Ready to Regulate Small Reactors in Canada

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Presentation Outline

• Overview of the Canadian Nuclear Safety Commission
• The Emerging Demand for More Reliable Sources of Energy in Remote Locations
• Canada’s Long History with Small Reactors
• Reactors are Regulated in a Continuum of Requirements
• Overview of Licensing Process
• Codes and Standards
• How to Ensure Efficient Licensing Timelines
• Small Modular Reactors Currently Being Reviewed By the CNSC
• Conclusion
• Established in May 2000, under the *Nuclear Safety and Control Act*.

• **Mandate:**

  Regulate nuclear activities to protect the **health, safety and security** of Canadians and the **environment**, and to implement Canada's **international commitments** on the peaceful use of nuclear energy.

**Canada’s Independent Nuclear Regulator – 66 Years of Experience**
CNSC Regulates All Nuclear-Related Facilities and Activities

- Uranium mines and mills
- Uranium fuel fabricators and processing
- Nuclear power plants
- Waste management facilities
- Nuclear substance processing
- Industrial and medical applications
- Nuclear research and educational uses
- Import/export control

...From Cradle to Grave
Independent Commission

- Quasi-judicial administrative tribunal
- Commission members are independent
- Commission hearings are public and Webcast
- Supported by a Secretariat and independent legal services

Transparent, science-based decision making
Emerging Demand for More Reliable Sources of Energy in Remote Locations

- Resource Projects
  - Many new projects are far from natural gas pipelines or regional electrical grids.

- Supply of reliable diesel and propane (good quality at decent price) is slowly drying up.

- Northern delivery routes becoming unreliable.

- Department of National Defence
  - Northern missions are vulnerable to fuel supply failures.

- In the North, “green” technologies are too small and unreliable.

Existing energy supplies have worked well so far but are becoming unreliable.
Canada’s Long History with Small Reactors

Lessons learned from all past small reactor projects have informed our regulatory requirements and will continue to do so!
Reactors are Regulated in a Continuum of Requirements

- CANDU Energy EC6
  - 720 MWe per unit
  - typical plant = 2 units

- NuScale Power
  - 45 MWe per module
  - typical plant = 6-12 units

- B&W mPower
  - 180 MWe per module
  - typical plant = 2 units

- Pool Reactor
  - 100 kWth

- **NEW**
  - "Nuclear Batteries" for remote power & heat applications
    - 2 to 25 MWe

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Commission canadienne de sûreté nucléaire
### Threshold between Small Reactor and Nuclear Power Plant?

<table>
<thead>
<tr>
<th>Small Reactors (approximately &lt; 200 MW thermal)</th>
<th>Nuclear Power Plant (approximately &gt; 200 MW thermal)</th>
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<tr>
<td>RD – 367: Design of Small Reactors</td>
<td>RD – 337: Design of New Nuclear Power Plants</td>
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**Why?**
- Not a hard threshold.
- Below approx. 200 MW thermal, the core inventory may present lower risks to the public, allowing for more flexibility in how safety can be demonstrated.
  - Example: Above 200 MW thermal use of containment as opposed to confinement will be necessary to demonstrate safety.

**Very Important Point:**
Flexibility in approach ≠ “relaxing” safety requirements!
Rigorous Licensing Process

- **CNSC Oversight**
  - Licence Conditions
  - Compliance Assurance:
    - Inspections, Enforcement, Safety Culture

- **Licensee Obligations**
  - Health and Safety
  - Environmental Protection
  - Security
  - Monitoring
  - Reporting
  - Financial Guarantee
  - Proactive Disclosures

... One process regardless of reactor size
Canadian Licensing Process Provides Flexibility

- Licence applications can be reviewed in series or in parallel depending on the needs and readiness of the licensee.

- Examples:

1. Simple Series process with deferred decision on Licence to Prepare Site (EA used as planning tool only).

   - EA
   - Review Licence to Prepare Site (LTPS)
   - Review Licence to Construct
   - Review Licence to Operate

   LTPS ‘trigger’ to initiate EA process
2. Parallel EA and Licence to Prepare Site with deferred construction licence.

3. Parallel EA and LTPS- First of a Kind.
Codes and Standards

• Canadian Standards Association (CSA) and American Society of Mechanical Engineers (ASME):
  – Example: The CSA N285 series regulates the pressure retaining components design

• Applications should include references to applicable codes and standards.

• Products from outside Canada - the vendor is required to identify gaps between their adopted standard and those used in Canada.

The licensing process is independent of reactor size and can be adapted to any licensing scenario.
Ensuring Efficient Licensing Timelines

• We suggest vendors use the Pre-licensing Vendor Design Review Process:
  – Optional service
  – Provides early identification of resolution of potential regulatory or technical issues in the design process.

• A vendor design review evaluates if:
  – the vendor understands Canadian regulatory requirements and CNSC expectations;
  – the design complies with CNSC regulatory documents RD-337, Design of New Nuclear Power Plants or RD-367, Design of Small Reactors and related regulatory documents and standards; and
  – a resolution path exists for any design issues identified in the review.
Ensuring Efficient Licensing Timelines

• Enter the licensing process with high quality, complete and timely submittals.
• The applicant is strongly encouraged to engage the public and aboriginal groups early and transparently.
• Understand the regulatory landscape.
Small Modular Reactors Currently Being Reviewed by the CNSC

- **B&W mPower Reactor**
  - 180 MW (electric) per unit in a 1-2 module station

- **NuScale Power System Reactor**
  - 45 MW (electric) per unit in a 6-12 module station
Conclusion

• Many vendors have already been in contact with the CNSC.
• There is an emerging demand for reliable sources of energy in remote locations.
• A strong understanding in safety requirements for small modular reactors.
• Flexible licensing process.
• Capable of ensuring efficient licensing timelines.
We Will Never Compromise Safety

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Questions?