

## **Dedicated Packagings for the Transportation of Alpha Waste**

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### **INTRODUCTION**

This paper deals with the dedicated packagings already in operation or designed for the transport in France of the alpha bearing (or TRU) wastes, issued from the process cycle, which belong to the categories of Low and Intermediate Level Waste.

Among the products involved are glove boxes contaminated by plutonium and uranium, working clothes, metallic equipment, cotton, incineration ashes, filter elements, uranium rejects. Some wastes can be sent directly to the shallow land repository operated by ANDRA at Soulaines for low level waste. This applies to the alpha-bearing wastes containing less than 0.1 Ci  $\alpha$  per ton ( $4 \cdot 10^{-6}$  TBq per kg) of conditioned waste. Such wastes have "very low" and "low" activity contents. Other wastes cannot be accepted in this final disposal site and must be transported either to an interim storage site set up at the Cadarache research center or to a Cogema plant for plutonium recovery and/or waste reconditioning.

### **SHIPMENTS TO ANDRA SHALLOW LAND FINAL DISPOSAL SITE**

The alpha-bearing wastes are issued from CEA (French Atomic Energy Commission) facilities, from Mox fuel manufacturing plants (Melox in Marcoule or CFCa in Cadarache) or from Cogema reprocessing plants. Most of the alpha-bearing wastes shipped to Soulaines are Low Specific Activity materials.

#### **Industrial Packages in large size overpacks**

Industrial packages are used for transporting alpha-bearing wastes when the following three criteria are fulfilled:

- the specific activity of the content is lower than  $10^{-4}$  A<sub>2</sub>/g for LSA II and lower than  $2 \cdot 10^{-3}$  A<sub>2</sub>/g for LSA III material;
- for LSA III material, the maximum water leaching rate of the industrial package content without any shielding material is limited to 0.1 A<sub>2</sub> per week;
- the maximum activity content is limited to 100 A<sub>2</sub> per conveyance (road vehicle, railcar) when the wastes are in the form of liquid, gas, or a combustible solid.

Then, standard transportation equipment is used for the transport of the container serving as an overpack for the industrial packages.

Two types of dedicated containers for the transport of LSA alpha bearing waste are available in France, named DV 78 and DV 28. The DV 78 is a 20 ft ISO container featuring, for increased operational safety, reinforced walls and a water drip tray. Equipped with an internal rack, the DV 78 container can for instance accommodate:

- approximately fifty 220 liter drums;
- 12 fiber-reinforced concrete cylinders type CBFC 1, holding each one 220 liter metallic drum;
- 6 fiber-reinforced concrete cylinders type CBFC 2, holding each one 400 liter metallic drum or large contaminated equipment.

An industrial package can transport alpha-bearing waste with a low activity content. For instance, an average Pu content per drum less than 0.02 g for wastes issued from CFCa and Melox facilities.

### **An upgraded Industrial Package (DV 77)**

Should total activity or leaching criteria not be fulfilled as it is the case for some CEA wastes, two possibilities can be contemplated:

- keep on using the container and the industrial packages while limiting the content activity, when the maximum content activity is the only problem. However, this solution entails the economic and safety drawbacks related to an increased number of transports;
- use a type B package.

To provide means of transportation for CEA wastes, easily made compatible with handling and unloading equipment at ANDRA disposal site, and in accordance with the French Competent Authority, it was decided to design a new type of packaging as an intermediate solution to the above possibilities. Regulatory aspects of the transport of irradiating and alpha waste in France have been addressed in a paper given by C.Devillers in Vienna in February 1994.

An upgraded industrial packaging has therefore been developed by Cogema and Transnucléaire, namely the DV 77, to transport LSA combustible waste with a total activity higher than 100 A<sub>2</sub> (exceeding Industrial Package capabilities). The water leaching rate of the waste contained in a single drum can be over 0.1 A<sub>2</sub> per week.

This new packaging is designed to provide the same safety level as the industrial package for a more demanding content. It is shown in picture 3.

It must withstand:

- a 30-cm drop test in the most stringent configuration - corner drop test with slap down in this case - (qualification required for Industrial Package).  
After this test, the drums should remain properly tied down in the rack to be protected from the fire and to remain watertight. Also, the rack is maintained in position and does not impact the walls.
- the fire test (800 °C during 30 minutes) required for type B packagings, bringing evidence that the protection incorporated in the packaging walls will prevent any combustion of the combustible content.

Following the two tests, the content shall keep a water leaching rate lower than 0.1 A<sub>2</sub> per week.

The overall maximum content activity of the packaging shall be lower than 600 A<sub>2</sub> and the maximum specific activity lower than  $2 \cdot 10^{-3}$  A<sub>2</sub>/g (LSA III limitation).

The DV 77 packaging has the size of a 20 ft ISO container and a gross weight of 24 metric tons. It will accommodate either sixty 200 litre drums or one hundred and twelve 100 liter drums. Its main features are summarized in table 2.

### **SHIPMENTS TO THE LLW INTERIM STORAGE SITE AT CADARACHE AND TO THE COGEMA RECONDITIONING FACILITY**

When the characteristics of alpha-bearing waste preclude its disposal in an existing final repository, it also requires a type B package for its transport to the interim storage site at Cadarache (waste coming from CEA facilities) or to the Cogema reconditioning facility (waste coming from the Mox fuel manufacturing plants).

Two type B packagings are available for such transports:

- the TN GEMINI packaging ( 20 ft ISO container), see picture 2, offering a capacity nearly equivalent to that of the DV 77 packaging. It will transport alpha bearing wastes with "high activity" content (for example an average Pu content per drum less than 5 g for wastes issued from CFCa facility and a Pu content per drum less than 10 g for wastes issued from Melox facility);
- with a cylindrical shape and a smaller volume, the RD 26 packaging has been designed for the transport of a single drum (see picture 1). It will be able to transport alpha bearing waste with "very high" activity content. For example an average Pu content per drum up to 20 g for wastes issued from CFCa, and up to 40 g for wastes issued from Melox.

As type B packagings, they withstand the corresponding tests required by the regulations: 9-m drop test, punch test, 800°C fire test.

The TN GEMINI has a gross weight of 30 metric tons and it can accommodate forty 200 liter drums or sixty 118 liter drums filled with solid waste. With a gross weight of 610 kg, the RD 26 accommodates one single 118 liter drum of solid waste or ten 2 liter bottles for liquid waste.

Table 2 shows the main characteristics of the TN GEMINI and RD 26 packagings.

### **ACTUAL STATUS FOR THE THREE TYPES OF PACKAGINGS**

To-date, the DV 77 design has been validated by preliminary tests. It has been demonstrated that the racks maintain the drums efficiently during drop tests and that the internal protection against fire conditions is effective. Specific design for drum closure system has already been qualified to comply with the water leaching criteria. Scale 1 qualification testing is planned early 1996, and the Safety Analysis Report is under preparation to be submitted to the French Competent Authority in 1996.

All the safety qualification tests related to the TN GEMINI packaging have been successfully performed. Two packagings have already been delivered, one for the transport from the Melox plant to the La Hague plant, and the second for the transport from CEA facilities to the Cadarache interim storage site. The approval certificate of the RD 26 as a type B package has been granted in 1993 for the transport of solid waste, and in 1995 for liquid waste.

Altogether 72 RD 26 packagings have been manufactured to perform transports from the Melox plant to the La Hague plant.

## A COMPREHENSIVE SET OF PACKAGINGS

These three packagings are complementary insofar as each use depends on the content intensity and volume and consequently on the destination : final disposal site, interim storage site, reconditioning plant. Table 1, hereafter, illustrates the various cases for which these dedicated packagings can be used.

**Table 1. Dedicated packagings according to destinations.**

DESTINATIONS	LLW final disposal site	Interim storage site or recovery and/or reconditioning facility
ALPHA-BEARING WASTES (Transport classification)	activity up to 0.1 Ci $\alpha$ per ton of waste	activity above 0.1 Ci $\alpha$ per ton of waste
LSA materials	Industrial packages in DV 78 or DV 28 containers	Not applicable
LSA materials with : • maximum content activity up to 600 A2 and $2 \cdot 10^{-3}$ A2/g • water leaching rate of the waste over 0.1 A2 per week	DV 77 upgraded industrial packaging	RD 26 TN GEMINI
Non LSA materials	Not applicable	

The DV 77 and the TN GEMINI packagings are transported on a truck like an ISO 20 ft container. Up to 12 RD 26 packagings can be transported, in order to facilitate handling operations, in a DV 78 container equipped with a specific tie-down arrangement.

The TN GEMINI can be used to transport large quantities of drums or large size contaminated equipment while the RD 26 is particularly suitable for waste issued from laboratories. Also, the RD 26 packaging can be used to transport higher plutonium concentrations than the TN GEMINI as well as liquid and solid alpha-bearing waste. Quick loading/unloading operations are among the key advantages featured by the RD 26.

## CONCLUSION

All the transportation needs for alpha-bearing waste in France are covered by these four categories of packages: various industrial packages, one upgraded industrial packaging and two different kinds of type B packagings.

Table 2. Dedicated packagings for alpha bearing waste.

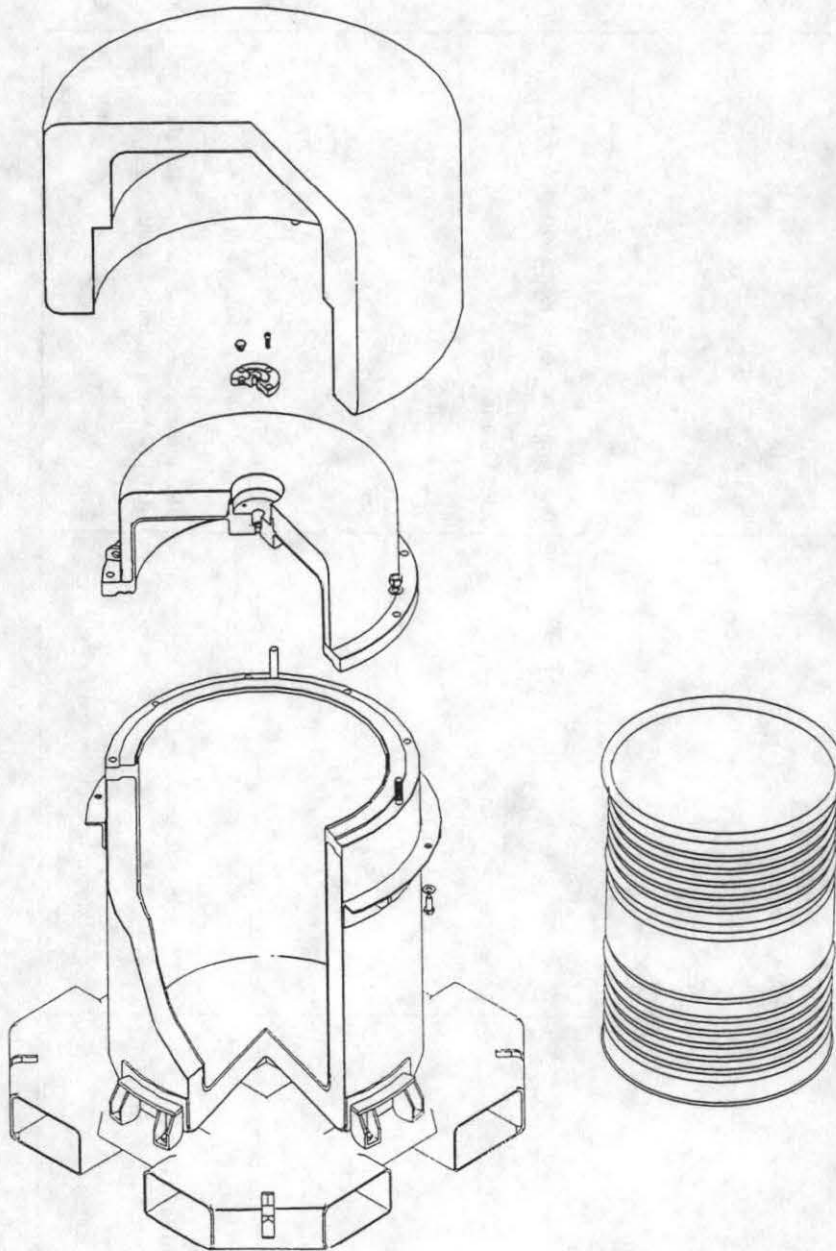
	DV 77	TN GEMINI	RD 26
<b>Overall dimensions</b>	Same as 20 ft ISO container	Close to 20 ft ISO container	Cylindrical container $\phi$ 860 H 1145
<b>Capacity</b>	60 x 200 l drums 112 x 100 l drums	40 x 200 l drums 60 x 118 l drums Large size equipment	1 x 98 l drum 1 x 118 l drum 10 x 2 l bottles
<b>Empty weight</b>	7 t	24 t	460 kg
<b>Gross Weight</b>	24 t	30 t	610 kg
<b>Qualification</b>	Upgraded Industrial Packaging 30-cm drop test. 800°C fire test (1/2 h)	Type B package 9-m drop test. punch test. 800°C fire test (1/2 h)	Type B package 9-m drop test. punch test. 800°C fire test (1/2 h)
<b>Content</b>	Alpha-bearing waste: <ul style="list-style-type: none"> <li>• <math>100 A_2 &lt; A &lt; 600 A_2</math></li> <li>• <math>As &lt; 210^{-3} A_2/g</math></li> <li>• water leaching rate per drum <math>&lt; 0.1 A_2/week</math></li> <li>• waste dose equivalent rate <math>&lt; 1 \text{ rem/h } 3 \text{ m}</math> from the waste</li> <li>• Pu content <math>&lt; 25 \text{ g}</math></li> </ul>	Alpha bearing waste: <ul style="list-style-type: none"> <li>• <math>A &gt; A_2</math></li> <li>• Pu content <math>&lt; 400 \text{ g}</math> per conveyance</li> </ul>	Alpha bearing waste: <ul style="list-style-type: none"> <li>• <math>A &gt; A_2</math></li> <li>• Pu content <math>&lt; 350 \text{ g}</math> per conveyance</li> </ul>
<b>Origin of the content</b>	CEA facilities	CEA facilities Mox fuel manufacturing plants (Melox, CFCa)	Mox fuel manufacturing plants (Melox, CFCa)
<b>Destination of the content</b>	ANDRA final disposal site (Soulaines)	CEA intermediate storage site (Cadarache) COGEMA reconditioning plant	COGEMA reconditioning plant
<b>Operational status</b>	First packaging operational end 1996	2 units available	72 packagings in operation

Note: A = total activity. As = specific activity

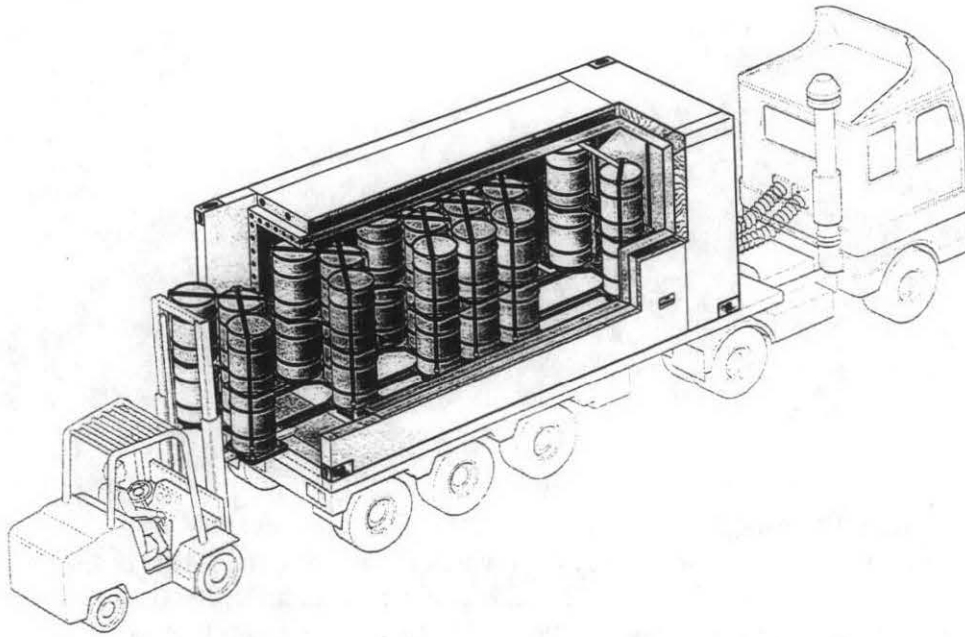
## REFERENCE

C. Devillers - M. Grenier - J. Lombard - F. Mathieu: Regulatory Aspects of the Transport of Irradiating and Alpha Waste in France, Vienna 21-25 Feb 1994

Picture 1. RD 26 packaging



**Picture 2. TN GEMINI packaging.**



**Picture 3. DV 77 upgraded industrial packaging.**

