MULTI-SECTOR WORKSHOP ON INNOVATIVE REGULATION

Challenges and benefits of harmonising the licensing process for emerging technologies

14-18 December 2020
MULTI-SECTOR WORKSHOP ON INNOVATIVE REGULATION

Challenges and benefits of harmonising the licensing process for emerging technologies

Welcome

Day 3 – Wednesday 16 December
Session 4

The international licensing system for transportation of nuclear material: a success story and a look to the future
Mr. Martin PORTER
Secretary General of the World Nuclear Transport Institute
World Nuclear Transport Institute

Working Within The International RAM Transport Regulatory Framework

Martin Porter – WNTI Secretary General
December 2020
Resume

• 25 years as a professionally-qualified Occupational Hygienist working under an enabling regulatory framework (UK HASAWA)

• 11 years experience as an operator (Consignor duty-holder) working in the UK under the UN/IAEA/ADR/RID/IMDG/IATA/CDG framework and transporting nationally and internationally:
  - Dispatched and received spent fuel shipments in support of the UK fuel cycle
  - Reprocessed product shipped to supply fuel manufacture
  - $1.2 \times 10^{18}$ Bq of vitrified HLW shipped safely and securely overseas
  - ILW, LLW, consolidation and research materials successfully transported

• 8 months as Secretary General of the World Nuclear Transport Institute
  - Provide value for money services to our 50 member organisations as an NGO
  - Offer a forum for technical exchange
  - Engage with policy-makers and other key stakeholders to better position transport
Background

• UN/IAEA/modal/national framework has existed for many decades
• Basis of regulations is heavily prescriptive rather than enabling or target-setting
• Broadly remains relevant but some old, existing and new nuclear processes now presenting challenge
Old Nuclear Challenge

• Post-operation clean-out (POCO) and decommissioning activities are manifesting novel payloads

• Higher (relative) dose rates from low activity materials present a particular challenge
  - Dose rates exceed current Industrial Package (IP) limits
  - Type B design/testing/manufacturing can be prohibitively expensive

• Hybrid (Type W/IP4) package is being considered

• Current thinking is that a technical case can be made for safety and security

• Economic case is being developed
• Safety design basis is challenged by extreme natural events and credible accident scenario
• Security is informed by intelligence and learning from experience of ever more aggressive challenges (cyber and physical)
• Safety and security ideals not always mutually inclusive
• Is it security-informed nuclear safety?, or:
• Is it safety-informed nuclear security?
• Reality is that it has to be safe and secure
• Small modular reactors and floating nuclear power plants are now a reality

• Current transport regulatory framework is broadly two-tiered
  - Low risk materials are deemed safe by payload (quantity and/or activity)
  - Higher risk materials are safe by engineering (robust packaging) and control (EPR etc)

• New nuclear may challenge the rigidity of the current, prescriptive regulatory framework
WNTI perspective is that the challenges require careful consideration, consultation and collaboration, such that;

- Policy is informed by the challenges that transporters face
- Regulatory deployment involves enablement and encouragement alongside enforcement
- Operators can demonstrate the competence to stay safe and secure whilst embracing change
WNTI Direction

• REACH OUT TO OUR STAKEHOLDERS

• Fully exploit Observer Status at IAEA to lobby on behalf of our members (active participation in TRANSSC & TTEG’s) in seeking fit-for-purpose regulations

• Engage with regulatory community to explore the ‘art of the possible’ on new ways of working

• Develop processes to harmonise competence (across frontiers) and encourage peer exchange for continuous improvement
  - Enhance policy-maker and regulator confidence in transport capability
  - Anticipate the next generation by redressing the transporter demograph (age, ethnicity and gender)
Summary

• The transport of radioactive materials is enabled because the public broadly accept that we, collectively, deliver it safely and securely (70 years of safe delivery attest to this)

• A changing environment makes the demonstration of safety and security a more complex dynamic

• The key to success is collaboration between policy-makers, regulators and operators in developing inclusive, fit-for-purpose ways of working
Further information is available from WNTI:

- Website: [www.wnti.co.uk](http://www.wnti.co.uk)
- Email address: [wnti@wnti.co.uk](mailto:wnti@wnti.co.uk)
- Office: WeWork Aviation House, 125 Kingsway, London, UK.
- Telephone: +44 (0) 207 580 1144
Mr. Steve WHITTINGHAM
Head of the Transport Safety Unit, United Nations International Atomic Energy Agency
The International Regulatory Framework for the Transport of Radioactive Material

Multi-sector workshop on innovative regulation: challenges and benefits of harmonising the licensing process for emerging technologies

OECD-NEA 14 – 18 December 2020

Stephen Whittingham
Head of Transport Safety Unit
Division of Radiation, Transport & Waste Safety
Department of Nuclear Safety and Security
e-mail: s.whittingham@iaea.org
<table>
<thead>
<tr>
<th>Publication History of IAEA ‘Regulations for the Safe Transport of Radioactive Material’</th>
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<tbody>
<tr>
<td>Safety Series No.6, 1961 Edition</td>
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<td>Safety Series No.6, 1964 Revised Edition</td>
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<td>TS-R-1, 2009 Edition</td>
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<td>SSR-6, 2012 Edition</td>
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<td>SSR-6 (Rev.1), 2018 Edition</td>
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</tbody>
</table>
The IAEA Safety Standards

GSR Part 1

IAEA Safety Standards for preventing, and controlling
Governmental, Legal and Regulatory
Framework for Safety

GSR Part 3

IAEA Safety Standards
for protecting people and the environment
Radiation Protection and Safety of Radiation Sources: International Basic
Safety Standards

SSR 6 (Rev.1)

IAEA Safety Standards
for protecting people and the environment
Regulations for the Safe Transport of Radioactive Material
2018 Edition

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

Advisory Material
Emergency response
Radiation protection programmes
Management System
Compliance assurance
Schedules

Guidance Documents

+ Contents and Format of a Package Design Safety Report
- Scheduled for publication in 2021
IAEA - SSR-6

• Prescriptive requirements - reviewed on biennial basis (12 months to complete), revised (2 – 3 years to complete) when necessary

• Supported by Advisory Material – aids consistent interpretation

• Global, multi-modal but not mandatory

• All 171 IAEA Member States can participate in review process

• Transposed into UN Model Regulations

• Text does not look like UN or modal text

• No guidance for UN or modal provisions, so legal text needs to address everything
Objective of SSR-6 (para. 104)

… is to establish requirements that must be satisfied to ensure safety and to protect persons, property and the environment from the effects of radiation in the transport of radioactive material. This protection is achieved by requiring:

- Containment of the radioactive contents;
- Control of external radiation levels;
- Prevention of criticality;
- Prevention of damage caused by heat.

No routeing or physical protection controls are specified - these may be implemented by Member States for reasons other than radiological safety.
IAEA – SSR-6

Regulatory approach (SSR-6 para. 106)

A graded approach is applied in specifying the performance standards which are characterized in terms of three general severity levels:

(a) Routine conditions of transport (incident free);
(b) Normal conditions of transport (minor mishaps);
(c) Accident conditions of transport.
‘Transport’ (SSR-6 para. 106)

... Transport comprises all operations and conditions associated with, and involved in, the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, unloading and receipt at the final destination of loads of radioactive material and packages.

Radioactive material (SSR-6 para. 235)

... any material containing radionuclides where both the activity concentration (Bq/g) and the total activity in the consignment (Bq) exceed the values specified in paras. 402 - 407
IAEA - SSR-6 – Review / Revision processes

Review (12 months)

• Member States invited to submit proposals for change
• Proposed changes are assessed by TRANSSC (accept, reject or request more information)
• TRANSSC determines if safety significant proposals have been accepted
• NO – SSR-6 remains unchanged
• YES – Revision process initiated (2 – 3 years)
  • Document Preparation Profile (DPP) is submitted for approval to the coordination committee and then the Commission for Safety Standards (CSS)
  • Revised draft prepared through consultants meetings to reflect accepted proposed changes
  • Revised draft submitted to TRANSSC for approval and then submitted to MS for comment
  • MS comments reviewed by consultants meetings and a final draft is submitted to TRANSSC for approval
  • Following TRANSSC approval, the final draft is submitted for approval to the other IAEA Safety Committees followed by the CSS and then the IAEA Board
• The revised SSR-6 is then published
The international regulatory framework

- SSR 6 (Rev.1) - Class 7 - All modes
- All 9 Dangerous Goods Classes - All modes

Regional Agreements eg
- Road, Rail and Inland Waterway
- Sea
- Air

Used as a reference by some Package design approval Regulators / some MS Transport Regulations

Some countries
Regulations – International framework

- **Land transport** (mandatory)
- **State variations**
- **Global for air and sea modes** (mandatory)
- **All modes** (not mandatory)

IAEA SSR6 (Rev.1) (2018 Edition)

Modal Regulations

UN Model Regulations

National Regulations
### SSR-6 Graded approach, UN numbers

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<th>UN number</th>
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<td><strong>Excepted package</strong></td>
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<tr>
<td>UN 2908</td>
<td>RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – EMPTY PACKAGE</td>
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<td>UN 2909</td>
<td>RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM</td>
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<tr>
<td>UN 2910</td>
<td>RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – LIMITED QUANTITY OF MATERIAL</td>
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<tr>
<td>UN 2911</td>
<td>RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – INSTRUMENTS or ARTICLES</td>
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<tr>
<td>UN 3507</td>
<td>URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - less than 0.1 kg per package, non-fissile or fissile excepted</td>
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<tr>
<td><strong>Low specific activity material (LSA-I, LSA-II, LSA-III)</strong></td>
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<td>UN 2912</td>
<td>RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile excepted</td>
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<td>UN 3321</td>
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<td>RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE</td>
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<td>UN 3325</td>
<td>RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), FISSILE</td>
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<td><strong>Surface contaminated objects (SCO-I, SCO-II, SCO-III)</strong></td>
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<td>UN 2913</td>
<td>RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I, SCO-II or SCO-III), non-fissile or fissile excepted</td>
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<td>UN 3326</td>
<td>RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II, SCO-III), FISSILE</td>
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Requires competent authority approval
### SSR-6 Graded approach, UN numbers

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<th>UN number</th>
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<td><strong>Type A package</strong></td>
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<td>RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non-fissile or fissile excepted</td>
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<td>UN 3327</td>
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<td>UN 3332</td>
<td>RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non-fissile or fissile excepted</td>
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<td>UN 3333</td>
<td>RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE</td>
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<td><strong>Type B(U) package</strong></td>
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<td>UN 2916</td>
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<td>UN 3328</td>
<td>RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE</td>
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<td><strong>Type B(M) package</strong></td>
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<td><strong>Type C package</strong></td>
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<td>UN 3330</td>
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<td><strong>Uranium hexafluoride</strong></td>
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<td>UN 2977</td>
<td>RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE</td>
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<td>UN 2978</td>
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<td><strong>Special arrangement</strong></td>
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<td>UN 2919</td>
<td>RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, non-fissile or fissile excepted</td>
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<tr>
<td>UN 3331</td>
<td>RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE</td>
</tr>
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</table>

Requires competent authority approval.
Compliance with SSR 6 requirements

Build a basis for mutual trust that enables Cooperation / Collaboration / Global Adoption of a Harmonized Regulatory Framework

** Package design verification is required, for packages containing fissile material, by Member States through or into which the package is transported.
Innovation in the context of international cooperation

Innovation

In the context of the international transport safety framework, innovation can be perceived as a potentially disruptive technology if

- it is related to a safety function, and
- Compliance with regulatory requirements cannot be independently verified

Consequently, innovation has the potential to disrupt international cooperation, increasing the risk of international cooperation becoming increasingly problematic OR simplify the international cooperation, if innovations bring undisputable safety improvements

Transport

The transport of radioactive material fits within a regulatory framework of international cooperation that has been reviewed, developed and refined by Member States since 1961.

Innovation can be accommodated if it can be incorporated within the approach of the transport regulations; that is, compliance with prescribed administrative, operational and performance-based requirements that can be, or are required to be, independently verified by Member States
Thank you!

Stephen Whittingham
Head of Transport Safety Unit
Division of Radiation, Transport & Waste Safety
Department of Nuclear Safety and Security
email: s.whittingham@iaea.org
Workshop Moderator

Mr. Ramzi Jammal
Executive Vice-President and Chief Regulatory Operations Officer Regulatory Operations Branch
Canadian Nuclear Safety Commission (CNSC)
Dr. Jean-Christophe NIEL

Director General of Institute for Radiological Protection and Nuclear Safety, France, Chair of the OECD NEA Committee on the Safety of Nuclear Installations
OECD/NEA “MULTI-SECTOR WORKSHOP ON INNOVATIVE REGULATION: CHALLENGES AND BENEFITS OF HARMONISING THE LICENSING PROCESS FOR EMERGING TECHNOLOGIES”

SESSION 4 PANEL : THE INTERNATIONAL LICENSING SYSTEM FOR TRANSPORTATION OF NUCLEAR MATERIAL: A SUCCESS STORY AND A LOOK TO THE FUTURE

DG Jean-Christophe Niel
Main point: Harmonization of regulations doesn’t guarantee harmonization on the ground

- Necessary harmonization due to the strong international nature of this activity
- Be aware about the differences in the safety case generated by the use of different approaches
- Importance of harmonization through the technical approaches related to safety regulation
- Issues related to increase digital safety demonstration
- Promote enhanced interactions between stakeholders (meetings such as Transsac, symposium PATRAM, networks, shared technical issues,..)

Shared safety evolutions take (too much) time to be implemented on the ground

- How to make more efficient the four steps: consolidating the experience feedback, integrate it in the international regulation, transfer it to national regulation, make it operational?

Technically founded rules, don’t forget humans

- How to better implement human and organizational factor relevant to safety issues?
- How to interact with people about nuclear activities implemented near them?

Interfaces consistency

- Facilities versus transports
- International versus national
- Nuclear safety versus nuclear security
- Normal operation versus nuclear emergency
MULTI-SECTOR WORKSHOP ON INNOVATIVE REGULATION: Challenges and benefits of harmonizing the licensing process for emerging technologies

Session 4 - The international licensing system for transportation of nuclear material: a success story and a look to the future

Ms. Rebecca TADESSE
Head of Radioactive Waste Management and Decommissioning Division, OECD Nuclear Energy Agency
RWMD Perspectives on Transportation of Fuel and Waste

Rebecca TADESSE
Head of the Division of Radioactive Waste Management and Decommissioning (RWMD), Nuclear Energy Agency

SAF Workshop, 2020
Transportation Challenges

1. Package
Transportation packages need to be certified for shipping the unique waste streams from non-light water reactors (LWRs).

2. Waste form
The chemical and physical form of radioactive material in unirradiated fuel, spent fuel and radioactive waste from non-LWRs need to be evaluated.

3. Modelling
Radionuclide inventory of non-LWRs may not present in computational codes for analysis of transportation or radiological impact of its accidents.

4. Criticality
Reduced number of criticality benchmarking is available above 5% enrichment, so additional analysis is necessary to support cask design and transportation.
Anticipated Regulatory Challenges

Enrichment and Fabrication Facilities
- Most commercial fuel cycle facilities are licensed to produce up to 5% enriched material.

UF$_6$ Transportation
- Existing UF$_6$ transportation packages are approved for up to 5% enrichment.

Fresh/Spent Fuel Transportation & Storage
- Shipping package certification for unique waste from non-LWRs.
- Fuel integrity and criticality safety.
Areas for Collaboration

- **Criticality**: R&D for criticality data above 5% enrichment
- **Process**: Streamline existing process for characterisation and transportation
- **Licensing**: Multi-national transportation cask, requirements, licensing framework
- **Modelling**: Technical assessments, confirmatory code development, and expert elicitations
- **Robotics**: Use of innovative technology, such as robotic system and sensors to monitor casks
Thank you for your attention.

If you have questions, contact Rebecca Tadesse [Rebecca.Tadesse@oecd-nea.org].

www.oecd-nea.org/jcms/c_12892
Mr. Serge GORLIN
Head of Industry Cooperation Department at World Nuclear Association (WNA)
Radioactive material transport model

Genesis
• Demonstrated need
• International cooperation
• Pragmatism

Benefits
• Common understandings
• Safety enhancement
• Efficient and effective licensing
A new approach for reactor design evaluation and licensing

- Sustained government support
- Regulatory cooperation
  - Harmonized terms
  - Codes and standards
  - Quantitative requirements (technology specific)
- Licensing processes
- Industry engagement

![Diagram showing relationships between Nuclear Industry, Multinational Advisory Panel for Regulation of Power Reactors (Name TBC), Governments, National Regulators, Nuclear Safety Standards (IAEA), Codes and Standards (SDOs), Design Review and Certification, Licensing Process, Radiological and Environmental Protection (IAEA, ICRP), Provide support and financing, and Provide inputs and implementation.]
Ms. Jennifer NUGENT
Head of Technical, and Member of the International Nuclear Services (INS) Executive Team
Jennifer Nugent

SESSION 4. The international licensing system for transportation of nuclear material: a success story and a look to the future

We need to consider Transport at each stage of the lifecycle of any innovation, this could be at the outset of Lab samples, Prototypes, fleet manufacture, operation and disposal. Each stage will have its own challenges so needs to be considered early so that Transport is an enabler and not a constraint.

The challenges with harmonisation is ensuring consistency while recognising the Duty Holder. Interpretation or emphasis on regulations can differ between States therefore creating challenges to getting a Right first time safety case.
MULTI-SECTOR WORKSHOP ON INNOVATIVE REGULATION: Challenges and benefits of harmonizing the licensing process for emerging technologies

Session 4 - The international licensing system for transportation of nuclear material: a success story and a look to the future

Mr. Steve WHITTINGHAM
Head of the Transport Safety Unit, United Nations International Atomic Energy Agency

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Head of Industry Cooperation Department at World Nuclear Association (WNA)

Ms. Jennifer NUGENT
Head of Technical, and Member of the International Nuclear Services (INS) Executive Team
Future Challenge: Transportable Nuclear Power Plants (TNPPs)

Multi-sector workshop on innovative regulation: challenges and benefits of harmonising the licensing process for emerging technologies

OECD-NEA 14 – 18 December 2020

Stephen Whittingham
Head of Transport Safety Unit
Division of Radiation, Transport & Waste Safety
Department of Nuclear Safety and Security
email: s.whittingham@iaea.org
Future Challenge:
Transportable Nuclear Power Plants (TNPPs)

There are two distinct regulatory frameworks one for NPPs and one transport of radioactive material in the public domain

**Individual Member State Approval / Licensing by National Regulatory Body**
Includes goal orientated and performance based analysis to obtain authorisation to operate in compliance with national nuclear safety and security regulations

**Global Transport Safety Infrastructure for Radioactive Material**
Prescribed package types, performance-based package requirements, defined routine and accident conditions of transport, defined package authorization processes

**Individual Member State Approval of Type BU Fissile package designs**
Safety Requirements of transport package(s) and consignments must be independently verified by Member States through or into which the fissile radioactive material is transported
Future Challenge: TNPPs

The ambition would be to achieve similar levels of cooperation, collaboration and mutual trust in the transport safety of TNPPs as exists for radioactive material.

A key objective to facilitate achieving this ambition, would be to develop a set of prescribed transport safety requirements that can be independently verified by a Member State within a global regulatory framework for transport, which will require mutual design approval of the TNPP by MS nuclear regulators.

The main challenges would therefore be to reach Member State agreement:

– To characterise the transport safety features such that the IPR of the reactor design are not compromised
– To enable, and reach agreement with MS designing the TNPPs, that the design of the transport safety features are independently verifiable (validated)
– To develop prescribed administrative requirements for transport accordingly

In addition to transport safety regulations, International Conventions and Codes, for Safety, Security and Safeguards would also need to be reviewed and revised as considered necessary.
The Member State regulatory framework will need to move into a revised global regime for transport in the public domain.
Thank you!

Stephen Whittingham
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Division of Radiation, Transport & Waste Safety
Department of Nuclear Safety and Security
email: s.whittingham@iaea.org
QUESTIONS FROM PARTICIPANTS

• Question 1
• Question 2
• Question 3
MULTI-SECTOR WORKSHOP ON INNOVATIVE REGULATION

Challenges and benefits of harmonising the licensing process for emerging technologies

Thank you for your participation today and see you all tomorrow!