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International Atomic Energy Agency  
*Atoms for Peace and Development*

# Transport Safety and Back End of SMR Fuel Cycle

*Shazia Fayyaz*  
*Head of the Transport Safety Unit*

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# Current Transport Safety Framework and SMRs

- IAEA SSR-6 covers transport of radioactive material considering classification of material and packages using graded approach.
- The term “Shipment after Storage” was introduced in 2018 Edition particularly to address transport of back end fuel cycle materials after long term storage.
- Framework is technology neutral and cargo approach is used.



Remains applicable If cargo approach is considered for back end of SMR fuel cycle.

# Current Transport Safety Framework



Images from [https://aris.iaea.org/Publications/SMR\\_Book\\_2020.pdf](https://aris.iaea.org/Publications/SMR_Book_2020.pdf)

## International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on board Ships

### INF Code

Addresses issues related to the safe transport of packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes carried as cargo, in accordance with class 7 of the IMDG Code, including shipboard emergency plan, and notification in the event of an incident involving INF cargo

**Class INF 1 ship** – Ships which are certified to carry INF cargo with an aggregate activity less than 4,000 TBq.

**Class INF 2 ship** – Ships which are certified to carry irradiated nuclear fuel or high-level radioactive wastes with an aggregate activity less than  $2 \times 10^6$  TBq and ships which are certified to carry plutonium with an aggregate activity less than  $2 \times 10^5$  TBq.

**Class INF 3 ship** – Ships which are certified to carry irradiated nuclear fuel or high-level radioactive wastes and ships which are certified to carry plutonium with no restriction of the maximum aggregate activity of the materials.



### SOLAS

#### Chapter I, Part A

#### Application, definitions, etc.

##### Regulation 1/(a)

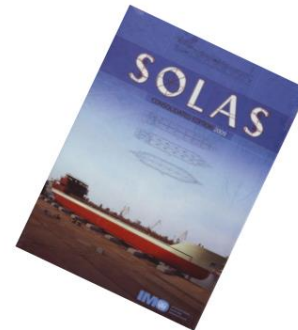
Unless expressly provided otherwise, the present regulations apply only to ships engaged on international voyages.

##### Regulation 2/(j)

A nuclear ship is a ship provided with a nuclear power plant.

#### Chapter VIII Nuclear ships

This chapter applies to all nuclear ships except ships of war.



- Floating Power Units do not formally fall under coverage of SOLAS

IAEA Safety Standards  
for protecting people and the environment

Regulations for the Safe Transport of Radioactive Material  
2018 Edition

Specific Safety Requirements  
No. SSR-6 (Rev. 1)



Images from IMO presentation to IAEA 27 Oct 2021

# Concept of Transportable Reactors

- Concept of “mobility” is already in practice for sealed sources and portable exposure devices having IAEA SSR-6 cover through certification as special form radioactive material and Type B(U) package.
- For SMRs, two approaches are considered:
  - Factory Manufactured TNMs (fueled with the option of onsite refueling)
  - Transportable Nuclear Power Plant (land based or sea based relocatable nuclear power plants but transported in shut down condition)

**Concept of Transportable reactors is out of scope of current Transport Safety Framework**

# Key Challenges

- Define and Classify Transportable reactors considering design, means of transport etc.
- Design safety and security of transportable reactors including platforms (ships, barge or vehicles), transportation scenarios etc.
- Review of existing safety standards to ensure safe management of spent nuclear fuel either stored at transportable reactors or the reactor is transported to refueling site.
- Study safety considerations in design of integrated TNM containing spent fuel for shipment after operation and storage phase.
- Detailed review of current legal framework, IAEA, IMO, United Nations Convention on the Law of the Sea (UNCLOS), other available material in member states, identify interface between international legal framework and national regulations, identify specific gaps on the regulation of transport safety for transportable reactors loaded with spent nuclear fuel.

# Current IAEA Activities



- A TRANSSC Working Group on TNPP is established. The group is holding virtual meetings to discuss the various aspects.
- Joint working (NSRW, NSNI, NSNS) on a new publication on security and design safety considerations for Transportable nuclear power plants is in progress. CSM is planned in December 12-16, 2022.





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*Thank you!*  
*Questions?*

