

# **Decommissioning in Canada**

## **September 2005**

### **CURRENT STATUS**

#### **Nuclear Power Reactor Sites**

No commercial nuclear power reactors are undergoing active decommissioning in Canada. Three prototype power reactors (NPD, Douglas Point and Gentilly-1) have been partially decommissioned and put into storage with surveillance mode pending final decommissioning at an undetermined future date. These three sites are all owned and operated by Atomic Energy of Canada Limited (AECL), under licences from the regulatory body, the Canadian Nuclear Safety Commission (CNSC) (see section entitled “Competent Bodies and Roles” for more information on the CNSC).

An environmental assessment was completed for the decommissioning of the Bruce Heavy Water Plant at the Bruce Nuclear Site in October 2003 with a decision by the Federal Minister of the Environment to allow the project to proceed through the licensing process. Following a public hearing in February 2004, the applicant was granted a licence on 1 April 2004, for a period of ten years, to carry out decommissioning of the facility.

#### **Atomic Energy of Canada Limited Research Facilities**

AECL, which is 100% owned by the Government of Canada, received the Government’s concurrence in 1998 to begin the process to decommission its Whiteshell Laboratories facility. The decommissioning of the Whiteshell Laboratories facility will encompass all of the site facilities, buildings, infrastructure and land affected by nuclear development and operations, including the partially decommissioned WR-1 research reactor. The decommissioning of the facility is planned to take place over a time period that optimizes the advantages of natural radioactive decay against the removal of buildings and structures as they come to the end of their economic and structural life. At this time, a neutron generator and a Van de Graaff accelerator have already been decommissioned.

An environmental assessment under the Canadian Environmental Assessment Act (CEAA) for this facility was completed in March 2002. Following public hearings in September and November 2002, the CNSC issued a decision in December 2002 approving a decommissioning licence for a six-year term for the Whiteshell Laboratories facility. This is intended to cover the first phase of decommissioning and will be part of the larger decommissioning program for this project.

Other decommissioning projects are continuing at AECL’s Chalk River Laboratories facility. Some shutdown buildings have been decommissioned and dismantled, whereas other buildings have been decontaminated and made available for other uses. Other shutdown buildings are in various stages of decommissioning. In particular, the former NRX research reactor at Chalk River is partially decommissioned and in a safe storage mode. AECL is currently seeking

approval to carry out decommissioning work on the former fuel bays associated with the NRX reactor, a heavy water upgrading plant, some facilities formerly associated with plutonium extraction, a wastewater processing plant and a small research reactor.

AECL is also currently preparing a site-wide preliminary decommissioning plan for the Chalk River site and has submitted a proposal for a financial guarantee of decommissioning costs for the nuclear facility. A public hearing was held in September 2004 to assess AECL's progress regarding decommissioning planning with a decision by the Commission expected in 2006.

## **Uranium Mining Facilities**

### **Ontario**

Decommissioning of the uranium mining facilities in the Elliot Lake area has been completed. Denison Energy Inc. (Stanrock, Denison) and Rio Algom Limited (Quirke, Panel, Stanleigh, plus five smaller sites) continue to manage the sites under licences from the CNSC. In the Bancroft area, Madawaska Mines Limited continues to be licensed for its decommissioned uranium mining facility.

In 2001, the CNSC initiated the Contaminated Lands Evaluation and Assessment Network (CLEAN) program, whose purpose is to identify and regulate the remediation of radiologically contaminated sites that were associated with the nuclear fuel cycle at various locations in Canada. Several mining sites have been identified, including three in Ontario.

### **Saskatchewan**

This province contains the only currently operating uranium mining facilities. These are all under CNSC licence. The first of its generation of Northern Saskatchewan uranium mines to move into decommissioning, the Cluff Lake mine received a decommissioning licence in July 2004. In addition, the decommissioned Beaverlodge uranium mining facility continues to be licensed and two former uranium mining facilities, Lorado and Gunnar, are included in the CLEAN program.

### **Northwest Territories**

Indian and Northern Affairs Canada, under CNSC licence, is managing the Rayrock former mine site in the Northwest Territories. The Port Radium and Contact Lake former uranium mining facilities are included in the CLEAN program.

## **Other Facilities**

A former research laboratory at Tunney's Pasture in Ottawa has been decommissioned and its site has been released for unrestricted use. The University of Toronto has completed decommissioning of its subcritical assembly and the facility is no longer licensed. In addition, the University's SLOWPOKE II research reactor has been decommissioned, and the building that housed the reactor has been decontaminated to levels permitting unrestricted use. Similar to the University of Toronto's research reactor, Dalhousie University in Nova Scotia has indicated that they intend to shut down their Slowpoke Reactor during the period 2006 to 2008. It is currently preparing a Detailed Decommissioning Plan and supporting documentation, including an environmental assessment under the CEAA, for submission to the CNSC in late 2005.

## **PURPOSE/OBJECTIVES OF D&D**

The Government of Canada's policy on radioactive wastes states that owners are responsible for their wastes. This policy also applies to the costs of decommissioning nuclear facilities and activities. Therefore it is up to each licensee to propose its strategy for decommissioning.

The licensee proposes when decommissioning should start and end, and the planned end state after the completion of decommissioning activities. The CNSC has the decision-making power as to whether to accept these proposals or require their modification prior to licensing, subject to the requirements for environmental assessment under the Canadian Environmental Assessment Act. Depending on the licensee's proposal and supporting comprehensive safety case, the strategies that could be permitted by the CNSC include immediate dismantling, deferred dismantling, safe enclosure, or any combination of these. The time scales for planned safe storage intervals at nuclear facilities in Canada are generally in the range of a few decades.

The proposed end state of decommissioning varies from site to site. Some sites, notably most uranium mine sites and some other waste management sites, will be under permanent institutional control. That is, it will never be possible to release these sites for unrestricted use, and they may be regarded as indefinite safe storage sites. The projected decommissioning plans for many other large nuclear facilities are based on a planned end state of use for conventional industrial purposes. Some smaller facilities, including research reactors at locations such as universities, have been or will be cleared for unrestricted use.

## **SOCIAL AND ENVIRONMENTAL IMPACTS**

The social and environmental issues that are of most interest to communities in the locality of decommissioning sites can vary considerably. Nevertheless, there are several issues that are common to a variety of such situations.

Among the issues of common concern are health impacts of releases and effluents, both during and subsequent to the decommissioning activity. In addition to such routine releases, the risks from possible accidents, both during and after decommissioning, are also of great interest to the community. Environmental impacts of interest include effects on water quality and effects on wildlife, such as fish in water bodies that might receive runoff from the decommissioned site.

Communities where nuclear facilities are located may be willing to accept that wastes and other remnants of the former facility remain in the community after the facility ceases to operate, but they are often unwilling to accept wastes from other locations. This results in the establishment of single-purpose waste management facilities for the storage and management of locally generated wastes only.

In some cases communities have expressed concern about the perceived stigma associated with the storage of radioactive wastes near their communities, and any residual contamination from past operations and activities, and the potential impacts on property values. In some communities, ways are sought to make positive use of the sites of former facilities, for example for recreational purposes. An example of this might be the proposed use of the former head frame from a mine as a tourist attraction.

Employment is another issue, both in terms of the loss of employment after the original facility shuts down, and employment opportunities during the decommissioning work.

## **COMPETENT BODIES AND ROLES**

With the exception of some legacy sites whose use predated the current regulatory system and for which an owner no longer exists, the organization responsible for decommissioning is the operator/owner of the facility. In cases of deferred decommissioning, the original operator, or a successor organization, continues to hold a licence for the facility and be responsible for meeting regulatory requirements, including those for financial guarantees. In the event that an operator becomes unable to meet its financial commitments for decommissioning, the regulator may draw upon a financial guarantee established by the operator to maintain safety and to complete the decommissioning process.

The Government of Canada recognizes the important contribution of the nuclear industry as well as the need to ensure safety, security, public health and the protection of the environment. Against this background, policies, legislation and regulations have been put in place in order to provide appropriate direction and oversight of decommissioning and radioactive waste management in Canada. Natural Resources Canada is responsible for the development and implementation of Canadian government policy on uranium, nuclear energy and radioactive waste management issues. The CNSC is the federal body for the regulation and oversight of all life-cycle stages of nuclear facilities, including decommissioning, as well as for other uses of radioactive materials. Natural Resources Canada also provides oversight, particularly through its Nuclear Fuel Waste Bureau, which administers the *Nuclear Fuel Waste Act*. Health Canada, Transport Canada and the Canadian Environmental Assessment Agency also contribute to federal oversight.

The CNSC operates under the terms of the *Nuclear Safety and Control Act*. The Commission consists of a seven person Tribunal which conducts public hearings for applicants and licensees to present information to the Tribunal for consideration and decision-making. The Tribunal also receives recommendations and information from CNSC staff as well as submissions from external interveners.

The CNSC makes regulations and issues licences for the siting, construction, operation, decommissioning and abandonment of nuclear facilities. This licensing process is comprehensive and is based on the licensee making a safety case for its intended activities, including requirements to maintain resulting effects on the environment and humans as low as reasonably achievable. The CNSC also coordinates the input of various other federal and provincial regulatory agencies with relevant/applicable requirements in establishing the licensing conditions for operations at and decommissioning of nuclear facilities.

The conditions for licence termination (licence to abandon) will be established by the CNSC on a licensee/site-specific basis. The CNSC has the responsibility to approve the conditions for release and/or continued control. The conditions for release may in some cases include arrangements for the establishment and funding of institutional controls under the auspices of a provincial or other level of government.

## **FUNDING ARRANGEMENTS**

The responsibility for paying for the costs of construction, operation and decommissioning of any nuclear facility rests with the licensee (owner/operator). In order to ensure that the costs of decommissioning will be funded, the CNSC has the power to require financial guarantees of its licensees. The CNSC exercises this power for any licensed activities where the expected cost of decommissioning is considered high enough to warrant requiring a guarantee. A prerequisite to establishing a financial guarantee is establishment of the amount of that guarantee, which in turn is based on an estimate of decommissioning costs. This estimate is part of the preliminary decommissioning plan required in support of a licence application for any nuclear facility. As these plans are received, they are reviewed and cost estimates agreed upon. Subsequently, the licensee is requested to propose financial guarantee arrangements to cover the full amount of the accepted decommissioning cost estimates. Once these arrangements are acceptable to the Commission, they are referenced in the construction or operating licence.

While the CNSC regulations require information to be submitted on decommissioning plans and financial guarantees, they do not specify the contents of those plans. The CNSC's expectations in these matters are communicated through Regulatory Guidance Documents. Two such documents of relevance to this subject were issued in June 2000. These documents are G-219, "Decommissioning Planning for Licensed Activities" and G-206, "Financial Guarantees for the Decommissioning of Licensed Activities". These guides as well as other regulatory documents and information can be found at the CNSC's web site: <http://www.nuclearsafety.gc.ca>.

The creation of a financial guarantee does not relieve the operator of its responsibility to pay for the entire cost of decommissioning its facility. The power of the regulator, to use the proceeds of a financial guarantee to pay for the cost of decommissioning by a third party, would be used only in the event that the licence holder became unable to meet its financial obligations.

## **DECOMMISSIONING TECHNIQUES AND INSPECTION**

Prospective licensees for decommissioning projects in Canada are free to propose the techniques they consider to be most appropriate for their particular situation. Techniques and equipment used for decommissioning, decontamination and dismantlement are regulated in the same way as techniques and equipment used during operations. The use of new technologies could be permitted by licence after review and acceptance by the CNSC of the proposed technology in the overall final safety/decommissioning plan. If the technology was not mentioned in the plan, the licensee would be required to make a safety case for its approval by the CNSC. A licence amendment might be required if the changes to approved activities were significant.

The CNSC has a comprehensive compliance program in place. This program includes, as appropriate, periodic inspections of all licensed activities. Such inspections are conducted and would be conducted during all periods/phases of the licensed process, including decommissioning and safe storage. The comprehensive CNSC inspection program and the various radiation protection, quality assurance and contingency programs implemented by the licensee and modified with approval by the CNSC as required, are intended to ensure that the risks associated with the decommissioning process are managed appropriately.

The CNSC establishes through an audit inspection by its own staff whether the site has met the agreed criteria and consequently whether it can be released for restricted or unrestricted use. After the release of the licensee from responsibility for the site/activity, the records required by the regulator would be kept using appropriate government archive mechanisms.

## **RADIOACTIVE WASTE MANAGEMENT**

In July 1996, the Government of Canada announced its Policy Framework for Radioactive Waste. This set the stage for further development of the institutional and financial arrangements required for implementation of long-term management of radioactive waste in a safe, environmentally sound, comprehensive, cost-effective and integrated manner. The federal government has responsibility to develop policy, to regulate, and to oversee the activities of radioactive waste producers and owners to ensure that they meet their operational and funding responsibilities, in accordance with approved long-term waste management plans. Accordingly, the CNSC issued in July 2004 a Regulatory Policy, *Managing Radioactive Waste*, which expresses the philosophy and principles used by the CNSC in regulating radioactive waste. It is fully consistent with the Policy Framework for Radioactive Waste. It is recognized, however, that there will be variations in the general approach to management of the different types of waste.

Health, safety, security and environmental aspects of the management of all radioactive wastes, whether ongoing or historic, are regulated under the *Nuclear Safety and Control Act* by the federal regulatory body, the CNSC. All radiological wastes, except for those discharged to the environment under the terms of licence conditions relating to authorized releases, are stored and managed under conditions permitted by a licence issued by the CNSC. Waste materials resulting from decommissioning may also be released for unrestricted use, conventional disposal, recycling, etc.; in each case pursuant to licence conditions set by the CNSC.

The CNSC is currently developing an integrated approach to the assessment of proposals by licensees to release materials via all routes and pathways from licensed activities. This integrated approach will take into consideration current proposals and practices for clearance criteria under discussion internationally.

## **Nuclear Fuel Waste**

As required by the federal government, AECL and Ontario Hydro, the precursor of Ontario Power Generation (OPG), developed a deep geological disposal concept for nuclear fuel waste. In October 1988, this was referred for review to an independent, federal Environmental Assessment Panel. Guidelines for preparing an Environmental Impact Statement (EIS) were published in 1992, and the EIS was duly submitted by AECL in 1994. In March 1998, the Panel published a report with conclusions and recommendations on the acceptability of the proposed concept. They found that, on balance, the concept was technically sound but not socially acceptable, and the Panel proposed further steps to remedy the situation.

In 1998, the Government of Canada responded to the Panel recommendations, in line with the 1996 Policy Framework for Radioactive Waste, and set the stage for developing institutional and financial arrangements for implementing long-term nuclear fuel waste management. The challenge was to ensure that the public would be confident that long-term management of nuclear fuel waste would be carried out in the best interest of Canadians. An important part of the answer to this challenge was the development of the *Nuclear Fuel Waste Act (NFW Act)*, which came into force on November 15, 2002.

The *NFW Act* requires nuclear utilities to create and maintain a waste management organization with a mandate to propose to the Government of Canada alternative approaches for the long-term management of nuclear fuel waste, and to implement the approach that is selected by Government. The *NFW Act* also requires the utilities and AECL to establish trust funds to finance the implementation of the selected long-term nuclear fuel waste management approach. The Nuclear Waste Management Organization, (NWMO), was established by the nuclear utilities in late 2002. The *NFW Act* requires it to submit to the Government, by November 15, 2005, a study setting out alternative approaches for the long-term management of nuclear fuel waste, and its recommendation on which approach should be adopted. The NWMO study is required to include approaches based on on-site storage, centralized storage and disposal. In carrying out this study, the NWMO must consult the general public on each of the alternative approaches. It must also create an Advisory Council whose role is to examine and provide written comments on the NWMO program activities. The Advisory Council membership must reflect technical and social sciences expertise and, when the Government of Canada has selected the general approach, it must include representatives from relevant local and regional governments and aboriginal organizations.

## **Low-Level Radioactive Waste**

All ongoing low-level radioactive waste from nuclear power production is presently stored at reactor sites. OPG, Hydro-Québec, New Brunswick Power and AECL all operate on-site storage

facilities. AECL also provides a waste storage facility for smaller producers on a fee-for-service basis. To date there has been no pressing need for early disposal of low-level radioactive waste (LLRW) as waste volumes are small and the interim storage is judged to be safe.

The major nuclear utility in Canada, OPG, and AECL together produce about 70% of the annual volume of LLRW in Canada. OPG's LLRW is safely stored on an interim basis at the Western Waste Management Facility at the Bruce Nuclear Power Development (BNPD). In April 2002, OPG and the Municipality of Kincardine signed a Memorandum of Understanding to jointly study options for the long-term management of the wastes at the BNPD site. The year 2015 is considered an achievable target date for bringing a long-term management facility into service.

The other major ongoing producer of LLRW, AECL, stores the waste it generates in in-ground and above-ground structures. Natural Resources Canada and AECL are assessing organizational approaches and long-term waste management strategies for dealing with the AECL inventory of LLRW, in support of future government decisions about the management of those wastes.

The bulk of historic LLRW in Canada is located in the area of Port Hope in Ontario. In March 2001, the Government of Canada entered into an agreement with the municipalities in whose localities the historic wastes are located. This agreement, termed the Port Hope Area Initiative (PHAI), addresses the cleanup and long-term management of these wastes. The Government proponent for the PHAI is the Low-Level Radioactive Waste Management Office (LLRWMO). This body was established in 1982 as the Government of Canada agent for the management of historic waste and is responsible for implementation of the PHAI.

The PHAI will involve long-term management of these historic wastes in newly constructed, above ground mounds in the local communities. The \$260 million project will take about eleven years to complete. The first phase of the Initiative involves environmental assessment and regulatory review and is expected to be complete in 2007. Ongoing public consultation remains a priority and municipal consent will be necessary to move into the next phase. Cleanup, waste facility construction and waste emplacement would take place in the following five years, after which the facilities would continue to be monitored and maintained for the long-term.

## **Uranium Mine and Mill Tailings**

All currently active uranium mining sites are situated in northern Saskatchewan. Most of the inactive sites are in the Elliot Lake area of northern Ontario, which was the major uranium-mining centre in Canada for over 40 years. Since the last facility closure in 1996, uranium mining companies have committed over \$75 million for decommissioning of all mines, mills and waste management areas.

## **PUBLIC INFORMATION**

The CNSC's licensing process is open to public scrutiny, and public hearings are held on licensing decisions for nuclear facilities. Information on the CNSC, its requirements and public hearings is available to the public at [www.nuclearsafety.gc.ca](http://www.nuclearsafety.gc.ca).

Environmental assessments are carried out before major licensing decisions, including before the issuance of decommissioning licences, and the environmental assessment process makes provision for public input. Information on the Canadian Environmental Assessment Agency (CEAA), environmental assessment policy, and on past and current environmental assessments is available to the public at [www.ceaa.gc.ca](http://www.ceaa.gc.ca).

For more information, the websites of the main government and industry organizations are listed below.

Canadian Nuclear Safety Commission  
[www.nuclearsafety.ca](http://www.nuclearsafety.ca)

Natural Resources Canada  
[www.nuclear.nrcan.gc.ca](http://www.nuclear.nrcan.gc.ca)

Nuclear Fuel Waste Bureau  
[www.nfwbureau.gc.ca](http://www.nfwbureau.gc.ca)

Nuclear Waste Management Organization  
[www.nwmo.ca](http://www.nwmo.ca)

Atomic Energy of Canada Limited  
[www.aecl.ca](http://www.aecl.ca)

Low-Level Radioactive Waste Management Office  
[www.llrwm.org](http://www.llrwm.org)

Canadian Environmental Assessment Agency  
[www.ceaa.gc.ca](http://www.ceaa.gc.ca)

Ontario Power Generation  
[www.opg.com](http://www.opg.com)

New Brunswick Power  
[www.nbpower.com/](http://www.nbpower.com/)

Hydro-Québec  
[www.hydro.qc.ca/en/index.shtml](http://www.hydro.qc.ca/en/index.shtml)