



Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Canada's Presentation to the 6th Review Meeting
Country Group # 8, 22 May 2018, Vienna

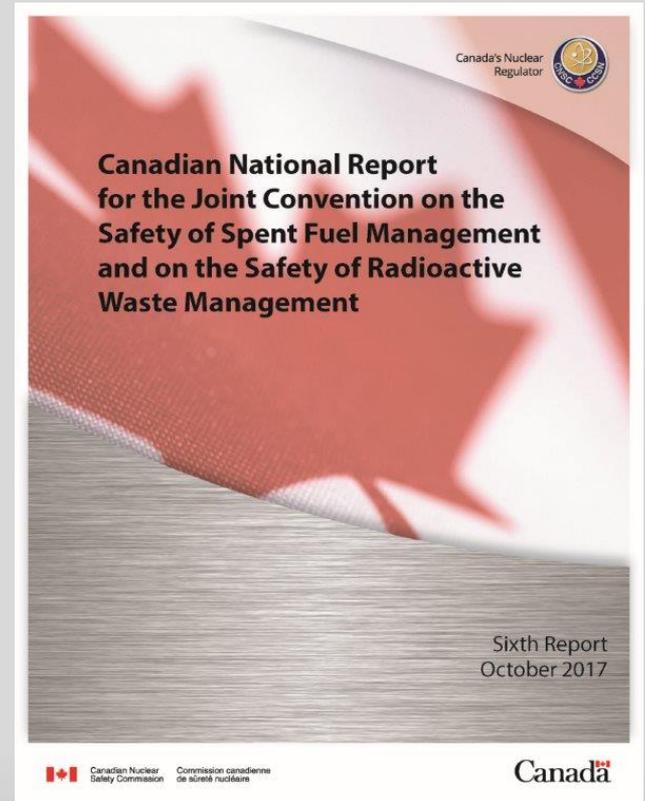
Canada 

Objectives of the Joint Convention

- 🍁 Achieve and maintain a high level of safety in spent fuel management and safety in radioactive waste management
- 🍁 Protect the public and environment from harmful effects of ionizing radiation during all stages of spent fuel and radioactive waste management
- 🍁 Prevent accidents and mitigate potential radiological consequences should they occur during any stage of spent fuel or radioactive waste management

Outline of Canada's Presentation

-  **Section 1**
Highlights of Canada's Report, and International Peer Reviews to Canada
-  **Section 2**
Canada's Legislative and Policy Framework
-  **Section 3**
Canadian Nuclear Safety Commission: Regulatory Framework and Initiatives Update
-  **Section 4**
Management of Spent Fuel and Radioactive Waste at CNL sites
-  **Section 5**
Long-term Management of Low- and Intermediate-Level Radioactive Waste from Nuclear Power Plants
-  **Section 6**
Long-term Management of Canada's Spent Fuel
-  **Section 7**
Responses to 5th Review Meeting, Questions on National Report, Planned Activities, Proposed Good Practices, Challenges, Conclusions, Recommendations and Overarching Issues
-  **Appendix A**
Matrix for Canada's 6th National Report



[Download Report](#)

Canada's Commitment to Safety

- 🍁 Comprehensive Legislative/Regulatory Framework
- 🍁 Independent, open and transparent regulator
- 🍁 Licensees are responsible for safety
- 🍁 Nuclear industry in Canada is committed to nuclear safety
- 🍁 Implement initiatives for the long-term management of radioactive waste

Canada's Guiding Principles for Nuclear Safety

- 🍁 Commitment to ongoing improvements
- 🍁 Clarity of requirements
- 🍁 Capacity for action
- 🍁 Effective communications
- 🍁 Healthy safety culture

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and on the Safety of Radioactive Waste Management

HIGHLIGHTS OF CANADA'S REPORT AND INTERNATIONAL PEER REVIEWS TO CANADA

Presented by the Canadian Nuclear Safety Commission

Government of Canada

Radioactive Waste Policy Framework (1996)

- ❖ **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

Highlights of Canada's Report Safety Record

Excellent safety record during reporting period

- 🍁 Licensees fulfilled their responsibilities for safety and their regulatory obligations
- 🍁 No radiation exposures exceeded the regulatory limits to workers, the public or the environment
- 🍁 No events occurred above International Nuclear and Radiological Event Scale (INES) 0

Highlights of Canada's Report **Safe Management of Radioactive Waste**

- ❖ Waste Management Programs required at all CNSC-licensed facilities
- ❖ Promote Reduce, Reuse, Recycle
- ❖ Plan for the complete life of the facility, including financial guarantees
- ❖ Regular open, extensive and transparent stakeholder engagement and opportunities for public participation throughout the life cycle

Highlights of Canada's Report Safety Enhancements

Continuous safety enhancements

-  Licence renewal and life extension processes drive improvements based on evaluations against:
 - Modern codes and standards
 - Operating experience (OPEX)
 - Research findings
 - Improved analytical methods
-  Annual reporting to the Commission on licensee regulatory performance
-  Implementation of long-term management solutions for legacy and historic waste

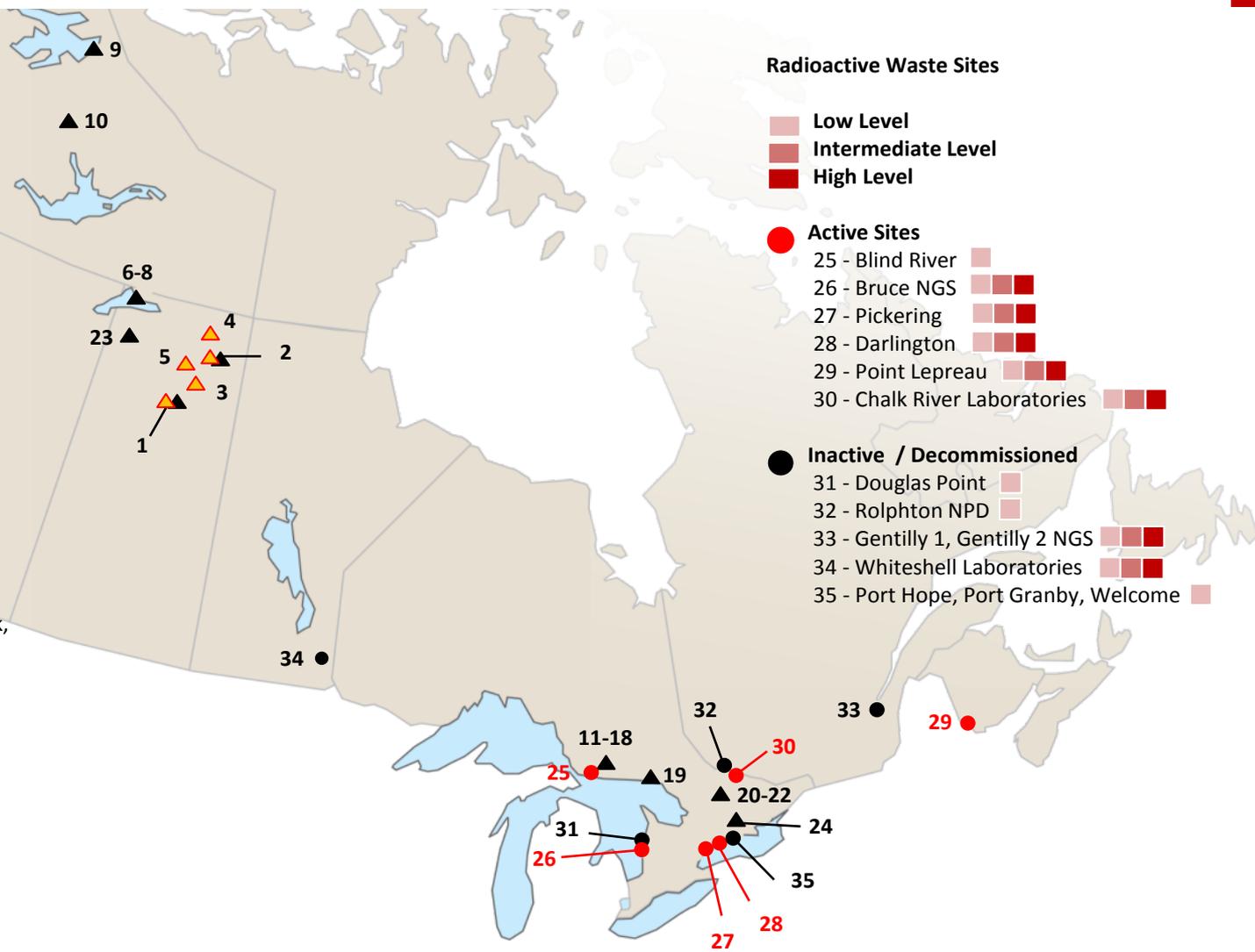
Waste Management Facilities/Areas

Uranium Mines and Tailings Sites

- ▲ Active**
 - 1 - Key Lake
 - 2 - Rabbit Lake
 - 3 - McArthur
 - 4 - McClean Lake
 - 5 - Cigar Lake
- ▲ Inactive / Decommissioned**
 - 1 - Key Lake
 - 2 - Rabbit Lake
 - 6 - Beaver Lodge
 - 7 - Gunnar
 - 8 - Lorado
 - 9 - Port radium
 - 10 - Rayrock
 - 11 to 18 - Elliot Lake Area Sites:
 - Quirke, Panel, Denison,
 - Lancor, Nordic, Pronto,
 - Spanish-American, Stanrock,
 - Stanleigh
 - 19 - Agnew Lake
 - 20 to 22 - Bancroft Area Sites:
 - Madawaska, Bicroft, Dyno
 - 23 - Cluff Lake
 - 24 - Deloro

Radioactive Waste Sites

- Low Level**
- Intermediate Level**
- High Level**
- Active Sites**
 - 25 - Blind River
 - 26 - Bruce NGS
 - 27 - Pickering
 - 28 - Darlington
 - 29 - Point Lepreau
 - 30 - Chalk River Laboratories
- Inactive / Decommissioned**
 - 31 - Douglas Point
 - 32 - Rolphton NPD
 - 33 - Gentilly 1, Gentilly 2 NGS
 - 34 - Whiteshell Laboratories
 - 35 - Port Hope, Port Granby, Welcome



Highlights of Canada's Report: Closure of the IRRS Follow-up Mission

- 🍁 Progress report to the IRRS follow-up mission to Canada
 - Recommendations and suggestions addressed and closed
 - 2009 mission and 2011 follow-up mission
 - 2013 – CNSC confirmed the closure of all actions
- 🍁 Completion of the Fukushima action items established in the CNSC Integrated Action Plan following the Fukushima Daiichi accident
 - The CNSC action plan also included enhancements to the CNSC's nuclear regulatory framework.
 - Updates to regulatory documents have been completed. Work is ongoing to amend the *Class I Nuclear Facilities Regulations* and the *Radiation Protection Regulations*
- 🍁 IRRS reports and management response published on CNSC public website

All IRRS findings are closed

Highlights of Canada's Report: International Peer Reviews

- ✦ Canada supports and participates in a variety of international peer reviews
 - CNSC participated in five safety-related, three security-related and eight technical IAEA review missions in 2017
 - Canadian utilities actively encourage staff participation in WANO and other international peer reviews
- ✦ Upcoming International Peer Reviews:
 - CNSC is requesting an IAEA ARTEMIS to focus on waste regulatory framework and structure (tentatively planned for the fall of 2018)
 - Canada is scheduled to host an International peer review mission for emergency preparedness (EPREV) (planned for early 2019)

Peer Review missions encourage international accountability and transparency to help strengthen global nuclear safety

Highlights of Canada's Report

Major themes - Questions on Canada's National Report

- 🍁 Long term management of Spent Fuel
- 🍁 Interim storage of spent fuel and design life of structures/containers
- 🍁 Waste minimization techniques
- 🍁 Waste classification and clearance of radioactive material
- 🍁 CNSC public hearing process
- 🍁 Community involvement
- 🍁 Import/export of sealed sources and orphaned disused sealed sources

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CANADA'S LEGISLATIVE AND POLICY FRAMEWORK

Presented by Natural Resources Canada

Legislative Framework in Canada

- Nuclear comes under federal jurisdiction
- The CNSC is Canada's single nuclear regulator
 - Independent – reports to Parliament through the Minister of Natural Resources
 - *Nuclear Safety and Control Act (2000)* includes safe spent fuel and radioactive waste management
- Government of Canada's legislative framework
 - *Nuclear Energy Act (1985, amended in 2011)*
 - *Nuclear Fuel Waste Act (2002)*
 - *Nuclear Liability and Compensation Act (entered into force January 1, 2017)*

Recent Government of Canada Decisions and Initiatives: Restructuring of AECL Completed

- ✦ Atomic Energy of Canada Limited (AECL) restructured to reduce costs and risks to Canadian taxpayers while positioning nuclear industry to succeed
- ✦ Phase 1 completed in 2011 with sale of the assets of AECL's CANDU Reactor Division
- ✦ Phase 2 put in place government-owned, contractor-operated (GoCo) model at Canada's nuclear laboratories to bring private-sector rigour and efficiency
- ✦ Canadian Nuclear Laboratories Ltd. (CNL) is a private-sector company responsible for the day-to-day management/operation of AECL sites
- ✦ AECL small, purpose-built Crown corporation responsible for oversight of the GOCO contract to ensure GoC liabilities are controlled, reduced, eliminated

**Private-sector rigour and efficiency will leverage capabilities
of the nuclear laboratories**

Recent Government of Canada Decisions and Initiatives: *Nuclear Liability and Compensation Act*

- ✦ NLCA entered into force on January 1, 2017 to:
 - Establish stronger legislation to better deal with liability and compensation for a nuclear accident; and
 - Implement Canada's obligations as a Party to the *IAEA Convention on Supplementary Compensation for Nuclear Damage*
- ✦ Key elements of the new legislation:
 - Absolute and exclusive liability of the operator
 - Increased limit of liability to \$1 billion
 - Expanded and clearer definition of damages
 - Elaboration of administrative process for claims handling
- ✦ Canada ratified the IAEA Convention on Supplementary Compensation for Nuclear Damage
 - Clarifies liability and jurisdiction in the event of a nuclear incident
 - Supports the IAEA Action Plan on Nuclear Safety

Liability cap increased to \$1 billion

Recent Government of Canada Decisions and Initiatives: ***Bill C-69 – The Impact Assessment Act***

- ✦ Bringing forward better rules for assessing the impacts of major projects to protect our environment and enhance public trust in how decisions about resource development projects are made
- ✦ Proposed changes:
 - Establishment of a new Agency and a new review process
 - Broader scope of impacts assessed
 - Increased focus on Indigenous engagement
- ✦ Proposed *Impact Assessment Act* undergoing review by Parliament

Proposed new impact assessment system should strengthen and enhance public trust in resource decision-making

Recent Government of Canada Decisions and Initiatives: *Generation Energy, SMR Roadmapping, CEM*

- ✦ Generation Energy – find out how Canadians want to meet Canada’s climate goals, create jobs and keep energy affordable
 - Nuclear energy part of the ongoing Generation Energy discussion
 - Pan-Canadian approach to SMRs to guide important decisions, and reduce uncertainty
- ✦ Government commits to a dialogue to develop Canadian Roadmap on SMRs
 - February 22, 2018 – Roadmapping process announced under the Energy Innovation Program
- ✦ Clean Energy Ministerial (CEM) – a global forum to promote policies and share best practices to accelerate the global transition to clean energy
 - Canada, Japan, the United States partnering to launch NICE Future to ensure that nuclear energy receives appropriate representation in high-level discussions about clean energy

**Nuclear Energy will continue to play a role in Canada’s low-carbon future –
Long-term solutions for waste will be required**

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CANADIAN NUCLEAR SAFETY COMMISSION
REGULATORY FRAMEWORK AND INITIATIVES UPDATE
Presented by Canadian Nuclear Safety Commission

Canadian Nuclear Safety Commission

✦ Established May 2000, under the ***Nuclear Safety and Control Act***

- Regulate the use of nuclear energy and materials
- Implement Canada's international commitments
- Disseminate information to the public

✦ Reports to Parliament through Minister of Natural Resources



Over 70 Years Of Nuclear Safety

The Commission

- ❖ Quasi-judicial administrative tribunal
- ❖ Agent of the Crown (duty to consult)
- ❖ Commission members are independent and part-time
- ❖ Commission hearings are public and Webcast
- ❖ Any member of the public may intervene
- ❖ Public Participant Funding
- ❖ Decisions are reviewable by Federal Court



**Public Hearings throughout
Lifecycle of facility**

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 educational activities
- 🍁 Transportation of nuclear substances
- 🍁 Export/import control
- 🍁 Security and safeguards
- 🍁 Waste management facilities



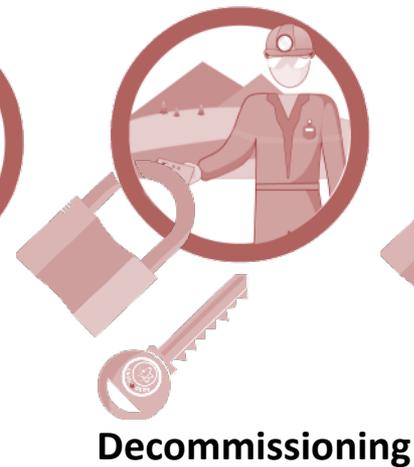
From Cradle to Grave

CNSC Regulatory Framework and Philosophy

- ✳ The *Nuclear Safety and Control Act* is the enabling legislation
- ✳ The Commission makes regulations through a transparent process
- ✳ Regulatory requirements are continuously updated based on a systematic and transparent process
 - Reflected in a comprehensive 10-year plan
 - Aligned with IAEA safety standards
 - Adoption of national and international standards in regulatory framework
- ✳ Extensive consultation is held with all stakeholders
 - Starts with discussion papers that are open and transparent
 - Comments solicited for draft regulatory documents
 - Resolution of comments published for stakeholder review
 - Public input sought prior to final issuance
- ✳ Regulatory philosophy is risk-informed

Activities requiring Licensing for Nuclear Facilities

- Commission authorization is required before any licensed activities are carried out



Regulatory Oversight Compliance and Enforcement

- Regulatory oversight includes licensing, compliance and enforcement activities, as well as reporting to the Commission
- Compliance is verified through:
 - Inspections
 - Reviews of operational activities and documentation
 - Licensee reporting of performance data, including annual reports and unusual occurrences
 - Independent environmental monitoring by the CNSC



Risk-informed and performance-based approach

Regulatory Oversight

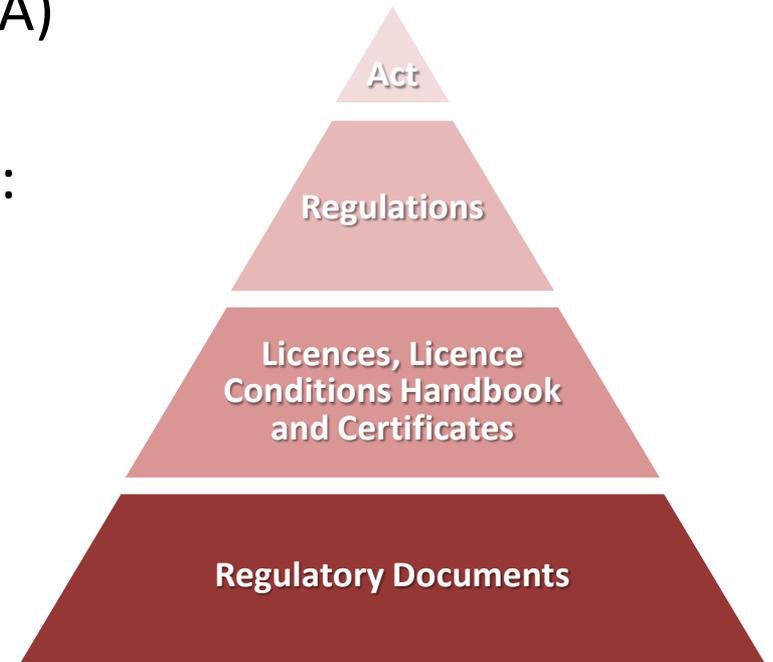
🍁 *Nuclear Safety and Control Act (NSCA)*
and Regulations

🍁 Commission Licensing requirements:

- Licence Conditions
- Regulatory Documents (REGDOCs) and standards

🍁 CNSC staff compliance activities:

- Verification, assessments, inspections, and enforcement



Clear and robust regulatory framework

Regulatory Focus Areas

🍁 All 14 Safety and Control Areas are assessed:

- Management System
- Human Performance Management
- Operating Performance
- Safety Analysis
- Physical Design
- Fitness for Service
- Radiation Protection
- Conventional Health and Safety
- Environmental Protection
- Emergency Management and Fire Protection
- Waste Management
- Security
- Safeguards and non-proliferation
- Packaging and Transport

CNSC Regulatory Principles for Waste Management

🍁 The licensee's waste program should encompass:

- Reduce, Reuse, Recycle
- Plan for the complete life of the facility, including financial guarantees
- Defence-in-depth – never rely on a single system or process for protection



Waste Related Regulatory Documents

Published since last RM:

- Discussion paper, Radioactive Waste Management and Decommissioning (May 2016) and follow-up What We Heard Report (November 2017)
- Waste and Decommissioning Regulatory Framework, Volume II: Assessing the Long Term Safety of Radioactive Waste Management (April 2018)

Under development:

- Guidance on Deep Geological Repository Site Characterization
- Waste and Decommissioning Regulatory Framework, Volume III: Management of Uranium Mine Waste Rock and Mill Tailings
- Decommissioning Planning (revision)
- Financial Guarantees (revision)

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 risk to the health and safety of humans and the environment.

	Uranium mine and mill waste	Low-level radioactive waste	Intermediate-level radioactive waste	High-level radioactive waste
	Includes tailings and waste rock generated by the mining and milling of uranium ore	Is more radioactive than clearance levels and exemption quantities. Examples include: mop heads, rags and paper towels	Contains enough long-lived radionuclides to require isolation and containment. Examples include: filters, resins and used reactor components	Is primarily used nuclear fuel, along with small amounts of waste that generate significant heat

Nuclear Waste Related CSA Standards

- ✦ The Canadian Standards Association (now called the CSA Group) is a not-for-profit organization composed of representatives from the government, industry and consumer groups
- ✦ Radioactive waste related CSA Standards published since last RM:
 - CSA N292.0-14, General principles for the management of radioactive waste and irradiated fuel
 - CSA N292.1-16 - Wet storage of irradiated fuel and other radioactive materials
 - CSA N292.2-13 - Interim dry storage of irradiated fuel
 - CSA N292.3-14, Management of low- and intermediate-level radioactive waste
 - CSA N292.5 Guideline for Exemption from Regulatory Control of Materials that Contain Nuclear Substances
 - CSA N294-09 - Decommissioning of facilities containing nuclear substances
- ✦ Under development:
 - CSA N292.6-18 - Long-term management of radioactive waste and irradiated fuel
 - CSA N292.7 Disposal of radioactive waste and irradiated Fuel (proposed title)

Open and Transparent Regulator

- ❖ Community outreach activities
- ❖ Participant Funding Program
- ❖ Public invited to participate in Commission proceedings throughout life-cycle
- ❖ Held in local communities when possible
- ❖ Regulatory, environmental, and nuclear safety information published on website
- ❖ Hearings occur throughout lifecycle of a nuclear facility
- ❖ Information-sharing through social media
- ❖ Dedicated telephone line and email address to respond to questions from the public



Examples of outreach activities

Licensee Public Communication Program

- ✳ Regulatory requirements for extensive proactive disclosure and public information programs
 - Public disclosure is a condition of licence
- ✳ Licensees develop information programs in consultation with the public
- ✳ Licensees conduct outreach activities:
 - Engagement with Indigenous Communities
 - Consultation with municipal governments and local stakeholders
- ✳ Licensees have environmental data and facility safety information available to the public
 - Corporate websites, social media
 - Newsletters
- ✳ Licensees communicate to the public when non-routine events occur at the facility



CNSC Independent Environmental Monitoring Program (IEMP)

🍁 Objectives

- Verify that public health and the environment is not adversely affected by releases to the environment around CNSC-regulated facilities
- Confirm that the licensee's environmental protection program adequately protects the public and the environment
- Complement the CNSC compliance program

🍁 Site-specific sampling plans

- Developed for publicly accessible locations (air, water, soil, sediment, vegetation and food)
- Engages local community and integrates Indigenous input in sampling program

🍁 Results available to public through technical reports and interactive maps on the CNSC website

🍁 Complements monitoring programs of other government agencies, such as Health Canada's Canadian Radiation Monitoring Network, as well as provincial and licensee monitoring programs



CNSC staff performing sampling for IEMP at various facilities

CNSC Continued Early Regulatory Involvement in Long Term Management of Spent Fuel

- ✳️ **CNSC outreach activities** – continued to engage in outreach activities focusing on heightening public awareness and understanding of its role and of regulating radioactive waste
- ✳️ **Independent Advisory Group** – established in February 2015 to provide advice to CNSC staff; composed of geoscientists from several Canadian universities and the Geological Survey of Canada
- ✳️ **Independent research program** — Since 1978, the CNSC has been involved in independent research and assessment on geological repositories
- ✳️ **International collaboration** — the CNSC belongs to six international groups that exchange information and knowledge on geological repositories

CNSC role will expand and adapt as initiative progresses

Joint Convention on the Safety of Spent Fuel Management
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**MANAGEMENT OF SPENT FUEL AND RADIOACTIVE WASTE AT
ATOMIC ENERGY OF CANADA LIMITED-OWNED SITES**
Presented by Atomic Energy of Canada Limited

Atomic Energy of Canada limited (AECL): Nuclear Science and Technology and Decommissioning

🍁 Mandate:

- Enable nuclear science and technology
- Manage the Government of Canada's radioactive waste responsibilities

🍁 Decommissioning Responsibilities:

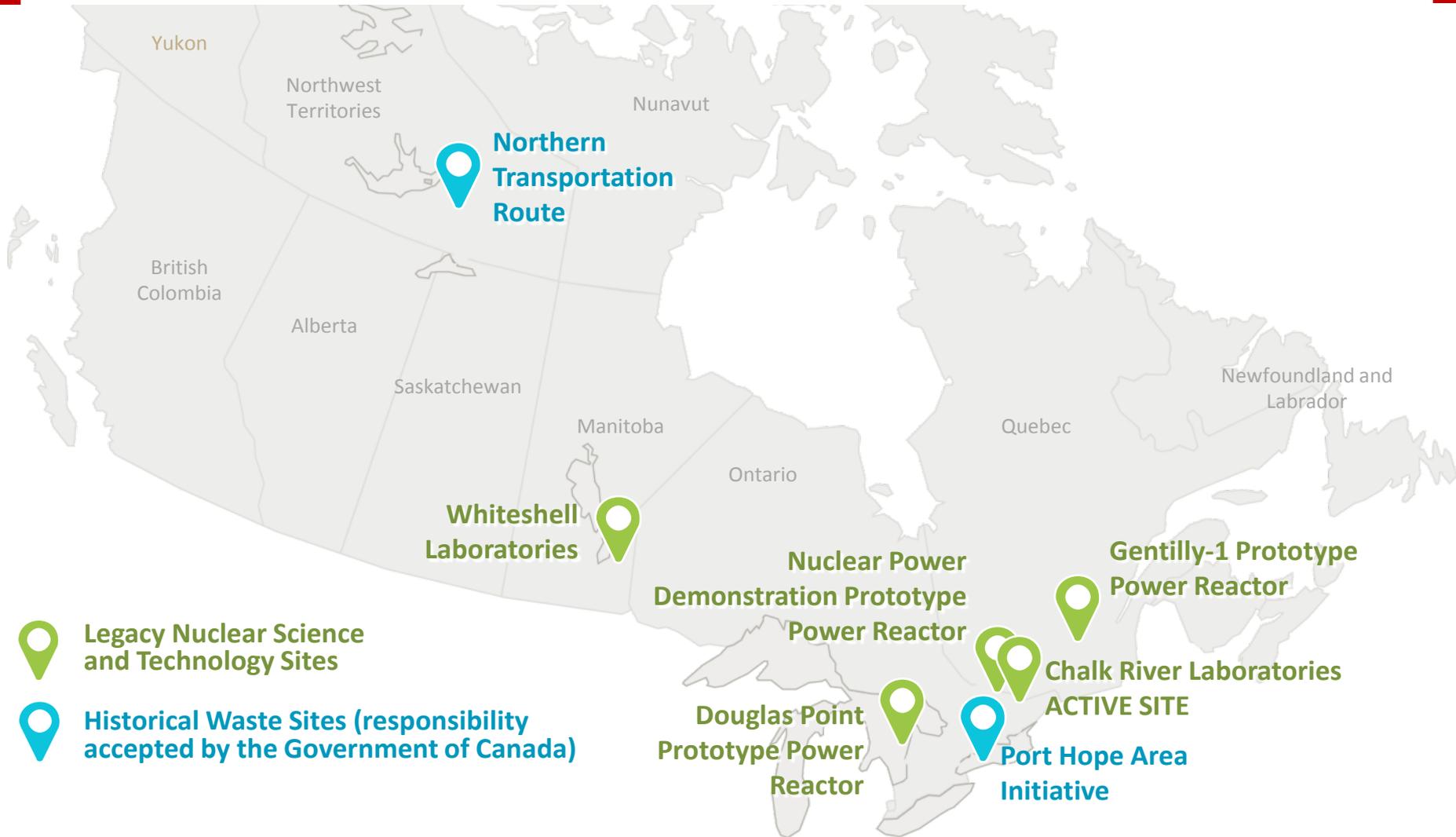
- Decommissioning of legacy nuclear science and technology sites
- Cleaning up sites contaminated with historic, low-level radioactive waste

🍁 Priority Areas:

- Accelerate decommissioning and remediation of legacy sites
- Revitalize the Chalk River Laboratories - \$1.2B CAD investment over 10 years in new and renewed science infrastructure

AECL delivers its mandate through a Government-owned, Contractor-operated model whereby Canadian Nuclear Laboratories, a private-sector company, manages and operates our sites on our behalf

Spent Fuel and Radioactive Waste Owned by AECL and Managed by CNL



 Legacy Nuclear Science and Technology Sites

 Historical Waste Sites (responsibility accepted by the Government of Canada)

Chalk River Laboratories: Addressing Health, Safety and Environmental Priorities

- ❖ The Chalk River Laboratories remain an active laboratory site
- ❖ Challenges include legacy buildings and waste management areas which require decontamination and remediation
- ❖ Spent fuel, ILW and LLW stored at the site



Chalk River Laboratories: Decommissioning of Shutdown Buildings



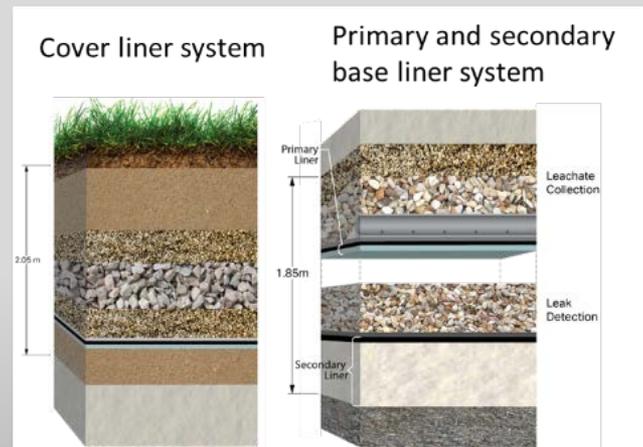
LEGEND:

- | | | | |
|---|--|---|-------------------------------------|
|  | Building to be decommissioned and demolished |  | New/Refurbished buildings |
|  | Building to be decommissioned and maintained in surveillance |  | Existing buildings that will remain |

Chalk River Laboratories: Near Surface Disposal Facility

- ❖ Proposed project for the disposal of up to 1,000,000 m³ LLW
- ❖ To be located at the Chalk River site, the location of the majority of the waste (>90%)
- ❖ Double lined landfill construction with leachate collection and treatment
- ❖ Strategically the most important enabler project for the remediation and revitalization of the Chalk River Laboratories

Project is currently undergoing an Environmental Assessment



Images of the proposed Near Surface Disposal Facility: aerial view (top picture) and liner system (bottom picture)

Chalk River Laboratories: Fuel Packaging and Storage Project

Goals

- 🇨🇦 Retrieve spent research reactors fuel from early degraded tile holes
- 🇨🇦 Transport the fuel to a new facility for repacking, vacuum drying, and storage

Project status

- 🇨🇦 Facility operation commenced 2015
- 🇨🇦 Fuel from 71 tile holes transferred by end 2017
- 🇨🇦 Transfers and drying to be completed by summer 2019



Fuel Packaging and Storage (FPS) Project

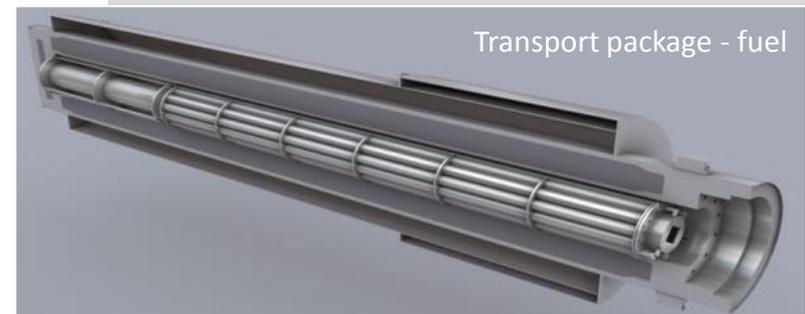
Chalk River Laboratories: HEU Repatriation as Part of the Global Threat Reduction Initiative

Goals

- 🇨🇦 Retrieve highly enriched uranium (HEU) fuel rods and target residue materials
- 🇨🇦 Repackage for transportation
- 🇨🇦 Repatriate to the United States to reprocess for peaceful purposes

Project status

- 🇨🇦 Fuel Rod Repatriation commenced 2015
- 🇨🇦 Target Residue Material Repatriation commenced 2017



Decommissioning Progress: Prototype Reactors

- ✦ Monitor, maintain, and repair Prototype Reactors as required
- ✦ Three Phase approach to decommissioning:
 - Phase 1 – Facilities brought to a safe state
 - Phase 2 – Storage with surveillance
 - Phase 3 – Final decommissioning
- ✦ Douglas Point and Gentilly-1 in Phase 2
- ✦ Nuclear Power Demonstration preparing for Phase 3



Douglas Point
(photo courtesy CNL)



Nuclear Power Demonstration
(photo courtesy CNL)



Gentilly-1
(photo courtesy CNL)

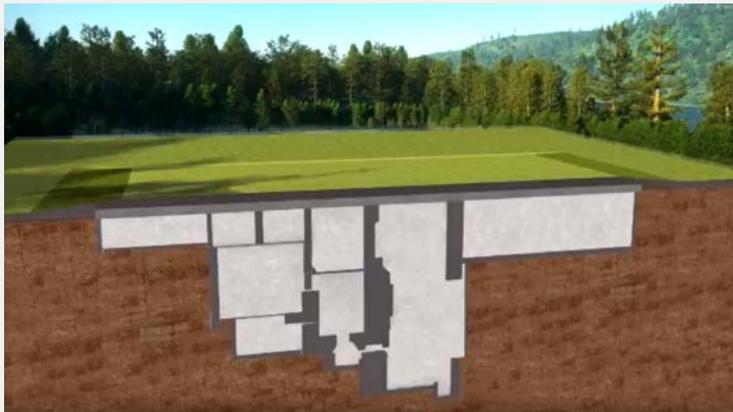
Nuclear Power Demonstration Proposed in-situ decommissioning



NPD below grade structure containing reactor vessel, system and components will be encased with grout.



The above ground structures will be demolished and the debris placed in the below grade structure previously occupied by the electrical generating equipment and filled with grout.



The grouted structure will be capped with concrete and an engineered barrier in situ.



Canadian Nuclear Laboratories will monitor the site for a minimum of 100 years - period of time referred to as institutional control.

Whiteshell Laboratories

- ❖ Nuclear laboratory site that is being decommissioned to achieve closure - managed under a target-cost agreement
- ❖ Radioactive waste and used fuel to be shipped to the Chalk River site for interim storage or final disposal (over 2,000 trucks travelling 2,000 km)
- ❖ WR-1 is proposed by CNL to be decommissioned in situ (currently in the regulatory decision phase)
- ❖ Performance Baseline schedule on track for September 2024 end date



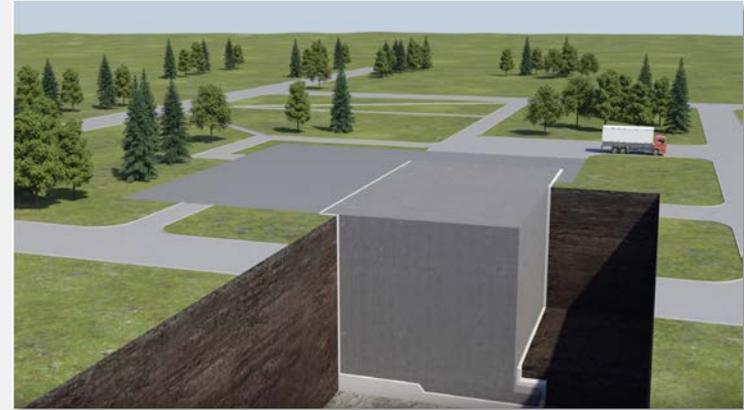
Pictures of the Whiteshell Laboratories site in Manitoba, Canada: aerial view of the built up site (top picture) and aerial view of the waste management area (bottom picture)

Whiteshell Laboratories

Proposed in-situ decommissioning



Because it is primarily located low grade the majority of contamination is in the reactor core the entire below grade portion will be filled with grout.



The above grade structure will be demolished and all material will be sent to appropriate disposal sites.



An engineered cover will then be installed over the grouted monolith to prevent intrusion.



Canadian Nuclear Laboratories will monitor the site.

Historic Radioactive Waste: Port Hope Area Initiative

- ✦ Loss of control of contaminated material from former Crown corporation Eldorado Nuclear and its private-sector predecessors
- ✦ Environmental restoration within the community involving 1.7M m³ LLW and a cost \$1.28B CAD
- ✦ Port Granby near-surface facility constructed and transfers commenced 2016
- ✦ Port Hope near-surface facility constructed and transfers commenced 2017
- ✦ Remediation well underway with completion of both projects by 2024
- ✦ Significant effort placed on public and stakeholder engagement



Aerial view of the site of the Port Granby Long-term Waste Management Facility



Aerial view of the site of the Port Hope Long-term Waste Management Facility

Stakeholder and Indigenous Engagement

- ❖ Communications and stakeholder engagement a key part of all site operations
- ❖ Targeted engagement activities as part of environmental assessment processes
 - More than 75 public information sessions to date
 - Presentations to local municipal councils
 - Site tours
 - Meetings with Indigenous groups; funding for community engagement and traditional knowledge studies



Indigenous engagement activities at the Whiteshell Laboratories site



Stakeholder engagement activity at the Chalk River Laboratories site



Stakeholder and Indigenous groups from the Whiteshell Laboratories area visiting the Hallam reactor in Nebraska, US

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**LONG-TERM MANAGEMENT OF LOW- AND INTERMEDIATE-
LEVEL RADIOACTIVE WASTE FROM NUCLEAR POWER PLANTS**
Presented by Ontario Power Generation

Low- and Intermediate-Level Waste Interim Storage

- 🇨🇦 All low- and intermediate-level waste (L&ILW) produced by Nuclear Power Plants (NPPs) in Canada stored on an interim basis at the nuclear facilities
- 🇨🇦 Low-level waste may be reduced through various processing methods

Low-level waste



Low activity radioactive waste stored in warehouse-type buildings

Intermediate-level waste



Higher-activity, longer-lived radioactive waste stored in in-ground containers



Refurbishment radioactive waste stored in above ground containers

Minimization Efforts for Low-Level Waste

- Waste Reduction at Source
 - Focus on pre-job briefings
 - Segregation of metal waste
 - Segregation of launderable Personal Protective Equipment (PPE)
 - Communication campaigns

- Waste diversion
 - Use of launderable/washable PPE
 - De-packaging of materials

Reduce, Reuse, Recycle



Sorting of Low Level Waste at OPG

🍁 Sorting of waste at the Western Waste Management Facility (WWMF) both from interim storage and incoming waste from the NPPs has:

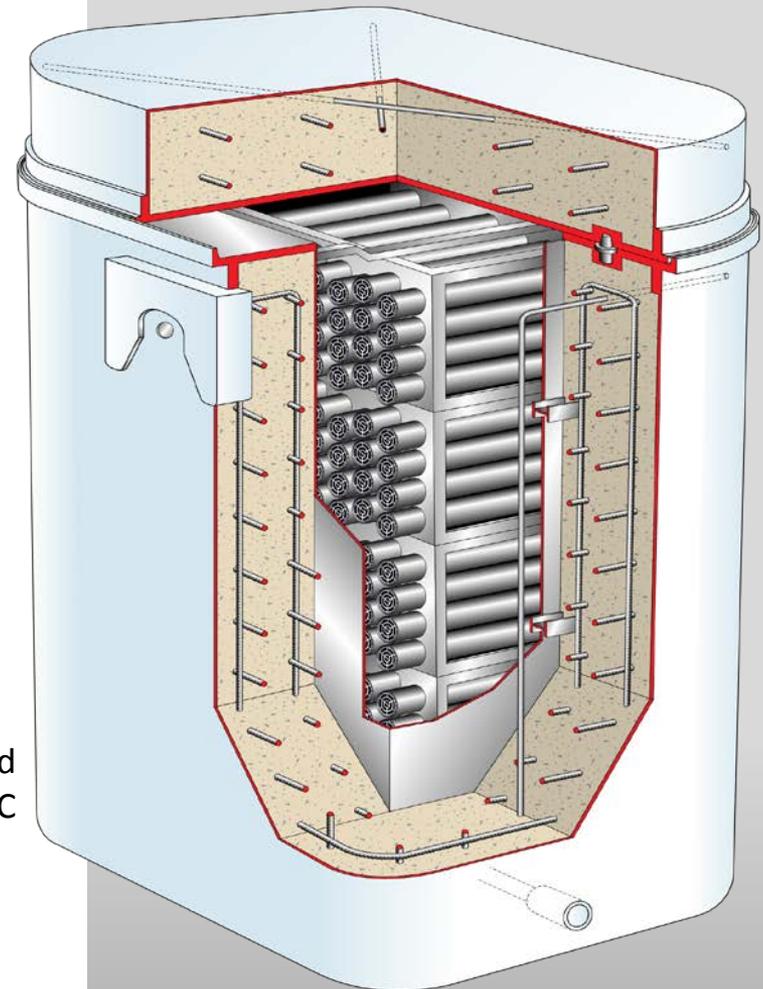
- Continued for past 3+ years
- Diverted waste from the non-processible waste stream to the compaction and incineration processes
- Diverted waste from the compaction process (5:1 reduction) to the incineration process (25:1 reduction)
- Resulted in the removal and free-release of metal and tools through extensive surveying, segmentation and decontamination methods



Workers sorting through radioactive waste to divert to volume reduction streams or for free release

OPG Dry Storage Containers for Used Fuel

- ❖ Dry storage containers (DSCs) hold 384 bundles in four modules
- ❖ Steel and high density concrete construction with a welded lid design
- ❖ Design life is 50 years



OPG Used
Fuel DSC

OPG Dry Storage Containers for Used Fuel

- ❖ All filled containers are stored at site
- ❖ Currently there are over 2900 DSCs stored at the three Used Fuel facilities



OPG Used Fuel DSCs stored at the Pickering Waste Management Facility



OPG Used Fuel DSCs stored at the Western Waste Management Facility

OPG and Bruce Power Refurbishment Projects

- 🇨🇦 Refurbishment at both OPG and Bruce Power for the next 15 years for 10 units
 - Approximately 50% increase in waste volumes for each unit
 - Non-routine waste streams such as reactor components and feeder tubes
 - Requires new containers and facilities as well as transportation packages
 - Significant effort to coordinate and manage logistics



End fittings in Retube Waste Container



Darlington Shielded Overpack Storage Container



Retube Waste Containers

Asset Management Strategy for Existing Waste Management Facilities

🍁 Phase One: Identification

- Identification of large scope work is complete. Includes aging management, buildings and transportation for next 10 years
- Second part of identification will include: repair, replacement and significant inspection requirements from now to End of Life



Arial View of WWMF



Waste Volume Reduction Building



Low Level Storage Building (LLSB)

Asset Management Strategy for Existing Waste Management Facilities



Phase Two: Actualization

- Incorporation into business plan, including funding stream, work processes and resources required
- Inclusion into Nuclear Fleet-wide software platform to enable continual program management



The DSTAR Transportation Package Containing Feeder Tubes



Type B Transportation Package

Large Metal Object Volume Reduction

- ❖ Large Metal Objects (LMO) include:
 - Steam generators
 - Heat exchangers
 - Transportation packages
- ❖ LMOs are large in volume but relatively low in radioactivity
- ❖ The aim of this initiative is to minimize the volume of the radioactive material



Bruce Power Units 1 & 2 Waste Steam Generators



Waste Heat Exchanger

Update - OPG's Deep Geologic Repository (DGR)

- ✦ A DGR, 680m deep, is proposed for disposal of L&ILW, from three nuclear generating stations owned by OPG
- ✦ Geology at Bruce Nuclear site will safely isolate waste from surface:
 - Region is seismically quiet
 - Limestone sedimentary rock is 450 million years old
 - Rock is mechanically strong and dry
 - Rock is virtually impermeable; a molecule of water moves just 1 m in 300,000 years



Conceptual emplacement for intermediate-level waste

OPG DGR: Intensive Review

- ❖ Project has undergone more than 12 years of scientific analysis and review
- ❖ Rigorous Environmental Assessment
 - Longest such public hearings in Canadian history – over two years
 - 12,500 pages of evidence
 - 300 interventions
- ❖ Joint Review Panel concluded in 2015:
 - Safety case is strong
 - Environment and Lake Huron are protected
 - Project should proceed “now rather than later”



Public hearings held in 2013 and 2014

OPG DGR: Project Status

- ❖ Willing host community: Kincardine
- ❖ Federal Minister of Environment has requested additional information:
 - In **2016** requested an alternate locations study
 - In **2017** requested an updated analysis of effects on physical/cultural heritage of Saugeen Ojibway Nation (SON)



Saugeen Ojibway Nation

Gentilly-2

Characteristics

- 🇨🇦 1983: start of commercial operation
 - 675MW, single unit
CANDU PHWR
- 🇨🇦 December 28, 2012: end of commercial operation
- 🇨🇦 December 31, 2014: Safe Storage State declared



Gentilly-2 is located on the St. Lawrence River and has one unit transitioning to safe storage state (photo courtesy Hydro-Québec)

Gentilly-2 Transitioning

Dormancy and surveillance phase

- ❖ Transfer of spent fuel from wet storage to interim dry storage
- ❖ Structures, systems and components monitoring program
- ❖ Environmental monitoring program
- ❖ Transfer of LLW and ILW to the solid radioactive waste management facility
- ❖ Reconfiguration of systems and building for dormancy



Fuelling machine connected to the reactor, at Gentilly-2, used to defuel the core and drain heavy water from the pressure tubes (photo courtesy Hydro-Québec)

Gentilly-2: Next steps

2021 – 2059 Dormancy and site monitoring phase

- ✦ Structures, systems and components monitoring program
- ✦ Environmental monitoring program
- ✦ All radioactive L&ILW stored on site
- ✦ 2050* transfer of irradiated fuel to national repository site

* date assumed for financial planning

2060 – 2066 Decontamination and Dismantling

- ✦ Preparation: planning, regulatory approvals, initial comprehensive and detailed radiological and hazardous characterization
- ✦ Operation: all radioactivity in excess of release criteria remove from site and disposed
- ✦ Site Restoration: remove remaining building using conventional techniques, final dismantling program report



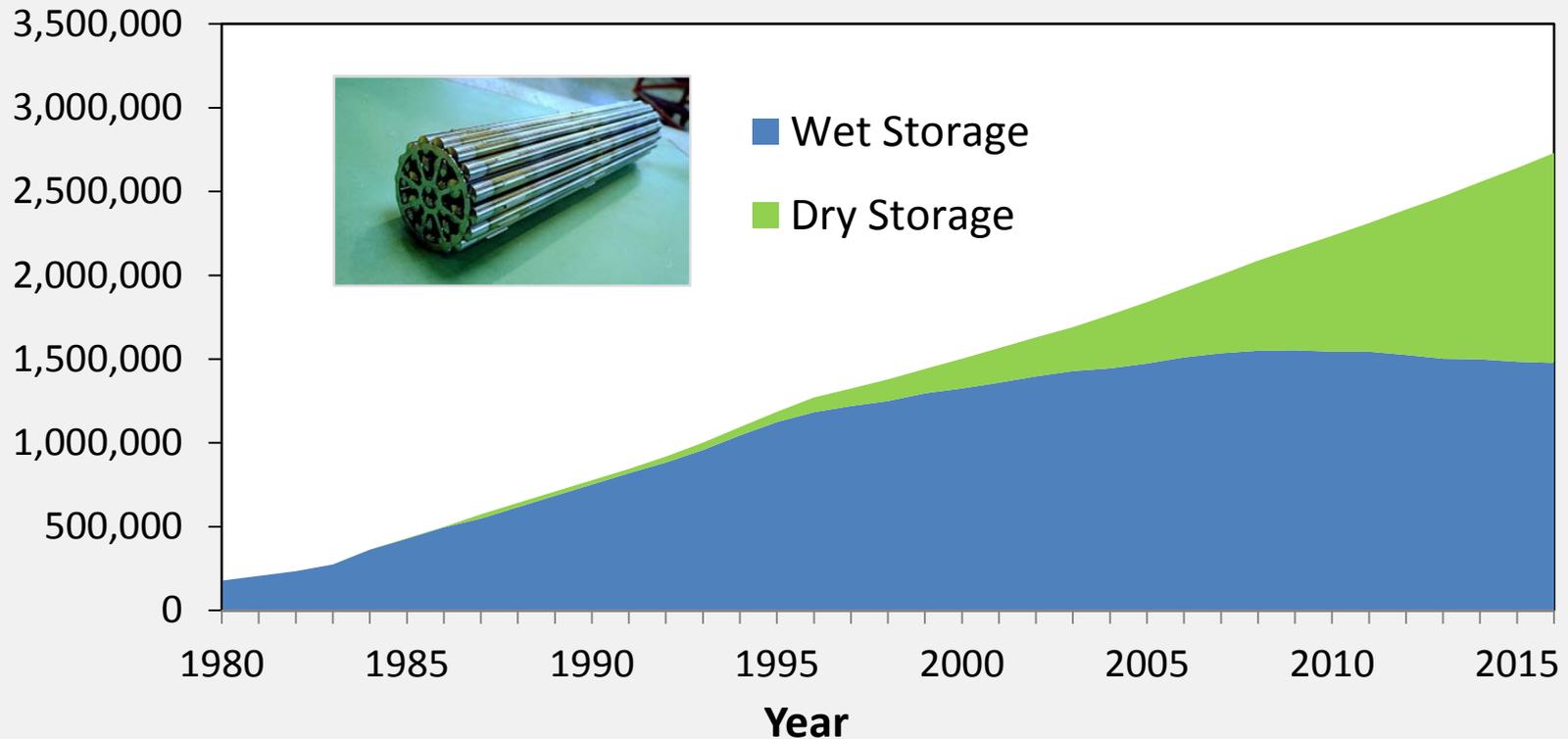
Onsite above ground dry storage at the Gentilly-2 site (photo courtesy Hydro-Québec)

Joint Convention on the Safety of Spent Fuel Management and on
the Safety of Radioactive Waste Management

LONG-TERM MANAGEMENT OF CANADA'S SPENT FUEL
Presented by the Nuclear Waste Management Organization

Current Management of Canada's Spent Fuel

Canada's Spent Fuel Inventory:
2,770,918 bundles as of June 30, 2017



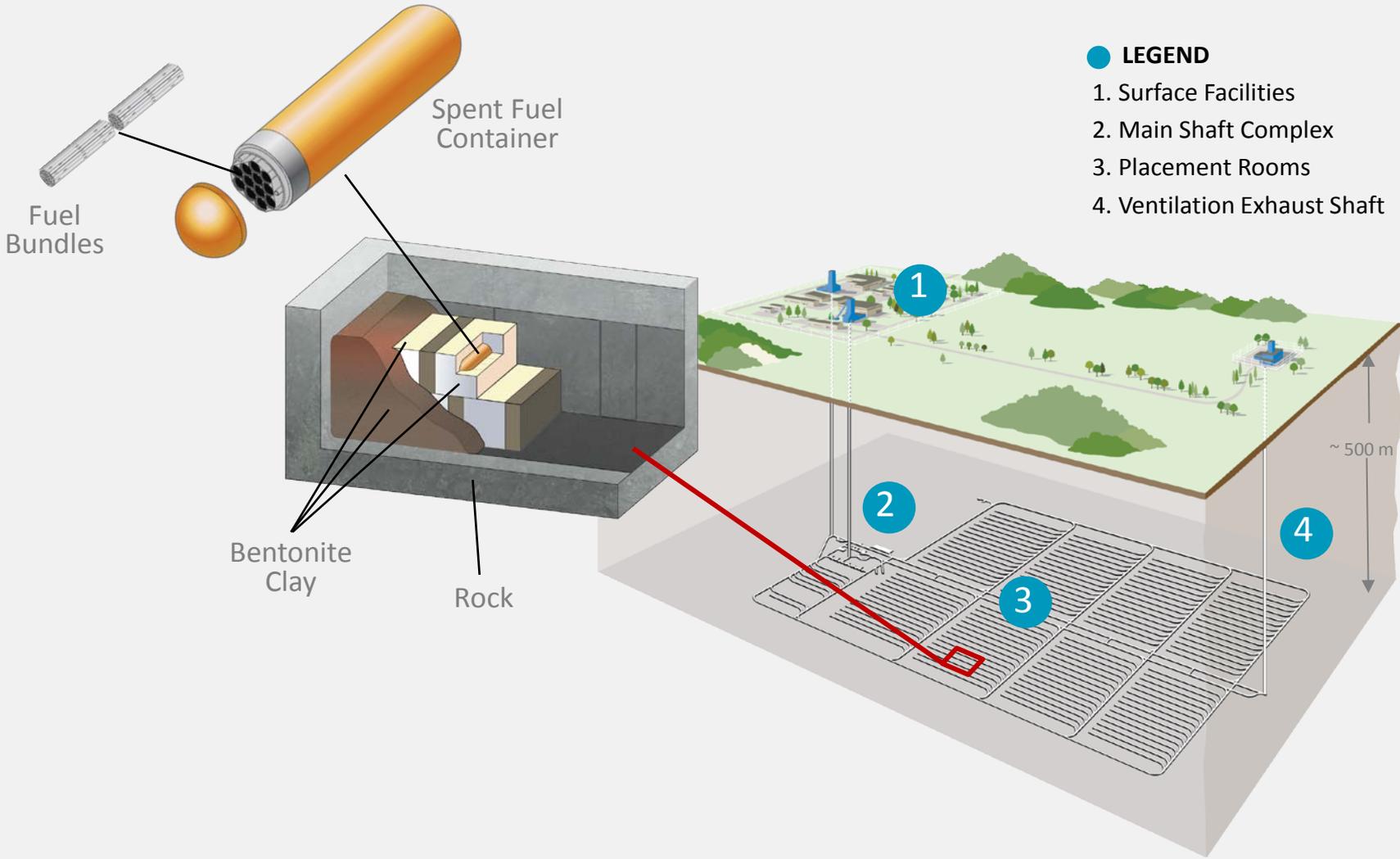
Adaptive Phased Management

- Three-year options study by NWMO with extensive dialogue with Canadians (2002-2005)
- Government of Canada selected Adaptive Phased Management (APM) approach in 2007
- NWMO continues to implement APM:
 - Centralized isolation and containment in a Deep Geological Repository
 - Flexibility in pace and manner of implementation
 - Open, inclusive, fair siting process to seek a willing and informed host
 - Sustained engagement of people and communities

National Infrastructure Project

- 🍁 Protection of health, safety and environment
- 🍁 High technology
- 🍁 Strongly regulated
- 🍁 Long-term partnership between NWMO and host communities
- 🍁 Investment \$23 B
- 🍁 Decades of sustainable operation

NWMO's Conceptual DGR for Spent Fuel

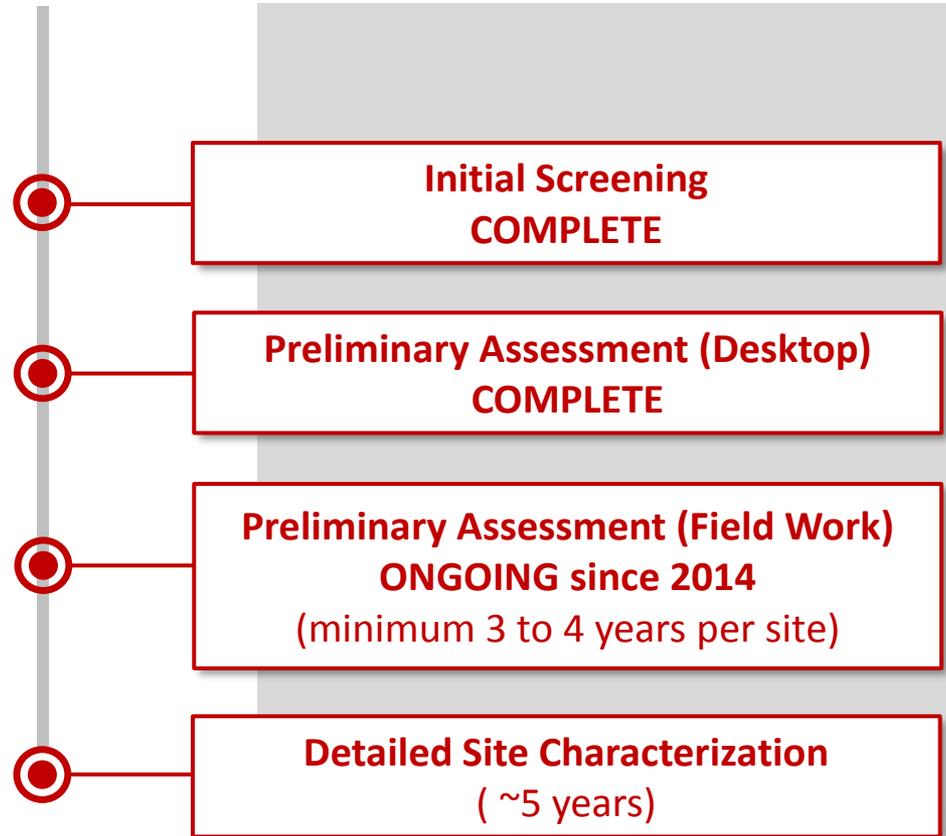


- LEGEND**
- 1. Surface Facilities
 - 2. Main Shaft Complex
 - 3. Placement Rooms
 - 4. Ventilation Exhaust Shaft

Site Selection Process

Guiding Principles:

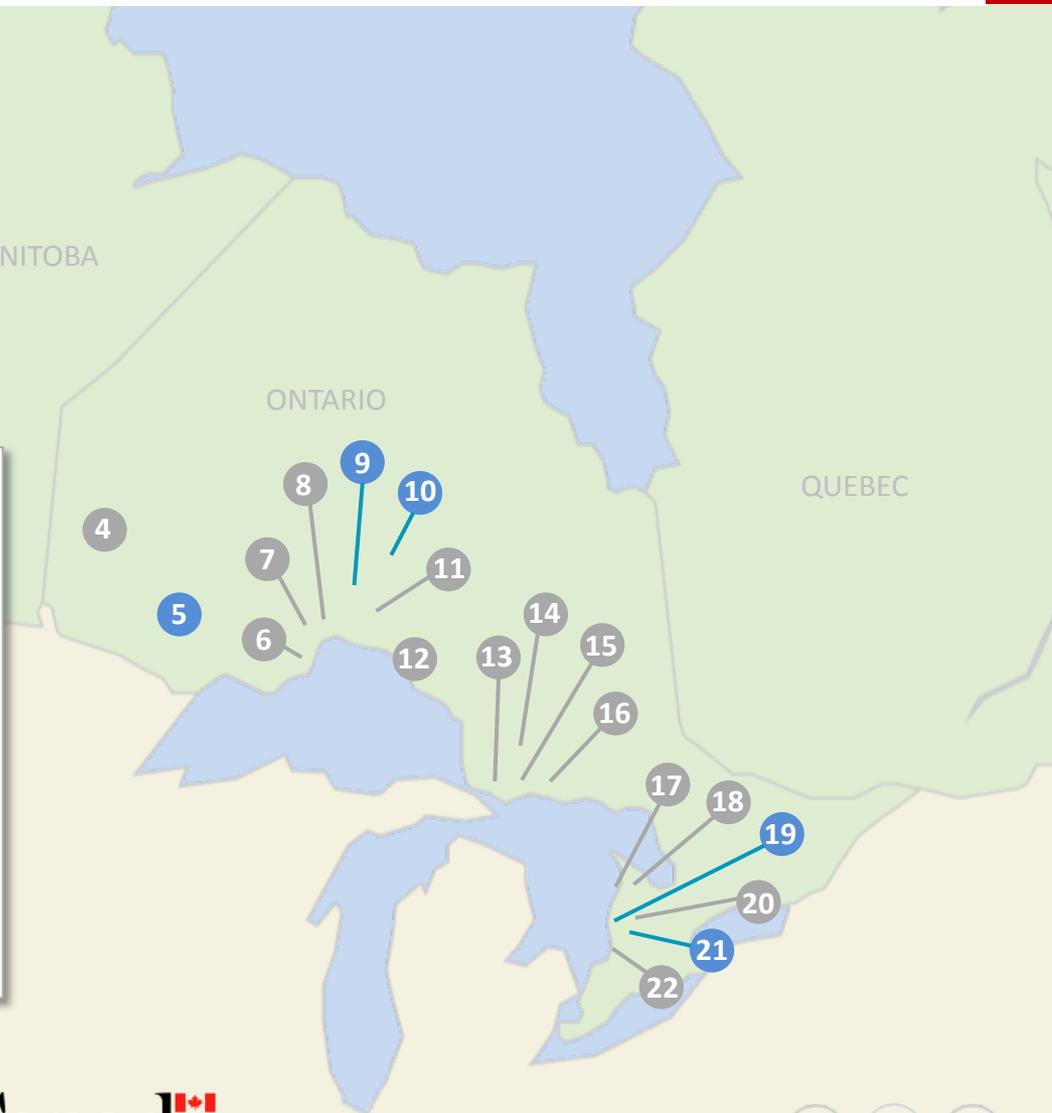
- 🍁 Safety first
- 🍁 Informed and willing host community
- 🍁 Multi-stage technical and socio-economic and cultural assessments
- 🍁 Broad involvement of people in siting areas and regions, including Municipalities, First Nations and Métis people



Site Selection Process

Communities That Expressed Interest In The Site Selection Process

- **Assessments Under Way**
 - 5. Ignace
 - 9. Manitouwadge
 - 10. Hornepayne
 - 19. Huron-Kinloss
 - 21. South Bruce
- **Communities Not Identified For Further Study**
 - 1. English River First Nation
 - 2. Pinehouse
 - 3. Creighton
 - 4. Ear Falls
 - 6. Red Rock
 - 7. Nipigon
 - 8. Schreiber
 - 11. White River
 - 12. Wawa
 - 13. Blind River
 - 14. Elliot Lake
 - 15. The North Shore
 - 16. Spanish
 - 17. Saugeen Shores
 - 18. Arren-Elderslie
 - 20. Brockton
 - 22. Central Huron



Looking Ahead

2018

Preliminary Assessments underway

2023

Preferred site is selected

2024

Detailed site characterization begins;
Construction of Centre of Expertise begins

2028

Licence applications submitted

2032

Licence granted (estimate);
Design and construction begins

2043

Operation of repository begins

Criteria for Selecting a Preferred Site

SAFETY

Confidence a deep geological repository can be developed with strong safety case at that location

TRANSPORTATION

Confidence a safe, secure and socially acceptable transportation plan can be developed

PARTNERSHIP

Confidence a strong partnership can be developed – with interested community, First Nation and Métis and surrounding communities

Advancing the Site Selection Process

- ❖ Ongoing engagement with municipal and Indigenous communities to build and sustain support for the project
- ❖ Gradually reducing the number of communities in an open and transparent manner
- ❖ Identifying technically suitable and socially acceptable repository sites with the involvement of people, taking into account traditional knowledge
- ❖ Actively exploring the potential for partnerships with communities



NWMO's engagement activities (courtesy NWMO)

Advancing Field Investigations

Initial Studies



Community members visiting survey plane (courtesy NWMO)

High Resolution Airborne Geophysical Surveys

Completed



Geologists conducting mapping (courtesy NWMO)

Geological Mapping

Completed



Intensive Field Work



Geologist analyzing drill core (courtesy NWMO)

Deep Borehole Drilling

Ongoing



In Collaboration with Communities

Interweaving Traditional Knowledge

🍁 Through its Indigenous Knowledge policy, the NWMO is committed to work together with Aboriginal peoples to respectfully interweave Indigenous Knowledge in all its activities:

- Joint planning of field studies
- Work together to collect information and interpret findings
- Ceremonies and offerings led by communities prior to field work
- Cultural training for contractors prior to field work
- Seek advice from a Council of Elders and Youth

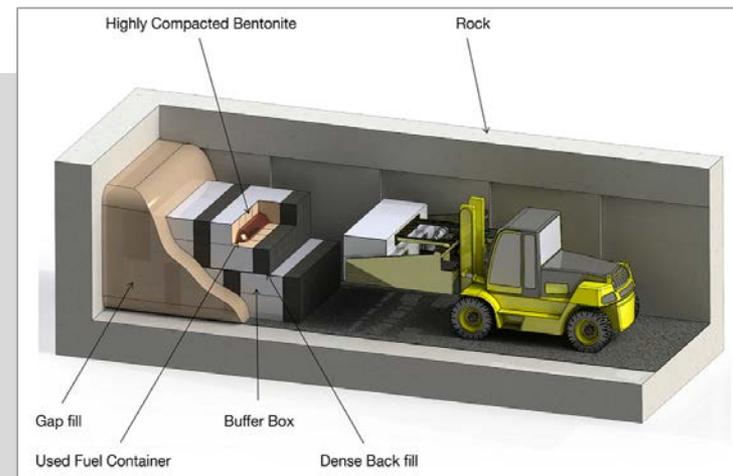


Engineered Barrier System Development

- ❖ Engineered Barrier System developed for CANDU fuel; with improvements in safety, fabrication and handling
- ❖ Focused on readiness for container serial production and emplacement trials:
 - Integrating research and development
 - Fabricating prototypes and process equipment
 - Establishing process procedures and defining tolerances



Cold spray copper coating being applied to container lid weld region (courtesy NWMO)



NWMO's Engineered Barrier System (courtesy NWMO)

Highlights

- 🍁 Sound legislative framework
- 🍁 Funding for the project in place; Government oversight
- 🍁 Progressing towards the selection of a safe and socially acceptable site in 2023, in an open and transparent manner
- 🍁 Continued and substantive progress in engineering design
- 🍁 Continued use of Peer-reviews and guidance from external advisory bodies

Joint Convention on the Safety of Spent Fuel Management
and on the Safety of Radioactive Waste Management

RESPONSES TO 5TH RM, QUESTIONS ON NATIONAL REPORT, PLANNED
ACTIVITIES, GOOD PRACTICES, CHALLENGES, SUGGESTIONS,
CONCLUSIONS, RECOMMENDATIONS AND OVERARCHING ISSUES

Response to 5th Review Meeting Challenges

Challenge 1:

Industry access to suitable skills and resources

- ✦ OPG, Bruce Power and New Brunswick Power use a number of strategies to focus on ensuring access to suitable skills and resources
- ✦ Hydro-Québec put in place a permanent organization to manage decommissioning of Gentilly-2 NGS

This challenge should be closed

Challenge 2:

Resources to ensure regulatory oversight

- ✦ The CNSC has adopted a “build” strategy to protect core organizational capabilities and competencies that are essential to carrying out its mandate over the long term
- ✦ Human resources management effort is focused on four areas: organization design, recruitment and workforce renewal, learning and leadership development, and employee engagement and retention

This challenge should be closed

Response to 5th Review Meeting Challenges (cont.)

Challenge 3:

Finding an acceptable site in a willing host community for spent fuel repository

- 🍁 Site selection process has progressed with potential planned completion by 2023
 - Initially 22 communities, 5 communities remain after initial assessments as of April 2018
- 🍁 A number of First Nations and Métis communities actively engaged in learning more about the project

This challenge should remain open

Challenge 4:

Implementing GoCo management model and completing procurement process

- 🍁 Completed Restructuring AECL through implementation of the GoCo model
- 🍁 CNL is a private-sector company responsible for day-to-day management and operation of all AECL's sites, facilities and assets

This challenge should be closed

Progress on Suggestion from 5th Review Meeting

Suggestion 1:

Develop an integrated strategy for non-OPG low and intermediate-level waste disposal

- ✳ CNL, on behalf of AECL, has constructed a near-surface disposal facility for PHAI project and has proposed a near-surface disposal facility for LLW at CRL
- ✳ Canada's radioactive waste owners (AECL, OPG, Hydro-Québec, NB Power) have formed the Radioactive Waste Leadership Forum and is discussing options for an integrated strategy

This item should remain open

Progress on Planned Measures to Improve Safety from the 5th Review Meeting

Planned Measures 1:

AECL sites – accelerated decommissioning and remediation

- ✦ Chalk River Laboratories 30 redundant structures removed in 2016/17, 20 redundant structures removed during 2017/18 - **completed**
- ✦ National Research Universal reactor came to the end of its operational mission and shut down on 2018 March 31. The transition from operations to decommissioning has commenced - **completed**
- ✦ Whiteshell Laboratories 14 redundant structures removed in 2017/18. A further 72 redundant structures at Chalk River Laboratories to be removed by 2026 - **open**
- ✦ Whiteshell Laboratories closure to be completed by 2024 - **open**
- ✦ Nuclear Power Demonstration decommissioning to be completed by 2022 – **open**
- ✦ Port Hope Area Initiative to be completed by 2024 - **open**

This item should be amended to reflect the closure and the remainder of open items

Progress on Planned Measures to Improve Safety from the 5th Review Meeting (cont.)

Planned Measures 2:

Development of radioactive waste management industry forum

- ✦ A RWM industry forum has been developed by Canada's radioactive waste owners (AECL, OPG, Hydro-Québec, NB Power) under the sponsorship of Canadian Nuclear Association's Nuclear Leadership Forum to discuss long-term management matters
- ✦ Collaboration to ensure cost-effective, publically acceptable and accessible long-term radioactive waste management facilities will be available to support sustainable Canadian nuclear industry

This item should be closed

Planned Measure 3:

Consolidated waste and decommissioning regulations

- ✦ CNSC Discussion paper on proposed approach published in May 16, 2016
- ✦ CNSC proceeding with modernizing of regulatory framework
- ✦ CNSC will revisit the need for regulations on waste management and decommissioning in the future once updated regulatory documents are in place and experience gained following implementation

This item should be closed

Progress on Planned Measures to Improve Safety from the 5th Review Meeting (cont.)

Planned measures 4:

Federal environment minister decision for OPG's DGR project for its L&ILW

- ✦ May, 2015, the Joint Review Panel (JRP) panel submitted an environmental assessment report to the federal Minister of Environment and Climate Change for a decision on its recommendations. The panel concluded “that the project is not likely to cause significant adverse environmental effects, taking into account the implementation of the mitigation measures committed to by OPG, together with the mitigation measures recommended by the panel”
- ✦ In 2017, the Minister of Environment and Climate Change requested additional information from OPG. OPG is currently working on this new request for information

This item is open and ongoing

Planned measures 5:

Continue progress in engineered design and site selection process for the long-term management of spent fuel (Adaptive Phased Management)

- ✦ In 2014, NWMO's engineering and design program completed a new engineered-barrier system design. NWMO has further optimized that design, in part to take advantage of current manufacturing capabilities
- ✦ NWMO completed the first phase of preliminary assessments, initiated geoscientific and environmental fieldwork , and broadened engagement with First Nations, Métis and other communities
- ✦ NWMO plans to select a site by 2023

This item should remain open

Planned Activities for Canada during the next JC Reporting Period

- ✦ Complete licensing process for CNL accelerated decommissioning and remediation projects (NDP, Whiteshell and NSDF)
- ✦ Canada's radioactive waste owners (AECL, OPG, Hydro-Québec, NB Power) have formed the Radioactive Waste Leadership Forum and are discussing options for an integrated strategy
- ✦ Modernize the Waste and Decommissioning Regulatory Framework
- ✦ Implementation of *The Impact Assessment Act* (IAA) (pending passage by Parliament)

Proposed Good Practices for Canada in Context of 6th Review Meeting

Openness and transparency

- Public Commission hearings
 - Throughout life-cycle, not just at initial licensing stage
 - webcast of **all** Commission hearings
- Regular opportunities for public participation throughout the licensing period via the presentation of Regulatory Oversight Reports (annually or bi-annually)
- Participant funding to help the public and Indigenous communities to submit value-added info to the Commission
- CNSC engagement program
- Licensees' public information programs and proactive public disclosure
 - Advance project implementation openly and collaboratively with communities involved
 - Publish findings from technical and social studies, decisions and rationale, to inform dialogue and ensure transparency
 - NWMO Indigenous Knowledge Policy ensures Indigenous Knowledge is valued and respected in planning and decision-making processes

Proposed Good Practices for Canada in Context of 6th Review Meeting (cont.)

CNSC's Independent Environmental Monitoring Program (IEMP)

- Independently confirms that the environment surrounding the CNSC regulated nuclear facilities are safe
- Establishes or updates baseline results of environmental data in public areas
- Program examines both radiological and non-radiological substances in a variety of environmental media
- Integrates Indigenous input in sampling plan (locations and food to be sampled)
 - Provides meaningful results by consulting with Indigenous communities, walking their lands and seeing what is of importance to them
 - Program is flexible and can react to requests from communities
- Reports and interactive map of results available on CNSC's public website

Proposed Good Practices for Canada in Context of 6th Review Meeting (cont.)

Interweaving of Indigenous knowledge with western science

- Siting of Deep Geological Repository implemented with the involvement of Indigenous people
- NWMO's Indigenous Knowledge Policy commits that Indigenous Knowledge will inform all of NWMO's work activities
- Importance of ceremony in planning and executing field investigations
- Involvement of local Indigenous Guides and knowledge holders
- Cultural Awareness Training regularly provided for NWMO staff, contractors and siting community members
- Strong Indigenous representation within NWMO

Proposed Challenges for Canada in Context of 6th Review Meeting

- ❖ Open from last Review Meeting: Finding an acceptable site in a willing host community for spent fuel repository
- ❖ Develop an integrated strategy for non-OPG low and intermediate-level waste disposal
- ❖ Continued accelerated decommissioning and remediation of CNL sites

Conclusions

Canada has demonstrated

- ✦ Its commitment to the Joint Convention objectives
- ✦ Its compliance with the Articles of the Joint Convention
- ✦ Its openness and transparency
- ✦ Its commitment to the safety of human health and the environment
- ✦ Its commitment to the improvement of the safety of spent fuel and radioactive waste management



All categories of radioactive waste are currently managed in facilities that are safe, secure and environmentally sound

Recommendations to the President of the Joint Convention

The President of the JC should continue to:

- ✳ Remind CPs of their obligations, especially to actively participate
- ✳ To name CPs who are not meeting the obligations of the JC in his report
- ✳ Write a letter to the Head of State of the countries who are not meeting the obligations of the JC
- ✳ Table issues and recommendations from the 6th RM to be discussed at the next Organizational Meeting for the 7th RM
- ✳ Monitor issues related to CPs not meeting their obligations, develop recommendations for remedial action and inform the IAEA Director General of such recommendations as appropriate

Canada encourages Contracting Parties to commit to peer reviews, openness and transparency

Overarching Issues for the Joint Convention and Contracting Parties

- 🍁 The Joint Convention must be the global champion of waste safety
- 🍁 Social acceptability of long-term waste management solutions
- 🍁 Internationally benchmarking the classification of intermediate-level waste
- 🍁 The growing number of nuclear facilities undergoing transition to decommissioning
 - Management of waste including large metal components
 - Decommissioning plans: Accelerated vs Deferred
 - Knowledge management and retention
- 🍁 Global implementation of the three “Rs”: Reduce, Reuse, Recycle
 - Reduction of environmental footprint through recycling

Nuclear safety is a global responsibility

Joint Convention on the Safety of Spent Fuel Management
and on the Safety of Radioactive Waste Management

APPENDIX A: CANADA'S MATRIX FOR THE 6TH NATIONAL REPORT

Matrix for Canada's 6th National Report

Type of Liability	Long-term Management (LTM) Policy	Funding of Liabilities	Current Practice / Facilities	Planned Facilities
Spent Fuel (SF)	National approach for the LTM of SF <i>Nuclear Waste Fuel Act</i> (NWFA, 2002) outlines process and implementation	Long-term: • licensees are required to contribute to segregated funds to finance LTM activities under the NWFA Short-term: • licensees are financially responsible and required to provide a Financial Guarantee (FG) for the decommissioning of interim WMFs for SF under the Nuclear Safety and Control Act (NSCA)	SF held in interim storage in wet or dry storage facilities located at the waste producers' site SF from research reactors is either returned to the fuel supplier or transferred to Canadian Nuclear Laboratories (CNL) Chalk River Laboratories (CRL) for storage	Long-term: • Nuclear Waste Management Organization (NWMO) implementing the Adaptive Phased Management (APM) Approach - a deep geological repository (DGR) for the LTM of SF in Canada Short-term: • Interim dry storage facilities are constructed as needed
Nuclear Fuel Cycle Waste	Licensees are responsible for the funding, organization, management & operation of their waste management facilities (WMFs) (<i>Radioactive Waste Policy Framework</i> , 1996) Government of Canada accepted responsibility for LTM of historic wastes and funds the management of legacy waste	Licensees are financially responsible and required to provide a FG for the decommissioning and LTM of the waste they produce	<ul style="list-style-type: none"> • Managed by licensee (onsite or at a dedicated WMF) • Managed in-situ/ above ground mounds • Managed in near-surface facilities adjacent to the mines and mills • Waste from small generators transferred to licensed WMFs for management 	<ul style="list-style-type: none"> • OPG planning a DGR for LTM of its low-level waste (LLW) & Intermediate-level waste (ILW) • CNL assessing CRL site for hosting LTM facilities for LLW & ILW • LTM of the bulk of Canada's historic waste implemented under the Port Hope Area Initiative (PHAI) • LTM of Uranium Mines and Mills (UMM) in near-surface facilities adjacent to the mines and mills • CNL assessing options at CRL site for hosting LTM facilities for radioactive wastes
Application Wastes	Licensees are responsible for the funding, organization, management and operation of their WMFs	Licensees are financially responsible and required to provide a FG for the decommissioning and the LTM of the waste that they produce	<ul style="list-style-type: none"> • delay and decay • returned to manufacturer • transferred to licensed WMFs for management 	CNL assessing options at CRL site for hosting LTM facilities for radioactive wastes
Decomm. Liabilities	<ul style="list-style-type: none"> • licensees are responsible for the funding, organization, management and implementation of decommissioning activities • licensees to give due consideration to the immediate dismantling approach when proposing a decommissioning strategy (G-219) 	Licensees are financially responsible and required to provide a FG for the decommissioning & the LTM of the waste that they produce	Major facilities required to keep decommissioning plans and FG up to date throughout the lifecycle of a licensed activity (G-219). These are reviewed on a five-year cycle by the licensee and regulator.	CNL assessing CRL site for hosting LTM facilities for LLW & ILW
Disused Sealed Sources	Licensees are responsible for the funding, organization, management and operation of their WMFs	Licensees are financially responsible and required to provide a FG for the decommissioning and the LTM of the waste that they produce	<ul style="list-style-type: none"> • delay and decay • returned to manufacturer • transferred to licensed WMF for LTM • recycling by reusing, re-encapsulating, or reprocessing National Sealed Source Registry & Sealed Source Tracking System	CNL assessing options at CRL site for hosting LTM facilities for radioactive wastes

Canada 

