CNSC’s Regulatory Approach to Small Modular Reactors and Other Advanced Technologies – Presentation to UK Nuclear Graduates

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Outline

• Background
• National Highlights and Challenges
• Pre-Licensing Engagement
• Regulatory Framework Considerations
• Conclusions
Small Modular Reactors (SMRs)

- There are a wide range of technologies and power levels under consideration
- Many developers propose to use novel and integrated technological approaches for design, construction and operation
  - proposing alternative approaches to meeting requirements
  - extensive use of factory-built modules
**Technology Evolution**

Regulatory approach

- Objective-based with few prescriptive requirements
- More prescriptive
- More regulatory certainty
- New safety claims and no operational experience – return to objective-based?
National Highlights

• New Canada-wide roadmap for SMRs under development
• Canadian Nuclear Laboratories’ Request for Expression of Interest on SMR Strategy
• Established nuclear utilities
  – are interested in becoming SMR operators for companies seeking to deploy SMRs in Canada
  – have introduced a new forum to discuss SMR issues
Deployment-related challenges include:

- security by design
- unattended / remote operation
- transportable / relocatable cores
- extensive use of factory-constructed facility / reactor modules

Safety claims can be validated by supporting evidence and a “first-of-a-kind” facility
Design-Related Challenges

- New engineered safety features have limitations and uncertainties that must be understood and addressed
  - passive safety features require proof of concept
- In-service inspection for sealed components and fitness-for-service
- Lack of operational experience
- Understanding how safety margins are being established

Pre-licensing vendor design reviews allow some challenges to be addressed early
Pre-Licensing Engagement

- Stakeholders are encouraged to engage with the CNSC early
- Formal pre-licensing activities:
  - GD-385, *Pre-licensing Review of a Vendor’s Reactor Design*
  - *Determining Appropriate Licensing Strategies for Novel Nuclear Technologies*
A vendor design review:

- considers areas of design related to reactor safety, security and safeguards
- provides feedback on the vendor’s efforts to address Canadian requirements in their design and safety analysis
- provides early feedback on the use of new design features and approaches
- promotes early identification of key issues and fundamental barriers
- identifies research activities that will support the design review and future licensing

The Commission retains the final licensing decision
Currently Engaged Vendors

- Terrestrial Energy
- Ultra Safe Nuclear Corporation
- Advanced Reactor Concepts
- Moltex Energy
- SMR LLC (Holtec)
- NuScale Power
- Westinghouse eVinci
- LeadCold
- URENCO
- StarCore Nuclear

Cross section of core module – courtesy ARC Nuclear

IMSR-400 facility cross section – courtesy Terrestrial Energy

Moltex design – courtesy Moltex
## Determining Appropriate Licensing Strategies

### for Novel Nuclear Technologies

Ensures a systematic and consistent risk-informed approach

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<tr>
<th>Prepare for and establish a preliminary description of hazards</th>
<th>Conduct risk assessment and document proposed licensing strategy</th>
<th>Operations management decides on licensing strategy</th>
<th>Licensing strategy decision is communicated to the proponent</th>
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<td>Proposal is evaluated on potential hazards, complexity and novelty</td>
<td>Licensing strategy recommends most appropriate regulations, licence application guide, REGDOCs and scope/depth of licensing review for each safety and control area</td>
<td>Proponent is informed of licence application expectations</td>
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Regulatory Framework Considerations

- **Nuclear Safety and Control Act**, regulations and complete suite of regulatory documents ensure safety requirements in all aspects of design, construction, operation, etc.
  - based on 60 years of operating experience of both heavy and light water reactors
  - alternative approaches are allowed, provided safety objectives are met (being used successfully in vendor design reviews for advanced reactors)
Key SMR Regulatory Framework Activities

• SMR Discussion Paper (DIS-16-04)
  – written to inform and validate readiness activities
  – What We Heard Report
• Graded approach workshop
What Is a Graded Approach?

• A graded approach is used by regulators and proponents/licensees
  
• A graded approach is fundamentally good engineering judgment, supported by a framework of decision-making tools, and rules that rest upon an organization’s management system
  – documents the analyses supporting decision making

• Proponents need to demonstrate their proposal meets requirements

A graded approach is the way in which risk-informed decisions are made to arrive at a response that is proportional to the hazards
The CNSC committed to providing greater clarity on the application of a graded approach for SMRs. The workshop examined:

- the application of the graded approach in regulating SMRs
- feedback from participants on the material presented, with a focus on fundamental safety principles

A synopsis of the workshop will be published shortly.
Conclusions

- Our regulatory framework is robust, flexible and based on decades of operating experience and can be applied to advanced reactor technologies.

- Our regulatory framework and internal processes are risk-informed and can be used to license advanced reactors; they allow for proposing alternatives and the use of grading.

- Vendor design reviews are a key element in establishing readiness.

The CNSC is ready and able to license SMRs
For More Information on the CNSC...

visit our website!
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Thank You!

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