REGULATING INNOVATIVE NUCLEAR TECHNOLOGIES

Mr. Ramzi Jammal
Executive Vice-President and Chief Regulatory Operations Officer
2018 Pacific Basin Nuclear Conference
Sep 30 - Oct 04, 2018
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

OVER 70 YEARS OF REGULATORY EXPERIENCE
THE CNSC REGULATES ALL NUCLEAR FACILITIES AND ACTIVITIES IN CANADA

Uranium mines and mills
Uranium fuel fabrication and processing
Nuclear power plants
Nuclear substance processing
Industrial and medical applications
Nuclear research and educational activities
Transportation of nuclear substances
Nuclear security and safeguards
Import and export controls
Waste management facilities
CNSC STAFF LOCATED ACROSS CANADA

Headquarters (HQ) in Ottawa
Four site offices at power plants
One site office at Chalk River
Four regional offices

Fiscal year 2017–18

• Human resources: 857 full-time equivalents
• Financial resources: $148 million
  (~70% cost recovery; ~30% appropriation)
• Licensees: 1,700
• Licences: 2,500
INDEPENDENT COMMISSION

TRANSPARENT, SCIENCE-BASED DECISION MAKING

- Quasi-judicial administrative tribunal
- Agent of the Crown (duty to consult)
- Reports to Parliament through Minister of Natural Resources
- Commission members are independent and part-time
- Commission hearings are public and Webcast
- Staff presentations in public
- Decisions are reviewable by Federal Court
Ms. Rumina Velshi appointed President and Chief Executive Officer for a five-year term effective August 22, 2018.

Replaces Dr. Michael Binder, who has served as President and CEO since January 2008.

MS. RUMINA VELSHI
President and Chief Executive Officer
Canadian Nuclear Safety Commission
REGULATORY APPROACH
Section 24(4) of the *Nuclear Safety and Control Act* (NSCA)

No licence shall be issued, renewed, amended or replaced... unless, in the opinion of the Commission, the applicant...

(a) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and

(b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.
REGULATORY PHILOSOPHY

LICENSEES RESPONSIBLE FOR
the protection of health, safety, security and
the environment, and respecting Canada’s
international commitments

CNСSC RESPONSIBLE FOR
regulating licensees, and assessing whether
licensees are compliant with the NSCA,
regulations, and international obligations
ADAPTABLE TO AN EVOLVING INDUSTRY AND ADVANCEMENTS IN POLICY, SCIENCE AND ENGINEERING

Act

Regulations

Licences, licence conditions handbook and certificates

Regulatory Documents
The CNSC establishes safety requirements
- applicant proposes how to meet the requirements
- CNSC regulatory philosophy allows the proponent to meet the objective of a regulation without compromising safety

Graded approach
- safety commensurate with risk
- Safety case will be the basis for the licensed activity

Uses a mix of management, performance-based and prescriptive approaches
TECHNOLOGY EVOLUTION

Early prototype reactors
(NPD, Douglas Point)

Commercial power reactors
(Pickering, Darlington, Bruce, Point Lepreau, Gentilly-2)

Advanced water + evolutionary designs
(EC-6, ACR 1000)

Revolutionary designs
(molten salt, liquid metal, high temperature gas)

Technology evolution (Generations)

Objective based with few prescriptive requirements

More prescriptive. More regulatory certainty.

New safety claims and no operational experience – return to objective based?

Regulatory framework

The CNSC is currently reviewing various small modular reactor (SMR) designs, several of which feature:

- non-traditional fuel
- operation in the fast neutron spectrum
- gas, light water, or liquid metal cooling
- longer fuel cycles
- non-traditional deployment models
- modular construction
- transportable reactors
- security by design
Innovative types of fuels are being proposed
- liquid fuels
- metallic fuels
- molten salt fuel

Non-traditional fuel cycles
- proposed refuelling times being extended
- some designs have no provisions for refuelling
- gaps in fuel qualification
  - Some fuels have not been fully tested at the proposed power/radiation levels and time periods outlined in new designs
- burner and breeder reactors

Long-term fuel storage
- new fuels could challenge the designs of long term fuel storage facilities
• Strong negative coefficients of reactivity with temperature
• Reducing the likelihood of the occurrence or progression of accident scenarios
  – e.g., better fission product retention in fuel
  – designs with fewer accident paths
• Inherent safety features
• Self-regulation
• Passive shutdown for design-basis accidents
• Fission product retention in fuel matrix
  – TRISO fuel
  – molten salt - fission product retention in metallic coolant
• Automatic passive heat removal in all modes of operation
• New generation of control systems
  – More control being given to automated systems

• Operating models may be different:
  – Remote monitoring
  – Reduced staffing
  – Glass control rooms
  – Multi-site monitoring
Stay flexible to technological developments
• allow testing and development with appropriate safety margins

Be responsive to evolving expectations and trends
• continuous effort to maintain and modernize regulatory framework
ELEMENTS OF REGULATORY READINESS STRATEGY

REGULATORY FRAMEWORK
*Nuclear Safety and Control Act (NSCA)*, regulations, licences, regulatory documents

SMR STEERING COMMITTEE (SMRSC)

RISK-INFORMED PROCESSES
Managed processes covering:
- Strategic decision making
- Pre-licensing and licensing compliance
- Continuous improvement

CAPABLE AND AGILE STAFF
- Capacity/capability
- Training
- International cooperation

ESTABLISHED PROCESSES FOR ENABLING DECISIONS FOR REGULATION

Canadian Nuclear Safety Commission - nuclearsafety.gc.ca
Pre-licensing vendor design review (VDR) process

- Assessment of a nuclear power plant design based on a vendor’s reactor technology
- Objective is to verify the acceptability of a nuclear power plant design with respect to Canadian nuclear regulatory requirements, codes and standards (it is not a certification process)

Determining the licensing strategy for novel applications

- Process to inform applicants of expectations regarding information to be submitted in support of the licensing process

10 VENDORS ARE CURRENTLY ENGAGED WITH THE CNSC VIA THE VDR PROCESS
INTERNATIONAL COLLABORATION ON SMRS

THE CNSC AND GOVERNMENT OF CANADA ARE COOPERATING AND SHARING INFORMATION WITH A NUMBER OF COUNTRIES ON SMR TECHNOLOGIES

• Working closely with the International Atomic Energy Agency and the Nuclear Energy Agency on sharing best practices in the regulation of SMRs
• Working bilaterally with a number of countries (e.g., United States, United Kingdom)
• Leveraging the experience of others – CNSC technical review can be informed by other regulators’ assessments
New technologies

New Opportunities
NEW TECHNOLOGIES

SMART GLASSES

Nuclear industry experimenting with smart glasses that display real time radiation levels and provide step by step guidance of work tasks.

3D PRINTING

Westinghouse chose binder jetting (additive manufacturing) to produce its passive hydrogen igniter prototypes for testing. The parts could not be produced with the same performance benefits using traditional manufacturing.
NEW TECHNOLOGIES

WIRELESS SENSORS

Comanche Peak Nuclear Power Plant is the site of a pilot program using a wireless, automated, remote diagnostic system.

DRONES

Ontario Power Generation (OPG) first used unmanned aerial vehicles to inspect Darlington’s vacuum building.
NEW TECHNOLOGIES

AUTONOMOUS VEHICLES

Rio Tinto has at least 54 autonomous trucks currently operating handling various transportation-related tasks.

WIRELESS BATTERY MONITORING

- Voltage monitoring
- Current monitoring
- Interval and on-demand polling
- Alert messages
NEW TECHNOLOGIES

NFC RELAYs

Allows for comprehensive in-field monitoring of important parameters (voltage, frequency, vibration, radiation, flow, etc.)

VIRTUAL REALITY

- Training
- Remote Assistance
- Visualization of objects on demand
CURRENT REGULATORY FRAMEWORK IN CANADA

- is suitable for licensing projects using advanced technologies as it provides flexibility to adapt to new types of reactors and is backed by solid management system processes and capable workforce
- is ready to address disruptive technologies
- provides flexibility for licensees to propose alternative means of meeting legal requirements, where appropriate
Connect With Us
Join the conversation

nuclearsafety.gc.ca