INPRO ACTIVITIES IN SUPPORT OF GLOBAL DEPLOYMENT OF SMRs: Collaborative Projects RISC and TNPP Phase II

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INPRO Objectives

- The *International Project on Innovative 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.

- To bring together technology holders and users so that they can jointly consider international and national actions required for achieving desired innovations in nuclear reactors and fuel cycles.

- INPRO is part of the integrated services of the IAEA provided to Member States considering initial development or expansion of nuclear energy programmes.

- Innovative Small and Medium Sized Reactors (SMRs) might be an attractive solution in many markets of technology holder and technology user/newcomer countries alike – Therefore, SMR shall be and are on the Agenda of INPRO
INPRO Structure

**INPRO PROJECT 1**
- Targeted nuclear energy system
  - Current nuclear energy system
  
  - Nuclear energy system assessment for sustainability (using INPRO Methodology for nuclear energy system assessment)
  
  - Modification of targeted nuclear energy system based on the outputs of the assessment
  
  - Desired degree of innovation in technology and infrastructure

**INPRO PROJECT 2**
- Global and regional scenarios of transition to future sustainable nuclear energy systems
  
  - Role of cooperation among countries in making such a transition
  
  - Synergies and ‘win-win’ strategies of collaboration between suppliers and users

**INPRO PROJECT 3**
- Collaborative projects on selected topics of innovative nuclear technology and infrastructure
  
  - Roadmaps for transition to future sustainable nuclear energy systems *(who does what, where and when?)*

Long-term national nuclear energy strategy & policy for cooperation with other countries
INPRO Methodology for nuclear energy system assessment (NESA) - a comprehensive, internationally agreed criteria-based sustainability assessment in areas of **economics, safety, waste management, proliferation resistance, physical protection, environment and infrastructure**
INPRO Holistic Approach
SMRs are nuclear reactors for NPPs and share many common features with reactors of larger capacity – in several INPRO projects they are considered as part of the nuclear energy system (NES)

INPRO Project 2: “Global Scenarios”

- On-going SYNERGIES collaborative project - NPPs and co-generation plants with SMRs are being considered, along with other thermal and fast reactors, in the analysis and assessment of transition scenarios to future globally sustainable NES

- Planned ROADMAPS collaborative project – guidance and template to develop national and regional roadmaps for transition to future globally sustainable nuclear energy systems (biennium 2014-15)

- Planned KIND collaborative project to develop a set of key indicators for the assessment of innovative NES not available today

INPRO Project 1: “Strategies”

- Nuclear Energy System Assessments (NESAs) with INPRO methodology: NES with SMRs are being/ could be assessed upon requests of Member States
New INPRO Activities (1)

✓ COLLABORATIVE PROJECT RISC (REVIEW OF INNOVATIVE REACTOR CONCEPTS FOR PREVENTION OF SEVERE ACCIDENTS AND MITIGATION OF THEIR CONSEQUENCES) (preparatory meeting in December 2013)

OBJECTIVE:
✓ To demonstrate that the evolution of safety requirements and related technical and institutional innovations in nuclear technologies provide continued progress to ultimately meet the requirement to avoid relocation or evacuation measures outside NPP sites in case of severe accidents.

Along with other innovative NPP designs, SMRs could be considered.

INPRO methodology in the area of reactor safety requires that “a major release of radioactivity from an installation of future Nuclear Energy System (NES) should be prevented for all practical purposes, so that NES installations would not need relocation or evacuation measures outside the plant site, apart from those generic emergency measures developed for any industrial facility used for similar purpose.”
New INPRO Activities (2)

INTER ALIA, COLLABORATIVE PROJECT RISC WILL

Review the (design and licensing) approaches to reduce off-site emergency planning requirements

Deterministic with supplementary Level 2 PSA

Barge mounted designs (KLT-40S), IAEA Nuclear Energy Series No. NP-T-2.2:

• To limit radiation dose to the population living within a 1 km radius from the floating NPP, depending on the actual radiation situation, some protection measures such as iodine prophylaxis or sheltering will be implemented

• Temporary limitation will be established on the consumption of some agricultural products grown within a radius of 0.5 km from the “floating” plant, when contaminated with radioactive release

• Evacuation of the population is not required at any distance from the “floating” NPP
New INPRO Activities (3)

COLLABORATIVE PROJECT RISC

Probabilistic, based on Level 3 PSA

*Regulations in Argentina, IAEA Nuclear Energy Series No. NP-T-2.2:*

FIG. III-4. Acceptance criterion for BDBA.
New INPRO Activities (4)

Probabilistic, based on Level 3 PSA Approaches under consideration, IAEA-TECDOC-1652:

FIG. 2. Step 1 of the methodology: Accident sequence re-categorization.

FIG. 3. Step 2 of the methodology: Dose versus distance evaluation.

FIG. 5. Step 4 of the methodology: Probabilistic/deterministic combination (part 2).

FIG. 6. Step 5 - final result: Risk-informed EPZ definition.
Some innovative SMRs may have distinct features making them somewhat different from NPPs with large reactors.

With reference to the presentation by Z. Drace yesterday:

- **A Transportable Nuclear Power Plant (TNPP)** is a factory manufactured, transportable and/or re-locatable nuclear power plant, which, when fuelled is capable to produce final energy products like electricity, heat, desalinated water, etc.
- The TNPP is physically transportable, but is not designed either to produce energy during transportation or provide energy for the transportation itself.
INPRO Activities in Support of Global SMR Deployment

PHASE I OF INPRO TNPP STUDY SUCCESSFULLY COMPLETED:

- Nuclear Energy Series No. NG-T-3.5 “Legal and Institutional Issues of Transportable NPPs (Preliminary Study)” approved for publication

  - The report focussed on issues of TNPP deployment in countries other than the country of origin
  - Export deployments of factory fuelled/refuelled TNPPs were found to pose more issues

The supplier State, the host State, and all involved third countries could agree to conclude an international treaty or treaties among themselves to cover relevant innovative aspects regarding the use of TNPPs that are presently not the object of existing legal norms.

On the basis of the provisions of the above mentioned treaties, the relevant safety, security and environmental requirements would need to be developed and emplaced as part of national regulations in all of the States involved in the export transaction.
CURRENT PROPOSAL FOR PHASE II OF INPRO TNPP STUDY

OBJECTIVE:

✓ To examine in more detail legal and institutional issues for export deployment of a TNPP with factory fuelled and tested reactor. It could be a case study among interest supplier and user and the third parties involved

✓ Other aspects of transportable nuclear power plants could be investigated – the proposal could still be amended/modified.

Preparatory meeting for the project will be convened in November-December 2013 in Vienna

YOU ARE INVITED TO JOIN INPRO COLLABORATIVE PROJECTS OF RELEVANCE TO SMRs!
THANK YOU!

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