)F and has been initially licensed in France since July 1997.

The compliance of the packaging with the AIEA regulation (1985 Edition amended 1990) is based on a campaign of 9 drop tests performed in 1994 on a half scaled model.

The content of the test program was:

- 4 drop tests from 9 meters
- 4 puncture drop tests from 1 meter
- 1 drop test from 0,3 meter.



Picture 2

After the tests, the leak tightness was controlled.

Due to the special rectangular shape of the packaging, the key point of the design was the resistance during puncture drop tests, especially on the large flat surfaces. In order to meet this severe requirement, Transnucléaire has designed a specific multi-layered mechanical structure also compatible with good thermal behavior for the fire resistance.

## CONTENTS

A very large range of alpha wastes can be transported in the TN GEMINI packaging:

- paper/cardboard/cellulose
- cotton
- polymer (vinyl sheet, vinyl polychloride, polyethylen methylpolymetacrylate, Teflon...)
- glass
- rubbish (soil, cement, plaster)
- iron, molybdenum
- uranium spheres
- ashes, metallic oxides
- ZnO, CaO, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, PuO<sub>2</sub>, U<sub>3</sub>O<sub>8</sub>,....
- Zircalloy (cladding pieces)
- filter dust
- over brick
- sodium phosphate
- silicon carbide spheres.

Hydrogen production due to radiolysis or chemical decomposition of organic materials is taken into account. Permeability envelope characterization for an acceptable H<sub>2</sub>/air ratio has been performed. The wrapping of waste is one of the checks that are made to verify compliance.

One of the key formula of the license is thus:

$$\frac{mPu}{374} + \frac{mU\ 235}{620} \leq 1$$

The maximum quantity of Uranium 235 and Plutonium is defined by the preceding equation where mPu (respectively mU235) is the mass of Pu (respectively U235) in grams.

The maximum heat power of the packaging is limited to 10 W.

## LOADING AND TRANSPORT OPERATION

The TN GEMINI package can be directly tied-down on a standard trailer for a ISO 20 foot container. It can also be handled with standard devices such as those commonly used for ISO containers.

The TN GEMINI can be loaded directly on the trailer or the package can be transferred to a loading facility depending on the site characteristics and requirements.

Presently, the TN GEMINI is mainly used for the transport of drums. Two types of loading equipment are used:

- **Type 1:** the drums are placed in pallets (12 drums per pallet) and each pallet is loaded directly in the package by using a fork-lift. Each pallet is then pushed manually to the bottom of the cask (the cavity floor is equipped with 2 rails which allow for easy maneuvering of the pallet within the cavity). Finally each pallet is tied-down.



Picture 3

- **Type 2:** the drums are placed in pallets (3 drums per pallets). The package floor is equipped with a specific handling equipment in order to maneuver the pallet within the cavity. This equipment is very similar to the one used in fret air transport for loading aircraft. This special external floor is removable and is transported with the drums. When the package is opened, it is connected to an automatic device, equipped with electric engines, which conveys the pallets within the cavity either for loading or unloading operation. This automatic devices is not transported inside the package but each facility should be equipped with it.

The Type 1 loading equipment is generally used for research reactors or laboratories for which there is no industrial steady flow of waste to be transported. The Type 2 device reduces the loading and unloading operation time and is mainly used between the MOX fabrication facilities and the reprocessing plants.

### **TRANSPORT EXPERIENCE**

The TN GEMINI has now been in operation for four years and has two main lines of activity for the transport of alpha waste in France:

- Transport of drums from CEA (Commissariat à l'Energie Atomique) research center and the CEA waste treatment facility.
- Transport of drums from the fresh MOX fabrication facilities, Mélox and the Cadarache, to the reprocessing plant at La Hague.

Several transports of alpha waste were also performed between France and Germany.



Picture 4

### **NEW DEVELOPMENTS**

Transnucléaire is continuing to extend the capability of the TN GEMINI packaging to other types of contents such as glove boxes or heavy crates containing miscellaneous alpha contaminated wastes. For each new content, the existing loading equipment may be used or a specific device may be designed in order to comply with the dimension of the content and with the requirement within new facilities. For instance, for content which may impact the internal confinement of the packaging, internal shock absorber may be especially developed and placed along the walls of the TN GEMINI.

For Emergency Response Plan, the TN GEMINI can be in interesting solution in order to transport damaged equipment.

Presently, four new TN GEMINI packages are under manufacturing and should be operative in 2002. Among these four packages, one is dedicated to Transnucléaire who will propose it to its customers.

### **CONCLUSION**

The TN GEMINI is a very unique design: it is the only B(U)F packaging with dimensions similar to an ISO 20 foot container. Such shape allows for easy transport of a wide range of alpha wastes: drums, glove boxes...



Picture 5

Within the near future market for dismantling facilities, the TN GEMINI will be an optimized solution for the transport of voluminous equipment in order to treat them in special facilities and not to cut them before the transport.

The TN GEMINI, as a versatile container, enables nuclear facilities operators to optimize their alpha waste transport management and more generally contributes to their D&D projects.