Modernization of the Canadian regulatory framework for radioactive waste management and decommissioning

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Canadian Nuclear Safety Commission

nuclearsafety.gc.ca
Canadian Nuclear Safety Commission (CNSC)

- Nuclear regulation falls under federal jurisdiction
- CNSC is Canada’s single nuclear regulator
- Regulate the use of nuclear energy and materials
- Implement Canada’s international commitments
- Disseminate information to the public
- Composed of 800 staff and the Commission

Over 70 years of nuclear safety
CNSC Regulates All Nuclear-Related Facilities and Activities...

- Uranium mines and mills
- Uranium fuel fabrication and processing
- Nuclear power plants
- Nuclear substance processing
- Industrial and medical applications
- Nuclear research and education
- Transport
- Export/import control
- Security and safeguards
- Waste management facilities

...from cradle to grave
CNSC Regulatory Framework

Enabling legislation

Requirements “must meet”

Requirements and guidance

Regulations are performance based with prescriptive requirements

Requirements language: “shall”, “must”

Guidance language: “should”, “may”, “can”, or passive voice in the case of disseminating info for context in the document

Regulatory philosophy is risk-informed
Radioactive Waste Policy Framework

- **The Federal Government** will ensure that radioactive waste management is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner.

- **The Federal Government** has the responsibility to develop policy, to regulate and to oversee owners to ensure that they comply with legal requirements and meet their funding and operational responsibilities in accordance with approved disposal plans.

- **The waste owners** are responsible for the funding, organization and operation of the waste management facilities required for their wastes.

  *Natural Resources Canada (NRCAN) is responsible for setting Canada’s Radioactive Waste Policy*
Legislative Instruments for the Management of Radioactive Waste

• Federal legislation used to regulate and oversee the nuclear industry, including the management of radioactive waste, comprises:
  – *Nuclear Safety and Control Act*
  – *Nuclear Fuel Waste Act*
  – *Nuclear Liability and Compensation Act*
  – *Nuclear Energy Act*

• Management of radioactive waste is also subject to:
  – *Canadian Environmental Assessment Act (CEAA 2012)*
  – *Canadian Environmental Protection Act*
  – *Fisheries Act*

* the Impact Assessment Act will replace the CEAA 2012
CNSC’s regulatory framework on waste management and decommissioning consists of:

- **Nuclear Safety and Control Act**
- Waste and decommissioning addressed in multiple regulations
  - Examples: *General Nuclear Safety and Control Regulations*, *Class I Nuclear Facilities Regulations*, *Uranium Mines and Mills Regulations*, *Nuclear Substances and Radiation Devices Regulations*
- Licence conditions to implement and maintain waste management programs
- The safety and control area (SCA) of waste management
  - waste characterization, waste minimization, waste management practices, decommissioning plans
- Regulatory documents on waste management and decommissioning
How We Regulate Waste Management and Decommissioning (2)

• Regulatory documents on waste management and decommissioning
  – REGDOC-2.11 Framework for Radioactive Waste Management and Decommissioning in Canada
  – G-219, Decommissioning Planning for Licensed Activities
  – G-206, Financial Guarantees for the Decommissioning of Licensed Activities
How We Regulate Waste Management and Decommissioning (3)

• The CSA Group is a not-for-profit organization composed of representatives from the government, industry and consumer groups

• Radioactive waste management and decommissioning CSA standards:
  – N292.0-19, General principles for the management of radioactive waste and irradiated fuel
  – N292.1-16, Wet storage of irradiated fuel and other radioactive materials
  – N292.2-13, Interim dry storage of irradiated fuel
  – N292.3-14, Management of low- and intermediate-level radioactive waste
  – N292.5-11, Guidelines for the exemption or clearance from regulatory control of materials that contain or potentially contain, nuclear substances
  – N292.6-18, Long-term management of radioactive waste and irradiated fuel
  – N294-09 (re-affirmed 2014), Decommissioning of facilities containing nuclear substances

• Under development:
  – CSA N292.7, Disposal of radioactive waste and irradiated Fuel (proposed title)
# Modernization of CNSC’s Waste and Decommissioning Framework

## 1.0 Regulated Facilities and Activities
- **1.1 Reactor Facilities**
  - REGDOC-1.1.4, Licence Application Guide: Licence to Decommission Reactor Facilities
- **1.2 Class IB Facilities**
  - REGDOC-1.2.1, Guidance on Deep Geological Repository Site Characterization
- **1.3 Uranium Mines and Mills**
- **1.4 Class II Facilities**
- **1.5 Certification of Prescribed Equipment**
- **1.6 Nuclear Substances and Radiation Devices**

## 2.0 Safety and Control Areas
- **2.1 Management System**
- **2.2 Human Performance Management**
- **2.3 Operating Performance**
- **2.4 Safety Analysis**
- **2.5 Physical Design**
- **2.6 Fitness for Service**
- **2.7 Radiation Protection**
- **2.8 Conventional Health and Safety**
- **2.9 Environmental Protection**
- **2.10 Emergency Management and Fire Protection**

## 2.11 Waste Management
- REGDOC-2.11: Framework for Radioactive Waste Management and Decommissioning in Canada
- REGDOC-2.11.1 Volume 1: Management of Radioactive Waste
- REGDOC-2.11.1, Volume III: Safety Case for Long-term Radioactive Waste Management (revision to 2.11.1 vIII)
- REGDOC-2.11.2, Decommissioning of Facilities (revision to G-219)
- **2.12 Security**
- **2.13 Safeguards and Non-Proliferation**
- **2.14 Packaging and Transport**

## 3.0 Other Regulatory Areas
- **3.1 Reporting Requirements**
- **3.2 Public & Aboriginal Engagement**
- **3.3 Financial Guarantees**
  - REGDOC-3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities (revision to G-206)
- **3.4 Commission Proceedings**
- **3.5 CNSC processes and practices**
  - REGDOC-3.5.1, Licensing Process for Class I Nuclear Facilities and Uranium Mines and Mills
Objectives of Revised Waste and Decommissioning Framework

- Consolidate, clarify and update waste management requirements and definitions
- Clarify the types of waste management licences and clarify licence application requirements
- Clarify and update decommissioning requirements
- Improve clarity of expectations for financial guarantees for decommissioning
Discussion Paper and Consultation Activities on Waste Management and Decommissioning REGDOCs

• DIS-16-03, *Radioactive Waste Management and Decommissioning*
  – used to solicit feedback on the proposal to update and clarify the CNSC’s regulatory framework as it relates to waste and decommissioning

• The CNSC published DIS-16-03 discussion paper for a 120-day public comment period on May 13, 2016

• Comments were received from 18 organizations and individuals, and were posted on the CNSC website for feedback between October 13 and November 2, 2016

• The CNSC published the *What We Heard Report* on December 11, 2017

• The draft REGDOCs took into account feedback received, and will be published for public consultation
<table>
<thead>
<tr>
<th>REGDOC #</th>
<th>Title</th>
<th>Safety Standards Referenced or Influenced By</th>
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<tr>
<td>1.2.1</td>
<td>Guidance on Deep Geological Repository Site Characterization</td>
<td>SSR-5, SSG-14</td>
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<td>1.1.4</td>
<td>Licence Application Guide: Licence to Decommission Reactor Facilities</td>
<td>GSR-6</td>
</tr>
<tr>
<td>2.11</td>
<td>Waste Management: Oversight of Canada’s Framework for Radioactive Waste Management</td>
<td>GSR-5, GSG-1, SSR-5, GSR-6</td>
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<td>2.11.1</td>
<td>Volume II Waste Management: Management of Uranium Mine Waste Rock and Mill Tailings</td>
<td>WS-G-1.2, NF-T-1.2</td>
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<td>2.11.2</td>
<td>Decommissioning Planning</td>
<td>GSR-6, GSR-4, WS.G-2.4, WS-G-2.1, WS-G-5.2</td>
</tr>
<tr>
<td>3.3.1</td>
<td>Financial Guarantee for Decommissioning of Nuclear Facilities and Termination of Licensed Activities</td>
<td>GSR-6</td>
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REGDOC-2.11, *Canada’s Framework for Radioactive Waste Management*, outlines six principles that govern the CNSC’s regulation of radioactive waste:

- The generation of radioactive waste is minimized
- The management of radioactive waste is commensurate with its hazard
- The timeframe for the assessment of future impacts encompasses the maximum impact
- Predicted impacts are no greater than those allowable at the time of the regulatory decision
- Mitigation measures are developed, funded and implemented as soon as reasonably practicable
- Transborder effects are not greater than the effects experienced in Canada

- Sets out requirements and guidance for all steps involved in the management of radioactive waste
- Clarifies waste management programs requirements

For examples, all licensees who manage radioactive waste must:

- Account for interdependencies for all steps the management of radioactive waste
- Establish and implement procedures and instructions that address all waste streams
- Consider waste hierarchy
- Apply defence-in-depth – never rely on a single system or process for protection
- Integrate programs as part of the organization’s safety culture
- Use operational experience, lessons learned and advances in science and technology in an effort to continuously improve the safety of the waste management facility or activity
Classes of radioactive waste are organized according to the containment and isolation required to ensure safety in the short- and long-term and take into consideration the risk to the health and safety of humans and the environment.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Characteristics</th>
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</thead>
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<tr>
<td>Uranium mine and mill waste</td>
<td>Includes tailings and waste rock generated by the mining and milling of uranium ore</td>
</tr>
</tbody>
</table>
| Low-level radioactive waste          | Is more radioactive than clearance levels and exemption quantities. LLW includes the following sub-classes:  
  • Very-low-level waste  
  • Very-short-lived low-level waste |
| Intermediate-level radioactive waste | Contains enough long-lived radionuclides to require isolation and containment. Examples include filters, resins and used reactor components |
| High-level radioactive waste         | Is primarily used nuclear fuel, along with small amounts of waste that generate significant heat |

*Classification system must be based on the site specific safety case*
Uranium Mines And Mills, Decommissioned Mines And Remediation Sites in Canada
Radioactive Waste Management Facilities In Canada

• Provide requirements and guidance to licensees and applicants for developing a safety case and supporting safety assessment for the long-term management of radioactive waste

• Specifically, the guide addresses:
  – General requirements for the safety case
  – Components of the safety case
    • Safety case context
    • Safety strategy
    • Waste management system description
    • Safety assessment, including the long-term safety analysis
Proposed REGDOC 2.11.2, Decommissioning (1)

- Establishes requirements and guidance for decommissioning activities from the planning for decommissioning to the completion of decommissioning
- The CNSC requires that planning for decommissioning take place throughout the lifecycle of a nuclear facility or for the duration of a licensed activity
Proposed REGDOC 2.11.2, Decommissioning (2)

<table>
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<th>Facility lifecycle</th>
<th>Decommissioning plans</th>
<th>Regulatory control</th>
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<td>Preparation for decommissioning</td>
<td>Execution of decommissioning</td>
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<td>Siting*</td>
<td>Operation</td>
<td>Decommissioning</td>
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<tr>
<td>Design, construction and commissioning**</td>
<td>Permanent shutdown</td>
<td>Storage with surveillance (if implemented)</td>
</tr>
<tr>
<td>Transition from operations to decommissioning</td>
<td></td>
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<tr>
<td>Decommissioning plans</td>
<td>PDP</td>
<td>DDP</td>
</tr>
<tr>
<td>Prepare and submit PDP</td>
<td>Prepare and submit permanent shutdown plan, stabilization activity plan, DDP and storage with surveillance plan***</td>
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<tr>
<td>Other regulatory control</td>
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<tr>
<td>CNSC licence</td>
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</tbody>
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* Class I facilities only
** Class I and II facilities only
*** If applicable

Release from CNSC regulatory control ***
Licensees must select a decommissioning strategy based on various considerations (e.g. public and Indigenous engagement, potential work and public dose, potential environmental impacts)

- Decommissioning strategies include:
  - Immediate (prompt) decommissioning
  - Deferred decommissioning
  - In-situ decommissioning

- In such a case where the end-state for in-situ decommissioning results in a waste disposal site, an applicant must demonstrate safety via a science based safety case of a disposal facility
Financial guarantees are:

- required as part of licence application and approved by the Commission
- payable to the CNSC
- separate from licensee’s assets and can be accessed by the CNSC if required
- required throughout the entire lifecycle of the facility
- required to be updated and reviewed every five years or sooner
- subject to annual reporting on status of FG

Cover all decommissioning, dismantling, disposal of waste and any long-term monitoring
Nuclear Facilities Carrying Out Decommissioning Activities in Canada
Public Engagement Is a Priority

- Public hearing process
- Participant Funding Program
- Indigenous and public consultations
- Extensive outreach and engagement program
- Requirement for licensees to communicate

CNSC recognizes, supports and encourages the involvement of the public and Indigenous peoples in all CNSC processes.

Building trust is a continuous process
Communication Tools: Infographics

What is radioactive waste?
Radioactive waste is any liquid, gas or solid that contains a radioactive nuclear substance and for which there is no foreseeable use.

There are four classes of radioactive waste in Canada.
Classes of radioactive waste are organized according to the containment and isolation required to ensure safety in the short and long term and take into consideration the risks to the health and safety of humans and the environment.

1. Uranium mine and mill waste
   - Includes tailings and mill tailings generated by milling and milling of ore.

2. Low-level radioactive waste
   - Is more radioactive than class A and B exempt material and
   - Is usually disposed of in a low-level disposal facility.

3. Intermediate-level radioactive waste
   - Contains enough long-lived radionuclides to require isolation and containment.

4. High-level radioactive waste
   - Typically used nuclear fuel, along with small amounts of waste that generate significant heat.

What does it come from?
- From mining and milling.
- Nuclear power plants, research reactors, test facilities, radionuclide manufacturer or users, uranium mining, and conversion, and nuclear fuel fabrication.

What does it look like?
- Tailings have the consistency of the sand and waste rock, which is often grey and broken up rock.

How is it stored in the interim?
- Tailings are stored in a pit or tailing containment facilities. Waste rock is stored in piles on the surface.

How long will it be radioactive?
- Because the decay of natural uranium is slow, it can take billions of years to reach the earth's normal background level of radiation.

Some short-lived waste can decay within hours or days, and be disposed of as regular waste. Longer-lived waste may need to be isolated for up to a few hundred years.

Radioactive Waste Characterization
Characterization is a determination of the physical, radiological, chemical and biological properties of radioactive waste.

Properties examined when characterizing nuclear waste:
- Origin
- Facility or activity that produced the waste

Criticality
Conditions under which the material can sustain a chain reaction.

Chemical properties
Compositional, solubility, compatibility of the material.

Physical properties
Size, weight and state of the material.

Biological properties
Biological hazard and organism absorption rate.

Radiological properties
Half-lives of radionuclides, dosage factors, surface contamination.

The licensees role
The licensees perform characterization activities at all stages of the radioactive waste, including generation, handling, processing, transportation, storage and long-term management. It is the licensees responsibility to conduct the waste activities in accordance with regulatory requirements.

The CNSCs role
The CNSC carefully reviews the applicants waste management process, including characterization, before providing a licence to any organization that participates in waste management activities.

CNSC inspectors perform regular inspections on all types of facilities and activities in Canada that generate or manage waste, and monitor the day-to-day work to ensure the safety of employees, the public, and the environment.
Summary

- Canada has a strong regulatory framework
- The framework provides for waste management decommissioning related activities
- Canada is progressing its waste management and decommissioning framework
- Engagement with stakeholders is critical
Thank You!