Overview of INPRO CP “Case Study for the Deployment of a Factory Fuelled SMR”

Department of Nuclear Energy, Division of Nuclear Power, INPRO Section
INPRO Overall Objectives

➢ To help to ensure that nuclear energy is available to contribute, in a **sustainable** manner, to meeting the energy needs of the 21st century

➢ To bring together technology **holders and users** to jointly considers the international and national actions required for achieving **desired innovations** in nuclear reactors and fuel cycles
INPRO cooperates with Member States to ensure that sustainable nuclear energy is available to help meet the energy needs of the 21st century in accordance with the UN concept of sustainability.

Brundtland definition of sustainable development: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”
In 2016, INPRO membership has grown to 42 Members
INPRO Tasks

Task 1: Global scenarios
- Provides long-term scenario evaluation using dynamic simulation of national, regional and global nuclear energy systems

Task 2: Innovations
- Designs and convenes collaborative projects on topics crucial to future nuclear sustainability and technological innovations

Task 3: Sustainability Assessment and Strategies
- Assists MS to build sustainable nuclear energy program strategies and plans through Nuclear Energy System Assessments (NESAs), using the INPRO Methodology

Task 4: Dialogue and Outreach
- Encourages and organises topical Dialogue Forums on cross-cutting subjects of interest to INPRO members and to the larger NE community
Task 2 “Innovations”

2.1. Study on Cooperative Approaches to the Back End of the Nuclear Fuel Cycle: Drivers and Institutional, Economic and Legal Impediments

2.2. Collaborative Project “Review of Innovative Reactor concepts for prevention of Severe accidents and mitigation of their Consequences” (RISC)

2.3. Collaborative Project on Transportable NPP phase II: Case study for the deployment of factory fuelled small sized reactor

2.4. Collaborative Project “Nuclear Fuel and Fuel Cycle Analysis for Future NES” (FANES)

2.5. Collaborative Project “Waste from Innovative types of Reactors and Fuel Cycles” (WIRAF)
Overall objective of the project is to:
Examine, in some detail, legal and institutional issues for export deployment of a transportable nuclear power plant (TNPP) with a factory fuelled and tested reactor and to investigate other aspects of transportable and modular reactor facilities.

Current participating countries:
Armenia, Finland, France, Indonesia, Romania, Russia, USA

Activities: 5 Consultants’ Meetings in 2015-2016 were held

Output: A TECDOC series publication in 2018

The CP will include a set of case studies performed by individual Member States and summaries of the findings of those studies.
To achieve this objective, the Collaborative Project will:

- Identify potential gaps in international nuclear law to cover factory fuelled SMRs through all its lifecycle, including the construction phase and training.
- Identify gaps regarding factory fuelled SMR transport and the related international law, including cases of transport through the territorial seas and territories of a third country. International Maritime Organization/IAEA agreements, recommendations and documents are also being reviewed and non-covered issues will be described and discussed.
- Suggest potential solutions in relation with the control supervision and its continuum over all the lifecycle, both in relation with utilities and State Authorities.
- Outline potential responsibility schemes between the Authorities and other stakeholders, including emergency management and civil liability.
- Outline potential impacts on typical licensing processes and potential adaptations to licensing processes indicated by factory fuelled SMRs.
INPRO Collaborative Project “Case Study for the Deployment of a Factory Fuelled SMR”

Background:

- A TNPP is defined as a factory-manufactured, transportable and/or re-locatable nuclear power plant, which, when fuelled is capable of producing final energy products like electricity, process heat, etc.
- A preliminary study (INPRO study on Legal and institutional issues of transportable nuclear power plants) addressing the specific legal and regulatory challenges of TNPP was performed in 2008-2013. It resulted in the Nuclear Energy Series Technical Report No. NG-T-3.5
- The TNPP is physically transportable, but is not designed to either produce energy during transportation or to provide energy for the transportation itself
- Current activity focuses on TNPP deployments in countries other than the country of origin

Proposed Case Studies performed by Member State’s experts are:

- Case Study 1 - Factory fuelled sub-surface marine-based SMR (France)
- Case Study 2 - Factory fuelled floating SMR (Russia)
- Case Study 3 - A small land-based factory fuelled transportable SMR (TBD – formerly Canada)
1. INTRODUCTION - draft exists, final editing is needed
   1.1. Background
       1.1.1. Review of gaps related to the “Legal and institutional issues of transportable nuclear power plants: a preliminary study (IAEA nuclear energy series No. NG-T-3.5)”
   1.2. Objective
   1.3. Scope
   1.4. Structure
2. DEFINITIONS - draft exists, final editing is needed
3. REFERENCE CASES - draft exists, final editing is needed
   3.1. Assumptions
       3.1.1. Identifying necessary host country interactions with the service facility country
       3.1.2. Identifying transferred liability between parties, including accidents and malfunctions at site, service facility and in transit
   3.2. Reference scenarios for TNPP deployment
       3.2.1. Case Study 1 - Factory fuelled sub-surface marine-based SMR
       3.2.2. Case Study 2 - Factory fuelled floating SMR
       3.2.3. Case Study 3 - A small land-based factory fuelled transportable SMR
   3.3. Conclusions (Comparison – Similarities and Differences)
4. LICENCING PROCESS FOR FACTORY FUELLED TNPP - first draft exists
   4.1. Licensing steps for the service facility, transport and the operation site
   4.2. Host country interactions with the service facility country
   4.3. Liability transfer between parties, including accidents and malfunctions at site, service
         facility and in transit
   4.4. Transportation of TNPP
   4.5. Conclusion on licensing issues

5. SPECIFIC ISSUES RELATING TO NUCLEAR SAFETY FOR TNPPs - draft needs to be prepared
   5.1. Introduction
   5.2. Applicability of the IAEA safety standards to TNPP
   5.3. Safety issues related to the siting, design and operation
   5.4. Building capacity in regulatory bodies
   5.5. Building capacity in codes and standards organisations
   5.6. Safety regulation of components
   5.7. Emergency planning – onsite and offsite
   5.8. Training TNPP operating and maintenance personnel
   5.9. Conclusion on safety issues
6. SAFEGUARDS ISSUES RELEVANT TO TNPPs - first draft exists

6.1. Physical protection at site, service facility and in transit – including characterizing Design Basis Threat (DBT)

6.2. Application of IAEA safeguards
   6.2.1. Countries under different safeguards agreements
   6.2.2. Authority to receive and verify design information and material inventory in the Service facility state
   6.2.3. Ability to receive and verify design information and material inventory in the Host state
   6.2.4. New technologies (e.g. satellite imaging)
   6.2.5. New policies (e.g. reduce reliance on reverification)
   6.2.6. Repatriation of spent fuel from the Host state to the Service facility

6.3. Conclusion on safeguards issues
7. LEGAL AND REGULATORY ISSUES RELATING TO TNPPs - draft needs to be prepared
   7.1. General legal arrangements applying to all TNPP
   7.2. How do various conventions impact potential deployment
   7.3. Legal issues for the supplier
   7.4. Legal issues of the transportation
   7.5. Legal issues for the host State
   7.6. Legal issues for other States and the international community
   7.7. Conclusion on legal issues

8. CONCLUSIONS

ANNEX 1: Case Study 1 - draft exists, final editing is needed
ANNEX 2: Case Study 2 - draft exists, final editing is needed
ANNEX 3: Case Study 3 - draft exists, but Canada has withdrawn

ABBREVIATIONS
REFERENCES
CONTRIBUTORS TO DRAFTING AND REVIEW
Objectives of the first extended Consultants’ Meeting were to:

- Gather additional information from the Member State experts in Legal, Regulation, Liabilities & Responsibilities, Safety, and Licensing Process to address the differences between conventional NPP lifecycle and the Factory Fuelled Transportable Nuclear Unit (TNU) / Transportable Nuclear Power Plant (TNPP)
- To further elaborate following topics of the Study: Legal, Regulation, Liabilities & Responsibilities, Safety, and Licensing Process
- To agree dates of the next extended CM, in which Member State experts will cover the following topics: Environment, Emergency Preparedness, Safeguards, Physical Protection
Questionnaires for Member State experts

in areas of:
Legal / Regulation / Liabilities & Responsibilities / Safety / Licensing Process Environment / Emergency Preparedness / Safeguards / Physical Protection
Main Outcomes of this Consultants’ Meeting are to:

- The Legal / Regulation / Liabilities / Responsibilities / Licensing Process topics have been substantially discussed (different presentations from Member State experts were delivered).
- The proceedings of the meeting have been written based on the list of questions, which had been adopted in January 2016 at the fourth CM.
- The second extended Consultants’ meeting will be held on 31 October - 4 November 2016 and will cover following topics: Environment / Emergency Preparedness / Safety / Safeguards / Physical Protection.

In addition:

- Canada officially informed the INPRO Section that Canadian participation is no longer possible. However, the participants of the activity believe that Case Study C, a land-based FF-SMR, previously being studied by Canada, remains of interest for the purpose of this study. Possible replacement for the Canadian Case Study is under consideration.
THANK YOU!

Please, go for more detail to: http://www.iaea.org/INPRO/