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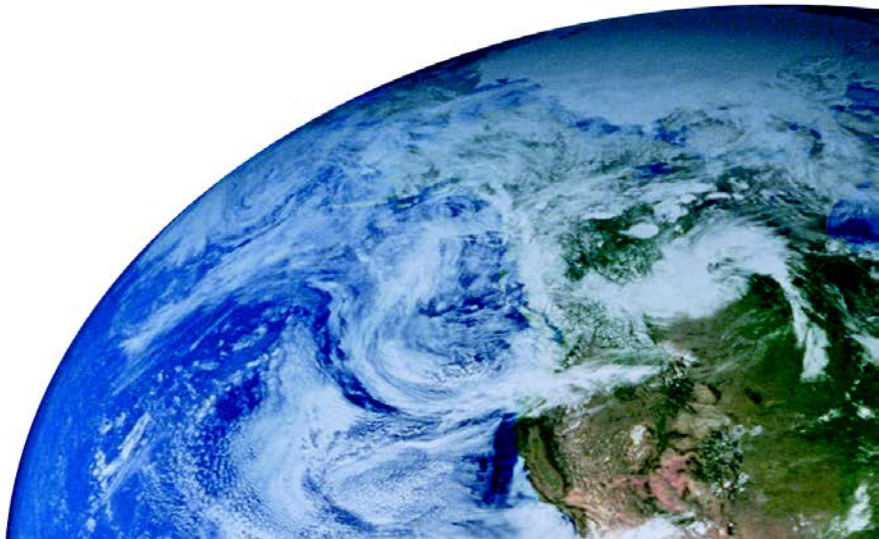
Transport Considerations for Fuel Cycle material

WINS Workshop on Security of Small Modular Reactors
Vienna, 5-6th March 2019

Capt. Simon Chaplin



What do WNTI see as possible challenges?

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- If the SMR (e.g. FNPP) is transported fuelled what regulations would it have to comply with?
- If using MOX fuel; this is subject to extremely high security requirements during transport (cat 1 shipment).
- Transporting spent fuel from the SMR, or transporting a decommissioned SMR module with spent fuel inside.
- If (like ROSATOM's) the floating NPP needs to be towed back 'home' every 12 years (?) for refit/overhaul.
- If an SMR is transported by sea the shipper may wish to transit the territorial waters of a third party nation.

In the next few slides we can look at what happens at the moment, and how this may differ (if at all) with SMR operations.

Front and back end transport

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Front End (fuel assemblies)

- Multi Modal transport – Road, Rail, Ship, air.
- Type A package - subject to test standards.
- Often loaded into a standard ISO container.
- Often carried on ‘liner’ routes with other mixed cargoes.
    - **At risk of delays and denials**

Back End

All operations concerned with the spent fuel which leaves the reactors, including the shipment of spent fuel elements from nuclear power plants to reprocessing facilities for recycling, and the subsequent transport of the products of reprocessing.
Alternatively, if the once-through option is chosen, the spent fuel is transported to temporary storage facilities pending its final disposal.

Regulations for the Transport of Radioactive Materials

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IAEA Regulations for the Safe Transport of Radioactive Material SSR-6

UN Recommendations on the Transport of Dangerous Goods-Model Regulations

International Maritime Dangerous Code (IMDG Code).
European Agreement Concerning the International Carriage of Dangerous Goods by Road.
Technical Instructions for the Safe Transport of Dangerous Goods by Air.

Convention on the Physical Protection of Nuclear Material (CPPNM) - for which the IAEA is the depository, provides a worldwide framework for ensuring the physical protection of nuclear material used for peaceful purposes while in international nuclear transport. (2005 Amendment extends the scope of the CPPNM to also cover domestic)

IAEA NSS 13 Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFIRC/225 Rev5)
IAEA Nuclear Security Series Implementing Guide - No.9 (rev as NST044) Security in the Transport of Radioactive Material
IAEA Nuclear Security Series Implementing Guide- No.26-G Security of Nuclear Material in Transport
IAEA Nuclear Security Series Technical Guidance - NST053 Security in the transport of nuclear material and other radioactive material

- To protect against unauthorised removal. To protect against sabotage.
- Threat Assessment and Designed Based Threat for transport.
    - Nuclear Material Categorisation – The primary factor in determining the necessary physical protection measures against the unauthorised removal of nuclear material is the potential for the material to be used in a nuclear explosive device - Transport Security Plan (Cat I Cat II).

Radioactive Material by sea - The guiding regulation

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INTERNATIONAL MARITIME ORGANIZATION (IMO)

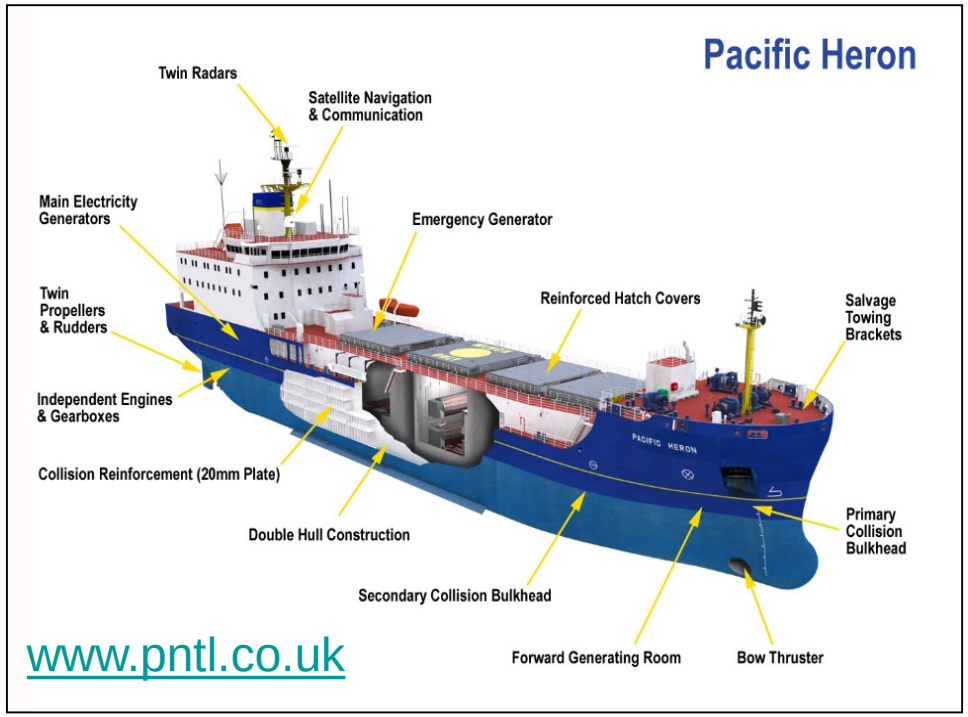
International Convention for the Safety of Life at Sea (SOLAS)
Ch VII – Carriage of dangerous goods.
Ch VIII – Nuclear ships (commercial)

International Maritime Dangerous Goods (IMDG) Code
Class 7 – Radioactive Material – 'any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed *(specified limits)'.*

This would include fuel cycle material and RA material in other forms such as Radioisotopes for medical, agricultural, industry and consumer products.

IMDG Code Supplement – International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (**INF Code**).

INF3 vessel



Cat 1 shipment

Increased physical security

- Armed personnel (Strategic Escort Group).
- Transport Security Plan (approved by the Regulator)
- External security agencies in ports of call, including protocol for hand-over of security responsibilities.
- Government to Government Communications.
- Continuous monitoring of progress by authorities ashore.
- Intelligence led operation – National security services. Shipment will not take place if there is any adverse security intelligence.
- Clear ‘Rules of Engagement’ and command structure.
- Joint training involving armed personnel, with the ships Officer and crew – signed off by the Competent Authority.

United Nations Convention on the Law of the Sea

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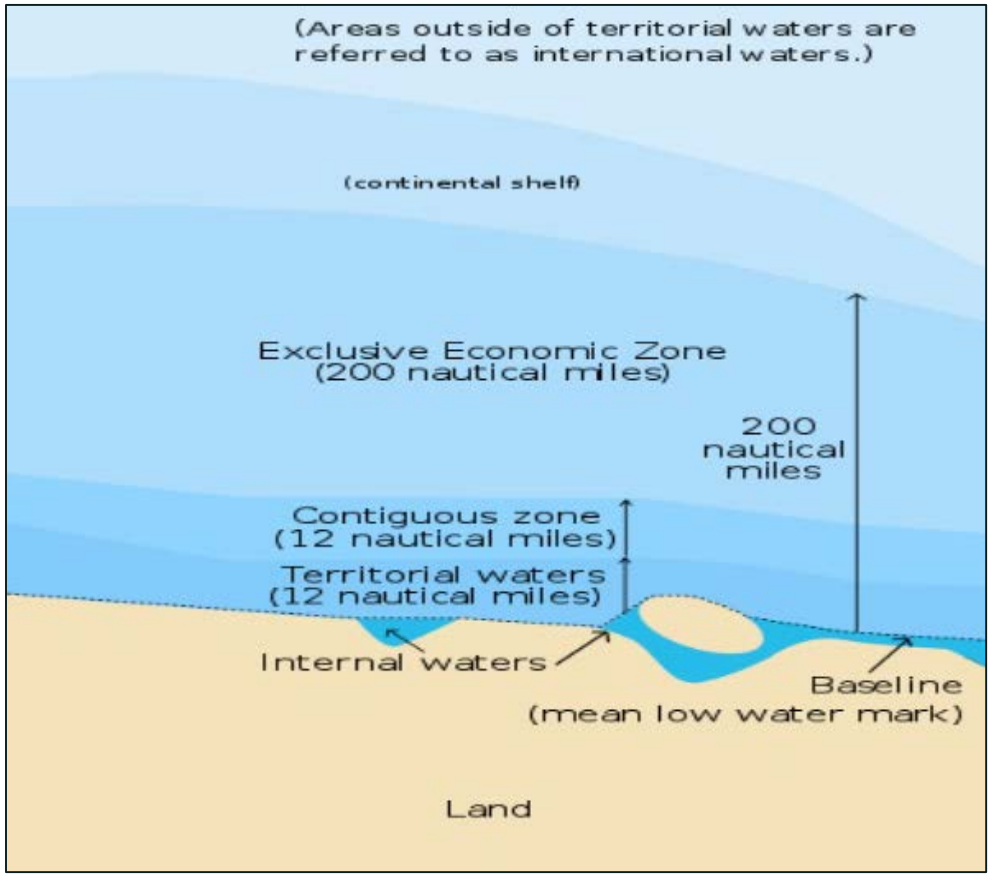
Replaces the older ‘freedom of the seas’ concept.

Coastal states claim Territorial waters and Exclusive Economic Zones (EEZs).

Vessels have the right of innocent passage through Territorial waters.

-not prejudicial to the peace, good order or the security of the coastal state.

- Coastal states can temporarily suspend innocent passage if essential for the protection of their security.



Floating Nuclear Power Plants

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USA – *'Sturgis'* was the first floating nuclear power station (MH-1A). It was a converted ship but was no longer self propelled. It was towed, with nuclear fuel on board, to the Panama Canal Zone in 1968. The reactor supplied electricity to the PCZ until 1976.
It was towed back to the US with nuclear fuel in the reactors.

It was operated by the US Army.

Russia - Rosatom – *'Akademik Lomonosov'* with more planned. This a barge and therefore needs to be towed. It was towed from the builders yard in Saint Petersburg through the Baltic and round to a base in Murmansk where the plant was loaded with nuclear fuel and commissioned. It will (soon?) be towed to the Russian Arctic port of Pevek where it will in put into service.

Will possibly need returning to its 'home' port every 12 years for overhaul.

World Nuclear Transport Institute (WNTI)

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- Non-Governmental Organisation
- Formed in 1998 (by BNFL, COGEMA and FEPC)
- Main Office – London, UK
- Global – Regional offices and representatives
  - USA, China, Japan, Australia, South Africa.
- Worldwide Membership– open to all companies involved in nuclear transport including generators, suppliers, uranium producers, fuel cycle and other nuclear supply chain companies, Packaging and licensing, radioactive waste management, Insurers, Logistics, Transport companies.

•British Nuclear Fuels Ltd (BNFL) - now International Nuclear Services (INS)
•COGEMA – Now Orano
•Federation of Electric Power Companies of Japan.

IAEA International Atomic Energy Agency *Atoms for Peace and Development*

IMO INTERNATIONAL MARITIME ORGANIZATION

ICAO • OACI • ИКАО 国际民航组织 • ايكاو

ISO

UNITED NATIONS

- UN ECONOMIC AND SOCIAL COUNCIL **Sub-Committee of Experts** on **the Transport of Dangerous Goods**

Transport of Radioactive Materials
From the Regulations…
to the operational Good Practices

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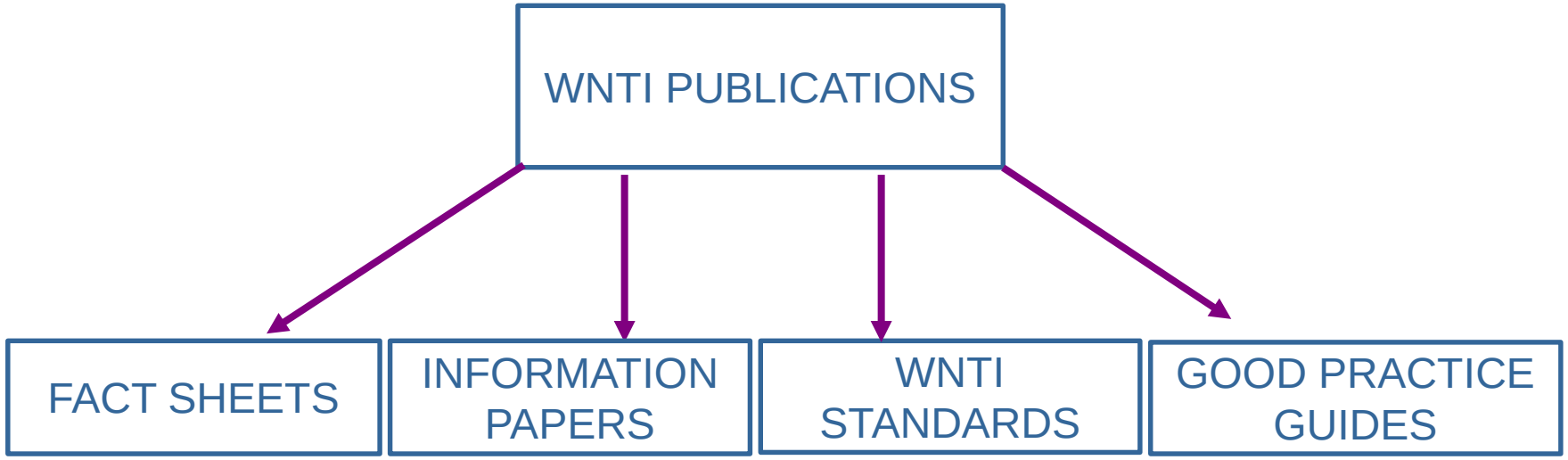
- **WNTI WORKING GROUPS develop a wide range of publications, which are shared among industry stakeholders for wider implementation**



- WNTI publications freely available on www.wnti.co.uk

WNTI future approach to SMR's?

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WNTI is a member lead organisation.

- Inclusion of security topics in WNTI Transport Security working group.
- Possible scope for a new WNTI working group.
- We would be fully involved in drafting any new regulations or amendments to existing regulations.
- Create WNTI publication.
- We can undertake research projects. (Internship programme)
- We can undertake public engagements to raise awareness of transport safety.
- Invite non-member SMR company to present at our Semi-Annual members meeting plenary session.

QUESTIONS

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THANK YOU