Natural Resources Canada | Ressources naturelles Canada

Nuclear in Canada

NUCLEAR ENERGY

A KEY PART OF CANADA'S CLIMATE STRATEGY AND A DRIVER FOR CLEAN GROWTH

- Nuclear electricity in Canada displaces about **50 million tonnes of GHG emissions** annually.
- Electricity from Canadian uranium offsets more than **300 million tonnes of GHG emissions worldwide.**

Yellowcake is refined at Blind Rive , Ontario, to produce uranium trioxide.

U_3O_8 YELLOWCAKE → REFINING → UO_3 URANIUM TRIOXIDE

15% of the world's uranium is mined and milled in northern **Saskatchewan** (2022)

The **uranium mining industry** is the **largest private employer** of **Indigenous people** in Saskatchewan.

At uranium mills, ore is processed into concentrate: "**Yellowcake**".

U_3O_8 YELLOWCAKE

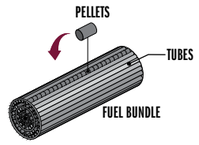
At Port Hope, Ontario, uranium trioxide is converted.

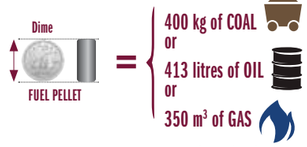
URANIUM TRIOXIDE UO_3 → CONVERSION → URANIUM DIOXIDE UO_2 / URANIUM HEXAFLUORIDE UF_6

UO_2 is used to fuel **CANDU nuclear reactors.**

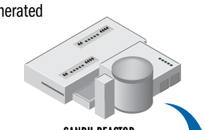
UF_6 is **exported for enrichment** and use in foreign light water reactors.

At plants in southern Ontario, fuel pellets are loaded into tubes and assembled into fuel bundles for CANDU reactors.





Equivalent electricity generated



17 CANDU reactors at
4 nuclear power generating stations
6th globally in nuclear power capacity

CANADA'S ELECTRICITY — SUPPLYING OVER **15%** → ON 52% / NB 31%

Supported by a robust supply chain of over 200 companies.

There are 10 large-scale CANDU reactors undergoing life extension programs that will keep the fleet operating past 2060
The $26B CAD investment is funded by the province of Ontario, executed by the utilities, and is currently on-budget and on-schedule.

$15 Billion

The nuclear industry in Canada contributes $15B to the Canadian economy and provides

OVER **70,000** **direct and indirect JOBS**

Large-Scale Nuclear Reactors

Canada has a history of deploying large-scale nuclear power and continues to lead in innovation and development.

- Bruce Power expansion project to add up to 4800 MWe of nuclear power in Ontario
- Wesleyville, another potential large-scale build site, could generate between 8,000-10,000 MW of new nuclear generation in Ontario
- Development could provide up to 1 GW of power per reactor
- There are 30 CANDU reactors operating around the world, representing a 6.5% market share

Small Modular Reactors (SMRs)

Different SMR designs support various electrification needs Canada has been charting a path forward through Canada's SMR Roadmap (2018) and Action Plan (2020), and the Enabling SMRs Program (2023). Current commercial SMR activities in Canada include:

- CNSC License to Construct issued April 2025 for first of four anticipated SMRs at Darlington
- Saskatchewan, Alberta, and New Brunswick are evaluating potential SMR deployments to decarbonize electricity systems and provide reliable generation

Research & Innovation Ecosystem

- Canada is a leading producer of radioisotopes for medical, industrial, and research applications
- Canada's largest dedicated nuclear R&D facility is Chalk River Laboratories, part of Canadian Nuclear Laboratories. It contains more than 50 unique facilities and has been undergoing a $1.2 billion revitalization
- Canada has nuclear facilities coast-to-coast, including TRIUMF (BC), the Sylvia Fedoruk Canadian Centre for Nuclear Innovation (SK), and the Centre for Nuclear Energy Research (NB), and is home to 4 nuclear research reactors - McMaster University, Polytechnique Montreal, Royal Military College, and CNL

Uranium fuels the world's nuclear power plants.

2nd largest uranium producer and exporter in the world
$3.8B in 2024

90% was exported for use in foreign nuclear power reactors (2024)

10% used to fuel Canadian nuclear power reactors (2024)

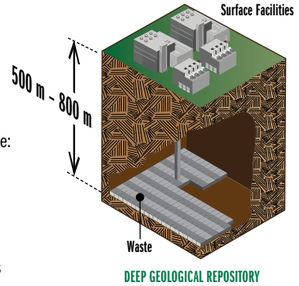
Radioactive waste is produced throughout the nuclear fuel cycle and safely managed in licensed storage facilities:

High-level waste - Nuclear fuel waste **HLW**
Low and intermediate-level waste **L&ILW**
Uranium mine and mill tailings waste **UMMT**

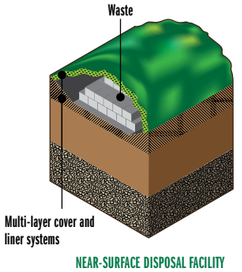
Initiatives underway for long-term management of radioactive waste include:

- Deep geological repository for nuclear fuel waste
- Near-surface disposal facility for LLW
- Tailings management facilities
- Deep geological repository for ILW and non-fuel HLW

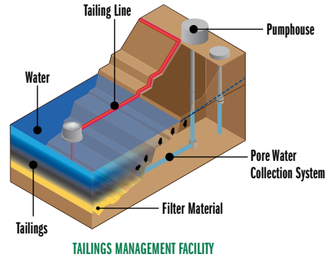
All in keeping with internationally accepted approaches and best practices



DEEP GEOLOGICAL REPOSITORY



NEAR-SURFACE DISPOSAL FACILITY



TAILINGS MANAGEMENT FACILITY

Cat. No. M134-67/2021E-PDF (Online)
ISBN 978-0-660-38782-6

Canada

Governance Framework

Policy Makers

FEDERAL

Nuclear energy is under federal jurisdiction.

Key Federal Legislation

- *Nuclear Safety and Control Act*
- *Nuclear Fuel Waste Act*
- *Nuclear Liability and Compensation Act*
- *Nuclear Energy Act*
- *Export and Import Permits Act*

Federal Nuclear Policy

- Natural Resources Canada is the lead department on behalf of the Minister of Energy and Natural Resources.
- Other federal departments: ECCC, GAC, HC, TC

- Uranium
- Nuclear Energy
- Nuclear Research and Development and Science and Technology
- Civil Nuclear Liability
- Radioactive Waste Management

Key Policies

- Canada's Policy for Radioactive Waste Management and Decommissioning
- Nuclear Non-Proliferation Policy
- Non-Resident Ownership Policy in the uranium mining sector

PROVINCIAL & TERRITORIAL

Provinces and territories have ownership over the natural resources and provincial grids that lie within their boundaries.

Electricity Supply

Provinces choose approaches and technologies for electricity generation based on their natural endowments and regional requirements.

Management of Natural Resources

JURISDICTION

Exploration — Production* — URANIUM — Mine Development*

* Also regulated by the CNSC

National Regulator

Canadian Nuclear Safety Commission

Regulates → Nuclear Energy → Protect: Safety, Security, Health, Environment

The **Canadian Nuclear Safety Commission** (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.

The CNSC is an independent administrative tribunal set up at arm's length from government.

URANIUM COMPANIES

- Cameco
- Orano

Nuclear Sector

NUCLEAR ENERGY PRODUCERS

- Bruce Power
- Ontario Power Generation
- New Brunswick Power

NUCLEAR SCIENCE & TECHNOLOGY

- Atomic Energy of Canada Limited
- Canadian Nuclear Laboratories
- Universities and Colleges
- Federal & Provincial Laboratories
- Hospitals
- Nuclear Applications
- Industry

NUCLEAR SUPPLY CHAIN

- Industry
- Engineering, Procurement, and Construction Firms
- Manufacturing
- Construction
- Services
- Original Equipment Manufacturer

A number of companies stretching along the Quebec City-Windsor Corridor and in others locations across Canada

MAJOR RADIOACTIVE WASTE OWNERS

Responsible for financing and management of facilities required for the waste

- Atomic Energy of Canada Limited
- Ontario Power Generation
- Hydro-Québec
- New Brunswick Power
- Uranium mining, milling and processing industry

Nuclear Waste Management Organization

As per the *Nuclear Fuel Waste Act*, the Nuclear Waste Management Organization is responsible for implementing Canada's plan for the safe long-term management of used nuclear fuel, with funding from waste owners.