



Towards Harmonisation in Licensing of Future Nuclear Power Technologies in Europe

Egidijus Urbonavičius

Lithuanian Energy Institute

e-mail: Egidijus.Urbonavicius@lei.lt

Andreas Ikonomopoulos

National Centre for Scientific Research “Demokritos”

e-mail: anikon@ipta.demokritos.gr

Funded by the European Union. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or EC-Euratom. Neither the European Union nor the EC-Euratom can be held responsible for them.

June 6-10, 2022

IAEA TM on Synergies in Technology Development between
Nuclear Fission and Fusion for Energy Production



Content

- Introduction
- Historical context
- Current status
- Activities for harmonisation of licensing
- Project HARMONISE
- Summary



Introduction

- The current nuclear regulatory framework appeared in the 1960s for licensing early NPP designs and since then it has undergone substantial modifications because of major nuclear accidents and in response to challenges posed by the licensing of Generation III designs
- Innovative fission and fusion installations encompass novel technologies that drive the need for developing new licensing procedures.
- The legal framework and procedures applied in the field of nuclear power are very rigid limiting the introduction of new technologies in operating NPPs
- There is a broad agreement on the need to review the existing regulatory framework, incorporate novel concepts and endow it with sufficient capabilities for assuring safety during design and enabling proper regulatory oversight during the operation of innovative facilities

Historical context

- While States opted for differing national regulatory frameworks, the Three Miles Island and Chernobyl accidents acted as catalysts for change mandating the need for international cooperation on nuclear safety and radiation protection leading to harmonised approaches notwithstanding that both are national responsibilities
- Achieving harmonisation requires establishing internationally agreed safety standards and supporting their global adoption
- IAEA has recognized that [1]: *“Regulating safety is a national responsibility. However, radiation risks may transcend national borders, and international cooperation serves to promote and enhance safety globally by exchanging experience and by improving capabilities to control hazards, to prevent accidents, to respond to emergencies and to mitigate any harmful consequences.”*

[1] <https://www.iaea.org/publications/12288/regulations-for-the-safe-transport-of-radioactive-material>



Current status

- In order to achieve political, scientific, technical and economic harmonisation among the Member States, EC introduced in 2003 two joint directives identified as the “*nuclear package*”
- The former directive defined general principles regarding nuclear site safety while the latter dealt with the management of spent fuel and radioactive waste in a legally binding sense at EU level
- Another directive on funds for NPP decommissioning and waste management until final storage was taken out and appeared as recommendations in 2006
- The nuclear package did not have majority in the Council and in 2008 the EC presented a new draft directive on nuclear safety with a focus on NPP safety
- In 2014, the Council Directive 2014/87/Euratom amended Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations



Current status

- State legislations maintain diverse definitions and interpretations in their application of basic safety principles while being consistent with the IAEA Safety Standards



Activities for harmonisation of licensing



- There is a number of initiatives in different fields to approach a common understanding and approach in NPP licensing, operation and decommissioning, e.g. ETSO – European Technical Safety Organisations Network, WENRA – Western European Nuclear Regulators’ Association, WANO – World Association of Nuclear Operators, etc.
- IAEA is a key player in achieving a common understanding in all stages of the nuclear fuel life-cycle
- Works that have been recently published include:
 - OECD NEA publication: “Harmonising the nuclear licensing process for emerging technologies: A global path forward”
 - EC publication: “Exploring regulatory options for fusion power plants”
 - UK Government publication: “Towards Fusion Energy. The UK Government’s proposal for a regulatory framework for fusion energy”
- EDF has announced that its NUWARD™ SMR design will be the case study for a European early joint regulatory review led by the French nuclear safety regulator with the participation of the Czech and Finnish nuclear regulators [2]

[2] <https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/edf-announces-that-its-small-modular-reactor-nuwardtm-will-be-the-case-study-for-a-european-early-joint-regulatory-review-led-by-the-french-nuclear-safety-authority-with-the-participation-of>



Project HARMONISE

- HARMONISE (*Coordination and Support Action in Horizon-Europe programme*) started on June 1, 2022 and has a 36 month duration
- Project coordinator – Lithuanian Energy Institute
- 17 partners from 10 European countries representing research organisations, regulators, SME and EU JRC
- Several partners are ETSON members



Project HARMONISE – Objectives

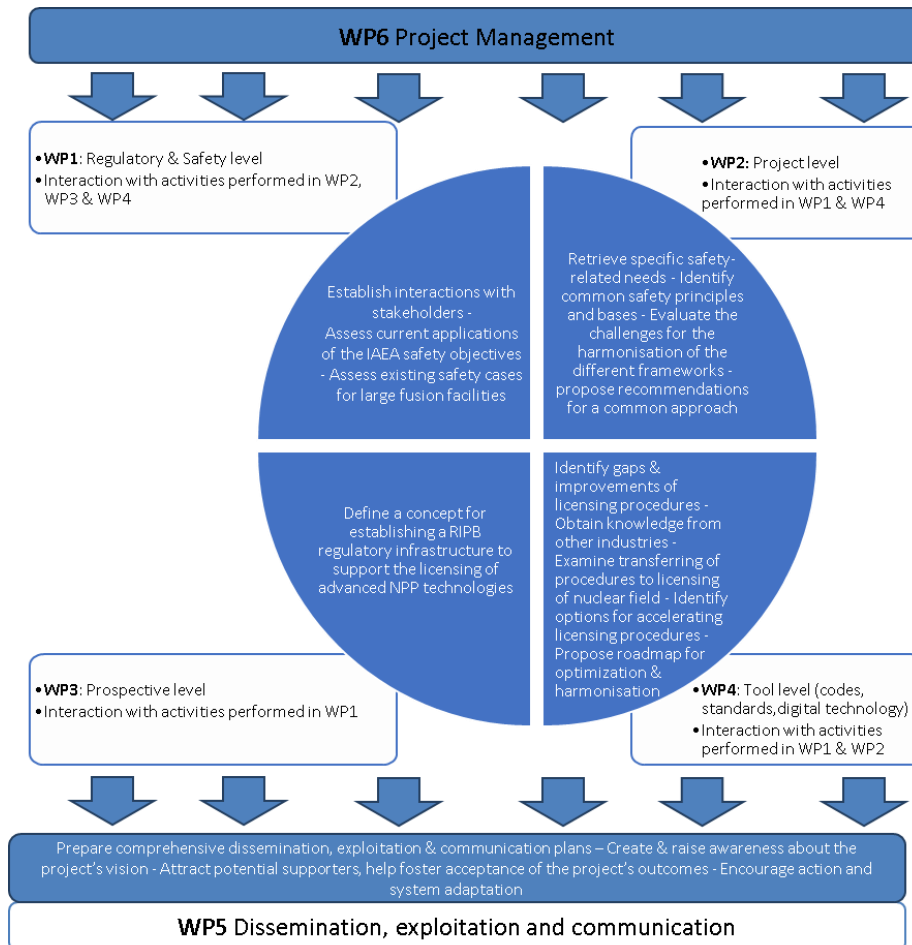
- Taking as a basis the IAEA fundamental safety objective, the HARMONISE project has set five Objectives:
 - **Objective 1:** *To analyse preliminary safety assessments of innovative fission and fusion installations*
 - **Objective 2:** *To peruse the licensing needs for innovative nuclear installations*
 - **Objective 3:** *To examine risk-informed, performance-based (RIPB) approaches in licensing reviews and regulatory decision-making*
 - **Objective 4:** *To delimit harmonisation and standardisation on component assessments, methodologies, codes and standards*
 - **Objective 5:** *To learn from earlier experience in harmonisation efforts*

Project HARMONISE – WBS

Work is organised in 6 WPs:

- **WP1** – interaction with stakeholders
- **WP2** – review of LFR ALFRED and fusion DEMO licensing issues
- **WP3** – risk-informed, performance-based approach in licensing
- **WP4** – harmonisation and standardisation on component assessments, methodologies, codes and standards

as well as result dissemination, exploitation and communication along with project management





Project HARMONISE – Activities

- Major HARMONISE activities include contacting all stakeholders, collecting their perspectives, identifying a common approach and recommending approaches on how the licensing of innovative NPPs and FPPs could be simplified
- Identifying the licensing needs for innovative technologies incorporated in future fission and fusion reactors requires an exhaustive analysis to determine whether, or not, current codes and standards address these needs
- “Licensing exercises” will be performed for the Gen-IV LFR ALFRED and fusion power plant DEMO to identify the bottlenecks and suggest ways for improving the licensing process
- The implementation of a Risk-Informed Performance-Based approach in licensing will be explored
- New technologies need to be detailed and grouped into different categories depending on the qualification and licensing process. To this end, HARMONISE will solicit the expertise of Standards Development Organisations responsible for code development
- The implementation of “numerical twins” in nuclear licensing will be studied

Summary

- HARMONISE will take advantage of the accomplishments achieved by current and earlier research and cooperation initiatives in standardisation and nuclear safety, in EURATOM and outside, considering also the outcomes of the EU stress tests
- An extensive consultation process will take place with ENSREG, WENRA as well as ETSO to benefit from the progress made in cooperative initiatives such as the ENSREG National Action Plans, the WENRA RHWG, the NEA CNRA and the WNA CORDEL Working Group
- HARMONISE findings will be disseminated and reported to Member States' nuclear safety regulators with the aim to facilitate their early involvement regarding safety verifications and licensing of future fission and fusion installations
- HARMONISE will suggest approaches but decisions will be later taken by the responsible decision making bodies