



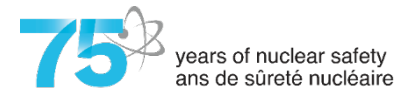
# CNSC Activities Related to Codes and Standards for Small Modular Reactors

IAEA Technical Meeting on Codes and Standards



May 10-13, 2022

[nuclearsafety.gc.ca](http://nuclearsafety.gc.ca)





# Canadian Nuclear Safety Commission

## OUR MANDATE



### REGULATE

the use of nuclear energy and materials to protect health, safety, and security and the environment



### IMPLEMENT

Canada's international commitments on the peaceful use of nuclear energy



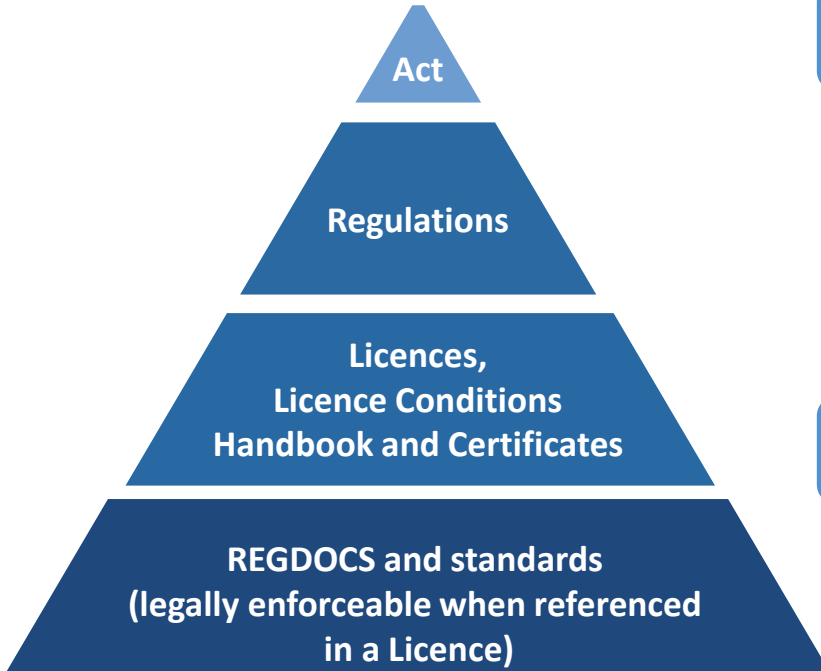
### DISSEMINATE

objective scientific, technical and regulatory information to the public

## 75 YEARS OF REGULATORY EXPERIENCE



# CNSC Regulatory Framework



## *CNSC Responsibilities*

- Set safety requirements, inform licensees, verify compliance
- Regulatory action based on level of risk
- Make independent, objective and risk-informed decisions
- Assure Parliament that licensee responsibilities are properly discharged

## *Licensee (Regulated Party) Responsibilities*

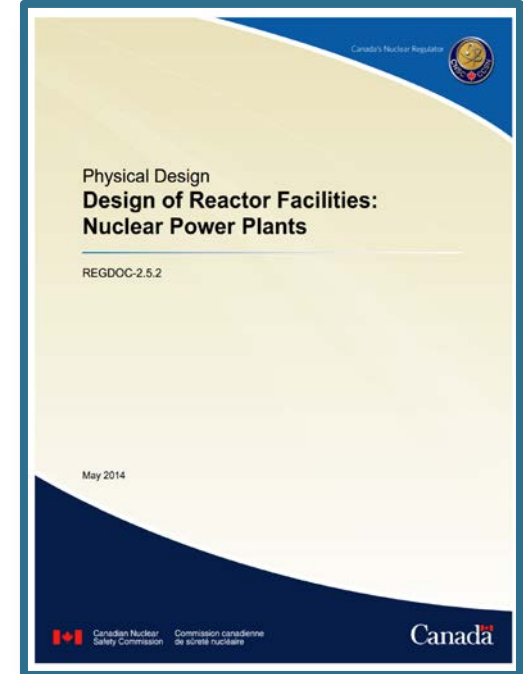
- **Primary responsibility for safety**
- Manage regulated activities in a manner that protects the health, safety, security and the environment, while respecting Canada's international obligations



# Reactor Facility Design Requirements and Guidance

## Section 5: Requirements for safety management in design:

- Design authority
- Design management
- Design control measures
- Proven engineering practices
- Operational experience and safety research
- Safety assessment
- Design Documentation





# Section 5.4 - Proven Engineering Practices

The design authority shall:

- identify the modern codes and standards that will be used for the plant design, and
- evaluate those codes and standards for applicability, adequacy, and sufficiency to the design.

Safety of new SSC designs, features or engineering practices must be demonstrated by:

- a combination of supporting research and development programs,
- examination of relevant experience from similar applications,
- adequate qualification and testing programs, and
- in-service monitoring to verify expected behaviour.



# Section 7.1 - Safety classification of SSCs

- The design authority shall classify SSCs using a consistent and clearly defined classification method. The SSCs shall then be designed, constructed, and maintained such that their quality and reliability is commensurate with this classification.
  
- The criterion for determining safety importance is based on:
  1. Safety function(s) to be performed
  2. Consequence(s) of failure
  3. Probability that the SSC will be called upon to perform the safety function
  4. The time following a PIE at which the SSC will be called upon to operate, and the expected duration of that operation



# International Collaboration

- CNSC cooperates and shares information with other countries and organizations on advanced reactor technologies
- Canadian Chair of IAEA Commission on Safety Standards
- Lead and participate in the IAEA advanced reactor initiatives, meetings, standards development, and peer reviews including the applicability of IAEA safety standards to SMRs
- Participate in OECD-NEA advanced reactor working groups
- Collaborating with the US NRC and UK ONR under memoranda of cooperation





# Technical reviews: US NRC MOC

## **Joint report on X-Energy's Reactor Pressure Vessel Construction Code Assessment White Paper – (Completed)\***

- Both the CNSC and US NRC reviewed the white paper provided by X-Energy
- Both organizations concluded that X-Energy's proposed approach for the design and fabrication of the Xe-100 RPV is viable with additional technical justification
- Acceptance Path forward was mutually developed

## **Comparison of the US Licensing Modernization Project (LMP) with Canadian regulatory approach – (Completed)\***

- Many more commonalities in regulatory frameworks of the CNSC and NRC than differences
- Overall licensing approaches include similar safety objectives, fundamental safety functions, and topical areas
- Common ground in safety case assessment reviews and acceptance criteria that can be used as a foundation, so that technical reviews performed by one regulator may be leveraged by the other

\* Completed joint reviews are available at the CNSC's external website





# Technical reviews: US NRC MOU

## **Terrestrial Energy postulated initiating events selection and methodology**

- Requested by Terrestrial to obtain regulatory feedback from both organizations
- Both regulators concluded that the methodology proposed appears to be sound
- Final report is expected in Q2 of 2022

## **Joint Review of the GE Hitachi containment evaluation methodology**

- Jointly assessing a method for predicting the conditions inside the containment vessel following a loss-of-coolant accident (LOCA) in a boiling water reactor
- Involved staff exchange between both regulators and collaborating on an audit
- Final report expected in Q2 of 2022

## **CNSC/NRC Joint tristructural isotropic (TRISO) fuel assessment project**

- Assesses TRISO fuel against the goals provided in the NEA fuel qualification framework and NUREG-2246
- Considers the regulatory basis for reactor fuel qualification in Canada and the United States
- Work remains on-going



# Technical reviews: US NRC MOU

## **New Joint Review Project – Classification of SSCs and assignment of engineering design rules**

The objective of this MOC project is to review the safety classification process for structures, systems, and components (SSCs) of each organization:

- Identify key similarities and differences in the safety significance determination process, the scope of SSCs subject to the process, and the process outcomes
- Identify key similarities and differences in the engineering design rules and specifications applied to each safety class and how this impacts the outcomes
- Review how each organization applies existing codes and standards and interacts with Standards Development Organizations to verify appropriate codes and standards are being developed, applied, and endorsed
- Final report expected in Q4 of this year



# International Collaboration: UK ONR

## Memorandum of Cooperation (MoC) between UK ONR and CNSC

- Signed October 2020 to enhance bilateral cooperation in the reviews of small modular reactors
- Strengthening existing relationship, increasing regulatory effectiveness and supporting innovation
- Development of shared advanced reactor and SMR technical review approaches
- Collaboration on pre-application activities to ensure mutual preparedness to efficiently review SMR designs
- Collaboration on research, training, and in the development of regulatory approaches to address unique and novel technical safety considerations



# CSA Small Reactor Task Force

- CSA Group is actively working with sector stakeholders, including Natural Resources Canada, CNSC, utilities, and technology vendors, to identify and address SMR standards-related needs.
- SMR priority areas have been identified and include areas such as pressure boundary, steel-concrete composite, functional containment, in-service and periodic inspection and embedded or deeply embedded structures.
- Recently, [Supplement No.1 to CSA N293-12, Fire Protection for Nuclear Power Plants](#) was published to provide direction for application and adaptation of fire protection requirements to SMRs.
- Other standards currently under evaluation include:
  - CSA N285.0-17, General requirements for pressure-retaining systems and components in CANDU nuclear power plants
  - CSA N287, suite of standards for concrete containment structures for nuclear power plants
  - CSA N290.9:19, Reliability and maintenance programs for nuclear power plants
  - CSA N1600:21, General requirements for nuclear emergency management programs
- Establishing a new Harmonization Task Force to review and develop an approach to assess, and potentially act on, needs/opportunities for new or enhanced standards harmonization

[Standards for small modular reactors \(csagroup.org\)](http://csagroup.org)



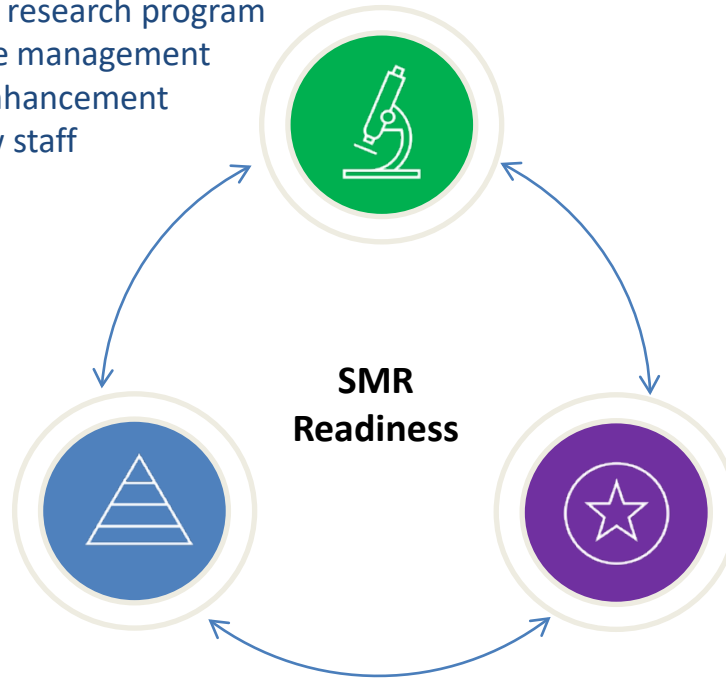
# Readiness Activities 2022/2023

## Ramping Up Capabilities

- Expanding research program
- Knowledge management process enhancement
- Hiring new staff

## Regulatory Refinement

- Review of CNSC Regulatory Framework
- IAEA projects for advanced technologies
- Process to leverage other regulatory reviews
- US NRC and UK ONR MOC



## First of A Kind (FOAK)

- Addressing novel means of containment
- Addressing novel means of shutdown
- Optimization of CNSC internal management systems
- Training and capability development
- International collaboration



# Conclusion

## CNSC is:

- Striving to be an effective, efficient, modern and agile regulator
- Continuously working towards regulatory optimization
- Setting the regulatory precedent in reviewing the license application of the first commercial SMR to be deployed in a G7 nation
- Leading and supporting a fora of international initiatives aimed at international regulatory harmonization
- Looking forward to further regulatory collaboration efforts on SMRs

# QUESTIONS?



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