

Ship building plan for radioactive material transport in NFT

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1. Introduction

For domestic maritime transport in Japan, application of either the Coastal Shipping Business Act or Marine Transportation Act is required, but not both. It is not possible to apply both of these laws to a shipping service simultaneously. Radioactive material transport is based upon the Japanese legal system and the question of which law applies depends on the radioactive material being transported.

Therefore, it is important that plans be formulated to achieve the best combination of radioactive material to be transported and applicable law for efficient radioactive material transport.

2. Japanese legal system

(1) Coastal Shipping Business Act

“Domestic shipping” refers to the transportation of goods by ships between ports within the territory of Japan, and excludes rowboats and fishing ships. The Coastal Shipping Business Act covers the domestic shipping business as well as the delivery of ships used for domestic shipping. The aim of this law is to soundly develop the domestic shipping industry, which has a weak economic foundation, through the harmonious and appropriate management of domestic shipping. Therefore, this law has implemented various restrictions which businesses wishing to enter the domestic shipping market must address.

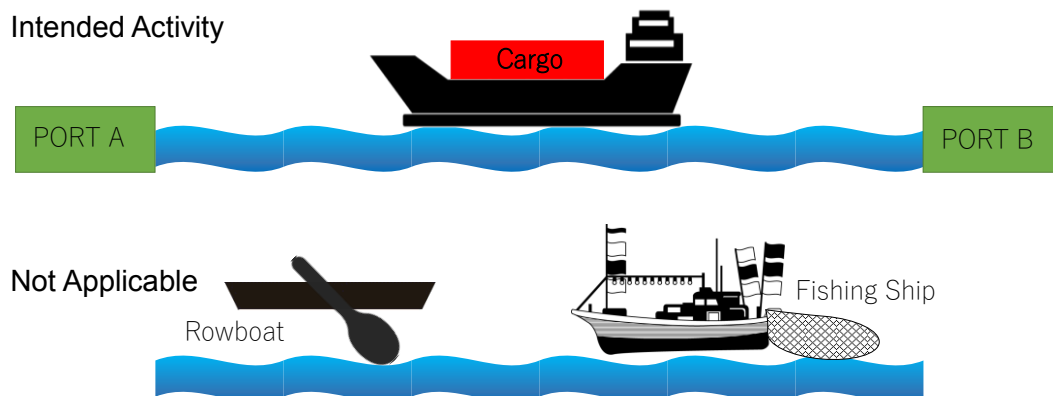


Figure 1. Domestic shipping under Japanese law

For example, a tonnage adjustment system (scrap-and-build system) was implemented to prevent the price of shipping goods from falling unreasonably low because there are too many ships. There is also a system for payment system at the time of construction

following project completion of the project. These and other restrictions make it difficult for ship owner to just enter this industry.

The Nuclear Fuel Transport Co., Ltd. (NFT) transports spent fuel (SF) pursuant to this law and will also transport MOX fresh fuel (JMOX) in the future under the same auspices.

(2) Marine Transportation Act

The purpose of this law is to ensure safe transport and protect shipping users. So, the businesses regulated by this law are the ship operation business, ship leasing business, shipping brokerage business, and shipping agency business.

Passenger transportation is carried out in accordance with this law as is some cargo transport.

When NFT set about constructing a low-level waste (LLW) cargo ship for the first time 30 years ago, we examined which business law would be applicable. We found that LLW transport was subject to the Maritime Transportation Act because general waste is covered under this act and the LLW is not considered a valuable material.

3. Applicable criteria for radioactive material ships

For radioactive material ships, a high level of safety is required regardless of the applicable business law. In addition to the equipment and structure requirements specified for general cargo ships, an even higher level of safety is required so it is necessary to comply with the Ship Safety Act, Regulations for the Carriage and Storage of Dangerous Goods by Ships, as well as the stipulations set out in the general provisions of special standards for radioactive material transport ships.

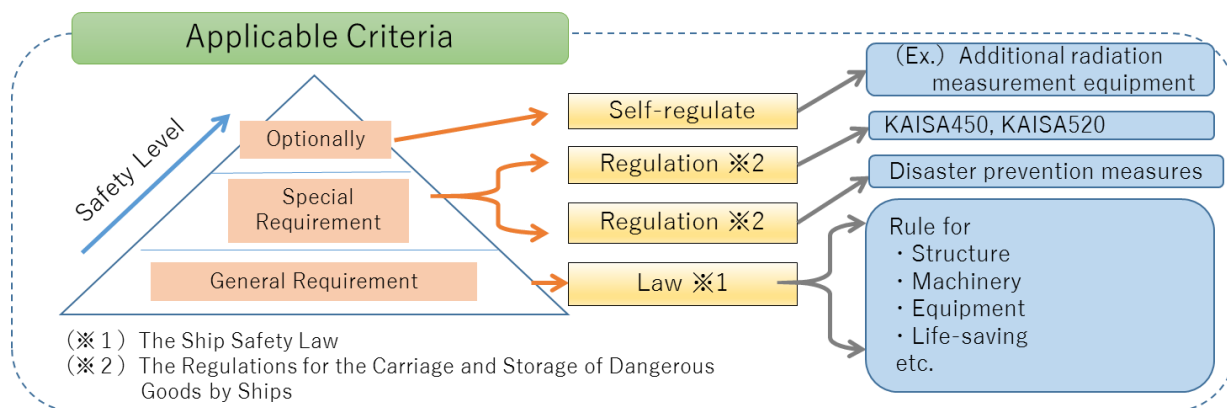


Figure 2. Criteria for radioactive material ships

(1) KAISA 450

This is a special Japan-specific requirement for low-level radioactive waste ships, which was enacted in 1988 in conjunction with the plan for construction of the Seiei-Maru, Japan's first LLW ship. Specifically, it requires the use of double hulls for the side and bottom. This double-hull structure is a strict requirement imposed only on tankers that transports dangerous liquids to keep the cargo, such as LLW, from flowing outside the hull. Also, equipment such as fire protection equipment, lifesaving equipment and

emergency power supplies must be provided to respond to accidents, equipment failures or other such cases.

In addition, although vessel stability when there is damage had been assessed using deterministic methods, the 2011 revision of the Act has also allowed for assessments using probabilistic methods.

(2) KAISA 520

This is a special requirement enacted in 1995, which coincided with plans for construction of the spent fuel transport ship Rokuei-Maru.

This requirement specifically calls for damage stability, double-hull structure, transport container cooling system, emergency water system, radiation control system, and other such requisites.

Although there is a provision concerning structure and equipment relating to the physical protection of nuclear material, no specific equipment is described.

Prior to enactment of KAISA 520, the competent ministries and agencies issued circular notices relating to spent fuel transport ships, plutonium transport ships, and high-level radioactive waste transport ships. Of these, the circular notices pertaining to spent fuel transport ships were introduced by MSC, discussed by IMO, and based on INF codes pursuant to the SOLAS Convention.

In addition, disaster prevention and other such measures are prescribed in Article 45 of the Regulations for the Carriage and Storage of Dangerous Goods by Ships, the particular content of which is, for the most part, equivalent to KAISA 520.

(3) KAISA 506

This is a circular notice that specifies measures for the physical protection of nuclear materials in marine transport, and covers not only transport ships but also transport containers, casks and methods, and compliance is required with requirements specified in INFCIRC / 225 / Rev.5 and Security Series No 26-G. Depending on the protection classification, the transport ship shall comply with requirements for devices to monitor suspicious persons and ships, equipment to prevent suspicious persons and ships from boarding the vessel, surveillance cameras, surveillance rooms, and other such tangible elements as well as for protection plans (intangible elements).

4. Ships construction & operation plan

Under the Japanese legal system, different ships are needed for transporting radioactive materials such as SF and LLW because the consolidated transport of SF and LLW together is not permitted. On the other hand, changing the applicable law for a transport ship is a complicated process.

(1) Transport containers to be loaded onto ships

The transport containers to be loaded onto ships are shown in Table 1 (including transport containers for low-level waste generated in the decommissioning nuclear power stations, which is currently being planned (L1/L2)).

Table 1. List of transport containers (examples)

Package	Type	Dimensions (m)	Max. weight	PP Category	Remarks
SF	Cask	L:6.4 D:2.6	125t	II	
Interim Storage	Cask	L:6.8 D:3.6	140t	II	
JMOX	Cask	L:6.3 D:2.6	30t	I	
LLW	Container	L:3.2 W:1.6 H:1.2	10t	Not applicable	
L2	Container	TBD	Approx. 30t	Not applicable	Planning stage
L1	Cask	TBD	Over 100t	Pending	Planning stage

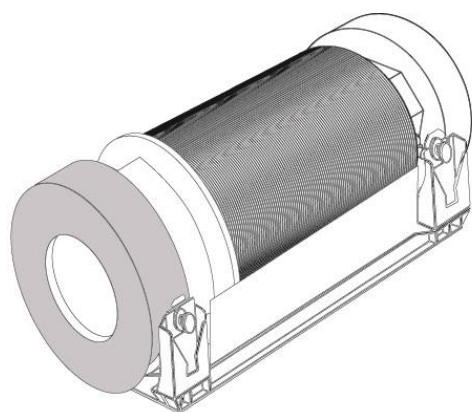


Figure 3. Cask type (SF)

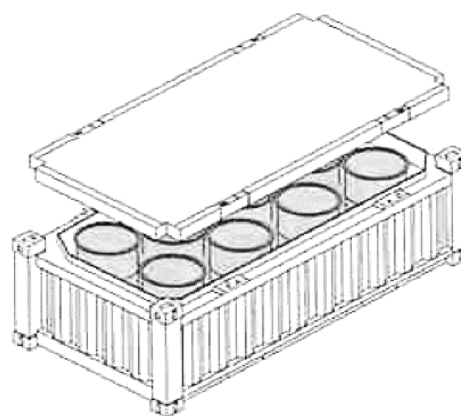


Figure 4. Container type (LLW)

(2) NFT's ships

An overview of the three transport ships currently owned by NFT is given in Table 2 and Figures 5 and 6.

Table 2. Transport ships owned by NFT

	Rokuei-Marui	Kaiei-Marui	Seiei-Marui
Law	Costal Shipping Business Act	Costal Shipping Business Act	Maritime Transportation Act
Applicable Criteria	KAISA 520	KAISA 520	KAISA 450
Main Cargo	SF	Interim Storage	LLW
Cargo Weight	125t	140t	10t
PP Category	II	I	Not applicable
Year Commissioned	1996	2006	2019



Figure 5. Rokuei-Maru



Figure 6. Seiei-Maru

(3) Ships deemed necessary in the future

At a minimum, a transport ship with L1 / L2 weight class capability will be required. In addition, when reprocessing volume reaches a certain level or higher, operations plans will require a second SF transport ship.

Table 3. Transport ships necessary in the future

	L1 / L2	SF No.2
Law	Maritime Transportation Act	Costal Shipping Business Act.
Applicable Criteria	Pending	KAISA 520
Cargo	Casks and containers	Casks
Max. cargo weight	130t	125t
PP Category	Pending	I or II
Commission timing	When continuous shipments of dismantled waste (L1/L2) begins to be transported	When reprocessing reaches 650t/year

5. Conclusion

From the above, Table 4 shows the combinations of ships and loaded cargo.

Table 4. Ships and loaded cargo

	Rokuei-Maru	Kaiei-Maru	Seiei-Maru	L1/L2	SF No.2
SF	M	A	N/A	N/A	M
Interim Storage	A*	M	N/A	N/A	A
JMOX	N/A	M	N/A	N/A	D
LLW	N/A	N/A	M	D	N/A
L1/ L2	N/A	N/A	N/A	M	N/A

Guide: M: Main cargo, A: Applicable, D: Review during design, N/A: Not applicable

*: Modification necessary and license approval

NFT needs to take the following into consideration in formulating a construction plan for transport ships.

- Amount of radioactive material generated and the duration in which it is generated
- Timing for replacement of existing ships
- Ratio of multipurpose use to exclusive use

Moreover, as there is a significant difference in the shape and weight of LLW containers and L1 casks, it is difficult and unreasonable to construct a dual-use cargo hold ship even if the applicable law is the same, so exclusive use ships are desirable.

Therefore, it is necessary to build at least three kinds of ships: one for transporting spent fuel and MOX fuel, one for transporting LLW, and one for transporting L1/L2.

Drafting of a ship construction plan needs to take into account the schedule and volume of the respective types of cargo to be transported as well as transport efficiency, specifically the extent of multipurpose use and exclusive use.

We will prepare safe and practical transport ships to meet the needs of all stakeholders.

Acknowledgment

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