LICENSING AND REGULATORY FRAMEWORK CHALLENGES FOR SMR DEPLOYMENT

GNSSN Plenary
22-23 February 2023

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Outline

Introduction

Applicability of IAEA Safety Standards to Evolutionary and Innovative Design (EID) technologies

Licensing of Nuclear Installations - SSG-12 Revision

Nuclear Harmonization and Standardization Initiative (NHSI)
Background

Growing interest in these technologies due to many factors

Evolutionary and innovative reactors can be very different from the current operating fleet:

- Different neutron spectrum
- Different coolants and moderators
- Simplified designs and passive means to maintain safety
- Advances in engineering, materials, manufacturing
- Serial factory, modular construction and standardization
- Deployment models and transportation

Are IAEA safety standards currently in use sufficient and relevant to ensure the safety of these innovative designs?
Regulatory Challenges (1)

- Large number of innovative designs (first of kind)
  - IAEA booklet on SMRs (2020)

- Unproven technology
  - Comprehensive analyses, simulations, and testing needed to close knowledge gaps
  - New design philosophy
  - New materials
  - New safety systems strategies

- Lack of operational experience

- Implications of SMR supply chain on licensee’s core safety capabilities

- Faster construction time
Regulatory Challenges (2)

- New deployment approaches
  - Serial production, largely in factories
  - Factory fuelling
  - Transport to final location
  - Factory (partial) commissioning
  - More than one regulatory jurisdiction involved in licensing/regulatory review

- Regulatory processes need to be adapted, as appropriate
  - Rules and Regulation
  - Safety Requirements and Guides
Outline

- Introduction
- Applicability of IAEA Safety Standards to Evolutionary and Innovative Design (EID) technologies
- Licensing of Nuclear Installations - SSG-12 Revision
- Nuclear Harmonization and Standardization Initiative (NHSI)
How the IAEA is supporting MSs on SMR safety and security

• The IAEA has completed the review of applicability of safety standards to novel advanced reactors throughout lifecycle
• Working with more than 150 experts from 30 countries and 40 organizations, including representatives of the SMR Regulators Forum
• Safety standards are generally applicable
  – Some areas not fully applicable or could be adapted for a better application
  – Some areas of novelty not fully covered
For most cases, issues identified may merit additional work (i.e. technical document development) but may not need to be reflected in the safety standards
• Review captured in a safety report published in 2022
Introduction

Objective
- A high-level review of the applicability of IAEA Safety Standards to non-water-cooled reactors (NWCR) and small modular reactors (SMRs)
- Includes consideration of interface safety, security, safeguards (3S)

Scope
- Water cooled SMRs, SFRs, I FRs, HTGRs
- Partial consideration of MSRs and Transportable NPPs (TNPPs)
- Entire lifetime

Approach
- Identification of areas of novelty
- Areas of novelty are compared with requirements and recommendations

Structure
- Six Sections
IAEA Safety Standards Considered
Areas of Novelty

The safety report identifies areas of novelty for lifetime of the SMRs and NWCRs, including the following topics:

- General areas of novelty
- Areas of novelty related to small-size, multi-modules or modularity
- Areas of novelty specific to NWCRs
- Preliminary areas of novelty specific to TNPPs

For each topic there are:

1. Siting
2. Design
3. Construction
4. Commissioning and operation
5. Fuel Facilities
6. Management of waste and spent fuel
7. Decommissioning
8. Emergency preparedness and response
9. Deployment models

Annex: summary tables
Mapping of Application of Safety Standards

For each safety standard the report identifies:

- Areas of applicability
- Areas of non-applicability
- Gaps and areas for additional considerations

1. Introduction
2. IAEA safety standards
3. Identification of areas of novelty
4. Mapping of application of safety standards
5. Interfaces between safety security and safeguards
6. Key outcomes of the applicability review

Annex: summary tables

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Recommendations for a Workplan on Safety Standards and Other Publications and Activities

In view of the findings of the review of applicability of the safety standards, the IAEA SMR Safety Working Group (WG) recommended to:

1. Enhance applicability of safety standards to SMRs and NWCRs as part of planned SSCs ‘reviews’ of safety standards
2. Develop publications to capture practical examples of application of safety standards for specific technologies
3. Develop a repository of technology specific knowledge
Recommendations on Plan to Consider SMRs and Non-WCRs in the Safety Standards

A plan developed based on IAEA SMR Safety WG evaluation of difficulty of revising safety standards to address areas of non-applicability and gaps previously presented

Resources and timeline:

Resources currently only available for safety standards identified in the medium-term plan (MTP) to be reviewed on the established timeline

Feedback on other areas of priority from Member States will help to develop a proposal to gather further resources for an accelerated programme of work

- Issues relevant to wide range of technologies
  - Y
  - Can issue be addressed in a TN manner?
    - Y
    - Sufficient information available?
      - Y
      - In MTP?
        - Y
        - SSC ‘review’ to be initiated or ongoing
      - N
      - SSC ‘review’ can be initiated when information is obtained
    - N
    - SSC ‘review’ recommended (issues may be covered by separate publication)
  - N
  - SSC ‘review’ recommended (issues may be covered by separate publication)
Safety Guide SSG-12, Licensing Process for Nuclear Installations

- Published in 2010
- Outlines recommendations on how the licensing process should be applied at the various stages of the lifetime of a nuclear installation, with discussion of the topics and required documents to be considered at each stage.

- SSG-12 was partially superseded by GSG-13 and needs to be read in conjunction with it and with GSG-12.
Safety Guide SSG-12, Licensing Process for Nuclear Installations – Review findings

- **Areas of applicability**
  All recommendations are applicable to Evolutionary and Innovative Design

- **Areas of non-applicability**
  Not identified.

- **Identified gaps and areas for additional consideration**
  - Guidance on
    - Early interactions/engagement between the designer and the regulator
    - RB Independent decisions x increased efficiency and minimized duplication.
    - Potential for sharing of regulatory responsibilities.
  - Evolutionary and Innovative Design deployment models
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1. Introduction
2. Applicability of IAEA Safety Standards to Evolutionary and Innovative Design (EID) technologies
3. Licensing of Nuclear Installations - SSG-12 Revision
4. Nuclear Harmonization and Standardization Initiative (NHSI)
Nuclear Harmonization and Standardization Initiative (NHSI) Background

**Harmonization of Regulatory Approaches Track**
- **WG1**: Framework for information exchange
- **WG2**: International pre-licensing regulatory reviews
- **WG3**: Leveraging other regulatory reviews

**Standardization of Industrial Approaches Track**
- **TG1**: Harmonization of high-level user requirements
- **TG2**: Common approaches to Codes & Standards
- **TG3**: Experiments and simulation codes validation
- **TG4**: Acceleration of nuclear infrastructure implementation for SMR

**IAEA as facilitator** within and between the tracks

- Regulators
- Governments
- Technology Holders
- Operators and other end-users
- International Organisations and Associations

Effective Global Deployment of Safe and Secure Advanced Nuclear Reactors

IAEA as facilitator within and between the tracks
Progress and Achievements (Regulatory Track)

- **Launch Meeting** held in June 2022
- Working Groups **membership** established
- **Overall scope and timeline** for the work developed
- **WG outputs** are TECDOCs, outline developed, work distribution agreed with WG members
- The IAEA internal **team** in place, **challenges in resources and funding**
- Regulatory Track WGs kick-off meetings held in October 2022, 2nd round in November, 3rd round in January
- Interface with Industry Track planned (selected industry representatives participated January meetings)
Timeline and Expected Outcomes

**2022**
- Work plans and outline of publications for each WG
- Key inputs, experience available, cooperation with ongoing projects
- Start development of publications
- Define interface between tracks

**2023**
- WG meetings and continue developing publications
- Progress meeting event in June 2023
- Targeted interface meetings between Industry and Regulatory Track

**2024**
- Completion of draft publications
- Interface meetings between Industry and Regulatory Track

*Regulatory Track Publications:*
- Publication to establish information sharing needs by regulators, potential obstacles to information sharing, and potential solutions
- Publication to establish the focus areas and process for an international pre-licensing design review
- Publication to establish an approach on how one regulator’s reviews can be used by another regulator

The success of this Initiative will require **clear commitment** and **support** from Governments, regulatory bodies and industry.
Thank you!

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