

Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada

## Management of Low and Intermediate Level Radioactive Waste

### Report 6



### Independent Auditor's Report | 2022



Office of the Auditor General of Canada

Bureau du vérificateur général du Canada

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# Introduction

## Background

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### Radioactive waste in Canada

6.1 Radioactive waste is a by-product of the use of nuclear technology, including nuclear power reactors, medical isotopes, industrial activities, and research. It can be a gas, liquid, or solid, has no foreseeable use, and can remain radioactive from hours and days to billions of years.

6.2 Radioactive waste will continue to be produced in Canada for the foreseeable future. New nuclear technologies that produce this waste, such as small modular reactors, also continue to be explored. Managing current and future waste will reduce its burden on generations to come.

6.3 Currently, all radioactive waste in Canada is managed in facilities that are licensed for storing this waste, as no disposal facilities currently exist in Canada. At the time of this audit, the Canadian Nuclear Safety Commission was reviewing a proposal for a near-surface disposal facility for low-level waste at Chalk River Laboratories, a nuclear technology complex owned by Atomic Energy of Canada Limited. [Exhibit 6.1](#) provides some definitions of terms.

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#### Exhibit 6.1—Definitions of terms

**Disposal**—The placement of radioactive waste in an appropriate facility without the intention of retrieval

**Near-surface disposal facility**—A facility for radioactive waste disposal located at or within a few tens of metres of the earth's surface

**Radioactive waste**—Any material (liquid, gas, or solid) that contains a radioactive substance for which no further use is foreseen

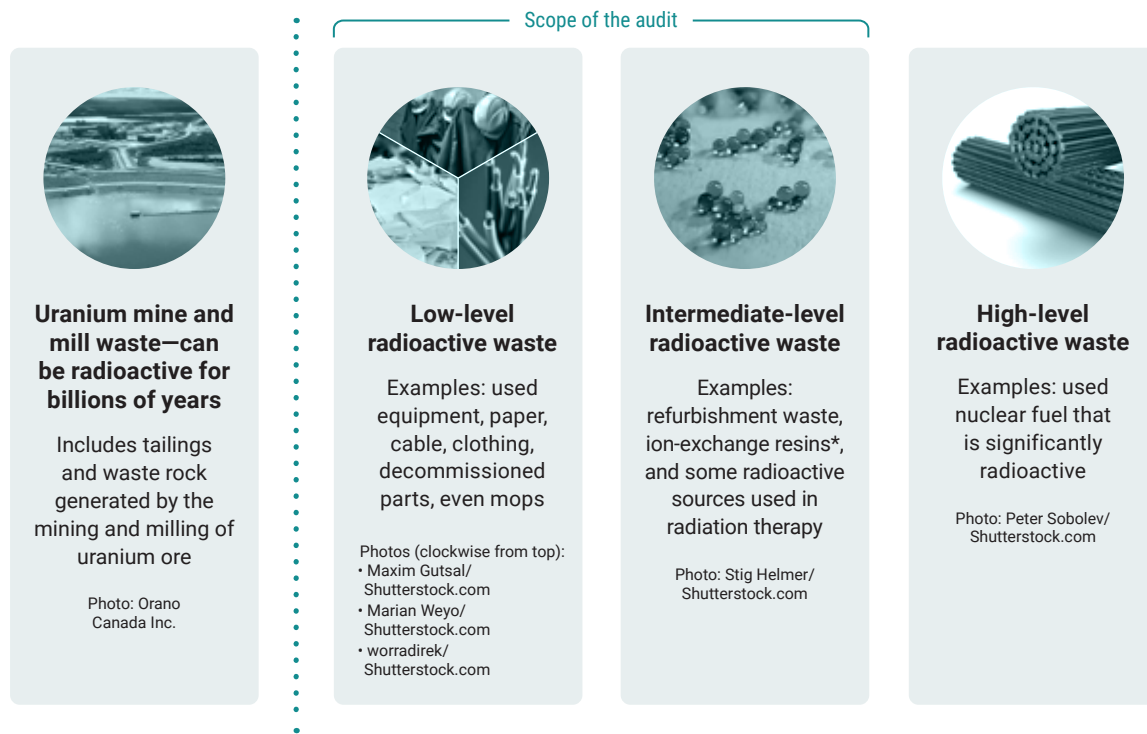
**Storage**—The holding of radioactive sources, radioactive material, or radioactive waste in a facility that contains them, with the intention of retrieval

Source: Adapted from the IAEA Safety Glossary, International Atomic Energy Agency, 2018 edition

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6.4 [Exhibit 6.2](#) illustrates the 4 classes of radioactive waste that are used in Canada. This international classification is adopted from the International Atomic Energy Agency's system, which is based on the degree of containment needed to ensure safety.

**Exhibit 6.2—Canada’s 4 classes of radioactive waste**



\* Ion-exchange resins are often used within a nuclear power plant’s water process systems to minimize corrosion of system components and to remove radioactive contaminants.

Source: Adapted from Application of Ion Exchange Processes for the Treatment of Radioactive Waste and Management of Spent Ion Exchangers, International Atomic Energy Agency, 2002

Source: Based on information from the Canadian Nuclear Safety Commission

[See the long description of Exhibit 6.2—Canada’s 4 classes of radioactive waste.](#)

6.5 In its 2019 report, Inventory of Radioactive Waste in Canada, Natural Resources Canada reported that most of Canada’s radioactive waste volume (98.9%) is low-level waste, and almost three quarters is in the form of contaminated soil resulting from past practices, some of which date back to the 1930s.

6.6 As a signatory to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Canada recognizes the importance of having sound practices for managing radioactive waste. The joint convention is the only legally binding international instrument that addresses the safety of radioactive waste management on a global scale. The joint convention was adopted under the auspices of the International Atomic Energy Agency. Many of the joint convention’s provisions are based on principles, rules, and practices established by the International Atomic Energy Agency.

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## Roles and responsibilities

6.7 In Canada, 3 federal entities are involved in activities related to radioactive waste management.

6.8 **Natural Resources Canada.** This is the lead department responsible for developing and implementing Canada's nuclear energy policies, including radioactive waste management. The department collects information from waste owners and producers and compiles it every 3 years to support reporting on the joint convention. The department also publishes its own report on Canada's radioactive waste inventory.

6.9 **The Canadian Nuclear Safety Commission.** This is Canada's nuclear regulatory agency, which regulates the management of radioactive waste. It develops licensing and compliance programs for facilities that manage radioactive waste. The *Nuclear Safety and Control Act* sets out the organization's mandate, responsibilities, and powers. The Canadian Nuclear Safety Commission is the lead agency for ensuring that Canada's obligations to the joint convention are fulfilled.

6.10 The Canadian Nuclear Safety Commission is an independent administrative tribunal and court of record, which consists of members appointed by the **Governor in Council**<sup>1</sup>, one of whom is designated as president. The commission grants licences to qualified organizations that manage radioactive waste, and its decisions can be reviewed only by the Federal Court. The members are supported by staff who carry out operational work. This audit focused on the operational activities carried out by the commission staff.

6.11 **Atomic Energy of Canada Limited.** This is a federal Crown corporation that owns and manages the Government of Canada's radioactive waste inventory as part of its mandate. Atomic Energy of Canada reports the federal government's radioactive waste liabilities, which were estimated at more than \$8 billion for the 2020–21 fiscal year. This figure results from a complex calculation, which is revisited annually, and represents the cost of planned decommissioning, remediation, and waste management work forecasted a number of years out. The estimate fluctuates over time as future planned work changes.

6.12 Every year, a portion of the planned liability work is carried out. In the 2020–21 fiscal year, this work represented close to \$600 million in costs for decommissioning, remediation, and storage of radioactive waste.

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<sup>1</sup> **Governor in Council**—The Governor General, who acts on the advice of Cabinet and, as the formal executive body, gives legal effect to those decisions of Cabinet that are to have the force of law.

6.13 Atomic Energy of Canada's liability is reviewed annually as part of the financial statement audit carried out by the Office of the Auditor General of Canada. In the 2020–2021 financial statement audit, our office found that the reported liabilities were reasonably estimated, and we issued a clean audit opinion.

6.14 Since 2015, Atomic Energy of Canada has delivered its mandate through a 10-year contract, using a government-owned, contractor-operated model. Under this model, Atomic Energy of Canada continues to own its assets and liabilities while a private-sector organization, Canadian Nuclear Laboratories, manages the day-to-day operations of its sites. Atomic Energy of Canada oversees all aspects of the contract, sets priorities, and assesses performance.

## Focus of the audit

6.15 This audit focused on whether Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited adequately managed low- and intermediate-level radioactive waste. Low- and intermediate-level waste represents the majority of the volume of radioactive waste in Canada. Understanding how Canada manages radioactive waste is important to minimize the burden of that waste on future generations.

6.16 More details about the audit objective, scope, approach, and criteria are in [About the Audit](#) at the end of this report.

## Findings and Recommendations

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### Overall message

6.17 Overall, we found that Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited did a good job of managing the low- and intermediate-level radioactive waste that makes up 99.5% of Canada's radioactive waste output. The entities' management of this waste aligns with key international standards that seek to protect the environment and the safety of current and future generations. Canada's previous and ongoing use of nuclear technology has created a legacy of radioactive waste that will be with us for years to come. Understanding how Canada manages radioactive waste is important to minimize the burden of that waste on future generations. Our audit work provides recommendations and highlights areas for improvement.



## Managing radioactive waste inventories

### Atomic Energy of Canada Limited was improving its inventory information

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#### What we found

6.18 The majority of Atomic Energy of Canada Limited's inventory of radioactive waste consists of historic waste, most of which is contaminated soils dating back to the 1930s, and legacy waste, which is from past federal government operations. Atomic Energy of Canada has worked to better understand and address this waste through various initiatives, including the Port Hope Area Initiative. However, we found errors in the eMWaste database that contained low- and intermediate-level waste inventory data.

6.19 The analysis supporting this finding discusses the following topics:

- [Limited details on legacy waste](#)
- [Historic waste being addressed](#)
- [Database errors](#)

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#### Why this finding matters

6.20 This finding matters because inaccurate information about radioactive waste inventory can affect related decisions, such as how to prepare the waste for eventual disposal.

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#### Context

6.21 Most of the historic waste in Canada is contaminated soil. Historic waste makes up 82% of all low-level radioactive waste in Canada and dates as far back as the 1930s. Legacy waste refers to other low- and intermediate-level radioactive waste generated from past federal government operations, buildings no longer in use, old infrastructure, and lands affected by past practices. It dates as far back as the 1950s. Historic and legacy radioactive waste represent almost all low- and intermediate-level radioactive waste in Canada, which is owned and managed by Atomic Energy of Canada. Details of the historic and legacy waste, along with all other radioactive waste, are captured in Atomic Energy of Canada's inventory databases.

6.22 The process of assessing the details of radioactive waste, including the type of waste, the level of radioactivity, and the volume, is called "waste characterization." Characterization is important because there are different requirements for waste that will be stored and waste that will be disposed of. Characterization can be done multiple times—for example, when waste is initially stored, when it is relocated, when monitoring indicates that additional characterization is needed, and prior to disposal.

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**Analysis to support this finding****Limited details on legacy waste**

6.23 Legacy waste is estimated to make up 14% of Atomic Energy of Canada's total volume of radioactive waste. We found that Atomic Energy of Canada had limited details on its legacy waste in its inventory. Because the information was collected at the time the waste was initially stored, Atomic Energy of Canada made assumptions about the waste's volume and level of radioactivity. Although Atomic Energy of Canada has done some work to gain more precise information, more work is needed for it to know the full details of its legacy waste.

6.24 We also found that Atomic Energy of Canada ensured that the level of radioactivity of the waste at its storage facilities was monitored. Monitoring activities included taking soil samples, monitoring buildings for radiation, and checking water for contamination. As Atomic Energy of Canada learns more about the characteristics of the waste, it may change its approach to monitoring and change its estimate of the cost of managing, storing, and disposing of the waste.

6.25 As part of the proposed near-surface disposal facility (see paragraph 6.3), Atomic Energy of Canada's low-level legacy waste has been targeted for disposal. On the basis of current requirements, all waste must be verified and if needed, characterized before disposal. To prepare for disposal, Atomic Energy of Canada undertook a pilot project to understand the resources and effort required to re-characterize the legacy waste. However, the project was still ongoing during the audit period, so the analysis of the final results was not yet available.

**Historic waste being addressed**

6.26 Atomic Energy of Canada began implementing the Port Hope Area Initiative in 2012 to address Canada's low-level historic radioactive waste. As part of this initiative, Atomic Energy of Canada started to characterize and remediate the waste. Two facilities were built to manage the waste, 1 in Port Granby, Ontario, and 1 in Port Hope, Ontario. The Port Granby facility was completed in October 2021, while the Port Hope facility is expected to be completed by 2029. This initiative has helped Atomic Energy of Canada understand the details of its historic waste, plan for the waste's management, and update its inventory database.

6.27 We found that Atomic Energy of Canada was on track to fully characterize and remediate its historic radioactive waste, which is estimated to make up more than 86% of its total volume of radioactive waste.

## Database errors

6.28 We examined Atomic Energy of Canada's eMWaste database, which captures radioactive waste inventory information for low- and intermediate-level waste. We looked at whether the key information being captured met national and international requirements and whether the inventory records matched the source documents. We did not examine older databases, as older information was known to be incomplete.

6.29 We found that information fields related to waste characterization and location captured in the database aligned with key national and international standards. However, when we examined a representative sample of 50 database records, we noted that 4 records, or 8%, did not match the source documents. The errors that we identified included mistakes in the listed waste volume and radioactivity.

6.30 We also found that Atomic Energy of Canada did not have detailed inventory controls in place. Although it oversaw the activities of the contractor that managed its waste, Canadian Nuclear Laboratories, it did not examine Canadian Nuclear Laboratories' radioactive waste inventory database records to ensure accuracy and completeness.

6.31 **Recommendation.** Atomic Energy of Canada Limited should have effective controls in place to ensure its radioactive waste inventory database is accurate.

**Atomic Energy of Canada Limited's response.** *Agreed.*

See [Recommendations and Responses](#) at the end of this report for detailed responses.

## Public reporting could be enhanced

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### What we found

6.32 We found that Atomic Energy of Canada Limited had publicly available plans to address all of its historic and legacy radioactive waste. However, its reporting on these activities did not clearly categorize the projects as being specific to historic and legacy waste.

6.33 The analysis supporting this finding discusses the following topic:

- [Reporting on addressing historic and legacy waste unclear](#)

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### Why this finding matters

6.34 This finding matters because clearly linking projects to historic and legacy waste would help Atomic Energy of Canada reassure Canadians that it was addressing this waste.

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## Analysis to support this finding

### Reporting on addressing historic and legacy waste unclear

6.35 We found that Atomic Energy of Canada had various activities underway to identify, manage, and prepare historic and legacy waste for storage or eventual disposal. However, the plans and reports that were made publicly available did not clearly identify whether the waste being addressed was historic or legacy waste.

6.36 **Recommendation.** Atomic Energy of Canada Limited should ensure that its public reporting clearly aligns its plans and activities with how it is addressing historic and legacy waste. For increased transparency, these reports should include monitoring activities and timelines.

**Atomic Energy of Canada Limited's response.** *Agreed.*

See [Recommendations and Responses](#) at the end of this report for detailed responses.

## Regulatory oversight of licensing and compliance programs

### The Canadian Nuclear Safety Commission used risk-based planning but documentation could be strengthened

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#### What we found

6.37 We found that the Canadian Nuclear Safety Commission staff applied a graded approach for the compliance verification of facilities licensed for low- and intermediate-level radioactive waste management, which aligns with international standards. However, it did not fully and consistently document the rationale for its decisions about how it would verify compliance for each facility. We also found that commission staff had documented their approval of all programs and documents related to managing radioactive waste that were submitted by applicants and licensees.

6.38 The analysis supporting this finding discusses the following topics:

- [Graded approach for compliance verification, but insufficient documented rationale for planning decisions](#)
- [Approval of key licensing documents](#)

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## Why this finding matters

6.39 Regulatory oversight of radioactive waste management facilities ensures accountability and ultimately keeps Canadians safe. Documented rationale, including professional judgment, about compliance verification activities, including planning, is important because it ensures that these activities can be consistently performed. A lack of documented rationale reduces the Canadian Nuclear Safety Commission staff's ability to demonstrate to Canadians how it verifies that radioactive waste is managed safely by licensed facilities.

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## Context

6.40 The Canadian Nuclear Safety Commission is responsible for ensuring that licensed facilities (licensees) comply with the *Nuclear Safety and Control Act*, regulations, applicable regulatory documents, and other compliance verification criteria. Commission staff carry out various activities such as physical inspections and remote technical assessments to verify that licensees are in compliance.

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## Analysis to support this finding

### **Graded approach for compliance verification, but insufficient documented rationale for planning decisions**

6.41 We found that the Canadian Nuclear Safety Commission staff applied a graded approach when verifying the compliance of facilities that manage radioactive waste, which aligns with international standards. A graded approach uses a risk-based process, which means that the degree of effort related to the assessment matches the level of risk the facility poses. We also found that commission staff had systematic and documented processes to develop risk-based plans for compliance verification activities. These plans were intended to ensure that licensed facilities were complying with requirements. The plans included a risk ranking and a number of compliance verification activities for each facility. The risk ranking prioritized facilities where the probability and impact of risk was greater.

6.42 However, we found that commission staff did not document their rationale, including professional judgment, for the initial risk ranking of the licensed facilities. We also found that most decisions about the planning of the annual set of compliance verification activities for each facility did not have supporting rationale. For example, neither the sources of information that staff used to determine the list of compliance verification activities, such as information submitted by licensees, nor the rationale to support the number and list of planned compliance verification activities was documented. Because the

rationale was not documented, we could not determine whether commission staff considered known risks when planning compliance verification activities for licensed facilities.

6.43 **Recommendation.** The Canadian Nuclear Safety Commission should fully and consistently document the rationale used throughout its planning of compliance verification activities for licensed low- and intermediate-level radioactive waste management facilities.

**The Canadian Nuclear Safety Commission's response.** *Agreed.*

See [Recommendations and Responses](#) at the end of this report for detailed responses.

### Approval of key licensing documents

6.44 We found that Canadian Nuclear Safety Commission staff documented their approval of the radioactive waste management programs and documents for all 26 facilities licensed for the management of low- and intermediate-level radioactive waste. When a licensee indicated that it intended to receive waste, we verified that commission staff had documented their approval of licensees' waste acceptance criteria. Waste acceptance criteria specifies the details of the waste that can be accepted for storage or disposal by the licensed facility for low- and intermediate-level waste.

6.45 Commission staff required that licensees submit planned and unplanned activity reports related to radioactive waste management. Unplanned activities were events that affected licensed facilities and could potentially affect health, safety, or the environment. We found that commission staff collected all annual and quarterly planned reports submitted by licensees. We also found that staff followed up on all 12 unplanned activity reports related to radioactive waste management that they received during the audit period.

## Compliance verification activities were supported by multiple systems

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### What we found

6.46 We found that the Canadian Nuclear Safety Commission staff used a number of disparate systems to capture and manage data for facilities licensed to manage low- and intermediate-level radioactive waste. These disparate systems created inefficiencies, such as the need for manual cross-referencing between systems, and data quality errors. We also found that, although commission staff had a digital strategy to modernize their systems, they did not have a detailed implementation plan to measure and track progress.

6.47 The analysis supporting this finding discusses the following topics:

- [Systems not linked](#)
- [Gaps in digital strategy implementation plan](#)

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### Why this finding matters

6.48 This finding matters because the Canadian Nuclear Safety Commission strives to be a modern regulator. If its systems are inefficient and require manual processes, it may not realize this objective and, ultimately, be unable to efficiently regulate radioactive waste from anticipated future sources.

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### Context

6.49 The Canadian Nuclear Safety Commission has several data systems to plan and execute compliance and licensing programs and manage compliance-related data and information for facilities managing low- and intermediate-level radioactive waste.

6.50 Commission staff developed a digital strategy in 2019, which included a review of the needs and capacities of its licensing and compliance programs. The strategy's goal was to create an open, digital, evidence-based regulatory organization that ensured modern, effective, and secure interactions with licensees, Indigenous communities, the public, and stakeholders. The digital strategy was not yet fully implemented at the time of the audit.

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### Analysis to support this finding

#### **Systems not linked**

6.51 We found that the Canadian Nuclear Safety Commission staff used a document repository to store compliance-related information, including documents received from and provided to applicants and licensees. Commission staff also used a number of other systems to capture compliance information. However, tracking licensee compliance information across systems was a manual process, as not all systems used were connected to each other.

6.52 We identified 278 low- and intermediate-level radioactive waste compliance cases from the Canadian Nuclear Safety Commission's tracking system within the audit period. We found that 30 of the 278 cases (11%) were not captured in the tracking system. Specifically, 1 or more compliance areas verified as part of the compliance activities were not captured. For example, a waste

management compliance area was documented but not reflected in the tracking system. However, all supporting source information was available in the document repository.

6.53 We found that the disparate systems, combined with the data quality errors, did not give commission staff a complete picture of the effectiveness of their compliance verification process.

6.54 **Recommendation.** The Canadian Nuclear Safety Commission should capture its compliance verification information in an integrated way, including having effective controls for data entry.

***The Canadian Nuclear Safety Commission's response.*** Agreed.

See [Recommendations and Responses](#) at the end of this report for detailed responses.

### **Gaps in digital strategy implementation plan**

6.55 The Canadian Nuclear Safety Commission staff developed a digital strategy with a vision for an open, digital, evidence-based regulatory organization that embraces the rapid pace of technological change to ensure modern, effective, and secure interactions with stakeholders. Two desired outcomes of the strategy included improved regulatory effectiveness and improved internal efficiency. We found that commission staff had initiated some activities related to the strategy, such as data modelling and a shift to a centralized cloud infrastructure. However, there was no overarching implementation plan detailing all actions, outcomes, and associated timelines. As a result, it was not clear how and when the digital strategy would improve the efficiency of the Canadian Nuclear Safety Commission's operations.

6.56 **Recommendation.** The Canadian Nuclear Safety Commission should develop a detailed implementation plan for its digital strategy that clearly articulates deliverables and associated timelines, and performance measures and targets to measure and track progress.

***The Canadian Nuclear Safety Commission's response.*** Agreed.

See [Recommendations and Responses](#) at the end of this report for detailed responses.

## Modernizing Canada's radioactive waste management policy

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### Context

6.57 In Canada, radioactive waste management is regulated at the federal level. The current Policy Framework for Radioactive Waste, released in 1996, reflects responsibilities for radioactive waste management.



## Natural Resources Canada was modernizing the national radioactive waste management policy

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### What we found

6.58 We found that Natural Resources Canada had begun to modernize its radioactive waste management policy. However, the policy modernization was ongoing during the audit period.

6.59 The analysis supporting this finding discusses the following topic:

- [Ongoing modernization of Canada's radioactive waste management policy](#)

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### Why this finding matters

6.60 This finding matters because Canada's Policy Framework for Radioactive Waste guides the management of all radioactive waste in Canada. The lack of detail in the current policy can lead to inefficiencies, such as overlap in roles and responsibilities, or to a lack of coordination in the implementation of the policy.

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### Analysis to support this finding

#### **Ongoing modernization of Canada's radioactive waste management policy**

6.61 In 2019, Canada invited an international team of experts for a peer review of Canada's regulatory framework for nuclear and radiation safety against the International Atomic Energy Agency safety standards, which are international benchmarks for safety. The peer review recommended that Canada enhance its national policy for radioactive waste management.

6.62 Canada accepted the recommendation of the peer review, and in November 2020, Natural Resources Canada began to modernize Canada's policy on radioactive waste management. We found that the modernization effort focused on the roles of government, waste producers, and owners. The modernization aligned with international guidance and Canadian legal requirements and considered input from the public and other government departments and agencies.

6.63 A modernized draft policy was completed in early 2022 and made available for public comment. The modernized policy is expected to be released later in 2022.

6.64 We found that Natural Resources Canada applied a **gender-based analysis plus**<sup>2</sup> assessment as part of its policy modernization. This assessment was informal, as no targeted funding was allocated to the process. Even though the assessment was in draft form during the audit period, it was used to inform the development of the policy.

6.65 Natural Resources Canada stated that it did not directly consider the United Nations' Sustainable Development Goal 12 (responsible consumption and production) and had not created specific indicators in support of this goal as part of its policy modernization. The management of radioactive waste is directly linked to target 12.4, which refers to the environmentally sound management of all wastes throughout their lifecycle and the minimization of adverse impacts on human health and the environment. In our view, Natural Resources Canada should place greater emphasis on its consideration of Goal 12 as part of the development and future implementation of its modernized policy.

## Conclusion

6.66 We concluded that Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited have adequately managed low- and intermediate-level radioactive waste. We did identify some weaknesses and provided recommendations that would improve the management of Canada's radioactive waste.

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**2 Gender-based analysis plus**—An analytical process that provides a rigorous method for the assessment of systemic inequalities, as well as a means to assess how diverse groups of women, men, and gender-diverse people may experience policies, programs, and initiatives. The "plus" acknowledges that gender-based analysis goes beyond biological (sex) and socio-cultural (gender) differences and considers many other identity factors, such as race, ethnicity, religion, age, and mental or physical ability.

Source: Adapted from Women and Gender Equality Canada

## About the Audit

This independent assurance report was prepared by the Office of the Auditor General of Canada on the management of low- and intermediate-level radioactive waste by Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited. Our responsibility was to provide objective information, advice, and assurance to assist Parliament in its scrutiny of the government's management of resources and programs and to conclude on whether the management of low- and intermediate-level radioactive waste complied in all significant respects with the applicable criteria.

All work in this audit was performed to a reasonable level of assurance in accordance with the Canadian Standard on Assurance Engagements (CSAE) 3001—Direct Engagements, set out by the Chartered Professional Accountants of Canada (CPA Canada) in the CPA Canada Handbook—Assurance.

The Office of the Auditor General of Canada applies the Canadian Standard on Quality Control 1 and, accordingly, maintains a comprehensive system of quality control, including documented policies and procedures regarding compliance with ethical requirements, professional standards, and applicable legal and regulatory requirements.

In conducting the audit work, we complied with the independence and other ethical requirements of the relevant rules of professional conduct applicable to the practice of public accounting in Canada, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality, and professional behaviour.

In accordance with our regular audit process, we obtained the following from entity management:

- confirmation of management's responsibility for the subject under audit
- acknowledgement of the suitability of the criteria used in the audit
- confirmation that all known information that has been requested, or that could affect the findings or audit conclusion, has been provided
- confirmation that the audit report is factually accurate

### Audit objective

The objective of this audit was to determine whether Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited adequately managed low- and intermediate-level radioactive waste.

Adequately means that management of low- and intermediate-level radioactive waste aligns with national and international practices: for example, national and international standards and governance models.

Managed means that governance and oversight of radioactive waste systems, processes, and inventories are included.

## Scope and approach

During the audit, we interviewed representatives from each entity, stakeholders, and subject matter experts. We examined documents from each entity, stakeholders, and national and international organizations. We analyzed database information from the Canadian Nuclear Safety Commission and Atomic Energy of Canada related to regulatory oversight and radioactive waste inventories, respectively.

We did not examine licensing and other decisions made by the Canadian Nuclear Safety Commission members exercising their administrative tribunal function. We also did not examine health and safety evidence. Canadian Nuclear Laboratories and its operations were not part of this audit.

## Criteria

Criteria	Sources
<p>We used the following criteria to determine whether Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited adequately managed low- and intermediate-level radioactive waste:</p>	
<p>Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited have clearly defined and met their respective roles and responsibilities for radioactive waste management.</p>	<ul style="list-style-type: none"> <li>• <i>Nuclear Safety and Control Act</i></li> <li>• Policy Framework for Radioactive Waste, Natural Resources Canada, 1996</li> <li>• Corporate Plan Summary 2021–22 to 2025–26, Atomic Energy of Canada Limited, 2021</li> <li>• General Principles for the Management of Radioactive Waste and Irradiated Fuel (CSA N292.0:19), Canadian Standards Association, 2019</li> <li>• Functions and Processes of the Regulatory Body for Safety, International Atomic Energy Agency, 2018</li> <li>• Government, Legal and Regulatory Framework for Safety, International Atomic Energy Agency, 2016</li> <li>• Transforming Our World: The 2030 Agenda for Sustainable Development, United Nations, 2015</li> <li>• Achieving a Sustainable Future: A Federal Sustainable Development Strategy for Canada 2019–2022, Environment and Climate Change Canada, 2019</li> </ul>

Criteria	Sources
<p>We used the following criteria to determine whether Natural Resources Canada, the Canadian Nuclear Safety Commission, and Atomic Energy of Canada Limited adequately managed low- and intermediate-level radioactive waste:</p>	
<p>The Canadian Nuclear Safety Commission has designed and conducted its compliance activities in relation to radioactive waste management to verify licensees have complied with regulatory requirements.</p>	<ul style="list-style-type: none"> <li>• <i>Nuclear Safety and Control Act</i></li> <li>• General Principles for the Management of Radioactive Waste and Irradiated Fuel (CSA N292.0:19), Canadian Standards Association, 2019</li> <li>• Functions and Processes of the Regulatory Body for Safety, International Atomic Energy Agency, 2018</li> <li>• Government, Legal and Regulatory Framework for Safety, International Atomic Energy Agency, 2016</li> <li>• Regulatory Fundamentals (Regulatory Document 3.5.3), Canadian Nuclear Safety Commission, 2018</li> <li>• Waste Management, Volume I: Management of Radioactive Waste (Regulatory Document 2.11.1, Volume 1), Canadian Nuclear Safety Commission, 2021</li> </ul>
<p>The Canadian Nuclear Safety Commission has used information from licensees to ensure its compliance activities in relation to radioactive waste management are risk-informed.</p>	<ul style="list-style-type: none"> <li>• Functions and Processes of the Regulatory Body for Safety, International Atomic Energy Agency, 2018</li> <li>• Government, Legal and Regulatory Framework for Safety, International Atomic Energy Agency, 2016</li> <li>• Policy on Results, Treasury Board, 2016</li> </ul>
<p>Atomic Energy of Canada Limited can demonstrate that its radioactive waste inventory is accurate and complete.</p>	<ul style="list-style-type: none"> <li>• General Principles for the Management of Radioactive waste and Irradiated Fuel (CSA N292.0:19), Canadian Standards Association, 2019</li> <li>• Methods for Maintaining a Record of Waste Packages During Waste Processing and Storage, International Atomic Energy Agency, 2005</li> </ul>
<p>Atomic Energy of Canada Limited can demonstrate the effectiveness of key controls for its radioactive waste inventory.</p>	<ul style="list-style-type: none"> <li>• General Principles for the Management of Radioactive Waste and Irradiated Fuel (CSA N292.0:19), Canadian Standards Association, 2019</li> </ul>
<p>Natural Resources Canada has compiled accurate and complete information for the Inventory of Radioactive Waste in Canada 2019 report and the Seventh Canadian National Report for the Joint Convention.</p>	<ul style="list-style-type: none"> <li>• Policy Framework for Radioactive Waste, Natural Resources Canada, 1996</li> <li>• Policy on Results, Treasury Board, 2016</li> <li>• Directive on Results, Treasury Board, 2016</li> </ul>

## Period covered by the audit

The audit covered the period from 1 January 2019 to 31 December 2021. This is the period to which the audit conclusion applies.

## Date of the report

We obtained sufficient and appropriate audit evidence on which to base our conclusion on 8 September 2022, in Ottawa, Canada.

## Audit team

This audit was completed by a multidisciplinary team from across the Office of the Auditor General of Canada led by Sami Hannoush, Principal. The principal has overall responsibility for audit quality, including conducting the audit in accordance with professional standards, applicable legal and regulatory requirements, and the office's policies and system of quality management.

## Recommendations and Responses

The following table lists the recommendations and responses found in this report. The paragraph number preceding the recommendation indicates the location of the recommendation in the report.

Recommendation	Response
<p><b>6.31</b> Atomic Energy of Canada Limited should have effective controls in place to ensure its radioactive waste inventory database is accurate.</p>	<p><b>Atomic Energy of Canada Limited's response.</b>            Agreed. Atomic Energy of Canada Limited notes that no inaccuracies found in the eMWaste database had any impact on the inventories reported to Natural Resources Canada as part of the Inventory of Radioactive Waste in Canada 2019 Report. Atomic Energy of Canada has been working with our contractor, Canadian Nuclear Laboratories on improving the accuracy of the radioactive waste database. Since the end of the audit period, Canadian Nuclear Laboratories has brought international expertise to support its staff to review and verify the existing records, as well as improve the quality controls over the data entry. Specifically, Canadian Nuclear Laboratories is conducting a 100% review of the waste records since 2018, which will conclude by August 2022, as well as applying a graded review of records generated between 2015 and 2018 by December 2022.</p> <p>To strengthen our controls over the radioactive waste database, Atomic Energy of Canada continues to oversee the verification of the database as well as Canadian Nuclear Laboratories' improvement plan to strengthen the process of entering and verifying waste data into the eMWaste database. To supplement the triennial reporting to Natural Resources Canada and enhance transparency, starting in 2023, Atomic Energy of Canada will report nuclear waste inventories on its website, to show progress on addressing its radioactive waste inventory.</p>
<p><b>6.36</b> Atomic Energy of Canada Limited should ensure that its public reporting clearly aligns its plans and activities with how it is addressing historic and legacy waste. For increased transparency, these reports should include monitoring activities and timelines.</p>	<p><b>Atomic Energy of Canada Limited's response.</b>            Agreed. Atomic Energy of Canada Limited will develop additional webpages on our website that will explain to Canadians the linkage between our reported waste inventories and the progress we are making on managing our waste, by 2022. These pages will include information on monitoring activities and forecasted timelines to place the waste in modern disposal or long-term waste management facilities.</p>

Recommendation	Response
<p><b>6.43</b> The Canadian Nuclear Safety Commission should fully and consistently document the rationale used throughout its planning of compliance verification activities for licensed low- and intermediate-level radioactive waste management facilities.</p>	<p><b>The Canadian Nuclear Safety Commission’s response.</b> Agreed. The Canadian Nuclear Safety Commission (CNSC) recognizes that improving the documentation of rationales related to the planning of compliance verification could help assure Canadians that we continue to meet the highest standards, as confirmed by the 2019 Integrated Regulatory Review Service conducted by the International Atomic Energy Association focused on waste.</p> <p>The CNSC’s activities are carried out following the established processes, procedures, and work instructions found in its management system. The CNSC will update existing relevant procedural documents to improve consistency in recording the rationale of decisions related to the planning of compliance verification activities for low- and intermediate-level waste management facilities.</p> <p>The CNSC will complete the assessment of the process and work instructions documents to determine and identify any gaps by March 2023. CNSC staff will complete the revisions to these documents by March 2024. The CNSC will use established communication channels (such as committees, all-staff meetings and watercoolers) for the rollout of new documents to ensure communication to affected staff.</p>
<p><b>6.54</b> The Canadian Nuclear Safety Commission should capture its compliance verification information in an integrated way, including having effective controls for data entry.</p>	<p><b>The Canadian Nuclear Safety Commission’s response.</b> Agreed. The Canadian Nuclear Safety Commission (CNSC) recognizes the need to build and adopt integrated solutions to improve the efficiency and effectiveness of the integrated analysis of compliance verification data, while also ensuring that compliance verification data is accurate and complete. Adoption of these capabilities in the regulation of waste management activities will facilitate accurate, integrated analysis of its compliance verification data.</p> <p>The CNSC will establish data management practices, including a data governance framework to support integrated management of compliance data and update existing procedures to include instructions for the review and oversight of the data entered into the existing information system, to ensure data entry is accurate and complete.</p> <p>Initially, the CNSC will review its existing tools to identify potential areas for improvement. As necessary, staff will update existing procedures and implement the necessary controls within its existing systems and governance framework.</p>



Recommendation	Response
<p><b>6.56</b> The Canadian Nuclear Safety Commission should develop a detailed implementation plan for its digital strategy that clearly articulates deliverables and associated timelines, and performance measures and targets to measure and track progress.</p>	<p>The CNSC will complete the assessment, update the documents required, and implement the necessary controls by December 2024. The CNSC will use established communication channels (such as committees, all-staff meetings, and watercoolers) for the rollout of new documents to ensure communication to affected staff.</p> <p>In the long term, the CNSC will assess an integrated system approach that will accurately capture and manage the information, in order to understand the effectiveness of the compliance processes and improve them as required.</p> <p><b>The Canadian Nuclear Safety Commission's response.</b> Agreed. The Canadian Nuclear Safety Commission's (CNSC's) Information Management and Technology Directorate has a detailed plan for the Digital Strategy within the Digital Program. Launched in 2021, the program is the execution arm for the implementation of the Digital Strategy. The Program is comprised of a number of themes or releases that will deliver a wide range of capabilities and tools to the organization in support of its regulatory mandate, and also to enable a modern digital workspace for all staff for their day-to-day operational activities. The program will execute in three horizons that build on each other and that will support and enable the CNSC's regulatory mandate for 10+ years. The CNSC is currently in horizon 1, focused on connecting people, processes, and core data to build capabilities that can be expanded upon in horizons 2 and 3.</p> <p>Horizon 1 (June 2020 through March 2025) key milestones are as follows:</p> <ul style="list-style-type: none"> <li>• Build and establish CNSC Cloud Tenant: March 2024</li> <li>• Enable Digital Workspace capabilities supporting hybrid workforce, self-service and enhanced employee experience: March 2025</li> <li>• Build CNSC Digital Front Door enabling digital business capabilities for CNSC external partners and stakeholders: March 2025</li> </ul> <p>The Digital Program has established governance to facilitate sound and coordinated management of the program; an implementation framework to map out activities, roles, and responsibilities; and performance monitoring and reporting to ensure effective and efficient use of resources.</p>

Recommendation	Response
	<p>Each theme or release of the program includes project management elements, including project charters, work breakdown structures, milestones and detailed schedules, organizational change management plans, regular status reports, and performance measurements and metrics.</p>

# Appendix

## Exhibit 6.2—Canada’s 4 classes of radioactive waste

[Back to Exhibit 6.2](#)

This chart shows Canada’s 4 classes of radioactive waste—uranium mine and mill waste, low-level radioactive waste, intermediate-level radioactive waste, and high-level radioactive waste. It also indicates the 2 classes that are within the scope of the audit—low-level radioactive waste and intermediate-level radioactive waste. Each class of radioactive waste includes photos of examples.

Uranium mine and mill waste (not in the scope of the audit)	Low-level radioactive waste (within the scope of the audit)	Intermediate-level radioactive waste (within the scope of the audit)	High-level radioactive waste (not in the scope of the audit)
Alt text of photo: A mining facility that includes a tailings pond	Alt text of photos: Used helmets and uniforms, used cable, used paper	Alt text of photo: Resin beads	Alt text of photo: Used fuel rods
Uranium mine and mill waste can be radioactive for billions of years. It includes tailings and waste rock generated by the mining and milling of uranium ore.	Low-level radioactive waste includes used equipment, paper, cable, clothing, decommissioned parts, and even mops.	Intermediate-level radioactive waste includes refurbishment waste, ion-exchange resins*, and some radioactive sources used in radiation therapy.  * Ion-exchange resins are often used within a nuclear power plant’s water process systems to minimize corrosion of system components and to remove radioactive contaminants.	High-level radioactive waste used nuclear fuel that is significantly radioactive. A photo shows used fuel rods.
Photo: Orano Canada Inc.	Photos (clockwise from top):  • Maxim Gutsal/ Shutterstock.com  • Marian Weyo/ Shutterstock.com  • worradirek/ Shutterstock.com	Photo: Stig Helmer/ Shutterstock.com	Photo: Peter Sobolev/ Shutterstock.com

\* Source for ion-exchange resin definition: Adapted from Application of Ion Exchange Processes for the Treatment of Radioactive Waste and Management of Spent Ion Exchangers, International Atomic Energy Agency, 2002

Source for chart: Based on information from the Canadian Nuclear Safety Commission

