



## Uranium Mining: The Facts on a Well-Regulated Industry

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Canada is among the top producers of uranium in the world, and there is increasing demand for production. As a result, the exploration and mining industry is conducting extensive exploration activities to identify new commercial sources in Canada and all over the world.

The CNSC is responding to the possible demand for new Canadian uranium mining and milling operations by enforcing strict regulatory requirements and processes for licensing and operating uranium mines, in order to protect Canadians, their health and the environment.

### How is the uranium mining and milling industry regulated?

The CNSC is responsible for regulating and licensing all existing and future uranium mines and milling operations in Canada. This is undertaken in accordance with the comprehensive requirements of the *Nuclear Safety and Control Act (NSCA)* and its related regulations, which reflect international safety standards. The CNSC and its staff focus on health, safety, security and the environment, and ensure Canada meets its international obligations on the safe use of nuclear materials.

Surface exploration for uranium is exempt from NSCA requirements because it poses low risk. Each province or territory is responsible for regulating and monitoring exploration activities within its jurisdiction and informing the public about those activities.

No person may site, construct, operate, decommission or abandon a uranium mine or mill without first receiving a licence from the CNSC. A separate licence is issued for each new phase in the lifecycle of a uranium mine or mill. The CNSC exercises rigorous regulatory oversight and ensures a financial guarantee is in place to cover decommissioning costs of each facility at all phases in its lifecycle.

### What are the health risks of uranium exploration?

Uranium exploration does not pose a risk to public health or the environment. Uranium exploration methods (such as drilling small core samples) do not significantly modify the natural environment. It has been

### Quick facts

- The uranium mining and milling industry is the only mining industry in Canada licensed, regulated and monitored by the federal government.
- The Canadian Nuclear Safety Commission (CNSC) is the federal regulator for the uranium industry. It is the responsibility of the CNSC to ensure the safety of uranium mining and milling operations.
- The CNSC employs full-time staff who ensure the safe operation of uranium mine and mill facilities.
- Canada has three operating uranium mines and mill sites, one mine site, and one new uranium mine site under construction (all in Northern Saskatchewan).
- In 2008–09, all mines and mills were routinely inspected by CNSC and provincial inspectors, and some received as many as eight CNSC inspections.
- Current uranium mine and mill licenses are issued for an average of five years.
- The CNSC is responsible for regulating more than 20 decommissioned tailings management sites across Canada associated with closed uranium facilities.
- Currently, the CNSC has applications for five new mines: the Millennium Mine Project in Northern Saskatchewan, the Kiggavik Project in the Kivalliq region of Nunavut, the Matoush Exploration Project in central Québec, and the Midwest and Caribou Projects located at existing mine sites in Northern Saskatchewan.
- Each province and territory is responsible for regulating and monitoring uranium exploration activities in its jurisdiction and informing the public about those activities.
- Some provinces have imposed moratoriums on uranium exploration.



determined that uranium exploration presents low to no risk of increasing radiation or radon exposure to the public and to the environment.

For more information on uranium exploration regulations and guidelines in your area, please contact your provincial or territorial government.

## **How does the CNSC license new mines and mills?**

The licensing process is rigorously structured under the NSCA and is initiated when a licence application is received from a proponent.

Licence applications must contain information required by the regulations. The *Uranium Mines and Mills Regulations* set out specific requirements for the each of the following licence categories:

- (1) licence to prepare a site and to construct
- (2) licence to operate
- (3) licence to decommission
- (4) licence to abandon (or release from CNSC licensing)

Each stage of licensing could also require an Environmental Assessment.

Information contained in licence applications can be organized in 14 general safety and control areas, which are regularly monitored and evaluated by qualified staff. The program areas are as follows:

- Management Systems
- Mining and Milling
- Operations
- Safety Analysis
- Physical Design
- Radiation Protection
- Occupational Health and Safety
- Environmental Protection
- Emergency Preparedness
- Waste Management
- Security
- Safeguards
- Packaging and Transport
- Public Information Activities

The CNSC assesses information submitted by proponents in support of their applications. This assessment is carried out by a team of technical specialists, with input from other federal and provincial or territorial government departments and agencies responsible for regulating health and safety, environmental protection, emergency preparedness, and the transportation of dangerous goods.

## **How does the CNSC make sure rules are respected?**

Once a licence has been issued, the licensee is required to comply with the requirements of the NSCA and regulations, specific conditions set down in the licence, and commitments made in the licence application.

CNSC staff conducts a compliance program to ensure these requirements are respected. Compliance is verified by reviewing reports submitted by the licensee and through site inspections. Licensees must submit environmental and radiation monitoring results, unusual occurrence reports and annual performance reports. CNSC staff will also work with licensees to further educate them about requirements if it is identified that they do not fully understand them. Finally, when necessary, the CNSC will use a graded series of enforcement actions to promote compliance.

CNSC staff continuously monitor the Saskatchewan uranium mine and mill facilities to protect workers, the public and the environment. The CNSC also works in a harmonized manner with the Saskatchewan Ministries of Environment and Advanced Education, Employment and Labour through regular facility visits and inspections.

### **How does the Environmental Assessment process work?**

The *Canadian Environmental Assessment Act* (CEAA) requires an Environmental Assessment (EA) of uranium mine or mill projects to be carried out. An EA identifies whether a project is likely to cause significant adverse environmental effects, taking into account the appropriate mitigation measures. The CNSC, or any other federal authority, may not issue a permit or licence, grant an approval, or take any other action for the purpose of enabling the project to be carried out, in whole or in part, until the EA has been completed. In addition, no project will proceed if it is found that it would create significant human health or environmental impacts.

In accordance with the *Canadian Environmental Assessment Act* and its regulations, CNSC oversees Environmental Assessments (EAs) to make sure uranium projects are safe for the environment. Provinces, territories and modern aboriginal land claim agreements all contain requirements for EAs. The CNSC and the Canadian Environmental Assessment Agency (CEAA) work with these jurisdictions to ensure that a comprehensive and efficient EA process is carried out and that meets all jurisdictional criteria.

EAs are used to predict the environmental effects of proposed initiatives and to identify measures to prevent or minimize these effects before initiatives are carried out. They provide opportunities for public participation in activities undertaken by potential licensees and/or the CNSC, including Aboriginal consultations.

### **How can the public participate in the regulation of uranium mines and mills?**

Public engagement and participation are key components of the CNSC's regulatory process. Before receiving an application, the CNSC will respond to invitations to discuss its role in the regulation of uranium mining.

Safety is the legislated mandate of the CNSC and the expectation of the Canadian public. The CNSC is open to discussions and public meetings related to any of its regulated activities, such as proposed or current uranium mining and milling facilities. As the CNSC does not regulate uranium exploration, the CNSC does not typically engage in discussions about this activity.

### **Quick health and environmental facts**

- Studies demonstrate that present-day uranium workers, and the public living near a uranium mine or mill, are as healthy as the general Canadian population.
- The yearly dose limit per uranium worker is 50 mSv (milliSieverts) and 100 mSv over a five-year period.
- While underground mine workers receive the highest radiation doses, in 2008, the average annual dose to miners was 4.0 mSv and the maximum dose was 10.9 mSv, well below acceptable dose limit.
- Risk of getting lung cancer from working in current uranium mines is low because current radon exposures are low; therefore the risk is low and is comparable to the risk of the general Canadian population.
- Studies have shown that uranium mining and milling activities do not increase radon levels above background levels in the environment away from the mine site.
- Studies and monitoring have shown there are no significant impacts to the health of the public living near uranium mines and mills.
- Strict environmental monitoring programs identify and manage environmental effects and keep them limited to mine and mill areas.
- There is no evidence of illness in Canada attributed to uranium exposure.

Once an application has been received, the CNSC initiates EA and licensing processes. These both give opportunities for public involvement.

In addition to public participation, the CNSC also has a duty to consult with Aboriginal communities whose established or potential treaty rights may be affected.

## What are the risks related to uranium mining?

Uranium mining could present risks to mine and mill workers, the public and the environment. To understand these risks, there have been many studies conducted on uranium mine workers, the public and the environment. Overall, studies have demonstrated that workers and the public living near mines were as healthy as the general Canadian population. Strict environmental monitoring programs are used to identify and manage environmental effects and to limit them to mine and mill areas.

Studies conducted on groups of workers employed in Canadian uranium mines and mills in the decades prior to the mid-1970s were used to strengthen regulatory requirements to better protect workers against the effects of exposure to radon.

### Public health effects

- A number of studies in Canada and around the world show that uranium mines, mills and refineries do not affect public health.
- Human exposure to radon and radiation from modern uranium mining is low and does not increase the risk of cancer.

## Examples of health and environmental monitoring:

- **Lost time incidents of workers** - Lost time incidents (LTIs) occur when workers become injured and lose time from work. Provincial workers' compensation boards compile LTI statistics for major industries as a conventional health and safety measure. As the table below shows, Saskatchewan's uranium mine workers had a lower LTI rate from 2004 to 2007 than other types of miners as well as workers in other industries — indicating the strength and effectiveness of Saskatchewan uranium mines' occupational health and safety programs.

Industry description	% of workers injured with time loss			
	2004	2005	2006	2007
Open pit uranium mining	0.84	0.94	0.68	1.08
Underground hard rock uranium mining	2.02	2.15	3.17	2.79
Underground soft rock mining	1.58	1.32	1.22	1.39
Construction trades	8.67	9.28	7.53	7.19
Automotive service shops towing	4.39	4.71	3.87	3.72
Operation of oil wells	1.11	0.89	0.82	1.21
Servicing of oil wells	5.43	5.53	4.44	3.74
Conventional logging	8.54	21.66	21.83	32.03
Mechanical logging	3.18	4.24	3.29	2.19
Refineries/upgrader	1.18	1.14	1.15	0.78
Machine shops	12.8	14.32	12.87	11.15
Government of Saskatchewan	3.73	3.54	3.75	3.02
<b>Average &gt;</b>	<b>4.46</b>	<b>5.81</b>	<b>5.39</b>	<b>5.86</b>

Source: Saskatchewan Workers' Compensation Board - Statistical Supplement

- **Radiation doses** - The main health hazards for uranium workers relate to exposure to radon and radon progeny, which develop from the natural decay of uranium. Long-term exposure to high levels of radon increases the risk of lung cancer, but is not linked to other cancers or causes of death. Modern controls and strict radiation protection programs at today's nuclear facilities ensure that uranium workers do not have a higher lung cancer risk than the general population.

The radiation dose limit for uranium miners is 50 millisieverts (mSv) per year and 100 mSv during a five-year period. (The mSv is a unit that measures the effect of radioactivity on the whole body.) Today's uranium mine workers receive very low total radiation doses that are well below regulatory dose limits.

The main health hazard directly related to uranium is not its radioactivity, but its chemical toxicity to the kidney. However, uranium releases at uranium mines and mills are at levels well below those that could pose a health hazard.

- **Environmental monitoring** - There have been studies of the environment to understand the impacts of uranium mining on the air, water, plants, fish and animals near mining facilities. One such program is the monitoring study in Northern Saskatchewan. Since 1994, this program has been assessing the cumulative impacts of radon and other radionuclides on the local environment.

Results have proven that uranium mines have no effect on radon levels. Also uranium, Radium-226, Lead-210 and Polonium-210 levels in fish were often below detection thresholds. Even when measurable, these levels were no different around mine sites compared to nearby or remote reference sites.

## **How does the CNSC ensure that a mine is closed down safely?**

The final stage for a mine or mill is its shutdown, decommissioning and end-state environmental monitoring. Long after a mine is decommissioned, the CNSC and provincial/territorial regulators continue to verify that the licensee complies with all licence conditions and regulatory requirements to ensure long-term stability. The licensee must always have a financial guarantee to ensure sufficient funding for the long-term management of the decommissioned site, during the siting, construction, operation and decommissioning phases.

## **What wastes are produced from uranium mine and mills?**

- **Waste rock** - Mining produces waste rock that must be removed to retrieve the uranium ore. For the most part, this rock is chemically inert and is placed in surface rock piles. Waste rock that contains low concentrations of radionuclides or heavy metals (mineralized waste) must be managed during operations and properly disposed of. This ensures that contaminants are not easily dissolved and released to the environment.
- **Tailings** - Milling uranium ore produces tailings. Tailings are the ground ore from which the uranium has been removed and are the consistency of fine sand. They contain long-lived radionuclides (such as Thorium-230 and Radium-226) produced from the decay of uranium, as well as trace metals like arsenic and nickel. They also contain chemical residues from the mill process. Decommissioned tailings management facilities require long-term regulatory (institutional) control.

## **How is waste from uranium mines and mills managed?**

Mining and milling generates large volumes of waste. In general, the only practical option is to use near-surface facilities, which are adjacent to the mines and mills, for long-term waste management. The tailings are monitored and managed in facilities such as engineered tailing ponds or are placed back in mined-out open pits. Cameco Corporation and AREVA Resources Inc. manage Canada's only operating uranium mines and mills, all located in Northern Saskatchewan. Tailings management facilities are engineered to prevent and minimize contact between ground water and tailings in the long term.

Uranium mines and mills that are no longer operating — such as the mining and tailings facilities around Elliot Lake, Ontario — have been decommissioned and the former operators continue to monitor and maintain them. There are also former uranium mining and milling sites in Saskatchewan, Ontario and the Northwest Territories. These inactive sites are being managed in the long term by their former owners or the federal, provincial or territorial government.

There are applications pending for the remediation of inactive legacy uranium mine and mill sites in Northern Saskatchewan, which were abandoned during the mid-1960s and that do not meet today's environmental standards. Following joint federal and provincial Environmental Assessments that are under way, these sites will undergo physical remediation work to properly close them.

**For more information:**

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