Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Canada

CANADIAN NUCLEAR SAFETY COMMISSION

Mr. Ramzi JAMMAL

Executive Vice-President and Chief Regulatory Operations Officer

Continuous Improvement of Safety for Facilities and Activities

International Nuclear Safety and Decommissioning Industry Forum 2018

July 11, 2018

OUR MANDATE

Regulate the use of nuclear energy and materials to protect **health**, **safety**, **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

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

CNSC's NEW PRESIDENT

Ms. Rumina Velshi appointed President and Chief Executive Officer for a five-year term effective August 22, 2018.

MS. RUMINA VELSHI
President and Chief Executive Officer,
Canadian Nuclear Safety Commission

DR. MICHAEL BINDER
President and Chief Executive Officer,
Canadian Nuclear Safety Commission
January 2008 to August 8, 2018

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

COMMISSION MEMBERS

MR. TIMOTHY BERUBE

Appointed
Mar. 12, 2018
Four-year term

DR. SANDOR DEMETER

Reappointed
Mar. 12, 2018
Five-year term

DR. MARCEL LACROIX

Appointed
Mar. 12, 2018
Four-year term

MS. KATHY PENNEY

Appointed
Mar. 12, 2018
Four-year term

MS. RUMINA VELSHI

Reappointed
Mar. 12, 2018
Five-year term

CANADA'S MINES AND MILLS

MINING OPERATIONS

ACTIVE MINING OPERATIONS (SASKATCHEWAN):

- Key Lake Mill (Cameco)
- McArthur River Mine (Cameco)

} **On 10-month suspension starting Feb 1, 2018**

- Rabbit Lake Mine/Mill (Cameco)
  - announced suspension – April 2016
- Cigar Lake Mine (Cameco)
- McClean Lake Mine/Mill (Orano)
  - licence renewed until June 30, 2027

Increased interest in exports to China and India

Global price not supportive of production – Low demand and oversupply

Above: Key Lake Mill Below: McArthur River Mine

MINING PROJECTS

MINING PROJECTS (NORTHERN SASKATCHEWAN):

Environmental assessment review complete:

- Midwest (northern Saskatchewan) (Orano)
  – awaiting application

Projects under review

- Millennium (northern Saskatchewan)
  – on hold for economic reasons
  – tailings management inspections ongoing

Above: Midwest Project Below: Millennium Project

CANADA'S NUCLEAR POWER PLANTS

CANADIAN TECHNOLOGY – CANDU

Wolsong Nuclear Power Plant, Republic of Korea

CANADA DEUTERIUM URANIUM (CANDU) REACTORS

- Pressure tube type pressurized heavy water reactor (PHWR) with calandria vessel
- Major components of primary heat transport system (PHTS):
  - Fuel channels (380–480)
  - Feeders pipes (760–960)
  - Steam generators (4–12)
- Deployed in Canada, and exported around the world, including to the Republic of Korea at the nuclear power plant

CANADA'S NUCLEAR POWER PLANTS

- Six NPPs have operating licences
- 19 reactor units are operational
- Pickering units 2 & 3 in safe storage
- Gentilly-2 was shut down in 2012; decommissioning licence 2016
- 60 years of operating and regulatory experience with CANDU reactors
- Nuclear energy is **15%** of Canada's electricity mix; **60%** of Ontario's

CANADA'S NUCLEAR POWER PLANTS

Bruce Nuclear Generation Station: Bruce A (top), Bruce B (bottom)

BRUCE NUCLEAR GENERATING STATION (ONTARIO)

- Licence expires on May 31, 2020. Letter of intent for refurbishment filed on June 30, 2017.
- Public Commission hearing (Part 2) held on May 28–31, 2018.

CANADA'S NUCLEAR POWER PLANTS

Aerial view of Darlington Nuclear Generating Station

DARLINGTON NUCLEAR GENERATING STATION (ONTARIO)

- Licence expires on November 30, 2025
- Refurbishment project began in October 2016 and is scheduled for completion by 2026.

CANADA'S NUCLEAR POWER PLANTS

Aerial view of Pickering Nuclear Generating Station

PICKERING NUCLEAR GENERATING STATION (ONTARIO)

- Licence expires on August 31, 2018
- Application for a 10-year licence renewal, during which time Pickering will undergo permanent shutdown. Public Commission Hearing (Part 2) held on June 26–28, 2018

CANADA'S NUCLEAR POWER PLANTS

Aerial view of Point Lepreau Nuclear Generating Station

POINT LEPREAU NUCLEAR GENERATING STATION (NEW BRUNSWICK)

- Licence expires on June 30, 2022
- Refurbishment completed – Returned to service November 2012

GENERIC SAFETY ISSUES (GSI)

- The best available science is used to identify safety issues
  - IAEA TECDOC-1554, *Generic Safety Issues for Nuclear Power Plants with Pressurized Heavy Water Reactors and Measures for their Resolution*
- Ongoing research and development, and feedback from operating experience, are key elements in continuous safety improvements
- The CNSC tracks licensee progress in research and analysis of GSIs and verifies that appropriate conservative measures are implemented

REGULATORY APPROACH: LONG-TERM OPERATION

APPROACH TO LONG-TERM OPERATION

- Decision to refurbish is an **economic one**, made by the operator based on business needs such as strategy, cost, plant condition, etc.
- Current approach to long-term operation for nuclear power plants in Canada is based on periodic safety review:
  - 2000 to 2006: IAEA documents used to guide the reviews (NS-G-2.10)
  - 2008 to 2015: CNSC document RD-360, *Life Extension of Nuclear Power Plants*
  - 2015 to now: CNSC REGDOC-2.3.3, *Periodic Safety Reviews* (based on SSG-25)

REGDOC-2.3.3, PERIODIC SAFETY REVIEWS

- Systematic and comprehensive self-assessment across fourteen Safety and Control Areas performed every ten years assesses
  - actual condition of the plant considering cumulative effects of aging and operating experience
  - degree of conformance to modern codes, standards and best practices
  - practicable modifications or enhancements that should be made to enhance safety during the PSR period
- Supports move to a ten-year licence and decision making on long-term operation

SAFETY AND CONTROL AREAS

- 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

INTEGRATED SAFETY REVIEWS

- An integrated safety review (ISR) identifies the improvements to be made to:
  - resolve safety issues
  - address gaps identified through the comparison of requirements in place at the time of plant construction with current requirements
  - assess the adequacy of arrangements in place to maintain plant safety for long-term operation
- The ISR process can:
  - validate existing plant safety features and programs
  - result in changes to plant systems and programs to improve safety

INTEGRATED IMPLEMENTATION PLAN

- Licensees are required to establish an integrated implementation plan (IIP) to address the identified gaps and to support LTO
- IIP should include:
  - replacements, maintenance or modification of degraded components
  - practicable physical and/or programmatic scheduled enhancements including safety upgrades
  - long-term R&D strategy to identify and mitigate potential life-limiting issues and enhance inspection techniques
  - long-term operating strategy beyond the PSR period based on potential life-limiting issues to the end of commercial operation

PROCESS OVERVIEW

- Process involves replacement, maintenance, and/or modifications to major systems, structures and components
  - steam generators
  - fuel channels/feeders
- Licensees address high-level safety goals to identify safety upgrades
  - emergency filtered containment venting system
  - makeup capability to shield tank (or calandria vault) to support retention
- Licensees may proceed with the activities supporting long-term operation upon acceptance of the plan by CNSC staff
  - licence is amended to include appropriate conditions for return-to-service

STATUS OF PSR-INFORMED LTO PROJECTS

YEARLY REGULATORY OVERSIGHT REVIEW OF LICENSEE REGULATORY PERFORMANCE WITH PUBLIC INTERVENTIONS

Pickering NGS

- ISR completed in 2009 for Pickering B to support LTO
- PSR completed to support continued operation of six units
  - 2024 forecast as end of commercial operations

Bruce NGS

- Bruce 1–2: Restarted in 2012 after refurbishment
- Bruce 3–8: PSR completed to support LTO
  - Refurbishment planned 2020–2033

Darlington NGS

- PSR completed in 2015
- Refurbishment started 2016; all four units to be complete by 2026
- Updated PSR for LTO beyond 2025

POST-FUKUSHIMA ACTION PLAN

CHRONOLOGY

Apr 2011 - CNSC Task Force convened

Jul 2011 - Safety Review Criteria – Canadian "Stress Test" issued

Oct 2011 - CNSC Task Force Report – Issued for public comment

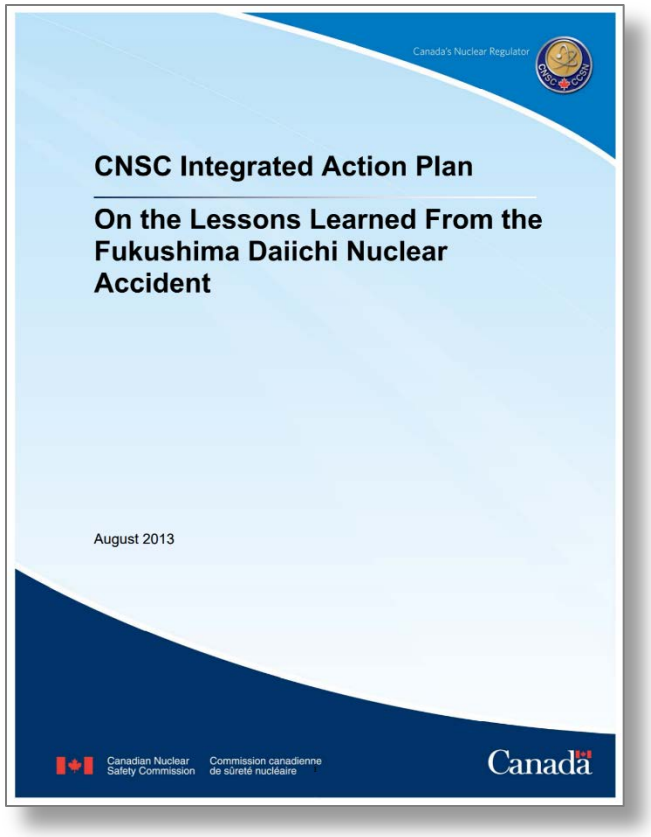
Dec 2011 - IRRS Mission conducted

Mar 2012 - CNSC Staff Action Plan – Issued for public comment

Apr 2012 - External Advisory Committee Report issued

Jun 2012 - CNSC Action Plan – Approved by the Commission

Dec 2013 - Short-term actions completed



CNSC SAFETY REVIEW CRITERIA

- Consistent with the defence-in-depth approach
- Prevention and mitigation of events at several levels
- Review elements
  - External hazards
  - Beyond-design-basis accidents
  - Accident mitigation
  - Emergency measures
  - Regulatory framework and processes

ASSESSMENT vs SAFETY REVIEW CRITERIA

- External hazards
  - Magnitude of external hazard
  - Combination of external hazards (seismic, flooding, extreme weather events)
- Beyond-design-basis accidents
  - Accident prevention and mitigation to verify margins to severe accidents
- Onsite accident management
  - Effective implementation of Severe Accident Management Guidelines
- Offsite emergency measures
  - Assess state of emergency readiness at all jurisdictional levels
  - Evaluate communications and responsibilities
- Regulatory framework and processes
  - Regulations and regulatory documents
  - Licensing and compliance

CNSC FUKUSHIMA TASK FORCE REPORT

Thirteen recommendations in three areas

- Strengthening defence in depth
  - External events and beyond-design-basis accidents
  - Design and safety analysis
  - Severe accident management
- Enhancing emergency preparedness
  - Offsite emergency response
  - Multiple jurisdictions
- Improving regulatory framework and processes
  - Act, regulations and regulatory documents
  - Compliance and licensing processes
  - International cooperation

Shift in regulatory focus from accident prevention to

ACCIDENT PREVENTION AND MITIGATION

STRENGTHENING DEFENCE-IN-DEPTH

Licensee actions

1. Verify effectiveness of existing plant design capabilities in beyond-design-basis accident conditions and supplement where appropriate
2. Conduct more comprehensive assessments of site-specific external hazards
3. Enhance deterministic and probabilistic modelling for beyond-design-basis conditions, including:
    a) Multi-unit events
    b) Accidents triggered by extreme external events
    c) Spent fuel pool accidents

EMERGENCY PREPAREDNESS / RESPONSE

Licensee actions

4. Emergency plans (onsite)
   a) Assess to ensure emergency response organizations capable of responding effectively in severe event and/or multi-unit accident
   b) Conduct sufficiently challenging emergency exercises
5. Emergency facilities and equipment - review and update

CNSC and federal/provincial actions

6. Provincial and Federal Nuclear Emergency Planning
   a) Ensure plan revision activities expedited and regular functional and full-scale exercises prioritized
   b) Establish formal, transparent, national-level oversight process for offsite nuclear emergency plans, programs and performance
   c) Review planning basis offsite arrangements for multi-unit accident scenarios

REGULATORY FRAMEWORK & PROCESSES

CNSC actions

7. Amendments to Class I Regulations
8. Amendments to *Radiation Protection Regulations*
9. Amendments to regulatory framework
10. Operating licence amendments
11. Implementation of periodic safety review process
12. Collaboration with CANDU owner countries
13. International regulatory cooperation

STRENGTHENING DEFENCE IN DEPTH

Licensee:

- Overpressure relief capacity for beyond-design-basis events
- Containment performance
  - Emergency filtered containment venting for severe accidents
  - Passive autocatalytic recombiners to control hydrogen and other gases
- Additional means for water make-up for beyond-design-basis accidents
  - steam generators, primary heat transport system, moderator, shield tank, and spent fuel pools
- Evaluation of the structural integrity of the spent fuel pools at temperatures in excess of design temperature

FUKUSHIMA ACTION ITEMS COMPLETED

ALL ACTION ITEMS WERE COMPLETED WITHIN TIMELINE

Deliverables

- 36 actions: Nuclear power plants (NPPs)
- 11 actions: Major nuclear facilities (non-NPPs)
- 35 actions: CNSC

Timeline

- Short-term: 12 months (December 2012)
- Medium-term: 24 months (December 2013)
- Long-term: 48 months (December 2015)

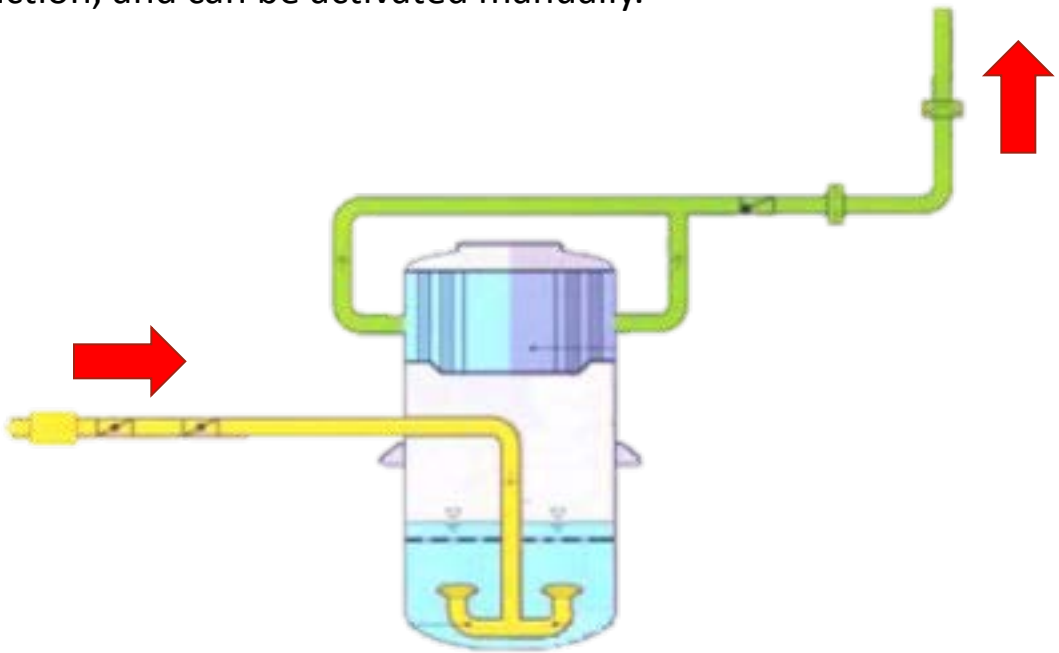
POST-FUKUSHIMA ENHANCEMENTS

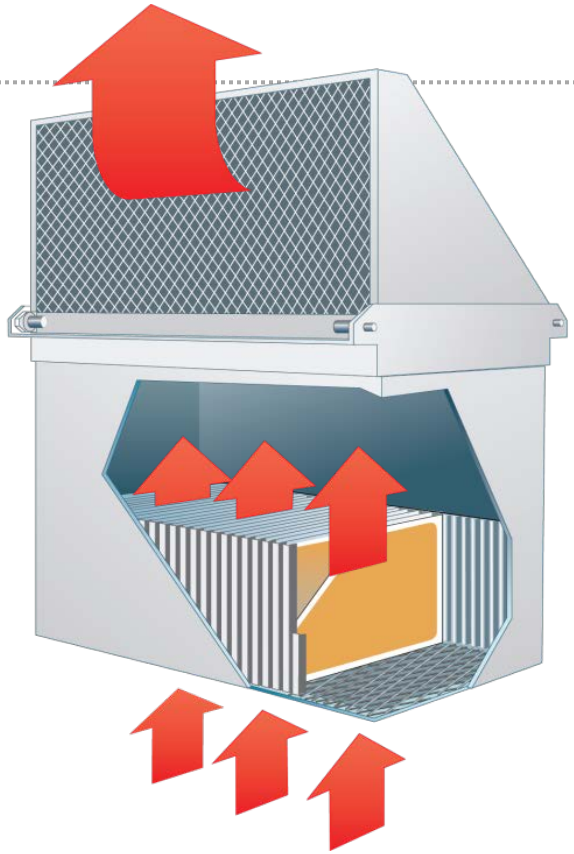
- **Level 4: Preventing and mitigating severe accidents**
  - protecting containment
    - passive hydrogen recombiners
    - containment cooling and filtered venting
    - severe accident management guidelines validation/exercise
  - implemented during scheduled outages
- **Level 5: Protecting the public**
  - automated real-time boundary radiation monitoring
  - source term estimation capability
  - integrated emergency plans and full-scale emergency exercises
  - study of consequences of hypothetical severe nuclear accident
  - pre-distribution of potassium iodide pills

PROTECTING CONTAINMENT

Emergency containment filtered ventilation

The system is designed to provide additional filtering in case of a severe accident. It does not require power to function, and can be activated manually.





Hydrogen control and mitigation

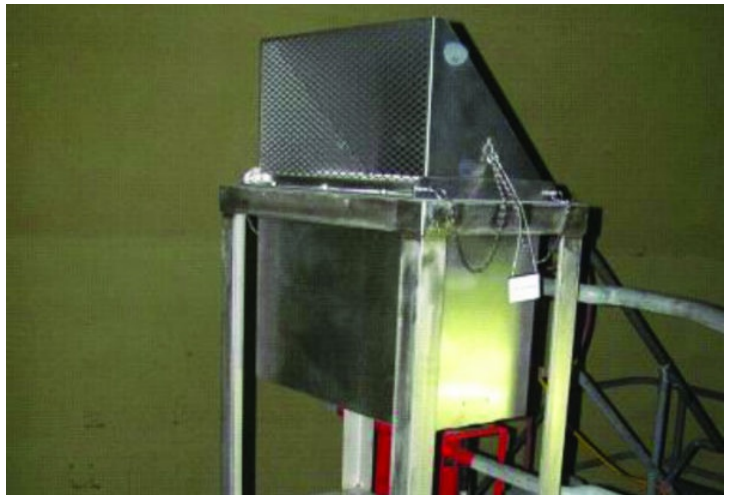
Passive autocatalytic recombiners (PARs) are designed to remove hydrogen in non-flammable atmospheres. Self starting it does not require power to function.

DEFENCE IN DEPTH

PROTECTING CONTAINMENT

Point Lepreau Emergency filtered vent stack

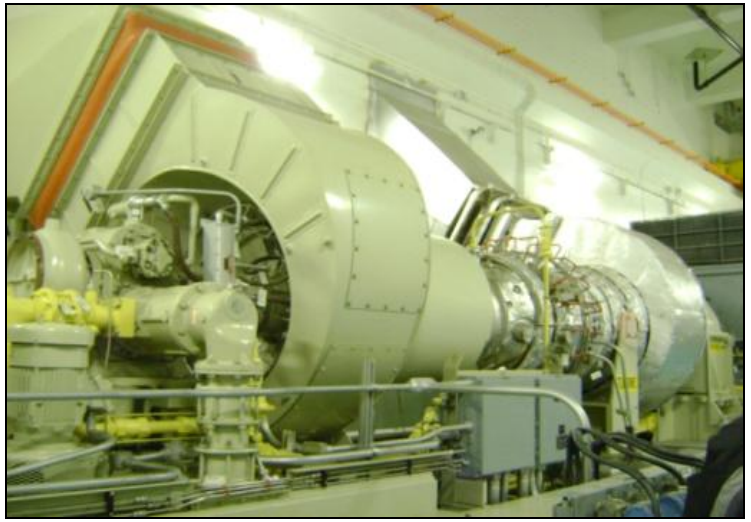
Containment filtered venting at Point Lepreau



Hydrogen control and mitigation with licensees have enhanced hydrogen control through installation of passive autocatalytic recombiners

POWER BACK-UP

Bruce A 400 kW Generator (2)



Emergency back-up equipment,
Darlington Nuclear Generation Station

Battery Bank, Bruce Nuclear Generating Station

DEFENCE IN DEPTH

SAFETY IMPROVEMENTS

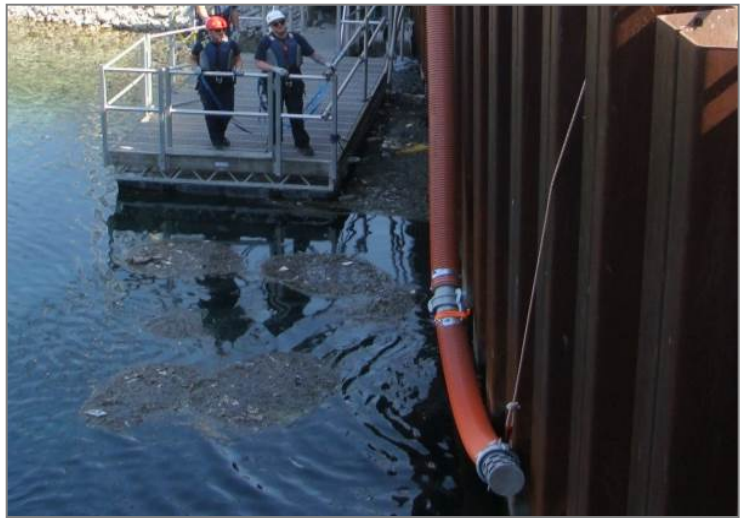
Flood protection

Dry hydrants

EME fire pumpers (five in total)

PREVENT SEVERE CORE DAMAGE

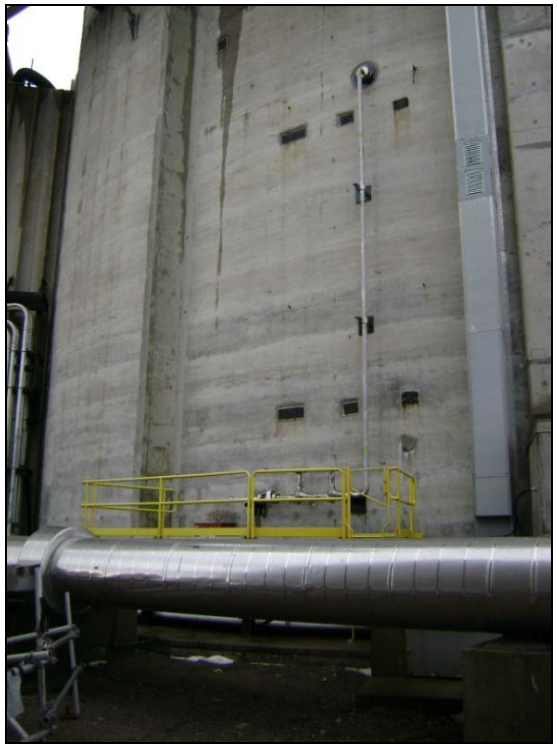
Bruce Power fire trucks provide cooling water. New emergency water pumping equipment procured and on site



Darlington emergency water supply

Darlington emergency portable pumps further strengthen emergency preparedness

CALANDRIA VAULT MAKE-UP



Point Lepreau calandria vault make-up

PROTECT SPENT FUEL POOLS

Water supply connection points

Permanent piping to spent fuel pool

ENHANCING EMERGENCY PREPAREDNESS (ONSITE)

Bruce Power new emergency response command and control facilities was demonstrated during Huron Challenge emergency exercise in Oct. 2012

OPG command centre

ENHANCING EMERGENCY PREPAREDNESS (OFFSITE)

Real-time radiation monitoring

Potassium Iodine (KI) Pills

Evacuation and decontamination station

NUCLEAR EMERGENCY MANAGEMENT

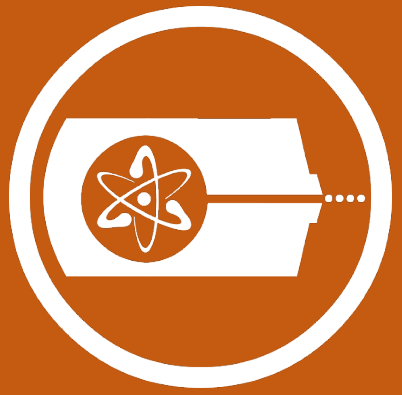
EMERGENCY MANAGEMENT REGULATIONS

- The CNSC is responsible for oversight of licensee actions and for providing support to provincial and federal authorities during an emergency
- CNSC published Discussion Paper DIS-17-01, *Framework for Recovery in the Event of a Nuclear or Radiological Emergency* (public comment period closed January 2018)
- The draft regulatory document is now posted for public consultation
- Canada will host an IAEA Emergency Preparedness Mission (EPREV) in 2019
- The mission will look at operators' and all levels of governments' nuclear emergency preparedness plans and procedures for Canadian nuclear facilities

EMERGENCY MANAGEMENT PROGRAM

The CNSC's role during a nuclear emergency is to:

- activate its Emergency Operations Centre (EOC)
- monitor the response of the licensee
- evaluate response actions
- provide technical advice and regulatory approval when required
- provide field response to assist local authorities as needed
- advise the government and inform the public on its assessment of the situation



REGULATION OF NUCLEAR SUBSTANCES

FOUR SECTORS

Medical (470 licences applicable to 9,802 workers)

- nuclear medicine, radiation therapy, veterinary nuclear medicine

Industrial (1,308 licences applicable to 43,072 workers)

- portable gauge, fixed gauge, industrial radiography and oil well logging

Academic and research (208 licences applicable to 7,240 workers)

- laboratory studies and consolidated uses of nuclear substances

Commercial (247 licences applicable to 1,899 workers)

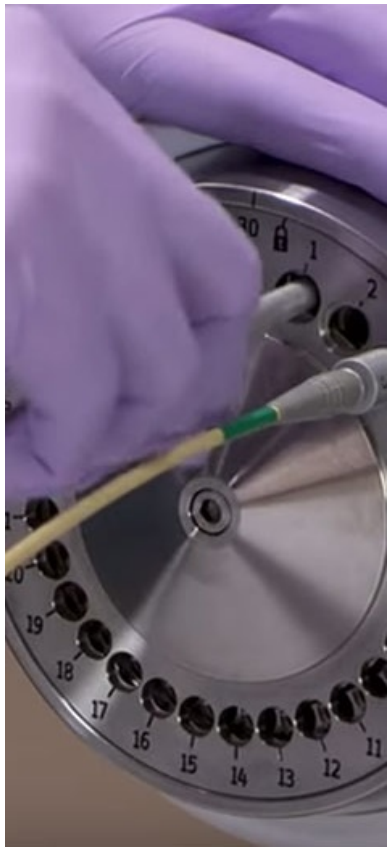
- Isotope production accelerators, processing of radiopharmaceuticals, distribution of nuclear substances and servicing and/or calibration of radiation devices and prescribed equipment

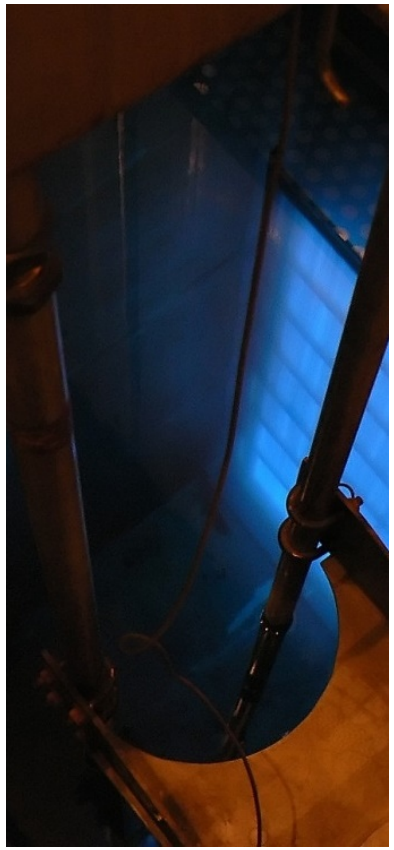
REGULATORY OVERSIGHT

- Licensees have the responsibility for safety
- Planning is based on risk-informed inspection frequencies and compliance history
- CNSC staff reviews applications and conducts technical assessments to determine if:
  - all CNSC regulatory requirements are met
  - adequate measures are in place to protect health, safety, security and the environment
- Continued safe use of nuclear substances in Canada
- REGULATORY REQUIREMNT FOR SEALED SOURCE TRACKING
  - IAEA CATIGORIES: 123- Risk significant sources – Tracked until final disposition
  - IAEA CATEGORIES: 4 and 5- Tracked annually through annual reporting.

SOURCE BASED PRESCRIBED EQUIPMENT

- Teletherapy and brachytherapy (medical)
- Pool type irradiators for sterilization (industrial)
- Research irradiators (academic)





CERTIFICATION OF PRESCRIBED EQUIPMENT

- The CNSC certifies prescribed equipment including certain types of irradiators, particle accelerators, and brachytherapy remote afterloader
- Manufacturers must prove that equipment has been designed to operate safely and meets Canadian regulations
- All equipment must be certified before it can be licensed
- The CNSC ensures compliance based on a risk-informed program, which includes desktop reviews, field inspections, and audits.

ONGOING REGULATORY FOCUS

- Improved oversight of radiation protection programs
- Continued focus on sharing OPEX from reported events
- Preparation for second phase of the implementation of REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources*
- Ongoing modernization of the regulatory framework

ADVANCED REACTOR PROJECTS

DEPLOYMENT OF SMALL MODULAR REACTORS IN CANADA

PROSPECT

- On-grid power generation to replace fossil fuels (~150-300 MWe)
- On- and off-grid combined heat and power for resource extraction and heavy industry; for example, oil sands or metal mining (~10-50 MWe)
- Off-grid diesel replacement for electricity, district heating, and desalination in remote communities (<10 MWe, many <2.5 MWe)
- Government-led pan-Canadian SMR Roadmap with utilities and stakeholders
- Many developers are proposing to use novel and integrated technological approaches for design, construction and operation

CNSC'S ROLE AND REGULATORY APPROACH

- The *Nuclear Safety and Control Act*, regulations and complete suite of regulatory documents ensure safety requirements in all aspects of design, construction, operation, and decommissioning
- Many developers are proposing to use novel and integrated technological approaches for design, construction and operation
- **Novel technologies and approaches are allowed, provided safety objectives are met**
- The CNSC published an SMR discussion paper in 2016 (DIS-16-04)

VENDOR DESIGN REVIEWS (VDRs)

- A pre-licensing VDR is a service provided by the CNSC when requested by a vendor
  - Considers areas of design related to reactor safety, security and safeguards
  - Provides feedback on how Canadian requirements are addressed in design and safety analysis and early feedback on the use of new design features and approaches
- Review does not certify a design or involve the issuance of a licence
- The CNSC is currently undertaking 10 VDRs in various phases

STRATEGY FOR READINESS – SMR

INCREASED REGULATORY CERTAINTY
Fairness, rigor, efficiency, transparency

ESTABLISHMENT OF TECHNICAL READINESS
Knowledge and capacity, enabling processes

ESTABLISHMENT OF PRIORITIES
What needs to be done and by when

INCREASED AWARENESS
Internally and with external stakeholders

SMR REGULATORY STRATEGY

- Current regulatory framework allows for flexibility in the licensing of projects using advanced technologies
- Need solid management system processes and capable workforce
- Necessary strategy, tools and process are either in place or are being developed to ensure regulatory clarity and effectiveness
- CNSC senior management are providing leadership to set the foundation for the regulation of SMRs
- Executive Vice-President chairs the internal SMR Steering Committee

WASTE MANAGEMENT AND DECOMMISSIONING

WASTES AND DECOMMISSIONING

- 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 and extensive stakeholder engagement and opportunities for public participation throughout the life cycle
- Annual reporting to the Commission on licensee regulatory performance
- Continuous safety enhancements based on modern codes and standards, operating experience, research findings and improved analytical methods

LICENSEE RESPONSIBILITY

- Waste owners are responsible for the funding, organization and operation of their waste management facilities and final disposal
- Licensees are responsible for justifying the option selected – accelerated or deferred – to decommission their facilities
- Applicants need to demonstrate that their proposed decommissioning strategy and activities meet CNSC requirements

MAJOR DECOMMISSIONING PROJECTS

Proposed Near Surface Disposal Facility, Chalk River Laboratories

THREE ENVIRONMENTAL ASSESSMENTS UNDER WAY FOR DECOMMISSIONING PURPOSES

- Near Surface Disposal Facility Project (Chalk River)
- Decommissioning of the Whiteshell Reactor #1 (Pinawa)
- Nuclear Power Demonstration Closure Project (Rolphton)

WASTE MANAGEMENT

OPG Used Fuel DSC's stored at the Western Waste Management Facility

OPG WASTE MANAGEMENT FACILITIES

- **Western** – Licence valid until May 31, 2027
- **Pickering** – Licence valid until August 31, 2027
- **Darlington** – Licence valid until April 30, 2023

WASTE MANAGEMENT

Aerial view of Port Hope and Granby

PORT HOPE AREA INITIATIVE (PHAI)

Port Hope and Port Granby – Implementation phase (facility construction ongoing)

- Port Hope waste nuclear substance licence – Valid until December 31, 2022
- Port Granby waste nuclear substance licence – Valid until December 31, 2021

OPG DEEP GEOLOGIC REPOSITORY (DGR) FOR LOW- AND INTERMEDIATE-LEVEL WASTE

- Joint review panel environmental assessment report – May 2015
- In November 2015, Minister of Environment and Climate Change requested additional information and further studies on environmental assessment
- On August 21, 2017, the Minister requested additional information from OPG on the potential cumulative effects of the DGR project on physical and cultural heritage of the Saugeen Ojibway Nation (SON) – the SON considers this as reconciliation in action

NUCLEAR WASTE MANAGEMENT ORGANIZATION (NWMO)

FINDING A SITE FOR HIGH-LEVEL RADIOACTIVE WASTE

There are 5 communities remaining in the NWMO's learn more process (out of 22 original communities – 19 in Ontario, 3 in Saskatchewan)

- **2023** – A single preferred site is identified
- **2028** – Licence applications submitted
- **2040 to 2045** – Operations begin

CNSC STAKEHOLDER ENGAGEMENT

WHY DOES PUBLIC ENGAGEMENT MATTER?

PART OF THE CNSC'S MANDATE UNDER THE *NUCLEAR SAFETY AND CONTROL ACT* IS TO DISSEMINATE OBJECTIVE SCIENTIFIC, TECHNICAL AND REGULATORY INFORMATION TO THE PUBLIC

- Public engagement ensures that regulators:
  - Make informed decisions
  - Are ready for change
  - Build trust in the regulatory process
- Part of the CNSC's mandate

CNSC ENGAGEMENT – WHO AND WHEN

Who?

- Core: Host communities, Indigenous peoples, and licensees
- Themed: Youth, academia, medical community and municipalities

When?

- On all major projects and initiatives
- In accordance with our Domestic Outreach and Engagement Plan
- In response to requests and unexpected issues
- On changes to our regulatory framework

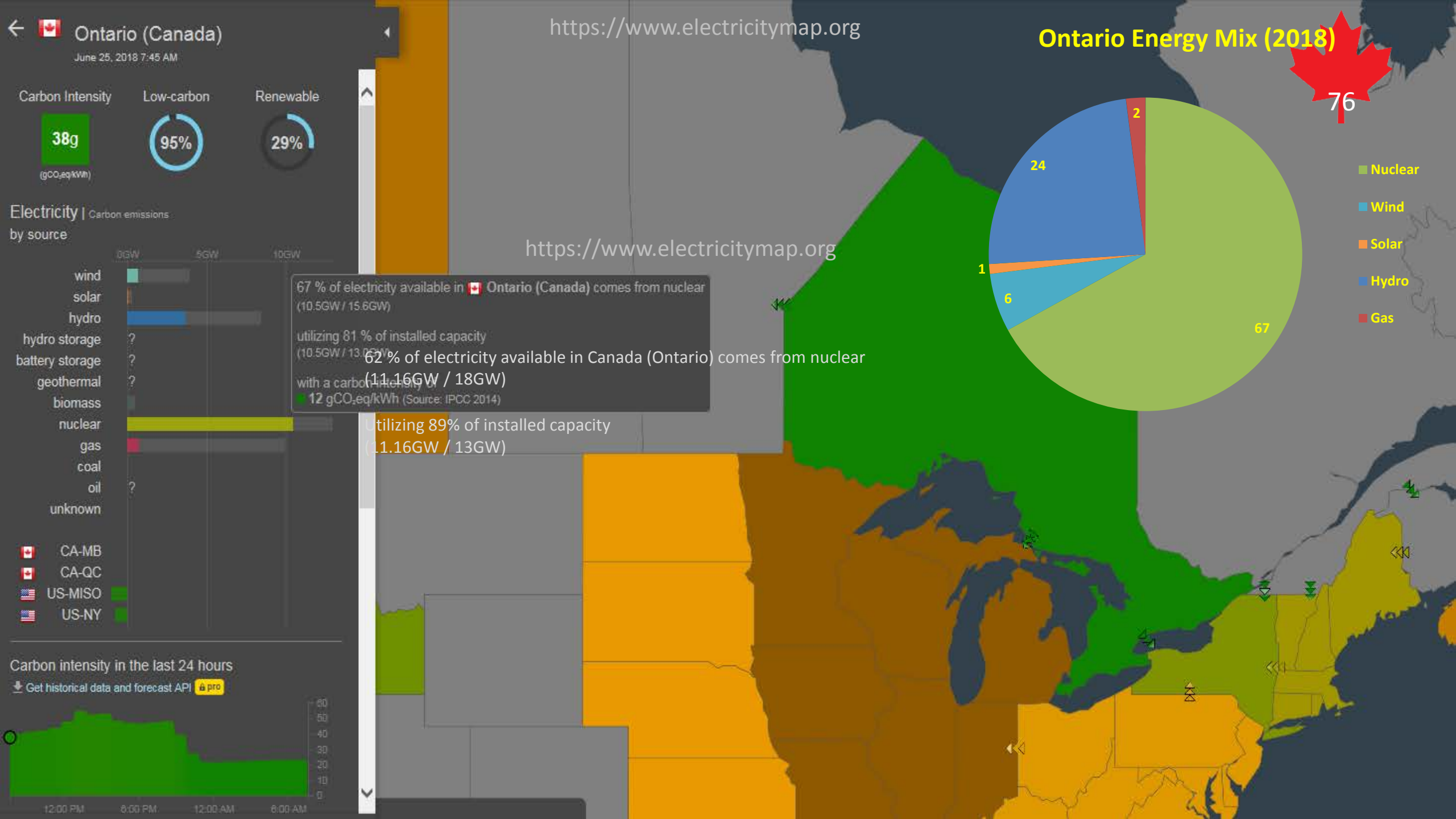
CNSC'S PUBLIC ENGAGEMENT ACTIVITIES

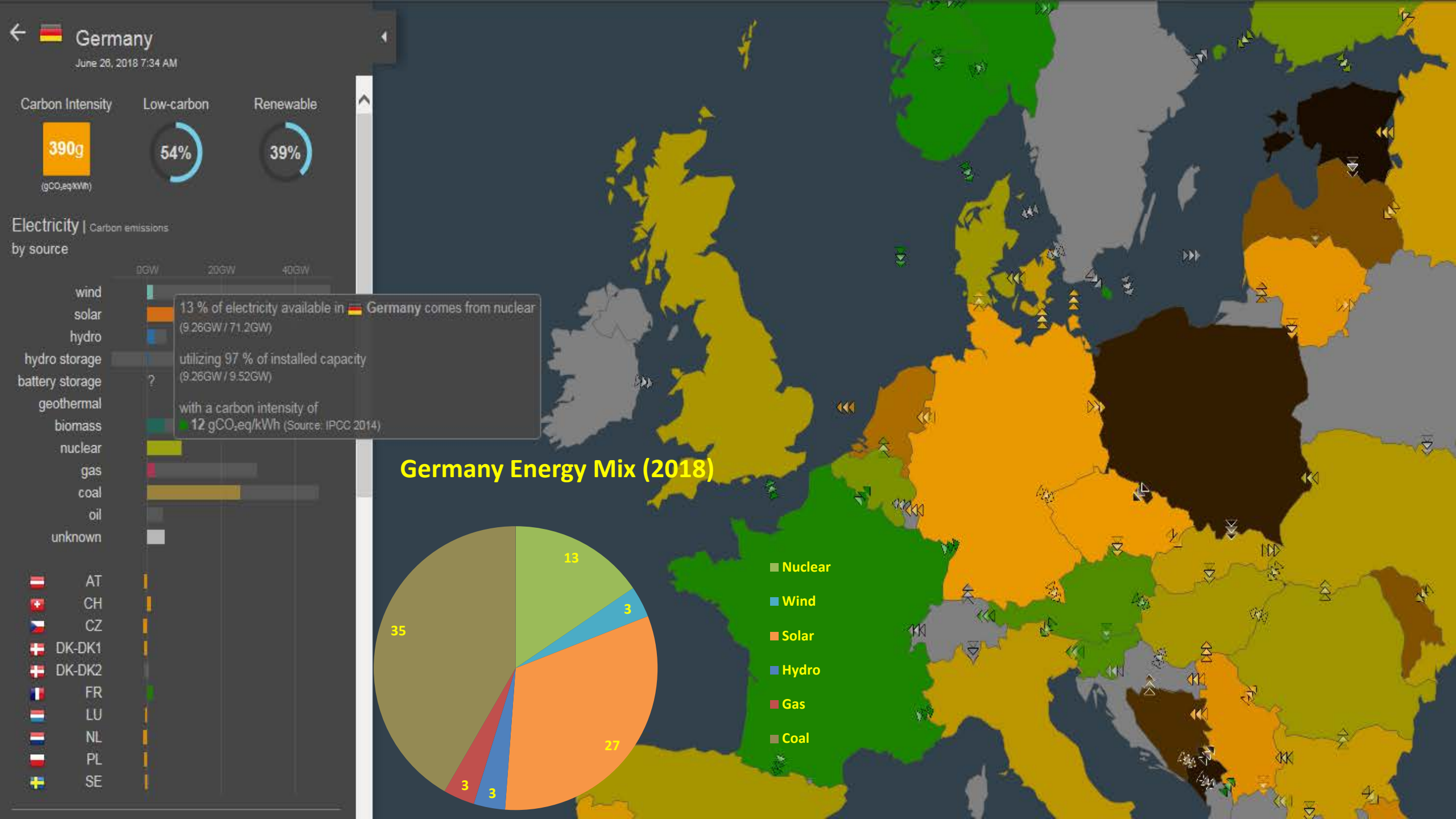
- In-person outreach activities
- Digital presence (website, emails, and social media)
- Consultations on regulatory framework
- Consultations with Indigenous peoples
- CNSC's Participant Funding Program
  - "Good Practice" at the 7th Review Meeting of the CNS
- Licensee's Public Information and Disclosure Program

CHALLENGES

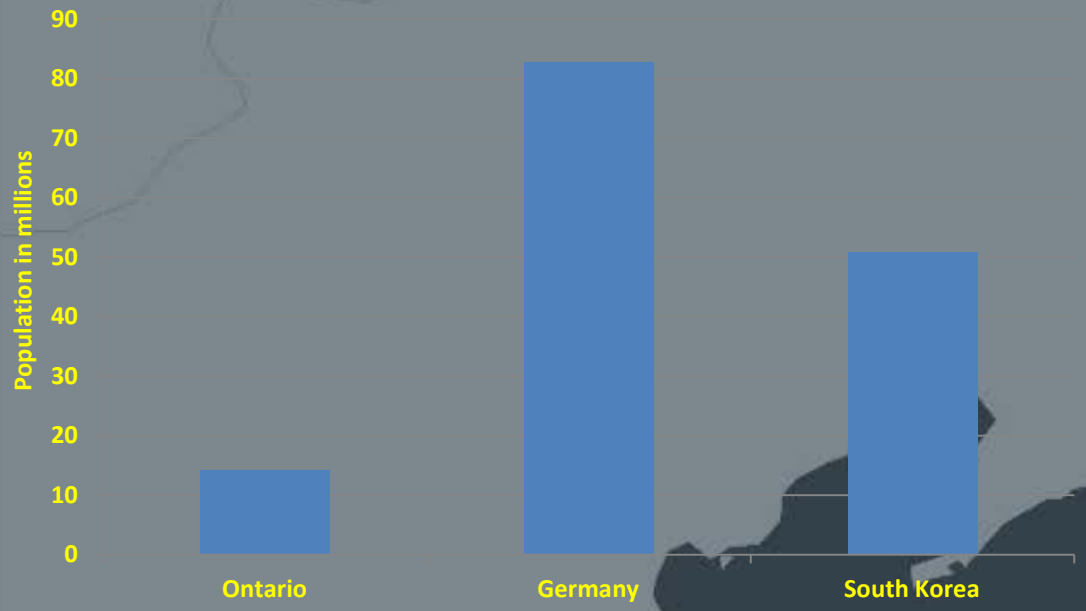
- The opinions of people who are either strongly for or against nuclear will not change, and it is difficult to capture the attention of the majority of people in the middle
- Social media has made it easier for false information to be spread quickly and broadly
- Unless there is an emergency, few people turn to the nuclear regulator for information
- Engaging in evolving issue areas such as transportation of waste require new approaches

NUCLEAR IS PART OF THE ENERGY MIX TO COMBAT CARBON EMISSION

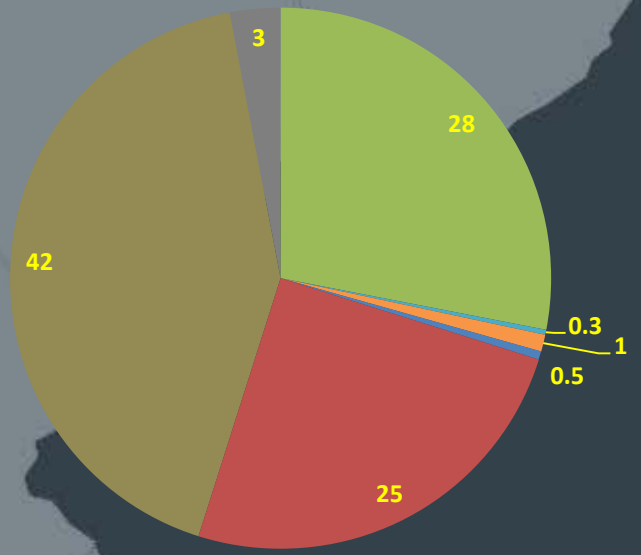

Ontario (Canada)
June 25, 2018 7:45 AM
Carbon Intensity
38g
(gCO2eq/kWh)
Low-carbon
95%
Renewable
29%
Electricity | Carbon emissions by source
0GW
5GW
10GW
wind
solar
hydro
hydro storage
battery storage
geothermal
biomass
nuclear
gas
coal
oil
unknown
CA-MB
CA-QC
US-MISO
US-NY
67 % of electricity available in Ontario (Canada) comes from nuclear
(10.5GW / 15.6GW)
utilizing 81 % of installed capacity
(10.5GW / 13.0GW)
with a carbon intensity of
12 gCO2eq/kWh (Source: IPCC 2014)
Carbon intensity in the last 24 hours
Get historical data and forecast API
pro
80
60
40
30
20
10
0
12:00 PM
6:00 PM
12:00 AM
6:00 AM
https://www.electricitymap.org
https://www.electricitymap.org
62 % of electricity available in Canada (Ontario) comes from nuclear
(11.16GW / 18GW)
Utilizing 89% of installed capacity
(11.16GW / 13GW)
Ontario Energy Mix (2018)
76
2
24
1
6
67
Nuclear
Wind
Solar
Hydro
Gas


Germany
June 26, 2018 7:34 AM
Carbon Intensity
390g
(gCO2eq/kWh)
Low-carbon
54%
Renewable
39%
Electricity | Carbon emissions by source
0GW
20GW
40GW
wind
solar
hydro
hydro storage
battery storage
geothermal
biomass
nuclear
gas
coal
oil
unknown
13 % of electricity available in Germany comes from nuclear (9.26GW / 71.2GW)
utilizing 97 % of installed capacity (9.26GW / 9.52GW)
with a carbon intensity of 12 gCO2eq/kWh (Source: IPCC 2014)
AT
CH
CZ
DK-DK1
DK-DK2
FR
LU
NL
PL
SE
Germany Energy Mix (2018)
13
3
27
3
3
35
Nuclear
Wind
Solar
Hydro
Gas
Coal

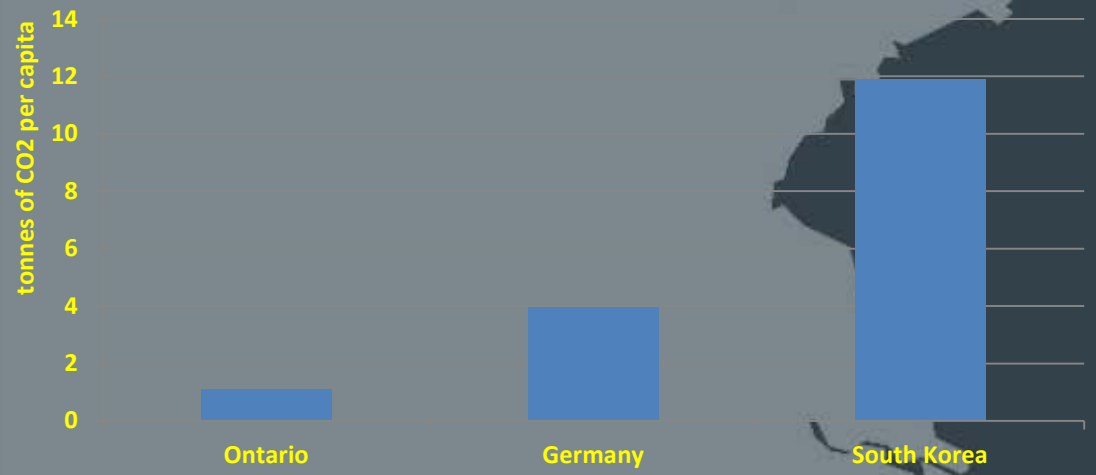
Comparison of population (2016)



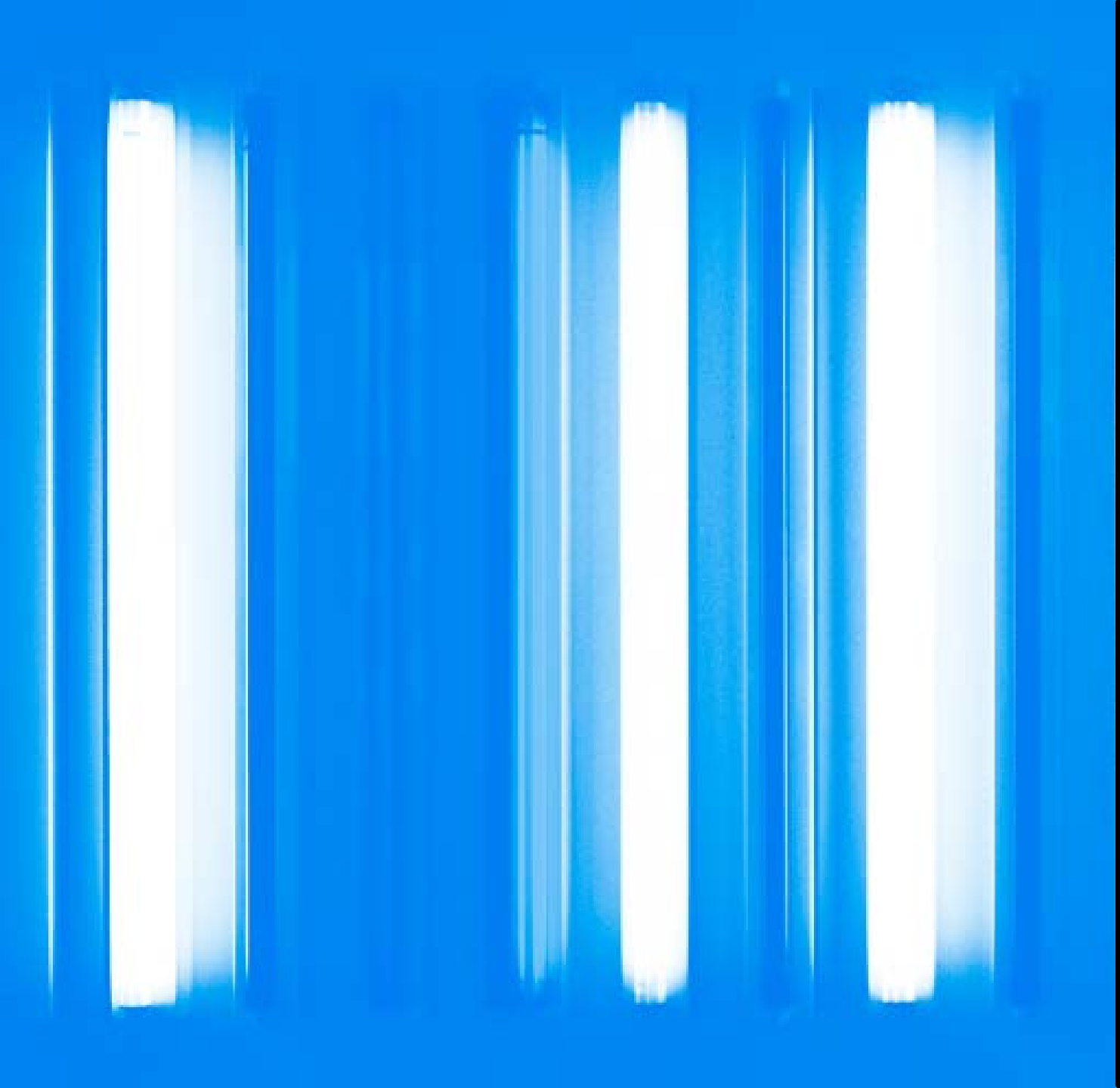
South Korea Energy Mix (2016)



Comparison of emissions per capita (2016)



CLOSING REMARKS



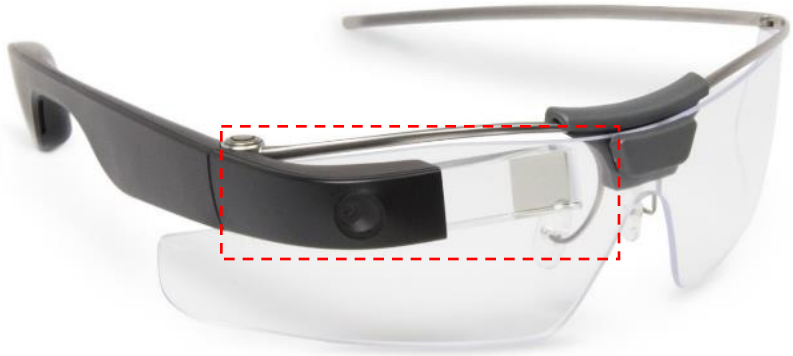
Disruptive technologies:

Are regulators ready?

DISRUPTIVE TECHNOLOGIES

GOOGLE (SAFETY) GLASSES

- Workplans projection
- Step-by-step guidance of work tasks
- Employees focus on tasks at hand
- Mimicking EPD performance



DISRUPTIVE TECHNOLOGIES

3D PRINTING

- Rapid prototyping
- Verify mechanical measurements
- In-house design verification
- Quick turnaround
- Pre-Implementation modelling

DISRUPTIVE TECHNOLOGIES

WIRELESS SENSORS

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

DRONES

OPG first used unmanned aerial vehicles to inspect Darlington's vacuum building

DISRUPTIVE TECHNOLOGIES

AUTONOMOUS VEHICLES

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

NEW ENERGY SYSTEMS

“Next-generation nuclear has the potential to disrupt the global energy mix”
“Fusion power has massive disruptive potential”

CONCLUSIONS

THE REGULATOR MUST

- have a questioning attitude
- seek continuous safety improvement
- increase regulatory knowledge
- have adequate numbers of competent staff
- make independent regulatory decisions
- encourage, promote and enforce compliance

GLOBAL SAFETY IS THE RESPONSIBILITY OF ALL STAKEHOLDERS, GOVERNMENT, INDEPENDENT REGULATORS AND INDUSTRY

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

nuclearsafety.gc.ca

Canada