

# URANIUM



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## What is it?

Uranium is a heavy, silver-white metal that is naturally radioactive. Physicists believe that the Earth's uranium originated in exploding stars billions of years ago. This and other elements accumulated as Earth formed from space dust and debris. Uranium's unique atomic properties give it the potential to generate incredible amounts of energy.

Uranium occurs in 16 different forms called isotopes, but almost all of it is the stable isotope U-238, and the rest is mainly U-235. U-235 is important because it is the only naturally occurring isotope that is used to produce energy. If U-235 is bombarded with neutrons it will first absorb them and then split into two smaller nuclei, releasing energy and more neutrons. This is called fission. If these neutrons are absorbed by more U-235 nuclei, a chain reaction can occur that can result in the tremendous explosion of a nuclear bomb, or, when controlled in a reactor, steady heat.

## Nuclear-Powered Homes!

After mining, uranium ore is processed to separate the uranium from the other elements and minerals mixed with it in the rock. The resulting powder ("yellow cake",  $U_3O_8$ ) is refined into uranium dioxide that is used as-is to make fuel pellets for Canadian reactors. Most of Canada's uranium is exported as hexafluoride from which U-235 is enriched for other reactor types. Nuclear generating stations are built around reactors that control the fission of the uranium in these pellets. The heat from fission is used to boil water and produce steam just like in a natural gas- or coal-powered station. The steam turns turbines that are connected to electrical generators. The electricity from these generators flows into the power grids and finally into our homes. Unlike electricity from fossil-fuel generating stations, nuclear generating stations create electricity without producing greenhouse gases.



Open pit at McLean Lake uranium mine, Saskatchewan

C. Jefferson, NRCCan

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Uranium yellow cake

Uranium dioxide pellets



Bruce Power Generating Station, near Kincardine, Ontario

## Did you know?

Uranium is common in the Earth's surface rock, soil, rivers, and oceans – each Canadian backyard contains about 0.2 kg of this element.

Uranium glass (vaseline glass) was once used for tableware and decorative items – it turns a fluorescent bright green under ultraviolet light because it contains uranium dioxide.

Weapons-grade uranium is now being converted into electrical energy as part of the global disarmament program.

Radioisotopes created from uranium make smoke detectors work.

20 kg of uranium produces as much energy as 400,000 kg of coal.

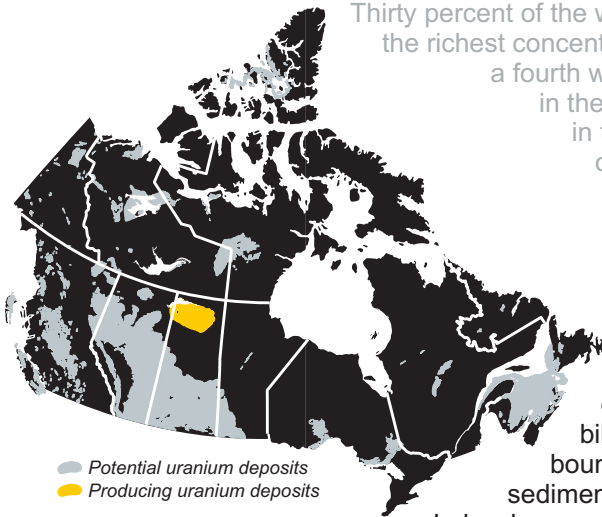
Half of Ontario's electricity comes from nuclear generating stations.



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## Canada is a Great Place to find Uranium

Thirty percent of the world's primary uranium is produced in northern Saskatchewan, the richest concentration of uranium in the world. Three mines are operating and a fourth will start in 2007. Uranium was previously mined at Port Radium in the Northwest Territories, near Uranium City, Saskatchewan, and in the Bancroft district of Ontario. A future mine at a deposit west of Baker Lake, Nunavut, is being considered by the people of Nunavut and AREVA Resources Canada Inc.



## Types of Uranium Deposits

Uranium deposits in Canada are found in rocks of different geological ages and environments. The oldest uranium deposits formed as placer deposits about 2.3 billion years ago in river gravels – Elliot Lake's deposits are this type. The deposits in northern Saskatchewan formed about 1.8 to 1.5 billion years ago, concentrated from fluids moving along a sharp boundary between very old deformed rocks, and younger sedimentary rocks. Other deposits occur in volcanic rocks such as in Labrador, granitic rocks like those at Bancroft, or in relatively young sandstone layers as in eastern Canada, British Columbia and southern Saskatchewan.

Cigar Lake underground mine



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Electrical turbines

© Bruce Power

## Uranium and the Environment

Uranium is special because all its isotopes are toxic and teratogenic (can produce birth defects). But careful use can limit the hazards. Radioactive waste can be grouped into three categories: uranium mine and mill tailings, low-level radioactive waste (contaminated soil, decommissioned nuclear facilities, and isotopes used in research, medicine, and industry), and nuclear fuel waste. Canadian operators of uranium mines practice stringent safety rules, and when the mines are closed, the land must be reclaimed. Nuclear fuel waste is a by-product of nuclear reactors around the world. Although the volume of this waste is small, storage and disposal are taken seriously, because it is both an energy source and a radiation hazard, and it takes about 500 years for the radioactivity of spent fuel to decay to the level of the original uranium ore. Some of it is reprocessed into new fuel and some is stored in safe underground sites. In Canada it is stored under water until cool and then placed in concrete storage containers.



Solid low-level radioactive waste storage, Point Lepreau Generating Station, New Brunswick

EMR-3523