MARITIME SHIPMENTS OF RADIOACTIVE MATERIAL

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ABSTRACT

Most shipments of a variety of radioactive cargo (e.g. enriched UF6, Uranium Ore concentrates or sources like Co60) are transported overseas on various routes to connect consignors and consignees located in different continents.

However there are a limited number of carriers available worldwide who are willing to accept radioactive material with the majority of carriers only accepting non-fissile material on board of vessels.

This paper will examine and explain the consequences of the different types of maritime services available to the transporters of radioactive materials including liner, fixed routes with fixed ports of call and schedules; charter, flexible routes and overall service; tramp, flexible routes, and schedule depending on cargo volume and agreements with charterers.

It will also consider the different modes of transport, comparing how radioactive materials are shipped in the containerized 20´, 40´ container, flat racks and platforms; in break-bulk (lash barges, vessel holds) and in Ro/Ro (Mafi-trailer).

There are many things that have to be considered when transporting radioactive materials from the basic regulatory framework: IMDG code (International Maritime code for Dangerous Goods) and supplement codes in combination with the laws and national requirements at ports of calls, licenses, handling permits, package approvals/validations, insurance needs and the list goes on. This paper provides examples of lack of harmonization and suggests ways of a more common approach to the transport of radioactive materials by sea.

INTRODUCTION

To connect various shippers of different kinds of radioactive material with various consignees located on several continents around the world, most of the cargo has to be transported overseas using intermodal traffic.

However there are only limited carriers available worldwide who are willing to accept radioactive material with the majority of carriers only accepting non-fissile material on board their vessels.

So there is not too much choice on services available to transport radioactive material from any place of origin to a dedicated destination.

It is even very difficult to build up logistics under the basic assumption that overseas transports of radioactive material generally start in a port of loading in the country of the shipper and end in a port of discharge in the country of the consignee.

Generally, there are 3 main types of services available to arrange for a maritime transport of radioactive material:

Liner services

Shipping lines operating liner services use fixed routes with fixed port rotations and published times of call allowing the shipper or designated agent to make the radioactive material available for overseas transport on a certain (fixed) time.

A liner service generally fulfills the schedule unless in cases where a call at one of the ports has been unduly delayed due to natural or man-made causes.

The main disadvantage of such a service is that a vessel can call at ports in various countries, which either prohibit a transit or transfer of radioactive material or may have various requirements which have to be fulfilled before a transit or transfer of radioactive material through the port is permitted, hence preventing any flexibility on the route chosen.

Charter services

Shipping lines operating dedicated vessels for a charter service do have flexible routes and can offer special services as ordered by the payor of the freight.

The main advantage compared with any liner service is that most of the ports in destination countries can be directly reached without calling a transit port, where limitations described above can apply.

A second advantage is that the type of vessel regarding size, fittings and necessary lashing possibilities can be nominated on demand of the radioactive material / volume to be shipped.
One main disadvantage is that the vessel is used only for this specific shipment with no other consignor involved, making the transport economically much more expensive than using a liner service which may be shipping additional goods for various customers on board the same vessel.

Tramp service

Shipping lines operating vessels for tramp service do not have a fixed routing or schedule and can be made available on short notice for loading of radioactive cargo from any port to any

destination port in their preferred shipping area when local requirements on both ends can be fulfilled.

So it is ultimately a kind of mixture between liner and charter service conditions.

Due to the fact that tramp services usually also carry various additional goods on board the same vessel for discharge in various ports, most of the tramp service operators simply reject transports of radioactive material, thereby avoiding the problem of obtaining authorization for radioactive materials.

Therefore, considering the transport of radioactive materials, this kind of service is the most limited one.

Other considerations which need to be taken into account when transporting radioactive materials include the following.

Liner, charter and tramp service providers offer different modes of transport

Depending on various conditions of the packages used for the safe packaging and transport of radioactive material, and complying with the relevant transport regulations, shippers mainly utilize the following for intermodal packaging:

Containers
(standard transport units, as prescribed by the **I**nternational **O**rganization for **S**tandardization (ISO))

The following are a few examples for ISO standard container designs available in the dimensions 20´, 40´ (and 45´):

- general purposes or dry van container
- flat
- platform
- open top container
- tank container

Containerized/unitized cargo improves the efficiency in port handling and allows an economic transport on board the vessel with reasonable freight rates.

Depending on the cargo volume and numbers of packages to be shipped, some consignments of radioactive material are transported in:

Break-Bulk
(cargo individually transferred from dock to vessel (break-in-bulk point) and loaded/lashed inside cargo holds or lash barges)

The advantage of this shipping mode is that high volumes of radioactive cargo can be transported with individual logistics solutions in one lot, although it bears a higher risk

potential of damage to the packages during cargo handling and transfers on the way from the shipper´s facility to the final destination.

Another transport mode sometimes used also for transports of radioactive material is:

Ro / Ro

("Roll on / roll off" – Cargo or container units transferred/placed on board vessels on drivable decks with either carrier or liner owned, standardized equipment (like truck chassis or MAFI-trailers)

Although this mode of transport is sometimes also used for deep-sea shipments (like across the Atlantic, depending on availability of suitable liner services), it is more popular for short sea trips offered by liners with ferry services (for example for shipments between continental Europe and the UK).

IMPORTANT REGULATIONS FOR MARITIME TRANSPORTS OF RADIOACTIVE MATERIAL

All important regulations for shipments of hazardous cargo by sea are written down in the IMDG code (**I**nternational **M**aritime code for **D**angerous **G**oods) published by the **I**nternational **M**aritime **O**rganization (IMO).

These regulations mainly:

- specify (in our case) radioactive goods
- classify radioactive goods (key word: UN-numbers)
- specify/describe overall conditions for a transport
- specify regulations on the package to be used
- specify separation distances for radioactive materials
- specify wording and content of shipping documents
- specify label instructions
  (for example: what kind of label, size, place on package or transport unit)

And also:

- identify goods, which are excluded from a transport at all

The IMDG code, a mandatory requirement for international sea transport, supplements the International Convention for the **S**afety **o**f **L**ife **a**t **S**ea (SOLAS), adopted in 1974 and the International Convention for Prevention of **Mar**ine **Pol**lution from Ships (MARPOL), adopted in 1973 and 1978.

Further important supplements are the:

- **Em**ergency **S**chedule guide (EmS)
  (guidance on emergency response procedures for ships carrying dangerous goods and emergency schedules to be followed in case of incidents where dangerous substances are involved)

- **M**edical **F**irst **A**id **G**uide (MFAG)

(guideline for medical first aid procedures in case of incidents on ships with dangerous goods on board)

Applicable only for the safe transport of categorical radioactive material like irradiated nuclear fuel, plutonium or high level nuclear waste:

- **I**nternational Code for Safe Carriage of Packaged Irradiated **N**uclear **F**uel, Plutonium and High-Level Radioactive Wastes on board Ships (INF)

Most of the requirements related to the radioactive material to be shipped by sea are abstracted and written down on the IMO Dangerous Goods declaration (IMO-Dec), which is the most important working-document for vessel masters, planners and agents prior to any transport.

But, all of the above mentioned regulations applicable for transports of radioactive material by sea have to be regarded in combination with the impact of **possible individual laws and national requirements at transit ports** which the vessel may call in any country on its way to any final destination.

The following key subjects are influential on whether a maritime transport is permitted or not:

- transit / transfer licenses available for the vessel carrying radioactive material
- handling permits available at port of transfer either for loading or discharging radioactive material
- applicable package approvals or validations for radioactive material available in countries the vessel transits
- varying insurance needs on the product requested for transit or transfer through a port

In addition to laws and national requirements, **local requirements in any port of loading or discharge** can influence the decision if a maritime transport of radioactive material is permitted or not:

- Port operators can require an independent permit issued from their local competent authority for handling of radioactive cargo inside their port;
- Port authorities and/or the local water police can decide if a planned shipment of radioactive cargo is finally accepted or rejected on their port territory (typical for ports, handling for example primarily food-stuff);
- Customs treatment in ports (embargo, etc.)

Also, the **individual infrastructure inside a port** can have an impact.

The following are some challenges which may be faced:

- absence of suitable cranes for lifting and handling either unitized/containerized cargo or cargo shipped in break bulk;
- absence of hazardous material yards, sometimes required for intermediate storage of high volumes of radioactive cargo;

- bad infrastructure in the terminal or berth at all to handle sensitive cargo, like radioactive material;
- restrictions to enter the port on a certain time due to the varying tidal range;
- restrictions to enter the port due to bad weather conditions (ice-situation on deep-sea);

CONCLUSION 1:
The radioactive materials transport industry is faced with a large number of international regulations and laws as well as national and local requirements that must be respected. Only a limited number of carriers are available but they do not necessarily offer every service on their various shipping rotations. However, despite these challenges, the industry is making the best possible efforts to ensure safe delivery of radioactive products using various routes worldwide.

The following are some examples of main international routes for the main products of the nuclear fuel cycle shipped by sea on a regular basis:

Route	**Product**	**Approx. ship. / year**
Australia – North America	U_3O_8	30
Africa – Europe	U_3O_8	20
North America - Europe	Natural UF_6	50
Europe – North America	Enriched UF_6 (5% U_{-235})	90
Europe – Far East	Enriched UF_6 (5% U_{-235})	20
Europe – North America	UO_2 (pellets or powder)	15

(1)

The corresponding transports of empty equipment and licensed packages either clean and washed out or in “heeled” state are returned also on regular basis.

CONCLUSION 2:
With the particular example of shipments of enriched UF_6 from Germany to North America the variety of different courses of action and problems can be clearly illustrated!

Any party involved in the logistic chain to perform an international maritime transport needs to settle the following main items:

- supply of individual shipping documentation in accordance with IMO regulations as requested by vessel´s booking office, the master, authorities in port of origin, transit ports and port of destination;

- supply of a transport permit in the country of origin;

- supply of transit permits for the vessel in conjunction with the UF6 to be shipped calling ports in various European and North American countries (such as Sweden, Belgium and Canada);

- supply of valid approvals for the UF6 transport-package of any transiting country-territory on the way from the port of loading to the port of discharge;

- supply of Nuclear liability insurances with different coverage depending on individual insurance requirements for the cargo in vessel´s transit countries;

- fulfilling all special requirements in the port of loading and in the port of discharge

  For example:
  - Germany: direct transfer / handling of cargo in the port;
  - USA: **I**mporter **S**ecurity-**f**iling (ISF), as requested by the government.

Taking into account that in past few years only one majorliner service accepted fissile material on board their vessels for the route from Europe to North America, it is in the interest of all responsible parties involved in the logistic chain to continue with efforts to support and maintain an acceptable number of routes and options for the continuity of service.

The World Nuclear Transport Institute has set up a sustaining shipment task force for its member companies, as detailed earlier this week, and has developed a knowledge base which lists all current applicable regulations for the safe maritime transport of radioactive materials, as well as providing a basis for training in order to support its members in their dealing with port authorities, maritime carriers, and all stakeholders involved in the safe transport of radioactive materials. The WNTI task force provides a forum for the radioactive material transport industry to exchange on experiences and develop common positions on subjects relating to the safe and secure packaging and transport of radioactive materials.

REFERENCES

(1) Internet-research in combination with RSB´s company experiences