

 Canadian Nuclear Safety Commission
 Commission canadienne de sûreté nucléaire

Nuclear Safety Research in Canada

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Outline



- CNSC Mandate and Mission
- Overview of Nuclear Research in Canada
- CNSC Regulatory Research
- Closing Remarks

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Canadian Nuclear Safety Commission



Regulates the use of nuclear energy and materials to protect the **health, safety and security** of Canadians and the **environment**; implements Canada's **international commitments** on the peaceful use of nuclear energy; and **disseminates objective scientific, technical and regulatory information to the public.**



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Canadian Nuclear Safety Commission (cont'd)



CNSC Regulates All Nuclear-Related Facilities and Activities Cradle to Grave

- 4 sites-19 operating nuclear reactors
- 5 uranium mines in Sask
- 8 processing and fuel fabrication facilities
- Major research facilities
- Hospitals and industrial users



Our website displays an interactive map with all our major facilities

Overview of Nuclear Research in Canada



Key Research Players

- Atomic Energy of Canada Limited (AECL) - Chalk River Laboratories
- Candu Owner's Group (COG) - Research by utilities
- University Based Research
 - TRIUMF
 - University Network of Excellence in Nuclear Engineering (UNENE)
- CNSC - Regulatory Research
 - International Cooperative Research

National Laboratories AECL CRL



AECL Capability Areas



- Nuclear and Radioactive Material Management
- Irradiation and Post-Irradiation Service
- Nuclear Safety, Security and Risk
- Radiation Biology, Radioecology and Dosimetry
- Materials and Chemistry in Nuclear Applications
- Advanced Nuclear Fuels and Fuel Cycles
- Systems Engineering
- Advanced Computing, Modeling and Simulation
- Hydrogen and Hydrogen Isotopes Management
- Environmental Remediation and Nuclear Waste Management

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Industry Led Research



- Canadian nuclear operators engage in a variety of research initiatives and in many cases work jointly
- A large part of the collaborative research is done through a formal agreement called CANDU Owners Group (COG), which includes CANDU owned utilities from Canada and around the world



All CANDU Operators in the world are members of COG

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Industry Led Research CANDU Owners Group (COG) (cont'd)



Research & Development

The COG Research and Development program addresses current and emerging operating issues to support the safe, reliable and economic operation of CANDU reactors. There are five R&D program areas:

- Chemistry, Materials and Components
- Fuel Channels
- Health, Safety and Environment
- Safety and Licensing
- Industry Standard Toolset

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University Based Research

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University Based Research - TRIUMF

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University Based Research - UNENE

INDUSTRIAL PARTNERS	UNIVERSITY PARTNERS
Atomic Energy of Canada Limited www.aec.ca	Ecole Polytechnique www.polymtl.ca
Bruce Power www.brucepower.com	McMaster University www.mcmaster.ca
Canadian Nuclear Safety Commission nuclearsafety.gc.ca	Queen's University www.queensu.ca
Candu Energy Inc. (Formerly AECL Engineering) www.candu.com	Royal Military College www.rmc.ca
CANDU Owners Group www.candu.org	University of Guelph www.uoguelph.ca
Nuclear Waste Management Organization www.nwmo.ca	University of New Brunswick www.unb.ca
Ontario Power Generation www.opg.com	University of Ontario Institute of Technology www.uoit.ca
	University of Saskatchewan www.usask.ca
	University of Toronto www.utoronto.ca
	University of Waterloo www.uwaterloo.ca
	University of Windsor www.uwindsor.ca
	Western University www.uwo.ca

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University Based Research - UNENE Projects



University	Functional Area	Sample Project
McMaster University	Safety Analysis	BD&A Modelling Post-Fukushima
Queen's University	Irradiated Material Testing	Delayed Hydride Cracking in PHTS Material
Royal Military College (RMC)	Finite Element & Multi-physics Modelling	Modeling of Fuel Codes
University of Toronto	Materials Performance	Stress Corrosion Cracking in Alloy 600/800
University of Ontario Institute of Technology (UOIT)	Radiation Protection - Dosimetry	Development of Tissue Proportional Counters
Waterloo	Reliability Models & Uncertainty Analysis	Statistical Analysis of Pickering Fish Kill Compliance
Western	Seismic Research, I & C, Chemistry, esp. Radiolysis	Seismic Risk Analysis of Nuclear Plants

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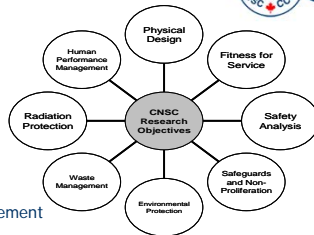
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CNSC Regulatory Research



Research Areas:

- Physical Design
- Fitness for Service
- Safety Analysis
- Safeguards
- Environmental Protection
- Waste Safety
- Radiation Protection
- Human Performance Management

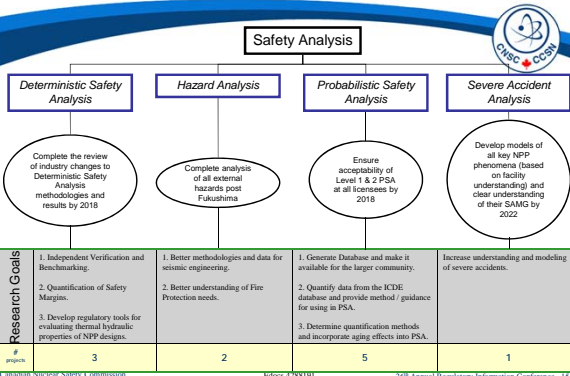


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Example of Research Goals Flowchart



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Potential CNSC Research Projects Following Fukushima Lessons Learned



- Improved analysis of external events and in the analysis of their effects on Structures, Systems and Components
- Better understanding of accident progression
- In-calandria retention of core debris - impact of penetrations and end-shield
- Development of sensitivity analysis methods for identification of cliff edge effects
- Development of capabilities for the emergency technical assessment response
- Release of radioactivity through liquid effluents in case of severe accidents

International Cooperation



- International relations are indispensable for CNSC to fulfill its regulatory mandate
- CNSC contributes to developing international safety standards, ensures compliance with Canada's international obligations, and participates in the strengthening of global nuclear security and the management of emergencies
- CNSC works closely with IAEA, OECD/NEA and other regulators

International Cooperation - IAEA



- I-GALL International Generic Ageing Lessons Learned Database - CANDU Power Plants
- Seismic Safety Evaluation & Beyond Design Basis Margin Demand
- IAEA Cyber Security Working Group : Emerging Issues for Nuclear Security
- IAEA Mission in Japan Fukushima - Daiichi
- Trends in the Development of Advanced Fuels for Fast Reactors

International Cooperation - OECD/NEA



- CSNI - Committee on the Safety of Nuclear Installations
- MDEP - Multinational Design and Evaluation Programme
- WGAMA - Working Group on Accident Management and Analysis
- WGRISK - Working Group on Risk Assessment
- PRISME - Project on Fire Safety
- CADAK - Cable Ageing Database and Knowledge
- ICDE - International Common-Cause Data Exchange

International Cooperation - USNRC



CNSC is involved with USNRC in several joint projects such as:

- Cooperative Agreement of Thermalhydraulic Code Applications and Maintenance Program (CAMP)
- Cooperative Severe Accident Research Program (CSARP)
- International Steam Generator Tube Integrity Program (ISG TIP-4)

Conclusions



- Nuclear safety research in Canada is being broadly coordinated between the CNSC, industry, AECL- CRL and academia
- Canada is well positioned via its domestic and international cooperative arrangements on safety research to ensure technical knowledge gaps now and in the future are being appropriately addressed

Thank You

We will never compromise safety...



...it's in our DNA!



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