

Nuclear Latency (NL) Dataset  
Country Coding Sheets

**CANADA**

**COW COUNTRY CODE: 20**

List of Country's Enrichment and Reprocessing (ENR) Facilities

1. Chalk River Site
2. CRISLA Enrichment Facility
3. Montreal Lab

**Note:** There was reportedly centrifuge-related research in Canada in 1962.<sup>1</sup> We have found no clear evidence that Canada attempted to enrich uranium with centrifuges, so we excluded these activities from the dataset.

Detailed Facility-Specific Information and Sources

**1. Chalk River Site**

- a. ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Plutonium reprocessing.

- b. Facility size (laboratory, pilot, commercial).*

Pilot.

- c. Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction of the plutonium reactor and extraction facility started in 1944. The facility became operational in 1944. All reprocessing facilities at Chalk River were shut down by 1956.

- d. Was the facility developed covertly? If so, identify years that facility was covert.*

Yes, the facility was part of the allies' weapons program during World War II. Canada later announced that it had participated in the Manhattan Project.

- e. Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

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<sup>1</sup> Kemp, R. Scott. 2014. "The Nonproliferation Emperor Has No Clothes." *International Security* 38, no. 4: 45.

This facility was closed long before Canada concluded a comprehensive safeguards agreement with the IAEA in February 1972.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

Yes, the facility was part of Canada's independent and mutual effort to develop nuclear weapons amongst the allies during WWII. The UK reportedly used some of the plutonium separated at this plant for at least one of its early nuclear tests.

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

No. However, the British used the plans and research from Chalk River to construct the Windscale reprocessing facility.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

Yes, Canada received support from the US and UK during the period. The UK provided technical assistance and research scientists. The US provided nuclear materials and technical assistance throughout the war period. However, as the European war drew down the US increasingly reduced information sharing to the point of criminalizing information transfer in 1946 with the McMahon Act. The most important assistance was from the UK. This was an extension of the Montreal Lab. The project team moved to Chalk River in 1944.

- j. *Sources:*

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<http://nuclearsafety.gc.ca/eng/readingroom/factsheets/Canadas-contribution-to-nuclear-weapons-development.cfm>. Accessed 06/08/2015.

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Hurst, Jack. 1997. *Canada Enters the Nuclear Age: A Technical History of*

*Atomic Energy of Canada Limited As Seen From Its Research Laboratories.*  
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Atomic Energy of Canada Ltd. [http://media.cns-snc.ca/history/early\\_years/earlyyears.html](http://media.cns-snc.ca/history/early_years/earlyyears.html). Accessed 06/08/2015.

PBS Newshour. 2005. "Tracking Nuclear Proliferation: Canada."  
[http://www.pbs.org/newshour/indepth\\_coverage/military/proliferation/countries/canada.html](http://www.pbs.org/newshour/indepth_coverage/military/proliferation/countries/canada.html). Accessed 06/08/2015.

Teach Nuclear. "Chalk River." [http://teachnuclear.ca/all-things-nuclear/canadas-nuclear-history/nuclear-research/chalk\\_river/](http://teachnuclear.ca/all-things-nuclear/canadas-nuclear-history/nuclear-research/chalk_river/). Accessed 06/08/2015.

Zentner, M.D., G.L. Coles, and R.J. Talbert. 2005. "Nuclear Proliferation Technology Trends Analysis." Pacific Northwest National Laboratory. Report 14480.

## **2. CRISLA Enrichment Facility**

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Enrichment, laser.

- b. *Facility size (laboratory, pilot, commercial).*

Laboratory.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

Construction began in 1990.<sup>2</sup> The facility operated from 1990 to 1993.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

No, the facility was a commercial effort by Cameco to gain value-added to the uranium ore that is exported.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

The facility was placed under IAEA safeguards. Canada ratified comprehensive agreements in 1972 and additional protocol in 2000.

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<sup>2</sup> The 1990 date is when Crisla Technologies, the Canadian joint venture of Cameco, Agra industries Ltd, and Isotope Technologies decided to replicate IT's results instead of pursuing US regulatory permission for the technology.

f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No, the facility was not placed under regional safeguards as none were available.

g. *Did the facility have a military purpose?*

No, the facility was for civilian purposes.

h. *Was the facility multinational? If so, identify the other countries that were involved.*

Yes, the facility eventually became a US-Canada joint venture. In 1990, Cameco Corp and Isotope Technology of Los Angeles formed CRISLA Technologies.

i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

Yes. The CRISLA technology was originally developed in the US and patented by Dr. Jeff Eerkins in the 1970's. Eerkins formed Isotope Technologies with Dick Griot to finance the CRISLA process. In 1990 Isotope Technologies began working with Cameco and equipment was transferred from the US to Canada.

j. *Sources:*

Crossland, Ian, Ed. 2012. *Nuclear Fuel Cycle Science and Engineering*. UK: Woodhead Publishing, LTD. 168.

Eerkins, Jeff . 2011. "The Nuclear Imperative." Talk at the Silicon Valley Photovoltaics Society. <https://www.parc.com/event/1356/silicon-valley-photovoltaics-society-svpvs-monthly-meeting.html>. Accessed 06/08/2015.

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Khlopkov, Anton. 2012. "Creation of Laser Enrichment Laboratory in Iran: A True Story of Jeff Eerkins." Center for Energy and Security Studies. [http://ceness-russia.org/data/doc/12-09-04%20Creation%20of%20Laser%20Enrichment%20Laboratory%20in%20Iran\\_ENG.pdf](http://ceness-russia.org/data/doc/12-09-04%20Creation%20of%20Laser%20Enrichment%20Laboratory%20in%20Iran_ENG.pdf). Accessed 06/08/2015.18.

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Maloney, Sean. 2007. "Learning to Love the Bomb: Canada's Nuclear Weapons During the Cold War." Washington, D.C.: Potomac Books.

Silver, Ray. 1990. "CAMECO Eyes Diversification From Uranium, Looks to Gold, Base Metals, U Enrichment." *Nuclear Fuel*. 15(23): 4.

Silver, Ray. 1993. "CRISLA Enrichment Project Lagging Behind Schedule in Experimental Maze." *Nuclear Fuel* 18(4): 7.

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### 3. Montreal Lab

- a. *ENR type (diffusion, centrifuge, EMIS, chemical and ion exchange, aerodynamic isotope separation, reprocessing).*

Plutonium reprocessing.

- b. *Facility size (laboratory, pilot, commercial).*

Laboratory.

- c. *Is the facility under construction or in operation? If under construction, list the construction years. If in operation, list the years of operation.*

The decision for Canada to pursue reprocessing was made in 1942. The facility operated from 1944 to 1946, when Canada concentrated its efforts at Chalk River. It is likely that the lab lacked material during its existence but did begin research into plutonium extraction.

- d. *Was the facility developed covertly? If so, identify years that facility was covert.*

Yes.

- e. *Was the facility placed under IAEA safeguards? If so, identify the years that the facility was safeguarded.*

No, the facility was not eligible for safeguards.

- f. *Was the facility placed under regional safeguards? If so, identify the years that the facility was under regional safeguards.*

No.

- g. *Did the facility have a military purpose?*

Yes, the facility was part of Canada's independent and mutual effort to develop nuclear weapons amongst the allies during WWII. The facility received limited support from the US, which limited the quality of research at the facility. The US possessed the only heavy water production facility

- h. *Was the facility multinational? If so, identify the other countries that were involved.*

Yes. This facility was a joint project between the war partners. There is no definitive evidence that it was "owned" by more than one country, but it was clearly collaborative wartime cooperation among allies.

- i. *Was the facility built with foreign assistance? If so, list the supplier(s) and what they provided.*

Yes, in 1942 the UK and Canada jointly established the Montreal Laboratory. Scientists from the UK, Canada, and France collaborated to design components of the facility, most notably the ZEEP reactor. The UK provided technical assistance and research scientists. Scientists from other European countries were initially involved in the project. The US was hesitant to discuss plutonium extraction details once the Russian-Anglo agreement had been concluded and the influx of European scientists' unsettled US elites. Churchill and Roosevelt agreed to more liberal exchanges in 1943. In August of 1943 an "agreement" between Canada, the UK and the US was signed stating mutual cooperation and mutual consent is required to use weapons developed from the project.

- j. *Sources:*

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