TRANSNUCLEAIRE EXPERIENCE IN RESEARCH REACTOR FUEL TRANSPORTATION CYCLE (Front end and back end)

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For 35 years TRANSNUCLEAIRE has been involved in all types of transportation for research reactors (front end and back end) and laboratories:

- Fresh uranium (LEU and HEU)
- Fresh MTR elements
- Irradiated MTR and Triga elements
- Sources, samples, fuels rods,...

For the front end of Research reactors and Laboratories, each year we perform an average of 10 transportations of fresh uranium representing approximatively 1 ton of material, and an average of 30 transportations of fresh MTR fuel representing about 300 / 400 elements.

For the back end, we are carrying out for shipments for research reactors to the USA, COGEMA La Hague reprocessing plant and between CEA sites (French Atomic Energy Commission). For example around 35 loaded casks will be transported over 1999.

In the present document, a shipment of low enriched uranium to be transferred from UK Atomic Energy Agency Dounreay to CERCA Romans Plant (France) and the specific operations involved will be presented.

We will also update the status of our licensed new cask TN-MTR which will be used for the transportation of irradiated MTR fuel elements this year.

1. TRANSPORTATION OF LEU FROM DOUNREAY TO ROMANS

The characteristic of the research reactor fuel transportation cycle is that each transfer is almost specific and must be carefully prepared.

In addition to the safety requirements, the Physical Protection concern is very strong due to the nature of the material to be transported. This kind of transport requires a lot of preparation and sound organization.

TRANSNUCLEAIRE has been operating a great number of shipments of LEU and HEU from UKAEA DOUNREAY (Scotland) to CERCA ROMANS (France). The operation described hereafter was the first LEU shipment from Dounreay for 2 years ago.
The material to be transported was uranium metal ingots with an enrichment of 19.75 %.

1.1. Preparation of transportation

Around three months of preparation are required for transportation.

- *Preparation related to the packaging*

  The first step in any transportation procedure is to verify the conformity of the material within the limits imposed in the packaging license. In the case presented the materials were in compliance with the existing license and the previously-issued United Kingdom validation. If this had not been the case, preparation time would have been much longer.

- *Preparation related to nuclear material transportation*

  A transport plan 1 month prior to actual transportation and complementary transport notifications detailing the technical and humans means must be addressed to the relevant French Ministry. Approval is issued a few days before transportation.
  Other notifications especially for air transport are managed by the aircraft company in compliance with international civil aviation regulation.

- *Coordination*

  Coordination between all the parties involved constitutes a very important aspect of the work at hand (consignee, consignor, authorities, road and air carriers...).

1.2. Cask

The cask operated for this transport is called TN-BGC1.

The TN-BGC1 cask has been designed by TRANSNUCLEAIRE for the CEA in accordance with 1985 IAEA for the transportation a wide variety of fissile materials such as plates of metallic plutonium and uranium, powder of plutonium and high enriched uranium. The fissile material is always packed in a canister placed into the cavity of the packaging.

The TN-BGC1 is a type B(U) F licensed since 1988 in France and validated in many countries.

For the transport, 20 TN-BGC1 casks used to transport the whole quantity of material.

The packaging consists of a rectangular cage inside which a generally cylindrical-shaped body complete with closure system and cover is fitted.

The principal dimensions of the packaging are the following:

External dimensions :

- cross section of cage	600 x 600 mm
- overall height of cage	1821 mm

Internal dimensions

- diameter	178 mm
- length	1475 mm

Maximum weights of the packaging are:

- unloaded	280 kg
- loaded	396 kg

For uranium metal ingots, the maximum total weight loaded inside the packaging is 45 kg of uranium metal; for metallic uranium and uranium oxide the maximum total weight is 60 kg.

The packaging has been designed to be transported either in full or non-full load, and can be transported by road, rail, sea and air. It can be transported vertically or horizontally.

It can be handled using a forklift or a lifting beam.

The loading operation consists of:

- Opening the package by removal of
  - The shock absorber cover.
  - The tightening ring and the bayonet ring with a pressure device.
  - The lid: this can be done manually or with a handling tool.
- Loading of the internal arrangement referred to as TN90 with aluminum boxes containing the uranium ingots.
- Closing the packaging (positioning of the lid, bayonet ring and the tightening ring).
- Carrying out the leak-proof test.
- Fastening the shock absorbing cover.

This whole operation can be performed within 30 minutes per cask by trained technicians.

After loading, preparation for the shipment (contamination checks, labeling, seals,...) can be carried out.

The 20 cask-loading operations took place in DOUNREAY in a 5-day period.

1.3. Organization and transport means

In reference to the French law and international Convention of Vienna for physical protection, TRANSNUCLEAIRE is authorized by the Ministry of Industry to perform Category I and II shipments.

TRANSNUCLEAIRE must provide appropriate measurements in order to ensure that the transport is performed in compliance with regulations. Detailed information regarding the transport and especially dates remain confidential. The subcontractors involved in the transport have to be approved by TRANSNUCLEAIRE and must receive the approval of the French Competent Authority through the transport permit.

- In the case presented, the transportation is divided into 3 parts

  - Road transport with a security truck (agreed by the relevant British Authority) from UKEA DOUNREAY to a nearby airport. This part of the transportation is managed by UKAEA.

  - Air transport from UK to France with a chartered aircraft selected by TRANSNUCLEAIRE. The aircraft as well as the company have to be authorized by the Civil Aviation Authority of the countries concerned and the flag of the aircraft must be authorized by the relevant French Authority in charge of Physical Protection regulation. The aircraft used for this transport was a BAE 146 with a payload capacity of 12 tones. In addition of the standard crew, a load master trained for dangerous goods transportation was in charge of checking all the loading operations and in particular the conformity of the stowing.

    A TRANSNUCLEAIRE representative followed all the loading operations at the airport and checked all the transport documentation. He remained onboard during the flight to inform TRANSNUCLEAIRE of the evolution of the transportation. The position of the aircraft was reported at a selected frequency to the operators of the follow-up room used for all the transport operations carried out by TRANSNUCLEAIRE. The representative of the relevant French Authority was informed by TRANSNUCLEAIRE operators.

    After landing at the destination airport, the unloading operations were carried out immediately (2 hours for 20 TN-BGC1 casks).

- Road transport from an airport in the south of France to CERCA Romans with a security truck. TRANSNUCLEAIRE owns a fleet of security trucks and containers approved by the Ministry for Industry for Categories I and II shipment. Road transport is followed in real time end tracked by a representative of the relevant French authority.

THE TRANSPORTATION WAS CARRIED OUT SUCCESSFULLY IN A SINGLE DAY

II. TN-MTR PACKAGING

2.1. General description

After more than 30 years of service, the six IU04 casks were withdrawn from traffic end of September. They were replaced by the TN-MTR cask offering a much larger capacity. This packaging, licensed as a B(U)F-85 in April 1999 also takes into account the new IAEA specification for transport package (ST-1) and ICPR 60 specifications for dose rate.

The main characteristics of the TN/MTR package are:

- Overall height:	2,080 mm
- Overall diameter	2,080 mm
- Height without shock absorber	1,610 mm
- Diameter of cavity	960 mm
- Height of cavity	1,080 mm
- Current total weight in transport (loaded)	22,000 Kg
- Total weight without shock absorber (full of water)	21,000 Kg

For heavy fuels, the total weight in transport can be 23,400 Kg.

There is a choice of three different internal arrangements or baskets which can accommodate a wide variety of fuel components:

- MTR 68, with 68 to 76 compartments
- MTR 52, with 52 compartments
- MTR RHF, with 3 compartments

Other types of basket are to be designed for specific fuel components.

At the present time, three casks have been manufactured and can be operated.

2.2. Licensing procedure

The French license has been issued for the three baskets. The Australian validations were issued recently and applications for other countries including Belgium and USA are under review.

2.3. Transportation program

A number of operations are already in progress

ANSTO (Australia) To COGEMA La Hague Reprocessing Plant (France)

A few shipments from ANSTO Lucas Heights site to COGEMA La Hague reprocessing plant will be carried out in order to resorb the stock of MTR spent fuel from HIFAR. Each shipment will combine a number of casks TN/MTR, TN 7/2, ANSTO's LHRL 120...

STRASBOURG University to COGEMA La Hague reprocessing plant

The transfer system used with IU04 cask in South America, Taiwan and Portugal, has been adapted to the TN-MTR and will be operated in Strasbourg University due to a limited capacity of the crane and an insufficient storage pool dimensions. This transfer system is composed of two main pieces of equipment:

- a shielded bell
- cask loading equipment

The shielded bell is used to handle each fuel component. Its comprises an external protective shield, made of steel and lead, and also a handle device to catch the top of the fuel. Each element can be handled with a minimum 3-ton crane from the storage area to the cask. This transport operation should be carried out in the coming months.

Continiung Transport Campaigns

- TN/MTR RHF will be used to meet the long term transport commitment from RHF research reactor in Grenoble (France) to La Hague plant.

- TN/MTR 68 and 52 will be used to meet the long term transport commitment from SCK/CEN BR2 Mol (Belgium), to La Hague plant.

- TN/MTR with different baskets will be used for various shipments to DOE sites.