

IAEA/USA INTERREGIONAL TRAINING COURSE

Technical and Administrative Preparations Required for Shipment of
Research Reactor Spent Fuel to Its Country of Origin

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WORLDWIDE EXPERIENCE IN RESEARCH REACTOR FUEL CYCLE TRANSPORTATION

Danièle Raisonier - Transnucléaire, France

John Mangusi - Transnuclear Inc, USA

Transnucléaire SA and Transnuclear Inc (TN) have more than 30 years of specialized experience in activities in support of transportation, storage, and handling of spent nuclear fuel (from both power and research reactors), radioactive waste, and other radioactive materials on a worldwide basis.

Due to the limited storage capacity of the pools of the MTR reactors, and the availability of reprocessing facilities in United States and Great Britain, we have made numerous international spent fuel shipments since 1964.

Up to 1976, the TN group carried out transports of MTR fuel elements and other fuels elements to the European reprocessing plant (Eurochemic) at Mol -Belgium and to Marcoule in France. Shipments originated from France, Europe and Japan.

However, following the decision made by these plants to stop reprocessing these elements, subsequent transports were made to the US DOE reprocessing plant under the US Off-Site Fuels Policy. Between 1978 and

1988, approximately 365 cask shipments of spent fuel were received by AEC/DOE for reprocessing at either the Savannah River plant complex in South Carolina or at the Idaho National Engineering Laboratory in Idaho (INEL).

After 1988, the TN Group continued to perform regular shipments of MTR spent fuel to Dounreay as well as to national reprocessing and/or storage facilities.

In 1994, transportation of MTR spent fuel to the Savannah River Plant was restarted. We were fully involved in the three shipments made in September 1994, 1995 and 1996.

During this time we have developed and demonstrated the full capabilities required for successful support of customer needs for certification, procurement and operation of spent fuel casks, canisters for failed fuel assemblies, and auxiliary equipment required for successful loading and transportation of spent fuel. This expertise is not limited to the packagings themselves, but extends to all considerations needed for operation such as canister loading, lifting, and handling equipment, transport frames and trailers, operating procedures, training, and quality insurance. This experience includes cask loading and unloading, site and facility surveys; design and fabrication of facility/package system interface equipment; package tiedown and restraint designs for truck, railroad car, and ship carriage; package maintenance; and transportation planning and implementation.

CASK PROCUREMENT

Since 1963, the majority of the spent fuel shipped to reprocessing plants in France and the U.K. has been and continues to be delivered in casks designed, certified, manufactured, and operated by the Transnuclear Group. Approximately 85 % of all shipments of spent fuel from test reactors in Europe to DOE facilities have been accomplished in casks provided by TN.

Several casks of the TN family have been developed to cover specific needs : TN1 (Diorit fuel and MTR fuel), TN 7 (Petten, Dido and other German fuels), Pegase (IUO4) for all MTR fuel (DR2/3, BR2, HFR, RHF, Saphir, GRR, Siloe, Osiris, Pegase, Jen/Ciemat) and also the EL4, Vandellos, Candu,

French submarines. All of these casks were certified by the relevant competent authorities in the United States and several other countries.

For the transport of the MTR-type and TRIGA-type spent nuclear fuel (SNF), the following casks are proposed :

- from 1997 to 1999, the IUO4 transport cask
- from 1999, the TN-MTR packaging.

The TN-MTR is currently under development by the TN Group and is a cask to replace the IUO4. It will be available in 1998/1999 to meet several needs : French programs : CEA (Orphee, Osiris, Siloe Reactors), ILL (RHF Reactor) and international programs such as MTR/Triga spent fuel returns to the U. S. and delivery to the COGEMA reprocessing plant in La Hague (France). The TN-MTR will have a much larger payload to weight ratio than the IUO4 and will weigh approximately the same. This package will comply with both the USNRC requirements and the IAEA 1985 Regulations and will be licensed accordingly.

When the reactor building crane does not have the necessary capacity to lift the shipping cask, alternate approaches to spent fuel removal must be pursued. The two possibilities are :

- to handle the cask using a mobile crane if the working space and the allowable ground load allow it. TN has experience with such operations at the PTB reactor in Germany in August 1996.
- to use a mono-lodgment transfer cask with a weight within the limits of the lifting crane. This solution was developed for the TRIGA reactor, located at Casaccia in Italy. The advantages of this approach are : simplicity, ease of operation, easily transportable and storable mechanical devices, low operation costs.

Other small casks, as the TN6-2, can also be used to transport TRIGA fuel. The capacity of this cask is 15 standard TRIGA spent fuel assemblies. Packagings for fresh fuel can also be provided.

FAILED SPENT NUCLEAR FUEL CANNING

TN has extensive knowledge about canning of failed spent fuel assemblies and has developed expertise in:

- compatibility studies of equipment (including canisters) with existing facilities
- operating procedure development and implementation, for operations involving failed fuel canisters
- designs of special canister handling equipment for unusual interface requirements at the reactor facility.

Among the 50 000 LWR (Light Water Reactor) spent fuel assemblies that have been transported in TN casks, around 0.5 % were failed or damaged. These fuel assemblies were loaded into canisters suitable for wet loading at the Nuclear Power Plant and unloading at the receiving facility. TN and its partners have developed canister designs compatible with the spent fuel casks being used and have obtained regulatory approval of these designs for use in the casks.

The IUO4 has been used to transport failed fuel assemblies from Vandellos 1, a gas graphite reactor located in Spain. Each fuel element was put in a tight canister filled with Argon gas.

Additional regulatory approval will be required for transport of MTR and TRIGA canistered spent fuel assemblies. We are currently investigating design and regulatory requirements for this application.

In the development of the design of the TN-MTR, TN will provide for the handling and transport of canistered fuel assemblies from the reactor site to the receiving site.

CERTIFICATION OF CASK

TN has been involved in the design, analysis, testing and operation of numerous packagings and containers for spent fuel, radioactive waste, and other radioactive materials for more than three decades. During this time we have developed the full capabilities required for successful design and certification of radioactive material packaging systems.

TNP/TNY have a staff of more than 70 graduate engineers having the skills and experience to carry out nuclear, mechanical, structural, criticality, and thermal design, analyses and testing for development and licensing by competent authorities of storage and transportation systems. This expertise is not limited to the packagings themselves but extends to all considerations needed for operation, such as canister loading, lifting and handling equipment, vacuum drying equipment, transport frames and trailers, operating procedures, training and quality assurance.

TN has developed spent fuel transport casks which are in use in Belgium, Denmark, France, Germany, Great Britain, Italy, Japan, Netherlands, South Africa, Spain, Sweden, Switzerland, Taiwan and the United States.

These casks are in constant operation. In each case and for each cask model, certificates of competent authority (COCA) have been obtained from national Competent Authorities. These COCA are constantly up-dated and renewed by TN in close contact with local authorities.

The TN Group follows and updates more than 200 cask licenses in various countries.

All these activities are conducted under a certified ISO 9001 quality assurance program in Europe and under an NRC-approved quality assurance program in the United States.

TN participates in specialists' meetings on transport and storage issues at IAEA, is a member of ISO and ANSI working groups for standardization (trunnions, leaktightness, and other packaging and transport issues), and maintains relations and exchange with official organizations, ICPR, Euratom, OECD, European Commission, NRC, DOE and DOT.

Indeed, TN possesses an in-depth understanding of licensing requirements due to continuing relations with Competent Authorities of more than 20 different countries.

INTERACTIONS WITH FRR OPERATORS

The TN Group has many years experience as a cask designer and transporter of radioactive materials, including SNF. This industrial experience based on qualified procedures has been used for operation in several countries and will be made available to help the FRR operators :

Fuel technical data

A fundamental aspect in preparation for any SNF (or other) transport is the detailed analysis of the fuel technical data in order to establish conformity with limits imposed in the transport package certificate. This activity implies close contact with SNF consignors to ensure correct submission of all required fuel technical data. In addition TN maintains and updates SNF data bases which allow rapid access to and comparison of technical data.

For all the spent fuel loaded into a shipping cask provided by TN, TN must review and certify the conformity of the fuel to be shipped with the COCA and with the receiving facility's acceptance criteria.

Fuel condition

Visual examinations of the fuel condition and the basin storage environment as well as records related to the fuel and the basin water chemistry is a critical aspect of the determination of the equipment and handling means necessary for successful removal of SNF from FRR sites. TN representatives regularly visit SNF storage sites to conduct these examinations, provide advice to operators and resolve technical problem in advance of transport.

Technical assistance

TN provides more than 100 technical assistance visits per year for loading of several types of casks (including IU04) with various contents and in numerous countries.

The scope of this assistance and subsequent training of the reactor operators is mainly to assure that the cask is properly loaded in

accordance with the regulatory requirements and the corresponding loading procedures.

A representative of the TN Group must also observe all cask loading operations to confirm the fuel conditions during loading and provide a written statement of the fuel condition to the receiving facility.

TRANSPORTATION SERVICES

We are familiar with and are ready to provide all transportation services from global management services to detailed transportation paperwork. Such services would be provided on a worldwide basis in full compliance with all regulations including customs formalities and insurance.

The new possibilities offered to the reactor operators to send back to the U.S. their US-spent fuel assemblies for storage and or to France and U. K. for reprocessing, will increase the number of ocean transports.

To transport this spent fuel in full compliance with the IMO A 748 Resolution regulating the transport of INF material (Irradiated Nuclear Fuel, Plutonium and High Level Waste), TN propose now several INF 2-certified ships. Two of them « Bouguenais » and « Beaulieu » are operated under an exclusive contract with a French ship-owner. These ships are not exclusively dedicated to the transportation of nuclear material in order to perform shipment in acceptable economic conditions.

These ships have been used for several transports in Europe (Spain, Sweden, France), from Japan to the U.S. and from Europe to the U.S. for delivery of MTR spent fuel assemblies to the U.S. Department of Energy Savannah River Site through the military port of Sunny Point in 1994 and 1995, and Charleston Naval Weapons Station in September 1996.

The total weight of material to be transported for the whole research reactor fuel cycle is not large, but the problems to solve are numerous and this activity will never become a routine activity. So, it is important for the reactor operators to rely on transport companies having a good knowledge about all aspects of international transportation.

In conclusion, Transnucléaire/Transnuclear

- have demonstrated their capabilities and expertise to cover all services in relation with international transportation aspects
- fully support the DOE program
- believe that partnerships with qualified organization is necessary for a successful implementation of this program.

For future information, please contact :

Daniele Raisonnier

Transnucleaire

9-11, rue Christophe Colomb 75008 PARIS France

Tel : 33 1 40 69 77 00/Fax : 33 1 40 69 77 01/e-mail : <nusys1@magic.fr>