NEW REGULATORY REQUIREMENTS AFFECTING LOW-LEVEL RADIOACTIVE WASTE SITES IN CANADA: AN OPERATIONAL PERSPECTIVE AT HISTORIC WASTE SITES

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ABSTRACT

The Canadian Nuclear Safety Commission (CNSC) is Canada's nuclear regulator (formerly the Atomic Energy Control Board) operating under the Nuclear Safety and Control Act, which was promulgated in May 2000. The Low-Level Radioactive Waste Management Office (LLRWMO) has been Canada's agency for the management of historic low-level radioactive waste sites since 1982. Operations of the LLRWMO at presently contaminated sites, interim storage sites and future disposal sites, must now consider the new regulatory context. A major change affecting the operations of the LLRWMO is that CNSC licensing decisions are now triggered based on total activity instead of specific activity or concentration as in the past. The paper discusses the impacts of this and other changes in the new act and new regulations on the operation of established facilities and programs of the LLRWMO. Among these are future cleanup activities at known and yet to be encountered sites. This paper will interest stakeholders in Canada and observers of regulatory practices elsewhere. Among the conclusions is the realization that through the immediate phase-in period of the next year or so, cooperation and action involving both regulators and licensees is essential to effect the necessary change.

INTRODUCTION

Role of the Office with Respect to the Government of Canada

The Low-Level Radioactive Waste Management Office (LLRWMO) was established by the federal government in 1982 to carry out the responsibilities of the federal government for low-level radioactive waste (LLRW) management in Canada. Its mandate is to:

- resolve historic waste problems that are a federal responsibility,
- establish, as required, a user-pay service for the disposal of LLRW produced on an ongoing basis, and
- address general public information needs about low-level radioactive wastes.

The Low-Level Radioactive Waste Management Office is operated by a federal agency, Atomic Energy of Canada Limited (AECL), through a cost recovery agreement with Energy, Mines and Resources Canada (now called Natural Resources Canada – NRCan), the federal department, which provides the funding and establishes program priorities for the LLRWMO.

The LLRWMO continues the work started by a Federal-Provincial Task Force set up in 1977. It is headquartered in Ottawa, with a field office and radioisotope laboratory in Port Hope, Ontario. The LLRWMO has no regulatory responsibilities. Regulatory responsibilities for LLR waste management in Canada rest with the federal agency, the Canadian Nuclear Safety Commission (CNSC). Policy direction is provided by the federal department of Natural Resources Canada.

BACKGROUND

History of Contamination

Historic low-level radioactive wastes date back to the 1930s in Canada, when a commercial radium refinery began operation in Port Hope, Ontario. Residual wastes and contaminated buildings and soils in Port Hope resulted from the casual waste management practices in the early years of radium processing and, subsequently, uranium production. Contamination of properties in the community near the refinery plant was discovered in the mid-1970s and an assessment and remediation program was carried out by a joint federal-provincial task team. This work concentrated on developed properties, which were found to trigger the remediation criteria established for the project. As a result, substantial quantities of contaminated materials remained in a number of large undeveloped areas within the Town, and also on smaller residential lots and roadways.

A number of additional historic waste sites have subsequently been discovered at other locations in Canada, where buildings and/or soils were contaminated with uranium ores or concentrates spilled during transport to or from the refinery plant in Port Hope, Ontario. Additional sites have been contaminated at yet other locations in Canada as a result of the use of radium containing materials.

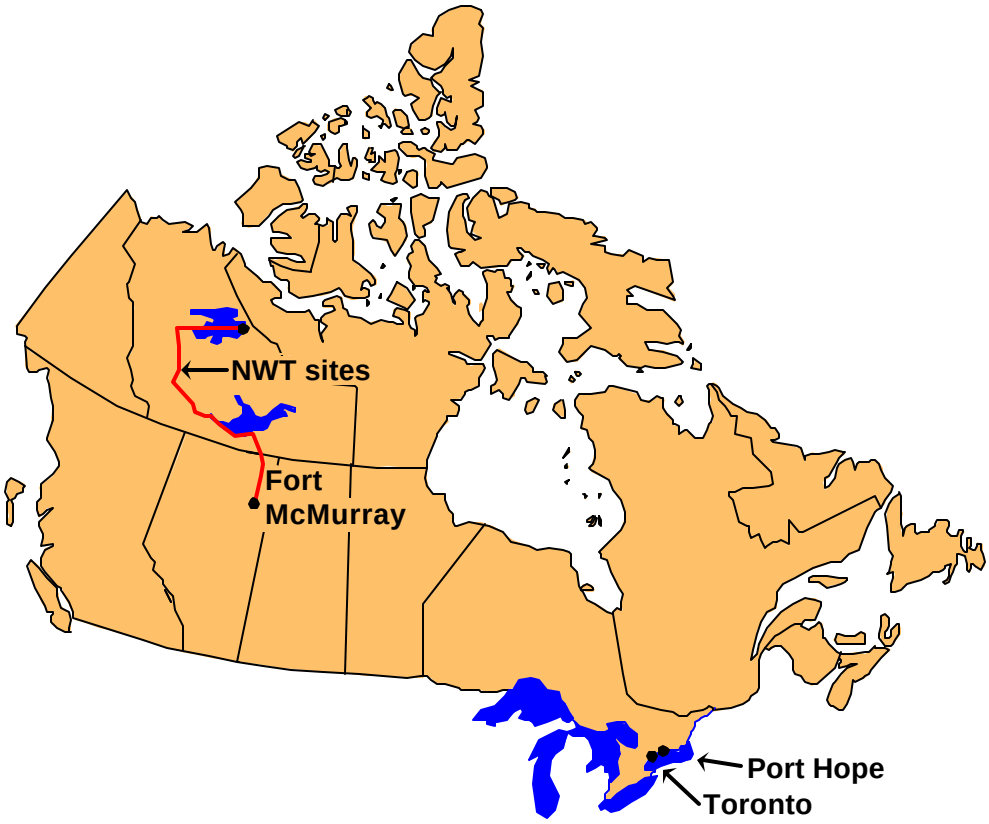
Thus, sites are found separated by thousands of kilometres. They all require management and remediation. Sites are found: in Fort McMurray, Alberta and in the Northwest Territories, along the radium and uranium ore transport route; in Port Hope, Ontario near the refinery; and at many individual small scale sites at scattered locations across Canada where radium dial painting operations existed in the past.

Definition of "Historic" LLR Waste vs Other LLR Waste

"Low-level radioactive (LLR) waste" in Canada is defined by exclusion. If a waste is radioactive, but is neither high-level waste (i.e. spent reactor fuel), nor uranium mine and mill tailings, then it is classed as low-level waste. "Historic" LLR wastes are low-level radioactive wastes which are managed in a manner no longer considered acceptable, but for which the original producer can no longer be reasonably held responsible. Responsibility for historic waste is exercised by the federal government on a case-by-case basis. The LLRWMO acts as the agent of the federal government in matters related to the management of historic LLR waste. Although historic LLR waste is no longer generated, the national inventory does increase from time-to-time when new historic waste occurrences are found or when the responsibility for disposal of an already identified inventory is assumed by the federal government. At present, there are about 1.2 million cubic metres of historic waste in Canada.

Inventory of Historic Waste

There are several large historic waste sites as well as numerous smaller sites throughout Canada. The main historic waste sites are shown in the map and described below.



Port Hope Area

Historic waste is present in various areas in the Town of Port Hope, Ontario. The waste dates back to the 1930s when radium was refined for medical applications at a refinery in the town. The waste is primarily soil contaminated with material from the refinery, and refinery by-products, but also includes some contaminated building materials that were incorporated into residential structures. The LLRWMO is responsible for the monitoring and safe management of the waste at these locations.

LLRW is located at the Welcome Waste Management Facility (closed in 1955) in Hope Township and the Port Granby Waste Management Facility (closed in 1988) in the Municipality of Clarington. While Cameco Corporation (formerly Eldorado Nuclear Limited, a corporation owned by the federal government) owns the waste at both sites, Cameco and the federal government share financial responsibility for capital and extraordinary operating costs, including decommissioning costs, associated with the management of the waste at these facilities.

Other Locations

Historic waste is found at various other locations across Canada; for example, in Toronto, Ontario; in Fort McMurray, Alberta; and in locations in the Northwest Territories along the historic uranium ore transportation route.

The current inventory of historic waste is 1.2 million m^3. The total inventory of historic waste for which the LLRWMO has management responsibility on behalf of the federal government is 329,600 m^3. The waste consists of the following:

Town of Port Hope, Ontario	266,400 m^3
Other locations:	
Toronto, Ontario	14,700 m^3
AECL-CRL, Ontario	600 m^3
Fort McMurray, Alberta	35,900 m^3
Northwest Territories	11,400 m^3
	62,600 m^3

Cameco Corporation continues to manage its two waste sites at Welcome and Port Granby. The Welcome Waste Management Facility contains about 492,000 m^3 of wastes and contaminated soils. The Port Granby Waste Management Facility contains about 380,000 ^{3} of wastes and contaminated soils. The total volume of these wastes to the end of 1998 remained at 872,000 m^3

Table I: Historic Waste

Waste Source	**Contaminated Soil (m^3)**
Town of Port Hope, Ontario	266,400
Welcome and Port Granby, Ontario	872,000
Other Locations	62,600
Total Historic Waste	1,201,000

Interim Management and Preparation for Future Disposal

In the absence of a national disposal site, progress has been made in the historic waste management program as demonstrated by the activities of the LLRWMO and its predecessor (1-2). Over 7,000 remediation properties and structures have been surveyed for historic waste contamination in Canada at communities involved with mining and refining of radium and uranium. Major projects involving homes, residential lots, commercial properties, wooded ravines, public parks and paved roadways have been performed in several communities. Interim storage facilities have been constructed by the LLRWMO. Monitoring of environmental conditions at contaminated sites and interim storage facilities is a continuing responsibility of the LLRWMO as part of its annual work program and its obligations to the CNSC. Interim remedial actions are taken where public health and safety may be potentially at risk, or where the continued spreading of contaminated material could occur.

Planning for complete remediation of sites and long-term storage of wastes has been advanced in the Port Hope area. The federal government is currently drafting legal agreements with the local municipalities in the development of a long-term storage facility in each of the three municipalities. Physical remedial and decontamination work is performed at sites where contamination level triggers the criteria adopted for intervention. Public involvement is sought out in locations where contamination is found. Interim consolidation work or other interim waste management activities are also undertaken when required, and at the request of the community.

IMPACT OF THE NEW ACT AND REGULATIONS

"Features" of the New Regime Relevant to Historic Waste Management

The Canadian Nuclear Safety Commission (CNSC) regulates nuclear facilities and uses of radioactive materials in Canada for the purpose of preventing undue risk to health, safety, security and the environment. A new Act, the Nuclear Safety and Control Act and Regulations pursuant to the Act, were promulgated on May 30, 2000. This new Act replaces the existing Atomic Energy Control Ac, which has been in force since 1946. Under the new Act, the CNSC was created replacing what was called the Atomic Energy Control Board, or AECB.

The new Act and Regulations have impacts on the operations of the LLRWMO in three areas:

- certain sites may now be subject to licensing,
- CNSC has legal authority to order remediation of Contaminated Sites,
- reduced limit for effective public dose.

Licensing

A fundamental change with the coming into force of the new Act and Regulations[(a)] is that the basic exemption from licensing will be based on the total activity of nuclear substances (e.g. Bq) instead of specific activity (e.g. Bq/g). The new regulations will now account for low activity sources that are physically very small (like most check sources) which have very high specific activities. Unfortunately, in addressing this issue, licensing of very large sources of very low specific activity (like most of the contaminated soil that the LLRWMO deals with) have become somewhat more complex.

The regulations define *Exemption Quantities* (EQ) of nuclear substances[(a)]. Of most interest to the LLRWMO are uranium, radium and thorium. Exemption quantities are explicitly given for dispersible and non-dispersible uranium (10^4 and 10^7 Bq). For radium and thorium, exemption quantities are calculated based on the radioactive decay series. For radium, the exemption quantity is 81 Bq of ^{226}Ra, for thorium the exemption quantity is 43 Bq of ^{232}Th, both assuming equilibrium throughout the series.

A license may be required when the quantity of a nuclear substance exceeds the exemption quantity (EQ). However, exemption from licensing may be granted if doing so does not "pose an unreasonable risk to the environment or the health and safety of persons". For example, licenses may not be required if the specific activity of the nuclear substance is <1 EQ/kg, and if an assessment indicates that potential doses to members of the public are <1 mSv/a.

Contaminated Sites

The Act[(b)] and Regulations[(c)] formally define a "Contaminated Site", as a location where a member of the general public may receive an incremental dose of 1 mSv or more per year from unlicensed nuclear substances. The CNSC may order measures to be taken to reduce the incremental dose to below 1 mSv/a.

It is important to make the distinction between contaminated sites and sites which require licensing. Contaminated sites are based primarily on dose considerations, while licensing determinations are based primarily on the amount of nuclear substances. It is possible for a site to be licensable but not considered contaminated. For example, the Port Hope harbour is very unlikely to cause an incremental dose of 1 mSv/a (and so would not be considered a contaminated site), although the total and specific activity of the contaminants would indicate that a license for possession may be required. It is also possible for a site

to be considered contaminated, but be exempt from licensing. This could be the case where the total activity at a site is below the exemption quantity, but the material is in a particularly available form and the site has a high occupancy.

Few of the sites that the LLRWMO encounters would be considered "contaminated" based on this definition and, therefore, the CNSC may not order remedial actions on this basis. However, many of the sites have total activities greater than the exemption quantity and, therefore, would not be exempt from licensing. Once licensed, the CNSC would then have the authority to impose licensing conditions.

Dose Limits

Effective dose limits are reduced to generally agree with ICRP-60 limits set in 1991. The limit for members of the public has been changed from 5 mSv/a to 1 mSv/a[(d)]. All licensees are required to ensure that these dose limits to members of the general public are not exceeded.

Effects of the New Act and Regulations on Interim Management and Remediation

Perhaps the change in the new Regulations with the most significant potential impact on the operations of the LLRWMO is the change from a specific activity based exemption quantity to an activity based exemption quantity. This means that even the most mildly contaminated material will not be exempt from licensing (i.e. possess, transfer, manage, store, etc.) given a sufficient volume of material.

As mentioned above, for natural uranium in non-dispersible form, the exemption quantity is 10^7 Bq (10^4 for dispersible). This is equivalent to about one truckload of soil (15 tons) at twice the mean background concentration of uranium. For radium contaminated material, the exemption quantity will be about 81 Bq. This is equivalent to about 180 g of soil at twice the mean background concentration of radium.

In essence, this will mean that every project undertaken by the LLRWMO, even on the smallest scale with very low contaminant concentrations, may not be exempt from licensing on the basis of the new total activity limit. However, based on a more detailed case-by-case assessment, exemption may be granted by the CNSC. Close cooperation and consultation with the CNSC will be required to resolve some of these uncertainties and define a workable and acceptable process.

Although the effective public dose limit has been reduced from 5 mSv/a to 1 mSv/a in the new regulations, this may not pose significant operational changes to the LLRWMO. During the past several years, the LLRWMO has been carrying out remediation and cleanup on the basis of both the Task Force criteria and the 1 mSv/a individual dose limit (3). Once remedial work is triggered by either mechanism, the ALARA principle is also applied. The operational experience of the LLRWMO over the last several years of adopting either mechanism is that it has made only a minor difference in triggering remedial work.

With respect to the determination of licensability based on total exemption quantity (i.e. Bq) rather than specific exemption quantity (i.e. Bq/kg), many of the sites, which are currently not licensed may be subject to the CNSC licenses.

With respect to the CNSC's power to order immediate remediation of contaminated sites, the effect is not clear, although the LLRWMO has been diligent in interim remediation of known contaminated sites, which have potential for impacting health and safety in the short term.

COOPERATIVE APPROACH

Although the Act and Regulations were promulgated in May 30, 2000, the Regulations allowed a transition period of 18 months, so that by December 31, 2001, all licensees and owners/possessors of radioactive materials will be required to implement the new Act and Regulations.

The LLRWMO is in regular contact with CNSC staff during this transition period to cooperatively assess and determine the effects of the new licensing regime on the operations and sites currently under LLRWMO responsibility.

As some of these sites are currently not under CNSC licensee, the LLRWMO over the past year have accompanied CNSC staff to introduce and review these sites, provide CNSC staff with technical and other related information such that an objective assessment can be carried out.

EXPERIENCE IN ADAPTING TO THE NEW REGULATORY ENVIRONMENT

Of about 40 or so LLRWMO unlicensed sites, it appears that about half of them may require some form of licensing under the new regulations. However, discussions with CNSC staff are continuing such that the parties share their concerns regarding the implementation of the new Act and Regulations. A solution is sought that is pragmatic for both parties without compromising the potential impact on health and safety and on the objectivity and independence of the CNSC.

CONCLUSION

The cooperative approach to licensing has been effective in the past and is likely to continue in order to bring about a solution, which is safe, pragmatic, socially and fiscally responsible, yet does not compromise the objectivity and independence of the CNSC. Experience of the LLRWMO in dealing with the CNSC, especially in this transition phase has been positive.

FOOTNOTES

(a) Section 1, Schedule, Nuclear Substances and Radiation Devices Regulations

(b) Subsection 46(1), Nuclear Safety and Control Act

(c) Section 24, General Nuclear Safety and Control Regulations

(d) Section 13, Radiation Protection Regulations

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