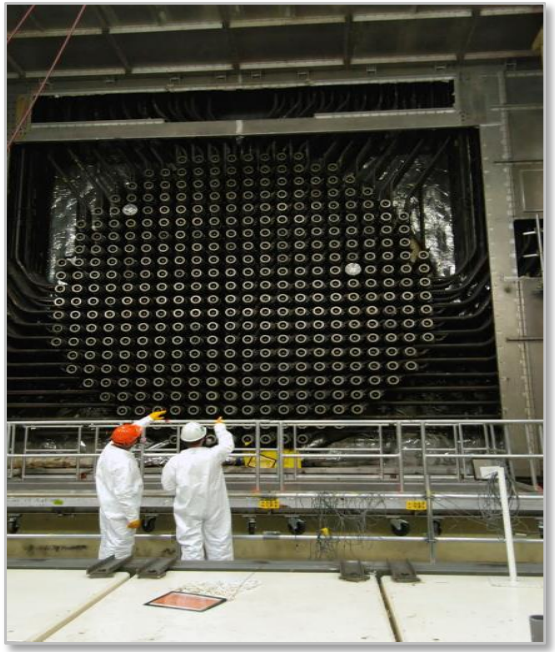
Canada

CANADA 150



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Canada

Convention on Nuclear Safety: 7th Review Meeting

Canada's Presentation
Country Group 3
March 28, 2017 - Vienna

CANADA 150

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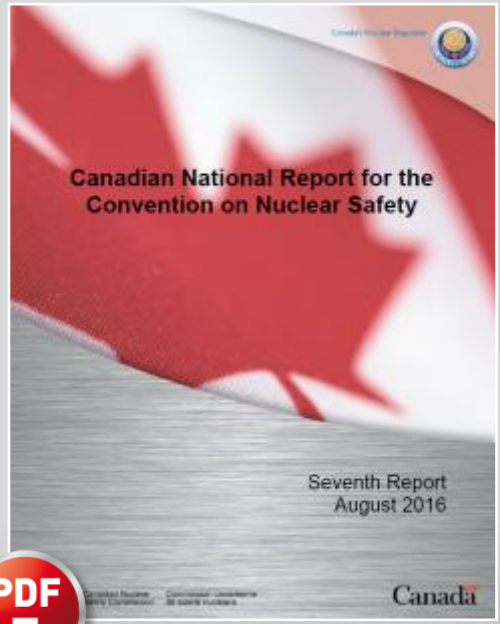

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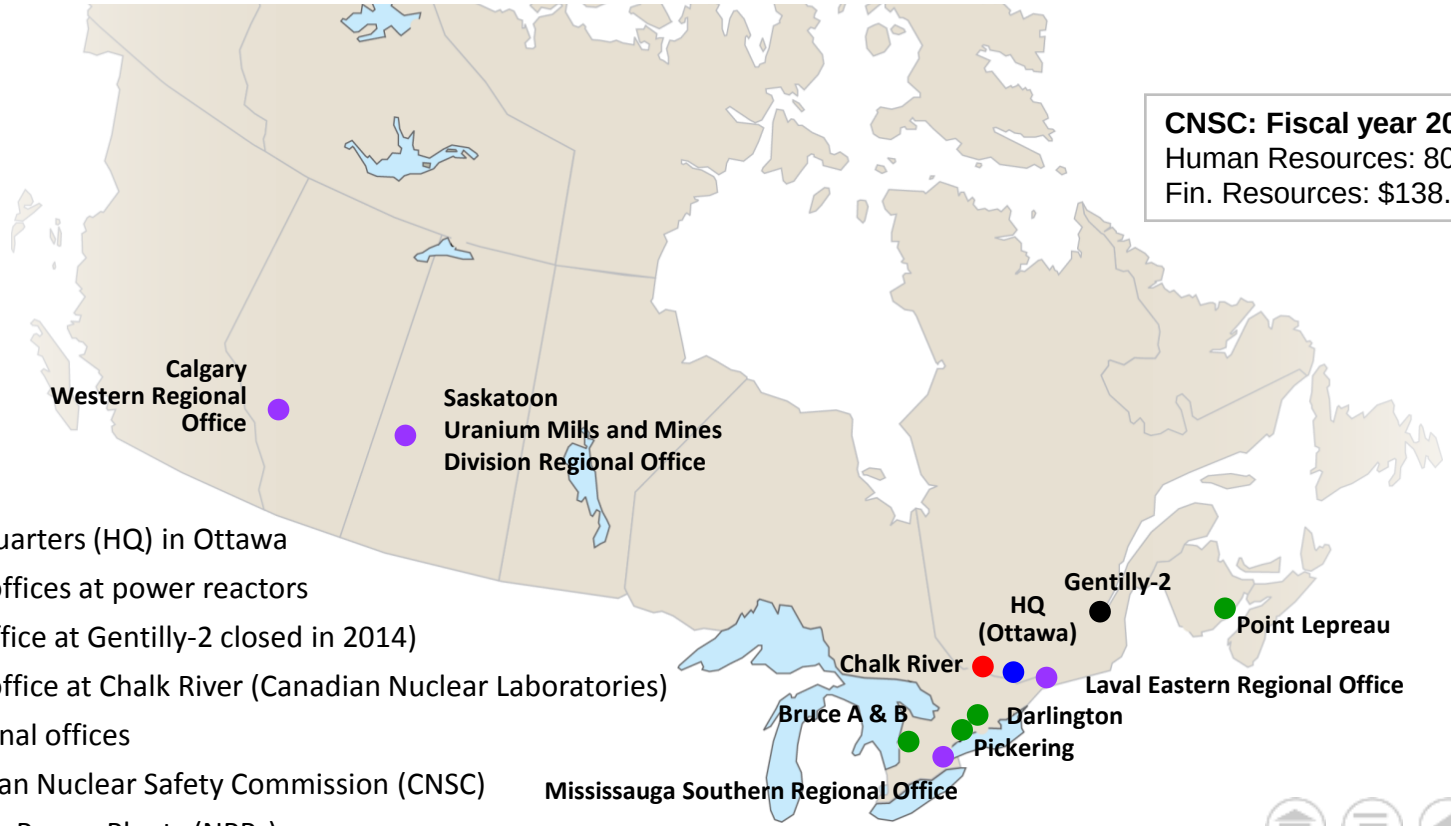
INTRODUCTION

Locations of CNSC Offices and NPPs in Canada



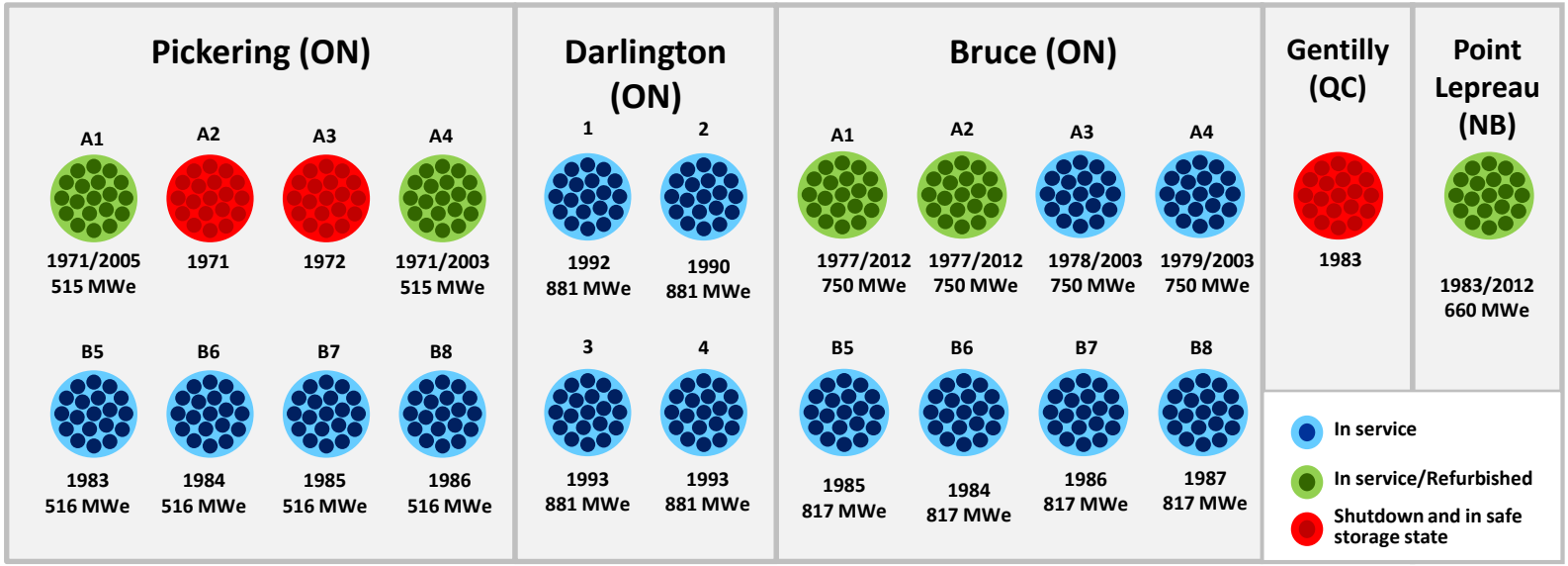
CNSC: Fiscal year 2015 – 16
Human Resources: 808 FTEs
Fin. Resources: $138.0 million

- Headquarters (HQ) in Ottawa
- 4 site offices at power reactors
- (Site office at Gentilly-2 closed in 2014)
- 1 site office at Chalk River (Canadian Nuclear Laboratories)
- 4 regional offices

Canadian Nuclear Safety Commission (CNSC)

Nuclear Power Plants (NPPs)

Status of NPPs in Canada



NPPs - Total of 19 units (operating) and 3 units (safe storage) at 5 sites

Bruce A & B	8 units
Pickering	6 units (operating), 2 units (safe storage)
Darlington	4 units
Gentilly-2	1 unit (safe storage)
Point Lepreau	1 unit

Typical share of nuclear energy in total electricity generation

- Canada - 17%
- Ontario - 66%
- New Brunswick - 31%

The Canadian Nuclear Safety Commission

- Established in May 2000, under the ***Nuclear Safety and Control Act***
  - Replaced the Atomic Energy Control Board, founded in 1946 under the ***Atomic Energy Control Act***
  - Assigns power and authority necessary to independently regulate nuclear activities

Over 70 years of nuclear safety

The Commission

- Independent, quasi-judicial tribunal and court of record
- Consists of up to seven members appointed under the authority of the *Nuclear Safety and Control Act*
- One member is designated as President of the Commission and Chief Executive Officer of the CNSC
- Supported by scientific, technical and professional staff

The Commission's decisions are reviewable only by the Federal Court of Canada

The Canadian Nuclear Safety Commission

- Mission:
  - The CNSC regulates the use of nuclear energy and materials to protect health, safety, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public
- Technical Support Branch forms an integral part of the CNSC
- Independent Legal Services Unit

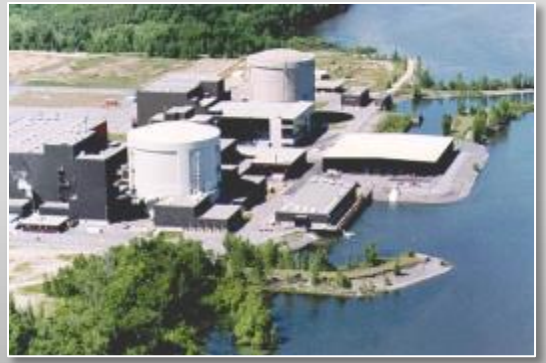
Transparent, science-based decision making

Canadian NPP Licensees (1/2)

- **Ontario Power Generation (OPG)**
  - Public company owned by the Government of Ontario
  - Licensed by the CNSC to operate the Darlington and Pickering sites (ten operating CANDU reactors and two reactors in safe storage)
  - Generates 6,600 megawatts of nuclear electricity
- **Bruce Power**
  - Private corporation
  - Licensed by the CNSC to operate the Bruce A & B sites (eight CANDU reactors)
  - Generates 6,400 megawatts of nuclear electricity
  - Largest operating NPP in the world in terms of electricity capacity

Canadian NPP Licensees (2/2)

- **NB Power**
  - Crown corporation owned by the Government of New Brunswick
  - Licensed by the CNSC to operate the Point Lepreau site (one CANDU reactor)
  - Generates 660 megawatts of nuclear electricity
- **Hydro-Québec**
  - Crown corporation owned by the Government of Quebec
  - Licensed by the CNSC with a decommissioning licence for the Gentilly-2 site (one CANDU reactor)
  - Reactor shutdown in 2012 and the transition to safe storage was completed by December 2014
  - Continuing to transfer irradiated fuel to dry storage modules



Associated Organizations

- **CANDU Owners Group (COG)**
  - Not-for-profit organization of licensees and international operators
  - Coordinates research and development activities and promotes sharing of operating experience
  - Provides various programs for its members
  - International members from Argentina, Canada, China, India, Republic of Korea, Pakistan and Romania
- **CSA Group (formerly the Canadian Standards Association)**
  - Canada's largest, member-based standards development organization
  - Sets voluntary consensus standards (CSA Group standards) developed by national stakeholders and public interests related to NPPs and other nuclear facilities and activities

Major Nuclear Power Industry Organizations

- **Atomic Energy of Canada Ltd (AECL)**
  - Crown corporation owned by the Government of Canada
  - Mandate is to enable nuclear science and technology for the benefit of Canadians and industry, and to fulfill Canada's radioactive waste and decommissioning responsibilities
  - Delivers this mandate through contractual arrangements with Canadian Nuclear Laboratories
- **Canadian Nuclear Laboratories (CNL)**
  - Private-sector company responsible for management and operation of nuclear laboratories formerly operated by AECL
  - Implemented government-owned, contractor-operated (GoCo) model in 2015
  - CNL is owned by the Canadian National Energy Alliance
- **SNC-Lavalin Nuclear**
  - Service provider of technology for nuclear power reactors and nuclear products and services
  - Consists of two subsidiaries: Candu Energy Inc. and SNC-Lavalin Nuclear Inc.
  - Candu Energy Inc. purchased the CANDU reactor division's assets from AECL

Other Government Organizations involved in NPP Safety

- **Health Canada**
  - Establishes radiological protection guidelines and assessments
  - Responsible for the Federal Nuclear Emergency Plan
- **Natural Resources Canada**
  - Establishes policies, priorities and programs for energy science and technology
  - Administers *Nuclear Energy Act*, *Nuclear Liability and Compensation Act* and *Nuclear Fuel Waste Act*
- **Global Affairs Canada**
  - Responsible for Canada's nuclear non-proliferation policy
- **Provincial emergency authorities**
  - Responsible for planning and executing nuclear emergency response

Canada's Guiding Principles for Nuclear Safety

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

Convention on Nuclear Safety

- Canada complies with all the articles of the Convention and is committed to:
  - Having an independent and effective regulator
  - Maintaining a high level of nuclear safety
  - Maintaining and enhancing defence in depth
  - Setting and meeting regulatory criteria for design-basis accidents and beyond-design-basis accidents
  - Preventing severe accidents and, should they occur, stopping their progress and mitigating their consequences

HIGHLIGHTS OF CANADA'S REPORT

Safety Record

- Excellent safety record during reporting period
  - Licensees fulfilled their responsibilities for safety and their regulatory obligations
  - Radiation exposures well below regulatory limits to workers, the public and the environment
  - Radiological releases to the environment extremely low and well below regulatory limits
  - No events occurred above INES 0

Continuous Improvements to Safety

- Licence renewal and life extension processes drive improvements based on evaluations against
  - Modern codes and standards
  - Operating experience (OPEX)
  - Research findings
- Completion of the Fukushima action items established in the CNSC Integrated Action Plan following the Fukushima Daiichi accident
- Implementation of periodic safety review (PSR)

International Peer Reviews (1/3)

- World Association of Nuclear Operators (WANO)
  - Evaluations done every two years at each NPP
- Operational Safety Review Team (OSART)
  - Bruce B (2015)
  - Pickering (2016)
- Integrated Regulatory Review Service (IRRS) missions
  - Findings of 2009 initial mission addressed
  - Follow-up mission in 2011 identified three new findings related to Fukushima lessons learned, which were also addressed

International Peer Reviews (2/3)

- Three findings from follow-up mission in 2011
  - Recommendation to review and assess NPP offsite emergency plans
    - addressed through workshops involving government and industry
    - the CNSC determined that the process for review of offsite emergency plans is adequate
  - Recommendation to conduct ongoing full-scale exercises of offsite emergency plans
    - Health Canada maintains a national nuclear exercise program and calendar through its nuclear emergency management committees
    - exercises conducted and planned: Exercise Unified Response (2014), Exercise Intrepid (2015) and Exercise Huron Resolve (2016); an exercise is planned for Pickering (2017)
  - Suggestion to invite an international peer review mission for emergency preparedness
    - Canada invited an EPREV mission for early 2019 (Challenge 4)

International Peer Reviews (3/3)

- Canada's involvement in IRRS missions
  - Canada has participated in many IRRS missions and follow-up missions of other countries including Russia, India and China
  - Encourage staff involvement in international peer reviews
- Canadian utilities actively encourage staff participation in WANO and international peer reviews

Regulatory Framework (1/2)

- The *Nuclear Safety and Control Act* is the CNSC's enabling legislation
- The Commission makes regulations through a transparent process, which includes public participation and public meetings
- The Commission issues licences with general requirements
- Regulatory documents and CSA Group standards provide detailed requirements and guidance
- Extensive consultation with stakeholders in developing regulatory documents and CSA Group standards

Regulatory Framework (2/2)

- CNSC regulatory documents
  - Aligned with IAEA safety standards
  - Review and update, as needed, in five-year plan
- Adding new regulatory documents to cover all regulated areas
  - Target to complete set of regulatory documents by 2018
- CSA Group standards
  - Developed through collaboration between industry, the CNSC and other international stakeholders
  - Continuously updated
- Regulatory documents and CSA Group standards
  - Integrated in regulatory framework
  - Reviewed and updated following the Fukushima Daiichi accident

Nuclear Liability and Compensation Act

- Canada signed the *Convention on Supplementary Compensation for Nuclear Damage* in 2013
- *Nuclear Liability and Compensation Act* (NLCA)
  - Received Royal assent in 2015
  - Came into force on January 1, 2017
- Replaces the *Nuclear Liability Act* (NLA, 1985)
- NLCA increases the absolute liability limit of an NPP operator to $1 billion from the $75 million amount under the NLA
- NLCA introduces a longer limitation period – 30 years – for submitting compensation claims for latent illnesses

Licensing

- Operating reactors
  - Licence for operating power reactors
    - Standard, high-level licence conditions
    - Licence conditions handbook (LCH) provides detailed compliance criteria and guidance
    - Licences and LCHs continuously improving
  - Licence renewal
    - Conducted multiple times over the life of the reactor
    - Requirements found in *Nuclear Safety and Control Act*, regulations, regulatory documents and CSA Group standards
    - Systematic review of licensee's past performance
    - Improvement plans over the proposed operating period
      - involves implementation of new regulatory documents and CSA Group standards
    - Future licence renewals will incorporate periodic safety reviews (PSRs) (additional details on slide 28)

Regulatory Oversight Compliance and Enforcement

- Inspections and verifications of NPPs
  - CNSC inspectors on site at each operating NPP
  - Five-year baseline compliance program
  - Additional inspections are risk-informed and performance-based
- Enforcement
  - Set of graduated enforcement actions to compel compliance
  - *Nuclear Safety and Control Act* amended in 2012 to introduce administrative monetary penalties (AMPs)
    - monetary penalties for the violation of a regulatory requirement
    - AMPs regulations and regulatory document published and in effect

Periodic Safety Review (PSR)

- PSR in Canada continuation of practice of integrated safety review (ISR) for refurbishment
  - CNSC regulatory document, REGDOC-2.3.3, *Periodic Safety Review* published in 2015
  - The CNSC is adding licence conditions requiring PSRs
  - Licensees performing PSRs for future licence renewals
    - re-baselining safety case against modern standards and best international practices
    - identifying improvements to address safety-significant gaps

Deterministic Safety Analyses

- NPP licensees update safety analysis reports every five years
- Post-Fukushima Daiichi accident: the CNSC and licensees confirmed that safety analyses are adequate
- Regulatory document REGDOC-2.4.1, *Deterministic Safety Analysis* was published in May 2014
  - Improvements address Fukushima response findings
  - Licensees implementing requirements of REGDOC-2.4.1 in safety report updates
- During reporting period, CNSC staff reviewed NPP licensees' safety analysis reports and confirmed safety margins for all Canadian NPPs remain acceptable
- Safety reports also address design extension conditions accidents, including severe accidents

CANDU Safety Issues (CSIs)

- In 2007, the CNSC and industry surveyed safety issues related to CANDU NPPs
  - Developed set of CANDU safety issues (CSIs)
  - Categorized issues into three categories
  - Category 3 CSIs have measures in place to maintain safety margins but adequacy of measures to be confirmed
  - In 2007: 21 Category 3 CSIs
- Resolving CSIs systematically applying:
  - Design changes
  - Analysis
  - Research and development
  - Program, process and procedural enhancements
- Four Category 3 CSIs remain
  - Regulatory position and path forward for addressing these Category 3 CSIs are well established
  - Given recent progress by industry in addressing CNSC findings, it is expected that remaining Category 3 CSIs will be re-categorized during next reporting period

Openness and Transparency (1/2)

- CNSC outreach programs
- Participant Funding Program
- Public participation during CNSC hearings or meetings held in Ottawa or local communities
  - Use of webcasts for public hearings/meetings
- Availability of regulatory and nuclear safety information on public website and social media
  - The CNSC posts results from the Independent Environmental Monitoring Program
  - Health Canada posts results from the Canadian Radiation Monitoring Network, and shares data with the IAEA through the International Radiation Monitoring Information System (IRMIS)

Openness and Transparency (2/2)

- Extensive licensee programs for proactive disclosure and public information program
  - Public disclosure protocols
- Licensee outreach programs
  - Consultation with Indigenous groups
  - Consultation with municipal governments and local stakeholders
- Licensees make their regulatory information, including environmental monitoring results, available through
  - Corporate websites
  - Social media
- Social media used to disseminate information
  - Facebook
  - Instagram
  - LinkedIn
  - Twitter
  - YouTube

Independent Environmental Monitoring Program

- During reporting period, the CNSC launched the Independent Environmental Monitoring Program (IEMP)
  - Complements staff reviews and confirms licensees' environmental programs
  - Sampling performed by CNSC staff in public areas
- Samples from air, water, soil, sediment, vegetation and foodstuffs
- IEMP results available to public through technical reports and interactive map on the CNSC website
- Results available on the CNSC website for all Canadian NPPs
- IEMP complements monitoring programs of other government agencies, such as Health Canada's Canadian Radiation Monitoring Network, as well as provincial and licensee monitoring programs

Follow-Up to Discovery of Suspect Material

- In 2015, licensees discovered valves containing suspect material
- There were 1,116 valves with suspect material - 740 had been installed
- Valves supplied between 2001 and 2015
- Reported to the CNSC per REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*
- Licensees performed root-cause analysis and implemented corrective actions
- CNSC staff concluded that engineering assessments were robust and thorough and that appropriate actions were taken
- In 2016, CSA Group published N299 series of standards addressing Counterfeit, Fraudulent and Suspect Items (CFSIs)
  - Other improvements to regulatory framework ongoing
- Operating experience shared within industry through WANO, including supply chain

Specific Improvements Since the 6th Review Meeting (1/2)

- Verification of pressure tube fitness for service beyond assumed design life of 210,000 equivalent full-power hours of operation at Darlington, Pickering, Bruce A and Bruce B
- Completion of Fukushima action items (including design changes and modifications)
- Emergency preparedness improvements following full-scale, national emergency exercises at NPPs involving all levels of government and other institutions (e.g., Exercise Unified Response 2014, Exercise Intrepid 2015)
- Distribution of potassium iodide pills to all residences, businesses and institutions within the primary zone (8 to 16 km from the NPP)

Specific Improvements Since the 6th Review Meeting (2/2)

- Completion of the transition to safe storage state with fuel stored in the irradiated fuel bays for Gentilly-2 in December 2014
- Completion of environmental assessment and integrated safety review for Darlington refurbishment
- Increased use of human performance dynamic learning activities in training
- Implementation of knowledge management and retention programs

RESPONSE TO CHALLENGES TO CANADA FROM THE 6TH REVIEW MEETING

Response to 6th Review Meeting Challenges

Challenge 1:
Complete the implementation of the CNSC Integrated Action Plan in response to the Fukushima accident

Response:

- Fukushima action items (FAIs) developed in 2011 to address safety improvements aimed at:
  - Strengthening defence in depth
  - Enhancing emergency response
- All NPP licensees implemented the 36 FAIs by December 31, 2015
- Verification of implementation is integrated into licensing and compliance processes
- Updates to regulatory documents completed and amendments to regulations are ongoing
- Enhancing international collaboration through greater cooperation with international peers (CNS, CANDU owner countries) and by sharing results of peer-review process

This challenge should be closed and a new challenge opened for amendments to related regulations. Canada will report on amendments at the 8th RM.

Fukushima Response – Equipment and Modifications

Portable generators

Portable pumps

Flood barriers

Passive autocatalytic recombiners

Fire emergency vehicles

Emergency containment filtered ventilation system

Calandria vault makeup

Improvements to irradiated fuel bays

Storage buildings

Response to 6th Review Meeting Challenges

Challenge 2:
Enhance probabilistic safety assessment (PSA) to consider multi-units and to consider irradiated fuel bays (spent fuel bays)

Response:

- All NPP licensees have PSAs that are compliant with CNSC standard S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*
- In May 2014, the CNSC published REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*
  - Requires Level 1 and Level 2 PSAs that include all potential, site-specific initiating events and potential hazards
  - New requirements related to multi-units, irradiated fuel bays (IFBs) and low-power operational states
  - Licensees are currently implementing it
- In Canada, IFBs meet seismic requirements
- Licensees developing a safety goal framework
  - Pilot application of whole-site PSA methodology is underway at Pickering and is to be completed by end of 2017

This challenge should be closed. Canada will report on updates to PSAs at the 8th RM.

Response to 6th Review Meeting Challenges

Challenge 3:

Establish guidelines for the return of evacuees post-accident and to confirm public acceptance of it

Response:

- Canada involved in post-accident recovery phase initiatives, including the IAEA's Modelling and Data for Radiological Impact Assessments Programme
- The CNSC carried out benchmarking on recovery and, in collaboration with Health Canada, developed a discussion paper on proposed guidelines
  - Discussion paper sent to provincial and federal partners for comments in 2016
  - Draft guidelines to be issued for public consultation
  - Will publish guidelines on recovery in the event of a nuclear or radiological emergency in next reporting period

This challenge should remain open and Canada will report on the guidelines at the 8th RM.

Response to 6th Review Meeting Challenges

Challenge 4:
Invite an IAEA emergency preparedness review (EPREV) mission

Response:

- Health Canada completed exercises to validate the Federal Nuclear Emergency Plan
- Lessons learned from national full-scale emergency exercise, Unified Response have been implemented
- In 2017, Health Canada invited an EPREV mission to be hosted in early 2019

This challenge should be closed and Canada will report on results at the 8th RM.

Response to 6th Review Meeting Challenges

Challenge 5:

Update emergency operational intervention guidelines and protective measures for the public during and following major and radiological events

Response:

- Health Canada is finalizing an update to the *Canadian Guidelines for Protective Actions During a Nuclear Emergency*
  - Guidelines address protective measures for the public, including evacuation, sheltering and iodine thyroid blocking
  - Includes operational intervention levels as well as guidelines for water and food consumption
- Guidelines released for public consultation in 2014 and 2016
- Guidelines to be published by the end of 2017

This challenge should remain open and Canada will report on the update to guidelines and measures at the 8th RM.

Response to 6th Review Meeting Challenges

Challenge 6:
Transition to decommissioning approach

Response:

- The CNSC has established a licensing strategy for decommissioning NPPs in the context of the 2016 licence renewal of the Gentilly-2 NPP
- Hydro-Québec submitted licence application in 2015, as its operating licence was to expire on June 30, 2016
- The Commission granted a 10-year power reactor decommissioning licence for Gentilly-2 in 2016
- Activities to complete transition of reactor to safe storage state have been completed and transfer of irradiated fuel to dry storage modules will be completed by 2020
- Canada has designed a regulatory decommissioning approach; end state of regulatory approach is a decommissioned NPP ready to be released from the CNSC's regulatory control

This challenge should be closed.

VIENNA DECLARATION ON NUCLEAR SAFETY

Vienna Declaration on Nuclear Safety - Fulfilling Principle 1 (1/2)

Principle 1: "New nuclear power plants are to be designed, sited, and constructed, consistent with the objective of preventing accidents in the commissioning and operation and, should an accident occur, mitigating possible releases of radionuclides causing long-term off site contamination and avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions."

- A "new nuclear power plant" is one with no previous operation
- Technical criteria and standards to address objective of preventing accidents
  - REGDOC-2.5.2, *Design of Reactor Facilities: Nuclear Power Plants*
    - based on IAEA SSR-2/1, *Safety of Nuclear Power Plants: Design*
    - IAEA safety standards have been shown to fulfill Vienna Declaration principles
  - Examples of design concepts from REGDOC-2.5.2
    - defence in depth applied throughout design process to prevent accidents and provide appropriate protection
    - independent defence for preventing accidents and mitigating consequences
    - use of dedicated systems for design extension conditions

Vienna Declaration on Nuclear Safety - Fulfilling Principle 1 (2/2)

- Technical criteria and standards to address the objective of mitigating and avoiding releases
  - REGDOC-2.5.2, *Design of Reactor Facilities: Nuclear Power Plants*
    - engineered systems to protect containment and to cool the core debris
    - containment to maintain leak-tight barrier for sufficient time to allow implementation of offsite emergency procedures
  - REGDOC-2.3.2, *Accident Management*
    - severe accident management guidelines

Vienna Declaration on Nuclear Safety - Fulfilling Principle 2 (1/2)

Principle 2: "Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner."

- National requirements on periodic comprehensive and systematic safety assessments of existing NPPs
  - REGDOC-2.4.1, *Deterministic Safety Analysis*
  - REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*
  - REGDOC-2.3.3, *Periodic Safety Reviews*

Vienna Declaration on Nuclear Safety - Fulfilling Principle 2 (2/2)

- Implementation of new and revised regulatory documents and standards at licence renewal
- Integrated safety reviews (ISRs) / periodic safety reviews (PSRs), including integrated implementation plans
  - required by licence conditions
  - details found in REGDOC-2.3.3
  - specific risk/engineering objectives and limits provided in list of modern codes, standards, and practices
- Example of a modification that addressed this principle is installation of emergency filtering venting system at Point Lepreau prior to Fukushima accident

Vienna Declaration on Nuclear Safety - Fulfilling Principle 3

Principle 3: "National requirements and regulations for addressing this objective throughout the lifetime of nuclear power plants are to take into account the relevant IAEA Safety Standards and, as appropriate, other good practices as identified inter alia in the Review Meetings of the CNS."

- Regulatory framework is aligned with and/or informed by IAEA safety standards

Vienna Declaration on Nuclear Safety - Application (1/2)

- What issues have you faced or do you expect to face in applying the Vienna Declaration principles and safety objectives to the existing fleet or new build of NPPs?
  - There are no impending issues related to the application of Principle 1
  - For Principle 2, the implementation of PSR is relatively straightforward because of Canada's experience with ISR
  - For Principle 3, significant effort has been spent in reviewing and updating CNSC regulatory documents and CSA Group standards, but the CNSC and industry do not anticipate any issues in continuing that effort
    - Robust review plans in place for updating regulatory framework

Vienna Declaration on Nuclear Safety - Application (2/2)

- Provide an overview of implementation measures, planned programs and measures for the essential safety improvements identified for existing NPPs
  - Canadian NPP licensees completed Fukushima action items (FAIs) by December 31, 2015
  - FAIs addressed safety improvements aimed at strengthening defence in depth, and enhancing onsite emergency response
  - The CNSC completed enhancements to its regulatory documents and is amending its regulations as a result of the Fukushima lessons learned
    - continue to align going forward
  - ISRs have been conducted and PSRs will be introduced with licence renewals
    - ISRs and subsequent refurbishments have introduced safety improvements

ALIGNMENT WITH THE IAEA'S *THE FUKUSHIMA DAIICHI ACCIDENT: REPORT BY THE DIRECTOR GENERAL* (DG-IAEA REPORT)

Alignment with the DG-IAEA Report (1/3)

CNSC assessed IAEA's report, *The Fukushima Daiichi Accident: Report by the Director General* (DG-IAEA Report)

- Results reported in *CNSC Assessment of the IAEA Director General Report of the Fukushima Daiichi Accident*, published in 2016
- Purpose was to benchmark action items from the CNSC Action Plan against 45 lessons (divided into two distinct phases)
- Canada's responses were compatible with and addressed the lessons in the DG-IAEA Report
- Assessment demonstrates that the CNSC continues to be on the right path with respect to continuous enhancements to safety

Alignment with the DG-IAEA Report (2/3)

Phase 1. Enhancing defence in depth and emergency response

- Comparison of Canada's response with 25 lessons in sections 2 and 3 of the DG-IAEA report
  - Section 2. The accident and its assessment
  - Section 3. Emergency preparedness and response
- Comparison reveals no outstanding issues in Canada's response with respect to this phase, including:
  - Re-evaluating safety of NPPs on a periodic basis
  - Strengthening of defence in depth
  - Considering emergencies that could involve severe damage to nuclear fuel in reactor core or to spent fuel on site
  - Defining clearly roles and responsibilities for operating organization and for local and national authorities involved in emergency response

Alignment with the DG-IAEA Report (3/3)

Phase 2. Assessment of radiological consequences and post-accident recovery

- Comparison of Canada's response with 20 lessons in sections 4 and 5 of the DG-IAEA report
  - Section 4. Radiological consequences
  - Section 5. Post-accident recovery
- Comparison reveals no outstanding issues in Canada's responses with respect to this phase for 13 lessons
- For the remaining seven lessons, work is ongoing with completion planned by 2017, e.g.,
  - Communication of factual information on radiation effects in an understandable and timely manner
  - Implementation of rigorous testing of and control on foods, as part of the remediation strategy for post-accident recovery

HIGHLIGHTS OF RESPONSES TO QUESTIONS ON CANADA'S REPORT

Questions to Canada on the National Report

Q12: Provide details of NPP rating system with respect to inspections and AMPs

- When a licensee's rating is satisfactory or higher, the CNSC continues to conduct a baseline set of compliance verification activities
- If a licensee's performance rating does not meet expectations, it may be necessary to increase regulatory scrutiny
- Administrative monetary penalties (AMPs) will be considered in the rating of the licensee

Q49: With regulatory documents/standards referenced in the licence conditions handbook, wouldn't the licensees be able to interpret licence conditions at their own will?

- Per the operating licence, a licensee is to operate in accordance with the licensing basis, which includes many detailed requirements, such as those in regulatory documents and standards
- Interpretation of general licence conditions in the operating licence is addressed in the LCH, where detailed requirements are cited

Questions to Canada on the National Report

Q129a: What are the plans with respect to decommissioning and/or life extension of Pickering 1 and 4?

- OPG is seeking a ten-year operating licence renewal for Pickering in 2018
- OPG is conducting a periodic safety review in support of the renewal

Q129b: Have any significant safety gaps been revealed in safety-significant systems at CANDU plants in the course of life-extension activities?

- For example, Pickering is currently completing component condition assessments (CCAs) to support the periodic safety review process leading to licence renewal
- No indicators in the CCAs to date present technical concerns or significant gaps that would preclude the continued safe and reliable operation of Pickering

Questions to Canada on the National Report

Q20: Is continuous improvement of NPPs legally binding?

- Should the implementation of new requirements need to be expedited, the CNSC can issue a regulatory request in accordance with the *General Nuclear Safety and Control Regulations*
- General requirements for ongoing improvement are set in CSA Group standard N286-12, *Management system requirements for nuclear facilities*
- Operating licences for NPPs now require licensees to conduct PSRs and complete the corresponding integrated improvement plans (IIPs)

Questions to Canada on the National Report

Q111: Elaborate on the safety goals for existing and new-build reactors

- For existing reactors, safety goals are established by licensees per IAEA document INSAG-12, *Basic Safety Principles for Nuclear Power Plants* and are included in the licensing basis for acceptance by the CNSC
- For new-build reactors, the CNSC has established safety goals in REGDOC-2.5.2, *Design of Reactor Facilities: Nuclear Power Plants,* and these are one magnitude lower than those for existing reactors
  - This approach is also consistent with INSAG-12

Q126: Does the CNSC have plans to require Level 3 PSA for NPPs?

- There are no plans at this time to introduce Level 3 PSAs; the CNSC is closely monitoring international progress on this topic

UPDATES TO NATIONAL REPORT TO 7TH RM

Updates to National Report to 7th RM (1/2)

- In June 2016, the Commission issued a 10-year power reactor decommissioning licence to Hydro-Québec for Gentilly-2
- In September 2016, an OSART mission was conducted at Pickering. Following the mission, the IAEA team recognized Pickering's continuous improvement to strengthen safety, and also identified areas where work is needed. The final report has been received and is being reviewed

Updates to National Report to 7th RM (2/2)

- Results of the *2016 Fall Report of the Commissioner of the Environment and Sustainable Development on the Inspection of Nuclear Power Plants*
  - Performance audit for the period 2013–2015
  - Audit found that CNSC inspectors follow up on issues identified during inspections to ensure compliance by NPP licensees
  - Five recommendations made related to documentation of inspection program
  - The CNSC addressed all of the recommendations
    - four of the recommendations by September 30, 2016
    - fifth recommendation on inspection planning will be completed by March 31, 2017

CHALLENGES, GOOD PRACTICES AND AREAS OF GOOD PERFORMANCE

Current and Future Challenges for Canada

- The six challenges from the 6th RM were addressed, with four proposed to be closed (see slides 37–44)
- Potential future challenges envisioned by Canada in next reporting period
  - Publish the drafted amendments to the *Class I Nuclear Facilities Regulations* and the *Radiation Protection Regulations* that address lessons learned from the Fukushima Daiichi accident
  - Complete the transition to the improved regulatory framework associated with CNSC regulatory documents
  - Formalize a planned approach to end-of-operation of multi-unit NPPs

Good Practices and Areas of Good Performance

- **Good practices as identified by reviewers**
  - The CNSC's Participant Funding Program
  - Use of discussion papers early in regulatory process
  - Learning and training tools and activities used by licensees: fuel handling simulator, dynamic learning activities (DLAs) and mock-ups at refurbishment training facility
- **Good performance as identified by reviewers**
  - Development of the CNSC Inspector Training and Qualification Program
  - Promotion of compliance/general outreach activities by regulator
  - The CNSC's continued modernization of documenting regulatory requirements and guidance in a single document, referred to as a regulatory document (REGDOC)
- **Other good performance**
  - Outreach activities by licensees
  - Vendor Design Review by the CNSC (for new NPP designs, including small modular reactors)
  - OPEX, including weekly screening meetings facilitated through COG

PLANNED ACTIVITIES FOR CONTINUOUS IMPROVEMENTS DURING THE NEXT CNS REPORTING PERIOD

Planned Activities During Next CNS Reporting Period (1/2)

- Refurbishment of Darlington
- Manage approach to end of commercial operation for Pickering
- Continue implementation of PSRs for all NPPs
  - PSR update for Pickering's extended operation
  - Completion of PSR for Bruce A and B
  - Conduct PSR for next licence renewal of Point Lepreau
- Improvements to deterministic safety analysis
- Improvements to PSAs
  - Completion of methodology development for whole-site PSA

Planned Activities During Next CNS Reporting Period (2/2)

- Completion of regulatory framework documents
- Conduct EPREV mission
- Conduct follow-up OSART missions for Bruce B and Pickering

CONCLUSIONS, RECOMMENDATIONS AND SUGGESTED PRIORITIES

Conclusions

Canada has demonstrated

- Commitment to the Convention's objective
- Compliance with the Articles of the Convention
- Fulfillment of the *Vienna Declaration on Nuclear Safety*
- Commitment to continuous improvement based on operating experience, best practices and research
- Openness and transparency

Canada's plans for continuous safety improvements

- Enhancements to deterministic safety analysis and probabilistic safety assessments
- Implementation of periodic safety reviews
- Conduct of EPREV mission in 2019

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

Recommendations to the IAEA and Contracting Parties

- The IAEA and Contracting Parties should continue to encourage countries to sign and ratify the CNS, especially those with existing or emerging nuclear power programs
- Contracting Parties should continue to meet their obligations under the Convention (including effectively conducting peer reviews) and should make their national reports available to the public
- Contracting Parties, in their capacity as Member States, should encourage the IAEA at the next General Conference to play stronger role in accountability and transparency for nuclear safety, including through promotion of effective and independent regulatory bodies
- To enhance the accountability of the CNS
  - The Summary Report should continue to identify Contracting Parties that do not meet the obligations of the CNS
  - The President's Report should identify Contracting Parties that do not meet the customary expectations of the CNS
  - The President of the Review Meeting should communicate this information to the national governments of the Contracting Parties in question
- The IAEA should work with WANO to engage non-responsive operators and to report them to their respective regulator and national government

Suggested Priorities for Contracting Parties

- Updating emergency operational intervention guidelines for the public, for major nuclear and radiological events
- Establishing practical measures using the ICRP reference level of 1–20 mSv for the existing exposure situations (e.g., recovery after a nuclear emergency)
- Establishing common approaches to address multi-unit events and beyond design basis events
- Adequate competency within emerging countries to ensure safety of NPPs during their full lifecycle
- Improved sharing of operating experience internationally

Holding each other accountable to the highest standards

Canada

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