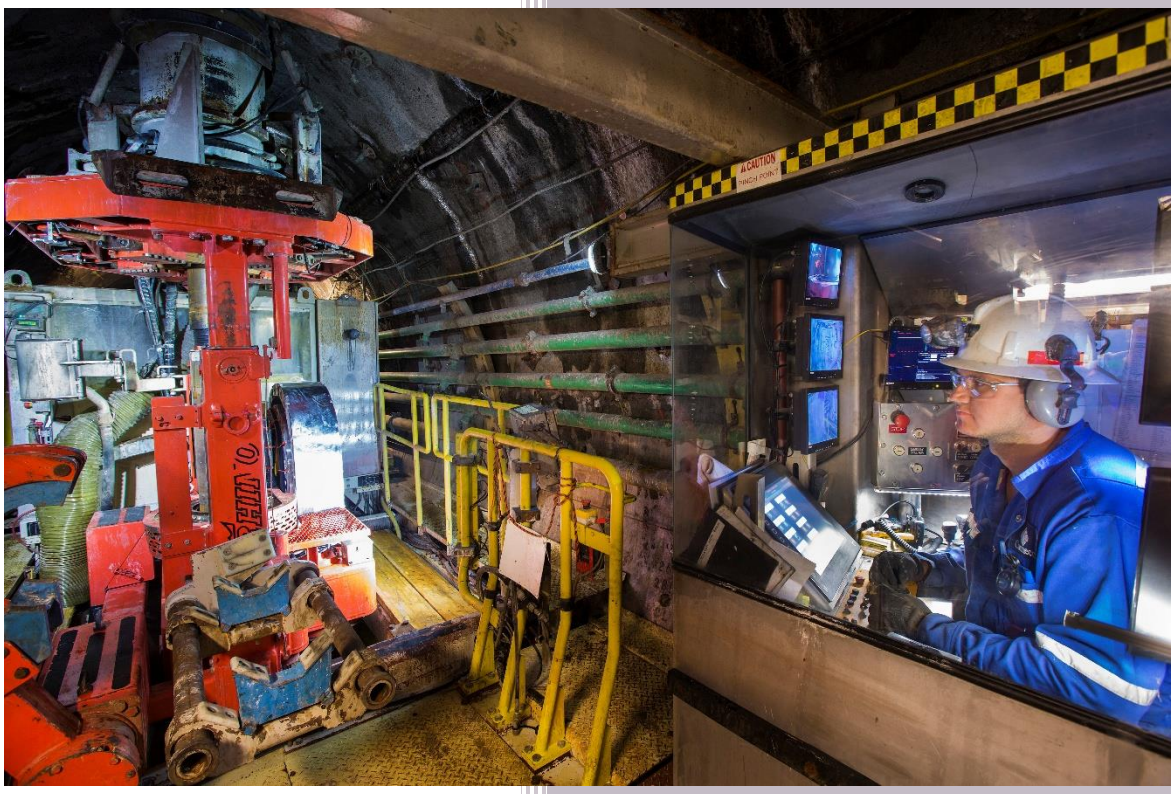
Uranium in Nova Scotia



MANS
Mining Association of Nova Scotia

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Mill Operator
Orano McCLean Lake Uranium Mine, Saskatchewan

EXECUTIVE SUMMARY

The Government of Nova Scotia repealed its ban on uranium exploration and mining in 2025. This sent a signal to the global mining industry that Nova Scotia is open for business, that we want the jobs, investment and economic opportunity that mining and quarrying create. It told the world that the Government of Nova Scotia is committed to making policy and permitting decisions based on science and facts, not misconceptions and politics.

Uranium is a critical mineral.[1] The term "critical minerals" usually refers to minerals that are particularly important in achieving climate goals and for which there are supply concerns. Examples include lithium, which is used in electric vehicle and cell phone batteries, and copper, which is used in wiring. Critical minerals can also include minerals essential for the digital economy and national security.

Uranium is considered a critical mineral because it is the key nuclear fuel. Experts around the world agree that nuclear power is essential to achieving climate goals because it provides vast quantities of baseload energy without generating any greenhouse gas emissions. Countries around the world, including Canada, have committed to tripling nuclear power generation as part of trying to achieve Net Zero emissions by 2050.

Tripling nuclear power generation will require huge additional quantities of uranium in coming years, and there are concerns about shortages.

Uranium also makes possible things like smoke detectors and medical equipment and procedures, such as radiation therapy treatments for cancer patients.

If uranium is that important, why did Nova Scotia ban exploration and mining of it?

Nova Scotia had a boom in uranium exploration from approximately 1976 to 1981. Tens of millions of dollars were spent on exploration. Companies like Shell Canada, Esso Minerals, Gulf Minerals and others were actively exploring in the province.

Uranium occurrences were documented all over Nova Scotia. Other minerals were also discovered during this period as a result of exploration for uranium.

[1] https://www.canada.ca/en/campaign/critical-minerals-in-canada/critical-minerals-an-opportunity-for-canada.html

The boom ended when a politically-motivated moratorium was imposed, in the middle of an election campaign, that had no basis in scientific evidence.

The moratorium nipped in the bud a potential uranium mining industry that could have brought much-needed jobs and investment to the province.

Uranium mining today is very different from what it was when Nova Scotia banned it. Today, most uranium is mined using solution mining (aka in-situ leaching), which results in less disturbance at surface and produces basically no tailings or waste rock.

The Canadian Nuclear Safety Commission (CNSC), the science-based Government of Canada regulator of nuclear activities, including uranium mines, says uranium mining is safe for both humans and the environment.

Some people say we should leave uranium in the ground because they think - incorrectly – it is safer there. The truth is uranium naturally causes health and safety risks, such as radon gas and elevated uranium levels in our water supplies. Nova Scotia's uranium ban prevented us learning more about our uranium deposits and how to improve public safety.

Nova Scotia's uranium ban could also have prevented the province from producing other critical minerals that are essential to achieving climate goals. Since uranium is sometimes concentrated in deposits of other critical minerals such as copper, lithium and rare earth elements, the ban could have prevented mining the other minerals.

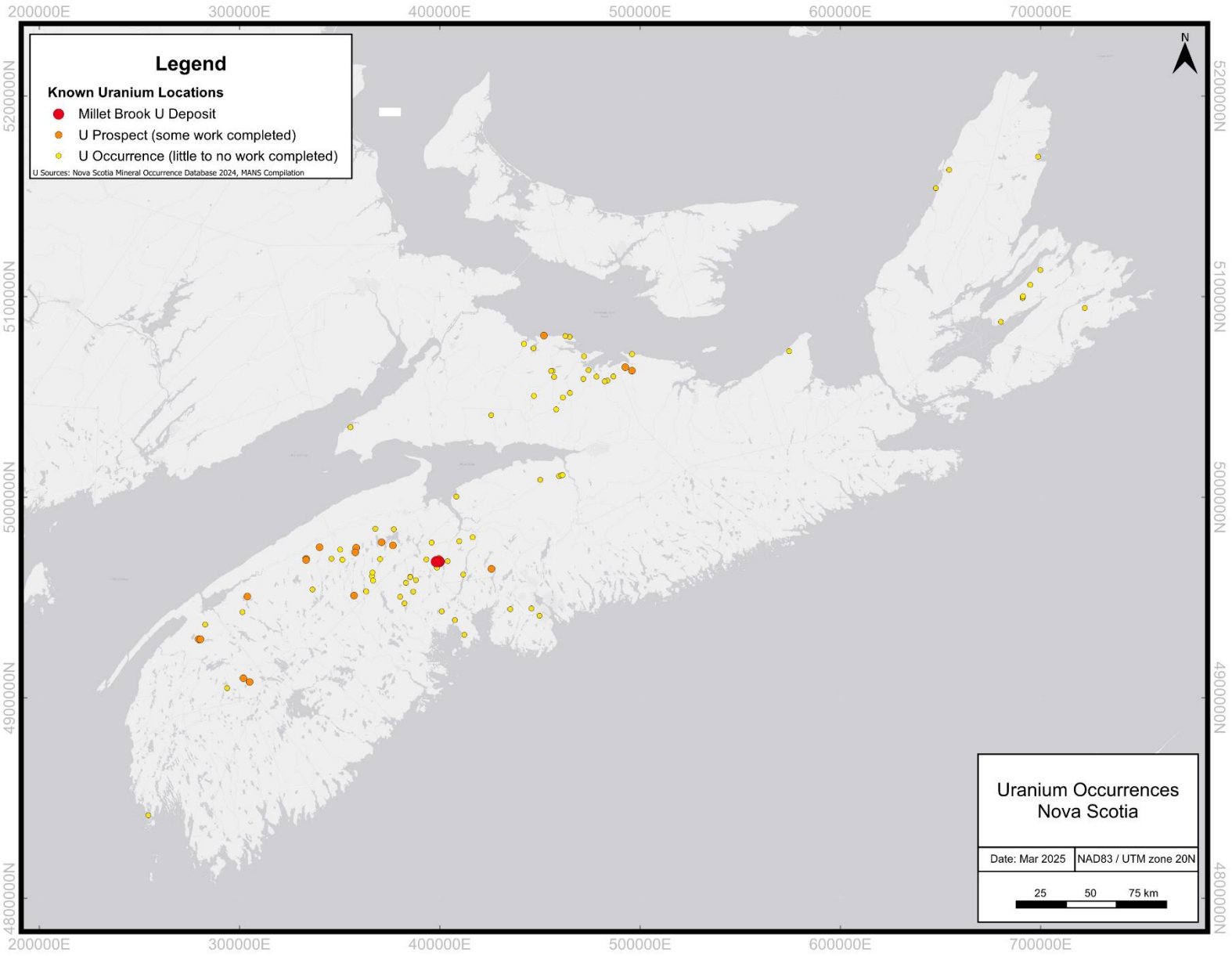
Saskatchewan has been one of the top suppliers of uranium globally since the 1950s. If uranium actually caused the problems that some allege, the people of Saskatchewan would tell us so. Instead, 83% of people in Saskatchewan support uranium mining, according to polling, and uranium has helped Saskatchewan transition from a "have-not" to a "have" province.[2]

Banning economic activities like uranium mining without legitimate cause harms our economy, discourages investment and costs Nova Scotians jobs. It makes Nova Scotia and Nova Scotians poorer.

Ending Nova Scotia's uranium ban allows the industry to do exploration and determine whether our uranium deposits are economically-viable. It also generates more data on the

[2] https://www.cameconorth.com/sites/default/files/documents/CCO-Polling-Summary-12-2020.pdf

province’s geology which governments can use to help keep Nova Scotians safe from geohazards like radon and uranium in drinking water.



URANIUM MINING IS SAFE AND ENVIRONMENTALLY RESPONSIBLE

Nova Scotia's uranium ban was based on myths and misconceptions, not science.

Anyone with questions about uranium mining can find answers on the website of the Canadian Nuclear Safety Commission (CNSC), the federal regulator of uranium mines: (https://www.cnsc-ccsn.gc.ca/eng/). The CNSC is the objective, science-based Government of Canada regulator of nuclear activities, including uranium mines.

Below are various statements taken from the CNSC's site which address myths about uranium mining.[3]

Health and Safety

"Studies and monitoring have shown that there are no significant impacts to the health of the public living near uranium mines and mills. Human exposure to radon and radiation from modern uranium mining is very low and does not increase the risk of cancer."

"Uranium mining and processing activities do not cause stillbirths, birth defects or cancer in humans or animals."

"Natural uranium is only mildly radioactive. If absorbed in large quantities, its main health risks relate to kidney damage. However, the public is not exposed to any levels that could cause kidney damage as a result of uranium mining and processing activities."

"Present-day uranium workers and people living near the facilities are as healthy as the general Canadian population."

"The CNSC oversees stringent programs to control exposure to radiation and chemical agents, and address any potential health risks to workers. As a result, members of the public are not exposed to any levels of contamination that could pose health risks."

[3] See https://www.cnsc-ccsn.gc.ca/eng/resources/fact-sheets/uranium-mining-milling/ and https://www.cnsc-ccsn.gc.ca/eng/resources/mythbusters/#M3

Environment

“Currently, the CNSC employs over 800 full-time staff who ensure the safe operation of nuclear facilities, including uranium mines and mills.”

“Studies have shown that uranium mining and milling activities do not increase radon levels in the environment away from the mine site. The level of radon near uranium mines is similar to natural radon levels monitored in background locations. Radon exposure to members of the public from CNSC-regulated activities is virtually zero.”

“The CNSC will only issue a licence if it is satisfied the proposed nuclear facility or activity is safe for the health, safety and security of persons and the environment.”

“The CNSC ensures streams, lakes and rivers downstream of uranium mining projects are safe for people, plants, fish and other animals.”

“The CNSC ensures groundwater, streams, lakes and rivers downstream of operating uranium mines and mills are safe for people, plants, fish and other animals.”

“Cumulative monitoring programs in Northern Saskatchewan, where all of Canada's operating uranium mines are located, have confirmed that contaminant levels outside operating mining and milling sites are barely detectable and do not pose a risk for the wildlife.”

“It is completely safe to consume fish, game and fruit from regions near operating uranium mines and mills.”

THE URANIUM BAN MAKES US LESS SAFE

Some people think we should leave uranium in the ground because they think – incorrectly – it is safer there. The truth is uranium naturally causes health and safety risks. Nova Scotia's uranium ban prevented us learning more about our uranium deposits and how to improve public safety.

Nova Scotia's ban largely prevented research and data collection about uranium in Nova Scotia. The mining industry cannot invest millions of dollars in exploring for a commodity it cannot mine, so very little uranium-specific data collection was done in Nova Scotia during the decades the ban was in place.

This left governments with less information on which to base public health initiatives.

Naturally-occurring health risks caused by uranium include the following:

Radon is a gas produced by the natural decay of uranium. Radon is the second leading cause of lung cancer, and an estimated 114 Nova Scotians die from exposure to radon each year.[4] People living in areas with elevated uranium levels can be at greater risk of radon exposure because it seeps into basements and is colourless and odourless. Radon testing is essential to ensuring safety.

Many Nova Scotians have high levels of uranium in their well water because uranium is naturally-occurring in all rock and groundwater absorbs minerals from the rock it interacts with. As a result, uranium levels in Nova Scotian wells often exceed drinking water guidelines. That is why it is important to regularly test well water.

Nova Scotia's uranium ban was effectively a ban on data collection and information gathering. It made us less safe.

[4] https://www.carexcanada.ca/Nova_Scotia_Radon_Workshop_Report_May-26-2016.pdf

THE URANIUM BAN COULD HAVE BLOCKED OTHER CRITICAL MINERALS

Nova Scotia's uranium ban could have prevented the province from producing other critical minerals that are essential to achieving climate goals.

Mining is essential to achieving climate goals because things like electric vehicles, wind turbines and solar panels are largely made of minerals. In fact, hundreds of new mines are needed – quickly – to supply the minerals necessary for clean energy. Many reports by global experts predict there will be mineral shortages because there simply are not enough mines in the world to meet the demand.

The global rush to source critical minerals creates an extraordinary economic opportunity for places like Nova Scotia that have the potential to provide them. The province can contribute to global supply while also generating jobs and government revenues to help pay for programs like health and education.

Our 2024 survey found that most Nova Scotians think we should contribute to global supply of these essential materials. In fact, 65% of Nova Scotians support mining critical minerals and only 16% oppose it, a ratio of about 4-to-1 in favour.[5]

A little-known aspect of Nova Scotia's uranium ban is that it did not just block uranium mines – it also prevented extraction of any rock that contains more than 100 parts per million (ppm) of uranium.

All rock contains some tiny amount of uranium. Here in Nova Scotia, most rock contains less than 10 ppm.

However, uranium is sometimes concentrated in deposits of other critical minerals such as copper, lithium and rare earth elements. It is possible that some Nova Scotian critical mineral deposits could contain quantities of uranium that exceed the 100 ppm limit. This would have prevented mining the other minerals.

[5] https://tmans.ca/polling

URANIUM MINING HAS CHANGED

Uranium mining today is very different from what it was when Nova Scotia first banned it.

Today, most uranium is not mined using conventional mining methods. Instead, it is extracted using solution mining (aka in-situ leaching).

Conventional mining means removing mineralized rock (ore) from the ground, breaking it up and treating it to remove the minerals being sought.

In solution mining, the ore is left in the ground, and the minerals are extracted by dissolving them in liquid and pumping the solution to the surface where the minerals can be recovered. (The liquid is usually just water, often with a reagent that helps dissolve the mineral. At in-situ uranium mines, it is often water with hydrogen peroxide as the reagent.)

Solution mining results in less disturbance at surface and produces basically no tailings or waste rock.

According to the International Atomic Energy Agency, "In 1997, the ISL [in-situ leaching] share in total uranium production was 13%; by 2011 it had grown to 46%."[6] Extracting uranium via solution mining has continued to grow since then. By 2022, it was responsible for 55% of global uranium production.[7]

Solution mining has been done in Nova Scotia since 1947 in Nappan, Cumberland County, where a world-class salt deposit has been extracted using the process. Hot water is pumped into drill holes under pressure and the resulting salt brine is pumped back out, then sent through a settling and evaporation process at the surface to produce a high-purity salt.

While there are advantages to solution mining, it can only be done for some minerals and in deposits that have the right conditions. For example, the deposit needs to be permeable (able to absorb the liquid) so the minerals can be dissolved, but located such that the process will not interact with groundwater (i.e. it is often done below groundwater and/or where the deposit is surrounded by other rock that is impermeable).

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[6] https://www-pub.iaea.org/MTCD/Publications/PDF/P1741_web.pdf

[7] https://world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production

With Nova Scotia's uranium ban repealed, more exploration can be done to determine whether the province's uranium deposits are economically viable and whether they could be extracted via solution mining.

See how modern uranium mining is done at one of Saskatchewan's mine:
https://www.cameco.com/businesses/uranium-operations

Uranium drill core
Orano McCLean Lake Uranium Mine, Saskatchewan

THE SASKATCHEWAN EXAMPLE

Saskatchewan has been one of the top suppliers of uranium globally since the 1950s. If uranium actually caused the problems that some allege, the people of Saskatchewan would tell us so. Instead, 83% of people in Saskatchewan support uranium mining, according to polling, and uranium has helped Saskatchewan transition from a "have-not" to a "have" province.[8]

Saskatchewan has shown Canadians that uranium mining is done safely and environmentally responsibly, while also creating many jobs and government revenues. In 2023, Saskatchewan's uranium mining sector created 2,192 direct jobs and 1,228 indirect jobs, paying $356 million in salaries. The average annual salary of uranium miners in Saskatchewan was $113,516.

More key statistics about Saskatchewan's uranium sector are at available at https://saskmining.ca/wp-content/uploads/2024/10/SMA-Uranium-Infographic-2024-Stats-WEB1.pdf

Saskatchewan has the largest high-grade uranium deposits in the world, so we are not implying that Nova Scotia could have a uranium sector of equivalent size and importance. Indeed, we were prevented for over four decades from exploring Nova Scotia's uranium deposits to learn more about them.

However, Nova Scotia has known potential for uranium and ending the uranium ban allows exploration to take place so we can determine whether our uranium deposits are economically-viable.

[8] https://www.cameconorth.com/sites/default/files/documents/CCO-Polling-Summary-12-2020.pdf

URANIUM'S USES

Uranium has many uses from which we all benefit. Below are several important examples.

Emissions-Free Nuclear Power

Uranium is the key nuclear fuel.

Experts around the world agree that nuclear power is essential to achieving climate goals because it provides vast quantities of baseload energy without generating any greenhouse gas emissions. In fact, Canada and 21 other countries have committed to tripling nuclear power generation as part of trying to achieve Net Zero emissions by 2050.[9]

Tripling nuclear power generation will require huge additional quantities of uranium in coming years, and there are concerns about shortages.

For example, the International Energy Agency says, "Greater diversity of uranium supply and enrichment services is essential for a secure and affordable expansion of the nuclear sector… Governments and mining companies need to bring idled mines back into service and develop new mines."[10]

Nova Scotia has the potential to contribute to global supply of uranium and help achieve climate goals.

[9] https://natural-resources.canada.ca/energy/resources/international-energy-cooperation/cop28-declaration-triple-nuclear-energy-2023/25591

[10] https://iea.blob.core.windows.net/assets/21947d24-cbe3-4fbe-a5b7-5c94de5c60f2/ThePathtoaNewEraforNuclearEnergy.pdf

Smoke Detectors

Smoke detectors save lives – thanks to uranium!

Most home smoke detectors use radioactive material to sense smoke in the air and warn of fire hazards. The radiation source is usually a tiny amount of americium-241, a material produced in uranium-fueled nuclear reactors.

The americium-241 ionizes (electrically charges) air in the device's detection chamber so electrical current can flow through a gap between two electrodes. When smoke enters the detection chamber, it interrupts the electricity flow and triggers the alarm.

Uranium makes smoke detectors possible in two ways.

First, uranium is the fuel that powers nuclear reactors in which americium-241 is produced.

Second, americium-241 is actually derived from uranium. During the nuclear reaction, uranium-238 atoms absorb neutrons, causing the uranium to break down to plutonium-239. The plutonium also captures neutrons and becomes americium-241.

So, without uranium, most household smoke detectors would not exist.

The idea for this type of smoke detector came from Swiss physicist Walter Jaeger who, in the late 1930s, was working on a sensor for detecting poison gas. When his device failed to register small amounts of gas, he lit a cigarette in frustration, and the cigarette smoke moved the meter on his device. This discovery helped pave the way for modern smoke detectors.

Americium-241 provides enough radiation to make smoke detectors work but "The slight amount of radiation that can be measured outside the unit does not pose any health risk," according to the Canadian Nuclear Safety Commission.[11]

That is partly because the americium-241 is shielded by gold in two ways: the americium-241 is alloyed/combined with gold, and the alloy is wrapped in gold foil. The gold helps contain the small amount of radiation.

[11] https://www.cnsc-ccsn.gc.ca/eng/resources/fact-sheets/household-smoke-detector/

Cancer treatments and other Medical Uses

There are many misconceptions about uranium but here's a fact – it saves lives!

In Canada, over 1.3 million diagnostic scans and thousands of radiation therapy treatments for cancer patients are performed annually thanks, in part, to uranium mining.[12]

Medical isotopes are used in health care to diagnose and treat conditions such as heart disease and cancer. Many medical isotopes are produced in uranium-fueled nuclear reactors, including at the Bruce Power Generating Station in Toronto, the second largest nuclear power plant in the world.

For example, Bruce Power has produced Cobalt-60 for over 30 years. Cobalt-60's many uses include cancer radiation treatments and sterilizing medical equipment such as syringes, gloves, implantable devices, surgical gowns and masks.

While other sterilization methods take up to seven days before products are available for use, Bruce Power's Gamma irradiation technology using Cobalt-60 can process such materials within a day. This gets equipment and devices to front-line health workers faster.

Bruce Power also produces Lutetium-177, which allows doctors to target and destroy cancer cells, while leaving healthy tissues unaffected.

Lutetium-177 is produced by irradiating Ytterbium-176. Ytterbium-176 is placed in special sealed containers that are put in one of Bruce Power's reactors. The Ytterbium-176 is irradiated for about one week and the resulting intermediate Lutetium-177 is then sent for further processing into highly-pure pharmaceutical grade Lutetium-177 for distribution to health care facilities worldwide.

We take for granted that medical equipment and procedures will be available to us and our loved ones in times of need, but Nova Scotia's ban on uranium mining prevented us potentially contributing to global supply of this life-saving material.

[12] https://cna.ca/wp-content/uploads/2023/02/CNA-Factbook-2023-English.pdf, page 3

Cameco’s McArthur River uranium mine in Saskatchewan.