

REGULATORY CHALLENGES OF HISTORIC URANIUM MINES IN CANADA**C.H. Clement, R.E. Stenson**

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Abstract. The radium and uranium mining industry began in Canada in 1930 with the discovery of the Port Radium deposit in the Northwest Territories. During the 1950s more uranium mines opened across Canada. Most of these mines ceased operation by the end of the 1960s. Some were remediated by their owners, while others were abandoned. The Atomic Energy Control Board (AECB), predecessor to the Canadian Nuclear Safety Commission (CNSC), was created in 1946. However, it was not until the mid-1970s that the AECB took an active role in regulating health, safety and environmental aspects of uranium mining; so many of the older mines have never been licensed. With the coming into force of the Nuclear Safety and Control Act (NSCA) in May 2000, this situation has been reviewed. The NSCA requires a licence for the possession of nuclear substances (including uranium mine tailings), or the decommissioning of nuclear facilities (including uranium mines and mills). Furthermore, governments (federal and provincial) are also subject to the NSCA, a change from the previous legislation. The CNSC has an obligation to assess these sites, regardless of ownership, and to proceed with licensing or other appropriate regulatory action. The CNSC has reviewed the status of the twenty sites in Canada where uranium milling took place historically. Eight are already licensed. Licensing actions are being pursued at the other sites. A review of nearly 100 small uranium mining or exploration sites is also underway to determine the most appropriate regulatory approach. This paper focuses on regulatory issues surrounding the historic mining and milling sites, and the regulatory approach being taken, including licensing provincial and federal government bodies who own some of the sites, and ensuring the safe management of sites that were abandoned.

INTRODUCTION

This paper describes the regulatory challenges associated with tailings management areas resulting from now closed uranium mines. With one exception, these uranium mines were in operation before the federal regulator of the nuclear industry, the Canadian Nuclear Safety Commission (CNSC), and its predecessor the Atomic Energy Control Board (AECB), began to take an active role in the regulation of health, safety and environmental aspects of uranium mining in the mid 1970s. Many of these mines ceased operations before this time.

This paper begins with a brief history of uranium mining in Canada, providing the reader with a historical context and describing, in general terms, the origins of the sites now under consideration. The past and current regulation of historic uranium mine sites and tailings management sites is then discussed, with an emphasis on recent legislative changes and how that has changed the approach of the federal regulator. An overview of the current status of the sites is provided, followed by an indication of the direction of future regulatory action.

A BRIEF HISTORY OF URANIUM MINING IN CANADA

The uranium mining industry in Canada began in 1930 with the discovery of uranium and radium bearing ore on the eastern shore of Great Bear Lake in the Northwest Territories. In 1932, Eldorado Gold Mines Limited began operating the Port Radium mine here. Initially, the product being extracted was radium, which was in demand at that time for use in cancer treatments and radium luminous compounds. However, by 1940, the demand for radium had decreased and the Port Radium mine was closed. During this time, a smaller mine a few kilometres south of Port Radium, the Contact Lake mine, also mined and milled radium/uranium ore from 1936 to 1939.

In 1942, the Port Radium mine was re-opened, to extract uranium for weapons production during World War II. To secure control of this resource, the Canadian federal government began purchasing

shares in Eldorado. By 1944, Eldorado was made a Crown Corporation.

It was not until the mid-1950s that other significant uranium mines began operations in Canada. The Gunnar mine, located on Lake Athabaska in northern Saskatchewan, near what was to be known as Uranium City, began operations in 1953. In the same year, uranium mining operations began near Bancroft, Ontario. Two years later, uranium mining operations began in Elliot Lake, Ontario. By the end of the 1950s, there were no less than two major uranium mines in operation in the Northwest Territories, three in the Uranium City area, three in the Bancroft area, and twelve in the Elliot Lake area. Figure 1 shows the location of now closed, or idle, uranium mines in Canada, which includes those described above along with the Agnew Lake mine, which would not begin operations until 1977. In addition to these major uranium mines, dozens of smaller mines were operated in the vicinity of Uranium City and Bancroft. These smaller mines, perhaps totalling as many as one hundred, hauled uranium ore to mills at the major uranium mine sites for processing.

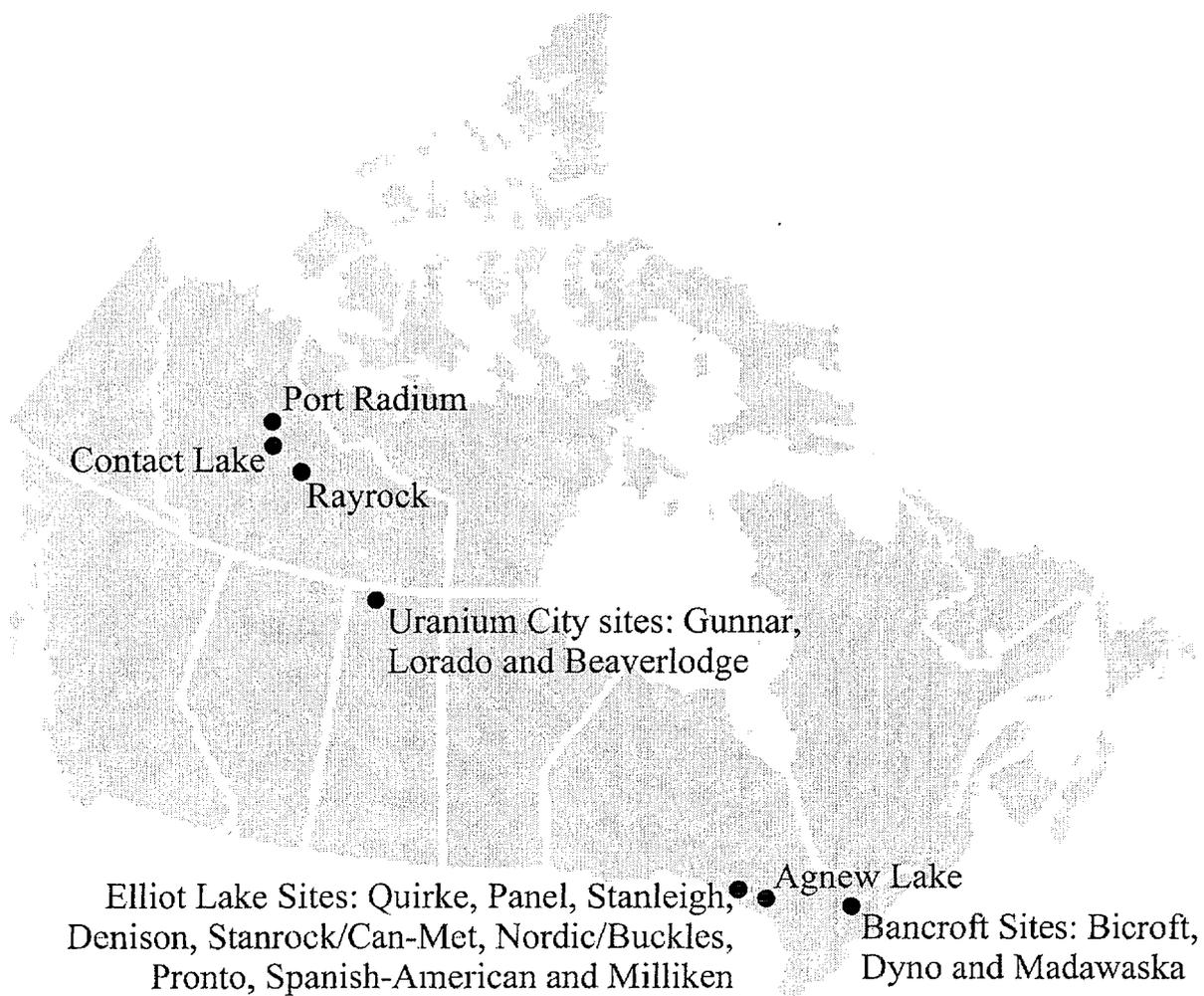


FIG. 1. Location of tailings management sites resulting from now idle uranium mines in Canada

The uranium mining industry saw the first of several declines in 1959. Only two of the twenty significant uranium mines in operation in the late 1950s remained in operation throughout the 1960s. Figure 2 shows the periods of operation of these mines, along with the now closed Agnew Lake mine.

No new mines were to begin operations until the 1970s. All of these newer mines, with the exception of Agnew Lake, are situated in northern Saskatchewan and are still in operation today.

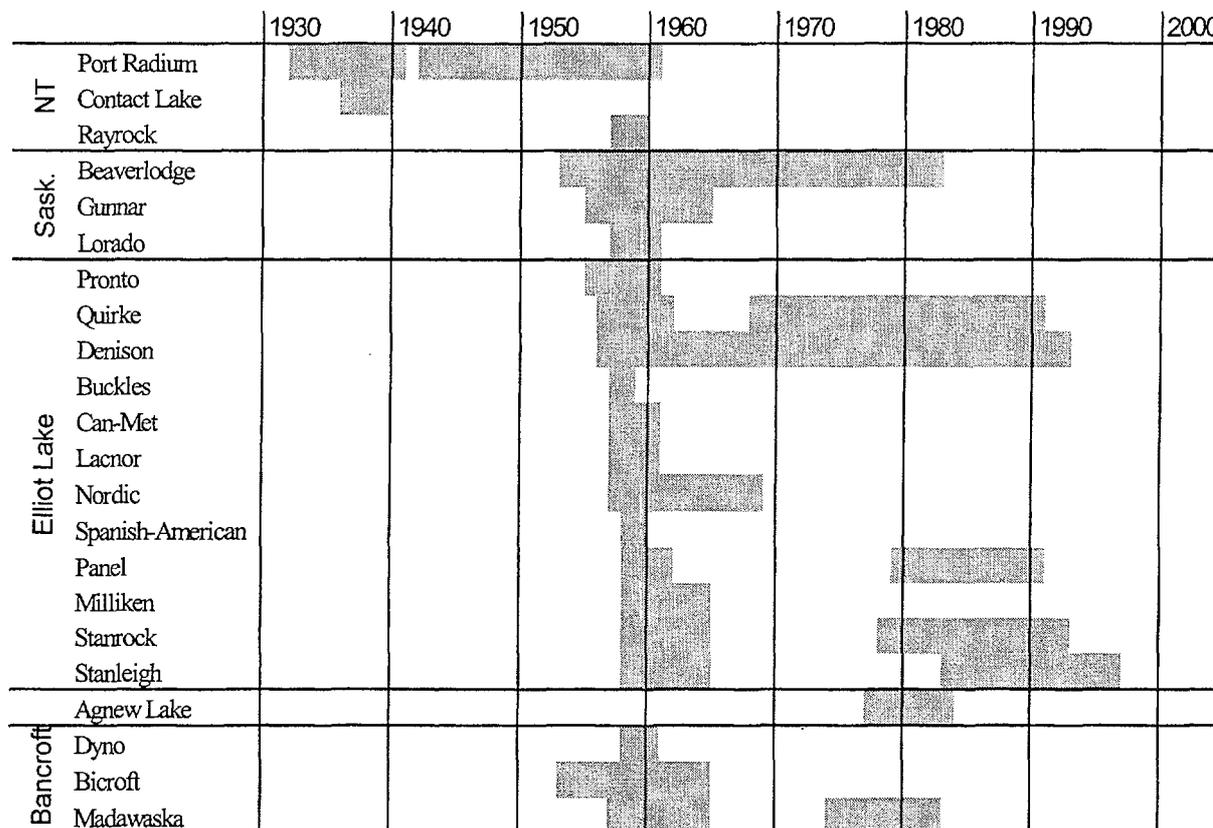


FIG. 2. Timeline of uranium mining operations at the now idle mine/mill sites in Canada

CANADIAN NUCLEAR REGULATORY HISTORY AND RECENT CHANGES

The Atomic Energy Control Board was established under the *Atomic Energy Control Act* of 1946. Its role was to assist the Government of Canada in its efforts "... to make provision for the control and supervision of the development, application and use of atomic energy and to enable Canada to participate effectively in measures of international control of atomic energy."

However, it was not until the 1970's that the Atomic Energy Control Board began to play a significant role in the regulation of health, safety and environmental aspects of the uranium mining industry. It was not until after this time that operations began at the now closed Agnew Lake mine (referred to previously) as well as the uranium mines now in operation in Canada. As a result, Atomic Energy Control Board licences were issued for these sites. The currently operational sites still have licences. The Agnew Lake mine licence was allowed to expire in the early 1990s once operations had ceased, the site had been cleaned up to the standard of the day, and the mining claims had reverted to the Ontario provincial government.

On May 31, 2000 the Canadian Nuclear Safety Commission replaced the Atomic Energy Control Board. The Commission's creation followed the coming into force of the *Nuclear Safety and Control Act* and its regulations. The new law represents the first major overhaul of Canada's nuclear regulatory regime since the Atomic Energy Control Board was established.

The creation of the Canadian Nuclear Safety Commission and the coming into force of the *Nuclear Safety and Control Act* had an impact on the regulation of historic uranium mines. One significant change was that the *Nuclear Safety and Control Act*, unlike its predecessor, the *Atomic Energy Control Act*, is binding on the Crown. This means that the federal, provincial and territorial governments are

subject to the requirements under the act.

The *Nuclear Safety and Control Act* requires that a licence be held for, at a minimum, the possession of nuclear substances such as uranium mine tailings and waste rock. This requirement is found in section 26 of the *Nuclear Safety and Control Act*, which reads in part:

26. Subject to the regulations, no person shall, except in accordance with a licence,
- (a) possess ... a nuclear substance...;
 - (b) ... manage, store or dispose of a nuclear substance; and ...
 - (e) ... decommission or abandon a nuclear facility; ...

Under the *Nuclear Safety and Control Act*, a nuclear substance is essentially any radioactive material. However, naturally occurring nuclear substances (NONS), commonly referred to as naturally occurring radioactive material (NORM) in other jurisdictions, are exempted from most provisions of the *Nuclear Safety and Control Act*.

The definition of a nuclear facility includes, among other things, uranium mines and mills, and facilities at which the resident inventory of nuclear substances exceeds 10^{15} Becquerels. With one exception (the Gunnar site), the historic tailings management areas are not captured under the definition of a uranium mine or mill. Furthermore, only a few historic tailings management areas contain an inventory of nuclear substances in excess of 10^{15} Becquerels. Therefore, most of the historic tailings management areas only require licensing for the possession, management and storage of nuclear substances.

With the coming into force of the *Nuclear Safety and Control Act* in May 2000, the CLEAN (Contaminated Lands Evaluation and Assessment Network) Program was established. The purpose of this program is to deal with sites previously not licensed under the *Atomic Energy Control Act*, but which may now be subject to licensing under the *Nuclear Safety and Control Act*. One category of such sites includes the tailings management sites resulting from the former operation of uranium mines. Some of these tailings management sites were previously exempted from licensing because they are in the care and control of a provincial or federal government agency (the *Atomic Energy Control Act* was not binding on the Crown). Others were not licensed because their operational lives ended before the Atomic Energy Control Board began exerting regulatory control on health, safety and environmental aspects of the uranium mining industry.

CURRENT STATUS

There are twenty tailings management sites resulting from the former operation of uranium mines in Canada (see Figures 1 and 2). Of these sites, eight were licensed under the *Atomic Energy Control Act*, before the coming into force of the *Nuclear Safety and Control Act* in May 2000. These are the five Elliot Lake sites that were in operation until the 1990s (Quirke, Panel, Stanleigh, Denison and Stanrock), the Madawaska site (in operation until 1982), the Beaverlodge site (also in operation until 1982) and the Rayrock site.

Public hearings are currently being held to consider a licence application for the remainder of the Elliot Lake sites. A licence for these sites could be issued in 2002.

Letters of intent to apply for licences have been received for the remaining sites. For Dyno and Bicroft, successor companies to those that operated the uranium mines are still the primary owners of the sites. These successor companies continue to provide site monitoring and maintenance, and have committed to licensing. Licensing will make this monitoring and maintenance a legal requirement, in addition to providing a mechanism to ensure that future use of the sites is controlled.

In the case of the Port Radium and Contact Lake mines in the Northwest Territories, Indian and Northern Affairs Canada (a department of the federal government) has taken responsibility for the sites. Indian and Northern Affairs Canada has indicated that they will hold the licences and have

begun the licensing process. It should be noted that although the *Atomic Energy Control Act* did not apply at these sites, the mines remained under the auspices of the federal government through Indian and Northern Affairs Canada, and was subject of other federal legislation related to the environment.

The Ontario Ministry of Northern Development and Mines has committed to applying for a licence for the Agnew Lake site. When the mining claims reverted to the Province of Ontario in the early 1990s, they became the owner of the site. As the *Atomic Energy Control Act* did not bind the Crown, this site has not been subject to federal oversight since that time. Licensing this site under the *Nuclear Safety and Control Act* will put in place minimum requirements for environmental monitoring and site maintenance, and will also provide a mechanism to ensure that future use of the site is controlled.

The former owners and operators abandoned the Gunnar and Lorado sites in the Uranium City area. As a result, the responsibility for these sites has fallen upon the government of the province of Saskatchewan. Saskatchewan Environment, a provincial department, has committed to applying for a licence or licences for these sites.

Although regulatory assessments are still underway, it appears that Gunnar is the one historic uranium tailings management site (and its associated mine and mill site) that will require licensing for decommissioning under the *Nuclear Safety and Control Act*. This site was simply walked away from in the mid-1960s. Most of the structures, including the mill and head frame, are still standing. Uranium mine tailings remain in the natural basins into which they were deposited during operations.

The Lorado site was also abandoned, but no structures remain. However, uranium mine tailings are not optimally contained. Saskatchewan Environment has estimated that the cleanup of the Gunnar and Lorado sites will cost approximately \$25 million (Canadian dollars).

In addition to the twenty tailings management sites resulting from the former operation of uranium mines, there is a number of small uranium mine or exploration sites that operated primarily from the 1940s to the 1960s. Any ore from these small sites would have been sent to one of the mills at the larger sites for processing, and therefore no tailings would be generated on site. The only nuclear substances that remain at some of these sites are those found in waste rock left on the surface. There are approximately forty of these small sites in Saskatchewan, and another fifty in Ontario. Canadian Nuclear Safety Commission staff, in cooperation with the two provincial authorities (Saskatchewan Environment and the Ontario Ministry of Northern Development and Mines), is in the process of reviewing conditions at these sites.

FUTURE REGULATORY DIRECTION

The Canadian Nuclear Safety Commission will continue to pursue licensing at the six outstanding uranium mine tailing sites. Exemptions from licensing under the Nuclear Safety and Control Act have been granted that extend to the end of 2004 to allow time to complete these licensing processes. It is anticipated that all of these sites will be licensed by this time.

Although licences for the Gunnar and Lorado sites should be in place by the end of 2004, it is unlikely that the decommissioning of both of these sites will be complete by this time. The Canadian Nuclear Safety Commission will continue to ensure the adequate protection of health, safety and the environment at these sites before, during, and after the decommissioning work.

Perhaps the most difficult issue at all of these sites is their long-term regulatory fate. Under the *Nuclear Safety and Control Act*, licensing for the possession, management and storage of uranium mine tailings will be required in perpetuity. The regulations made pursuant to the Nuclear Safety and Control Act provide several exemptions from licensing. As mentioned earlier, these include an exemption for naturally occurring nuclear substances. Other exemptions are provided under the *Nuclear Substances and Radiation Devices Regulations* for certain activities related to: small quantities ("exemption quantities") of nuclear substances; certain smoke detectors; tritium-activated self-luminous safety signs; and, limited numbers of radium luminous devices. None of these general

exemptions apply to the quantities of tailings and waste rock found at historic uranium mine sites.

The only alternative under current legislation is an exemption from licensing under section 7 of the *Nuclear Safety and Control Act*, which gives the Commission broad powers of exemption:

7. The Commission may, in accordance with the regulations, exempt any activity, person, class of person or quantity of a nuclear substance, temporarily or permanently, from the application of this Act or the regulations or any provision thereof.

Note that the Commission's powers of exemption are limited by the regulations. Specifically, section 11 of the *General Nuclear Safety and Control Regulations* states:

11. For the purpose of section 7 of the Act, the Commission may grant an exemption if doing so will not:

(a) pose an unreasonable risk to the environment or the health and safety of persons;

(b) pose an unreasonable risk to national security; or

(c) result in a failure to achieve conformity with measures of control and international obligations to which Canada has agreed.

Meeting these requirements for exemption from licensing will be a challenge for the tailings management areas associated with historic uranium mines. Paragraph 11(b), relating to national security, is not a significant issue at these sites, but both paragraphs 11(a) and 11(c) may be.

It is not clear whether licence exemptions would pose an unreasonable risk to the environment or the health and safety of persons. It may be possible to allow another competent public institution, such as a provincial government or a federal organization, to maintain care and control of these sites without requiring that a licence be held. However, it does not appear that the Canadian Nuclear Safety Commission can delegate its responsibility to ensure that these sites continue to not pose unreasonable risks. In the long run, maintaining licences may be the most appropriate mechanism to achieve this, although other arrangements may be possible. This is currently an unresolved issue.

In addition, it is not yet entirely clear how these sites fit into Canada's international obligations with respect to safeguards and complementary access. International Atomic Energy Agency safeguards inspectors, accompanied by Canadian Nuclear Safety Commission Staff, have visited one of the historic mine sites in the Elliot Lake for complementary access purposes under the Additional Protocol to the safeguards agreement with the International Atomic Energy Agency. Whether or not these sites will need to remain under licence indefinitely to ensure the ability of the Canadian Nuclear Safety Commission to continue to facilitate access by international safeguards inspectors is another unresolved issue.

The long-term fate of most of the approximately ninety small sites without tailings may be simpler to determine. Although the assessment of these sites is ongoing, it is likely that many can be exempted from licensing based on two of the general provisions of the *Nuclear Safety and Control Act* and pursuant regulations.

Any nuclear substance arising from exploration activities is considered naturally occurring under the *Nuclear Safety and Control Act*, and is therefore exempted from almost all provisions of the act and pursuant regulations. Naturally occurring nuclear substances that have "been associated with the development, production or use of nuclear energy" (where the act defines nuclear energy as "any form of energy released in the course of nuclear fission or nuclear fusion or of any other nuclear transmutation") are not exempted, but Canadian Nuclear Safety Commission staff has made the interpretation that nuclear substances arising from exploration (as opposed to removal) do not fit this definition.

As well, paragraph 5(1)(a) of the *Nuclear Substances and Radiation Devices Regulations* states that a licence is not required to "possess, transfer, import, export, use, mine, produce, refine, convert, enrich,

process, reprocess, manage or store a nuclear substance, if the quantity of the nuclear substance does not exceed its exemption quantity". The exemption quantity for natural uranium in non-dispersable form is 10^7 Becquerels, which equates to approximately a tonne or two of waste rock. Therefore, any sites with less than this quantity would also be exempted from licensing.

Although there may be a few small sites that are not exempted as described above, it is anticipated that the majority will meet the requirements for one of these two exemptions. For those that do not, Canadian Nuclear Safety Commission staff will need to consider the prerequisites for exemption by the Commission in section 11 of the *General Nuclear Safety and Control Regulations* described above, and determine whether or not an exemption from licensing should be granted on this basis.

Regardless of the regulatory mechanisms used in the long run at these sites, the Canadian Nuclear Safety Commission remains committed to ensuring the protection of health, safety and the environment, and to respecting Canada's international commitments on the peaceful use of nuclear energy. It will continue fulfill this mandate in the most effective, efficient and transparent manner possible.