Canada's Integrated Strategy for Radioactive Waste (ISRW)

Results From an Open Survey of Canadians

January 26, 2022

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Summary and Highlights

Introduction

In the fall of 2020, the Minister of Natural Resources Canada tasked the Nuclear Waste Management Organization (NWMO) with leading an engagement process with Canadians and Indigenous peoples to inform the development of an integrated long-term management strategy for all of Canada's radioactive waste, in particular low- and intermediate-level waste, as part of the government's radioactive waste management policy review.

Over the past year, we engaged with Canadians and Indigenous peoples on the best options to ensure all of Canada's radioactive waste is managed safely, responsibly, and effectively long after we are gone. One of the ways we explored what is most important to people regarding the long-term management of Canada's radioactive waste was through our online survey. Our online survey provided an opportunity for Canadians and Indigenous peoples to identify potential priorities, principles and considerations for developing a comprehensive strategy. It also provided us with valuable perspectives, opinions and feedback that will help ensure the best options are in place for the management of Canada's radioactive waste.

One of the distinguishing features of this online survey is that it was open to all. Thus, throughout this report, we refer to it as the "Open Survey". This Open Survey complements the research that was conducted during the last two weeks of January 2021, in which a random sample of n=1,625 adult residents of Canada provided input online. A total 345 people participated in the Open Survey.

Both surveys looked at the same set of issues, mostly using the same exact questions. The two surveys also provided essentially the same fact-based background information on the topic (e.g., levels of radioactive waste, current waste management practices, international practices). Of note is that the Open Survey included an informational video on transportation and another on the regulation of radioactive waste in Canada, whereas the initial survey did not.

Overall, the results of the two surveys are consistent. It also seems apparent that, overall, Open Survey respondents are more knowledgeable about the management of radioactive waste (18% are employed by the nuclear industry and 10% are public sector employees). The views of nuclear industry members are much more homogeneous and unequivocal, but their views are generally consistent with those of other Open Survey respondents.

The highlights presented below focus on the results of the Open Survey, while highlighting key similarities and differences with the results of the Representative Sample Survey.

What are the most common questions respondents have about current and future radioactive waste management?

Before obtaining input on specific issues, such as potential strategy principles and priorities, the survey asked respondents about the questions they have about the management of radioactive waste. The most common are described below:

Consistent with the Representative Sample Survey, as well as past Public Attitude Research conducted by the NWMO, the largest cluster of questions pertain to safety (e.g., how the safety of people and the environment would be assured).

Respondents also asked about potential alternatives (e.g., recycling) to surface storage and below ground disposal (e.g., Deep Geological Repository (DGR).

Several respondents wanted to know about Canada's use of nuclear technology, past, present, and especially, future (e.g., will radioactive waste be produced indefinitely, or is an endpoint foreseen?).

Of note is that there were few questions about transportation, whereas in the Representative Sample Survey, this issue generated a lot of questions.

Potential Guiding Principles

Respondents were asked to review a preliminary list of 9 principles for guiding the development of Canada's comprehensive strategy for the long-term management of low-level and intermediate-level radioactive waste and then suggest other planning requirements or considerations that should be addressed.

Several respondents wrote about the completeness or adequacy of the principles, while others underlined the importance of certain principles, without suggesting a change/addition.

In terms of suggestions, perhaps the most common was for the strategy to indicate whether nuclear waste would continue to be produced and for how long-long (e.g., Should Canada commit to "phasing out" nuclear power?). Most of those who wrote about this hope that nuclear power would be phased out soon.

While the list includes the principle of "transparency", there were several comments and questions about the need to involve communities in the decision-making process, both with respect to facility siting and transportation.

Another set of comments talked about the need for the strategy to be "flexible" and "adaptable", including the use of technology yet to be developed (e.g., to be able to retrieve the waste in order to "decontaminate" or "recycle" it).

Priorities

Priorities were examined by means of a paired trade-off exercise involving a total of 10 items (i.e., each was randomly "paired" against the other nine a roughly equal number of times).

Obtaining the “active support” of non-Indigenous and Indigenous communities near facilities are top priorities, along with having “a separate not-for-profit organization” responsible for implementing Canada’s strategy. At the bottom are “minimizing transportation” and “minimizing costs to electricity ratepayers”.

In comparison, Representative Sample Survey respondents placed relatively higher priority locating waste disposal facilities away from the Great Lakes and population centers. They also placed more emphasis on reducing transportation.

Perceived Pros and Cons of Potential Approaches to Radioactive Waste Management

The survey shifted from examining principles, priorities, to gathering input on more tangible considerations (e.g., the use of one versus several disposal facilities). The results are as follows:

- Consistent with the findings from the Representative Sample Survey, respondents express an overall preference for not leaving radioactive waste on the surface, especially ILW. This approach is thought to be safer, as well as more responsible vis-a-vis future generations.
- Views are relatively divided on the merits of having a single centralized facility, versus a decentralized approach based on multiple facilities. There is plurality support for decentralization when it comes to managing LLW, and for centralization with respect to ILW. The key trade off is viewed as being between reducing the perceived risks associated with transportation against the design, construction, monitoring and accountability benefits that would come from having everyone focus on one facility. In the Representative Sample Survey, a decentralized approach was somewhat preferred for both levels of waste.
- Consistent with other results from the survey, most respondents express a preference for the creation of a separate organization to implement Canada’s strategy, feeling this approach is more likely to protect the public interest (e.g., more government involvement, higher profile/more visible organization).

Views on Strategy Implementation and the Regulatory Framework

The survey included six attitudinal questions that examined people’s level of comfort/trust in the organizations involved in waste management and in regulations.

- Over half of respondents (56%) say they have “complete confidence” in the regulations surrounding radioactive waste management, which is 10 percentage points higher than the Representative Sample Survey result.
- Respondents are divided on whether radioactive waste owners can implement a “safe and secure” strategy for the long-term management of Canada’s LLW and ILW: 44% think they can, while 42% do not.
- Consistent with the Representative Sample Survey results, Open Survey respondents are more comfortable with having the federal government lead the

implementation of a strategy for the long-term management of LLW and ILW, than with waste owners in the lead (59% vs. 38%).

- Similarly, most (61%) agreed that the long-term management of all radioactive waste in Canada should be the responsibility of a separate not-for-profit organization. In the Representative Sample Survey the corresponding number was 70%.
- We also find that compared to those who participated in the Representative Sample Survey, Open Survey respondents are more likely to view LLW and ILW as less concerning. This is also echoed in their written comments.

Analysis of Differences Among Open Survey Respondents

As noted earlier, 18% of Open Survey respondents are employed in the nuclear industry. Analysis reveals a few noteworthy differences in their views compared to those of other respondents.

Overall, and as could be expected, members of the nuclear industry express a much high degree of confidence in the regulatory regime (81% versus 52%), as well as in waste owners (e.g., 70% are confident waste owners can implement a safe and secure strategy compared to 40% of other respondents).

There are also a few large differences in how nuclear industry employees view potential strategy priorities. For example, they assign the highest priority to making use of existing projects for the long-term management of Canada's radioactive waste (77% compared to 51% for other respondents). Industry members are also much more likely to prioritize the minimization of costs to electricity rate payers (62% compared to 33%). In contrast, locating the facilities away from the Great Lakes is much less of a priority for those employed in the nuclear industry (30% vs. 54%).

Turning to preferred approaches, relatively few nuclear industry members opt for the status quo (i.e., continued surface storage). We also note that almost none of them said they "don't know" what approach they prefer. The views of industry members are consistent with those of other respondents on the question of whether to adopt a centralized or decentralized approach (i.e., everyone is divided on this). Views are also consistent with respect to creating a separate organization to implement Canada's strategy: 53% of industry members versus 51% express support for this option compared to 15% and 9% respectively who would rather see waste owner implement it.

Appendix A compares the survey results across three groups: 1) industry members, 2) the other Open Survey respondents, and 3) the respondents to the Representative Sample Survey. You will notice that the views of groups 2 and 3 are very closely aligned.

Objectives and Methodology

Background and Objectives

All radioactive waste in Canada is safely and securely managed, but most of it is being stored on an interim basis, above ground. Given the length of time most waste remains radioactive, however, a long-term management strategy (or permanent solution) is required.

Canada has a plan for the safe long-term management of used nuclear fuel, which involves putting all of it in a single deep geological repository (DGR). Long-term management plans also exist for low-level radioactive waste (LLW) temporarily stored at research reactor sites, and environmental assessments are underway.

There are no long-term management plans, however, for low-level waste stored temporarily at nuclear power plants and at uranium processing facilities. Additionally, there are no long-term management plans in place for any of Canada's intermediate-level radioactive waste (ILW).

These gaps need to be addressed and integrated into a long-term strategy. This is whyin the fall of 2020, the Minister of Natural Resources Canada tasked the Nuclear Waste Management Organization (NWMO) with leading an engagement process with Canadians and Indigenous peoples to inform the development of an integrated long-term management strategy for all of Canada's radioactive waste, in particular low- and intermediate-level waste.

A pan-Canadian survey was conducted in early 2021, based on a representative sample of 1,625 members of the general public. That survey was a first step in the Nuclear Waste Management Organization (NWMO)'s efforts to engage Canadians on the development of an integrated long-term strategy for managing Canada's radioactive waste.

As part of the NWMO's ongoing consultation process another survey was conducted looking at the same issues. This survey, however, was open to everyone and available from April to December 2021. The NWMO promoted it on its website, social media and at other events (e.g., virtual workshops on the same topic).

Both surveys were aimed at identifying the principles, priorities and considerations the public believes should guide the development of Canada's long-term strategy for the management of radioactive waste.

Methodology

The design of the Open Survey is consistent with public engagement best practices. Notably, 1) all questions were optional, meaning that respondents were free to respond to as few or as many as they wanted, 2) respondents could save their input at any time to continue the survey later, and 3) they were provided with an opportunity to review

fact-based information about the issues prior to providing input on potential policy priorities and options. The provision of such information is key when consultation subject-matter is complex, technical, or little known to the public. The survey took an average of 20 to 25 minutes to complete in its entirety.

In terms of outreach and participation rates, ads on social media platforms (i.e., Twitter, Facebook) advertised the opportunity to participate. Collectively, these ads appeared approximately 415,000 times, bringing about 15,000 people to the ISRW engagement site. Of these 15,000 site visitors, 3,518 people opened the survey and provided at least some profiling information (e.g., basic demographic information, which was optional). From this group of 3,518, a total of 345 respondents passed through the initial informational part of the survey to provide substantive input on the ISRW. About 80% of the 345 respondents completed the entire questionnaire, for a completion rate of about 8%.

The design of the Open Survey mirrored that of the Representative Sample Survey. Most of the questions were replicated, the questionnaires were the same length and both included much of the same fact-based information in the form of text, images and several animated videos covering the following topics:

- What are the three levels of radioactive waste (e.g., where does it come from)?
- Who is responsible for managing the waste?
- Who are the regulators?
- How are the different levels of waste being managed now?
- How do other countries manage nuclear waste?
- What options for the long-term management are being considered for Canada?

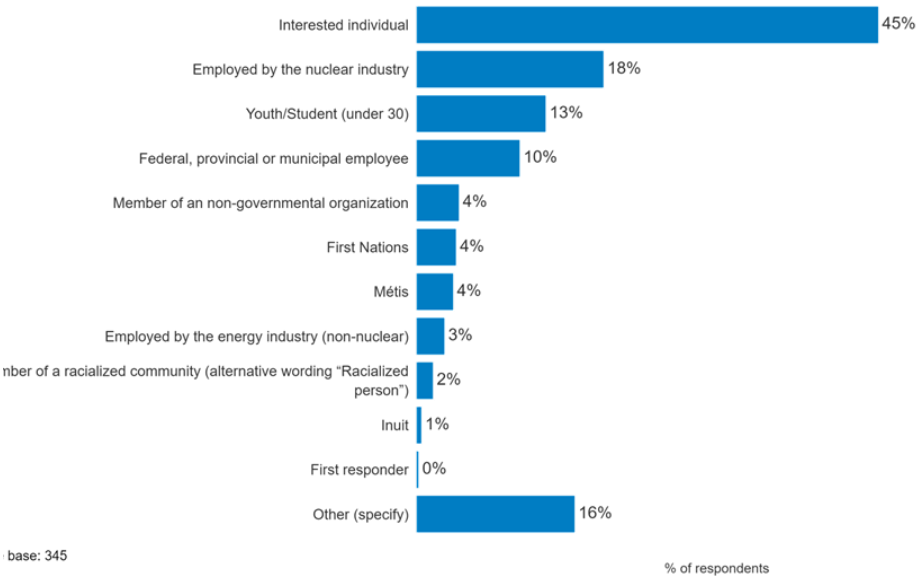
The Open Survey also had information on transportation and on the regulation of radioactive waste in Canada, given the number of questions Representative Sample Survey respondents had about this issue.

A review of the data suggests that respondents to this Open Survey were generally more familiar with the issues, with several displaying significant knowledge about the management of radioactive waste.

The only respondent profiling question on the survey asked people to indicate which item(s) (from a list) best described who they are. The profiling information, which is presented on the following page, shows that about half selected “interested individual” as an apt descriptor. It is also interesting to see that 18% said they were employed by the nuclear industry and 10% by government.

Respondent Profile

Q1 Before you get started we have a question to help us understand who participated in the survey Which of the following best describes you? (Select all that apply)



About the Survey Development

This Summary Report was developed by Hill+Knowlton for the NWMO. We gratefully acknowledge the contribution of survey participants. This Summary Report is part of the NWMO's engagement efforts towards the development of an Integrated Strategy for Radioactive Waste, which have been undertaken at the request of the Minister of Natural Resources Canada.

As outlined by Natural Resources Canada, Canada's integrated strategy for radioactive waste represents a next step to identify and address gaps in Canada's current radioactive waste management strategy, and to look further into the future. The integrated strategy being developed by the NWMO will be informed by the Government of Canada's radioactive waste management policy review. For more information about the Integrated Strategy for Radioactive Waste, please visit our web site radwasteplanning.ca.

About NWMO

The Nuclear Waste Management Organization (NWMO) is a not-for-profit organization implementing Canada's plan to safely contain and isolate used nuclear fuel over the long term. The NWMO has been tasked by the Government of Canada to lead dialogue to develop an integrated nuclear waste management strategy for Canada, building on its earlier work to engage Canadians to develop Canada's plan for used nuclear fuel.

About Canada's Integrated Strategy on Radioactive Waste

The development of an integrated strategy on radioactive waste (ISRW) is led by the Nuclear Waste Management Organization (NWMO), at the request of the Honourable Seamus O'Regan, (former) Minister of Natural Resources Canada. This is part of the Government of Canada's Radioactive Waste Policy Review and leverages the NWMO's 20 years of recognized expertise in the engagement of Canadians and Indigenous peoples on plans for the safe long-term management of used nuclear fuel.

Detailed Findings

Common Questions About the Current and Future Management of Radioactive Waste

Before providing their input on the priorities, principles and considerations for guiding Canada's strategy for the long- term management of LLW and ILW, respondents were invited to identify the questions they had about the current and/or future management of radioactive waste in Canada.

Overall, and consistent with the Representative Sample Survey, as well as past PAR conducted by the NWMO, the largest cluster of questions asked by Open Survey respondents pertain to safety. In contrast with the results of the Representative Sample Survey, there are very few questions about transportation, likely due to the inclusion of information on this topic in the Open Survey.

Other common questions center on the possibility of "recycling" or other alternatives to disposal, the amount of waste being produced, siting locations, and costs.

The following summarizes the results and provide illustrative quotes.

Questions concerning safety often pertained to oversight and environmental protection, including the safeguarding water.	• "How often are standards updated and decided on both at an IAEA perspective and others. How do standards in European countries reflect similar needs in Canada. What is the process for updating standards?" • "What are your plans to 100% guarantee that the waterways and future generations will be safe from nuclear energy/waste?" • "How does climate change affect the options?"
Consistent with the previous survey, multiple respondents asked questions about the possibility repurposing and/or decontaminating radioactive waste, if not now, then at some point in the future.	• "As much recycling of waste as possible. We should open more modern energy plants that run on the waste product of our old plants now that this is an option." • "My understanding is that high level waste still contains 'energy' or potential usable components, as science progresses, that could be used at a later time. Will high level waste be accessible in the future for this to occur?" • "Is any consideration given to possibly retrieving 'permanently' stored waste to obtain valuable materials in it?"
Several questions asked about the current and future use of nuclear power.	• "You have discussed options for disposing nuclear waste but haven't touched on reducing use of nuclear energy therefore reducing the waste." • "How much waste is existing and how much waste will be generated/year into the future?" • "Do we have a policy in place re: whether we should be making more waste, before we've figured out what to do with current inventories?"

Feedback on Potential Principles: Missing Elements

Principles for Guiding the Long-Term Management of LLW and ILW

We've heard from Canadians that Canada's strategy for the long-term management of low-level and intermediate-level radioactive waste should be guided on the following principles.

- **The Strategy must have safety as the overarching principle** guiding its development and implementation. Safety, including the protection of human health, must not be compromised by other considerations.
- The Strategy must **ensure the security of facilities, materials, infrastructure and information.**
- The Strategy must **ensure that the environment is protected**, including the protection of the air, water, soil, wildlife and habitat.
- The Strategy must be developed and implemented **to meet or exceed regulatory requirements** for the protection of health, safety, and the security of people and the environment.
- The Strategy must be **informed by the best available knowledge**. This includes Indigenous Traditional Knowledge, science, social science, local knowledge and international best practices. Ensuring that Traditional Knowledge and ways of life are interwoven throughout is important for a strong Strategy. This includes knowledge about the land and environment. It also includes values and principles about developing and maintaining effective and meaningful relationships.
- The Strategy must **respect Indigenous Rights and Treaties** and consider that there may be unresolved claims between Indigenous peoples and the Crown.
- The Strategy must be developed in **a transparent manner that informs and engages the public**, including youth and Indigenous peoples. It is important to proactively provide easily understandable information to those most likely to be affected by the implementation of the Strategy. Questions and concerns must be heard, acknowledged and addressed. Information used to develop the Strategy will be readily available to the public.
- The Strategy must be **developed and implemented in a fiscally responsible way** to ensure that the cost of the project does not become a burden to current electricity ratepayers, taxpayers, or future generations.
- Where possible, the Strategy **should make use of existing projects** for the long-term management of Canada's nuclear waste.

Several respondents wrote about the completeness or adequacy of the principles: *"Nothing seems to be missing*." Some respondents echoed the importance of certain principles, without suggesting a change/addition: *"Lakes, rivers, streams, creeks and all groundwater should be protected from any contamination from nuclear waste."*

The most common comment or suggestion is about the need for the strategy to include a principle that would speak to how radioactive waste would be reduced or phased out completely:

"Commit to ending nuclear so no waste is produced."

« Fin de tout nouveau développement nucléaire qui produirait de nouveaux déchets. »

There were several comments, sometimes in the form of questions, about involving communities in the decision-making process, both with respect to facility siting and transportation:

"Not at this time. I am concerned that the focus now seems to be on the endpoints of storage but while we can say that the transportation meets the CNSC requirements, how can acceptance of communities through which the waste is transported be assured?"

A few respondents mentioned UNDRIP and how it could or would "fit into the strategy?"

Several participants wrote about the principles needing to more explicitly acknowledge the importance of using the best available technology and innovations, including some that are different that what is being currently contemplated (e.g., DGR):

"Ability to recover the waste if we find a use for it in the future."

"I have a couple of suggestions. First, in regard to liquid waste, there is a technology called a self-inducing plasma reactor that cracks molecular bonds resulting in clean exhaust, free from pollutants and radiation. Second, in regard to solid waste, a pyramid structure oriented north like Cheops, can be used to decrease the level of radioactivity. There is little science available on this effect but here is something from the Tenth Radiation Physics & Protection Conference on 27-30 November 2010 at Nasr City - Cairo. Egypt https://inis.iaea.org/collection/NCLCollectionStore/_Public/42/076/42076659.pdf."

"The Strategy is flawed as it only has tunnel vision for one manner of dealing with waste - perennial storing, instead of utilizing technology to render it impotent and possibly obtaining energy from every last drop of waste, as described in my previous comment. Where is the long term thinking for this long term strategy to deal with radioactive waste?"

In a similar vein, the term "flexibility" was used a few times to highlight the need for the strategy to be adaptive (as indicated above) and to allow for different approach to be used where it made sense to do so (e.g., for LLW vs. ILW).

Some respondents felt that something should be added around timeliness: *"Should be undertaken and implemented in a timely manner, neither rushed nor unduly delayed, especially by politics. Requires an enormous public education effort."*

Detailed Findings and Priorities

Broad Priorities

The issue of priorities was addressed by means of the same paired 10-item trade-off exercise used in the Representative Sample Survey. Each respondent received five sets of randomly generated pairs and asked to pick the one they believed should receive the highest priority in guiding the development of Canada's strategy for the long-term management of LLW and ILW.

Each item (or potential priority) was paired with all other items a roughly equal number of times. The chart below presents the overall results, which show that:

- "Obtaining the active support of communities" near facilities emerges as a top tier priority (winning out against the other items in 60% of cases). The top tier also includes having "a separate not-for-profit organization" responsible for implementing Canada's strategy (58%) and "obtaining the active support of Indigenous communities" near facilities (56%).
- At the bottom of the priorities list there is "minimizing transportation" (which won out 44% of the time it was included in a trade-off) and minimizing costs to electricity ratepayers (37%).

The exhibit also reveals a few noteworthy differences with the results from the Representative Sample Survey. For these respondents, the top priorities were locating waste management facilities "*away from the Great Lakes*" (winning out against the other items in 64% of cases). This was followed by "l*ocating waste management facilities away from population centers*" (selected 59% of the time it was paired).

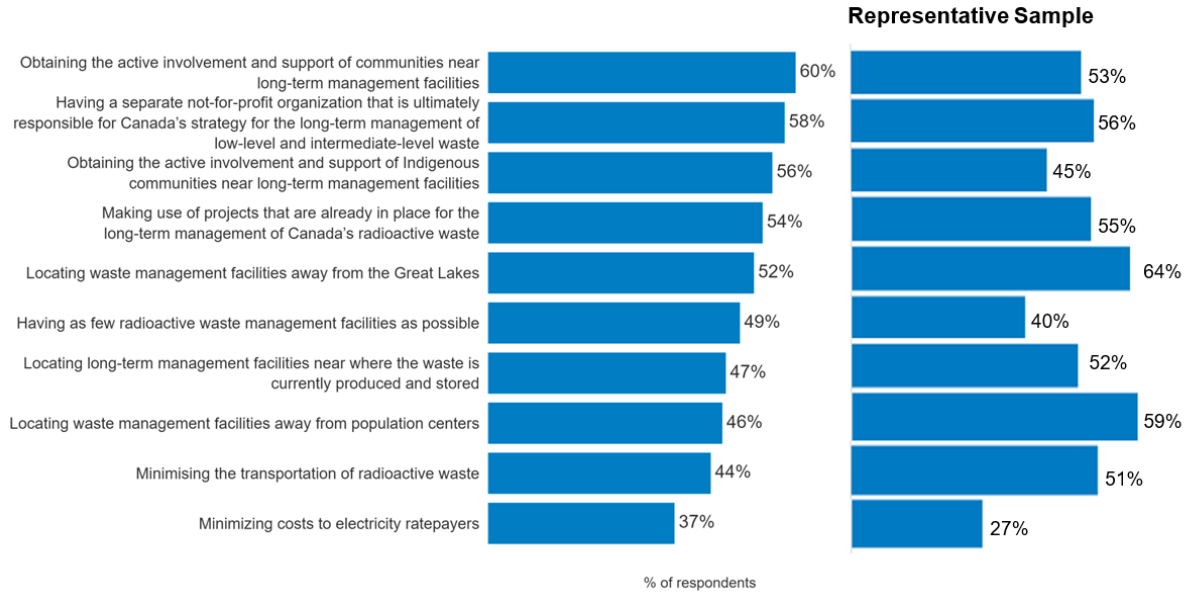
We also find that minimizing transportation appears to be much more of a priority for Representative Survey Sample respondents, who picked this priority 51% of the time compared to 40% for "*having as few… facilities as possible*", which is the obvious transportation trade-off. The numbers in the Open Survey are 44% and 46% respectively.

In essence, Open Sample respondents appear to be relatively more concerned about engagement and governance and less concerned about transportation. The latter is also reflected in their relatively stronger support for a centralized approach to managing ILW (i.e., centralization would very likely require more of the waste to be transported).

Exhibit 1: Priorities (Forced Choice Paired Trade-offs)

Q. ***On the next pages, you will see five pairs of potential considerations for guiding the development of Canada's strategy for the long-term management of low-level and intermediate-level waste. For each pair, please select the consideration you think should have the highest priority.***

Total percent of times each priority was chosen vs. all others.



Perceived Pros and Cons of Approaches to Radioactive Waste Management

The survey shifted from examining principles and priorities for the development of a strategy for the long-term management of radioactive waste, to a discussion of tangible considerations. Respondents were invited to provide input on two fundamental questions:

1) Should Canada continue to manage LLW and ILW as it is being managed now? That is, on the surface by continually refurbishing/replacing interim facilities. Or should the waste be put in specially designed permanent facilities, likely underground?

2) If long-term disposal facilities were to be used, should several of them be built (i.e., a "decentralized" approach), or should waste disposal be centralized into one location?

Respondents considered these two issues separately for LLW and ILW.

A fifth question pertained to implementation. Specifically, respondents were asked to discuss the relative merits of creating a separate organization to implement Canada's strategy versus allowing each waste owners to implement the strategy.

All five questions asked respondents to select from two options (e.g., decentralized or centralized), as well as a third option that read: "Either approach is fine, as long as all federal and international safety regulations are met." A fourth and final option allowed respondents to select "I don't know". Respondents who selected one of the first two options received an open-ended follow-up question asking them to briefly explain their preference.

The exact same five questions were asked in the Representative Sample Survey.

Overall Findings

Respondents express an overall preference for not leaving radioactive waste on the surface, the way it is stored now. This is especially the case for ILW. Essentially, those who prefer this approach feel that it is safer than continuing to manage it above ground, over multiple generations. Some also feel that it is the morally right and responsible thing to do vis-à-vis future generations. More ominously, quite a few people noted in their comments that future generations may not be in a good position to deal with the waste. It is important to note that use of specially designed facilities for "permanent" disposal was also preferred in the Representative Sample survey and for much the same reasons.

Views are more divided on the merits of having a single centralized facility versus a decentralized approach based on multiple facilities closer to the sources of waste, but an edge to decentralization for LLW and centralization when it comes to ILW. In the Representative Sample Survey, a decentralized approach was preferred for both levels of waste. In both surveys the main advantage of decentralization is seen as a reduction in transportation, while the key benefit of centralization is thought to be ease of monitoring and the opportunity for the industry and regulators to focus their efforts on building one “best” facility.

Finally, on the fifth question, we see a clear preference (by a ratio of 5:1) for creating a separate organization to implement the Canada’s strategy for the long-term management of LLW and ILW. This result is very consistent with the 56% of Representative Sample Survey respondents who also preferred the creation of a separate organization to implement the strategy.

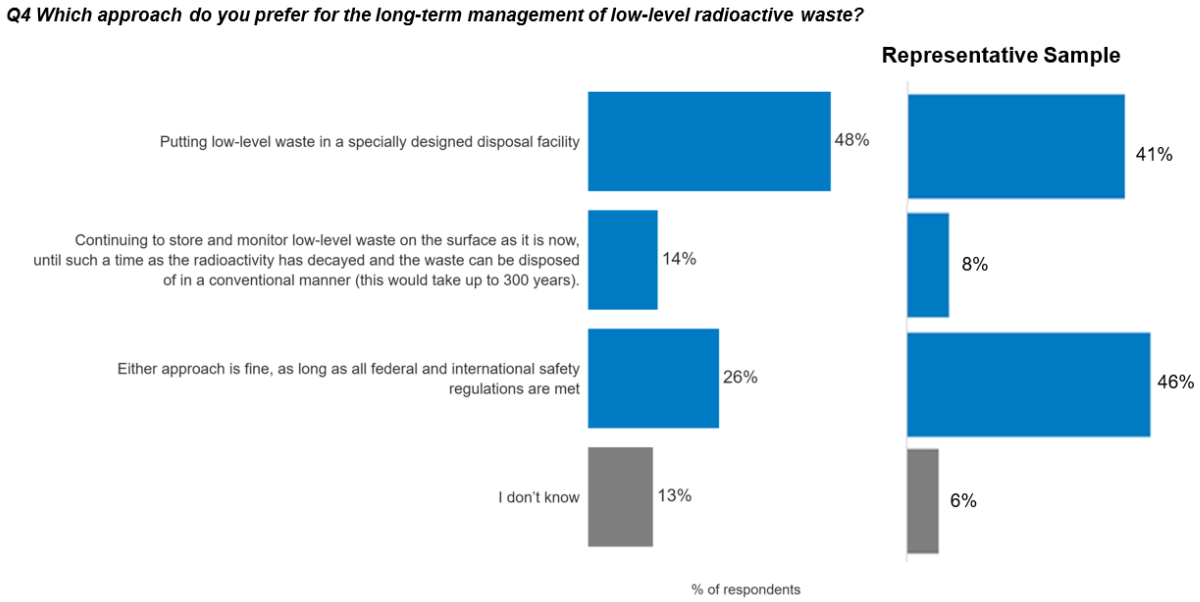
The detailed results for each of the five questions are presented below, starting with the question of whether LLW and ILW should continue to be managed the way they are now, or whether new facilities should be built to permanently dispose of the waste.

Continued Surface Storage or Use of Specially Designed Facilities for LLW

On the next page we see that a strong plurality of respondents (48%) prefer that LLW be managed over the long-term using a specially designed disposal facility. In contrast only 14% opt for continued surface storage, and the remaining 26% find either approach acceptable as long as all federal and international safety regulations are met.

In the Representative Sample survey, we found that a slim plurality were in fact ambivalent about the approach to be taken, with 46% saying that either approach would be acceptable.

Exhibit 2: Continued Surface Storage or Use of Specially Designed Facilities for LLW



Rationale: Put LLW in a Specially Designed Facility (Preferred by 48%)

Consistent with the findings from the Representative Sample Survey, proponents of this option put forward two interrelated reasons for their choice:

The most common is that a specially designed facility would be more secure and safer, in part because it was impossible to predict the ability of future generations to deal effectively with the waste:

"Rolling stewardship has too many possibilities of being derailed in the future. Designing and storing LLW in a repository/borehole is a long term solution not based on assuming future generations will do the correct thing with the waste."

"Managing on-surface facilities for 300 years does not seem practical as facilities degrade overtime and these facilities come with security requirements that may be lessened with a specially designed facility in a central location."

"Earthquakes, tornadoes floods and other disasters will result in the loss of control of the waste stored in shipping containers, above ground warehouses, etc. Fukushima is a prime example of nature proving the exception to human planning. Put it deep underground, and in a secure location."

Implementing a long-term solution now is the "morally right" and responsible thing to do: *"The waste needs to be stored so that no future monitoring or handling is required. We do not want to put the onus of our waste on future generations."*

Rationale: Continue to Monitor and Store LLW on the Surface (Preferred by 14%)

Also consistent with the findings from the Representative Sample Survey, four reasons emerge in support of this option:

- The most common reason, by far, is that the waste will be easier to monitor if is kept above ground: *"It's easier to keep track of on the surface. It requires constant attention which is unavailable underground."*
- The LLW is less hazardous and therefore does not require such an ambitious, costly and potentially risky long-term approach such as a DGR: *"This option reduces cost and allows for facilities to be made and not go through the licensing ringer to actually even get a license before another 30+ years of construction. It is effective and does not require as many people to man it with the proper uses of control systems (incl. sensors and monitors)."*
- The waste will be more easily retrievable if ever a technology is developed to recycle and/or decontaminate the LLW: *"This seems like a cost effective approach that allows for changes in how the low-level waste is handled in the future. Future technologies may allow for more efficient disposal of these materials."*
- A few respondents noted that there would be less need for transportation in a status quo approach: *"Less transport of waste, therefore lower production of greenhouse gases."*

Continued Surface Storage or Use of a DGR or Other Facility (e.g. Deep Borehole) for ILW

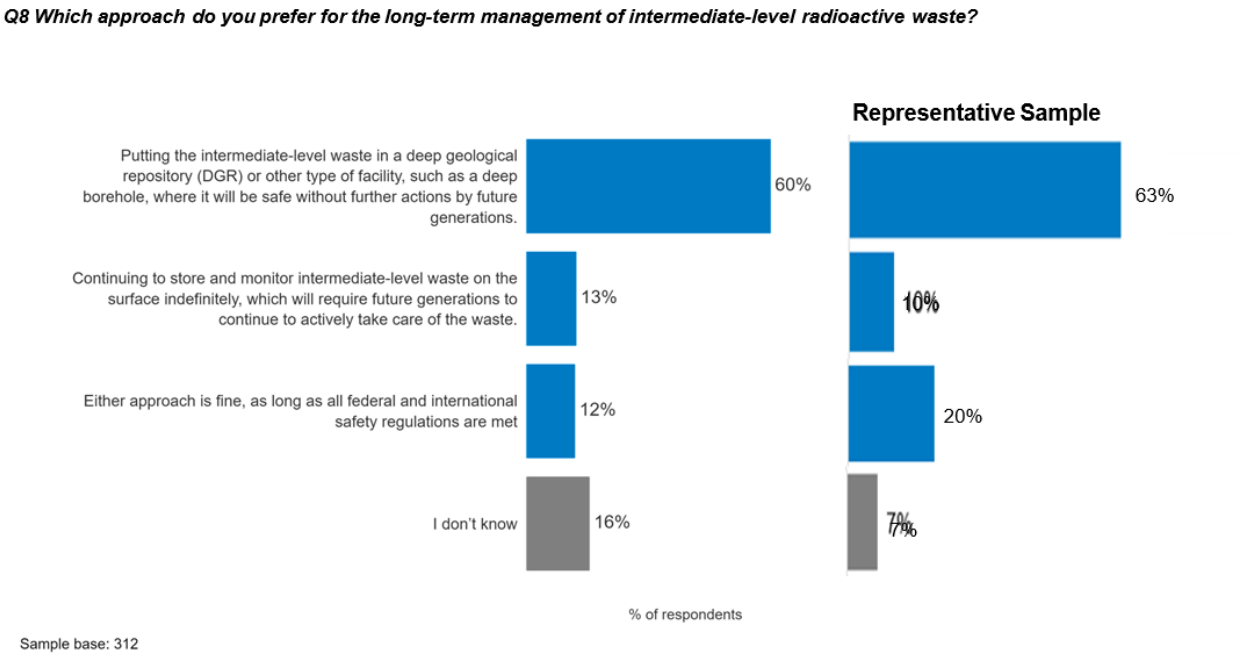
The chart on the next page reveals a clear preference for use of a specially designed facility, such as a DGR or deep borehole, for the long-term management of ILW, over the continued used of surface storage, by a ratio of almost 5:1.

Compared to the results of the previous question pertaining to LLW, the proportion of respondents who say that either option is fine, is much smaller at 12% (compared to 26% for the LLW options).

Only 13% of respondents feel that continued surface storage is probably the best option.

Results are very consistent with the results of the Representative Sample Survey, in which 63% opted for the specially designed facility.

Exhibit 3: Continued Surface Storage or Use of a DGR or Other Facility (e.g., Deep Borehole) for ILW



Rationale: Use of a DGR or other Permanent Facility to Store ILW (Preferred by 60%)

Not only are the preferences on this policy option consistent with the results from the representative sample survey (where 63% preferred this option), the reasons put forward in support of it are also very similar.

The most common rationale is that this approach deals with the "problem" in a direct and permanent way, with the added benefit of not leaving it for future generations (who might not have the capacity to deal with it as well as we can now):

"safer to put the waste underground than to store on the surface. Fewer chances for accidents."

"Safer against future uncertainties. Let's do the right thing now and not have to look after this problem in the future." "DGR facility is the way to go. Safety, security and long term monitoring all come into play."

"Well I saw on news … one European nation build underground facility for disposing off the waste so I think underground waste facility is appropriate as it will be only place to be monitored in case of any emergency, rather than keeping it at nuclear power plant sites, so I think the 2nd option is more feasible and economical and safe to public."

It is also important to note that several respondents indicate that their view of the options is influenced by the fact that ILW poses a greater risk than LLW: "*The problem is worse with ILW than LLW*."

Rationale: Continue to Store and Monitor ILW on the Surface (Preferred by 13%)

Some of the support for this option is based on a belief that a better technology will be developed to repurpose or decontaminate radioactive waste. Leaving it on the ILW on surface, therefore, will make it easier to retrieve. It can serve as a dramatic reminder that the challenge of radioactive waste persists, and thus serve as impetus for development of new technologies.

'Keep it where it is produced until science figure how to use up the remaining hazardous components of the nuclear waste."

"As the science evolves there should be ways to neutralize the radioactive properties and still be able to harness these materials and reuse and recycle some of these items."

Many said they lack confidence in DGR and bore hole technology and that "burying" would make monitoring more challenging, as well as more difficult to deal with if something (e.g., a "leak") were to happen. As in the Representative Sample Survey, the notion of "burying" the ILW reminds some people of sweeping a problem under a rug.

"DGR will get forgotten, underfunded in future and dangerous. If producers want to keep producing waste from uranium reactors, make sure they look after it where we can see they are looking after it."

"DGR seems like it would be impossible to control for a black swan event. Also, should something happen, seems like it would be harder to mitigate after."

"Because who knows what happens when put down a bore hole, could be leaking for decades before discovered"

A Centralized Versus a Decentralized Approach to the Long-Term Management of LLW

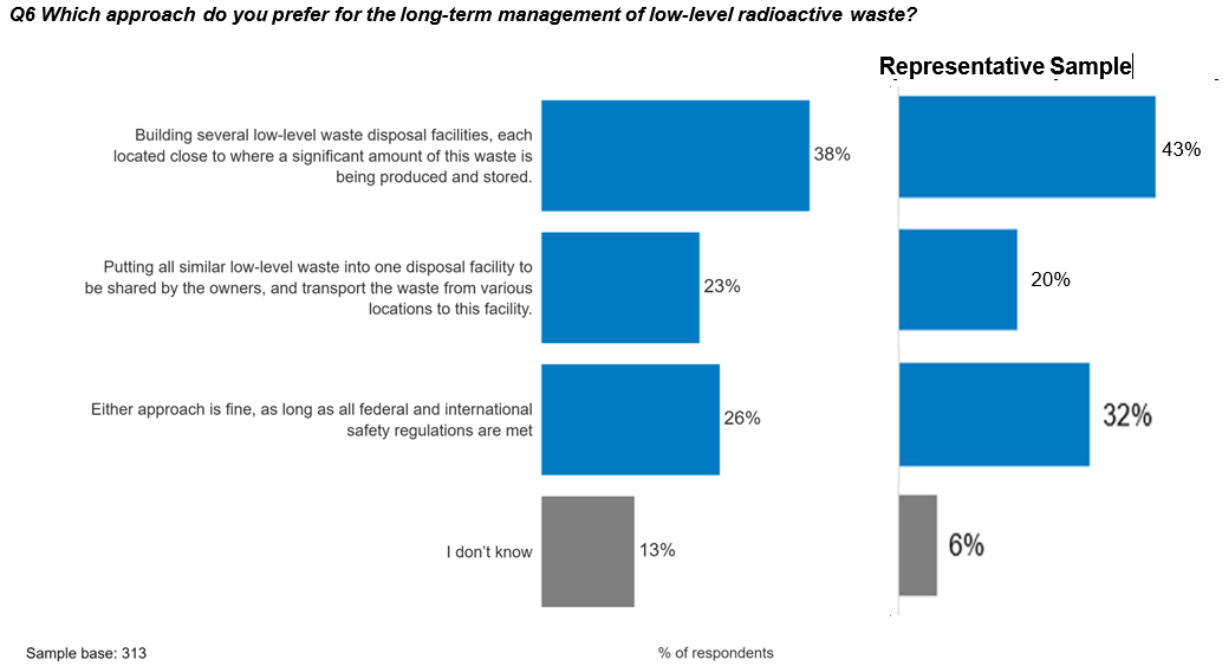
Notwithstanding their views on whether Canada should maintain the status quo for managing LLW over the long term or use specially design disposal facilities, respondents were asked for their opinion on the merits of adopting a centralized versus a decentralized approach, with the assumption being that new specially designed disposal facilities would be used.

The next graph indicates that, if new disposal facilities were to be used, a 38% plurality of respondents prefer a centralized option, which involves transporting LLW to one disposal facility shared by waste producers. In contrast, 23% opt for decentralized approach to the long-term management of LLW. That is, building several LLW disposal facilities, each close to where a significant amount of waste is being produced and stored.

Almost one-quarter think either approach is fine, as long as all federal and international safety regulations are met.

The results are very consistent with those of the Representative Sample Survey, in which the option of building separate facilities at different locations was also the most popular (selected by 43%). We also see that a higher proportion of these respondents were ambivalent about the direction to take (32%).

Exhibit 4: A Centralized Versus a Decentralized Approach to the Long-Term Management of LLW



Rationale: A Decentralized Approach to Managing LLW (Preferred by 38%)

Results are very consistent with the findings from the Representative Sample Survey. The main reason for having a decentralized approach, in which several facilities are built and located near where a significant amount of LLW will be, is to minimize the need for transportation (e.g., less risk of "contamination", less C02 emissions, less cost):

"Moving the waste is a problem and many sites where low level waste occurs like Chalk River are grossly contaminated with radionuclides already dispersed in the environment. It makes no sense to move the Chalk River waste some where else and create a potential new site for contamination."

"Because it will reduce transportation coast and will reduce risks related to waste release during the transportation." "Réduire le transport."

A few respondents suggest that it would be easier to build off of existing facilities rather than trying to obtain social acceptance for new, larger, centralized facility: *A single disposal facility is more risky over the long-term and will be a concern for local residents who object to having a disposal facility nearby. Spreading the waste to several low-level*

waste disposal facilities will be safer and more appealing. It will also reduce transporting the waste over long distances."

Rationale: A Centralized Approach to Managing LLW (Preferred by 23%)

Results are very consistent with the findings from the Representative Sample Survey:

Support for this option is most often based on a view that a single, centralized location will be safer and more secure over the long term, as well as more cost-effective:

- Easier to monitor
- A more efficient use of land and resources
- Easier to gain social acceptance once
- It can be located away from population centers

"One site can be managed properly. Safety, Security and long-term monitoring would be cost effective."
"I think it will be cheaper, and I think the public will wind up paying for whatever solution is chosen, so let's go cheap." "Having all the waste in one location will be safer and more manageable for future generations."
"One centralized location allows for better accounting of the waste, multiple locations makes it significantly more difficult to account for the waste and increases the chance of having a significant failure."
"Close to where it's being produced means near people. That's not acceptable."

A Centralized Versus a Decentralized Approach to the Long-Term Management of ILW

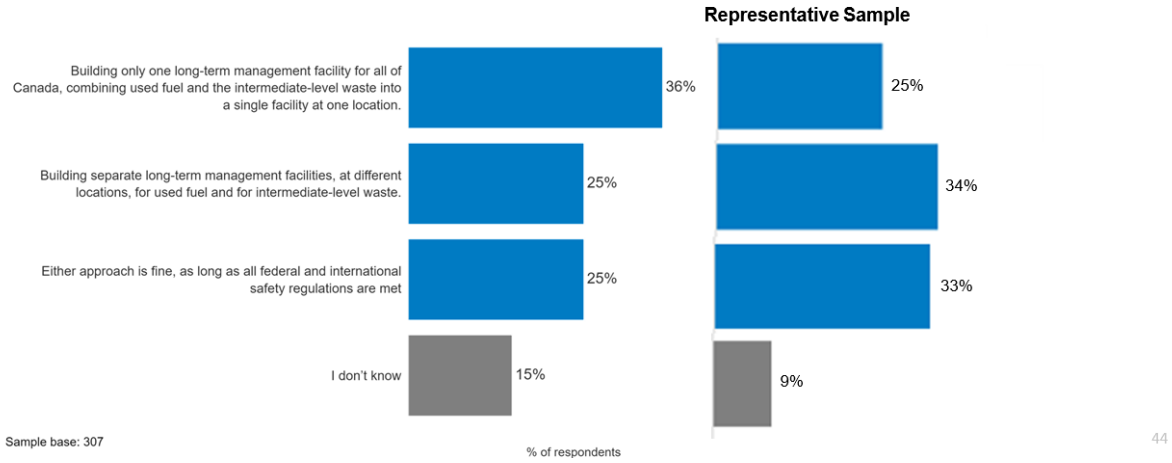
If new disposal facilities were to be used, a 36% plurality of respondents prefer a centralized option, which involves transporting ILW to one disposal facility shared by waste producers. In contrast, 25% opt for decentralized approach to the long-term management of ILW. That is, building several ILW disposal facilities, each close to where a significant amount of waste is being produced and stored.

Almost one-quarter thinks either approach is fine, as long as all federal and international safety regulations are met.

This is one of the few instances where the results of the Open Survey differ from those of the Representative Sample Survey. In the latter the building separate facilities at different locations was the most popular (selected by 34%). We also find a higher proportion of these respondents were ambivalent about the direction to take (33%).

Exhibit 5: A Centralized Versus a Decentralized Approach to the Long-Term Management of ILW

Q10 Both high-level waste (used fuel) and intermediate-level waste are hazardous over a very long time and therefore need to be placed deep underground for the long term.
In some countries, there are plans to store high-level waste (used fuel) and intermediate-level waste <u>together</u> in the same deep geological repository (or side-by-side repositories at the same facility).
In other countries, plans are to manage high-level waste (used fuel) and intermediate-level waste <u>separately,</u> using separate facilities at different locations.
Which approach do you prefer for the long-term management of <u>intermediate-level radioactive waste?</u>



Rationale: Building One Integrated Facility for All of Canada, Combining Used Fuel and ILW (Preferred by 36%)

One of the few differences we see between the Open Survey and the Representative Sample results is that plurality of the former opt for this option over a decentralize approach. The rationale put forward in support of policy preferences, however, is consistent across both surveys.

The integrated option is seen by many proponents as having lower overall risk because one facility should be easier to manage and monitor. Similarly, having one large integrated facility is thought to lessen the chance of error compared to a multiple-facility approach (e.g., more things can go wrong):

"*Long term, fewer locations for hazardous material - easier to find one very good location, and keep records of that location."*

"Multiple sites may be very difficult for future generations to manage."

Some respondents feel it should be easier to secure the social acceptance required to adjust/expand the used fuel DGR. They also believe economies of scales/lower cost should be possible.

"It seems the simplest as I know that plans for a low and intermediate level waste site have met resistance and fell through. If a site for high-level waste can be accepted and agreed upon, then it would make sense that the site community would also be willing to accept the less hazardous intermediate waste. It seems like this option would be cheaper as well. Additionally, the video pointed out that intermediate level waste is only

a very small percentage of the total waste, so should be able to be accommodated at the high-level waste site."

"Building multiple DGRs would be extremely costly, and require decades to get through approvals and social acceptance. We should take advantage of one when built to place all of the waste that should be disposed of in a DGR"

Rationale: Building Separate Long-Term Management Facilities, at Different Locations, for Used Fuel and for ILW (Preferred by 25%)

Consistent with the previous survey, reduced need for transportation emerges as a core rationale for this option: *"Canada is a big country. To transport the waste across the country is less efficient and will weaken the safety measures."*

Some see multiple facilities as spreading out risk: *"Separate facilities would reduce risk levels that are inherent with a larger single facility."*

Some see the much higher level of danger associated with used fuel as warranting separate approaches. There is also a sense among a few that getting social acceptance for one large integrated facility will be more challenging:

"Besides both being hazardous, I would think the high level waste should be monitored separately, for this reason 'monitored more carefully'…"

"Spent fuel rods could potentially be refined and reprocessed into more fissionable material once the technology and economics demand it. By separating the two levels of waste it will make it easier to reprocess them as new technologies develop.

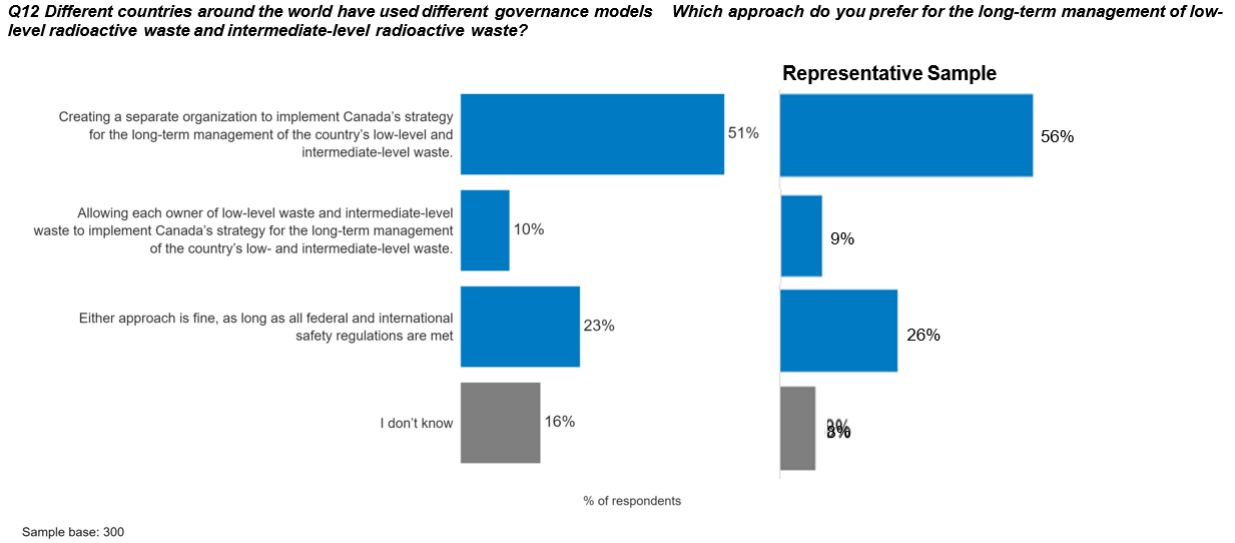
"… Presumably, integrating both intermediate and high-level waste in one facility will change the design of the proposed DGR. This will also lead to implications for the siting process that is currently ongoing at the two candidate locations and could decrease the possibility of finding a willing host community."

Creating a Separate Organization to Implement Canada's Strategy Versus Allowing Waste Owners to Implement It

We see a clear preference among Open Survey respondents (by a ratio of 5:1) for creating a separate organization to implement the Canada's strategy for the long-term management of LLW and ILW. This is consistent with a result presented later showing 61% of respondents agreeing that "the long-term management of all radioactive waste in Canada should be the responsibility of a separate not-for-profit organization".

These results are very consistent with those of the Representative Sample Survey, in which 56% versus 9%, preferred the creation of a separate organization to implement the strategy.

Exhibit 6: A Centralized Versus a Decentralized Approach to the Long-Term Management of ILW



Rationale: Creating a Separate Organization to Implement Canada's Strategy (Preferred by 51%)

Many respondents feel that leaving implementation solely, or even primarily, to waste owners would lessen the chances of success because 1) waste owner might be tempted to put profits before people and the environment, and 2) having only one (higher-profile) organization involved should make monitoring and accountability easier.

"Waste owners have too much incentive to find shortcuts and ways to cheat or cut corners. These bodies also lack long- term stability and may come and go, leaving facilities abandoned like so many uranium mines in northern Sask. and elsewhere."

"There needs to be a unified and well funded entity which is not subject to fluctuations in social and political whims."

The nature of the risk to people and the environment, as well as the size and intergenerational nature of the problem, suggests that the federal government should be closely involved, not only as regulator, but also as implementor: *"Governments have a duty of care to ensure the safety of their citizens and the environment and with so many jurisdictions in Canada a federal governance will ensure consistency of application."*

It should be easier to generate economies of scale and to allow the most expert people to work collectively on a challenging problem: *"Centralized waste management will first of all will reduce business costs, develop and maintain highly skilled staff in one location, and regulating authorities will require less effort to control the waste management."*

A few respondents noted that the NWMO "model" should be emulated for ILW and LLW because it was worked well so far: "*Use the NWMO model for implementation for the management all Nuclear waste.*"

Rationale: Allowing Each Waste Owner to Implement Canada's Strategy (Preferred by 10%)

Among the relatively few respondents who opt for this approach, several say they believe waste owners could manage the waste responsibly on their own, as they have so far. Some also note that the government is already involved as regulator. Some also like the fact that this approach clearly puts the financial onus on industry.

"Multiple approaches may prove beneficial and again keeps industry competitive on technology and cost as well. The overarching regulatory guidelines should provide a framework regardless."

"This will allow for increased innovation to how the waste is disposed of, as well as placing much of the burden of developing the facility on the producers and incentivize development of methods to recycle or utilize the waste."

"Operators are adept at managing their waste today and understand the consequence of error."

Perhaps more significantly, several people believe that different approaches could and should be used for LLW and ILW, given that the later poses more of a threat. Thus, waste owners could continue to manage LLW, but perhaps a more collective approach could be used for ILW (as it is for used fuel).

"First, I think the question is flawed. Why should the approach be the same for both LLW and ILW? I can see the same approach for ILW and HLW - both are hazardous, and I think should have a DGR. But that is NOT true for LLW, so lumping it in with ILW is logically flawed and erroneous. For LLW, let each accountable waste owner deal with it per the regulations. But for ILW, a national strategy and approach makes sense."

Views on Strategy Implementation and the Regulatory Framework

Perceptions and Preferences on the Regulatory Framework and Strategy Implementation

The Open Survey replicated six attitudinal questions on implementation issues and the regulatory framework. The results are visualised in the following five charts.

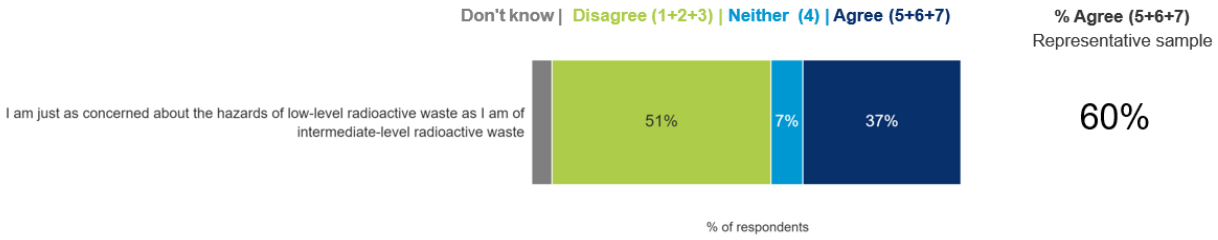
Overall, we continue to see consistency in the results of the two surveys, but with one notable exception: we find that Open Survey respondents are much more discerning in how they view the hazards associated with ILW versus LLW. As shown in the next graph, only 37% say they are “just as concerned” about the hazards of LLW as they are of ILW, compared to 60% in the Representative Sample Survey.

A little over half of respondents (56%) say they have “complete confidence” in the regulations surrounding radioactive waste management, compared only 28% who do not. This level of confidence is higher than it was in the Representative Sample Survey (46%).

Both of the above results, as well as the content of responses to the open-ended questions, suggest that respondents to the Open Survey are, on the whole, more familiar with the issues compared to those who participated in the initial survey. It is also important to reiterate that 18% of Open Survey respondents work in the nuclear industry.

Relative Concern with the Hazards of LLW and ILW

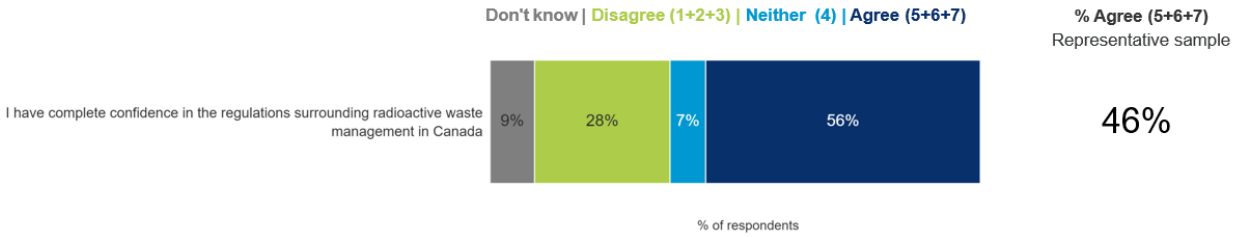
Q13 Please indicate whether you agree or disagree with each of the following statements



Sample Size: 296

Confidence in the Regulatory Framework

Q13 Please indicate whether you agree or disagree with each of the following statements



Sample size: 275

Moving from gauging confidence in the regulatory regime to looking at waste owners, we find that close to half of respondents (44%) express confidence in the ability of waste owners to implement a safe and secure strategy for the long-term management of LLW and ILW. This level of confidence is similar to the 39% registered in the Representative Sample Survey.

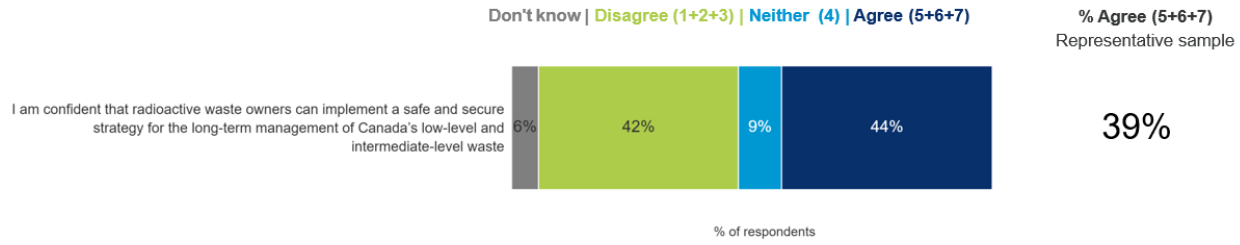
Consistent with the results of the Representative Sample Survey, Open Survey respondents are significantly more comfortable with the federal government leading the implementation of a strategy for the long-term management of LLW and ILW, than with having waste owners in the lead.

The next to last set of graphs shows that a little over one in three (38%) agrees that the strategy's implementation should be led by Canada's waste owners, "with the input" of the federal government. In contrast, the level of agreement to a very similarly worded question, but with the roles reversed (i.e., the federal government playing the lead role), is much higher at 59%. The results of the Representative Sample Survey were 44% and 73% respectively.

Finally, we see that a large majority of respondents (61%) agrees that the long-term management of all radioactive waste in Canada should be the responsibility of a separate not-for-profit organization. In contrast, only 18% disagree. The result is consistent with the findings presented in the previous section of report (i.e., a 5:1 preference for creating a separate organization to implement Canada's strategy versus allowing waste owners to implement it).

Confidence in Waste Owners

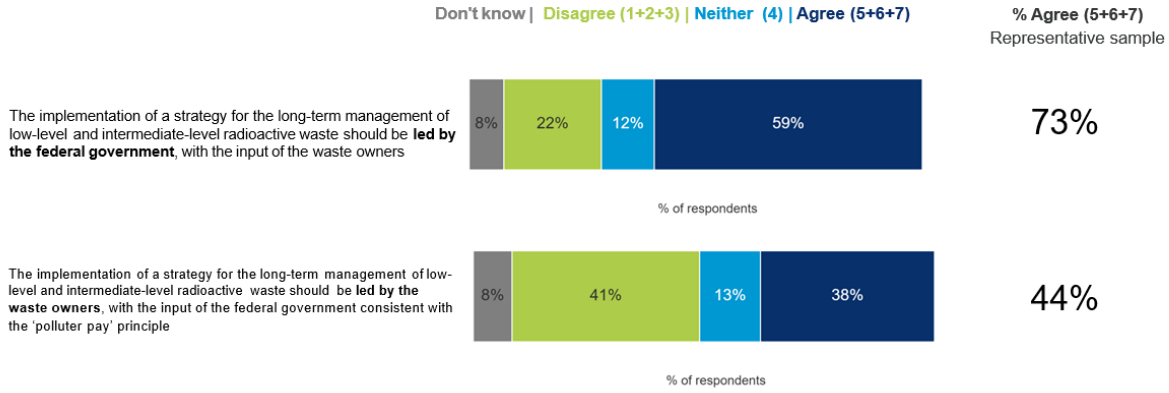
Q13 Please indicate whether you agree or disagree with each of the following statements



Sample size: 274

Preferred Implementation Roles

Q13 Please indicate whether you agree or disagree with each of the following statements

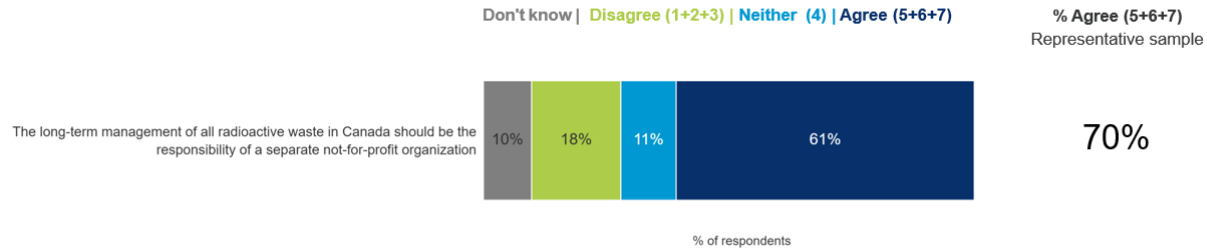


Sample size: 273-274

5

Preferred Implementation Roles (Use of a Separate Non-Profit Organization)

Q13 Please indicate whether you agree or disagree with each of the following statements



Sample size: 275

Appendix A:

Analysis of Differences Among Open Survey Respondents

Priorities (Forced Choice Paired Trade-offs)

	Work in Nuclear Industry	Rest of Respondents	Representative Sample
Obtaining the active involvement and support of communities near long-term management facilities	66	60	53
Having a separate not-for-profit organization that is ultimately responsible for Canada's strategy for the long-term management of low-level and intermediate-level waste	48	60	56
Obtaining the active involvement and support of Indigenous communities near long-term management facilities	54	55	45
Making use of projects that are already in place for the long-term management of Canada's radioactive waste	77	51	55
Locating waste management facilities away from the Great Lakes	30	54	64
Having as few radioactive waste management facilities as possible	37	51	40
Locating long-term management facilities near where the waste is currently produced and stored	39	47	52
Locating waste management facilities away from population centers	43	47	59
Minimising the transportation of radioactive waste	36	44	51
Minimizing costs to electricity ratepayers	62	33	27

Preference for Continued Surface Storage vs. Use of Specially Designed Facilities for LLW

	Work in Nuclear Industry	Rest of Respondents	Representative Sample
Putting low-level waste in a specially designed disposal facility	69	46	41
Continuing to store and monitor low-level waste on the surface as it is now, until such a time as the radioactivity has decayed and the waste can be disposed of in a conventional manner (this would take up to 300 years).	11	13	8
Either approach is fine, as long as all federal and international safety regulations are met	19	26	46
I don't know	0	14	6

Preference for Continued Surface Storage vs. Use of a DGR or Other Facility (e.g., Deep Borehole) for ILW

	Work in Nuclear Industry	Rest of Respondents	Representative Sample
Putting the intermediate-level waste in a deep geological repository (DGR) or other type of facility, such as a deep borehole, where it will be safe without further actions by future generations.	82	57	63
Continuing to store and monitor intermediate-level waste on the surface indefinitely, which will require future generations to continue to actively take care of the waste.	10	13	10
Either approach is fine, as long as all federal and international safety regulations are met	8	12	20
I don't know	0	18	7

Preference for a Centralized vs. a Decentralized Approach to the Long-Term Management of LLW

	Work in Nuclear Industry	Rest of Respondents	Representative Sample
Building several low-level waste disposal facilities, each located close to where a significant amount of this waste is being produced and stored.	34	39	43
Putting all similar low-level waste into one disposal facility to be shared by the owners, and transport the waste from various locations to this facility.	36	22	20
Either approach is fine, as long as all federal and international safety regulations are met	30	24	32
I don't know	0	15	6
Building only one long-term management facility for all of Canada, combining used fuel and the intermediate-level waste into a single facility at one location.	46	34	25
Building separate long-term management facilities, at different locations, for used fuel and for intermediate-level waste.	23	26	34
Either approach is fine, as long as all federal and international safety regulations are met	31	24	33
I don't know	0	17	9

Preference for Creating a Separate Organization to Implement Canada's Strategy vs. Allowing Waste Owners to Implement It

	Work in Nuclear Industry	Rest of Respondents	Representative Sample
Creating a separate organization to implement Canada's strategy for the long-term management of the country's low-level and intermediate-level waste.	53	51	56
Allowing each owner of low-level waste and intermediate-level waste to implement Canada's strategy for the long-term management of the country's low- and intermediate-level waste.	15	9	9
Either approach is fine, as long as all federal and international safety regulations are met	30	22	26
I don't know	2	17	8

Perceptions and Preferences on the Regulatory Framework and Strategy Implementation

	% Agree (5+6+7)		
	Work in Nuclear Industry	Rest of Respondents	Representative Sample
I am just as concerned about the hazards of low-level radioactive waste as I am of intermediate-level radioactive waste	22	39	60
I have complete confidence in the regulations surrounding radioactive waste management in Canada	81	52	46
I am confident that radioactive waste owners can implement a safe and secure strategy for the long-term management of Canada's low-level and intermediate-level waste	70	40	39
The implementation of a strategy for the long-term management of low-level and intermediate-level radioactive waste should be led by the federal government, with the input of the waste owners	57	59	73
The implementation of a strategy for the long-term management of low-level and intermediate-level radioactive waste should be led by the waste owners, with the input of the federal government consistent with the 'polluter pay' principle	57	35	44
The long-term management of all radioactive waste in Canada should be the responsibility of a separate not-for-profit organization	55	62	70