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What We Heard: Modernizing Canada's Policy for Radioactive Waste Management and Decommissioning

Canada

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1. Introduction

1.1. Review and Modernization of Canada's Radioactive Waste Policy

On November 16, 2020, Canada's Minister of Natural Resources launched the process to review and modernize Canada's policy for radioactive waste. The objectives of this initiative are to:

- elaborate on the existing radioactive waste policy, and to provide clearer direction and greater leadership on radioactive waste management;
- stimulate and facilitate progress on the safe, effective and environmentally acceptable management of radioactive waste in Canada; and
- continue to meet international standards based on best available science, and to reflect the values and principles of Canadians.

Protecting the health, safety and security of Canadians and the environment is the Government of Canada's top priority when it comes to nuclear energy and radioactive waste. To this end, we are committed to continuous improvement with respect to ensuring that safe solutions are in place for managing radioactive waste and decommissioning for generations to come.

All radioactive waste in Canada is currently being safely managed and regulated in compliance with Canadian legislation and according to international standards at facilities that are licensed by our independent nuclear regulator—the Canadian Nuclear Safety Commission (CNSC).

The review and modernization of Canada's radioactive waste policy is applicable to all of Canada's existing and future radioactive waste, including waste that arises from normal operations and from emergency scenarios. This report sets out the context for the management of radioactive waste and decommissioning in Canada, the oversight regime that applies, and the main points of feedback that we received on modernizing Canada's policy for radioactive waste.

1.2 Canada's Evolving Landscape

Canada is a different place today as compared to 1996, when the Policy Framework for Radioactive Waste was created, and much has changed over the years. Interested Canadians, such as Indigenous peoples, members of public interest groups, people living in nuclear host communities and those involved in industry are seeking more policy clarity and transparency for continuing to manage radioactive waste and decommissioning in a responsible, safe, secure and environmentally friendly way.

Looking at the nuclear industry and the evolving Canadian society, we can point to some changes that make the context for a modernized radioactive waste policy different today:

> **Climate Change** | Climate change has emerged as perhaps the single most important global policy issue, affecting every country, and every sector of society. Moreover, climate change is not a theoretical concept: the effects are real and happening now, with extreme weather and disruptions to social and economic activity already taking a toll on Canadians. How we think about nuclear energy and radioactive waste must be understood in the context of climate

change, the use of nuclear energy as an emissions-free source of energy, and efforts to decarbonize energy production.

Indigenous Involvement | The Government of Canada is deeply committed to advancing reconciliation and a renewed relationship with Indigenous peoples, based on the recognition of rights, respect, co-operation and partnership. No relationship is more important to Canada than the one with Indigenous peoples. As laws and policies are developed and reviewed, Canada recognizes that Indigenous perspectives and rights must be respected.

Openness, Transparency and Public Engagement | Societal expectations, modern environmental standards, data management and communications have evolved, and today's citizens expect a degree of engagement and transparency greater than what was expected at the time of the 1996 Policy Framework.

Aging Infrastructure | Canada's principal nuclear infrastructure is aging and reaching a point where planned life extension programs are needed to extend the safe operating life of the facilities for another generation, which means that considerations around refurbishment (which can extend the life of some facilities), decommissioning and disposal have greater importance. The decommissioning of older infrastructure facilities that are to be closed will require better understanding regarding timing, preferred approaches, and the availability of waste management infrastructure.

New Technologies | New technologies, particularly Small Modular Reactors, have the potential to transform the future of what nuclear energy could look like. While not in place in Canada now, these technologies may reorder how we think about and manage radioactive waste across Canada, including in regions that do not currently have nuclear power. This could challenge existing radioactive waste management models that are based on a small number of large nuclear generating sites.

2. Canada's Radioactive Waste

Source: Western Waste Management Facility, Ontario Power Generation

What is radioactive waste?

Radioactive waste consists of a gas, liquid, sludge or solid that has been declared as waste and contains a nuclear substance in excess of the clearance or exemption criteria, and is without foreseeable use.

Radioactive waste has been produced in Canada since the early 1930s, when the first radium mine in Canada began operating at Port Radium in the Northwest Territories. At present, it is generated in Canada from a variety of activities, including the following: uranium mining, milling, refining and conversion; nuclear fuel fabrication; nuclear reactor operations; nuclear research; industrial applications; medical applications that support life-saving procedures; facility decommissioning; and the remediation of contaminated sites. Canada's approach to radioactive waste management is founded upon the Government of Canada's 1996 Radioactive Waste Policy Framework.

2.1 The 1996 Radioactive Waste Policy Framework

Canada's Policy Framework for Radioactive Waste (1996), which is the subject of this review and modernization initiative, consists of a set of principles governing radioactive waste management and the institutional and financial arrangements for disposal of radioactive waste by waste producers and owners. It reads as follows:

- The federal government will ensure that radioactive waste disposal is carried out in a safe, environmentally sound, comprehensive, cost-effective and integrated manner.
- The federal government has the responsibility to develop policy, to regulate, and to oversee producers and owners to ensure that they comply with legal requirements and meet their funding and operational responsibilities in accordance with approved waste disposal plans.
- The waste producers and owners are responsible, in accordance with the principle of "polluter pays," for the funding, organization, management, and operation of disposal and other facilities required for their wastes. This recognizes that arrangements may be different for nuclear fuel waste, low-level radioactive waste and uranium mine and mill tailings.

The Policy Framework is supported by primary pieces of legislation that govern the management of radioactive waste in Canada:

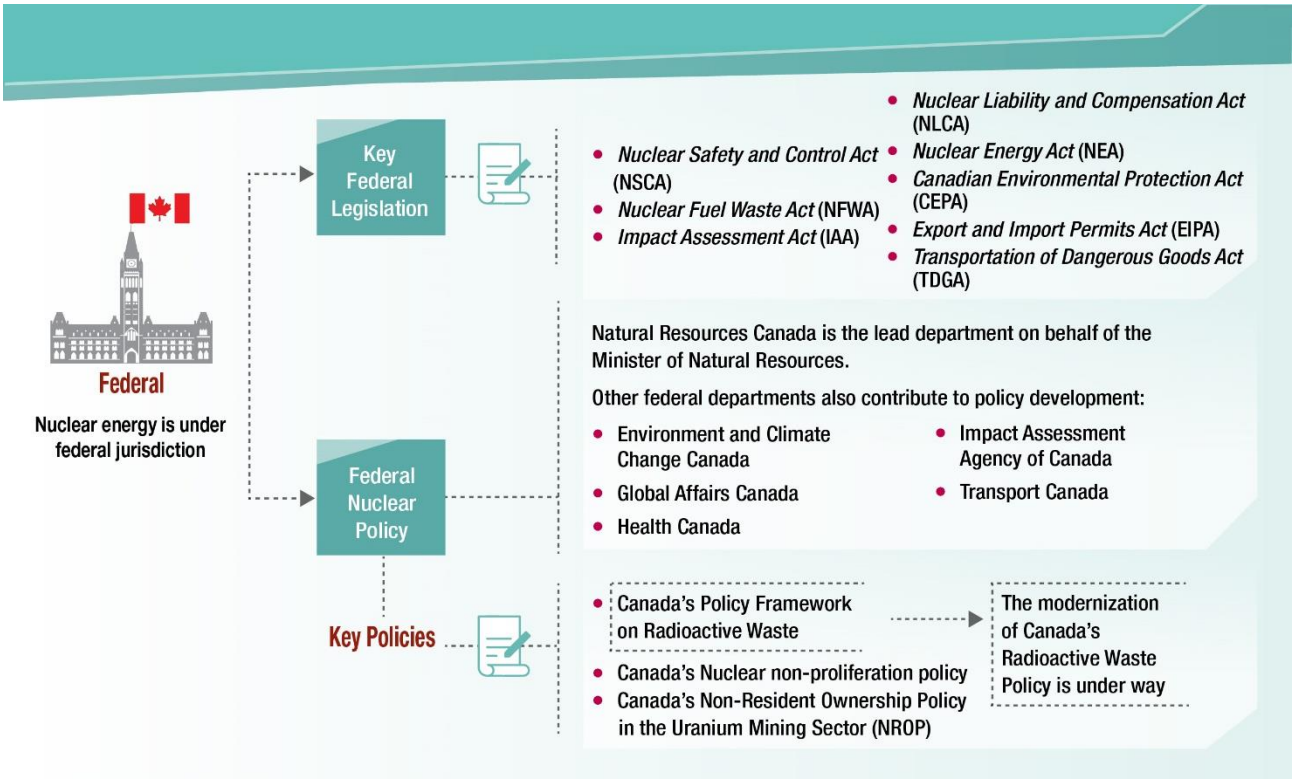
- the *Nuclear Safety and Control Act*, which sets out the Canadian Nuclear Safety Commission's mandate, responsibilities and powers;
- the *Nuclear Fuel Waste Act*, which provides the framework for progress on a long-term strategy for the management of nuclear fuel waste, and led to the establishment of the Nuclear Waste Management Organization, a not-for profit agency responsible for designing and implementing Canada's plan for the safe, long-term management of used nuclear fuel; and
- the *Impact Assessment Act* (and previously, the *Canadian Environmental Assessment Act*, 2012, now repealed), which, while not being specific to radioactive waste management, establishes the legislative basis for the federal impact assessment process.

Other key pieces of federal legislation pertaining to nuclear energy include:

- the *Nuclear Liability and Compensation Act*, which establishes a compensation and liability regime in the unlikely event of a nuclear accident resulting in civil injury and damages. Nuclear fuel waste processing, nuclear fuel waste management and radioactive waste management facilities are all designated installations under the NLCA, each facility with a liability limit proportional to its respective risk. Operators have absolute and exclusive liability for any third-party damages resulting from an incident, and are required to maintain adequate financial security to meet their respective liability limits.
- the *Nuclear Energy Act*, which addresses the development and use of nuclear energy in Canada;
- the *Canadian Environmental Protection Act, 1999* (CEPA), whose primary purpose is to protect the environment, and the health and well-being of Canadians. A major part of the Act deals

with sustainable development, pollution prevention, and enabling instruments to prevent the release of dangerous chemical substances, such as radioactive waste, into the environment. The Act enables federal programs and includes activities related to: air and water pollution, hazardous waste, greenhouse gas emissions; ocean disposal; and environmental emergencies;

- the *Export and Import Permits Act*, which pertains to the export, transfer and brokering of goods and technology, and the import of goods; and
- the *Transportation of Dangerous Goods Act, 1992*, promotes public safety in the transportation of dangerous goods, and includes references to nuclear substances that are regulated by the Canadian Nuclear Safety Commission.



2.2 Federal Organizations

In Canada, while the decision to invest in electric generation rests with the provinces and territories, constitutionally nuclear energy falls within the jurisdiction of the federal government. The federal government's role encompasses Research and Development (R&D), as well as the regulation of all nuclear materials and activities in Canada. A number of federal organizations have different areas of responsibility in leading policy, regulating industry, environmental protection, and nuclear security, health, and safety:

Natural Resources Canada (NRCan) is the lead government department responsible for developing and implementing federal nuclear energy policy across the nuclear supply chain, from uranium mining to the final disposition of waste. It administers and oversees the

Nuclear Fuel Waste Act. NRCan also provides expert technical, policy and economic information and advice to the Minister of Natural Resources and the Government of Canada on issues regarding radioactive waste.

The **Canadian Nuclear Safety Commission (CNSC)** is Canada's nuclear regulator. It is responsible for the following: regulating the use of nuclear energy and materials to protect health, safety, security and the environment; implementing Canada's international commitments on the peaceful use of nuclear energy; and disseminating objective scientific, technical and regulatory information to the public. More specifically, it regulates all radioactive waste management facilities and activities, including, as applicable, the generation, handling, processing, transport, storage and disposal of radioactive waste. The Commission is an independent entity that reports to Parliament through the Minister of Natural Resources. The Minister has no role in CNSC decision making; the decisions made by the CNSC are reviewable by the Federal Court of Canada.

Atomic Energy of Canada Limited (AECL) is a Crown corporation whose sole shareholder is the Government of Canada. It reports to Parliament through the Minister of Natural Resources. Its mandate is to enable nuclear science and technology, and to manage the federal government's decommissioning and radioactive waste liabilities.

In addition, several federal departments have important roles to play in contributing to federal nuclear policy, managing aspects of the nuclear industry, managing radioactive waste, and protecting people and the environment. These include:

Environment and Climate Change Canada: protects and conserves our natural heritage; ensures a clean, safe and sustainable environment for present and future generations; preserves, enhances and protects the natural environment (water, air, soil, flora, fauna, species at risk and migratory birds). Provides expertise to NRCan and the CNSC on radioactive waste matters to ensure environmental protection and compliance with regulatory requirements.

Global Affairs Canada: manages Canada's relationship with the International Atomic Energy Agency (IAEA), is the lead government department responsible for nuclear non-proliferation policy, and ensures that Canada upholds its international legal obligations (e.g., Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management; Additional Protocol with the IAEA).

Health Canada: in the area of radiation protection, Health Canada contributes to maintaining and improving the health of Canadians by investigating and managing the risks from natural and artificial sources of radiation.

Impact Assessment Agency of Canada: is responsible for administering the *Impact Assessment Act*, the primary federal legislation that defines the requirements for assessing the environmental, health, social and economic impacts of proposed projects.

Transport Canada: Transport Canada's mission is to serve the public interest through the promotion of a safe and secure, efficient and environmentally responsible transportation system in Canada. Its oversight covers the transportation of dangerous goods, including nuclear substances such as radioactive waste.

2.3 Canada's Plan for Nuclear Fuel Waste

The Nuclear Waste Management Organization (NWMO) is a not-for-profit organization established in 2002 by Canada's nuclear electricity producers in accordance with the *Nuclear Fuel Waste Act* (NFWA).

Funded in trust by Ontario Power Generation, the New Brunswick Power Corporation, Hydro-Québec and Atomic Energy of Canada Limited, the NWMO is responsible for designing and implementing Canada's plan for the safe, long-term management of used nuclear fuel.

This plan, known as **Adaptive Phased Management**, requires used fuel to be contained and isolated in a deep geological repository in an area with suitable geology and an informed and willing host. It calls for a comprehensive solution that is socially acceptable, technically sound, environmentally responsible and economically feasible for Canadians. It also involves the development of a transportation system to move the used fuel from the facilities where it is currently stored to the new site.

APM emerged from a three-year dialogue with both scientific specialists and the general public. It is consistent with long-term management best practices adopted by other countries with nuclear power programs, such as Finland, France, Sweden, Switzerland and the United Kingdom.

Nuclear Fuel Waste Trust Funds

The *Nuclear Fuel Waste Act* requires Canada's nuclear electricity producers to establish trust funds to finance the long-term management of used nuclear fuel. These funds will accumulate and may only be used for the purpose of implementing the management approach selected by the Government of Canada, once a construction or operating licence has been issued under the *Nuclear Safety and Control Act*.

Each year, the NWMO makes public the audited financial statements of the trust funds when they are provided by the financial institutions. At the end of 2020, trust fund balances were at $5.4 billion. The NWMO's Annual Report provides the latest numbers, projections and financial reports.

The federal government selected APM as Canada's plan in June 2007. The NWMO is now responsible for implementing APM, subject to all necessary regulatory approvals.

2.4 Radioactive Waste Management: Canada's International Commitments

Canada is a member country of both the Nuclear Energy Agency (NEA) and the International Atomic Energy Agency (IAEA), the two foremost international organizations that deal with the safe use of nuclear power for peaceful purposes.

Joint Convention

Canada is a signatory of the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*. This Joint Convention is an international agreement governing all

aspects of spent fuel and radioactive waste management, and is the first legally binding international treaty on safety in these areas. It fosters an international approach to spent fuel and radioactive waste management, and encourages the sharing of expertise in these areas.

The Contracting Parties to the Joint Convention have made a commitment to apply stringent safety measures, to prepare a national report on the measures applied, and to submit it for review by the other Contracting Parties. In addition, they will actively participate in the review meetings of the Contracting Parties. The peer review process for each signatory occurs every three years. The IAEA website provides reports from the 6th Review Meeting 2018, as examples of past reports from Canada and other countries.

The objectives of the Joint Convention are to:

- achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management
- ensure that there are effective defences against potential hazards in the course of such activities
- prevent accidents with radiological consequences and mitigate these consequences should they occur at any stage of spent fuel or radioactive waste management

The Joint Convention applies to:

- spent fuel arising from the operation of civilian nuclear reactors
- radioactive waste arising from civilian applications
- uranium mining and milling wastes
- discharges from regulated activities
- specific provisions on disused sealed sources

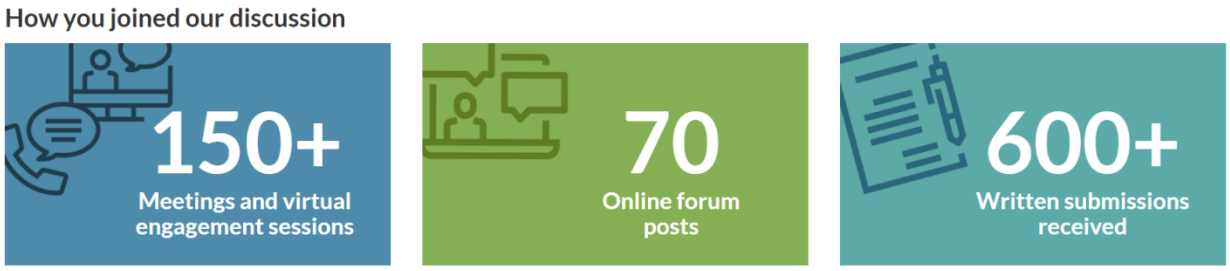
The IAEA serves as the Secretariat for the Joint Convention. The responsibility of implementing the obligations of the Convention on behalf of the Government of Canada has been delegated to the Canadian Nuclear Safety Commission (CNSC).

3. What We Did – Inclusive Engagement

3.1 The Process to Date

Engagement with interested Canadians on modernizing Canada's radioactive waste policy took place virtually from the Fall of 2020 to the Spring of 2021 through various online forums and activities, and by telephone. The engagement approach was designed to help ensure public safety during the COVID-19 public health pandemic. Engagement activities were led by Natural Resources Canada (NRCan) with the support of federal departments that have responsibilities for radioactive waste in Canada. The avenues of engagement were:

- An online engagement and policy modernization website at http://www.radwastereview.ca/ featuring discussion papers on key topics, including waste minimization, waste storage facilities, decommissioning and waste disposal, and an open forum available to all Canadians to suggest ideas and discuss topics.
- Written submissions from individuals and organizations—NRCan received over 600 written submissions and 70 online forum posts, which are available for review at http://www.radwastereview.ca/.
- A series of over 150 meetings and virtual engagement sessions, including 24 round tables, with participants from organizations such as environmental and public interest groups, interested citizens, Indigenous peoples, the industry sector, other levels of government, youth, and academics.



This report presents the main points of feedback received throughout the entire engagement process, from November 16, 2020 to May 31, 2021. During the engagement process, NRCan also prepared two Engagement Summary reports, both published on the policy modernization website. These reports provide a summary of feedback received at different stages of the engagement process (from November 16, 2020 to February 19, 2021, and from February 20 to May 14, 2021, respectively). This final report builds on those points of feedback, as well as capturing views from written submissions, emails and online discussion forums.

We received comments and feedback on a wide range of issues, some of which are more or less relevant to modernizing Canada's radioactive waste policy. Some comments touched on elements of policy implementation, waste management, and other aspects of nuclear waste. We have included this wide range of feedback as it is instructive beyond the limited scope of the policy modernization exercise itself.

3.2 The Process: Next Steps

The engagement period was designed for NRCan and other federal departments to hear the views and input of interested parties on a wide range of topics, and to help guide us in modernizing the existing radioactive waste policy. Based on this feedback, NRCan has prepared a draft Policy on Radioactive Waste Management and Decommissioning and is interested in receiving your written comments and feedback.

- As of the publication date of this report, the draft Policy for Radioactive Waste Management and Decommissioning is available on the Modernizing Canada's Radioactive Waste Policy website for public comment. All Canadians, including Indigenous peoples and representatives of organizations are invited to provide input.

Following the comment period, NRCan plans to finalize the policy in 2022.

4. What We Heard: Summary of Major Points of Feedback

The feedback in this report is reflective of what we heard from interested participants throughout the engagement process, but does not reflect policy direction or Natural Resources Canada's intent.

The Modernizing Canada's Radioactive Waste Policy website features the full text of all written submissions received during the engagement process, as well as summaries of feedback from roundtable discussions. Readers interested in seeing more detail are encouraged to review those sources.

4.1 High-Level Feedback

Source: SMR Action Plan website

Role of Nuclear Energy in Canada's Energy Mix

While the subject of the engagement process was the management of radioactive waste, this of course included a discussion of the role and value of nuclear energy and nuclear products (e.g., emissions-free energy, medical isotopes, research). High-level questions about whether Canada should have a nuclear industry and/or what type of nuclear industry Canada should have are outside of the scope of this exercise. However, since we heard views and perspectives on these topics, they have been included. In this regard, we heard a wide range of differing views, and it is important for opposing views to be acknowledged, on this subject as well as others. On the one hand, we heard from those who view nuclear energy, and the expansion of the industry into the next generation, as a powerful force for social good, particularly as a non-emitting energy

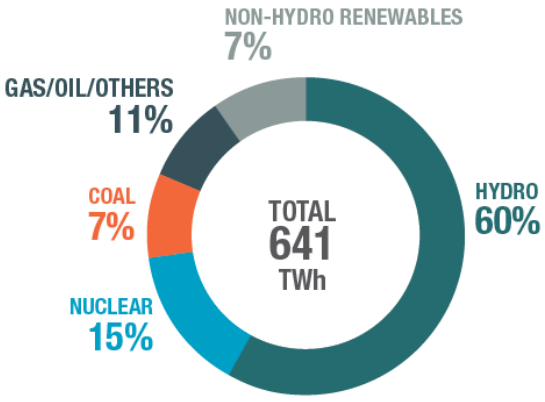


Figure 1 Electricity Generation by Source, 2018, NRCan Energy Fact Book

source in the era of climate change. Nuclear energy offers benefits to many Canadians today, and some participants view its role as positive, and see a clear role for nuclear energy in the years to come.

Uranium and Nuclear Energy in Canada

After raw uranium is mined and milled, it is processed to make fuel for nuclear reactors to generate electricity.

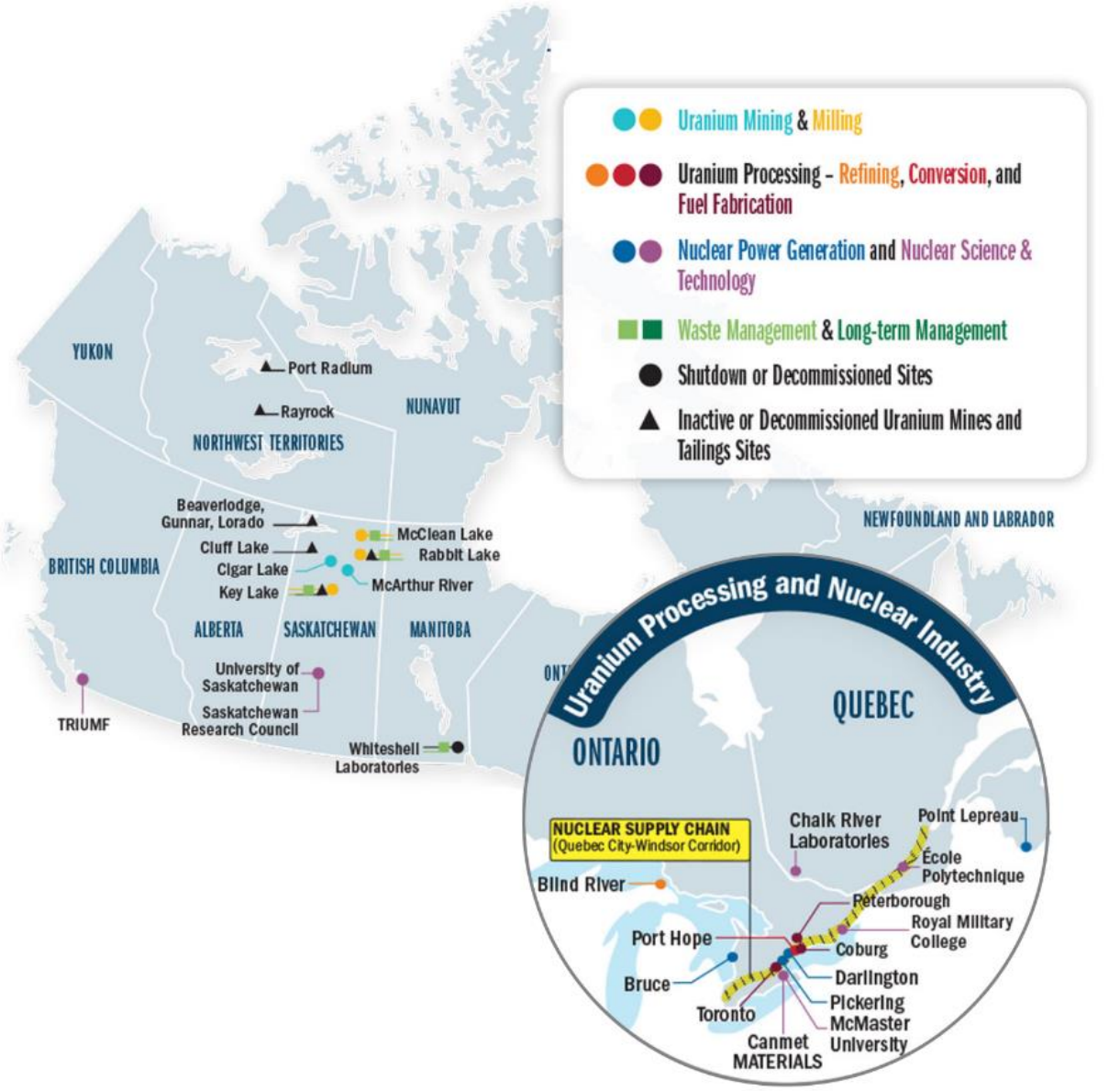
Nuclear technologies are a major part of the Canadian landscape. Canada has a strong nuclear science and technology presence, covering research and development activities, production and use of isotopes for medical and industrial applications, and nuclear power stations that operate in Ontario and New Brunswick. Uranium mining, refining and fuel fabrication steps are completed in Saskatchewan and Ontario.

Key facts

- Canada is one of the largest producers and exporters of uranium in the world, and was responsible for 13% of global production in 2019.
- Nuclear power generation accounted for approximately 15% of Canada's electricity in 2018. Nuclear power is a source of energy that does not emit greenhouse gases.
- Under Canada's nuclear non-proliferation policy, Canadian uranium may be used only for peaceful purposes.

These respondents told us that radioactive waste is indeed a regrettable feature of the industry, but expressed confidence that the risks can be managed effectively, and that future technologies will help us do an even better job of minimizing waste generation and managing waste. Some people suggested that other forms of energy have inherent health and environmental risks and challenges, and that some of these contribute to greenhouse gas emissions, but are not subjected to such a rigorous management regime. We heard that the policy should clearly take into consideration the nuclear context, especially as it relates to climate change, and should make it clear that radioactive waste is not the sole output of nuclear energy generation, and that several societal benefits exceed the risks.

On the other hand, we heard from people who have concerns about the industry as a whole, and who believe that the best solution is to declare a moratorium on all nuclear development and to wind down existing nuclear generation facilities. These respondents felt that the risks of radioactive waste are simply too great to bear and that, in order to keep radioactive waste contained and isolated from the biosphere, these risks need to be managed over a very long period. We heard that the current practice is creating an unfair burden for future generations. There were also those who expressed doubts about the existing safety and security regimes, and about our ability to manage these risks over the very long term since, of course, no evidence of managing radioactive waste over hundreds of years exists. It was suggested that Canada should convene a national debate on the role of nuclear energy to decide on its course for the next generation.



Scope of the Policy

We heard expectations that the modernized radioactive waste management policy should elaborate on principles, roles and responsibilities, and should account for changes that are under way now and those that are likely to occur over the next several years. In other words, the respondents were expressing that the policy should not be written in a way that stifles the adoption of new approaches or technologies (provided that they are safe and effective). We heard that the policy should provide a strong framework, but should not try to be prescriptive about specific practices, especially as the context for those practices may well change. In addition, with respect to scope, participants expressed the view that Canada's new policy should be broad, and not limited to just energy generation and subsequent waste. This means being inclusive of radioactive wastes from uranium mining and milling, storage, transportation, decommissioning, disposal, and other steps in the chain.

Flexibility was a concept that entered the discussion repeatedly. Participants want to see a policy that is nimble and results-oriented, more than just a set of inflexible rules.

Inclusion and Public Engagement

Views were expressed that Canada should have a policy and regulatory environment based on inclusion and engagement of a broad set of interested parties with a stake in radioactive waste management. We heard that a wide range of groups and individuals would like to play some sort of role, and would like to see policy guidance on how that should work.

Joint Engagement Table

During the engagement process, NRCan convened two Joint Engagement Tables (JETs), which brought together stakeholders and interested parties representing industry, Indigenous communities, academia, public interest groups, youth, and the health and safety sector. In addition to the rich feedback on the issues that we received from the JET process, we also received positive feedback on the format itself.

JET participants told us that bringing together individuals and groups from different backgrounds allows people from different constituencies holding different views to dialogue with one another and share perspectives. Participants felt that this was a good model to use in the future.

Effectiveness of the Policy

We heard suggestions that the policy should include specific provisions for policy evaluation and information sharing. It was noted that the current policy has been in place for over two decades, but does not provide guidance on when or how to evaluate its effectiveness. It would therefore be helpful for a modernized policy to provide clarity on policy goals, and some means by which the achievement of those goals will be evaluated. This includes provisions for information collection and sharing to allow those outside of government—such as scientists, Indigenous communities, host municipalities and interested citizens—to understand what is happening and how Canada is doing, and to assess results for themselves.

End-State Objectives

We heard that the policy should be as clear as possible about the objectives that it aims to achieve, not just principles or process. As an example, when we talk about radioactive waste disposal sites, what do we intend as the end-state objective? For some participants, targeted end-state objectives are full, remediated green spaces, integrated back into communities. For others, end-state objectives are more closely linked to the re-use of a site for various industrial purposes (especially in light of the fact that some sites will be located near transmission and other important infrastructure). Desired

end-states also vary according to the location and nature of a specific site. There are many different views about what end-states might look like, and policy clarity would be helpful. This is not to say, however, that the policy should be so specific as to make implementation difficult or incapable of being adapted to change.

Clear Definitions

Radioactive waste management involves numerous terms, ideas and classifications in a highly technical context. We heard that the policy should clearly define important concepts like minimization, disposal, retrieval, stewardship, reprocessing, recycling and more. During the engagement process, it was noted that such terms may mean different things to different people, necessitating debate and clarification. In order for parties from different disciplines and perspectives to communicate and collaborate effectively, shared terminology will be important.

Policy Design: Bias Towards Strongest Protection

It was suggested that, in some cases, there are jurisdictional overlaps within Canada, as well as between Canada and international regimes. It was recommended that the policy could explicitly state that, in such cases, the highest safety or health protection should take precedence, to ensure that Canadians are subject to the highest standards, and to help eliminate jurisdiction confusion or ambiguity.

Acknowledging the Limitations of Our Knowledge

For some participants it was important to acknowledge that neither the government, the industry sector or public interest groups know all of the answers. When considering the very long life of radioactive materials, in comparison to the over-70-year history of nuclear energy in Canada, it is entirely plausible that we have gaps in our collective knowledge. Thus, while we should be guided by science, some feel that we should not assume that science is 100% correct, and that policy should adopt a precautionary approach.

Risk Management but Not Risk Elimination

Radioactive waste will likely always entail some degree of risk to the environment and human beings. Our collective goal, we heard, should be to reduce that risk as much as possible. However, some respondents emphasized that this does not entail setting the goal of simply eliminating all risk entirely (largely because doing so is impossible). Thus, it was suggested that some reasonable degree of safety and precaution be obtained, but that there is a point beyond which further investment in risk mitigation is simply not warranted. Others disagreed with this view, finding it difficult to identify specific criteria that might define how much risk mitigation is enough.

Implications of Small Modular Reactors

Small Modular Reactors

Small Modular Reactors (SMRs) are a new class of nuclear reactors:

Small: in both power output and physical size;
Modular: meaning that they are factory-constructed, portable and scalable;
Reactors: using nuclear fission to produce energy for electricity, hybrid energy systems, district heating, water desalination and high-quality steam for heavy industry applications.

This technology has the potential for a range of applications, from grid-scale units that can provide non-emitting reliable electricity to smaller units suitable for heavy industry, and powering remote communities. Several provinces are actively pursuing SMRs, and Canada's first SMR could be in operation as early as the mid-to-late 2020s.

Canada's SMR Action Plan is the result of a pan-Canadian effort bringing together key enablers from across the country, including the federal government, the provinces and territories, Indigenous Peoples and communities, power utilities, the industry sector, innovators, laboratories, academia and civil society.

Source: https://smractionplan.ca/

Participants had much to say about SMRs and their implications for waste management. Some stated that SMRs have the potential to repurpose existing waste for new energy uses, while reducing Canada's radioactive waste. For those excited about this potential, it is important that the modernized policy not create unintentional roadblocks to innovation. For example, it might be desirable to store or dispose of waste far from where SMRs are deployed, in consolidated sites, which would require a flexible approach around waste management and transportation.

We also heard from those who view this emerging technology as unfounded, and saw risks in SMR technologies that could require the importing of new fuels or potential reprocessing of used nuclear fuel from Canada's conventional reactors. Rather than reducing the overall volume of existing nuclear fuel waste, some contend that SMRs could create new waste streams that are more difficult to manage than those that currently exist. Others contend that Canada needs extensive consultation in the communities where SMRs may be deployed, including emergency response plans for communities without road access. The communities must be made aware of the potential risks of SMRs.

In addition, some respondents raised concerns that SMRs will entail new security risks, especially if they are located in remote areas and are not subject to the same type of institutional controls and security as those for traditional facilities.

Reprocessing and Proliferation Risks

We heard mixed views on the proliferation risks associated with the reprocessing of used nuclear fuel via Small Modular Reactors (SMR). Some view this technology as a potential proliferation risk. The design and implementation of SMRs are still in the early phases, but some respondents expressed concern that accessibility of used fuel, particularly in remote locations, could create new

risks for proliferation. Others view this risk as minimal and see reprocessing as a way of reducing radioactive waste, at least over the long term. They see the design phase of SMR deployment as the place to ensure that proliferation risks are addressed. Ultimately, Canada has long been committed to nuclear non-proliferation, and we heard a strong consensus that the policy should affirm and support non-proliferation goals.

Nuclear Non-Proliferation Treaty

The Government of Canada remains deeply committed to the 1970 Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which remains the only legally binding global treaty promoting nuclear non-proliferation and disarmament.

The NPT has 191 members. At its core, the NPT outlines a three-part bargain: states not possessing nuclear weapons commit not to acquire them; the five "Nuclear Weapons States" (the United States, the Russian Federation, the United Kingdom, France and China) agree to pursue good-faith negotiations aimed at nuclear disarmament; and all NPT States Parties undertake to facilitate international co-operation in the peaceful uses of nuclear energy, fully in line with International Atomic Energy Agency (IAEA) safeguards.

Source: Global Affairs Canada

4.2 Governance and Structure

As with other topic areas, some feedback received on governance pertains to aspects of the nuclear regulatory system and is outside of the scope of radioactive waste policy in particular. We have included this feedback because it provides useful information that goes beyond just this review.

Governance and the Importance of Independence

Some participants had questions concerning the current governance structure for the nuclear industry, and particularly expressed their view that the present system does not adequately allow for input or participation from groups outside of the industry. It was noted that NRCan is responsible for overall policy direction, but that, at the same time, the Department also plays a role in promoting Canadian industry internationally, and promoting investment in Canada. To some, this has the appearance of a conflict of interests, with the policy centre seemingly having an interest in industry promotion as well. Similarly, we heard concerns that the CNSC and the NWMO appeared to have an overly close relationship with industry, making their roles difficult to accept for some. Others felt that the Government has not done enough to communicate how the entire system is organized and regulated, and that the complex network of complementary organizations and areas of responsibility can be difficult to navigate.

The overriding theme running through much of this feedback centered on real and perceived independence. It was important to all parties that decisions around radioactive waste management be made based on the facts, and from an independent point of view. We heard governance structure suggestions such as the creation of another body for nuclear policy/oversight, or a separate

regulatory body, as well as parliamentary inquiries and more. Some asked for an agency independent of government and the nuclear industry with the sole mandate of managing radioactive waste. They also asked that scientific, technical and social advisory groups, including representation by Indigenous peoples, should be created to support this agency for the sake of transparency.

"Polluter Pays" Principle

The "polluter pays" principle—i.e., that waste producers and owners are responsible for the funding, organization, management and operation of disposal and other facilities required for their wastes—is enshrined in the current policy, and we heard that, on its face, this principle is a sensible approach. However, we also heard that, in practice, because nuclear energy is integrated into our electricity system, the paying "polluter" is also the power utility ratepayer. In this sense, the public is not insulated from the cost of radioactive waste management because it ultimately pays.

Roles and Responsibilities: Indigenous Peoples and Public Interest Groups

We heard a desire to see a clearer role for interested parties and rights holders within the policy, beyond the roles of government, waste owners and regulators. It was noted that Indigenous peoples and public interest groups have important perspectives and unique knowledge that can help Canada do the best possible job in managing radioactive waste. Resourcing and funding are critical to make meaningful participation possible on a sustainable basis. This is especially true for smaller communities and Indigenous communities, where technical and scientific expertise must often be contracted out to help inform analysis, and where a lack of both financial resources and time can make full and meaningful participation difficult (i.e., bringing in relevant expertise on an unplanned basis can take a long time, and communities can miss their window to provide input into decision making). Some interveners indicated that Sweden is a good model in terms of its funding towards participation.

Roles and Responsibilities: Other Key Federal Government Departments

We heard that other entities within the federal government have important roles to play in terms of radioactive waste management, notably Environment and Climate Change Canada (ECCC) and the Impact Assessment Agency of Canada. With respect to ECCC, we heard that the Government should consider using provisions under the *Canadian Environmental Protection Act, 1999* to regulate and control radioactive waste, either as an alternative or in addition to the present regulatory regime. With respect to Impact Assessments, we heard questions about how Impact Assessments and radioactive waste-producing projects are approved, and what provisions apply. It was suggested that the policy should be clear in defining roles for the many federal players with an interest in aspects of radioactive waste, from pollution prevention to transportation, to Indigenous consultation and engagement, to non- proliferation, to name a few.

Host Communities

We received input to the effect that nuclear host communities want to be more engaged in decision making and communication. We heard that host communities require funding to address the specific challenges that they face, which are often beyond the available resources of most municipal governments. Communities that host nuclear and/or radioactive waste facilities assume long-term risks more so than do other communities (while millions of Canadians outside of such host

communities benefit from nuclear energy). Thus, host communities require additional expertise and communications support to address these risks. Moreover, some find that the role of municipalities is unclear in a system designed around federal and provincial governments and waste owners.

Funding for Participation

We heard that limited funding resources can be a major barrier for participation in engagement, monitoring and other activities. The issues involved are complex and highly specialized. Meaningful input is dependent on an understanding of the issues, informed by deep expertise. The big players in the nuclear space have scientists, engineers and vast resources at their disposal. Smaller groups do not enjoy these advantages, and it can be difficult for them to engage at a high level, or to delve into the important technical details that can be so decisive. Thus, it was suggested that the Government should seek ways to enable the participation of a wider variety of interested parties through a stable funding arrangement of some sort.

Trusted Science

We heard that decisions around radioactive waste management must be made on a sound basis of scientific analysis and evidence. No single system is perfect, nor is any source trusted by all parties, but there is an important role for government to play in presenting factual information clearly and openly, so that all concerned parties can draw conclusions from a shared evidence base. If trust in the underlying science is eroded or lost, it will be difficult to make decisions that address the fundamental needs and interests of most parties. We also heard that funding for all research and academia related to radioactive waste should be independent and funded through the federal granting councils to ensure independent peer review.

4.3 Indigenous Rights and Perspectives

In addition to feedback from Indigenous peoples on all issues, we received input on considerations specific to Indigenous peoples and communities.

Anishinabek Nation and Iroquois Caucus Joint Declaration

We heard that government should refer to the 2017 *Joint Declaration on the transport and abandonment of radioactive waste* by the Anishinabek Nation and the Iroquois Caucus.

The declaration identifies five key principles for radioactive waste management. Though it may not speak for all Indigenous communities, we have noted it here because some Indigenous and non-Indigenous participants referenced this document specifically and encouraged the Government to use it as a foundational piece in understanding Indigenous perspectives on radioactive waste management issues.

Anishinabek Nation and the Iroquois Caucus Principles – In Brief

For the long-term management of radioactive wastes, the five (5) principles that were all agreed upon are:

1. No Abandonment
2. Monitored and Retrievable Storage
3. Better Containment, More Packaging
4. Away from Major Water Bodies
5. No Imports or Exports

Source: Joint Declaration between the Anishinabek Nation and the Iroquois Caucus on the transport and abandonment of radioactive waste

Radioactive Waste Management Policy in the Overall Legal and Policy Context for Indigenous Rights

We heard that any future policy on radioactive waste management should conform to the current and evolving legal context for Indigenous rights, including those enshrined in Treaties and in the Constitution of Canada, and espoused in the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). Canada's relationship with Indigenous peoples, not just as interested parties, but also as rights holders, must be upheld in the radioactive waste policy. We also heard, specifically, of the importance of the right of Indigenous peoples under the UNDRIP to give or withhold Free, Prior and Informed Consent on decisions affecting them, as well as the importance of ensuring proper Crown-Indigenous consultation and accommodation.

Impact on Indigenous Communities and Traditional Territories

We heard that several key aspects of the nuclear industry have a particular impact on Indigenous peoples, because of where these activities take place (or in the case of long-term storage, where sites may be located in the future). Some industry activities may be conducted in remote areas, away from major population centres, and therefore thought of as less risk-laden or intrusive. These lands, participants told us, are not "remote" or "empty," but are vital parts of traditional and contemporary Indigenous ways of life. Risks to water, land, air, animals, plants and the use of traditional territories are therefore especially important to Indigenous peoples, making it even more critical for the future policy to make clear the need to engage or consult with Indigenous peoples on practices that affect them. It was further noted that the potential effects of radioactive waste could be broad and persistent, making the geographic scope of interested parties much greater than just a local community whose legal boundaries are located near a proposed facility, mining operation or transportation route.

Achieving and Maintaining Balance

We heard of the importance of achieving and maintaining balance in all natural systems, including air, water, soil, fish, game, medicine and more. There was a suggestion to use the wording "in the balance" as it is closer to this value system instead of "as practicable," which may connote to some that economic considerations are paramount when making decisions. The integrity of the entire natural system is critical to the long-term health of the land and of the people who share in its bounty. Radioactive waste presents a singular challenge to this concept, because it has the potential to unbalance ecosystems for very long periods of time, given its persistence in the environment. Canada, in designing policy, should carefully think through how long-term ecological balance can be achieved while radioactive waste is safely managed. Bringing Indigenous perspectives and knowledge to bear in designing such policy objectives would be helpful and insightful.

Beyond Seven Generations

It was noted that radioactive waste is unique for its long lifecycle, especially as compared to other forms of waste or risk to the natural environment. Indigenous teachings tell us to think and plan for seven generations ahead, and that the resources of today are not ours, but are merely borrowed from those yet to come. We heard that radioactive waste management pushes this obligation much further, beyond seven generations. The policy should account for the full life cycle of waste, and include responsibilities for its management over the very long term. Furthermore, we heard that we should not plan to abandon waste or in any way walk away from our obligations to future generations, and that there is a need for proper knowledge management to ensure that our collective responsibility to future generations is upheld. The importance of restoring land that has been used for waste management to its natural environment was stressed.

Importance of Monitoring and Indigenous Involvement

Participants told us that monitoring of radioactive waste is critical to ensuring the ongoing safety of people and the environment. Canada's monitoring obligations will extend well into the future, and we heard of the need to work collectively to design monitoring approaches that are sound and complete. Indigenous peoples and communities have an important and unique role to play with respect to monitoring. Indigenous peoples—especially Elders—have traditional knowledge and insight into land, air and water that are distinct from Western knowledge, and enhance our understanding of natural systems significantly. Moreover, Indigenous peoples, as stewards of their land, have opportunities to observe changes that are important elements of any monitoring framework. Thus, we were advised by participants that the policy should make clear the legal requirement and importance of involving Indigenous peoples, especially Elders, in the ongoing monitoring of radioactive waste.

Social Effect on Indigenous Communities

We heard that divisive issues, such as energy policy or waste disposal locations, may entail additional harmful effects for Indigenous communities: the fracturing of communities based on project acceptance or not, driven by inequities in economic participation in projects, or the design of consultation processes. Some participants told us that industry practices regarding Indigenous engagement can sometimes feel like the industry sector is using financial resources to buy consent on the part of communities. According to what we heard, there is no simple solution for this issue, but it must be weighed along with the other effects on Indigenous peoples; engagement approaches and governance design should be informed by these considerations.

4.4 Minimization

Source: Ontario Power Generation

We asked Canadians and engagement session participants for their views on the role of radioactive waste minimization in the future policy. This discussion was informed by a short discussion paper, which can be found on the Modernizing Canada's Radioactive Waste Policy website. The highlights of the feedback include:

Questions of Practicality

Today's waste management system allows some leeway for waste owners to take action within the realm of what is "practical," and this concept of practicality includes affordability. We heard that safety and security requirements should be defined by science and public interest, and should not be limited by what is deemed practical or affordable. This applies to waste minimization and to all of the other topics, to some degree. There was debate and discussion about how much waste minimization is enough to minimize the radiation risks that need to be managed.

We also heard that the goal of radioactive waste management should not be to simply eliminate all risk at any cost, and that there is a level at which stakeholders and the public can feel that every reasonable precaution has been taken. This raised questions around the most productive use of limited resources—e.g., it may be more beneficial to invest in research to improve waste minimization and other technologies than to make marginal improvements in existing practices. For some people, we heard that minimizing waste as a goal is a good place to start, and that there is an inherent incentive for industry to minimize waste to reduce storage and disposal costs. However, we also heard of the need not to force an undue burden on certain smaller businesses in the industry. For others, we heard expectations that safety and waste minimization should be maximized, regardless of the cost.

Reprocessing

We heard from some participants that new nuclear technologies for reprocessing and recycling existing used fuel into new fuel for some Small Modular Reactor designs could reduce the volume and long-term radioactivity of Canada's used fuel waste, while producing non-emitting energy. On this topic, we also heard from other participants that they have reservations as to whether new nuclear technologies—Small Modular Reactors foremost among them—will be capable of repurposing used nuclear fuel. They suggest that doing so could actually increase the challenges of managing radioactive waste due to the emergence of new forms of waste, such as liquid wastes, as well as proliferation risks that raise important international relations issues. Some participants said that commercial reprocessing of CANDU spent fuel would be a significant departure from current federal policy and should require discussion and debate by Parliament.

For some, the terminology is unclear. Some people told us that the idea of radioactive waste "recycling" is misleading, and that this may lean more toward branding than science. Similarly, we heard that terminology such as "recycling" and "reprocessing" should not be conflated. For instance, we heard that recycling processes are currently used to minimize low-level waste, whereas, reprocessing is a different process altogether that pertains to used nuclear fuel.

Some respondents expressed the view that future technology may play an important role in enabling the reuse or recycling of waste in ways that we cannot envision right now. Therefore, the policy should enable the adoption of new technologies, and should not limit Canada to only what is practical today.

Reprocessing of Used Nuclear Fuel

The reprocessing of used nuclear fuel is a chemical process for the recovery of fissile nuclear materials (primarily uranium and plutonium) from used fuel. There are currently no reprocessing activities in Canada as part of our nuclear fuel waste management, and this is not part of the current CANDU fuel cycle. However, certain technology developers may propose future reprocessing activities in Canada, as some SMR technologies could operate on reprocessed used nuclear fuel.

The Government of Canada is exploring the science, technologies, benefits and risks associated with any potential technologies that can reprocess used nuclear fuel. Any decision on the deployment of reprocessing technologies in Canada would require a decision by the Government of Canada to address health, safety, security, safeguards, non-proliferation and environmental perspectives and considerations.

Canada remains committed to the Treaty on the Non-Proliferation of Nuclear Weapons, including the full implementation of safeguards set by the International Atomic Energy Agency to provide assurances that nuclear materials are used solely for peaceful purposes in Canada.

Optimizing Waste Generation

Many participants voiced support for the waste hierarchy as a useful overall construct to guide minimization activity. However, we also heard views that minimization should be understood to mean more than just a drive to reduce volumes of waste. A more accurate but complex answer, we heard, is that Canada needs to optimize its waste management, such that minimization is focused on minimizing risks and hazards, not just waste volumes alone. In discussing the general approach that the Government should take, we heard support for the ALARA—as low as reasonably achievable—principle that currently underlies Canada's approach to radiation.

Should Canada invest in new nuclear generation capacity, we heard that overall volumes of waste may in fact increase or decrease, depending on the approach and the technology used. Therefore, in terms of minimization or optimization, we should consider performance in terms of the nature of the risks involved, and the overall performance of the system from the perspective of protecting human and environmental health.

Minimization and Optimization

According to International Atomic Energy Agency guidance:

> The objectives of waste minimization are to limit the generation and spread of radioactive contamination and the activation of materials, and to reduce the volume of waste for storage and disposal, thereby limiting any consequent environmental impact, as well as the total costs associated with the management of such waste and of contaminated materials.
>
> …implementation of a waste minimization strategy is always an optimization exercise that takes into consideration factors such as worker doses, the cost of recovering materials, the availability of disposal routes for specific types of waste, the quantities of waste generated in each category, and the duration and cost of interim storage of waste compared with the estimated ultimate disposal cost.
>
> The safety measures that are applied to facilities and activities that give rise to radiation risks are considered optimized if they provide the highest level of safety that can reasonably be achieved throughout the lifetime of the facility or activity, without unduly limiting its utilization.

Sources: IAEA, Considerations for Waste Minimization at the Design Stage of Nuclear Facilities, Technical Reports Series No. 460 and IAEA, Fundamental Safety Principles, Fundamental Safety Standards for protecting people and the environment, No. SF-1

Engagement

Science and social expectations come together when we talk about minimization—we heard that it is important for Canada to engage with and visibly meet the expectations of Canadians around waste minimization, even if that means going beyond the minimum measures required from a purely scientific perspective. This vision of minimization, then, is a collaborative one, where all parties work together to answer the needs of society and visibly work to achieve as much as possible. This differs from a regime based solely on compliance with basic standards.

Waste Classification

We heard that how we classify waste can make an important difference in understanding and achieving minimization goals. Today's definitions of waste streams and types can be difficult to implement at a practical level and can entail an over-classification of waste. We heard in particular that other jurisdictions have done a good job of implementing a "very low-level" waste category that can lead to better outcomes and a clearer focus on higher levels of waste. In addition, we heard that waste streams are not homogenous, and may demand different approaches to minimization. With respect to classification, over-classified waste also entails additional cost; there is an economic benefit to focusing resources where they are most needed. It was suggested that the policy should allow for consideration of the specific nature of waste at a particular site or operation. There is significant variety and one size does not fit all.

Some respondents suggested that if waste minimization is made the goal of the system without proper context and understanding, this could incent waste owners to minimize waste through its reclassification to very low-level waste, and ultimately allow release to landfills. The concern here is that well-meaning policy goals might drive behaviour that does not truly affect the overall volume of waste produced, but moves it around on paper.

Waste Classification

In Canada, four main classes of radioactive waste are recognized:

High-level radioactive waste (HLW) is used nuclear fuel that has been declared as radioactive waste and/or is waste that generates significant heat via radioactive decay. HLW contains significant quantities of long-lived radionuclides necessitating long-term isolation.

Intermediate-level radioactive waste (ILW) generally contains long-lived radionuclides in concentrations that require isolation and containment for periods greater than several hundred years. ILW needs no provisions, or only limited provisions, for heat dissipation during its storage and disposal. Due to its long-lived radionuclides, ILW generally requires a higher level of containment and isolation than can be provided in near-surface repositories.

Low-level radioactive waste (LLW) contains material with radionuclide content above established unconditional clearance levels and exemption quantities (set out in the Nuclear Substances and Radiation Devices Regulations), but generally has limited amounts of long-lived radionuclides. LLW requires isolation and containment for periods of up to a few hundred years. An engineered near-surface disposal facility is typically appropriate for LLW.

LLW includes the following sub-classes:

- **Very low-level radioactive waste** has a low hazard potential, but is above the criteria for clearance and exemption levels. Long-term waste management facilities for this level of waste do not need a high degree of containment or isolation.
- **Very short-lived low-level radioactive waste** is waste that can be stored for a decay period of not more than a few years and subsequently cleared for release.

Uranium mine and mill tailings are a specific type of radioactive waste generated during the mining and milling of uranium ore and the production of uranium concentrate. In addition to tailings, mining activities typically result in the production of large quantities of waste rock as workings are excavated to access the ore body. The wastes contain long-lived radionuclides that do not decrease significantly over extended time periods.

Source: CNSC REGDOC-2.11.1, *Waste Management, Volume I: Management of Radioactive Waste*

For more information on classification, see IAEA, Classification of Radioactive Waste, General Safety Guide No. GSG-1

4.5 Storage

Source: Ontario Power Generation

We asked Canadians and engagement session participants for their views on the role of radioactive waste storage in the future policy. This discussion was informed by a short discussion paper, found on the Modernizing Canada's Radioactive Waste Policy website. The highlights of the feedback include:

Transportation

Waste storage is inextricably linked to transportation, particularly as not all waste may be stored where it is produced. We heard that transportation of waste is of particular interest because it has the potential to affect many communities along the route, as opposed to fixed facilities with a relatively delimited area of direct effect/interest. Some participants had questions about controls for the transport of radioactive waste, and the role of various regulators, most particularly Transport Canada. That said, other respondents pointed to the existing track record of safety in the transport of radioactive waste, and expressed confidence that transportation to storage facilities is currently done safely.

Some expressed a desire for greater engagement with various affected communities along waste transportation routes. Some said that community engagement is, not surprisingly, an area of focus for the immediate areas around generation or storage sites. At such sites, the presence of waste is clear and the interest of the community is obvious. For those along transportation routes, there is less awareness of a need to be engaged, and less engagement overall. Some expressed concern that the public has not been informed about the transport and the routes of nuclear wastes in Canada.

They expressed that there should be no transport of waste from decommissioned facilities and sites unless there has been full public consultation and transparency about a destination for that waste. Interveners also expressed the need for the CNSC to have a public registry for the transportation of radioactive waste in Canada.

Waste Transportation Safety

Canada is one of the major producers of nuclear substances (radioactive material) in the world and has an excellent safety record for the transport of these substances. More than a million packages carrying a variety of nuclear substances are transported safely in Canada each year. All nuclear substances can be shipped only by a qualified carrier and can be transported solely in accordance with strict federal regulations. Canada's regulations are based on the IAEA's *Regulations for the Safe Transport of Radioactive Material.*

The Canadian Nuclear Safety Commission (CNSC) and Transport Canada work together to regulate the transportation of nuclear substances, including used nuclear fuel.

CNSC – Through the *Packaging and Transport of Nuclear Substances Regulations* (PTNS Regulations), the CNSC ensures that every package transporting used nuclear fuel conforms to all established safety standards. The CNSC is responsible for certifying the design of the package, verifying that it meets the regulatory requirements, and ensuring that the health, safety and security of the public and the protection of the environment will not be compromised.

Transport Canada – Through the *Transportation of Dangerous Goods Act, 1992* and related regulations, Transport Canada also shares in the responsibility of ensuring the safe transport of used nuclear fuel. Transport Canada develops safety standards and regulations, provides oversight and gives expert advice to promote public safety in the transportation of dangerous goods (of all classes) by all modes of transport in Canada.

Source: CNSC website, Transport FAQs on used nuclear fuel

Transportation and Emergency Preparedness

We heard that a further consideration pertaining to the transportation of waste to storage or other facilities is the need for emergency preparedness among a large number of jurisdictions and agencies. Participants told us that either the policy or the resulting regulation should take into account the need to both require and support emergency preparedness. This is especially the case in smaller or more remote communities, such as those that might host new Small Modular Reactor development, where the resources found in major centres or existing nuclear host communities may be lacking. This consideration entails resolving a major question: funding for preparedness and planning.

Small Modular Reactor Implications

Small Modular Reactors (SMRs) will have important implications for how Canada thinks about radioactive waste storage. We heard that, today, the storage regime is based on a small number of large sites, many of which are proximate to supporting storage infrastructure. In the future, however, SMRs may change this dynamic, given they will have a smaller generating capacity, and be located

across the country, in locations far from existing storage facilities. If this is to become reality (on which there is not consensus, to be clear), Canada will require a vision and enabling policy to deal with the storage considerations. Will waste be stored in communities that host SMRs? Will it be consolidated somewhere? What will be the effect on waste transportation? In short, for waste storage, we heard that the policy should adapt not just to today's situation, but be drafted in a way that responds directly to, or allows for flexibility in responding to a next-generation nuclear industry with many different characteristics compared to today's industry.

Openness, Transparency and Accessibility of Information

Earned public trust is a critical feature of the radioactive waste management regime. Doing the right thing is mandatory, but allowing Canadians a window into how waste is managed is equally important. In this vein, we heard that transparent, accessible, detailed and up-to-date inventories of waste in storage are fundamental to gaining trust in the system, and in enabling important oversight. More transparency is needed to ensure that the public understands its liabilities with respect to nuclear waste.

Communities, organizations or individuals wanting to engage and provide input find that there is either a lack of clear information, or that it is challenging to know where to find information, which can be a significant barrier. In particular, participants told us that they would like to be able to easily access information about what waste is stored where, over what period, in what volumes, what classifications are involved, and what the future plans are for management of the waste. Without this information, the engagement that is noted elsewhere in this report as being so important can be difficult at best.

Understanding Canada in an International Context

International comparison and context can help us understand the storage issue in Canada, and enable better public debate and decision making. We heard that the government should provide information not just on the Canadian reality, but also on how Canada is performing or what strategies it has adopted, as compared to its international peers. Providing this type of information and comparative analysis can help the public understand risk management in a more complete context, and focus on areas where Canada may differ from other countries.

Security and Safety of Storage Sites

There were questions posed about the security, safety and proximity to major water bodies of existing storage facilities. Such questions focused on how waste is moved within facilities, on how releases are monitored and reported, and on overall readiness with respect to natural disasters, attacks or infiltration. These questions are particularly relevant for sites located near major water bodies (Lake Ontario and the Ottawa River), which supply drinking water to millions of Canadians and are therefore, naturally, under greater scrutiny given the potential for catastrophic impact.

Concurrently, we heard views that storage practices today meet and exceed regulatory requirements and international guidelines, and that facilities are adequately hardened to resist disaster or malevolence.

Critical People and Skills

Some participants told us that effective radioactive waste storage depends on more than just regulations and guidelines: critical skilled labourers are necessary to make practices real. A growing nuclear sector may face an important shortage of critical people—scientists, engineers and skilled tradespeople—who drive the industry. Labour or skills development policy is, of course, outside the scope of a radioactive waste policy. However, we heard that the policy could acknowledge this critical dependency, and this comment is useful for the Government overall as it considers the important skills that will drive the energy economy of the future.

Prioritize long-term storage for intermediate-level waste

We heard that a plan for the long-term management of intermediate-level waste (ILW) is needed, and that this should be reflected in the policy. Participants stated that, to date, nobody in Canada has proposed a plan for the long-term management of intermediate-level radioactive waste. Some are concerned that there will be attempts to put this waste in disposal facilities near the surface without proper isolation from the biosphere.

4.6 Decommissioning

Source: AECL

We asked Canadians and engagement session participants for their views on the role of radioactive waste management in the decommissioning of sites in the future policy. This discussion was informed by a short discussion paper, found on the Modernizing Canada's Radioactive Waste Policy website. The highlights of the feedback include:

Criteria for In-Situ Decommissioning

We heard concern that some legacy sites are candidates for *in-situ* decommissioning. These sites, dating back to the early days of the nuclear age, were not designed with modern expectations and planning for decommissioning in mind. Legacy sites are distinct from the rest of the nuclear portfolio, and may require different approaches to decommissioning. How and under what circumstances Canada adopts the strategy of in-situ decommissioning, in particular, is unclear. We heard concerns that international guidance recommends in-situ decommissioning primarily as a method reserved for disaster remediation or other special cases, and that the application of this approach for legacy sites may not necessarily conform to international guidance. Some would like to see in-situ decommissioning banned altogether. Canada needs clear criteria for when and why in-situ decommissioning would be appropriate.

Decommissioning: Prompt or Deferred?

Participants noted that decommissioning, in practice, is highly dependent on key elements: storage design, transportation, labour, and the availability of disposal facilities, in order to proceed. This may mean that waste owners and regulators have perhaps less latitude for unilateral action and pursuit of timelines than we might think, because many aspects of a project can depend on other factors.

We heard mixed perspectives on the optimal timing for the decommissioning of legacy sites. Some participants told us that deferred decommissioning, by design, can result in better outcomes and increased worker safety. The idea is simple: safely designing a waiting period (which might be quite long) before undertaking decommissioning activities can allow radiation levels to decay markedly, and can reduce risks to all involved in the project. Thus, we heard that some believe that deferred decommissioning should be a standard enshrined in the policy.

Conversely, we heard from others a desire for prompt decommissioning to avoid shifting the burden of decommissioning to future generations: beginning work as quickly as possible to decommission a facility or site. In this context, there may be some ambiguity about realistic expectations for promptness. We heard that very fast decommissioning may still appear to be progressing slowly from an outside perspective, given the complexity and difficulty of the task. If the policy does specify a desire for promptness, it should therefore be careful not to be overly prescriptive and should consider the unique circumstances of each facility or site.

Decommissioning: Not Delayed, Once Under Way

Regardless of the strategy chosen on when to begin a decommissioning project, we heard the expectation that a project should be undertaken vigorously. Decommissioning projects should not be unreasonably delayed once they are under way, and issues of regulatory oversight, safety, security and environmental protection should be addressed with appropriate urgency. In practice, this means dealing promptly with issues that inevitably arise and not just waiting on future technology to solve problems down the road.

Planning and Financing for Decommissioning

We heard concerns that some facilities may not have fully fleshed out decommissioning plans, and that the policy should direct operators to provide greater detail on their decommissioning plans well before that process begins (and, for new projects, as a major feature of regulatory approval). We also heard that, in some cases, the specific details of decommissioning activities are determined as the project is initiated or unfolds, and that it is not possible to plan everything in detail years or decades ahead of time. With respect to financing, participants noted that the policy should require financial resources in place to fund decommissioning, so as to prevent lack of funding or default during this critical stage.

Financial guarantees for decommissioning of nuclear facilities and termination of licensed activities

Applicants and licensees are required by the Canadian Nuclear Safety Commission to make adequate provision for the safe decommissioning of existing or proposed nuclear facilities by ensuring that sufficient financial resources are available to fund all approved decommissioning activities should the licensee not be able to fulfill its obligations. Operationally, the Canadian Nuclear Safety Commission may also require financial resources to be available for the termination of licensed activities other than for the decommissioning of nuclear facilities.

Financial guarantees are a tangible commitment by a licence applicant or a licensee that there will be sufficient resources to safely terminate the licensed activities. A financial guarantee does not relieve licensees from complying with regulatory requirements for decommissioning of nuclear facilities or termination of licensed activities—the financial guarantee ensures that there are funds available to the Commission when licensees are unable to carry out safe decommissioning or termination of activities.

Licensees must ensure that the financial guarantee in place remains valid, in effect and sufficient to meet decommissioning needs according to the most up-to-date preliminary decommissioning plan (PDP). Therefore, licensees must revise their financial guarantee at a minimum every five years or earlier when requested by the Commission.

The total Financial Guarantees available for all licensees at year-end 2020 was $22.4 billion.

Source: CNSC REGDOC-3.3.1, Financial guarantees for decommissioning of nuclear facilities and termination of licensed activities

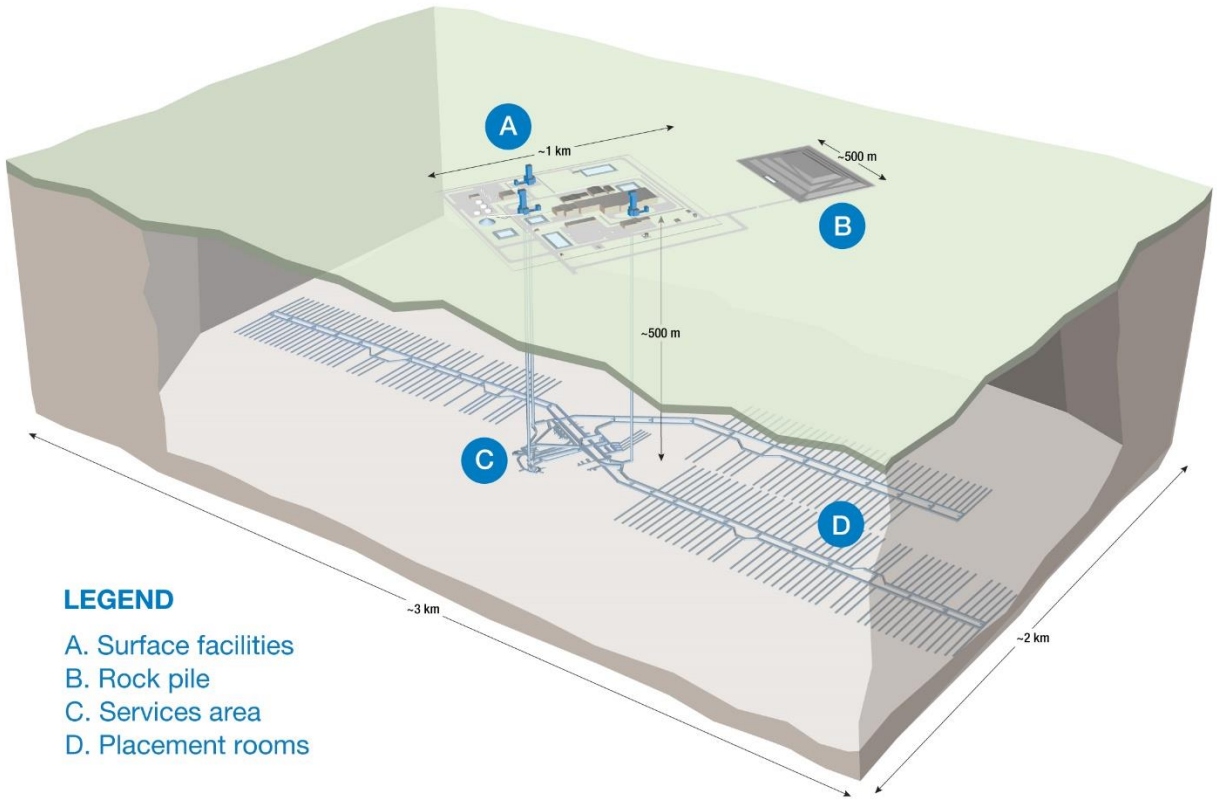
Knowledge Management

Decommissioning projects can last for decades, and have implications for generations well into the future. Because of the lengthy timeframes, it is possible for staff to cycle through a project, and for important knowledge to be lost when staff members move on or retire. Such knowledge is crucial for future management of sites, in order to know exactly the nature of the site, the unique features, and any challenges that were encountered. Therefore, we heard that the policy should emphasize knowledge management and records retention, to ensure that key knowledge is not lost over time.

Making Decommissioning Expertise and Knowledge Management a Strategic Asset

Canada's approach to decommissioning can become an important asset. Our country is a small part of the global decommissioning market, and we may be able to develop waste management technologies and services to meet the demands of a global marketplace as current generation infrastructure reaches end of service around the world. We heard that Canada should play a leading international role in radioactive waste management, and in developing and deploying new practices and technologies. The policy should, therefore, promote and enable the domestic industry, and consider how Canada can market its expertise abroad, to the benefit of all.

4.7 Disposal



Source: Nuclear Waste Management Agency

We asked Canadians and engagement session participants for their views on radioactive waste disposal in the future policy. This discussion was informed by a short discussion paper, found on the Modernizing Canada's Radioactive Waste Policy website. The highlights of the feedback include:

Defining Disposal End-States

Throughout the engagement process, participants expressed a desire for clarity and direction in the policy on the desired end-states for disposal. "Disposal" is a term that has different connotations for different people, ranging from ongoing monitoring, through to the eventual release from institutional control. What does disposal mean in the Canadian context? What is the end-state that decommissioning and disposal activities ultimately aim to achieve? Respondents told us that the modernized policy should provide a good understanding of the end-state in mind, so that the rest of the system and the various players can be aligned to produce that desired result.

No Import of Radioactive Waste

We heard that Canada should adopt a policy of prohibiting the import of waste from other countries for disposal in Canada, such that the country does not become a clearinghouse for waste disposal, even if we possess comparatively advantageous geography, technologies and a robust regulatory

context. It was noted that the risks of taking on this burden are simply too great, and would create an ongoing, long-term liability for Canadians, and that the policy should be clear on this point. We also heard that the policy should prohibit Canada's exporters of medical isotopes from committing to re-import and dispose of them in Canada at the end of their useful life.

At the same time, we heard that if nuclear energy is key to fighting climate change, and if Canada can provide critical disposal solutions for jurisdictions that—in the absence of those options domestically—would otherwise continue to use high-emitting energy sources, it might be in our strategic, global interest to accept a certain amount of waste for disposal. Moreover, as an exporter of nuclear materials, Canada is justified in arguing that we have a responsibility to help ensure the long-term stewardship of the products that we export.

Others advocated for the policy to recognize Canada's current ongoing waste trade (e.g., transboundary shipments of some waste to be reduced/minimized and then returned).

Retrievability

Disposal of radioactive waste, according to some, may be thought of as a process of burying and entombing waste such that it can never be released or recovered. However, some participants suggested that retrievability should be an important policy principle guiding waste disposal design. This was for two broad reasons. First, some maintain that waste should be retrievable in principle so that it can be more easily monitored, and so that action can be taken if any issues arise. Secondly, others further suggest that retrieval can be useful from a long-term environmental and human health perspective, as technologies may emerge that can treat waste in ways not yet imagined. In such cases, it would be a shame if waste could not be further treated, and instead stayed in the ground as is.

Canada's Adaptive Phased Management Approach to Retrievability

Retrievability is the ability to remove the used nuclear fuel from where it has been placed. Retrievability is an important component of APM and was included on the direction of Canadians. It is part of a risk management approach to allow corrective action to be taken if the repository does not perform as expected or if new technologies emerge in the future that could significantly improve the safety of used fuel long-term management.

While used nuclear fuel will be retrievable as part of APM, the process will become progressively more demanding as the used fuel containers are sealed in the placement rooms, and then years later when access tunnels and shafts are eventually backfilled and sealed.

According to the International Atomic Energy Agency, several national programs facilitate retrievability.

Sources: NWMO, Implementing Adaptive Phased Management 2019 to 2023; IAEA Safety Standards, Disposal of Radioactive Waste

Stewardship and Monitoring, Not Abandonment

We heard from some respondents that the ultimate desired end-state for radioactive waste in Canada should be rolling stewardship. Their view is that there is unlikely to ever be a time when waste is permanently disposed of, and that Canada has a duty to provide monitoring and stewardship of waste in perpetuity. Participants stressed that Canada should not attempt to get to the point of "walking away" from waste, as its persistence and long-term risks to humans and the environment require ongoing management. We heard that radioactive waste is and will be with us for a long time, and that all system planning should be predicated on the notion that waste management is a permanent obligation. This notion has a further implication on the financial structure of the nuclear industry. Who bears the cost of ongoing stewardship or monitoring? Is there a point at which waste owners are released from responsibility? If so, are costs transferred to the public? In this sense, then, what we think of as "disposal" might include some degree of monitoring or other oversight, while differing from the more intensive storage of today. Policy guidance or regulatory direction on these points would be helpful.

Site Selection

Discussions about radioactive waste policy naturally run into discussions about one of the most critical implementation issues in waste management: site selection for disposal sites. First, we heard that the site selection process requires greater consideration of Indigenous perspectives (as per the UN Declaration on the Rights of Indigenous Peoples), and other communities. Critically, we heard that governments should be wary of industry-led engagement processes that emphasize economic benefits, and may be seen to buy the consent of communities.

Secondly, there are open questions about the science of radioactive waste disposal, specifically, where and how it can be achieved, and what the risks are. This is a scientific question, and it may be that we do not yet have all of the data, or that the information has not been shared and communicated adequately. In any case, participants saw determinations around disposal direction as a linchpin for the entire system of radioactive waste management. Some stated that it is important to have accurate inventories of waste and costs in order to plan and select sites for waste disposal.

Enabling Collaboration

We heard that collaboration on disposal can yield benefits for everyone: resources that are more focused on safety concerns, less overall exposure to risk, and more. This does not mean that Canada should aim for a single, national disposal site. However, the policy should endeavour to enable collaboration and relationships that allow for multiple waste owners to work together in the interest of overall protection.