

Impact of New IMDG Regulations on the Transport of Irradiated MTR and Experimental Fuel

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INTRODUCTION

In 1994, the International Maritime Organization Assembly adopted, in its eighteenth session, by resolution A 748, the Code for the Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes in Flasks on Board Ships, known as INF Code.

It appeared rapidly that the application of this Code brings drastic changes to the implementation of some transports by sea.

In fact, the consequences of the applicability of this INF code are not the same on the different types of maritime transport.

This paper aims at analyzing these consequences and describing the solution adopted by Transnucléaire to comply with this regulation.

The recent experience of radioactive material transatlantic shipment of MTR spent fuel between Europe and the United States is also presented and commented.

DIFFERENT CATEGORIES OF SEA SHIPMENTS OF RADIOACTIVE MATERIALS

Many transports by sea occur between the different countries where the nuclear industry has been developed. These shipments can be separated in four main categories:

- transport of front end products from the electronuclear fuel cycle: concentrates, natural and enriched UF₆, uranium oxide, fresh fuel assemblies;
- transport of back end products of the electronuclear fuel cycle: spent fuel assemblies, residues;
- recycled material of the electronuclear fuel cycle : plutonium powder, MOX fuel assemblies;
- laboratory products, fresh and spent research reactor fuel, sources ...

The first category concerns rather large quantities of low radioactivity products transported all over the seas in industrial packages and generally using commercial line vessels. These transports are performed in full compliance with existing IMDG regulation. The INF Code does not apply to these products.

The second and third categories concern mostly products from the electronuclear fuel cycle and from the reprocessing activity. These transports are made on a regular basis and are subject to the application of INF Code. In most of cases, the ships used belong to the upper classification, i.e. INF3.

The last category concerns shipments performed between nuclear research organizations. They do not take place on a regular basis. Generally, the quantity of material involved in these transports is small. Nevertheless, the INF Code obligations apply to some of these transports, especially to the transport of MTR spent fuel assemblies.

Directly, or indirectly through its mother company Cogema, Transnucléaire is involved in these four categories of sea shipments.

OPTIMIZATION OF THE TRANSPORT OPERATIONS

The goal of a transport company is to provide its customers with the right solution at a reasonable price and in full compliance with the regulations.

Therefore, two dangers must be avoided:

- technically under-evaluated solutions, because in this case there is a high risk not to fully comply with the regulations;
- technically over-evaluated solutions, but at a very high price which would not be economically acceptable.

The application of INF Code in the IMDG regulation is probably one of the most important changes brought in the radioactive material transport regulations within the last 25 years.

Firstly, because it is a major change in a modal regulation, coming in addition to the basic IAEA regulations.

Secondly, because the economic consequences of this change are dramatically important.

Thirdly, because it is the first large breach to the multimodal philosophy in the IAEA regulations.

Therefore, the transport companies must take this fact into consideration and find new schemes in order to keep the optimization between transportation costs and compliance with the regulations in force.

RESOLUTION A.748 OF IMDG REGULATION

The INF Code applies to the sea transportation of :

- spent fuel;
- plutonium products;
- high level radioactive waste.

Depending upon total radioactivity of the transported products, three classes are considered :

- class INF 1: less than 4000 Tbq
- class INF 2: between 4000 Tbq and 2×10^6 Tbq
(2×10^5 Tbq for plutonium products)
- class INF 3: over 2×10^6 Tbq
(2×10^5 Tbq for plutonium products)

In each of these three classes, different specifications are imposed in order to meet the following requirements:

- ship stability after damage;
- fire protection;
- temperature control of cargo spaces;
- structural resistance;
- cargo securing arrangements;

- redundancy of electrical supplies;
- radiological protection equipment;
- management, training and shipboard emergency plans.

Of course, the severity of the specifications is increasing with the figure of the class index.

It rapidly appeared that some standard commercial ships were able to fulfill the INF1 class requirements with minimum additional equipment and training of the staff.

On the contrary, INF 2 and INF 3 classes were impossible to achieve with the standard commercial fleet and it was necessary to take actions to fulfill the INF Code.

TRANSNUCLEAIRE's SOLUTION

In order to comply with the above mentioned INF code requirements and to keep transportation costs at an acceptable level, Transnucléaire adopted the following strategy:

- the ships must be upgraded to comply with INF2 and if necessary to INF3 requirements;
- the ships must remain able to transport other industrial goods in order to amortize fixed costs on a wider turnover basis.

Transnucléaire made a commercial agreement with the French ship owner "Compagnie Morbihannaise de Navigation" in order to equip the ship named "Bouguenais" according to INF Code class INF 2.

The "Bouguenais" is a twin engine multipurpose ship. Her double hull allows to fulfill the stability criteria after damage. The overall length of the ship is 90 meters and the dead weight 4,800 metric tons.

This ship is equipped with INMARSAT and GPS stations allowing to remain in constant communication with shore and to track her position accurately.

The Bouguenais is operated by the Compagnie Morbihannaise et Nantaise de Navigation and is registered in France.

Her INF2 certification was granted in July 1995 by the French Competent Authority.

Three sister ships of the Bouguenais are also in operation and would be able to replace her or to come in addition to her if necessary.

RECENT EXPERIENCE

After completion of an Environmental Assessment (EA) and Urgent Relief Acceptance of Foreign Research Reactor Spent Fuel, the U.S. Department of Energy has issued a Finding Of No Significant Impact (FONSI) and decided to accept a limited number of spent fuel elements -exactly 409- issued from European research reactors in Austria, Germany, Greece, the Netherlands, Sweden and Switzerland.

Several specific constraints were imposed by the DOE:

- unloading at Sunny Point military port;
- rail transport in the United States;
- limitation of the number of shipments.

In cooperation with EDLOW International Company, Transnucléaire was in charge of the sea transport, of the handling at French port and of some European ground transports.

The first shipments involving four casks took place in September 1994, using Danish chartered ships.

Transnucléaire was informed by the Danish Authorities of their decision to put immediately in force in Denmark the INF Code recently adopted by the International Maritime Organization (IMO) but not yet implemented in national laws.

The total activity of the four casks exceeding 8,000 Tbq, we were unable to load them all at the same time on board our INF 1 ship and two INF1 ships therefore had to be chartered.

The second shipment occurred in October 1995, using the INF2 class "Bouguenais" which had been upgraded in the meantime.

CONCLUSION

The application of INF Code in IMDG regulation imposes very stringent restrictions to the use of commercial line ships for the transportation of spent fuel.

Almost all the transports of spent fuel, even fuel used for research purposes, must be performed by specially equipped chartered ships.

Until last year, most of the ships equipped to transport nuclear materials and complying with the INF Code were ships dedicated only to nuclear transports.

In order to keep the sea transport costs at a reasonable level for the customers, Transnucléaire proposes a specially equipped ship complying with the INF Code, but not exclusively dedicated to the transportation of nuclear materials.

This solution allows to transport nuclear materials in full compliance with the regulations at a price level remaining comparable to that of other industrial goods.