



OPEX at Canadian Nuclear Processing Facilities

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Canadian Nuclear Safety
Commission (CNSC)



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire



YouTube

Canada

Our Mandate



The CNSC's mandate is to

- Regulate the use of nuclear energy and materials so that the health, safety and security of Canadians and the environment are protected
- Implement Canada's international commitments on the peaceful use of nuclear energy
- Disseminate objective scientific, technical and regulatory information to the public

**Safety, Security, Safeguard and
Environmental Protection**

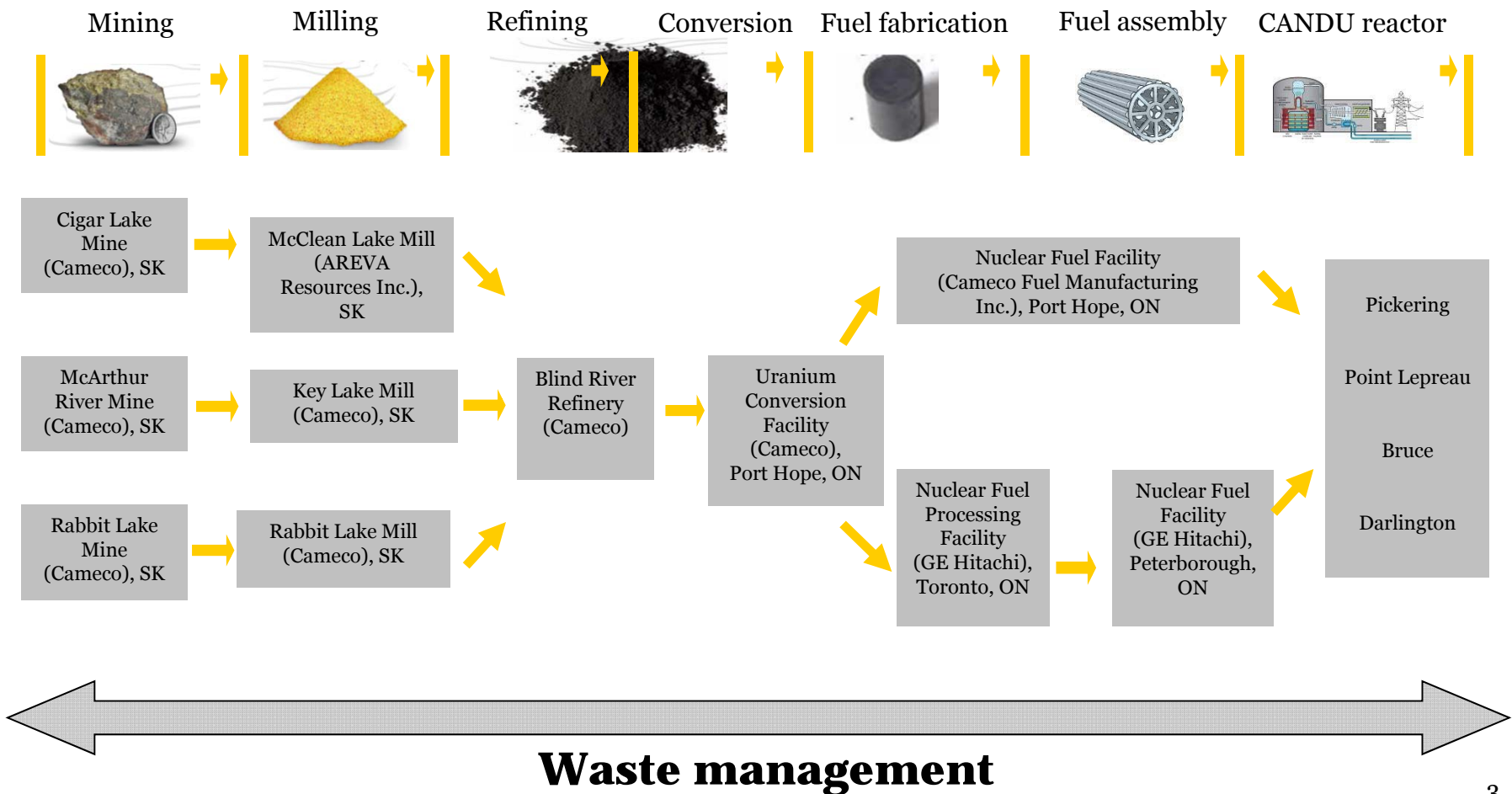


CNSC Regulates all Nuclear-Related Facilities and Activities



Imports, exports and safeguards

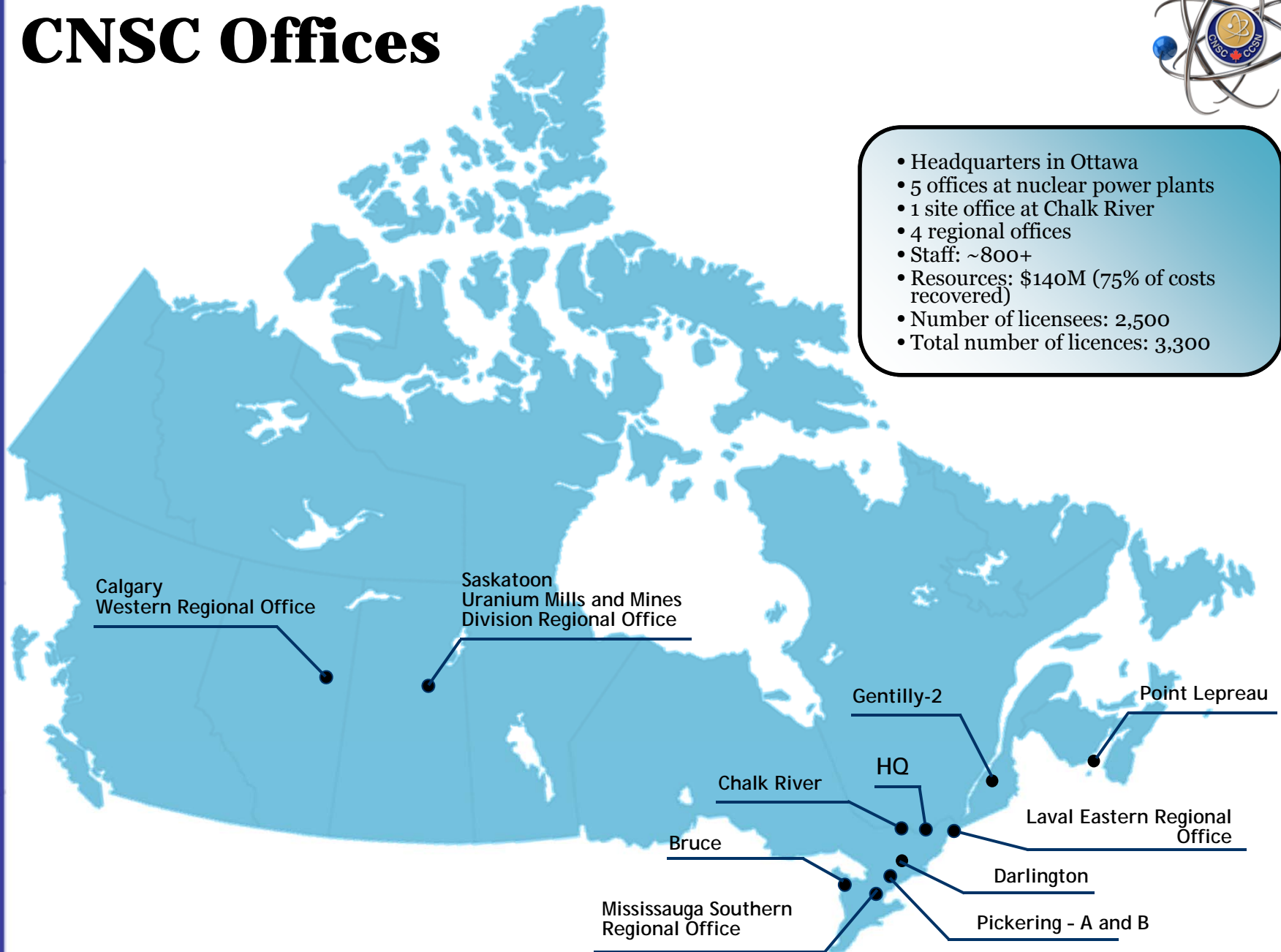
Controlled information, controlled material, controlled equipment



CNSC Offices



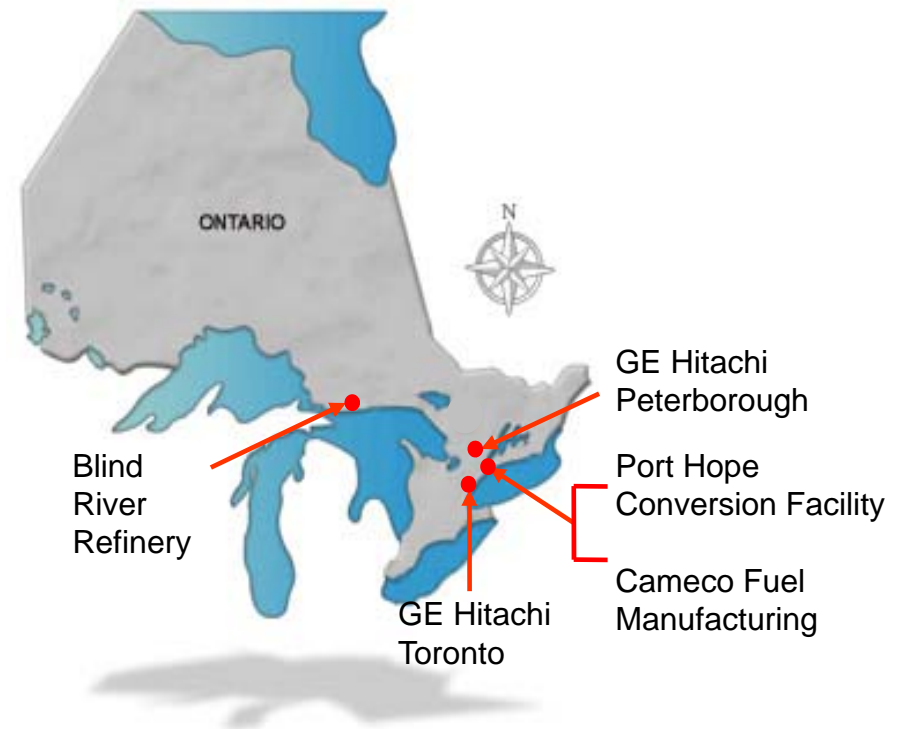
- Headquarters in Ottawa
- 5 offices at nuclear power plants
- 1 site office at Chalk River
- 4 regional offices
- Staff: ~800+
- Resources: \$140M (75% of costs recovered)
- Number of licensees: 2,500
- Total number of licences: 3,300



Uranium Processing Facilities in Canada



- **Blind River Refinery**
 - Conversion of Uranium Concentrate (U_3O_8) to Uranium Trioxide (UO_3)
- **Port Hope Conversion Facility**
 - Conversion of UO_3 to UF_6 or UO_2
- **GE Hitachi Canada - Toronto and Peterborough**
 - Processing of UO_2 fuel pellets
- **Cameco Fuel Manufacturing**
 - Processing of UO_2 fuel pellets



Blind River Refinery



- Conversion of Uranium Concentrate (U_3O_8) to Uranium Trioxide (UO_3)
- UO_3 sent to Port Hope facility for conversion to UF_6 or natural UO_2
- World's largest commercial uranium refinery



Port Hope Conversion Facility



- Cameco Corporation's Port Hope Conversion Facility
- Converts Uranium Trioxide powder to natural UO_2 and UF_6
- Started as a Radium Processing facility in the 1930s, located on Lake Ontario



Pressurized Uranium Concentrate Drum



- June 2012 – depressurized when lid loosen by worker
- About 20 kg of Uranium Concentrate released to air within the facility
- Dose to the employee of approximately 1.7 mSv
- Root Causes (both at US Mill and Cameco facility)
 - Failure to identify hazards in previous OPEX (US-NRC IN99-03)
 - Failure to ensure that OPEX was shared between all stakeholders



Picture of the drum which resulted in Uranium Concentrate release within the facility

Pressurized Uranium Concentrate Drum (Cont'd)



- Regulatory Actions
 - Cameco required to isolate all concentrate from the same mill
 - Cameco required to put in place immediate measures to protect workers
 - Cameco required to develop methods to test for pressure and safely de-pressurize concentrate drums
 - Inspections of all Canadian Uranium Mills for similar issues



Pressurized Uranium Concentrate Drum – OPEX



- US-NRC, CNSC, Industry working group to disseminate “lessons learned”
 - Survey results identified that pressurized drums instances were limited to mills using a peroxide based process
 - Drum pressurizations were a result of continued decomposition of dried uranium product and the production of oxygen after the drums have been filled and sealed

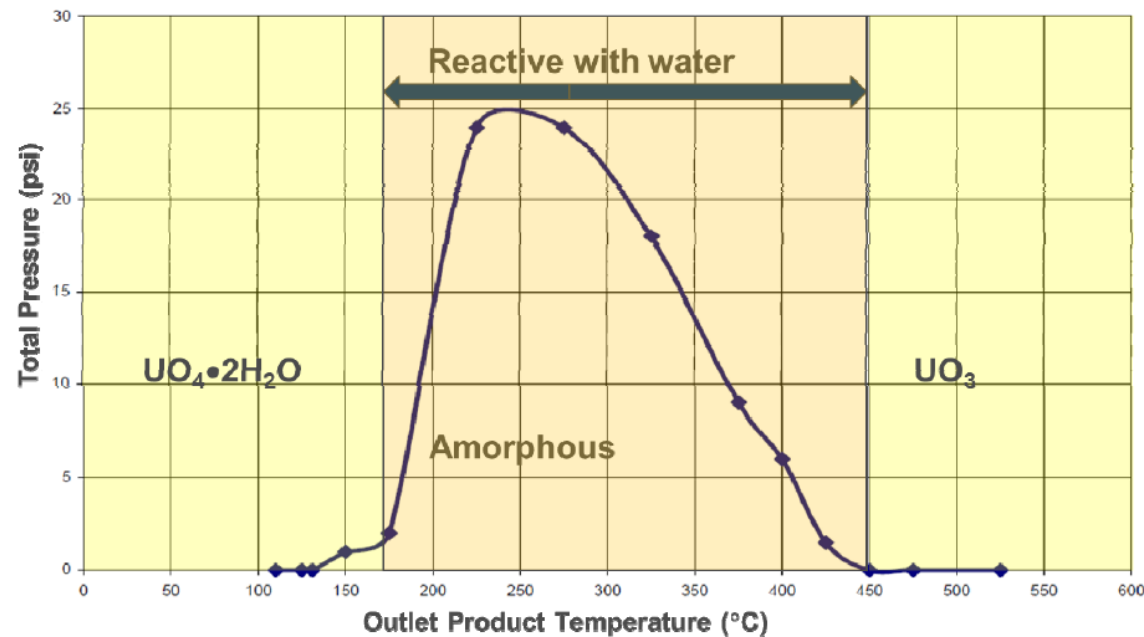


Figure 1: Dried Hydrogen Peroxide precipitated Uranium Concentrate reactivity with water

Pressurized Uranium Concentrate Drum – OPEX (Cont'd)



- Recommendations from US-NRC working group
 - Increase cooling and venting time for facilities utilizing Hydrogen Peroxide precipitation process
 - Conducting visual inspections of the drums for signs of pressurization prior to shipment
 - Facility operators should develop protocols to minimize the potential for organics, including oils and greases, to enter into Uranium Concentrate process circuits

Port Hope Conversion Facility Loss of Supervisory Control



- January 2014 - PHCF lost supervisory control of UF₆ Plant
- Manual mode was required to re-establish plant control which resulted in eroding safety barriers
- No releases from the facility or exposures to workers
- Root Causes
 - Less than adequate management practices
 - Less than adequate policies and procedures



H₂ and F₂ gas lines located in UF₆ Plant at the Port Hope Conversion Facility

CNSC Staff Response to Cameco's January 2014 Event



- Cameco was required to take the following actions
 - Provide additional mitigation measures prior to the restart of the facility
 - Explain why work was performed on safety critical processes during normal operations and what controls were in place to prevent such a situation
 - Investigate why the Supervisory Control system required further intervention to bring the UF₆ plant under a safe shutdown state
 - Provide a root cause analysis of how this incident occurred and identify appropriate corrective actions to ensure the safety of the plant is maintained
 - Identify a schedule for the implementation of the corrective actions

Conclusion

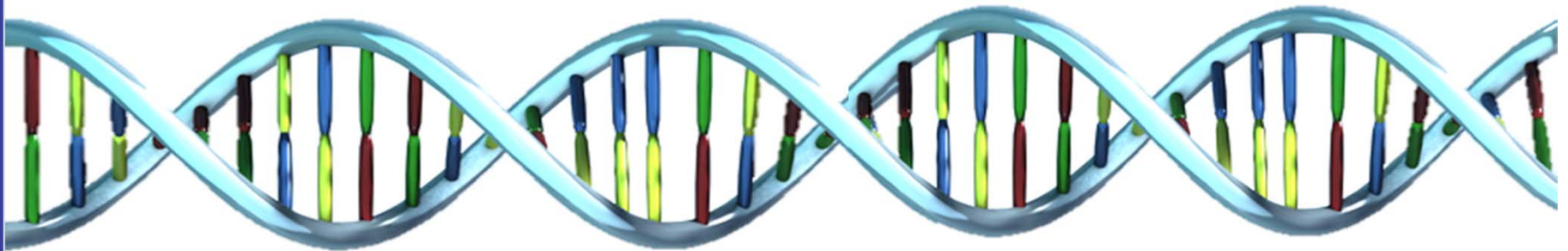


- Recent events in Canada confirm the importance of international sharing of operating experience
- Operators need formal systems to share operating experience both internally and externally. This is part of the Canadian Management System requirements
- Fuel cycle facilities can learn intelligently from NPP events

Thank You



We will never compromise safety...



it's in our DNA!

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nuclearsafety.gc.ca**

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