A NEXT STEP

Part of Canada's Radioactive Waste Review

Integrated Strategy for Radioactive Waste

What We Heard Report (6)

Formal Submissions

Received through January 2022

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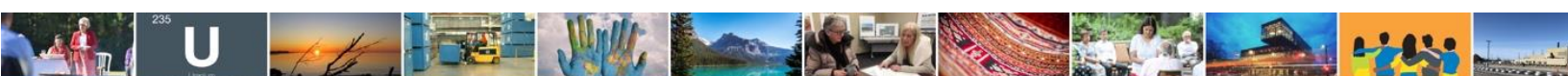


Executive Summary

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 (radwasteplanning.ca), as part of the government's radioactive waste management policy review.

The NWMO was asked to lead this work because it has close to 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. The ISRW is distinct from the work that the NWMO is leading on the deep geological repository for used nuclear fuel, which will continue as planned.

In 2021, the NWMO began engaging with Canadians and Indigenous peoples, conducting public opinion research, hosting a Summit to hear from diverse voices, listening to citizens in a series of engagement sessions in communities where waste is stored today, hosting roundtable discussions, technical workshops, and inviting formal submissions. This report summarizes what we heard from the formal submissions we received.

The intent of the ISRW is to identify next steps to address gaps in Canada's current radioactive waste management strategy, in particular for low- and intermediate-level radioactive waste, and to look further into the future. Our focus is on engagement, information sharing and gathering, not consultation.

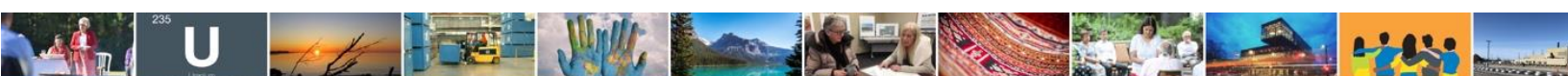
This What We Heard Report presents the commonly heard themes that arose from the formal submissions received, the full text of which is included in **Appendix A, Formal Submissions,** in the language of the original submission.

Through these formal submissions we heard from interested participants, member of the public and organizations from various sectors including civil society organizations, industry and municipal officials. We invited participants to discuss the long-term strategy for managing Canada's low- and intermediate-level waste.

We also heard from Indigenous peoples; their submissions, while noted here, will be included with our Indigenous What We Heard Reports.

Input from our engagement efforts will be considered in the drafting of the recommendations for the ISRW. This strategy will be based on public input, Indigenous Knowledge, international scientific consensus, and best practices from around the world. Draft recommendations will be published later this year and will also be informed by the Government of Canada's revised radioactive waste management policy.

Refer to **Appendix B – Promotion of Request for Formal Submissions** for more details on how we promoted the opportunity for interested parties to submit their input.



Formal Submissions were received from the following individuals, groups, and organizations, listed in the order received (note that some organizations submitted presentations and letters separately):

- Ed Dunhill
- Ralliement Contre La Pollution Radioactive (two submissions)
- Atomic Energy of Canada Limited (two submissions)
- Kinectrics
- Hydro-Québec
- Candu Owner's Group
- Canadian Nuclear Laboratories
- Moltex Clean Energy
- Durham Region

At a Glance - Key Themes from the Formal Submissions

This What We Heard Report represents the commonly heard themes that arose and is not a reflection of all the individual comments that were made. These formal submissions gave participants the opportunity to express their ideas, questions, and concerns, and provide feedback that would reveal what considerations should be given toward long-term radioactive waste management.

A summary of common key findings is below.

Key Finding 1 – Safety is Paramount

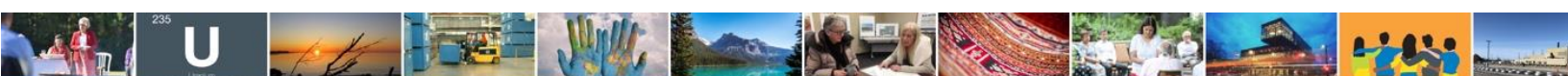
We heard from the submissions that safety was important in every aspect of the nuclear waste strategy; protecting the environment was a key consideration across all sectors.

Key Finding 2 – Communication and Transparency

We heard that the ISRW needed to consider the social dimension and emphasize consensus building, transparency and informed consent. Some submissions expressed the importance of having more visibility of waste inventories, as they exist today, and what could be expected in the future, including anticipated waste inventories and characteristics from potential Small Modular Reactors (SMRs).

We also heard that the Technical Options Report used as part of the ISRW engagement process would have benefitted from the addition of more fulsome data on waste inventories and characteristics, and disposal costs[1].

[1] A report on cost estimates entitled "Integrated Strategy for Radioactive Waste Initial Plan Development – Characterization and Options Cost Estimate" was subsequently published.



Key Finding 3 – Education and Engagement

We heard that education is vital to enable potentially impacted people and communities to be appropriately informed and will help Canadians and Indigenous peoples understand the unique challenges posed by radioactive waste, and how safety is assured.

Key Finding 4 – Sustainability and the Environment

We heard that protecting the environment, in particular water, over the long-term was important. Submissions highlighted that the ISRW needs to respect the environment and protect water sources for all future generations. We also heard that minimizing the waste is essential. Industry and Civil Society Organizations both advocated for the importance of minimizing waste. Further, it was identified that there may be opportunities for Canada to invest in technologies to support waste minimization initiatives. Accurate waste characterization was also identified as important to ensure that waste is managed and disposed of in accordance with the hazard.

Key Finding 5 – Transportation

We heard that transportation is an important aspect of the long-term plan and that, when radioactive waste is transported, it must be done safely. We heard that people have concerns about the risks associated with transportation, and the consequences of transportation accidents on the safety of the radioactive waste being transported. We also heard that people preferred to minimize the transportation of radioactive waste, to reduce any associated risks.

Key Finding 6 – Rolling Stewardship and Waste Disposal

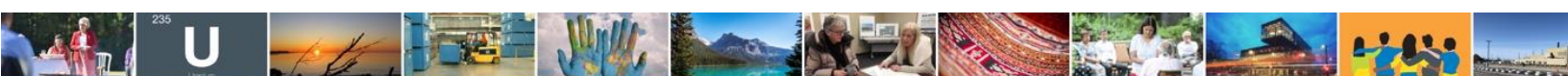
We heard differing views on rolling stewardship versus ultimate disposal of radioactive waste. Most submissions supported the idea of finding solutions to permanently dispose of the waste now, and not leaving the decision for future generations. We heard that monitoring of the waste should be assured over the long-term, ensuring that any environmental impacts could be identified and remediated before causing significant harm, especially to the water table.

Key Finding 7 – Co-location and Centralization

We heard that co-location of waste should be explored as an option. We also heard that we should minimize the number of facilities. Alternatively, we heard that leaving waste nearer to the sites where it was generated or stored, rather than transporting it vast distances, was preferable.

Key Finding 8 – Shared Responsibility Framework / Independence of Accountable Entity

There were varying perspectives regarding who should be responsible for the waste. There were differences of opinion about the role of industry, but there was a general preference for a single entity with appropriate expertise that is independent from government and industry, but subject to safety regulations and environmental oversight.



Key Finding 9 – Flexibility

We heard that industry preferred a broad, flexible framework allowing waste owners to consider all the strategies, methods, and acceptable technologies that can ensure safety.

Key Finding 10 – Sense of Urgency

We heard that an integrated strategy was needed, and the approach to the long-term management of low-level and intermediate-level waste should be determined. We also heard that the current lack of a disposal facility for intermediate-level waste meant higher risk because the waste is being stored above ground in interim storage facilities, and that this should be addressed as a priority. There was general agreement that to have and to implement a plan for all of Canada's radioactive waste, and to do so with a sense of urgency rather than leaving this to future generations, was the right thing to do.

Conclusion

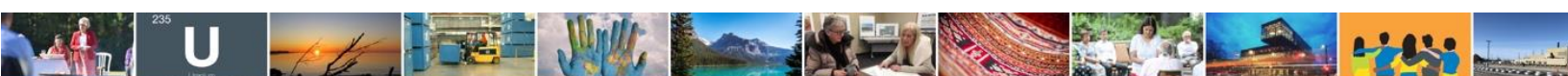
We have heard various opinions, feedback, and thoughts from individuals and organizations with an interest in the development of an Integrated Strategy for Radioactive Waste, including formal submissions from civil society organizations, industry, and municipal officials.

There is a wide range of sentiment regarding this nuanced issue.

It was our intention to collect and present these views in a manner that reflects the voices of the people we engaged with and integrate this invaluable feedback as we proceed with recommending the next steps towards managing low- and intermediate-level waste in Canada for which there are currently no long-term plans.

This is an ongoing conversation, and inclusion is an essential aspect of our project as this will be a decision affecting future generations of Canadians and Indigenous peoples.

The NWMO's recommendations will also be informed by the revised policy on radioactive waste, which was published for public comment in February 2022



Appendix B –Formal Submissions

Prepared by: Ed Dunnill

January 22, 2021

EXPRESSIONS OF INTEREST

To the attention of: Ms. Karine Glenn –

Strategic Projects Director with NWMO

Dear Ms. Karine Glenn,

I have read the article titled: "*Canadians invited to be part of solution in effective handling of radioactive waste*[1]" where you have asked Canadians for their input regarding the safe handling and storage of radioactive waste. My concerns and suggestions are stated in this narrative in hope that they will be taken into consideration when you and the NWMO team prepare your 'Strategic Plan'.

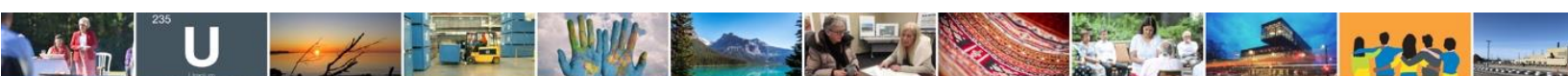
Since about 1989, I have been a voice protesting the storage of radioactive waste in, or near, the municipality where I live. For a period of about 20 years, a *'Learn More'* initiative has been developed by NWMO to help educate community leaders and local residents about the *Adaptive Phase Management* program and about research technologies for safe handling and storage of all radioactive levels of used nuclear waste. I have attended many seminars, been invited to visit the research facility and forwarded many correspondences to NWMO about my concerns and opinions regarding safe handling and storage of used nuclear waste. An opportunity has now became available to compile all of my thoughts, issues and suggestions in one correspondence in hope that my voice will be heard.

Environmental Trade-offs

As stated in the cited article, the author spoke about how; "Nuclear power is expected to play a significant role in helping Canada meet its commitment of net-zero emissions by 2050, creating jobs and economic opportunities across the country and around the world." My interpretation of net-zero emissions infer that it is relative to coal or diesel power generating plants. Carbon emissions are very toxic and emissions are the no. 1 culprit for the depletion of our planet's ozone layer. Now, there are more noticeable effects of hydrocarbons present throughout the world than ever before. In the 1970s, many scientists made predictions of what would happen if carbon emissions were not reduced. Comments were also made that alternative clean energy sources were needed to replace coal and diesel powered generating plants. Fifty years later, politicians, science community and concerned individuals are all advocating for a cleaner source of energy; especially now that empirical evidence is readily available about the effects of carbon emissions. Many countries are using nuclear power generators as a cost-effective source of power. However, added dilemmas are raised when trying to control and contain the byproduct of radioactive nuclear waste.

When radioactive waste is stored in deep geological repository (dgr) sites, this does not eliminate the threat of environmental damage. Radioactive waste takes thousands of years of decay to reach a non-harmful state. Since

1 Author: Lori Thompson; *SOOTODAY*; dated: December 17, 2020



containment cannot be 100% guaranteed to prevent discharge from the dgr, we would have to fear for our safety due to leaching. Leaching of harmful radioactive waste into our water systems will produce world-wide issues once the contaminants reach the oceans. Aquatic life will be affected. The immediate area of land surrounding the water flow will also be contaminated; thus causing harmful effects to soil, plant and wildlife. This may sound over-reaching in thought, but 50 years ago, I was a high school student when these very same issues of discussions were raised in our science classes.

Is nuclear power the answer? Undoubtedly, there is virtually no atmospheric contamination; unless a nuclear reactor melt-down occurs. At this point, local residents, communities in surrounding areas and residents of neighbouring countries affected by the fallout wished that nuclear power generators were never invented. The death of their loved ones speaks volume.

There are alternatives for clean energy available. Wind and solar power technologies have advanced greatly over the past decades and net-zero emissions is a given. Politicians need to rethink about what is truly a net-zero emission source of energy and start thinking about decommissioning current nuclear power generating plants. The current supply of used nuclear waste would become a finite issue once decommissioning of nuclear power generating plants begin. As it is, if nuclear power generating plants continue to operate, then there will never be an end to radioactive waste at its threat of contamination.

Storage Facilities – Deep or Shallow Repository Sites

I have been an underground hard rock miner for over 30 years. Throughout my career, I specialized in various drilling techniques with experiences of many different types of drilling machines. Also, the art of small and large borehole blasting accompanied this trade. With respect to excavating ground required to either produce deep or shallow repository sites, fracturing of ground becomes a given. Finding the perfect host ground formation, is somewhat the same as trying to find a ghost. It does not exist. Simply put, when ground is either blasted, or bored, ground conditions are compromised. Rock conditions become fractured. When using explosives, it is more predominant to visualize the effects. If the method of excavation is by rotary boring, then the ground is subjected to micro fractures that can enlarge over time. Either method of excavation will leave endless avenues of fractured ground for the leaching of radioactive waste from their containment compartments. There is no positive for the use of deep or shallow repository sites other than *'out-of-sight; out-of-mind'*.

In a news article stated in the NWMO News, *"Dr. Erik Kremer discusses findings from the seventh case study, which assesses the long-term safety of a deep geological repository in sedimentary rock formations, similar to those found in southern Bruce County".* He further states that: *"The report builds on a series of [post-closure] safety assessments illustrating the long-term performance and safety of different repository designs within various geological settings across Ontario"*[2]. Even though the most pristine rock formation is targeted by researchers and found in the

2 NWMO – Volume 17, Issue 3, 2019

Precambrian shield area, the seventh research study suggests that a dgr can be built in sedimentary rock found in southern Ontario. The only variable to site selection would be the engineering design of the dgr. The only issue now is to focus on proximity of where a dgr site could be built that is near Ontario's three nuclear power generating plants – Bruce, Darlington and Pickering. Since these nuclear power generating plants are located in southern Ontario, then it would be reasonable to concur that the dgr be built in southern Ontario. Bruce-Huron is one of the remaining two site selections as a host community.

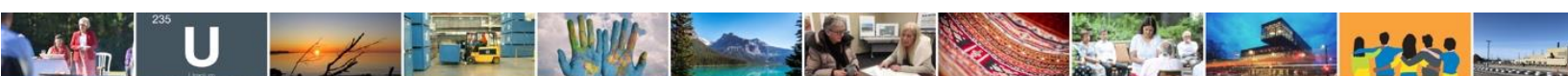
Transportation

There are concerns about safety when transporting radioactive waste. These concerns stem from proximity to/from place of production to storage; mode of transportation; weather conditions; human error; residential areas; environmental impact and costs.

Proximity – it is without argument, that the closer the dgr. site is to the power generating plant, the less of a chance that there would be any kind of mishap. The law of probability comes into play here. Also, it would be safe to say that the shorter the distance to travel, the more cost effective it would become.

Mode of transportation – there are three viable options, either independent or combined with the logistics of this topic. The more reasonable mode would be by road transportation. However, this poses many threats of safety for people and the environment. In fact, the next two suggested modes: by ship or rail will also pose similar threats of safety.

- With respect to road transportation, such factors as vehicle malfunction on route; road maintenance; year-round weather conditions; trucking operators (human error); chosen routes passing through residential areas; etc., are just a few issues that can be named. Any road mishaps could cause container rupture and dislodging of used radioactive waste. Harmful threats of radioactive waste will affect humans, wildlife, and our environment. Any threat to the environment is extremely long-lasting.
- With respect to rail service, the mode of road transportation will also need to be used to reach point of destination. This poses additional handling of used nuclear waste, which could potentially cause mishap due to human error. Once again, the above stated threats of safety to humans, wildlife and environment come into play.
- With respect to shipping via waterways, this mode of transportation becomes cost effective, but is more vulnerable to weather conditions than any other mode. Both Lake Superior and Lake Huron are well known for shipping mishaps due to severe weather conditions. Any loaded ship that succumb to their watery grave will not only produce local environmental impact, but worldwide as well. All waterways in the world are connected.



Costs

Costs are tied into every sector of business. Nothing would be more true than the transportation of used nuclear waste to a dgr. The math is simply; further the distance for transportation, the higher the cost will be. This is inversely proportional. Somewhere in the equation, OPG operators will recapture their expenses usually at the expense of consumers. Then there are costs involved for clean-up if a mishap occurs. This cost takes into consideration material used, manpower, environmental, society – mental health due to incident, lingering health risks to people's properties, devaluation of personal property, etc. Most home owners may not be aware that their home insurance coverage does not cover this type of catastrophe. If a rider is written in the policy and the transportation route passes by the community, then insurance coverage becomes more expensive. Of all of the Learn More seminars that I attended, never has anyone from NWMO stated that people or homeowners would be compensated for fault of any vehicle mishap in or around affected communities. However, what is stated by NWMO's representatives is that all clean-up costs will be absorb by insurers of OPG operators and their contracting parties. There is no monetary relief for individuals. In the end, costs for clean-ups will trickle back down to the consumer.

Proximity – currently, there is a dgr. under construction on Olkiluoto island in Finland, which is 275 kilometres northwest of Helsinki. At the ONKALO site, there are three nuclear power generating plants in operation. The project varies in design and engineering. Posiva is the counterpart to NWMO and share information of their expertise with NWMO[3]. By having close proximity of the dgr., all used nuclear waste from these plants reduce expensive costs of transportation and handling. Also, it increases safety by reducing the risk of incident through logistics.

Recent news about a vehicle mishap was posted at a local news station in Thunder Bay, Ontario, about a transport truck that rolled over onto its side just after leaving a gas bar. The incident happened in a small rural community known as Upsala, located west of Thunder Bay, Ontario on Hwy. 17, which runs through the community[4]. It would be easy to concur that speed was not a factor, nor was any other vehicle involved in this incident. Since the investigation is still ongoing, what could be inferred is that the operator failed to negotiate the left hand turning radius, and the transport took the shoulder and rolled over. This is definitely human error, and it is a very common throughout the trucking industry; especially on the roadways in northern Ontario – Human Error! What if the transport was carrying radioactive waste?

Economic Inducements

Throughout the site selection process, NWMO has made Community Well-being inducements to municipalities who are willing to become a host community. The Learn More program remains in tact as geological testing continues.

So why does the town of Ignace seem so appealing as a host commuity? Northwestern Ontario has been in an economic slump with respect to the forest industry for about two decades now. This means that many people are out

3 NWMO News – Volume 17, Issue 2, 2019
4 TbNewsWatch.com – Staff – *"Overturned transport truck disrupts traffic at Upsala"*, January 18, 2021

of work and willing to accept the risks of handling and storage of used nuclear waste. Also, mining operations in northern Ontario have been declining; either because of world-wide market down-turns, or that the finite resources are being depleted. Northern and northwestern Ontario are faced with economic strife. Thunder Bay (closest city to Ignace) is once again facing the closure of their rail-car manufacturing plant; thus putting about another 400 employees out of work[5]. NWMO's timing is impeccable. Northwestern Ontario has been starving for economic relief, and the proposed dgr. site in Ignace would be an economic lifeline for Thunder Bay and many surroundings communities.

The irony of such economic strife that started in northern and northwestern Ontario comes at about the same time the "*Nuclear Fuel Waste Act*, S. C. 2002, c. 23," has come into affect by our federal government. NWMO has been commissioned to find a host community that has acceptable ground conditions. Also, the municipality is willingly to become a host community. NWMO has focused their efforts primarily in northern and northwestern Ontario throughout their campaign. Nobody wants radioactive waste stored in their "back yards". So, why should a potential host community be sought for storing radioactive waste so far from where it was produced and will continue to be produced?

Conclusion

It is reasonable to infer that I am not in favour of any radioactive waste being produced. However, what is produced needs to be contained, handled and stored in a safe and responsible way. The best practice that I believe to contain, handle and store used nuclear waste is by close proximity. Safety in containment and handling should be nothing less then imperative. Finally, it is a personal vision of mine that nuclear power generating plants be decommissioned at the same time that wind and solar power generating facilities are commissioned. A safe clean environment should be the vision for all, and the responsibility of that vision be transcended onto other people and future generations.

Prepared by:

Ed Dunnill Dated: January 22, 2021

Cc. Minister of Natural Resources – Honourable Minister Seamus O'Regan

E-mail: nrcan.media.rncan@canada.ca

5 TbNewsWatch.com – Gary Rimme – "*National Unifor president warns that Thunder Bay's Bombardier plant faces closures*", January 19, 2021

Prepared by: Ralliement Contre la Pollution Radioactive

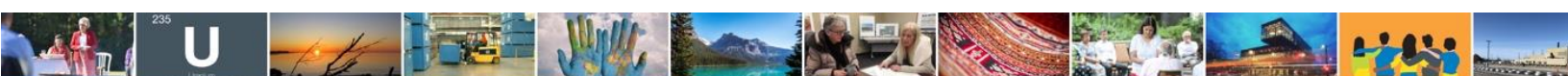
10 August 2021

1er critère fondamental : Ne jamais abandonner les déchets radioactifs

- Ni les déchets des petits réacteurs modulaires (PRM) exempts d'évaluation environnementale, ni même les déchets dans les sites d'enfouissement en couches géologiques profondes.
- Les déchets radioactifs devront toujours être surveillés.

2e critère fondamental : La consultation sur la stratégie de gestion doit respecter les conclusions de la consultation en cours sur la politique de gestion des déchets radioactifs

- Puisque l'opinion de la population est sollicitée, il faut la respecter.
- Il aurait mieux valu attendre que la politique soit élaborée avant de commencer la consultation sur la stratégie.
- La stratégie doit correspondre aux exigences de la politique.



3e critère fondamental : Stockage des déchets radioactifs loin des plans d'eau

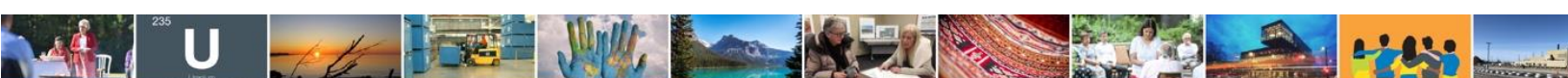
- Parce que les déchets radioactifs finissent toujours par s'infiltrer dans la nappe phréatique et dans les cours d'eau.
- Parce qu'il faut protéger notre eau potable.

Impossible de choisir la meilleure stratégie sans connaître les paramètres suivants :

- les inventaires actuels et projetés de tous les types de déchets radioactifs
- les coûts estimés des solutions proposées incluant le coût du transport nécessaire
- les raisons qui obligeraient à accepter des projets qui généreraient de nouveaux déchets radioactifs

Il faut établir des inventaires et des projections de la quantité de tous les types de déchets afin de pouvoir planifier les options de leur gestion lors de votre consultation.

Il faut comparer le rapport coûts/bénéfices des différentes options de gestion des déchets radioactifs (intendance perpétuelle, site en moyenne profondeur, site près de la surface, enfouissement en couches géologiques profondes, sites dispersés ou nationaux) afin de pouvoir choisir les options de leur gestion lors de votre consultation.

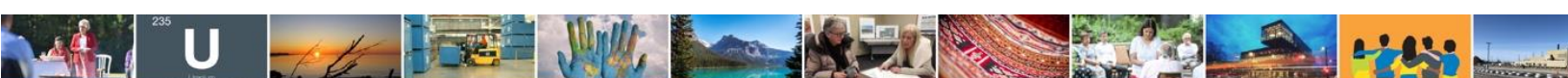


Recommandations pour isoler à long terme les déchets radioactifs de haute activité (DHA)

- La surveillance perpétuelle des déchets radioactifs est absolument nécessaire.
- Les déchets doivent être récupérables en cas d'accident, d'entretien ou de nouvelles technologies pour mieux les isoler.

Recommandations pour isoler à long terme les déchets radioactifs de faible activité (DFA) et de moyenne activité (DMA)

- Minimiser la production de nouveaux éléments radioactifs et de nouveaux déchets.
- Utiliser une classification plus précise et scientifique, mais moins trompeuse, pour les DFA et les DMA.
- Départager les déchets radioactifs de courte vie (demi-vie de 30 ans) et de longue vie.
- Les installations pour les DFA et les DMA doivent avoir une vie plus longue que celle des déchets radioactifs qu'elles abritent.
- Instaurer une surveillance perpétuelle obligatoire des déchets radioactifs.
- Les déchets doivent être récupérables en cas d'accident, d'entretien ou de meilleures technologies pour les traiter.
- Susciter un débat public sur le retour au Canada des sources radioactives médicales hors service, vendues par le Canada, ce qui crée un fardeau de déchets radioactifs provenant du monde entier.
- Interdire l'importation et l'exportation de combustible usé.

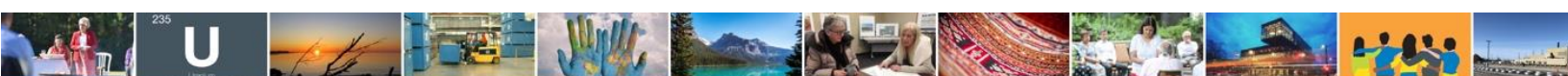


Recommandations pour le transport des déchets radioactifs et le déclassement des installations nucléaires

- Maintenir des inventaires plus précis et mieux catalogués.
- Minimiser le transport des déchets radioactifs.
- Les transporter loin des plans d'eau.
- Bannir le déclassement in-situ, pour toutes les catégories de réacteurs, y compris les PRM que l'on veut multiplier.

Recommandations pour la gestion des déchets radioactifs

- L'organisme de gestion des déchets radioactifs (polluants) devra être indépendant de l'industrie nucléaire, et sous le ministre de l'Environnement et des Changements climatiques.
- L'organisme de gestion devra faire preuve de transparence et devra rendre des comptes.
- L'industrie nucléaire devra payer, selon le principe du pollueur-payeur, mais ne devra pas contrôler les décisions qui déterminent la gestion des déchets radioactifs.
- Le double mandat d'AECL de développer l'industrie nucléaire et de gérer les déchets radioactifs devra cesser car c'est une contradiction. Même chose pour la CCSN.
- Il faudra évaluer publiquement les conséquences des déchets radioactifs dans tout nouveau projet.
- Il faudra interdire tout nouveau projet nucléaire qui crée des déchets radioactifs quand il y a des alternatives plus écologiques.

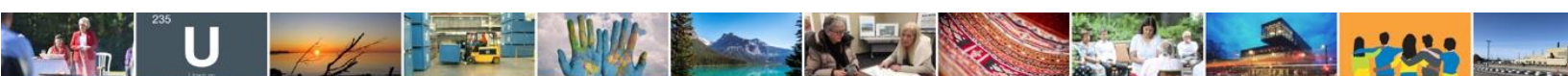


Recommandations pour la gestion des déchets radioactifs (suite)

- Le système de gestion des déchets radioactifs au Canada devra être réservé exclusivement aux déchets canadiens.
- Il faudra arrêter l'importation et le retour des déchets radioactifs, quel qu'en soit la raison.
- Il faudra donner PRIORITÉ à la gestion permanente des déchets de moyenne activité pour éviter les abus de classification et les entreposages risqués et coûteux d'intendance perpétuelle.
- Il faudra remettre en question le développement et le déploiement des petits réacteurs nucléaires.

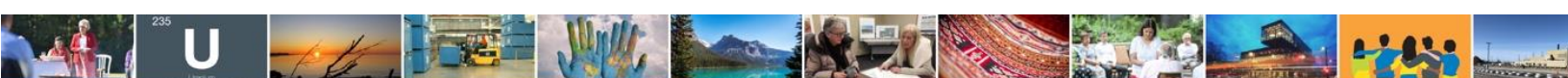
Recommandations pour la réglementation

- Améliorer la classification des déchets qui est trop vague.
- Un seul organisme devrait être en charge des normes et règlements pour les déchets radioactifs.
- Abolir le rôle de la CSA.
- Surpasser les recommandations de l'AIEA, être plus restrictif et surtout bannir le démantèlement in-situ.



Recommandations pour le perfectionnement des travailleurs dans le domaine nucléaire

- Préserver les compétences après la fermeture d'une centrale nucléaire.
- Mieux former les opérateurs de centrales nucléaires.
- Former du personnel en gestion de déchets radioactifs.



Prepared by: Atomic Energy of Canada Limited (AECL)

August 2021

AECL

We are a federal Crown corporation

Driving nuclear innovation

Science is at the core of everything we do

Cleaning up the Government of Canada's radioactive waste

To protect the environment and enable nuclear science and technology, we are addressing legacy wastes and new liabilities

AECL

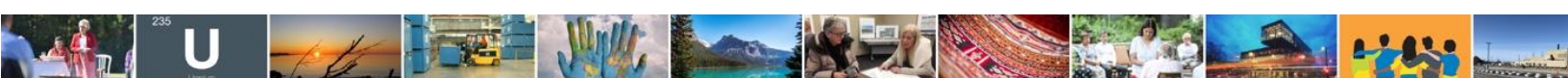
Government-owned, Contractor-operated model

Long-term contract with Canadian Nuclear Laboratories (CNL) and its parent companies (Canadian National Energy Alliance: SNC-Lavalin, Fluor and Jacobs)

AECL = owner
Sets priorities
Oversees CNL's work
Measures performance

Regulator
Canadian Nuclear Safety Commission

CNL = licensee
Manages day-to-day operations of our sites



AECL

AECL's Role

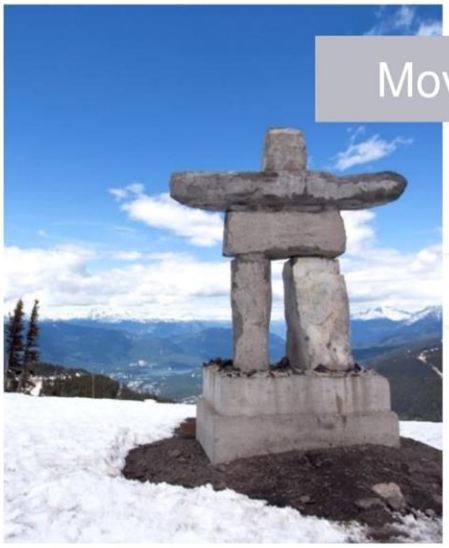
- Set priorities
- Oversee the contract, assess performance
- Agent of government, support the development of nuclear policy

4

Sites Across Canada

- Active nuclear science and technology laboratories: Chalk River
- Legacy AECL research sites (in decommissioning): Whiteshell, Nuclear Power Demonstration, Douglas Point, Gentilly-1
- Sites contaminated with historic low-level radioactive waste for which the government has accepted responsibility: Port Hope Area Initiative and Northern Transportation Route

AECL



Moving forward together

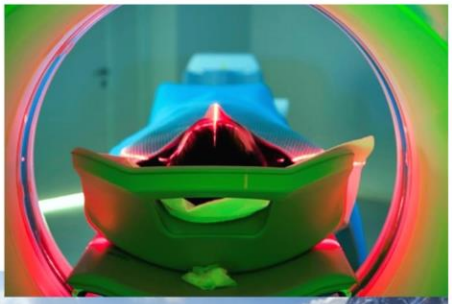
Advancing science, decommissioning and environmental remediation through partnerships and reconciliation

Nuclear Science & Technology for Government

- Biological and health applications
- Environment and responsible waste management
- National security and emergency preparedness
- New nuclear technologies

Nuclear Science and Technology: Strategic Initiatives

Small modular reactors (SMRs)
Next-gen medical isotopes
Hydrogen technologies
Reactor sustainability: "CANDU and more"



AECL

A unique radioactive waste inventory

Type – LLW, ILW, and prototype and research reactor fuels

Volume – the largest volume of LLW in Canada (contaminated soils and building debris)

Complexity – the specific role of R&D has resulted in a wide range of complex waste characteristics (form, location)

Accumulated waste (buried and stored)

Integrated Waste Management

- CNL has in place an integrated waste strategy for all AECL wastes
- Both AECL and CNL are participating in the NWMO-led engagement to make recommendations for an integrated radioactive waste management strategy for Canada
- Additional detail can be found at https://www.cnl.ca/environmental-stewardship/waste-programs/

Safe Storage

- Radioactive wastes continue to be safely stored at AECL sites until disposal is available

AECL

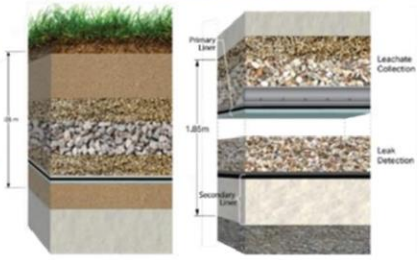
Overview of long-term plans

- High-level waste (used fuel): to be disposed at NWMO deep geologic repository
- Intermediate level waste: plans still under development – see slide 15

AECL

Overview of long-term plans

- Low-level waste:
  - Port Hope Area Initiative: two near surface facilities have been built for 2.1M cubic meters of historic low-level radioactive waste for which the Government has accepted responsibility
  - Low-level waste from historic and ongoing AECL science activities: to be consolidated at Chalk River Laboratories and disposed of in the Near Surface Disposal Facility (currently undergoing an Environmental Assessment)



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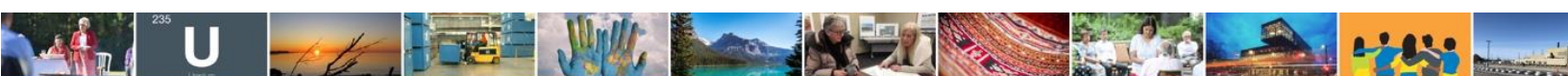
Gaps

- NWMO mandated to develop Integrated Waste Strategy where no long term plans exist
- For AECL, this means Intermediate-level waste as projects are underway for high-level and low-level waste

AECL

AECL's Intermediate-level Waste

- The long-term forecast for total volume of ILW requiring disposal is approximately 10,000 m^3
- In the current context where there is an absence of a national strategy, AECL as a responsible waste owner continues to explore options for disposal of its ILW
- Further evaluation is ongoing on two options of geologic disposal:
  - A cavern type, appropriately sized for AECL's inventory
  - A shaft type involving emplacement from above



AECL

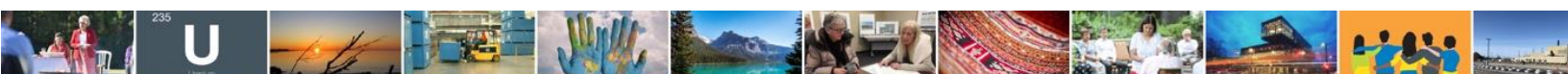
Other Considerations

- AECL welcomes consideration of other potential options for disposal of AECL's ILW, such as in another facility
- As a research organization we make decisions based on sound science and robust analysis of options with considerations of stakeholder's and Indigenous input
- As a steward of public funds, we ensure decisions affecting our liabilities provide value to Canadians
- As such, AECL wishes to participate and be included in the analysis of other options for disposal of ILW
- ILW is being stored in a range of passively-safe, "disposal ready" packages and AECL would wish that whatever is decided is sufficiently flexible to be able to receive the range of such packages

AECL

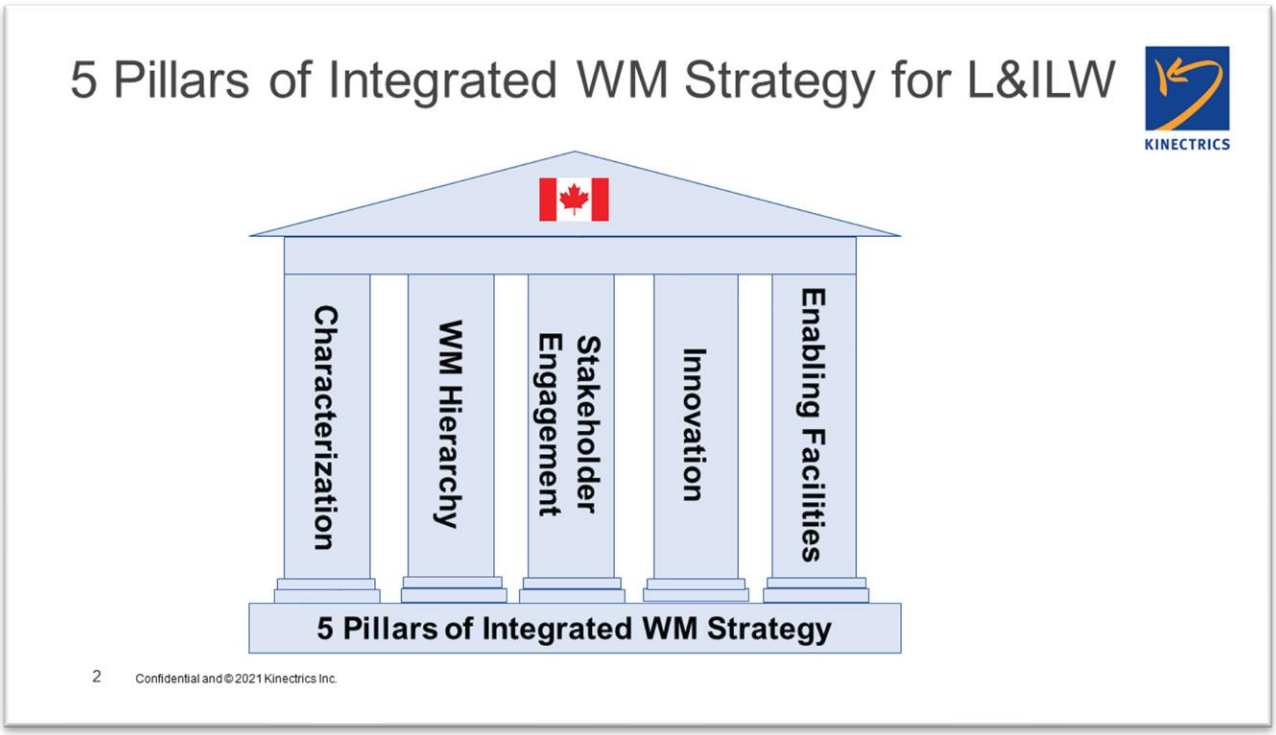
Principles influencing selection of options

- "Rolling stewardship" is not considered to be an acceptable solution as it defers addressing the problem to future generations
- The selection of the specific technology for disposal should be the responsibility of the disposal project proponent
- Choice of disposal solution is not a matter of general preference, but depends upon many considerations, including the inventory under consideration, site characteristics, including geology and hydrogeology
  - Existing formal regulatory, siting (including transport) and impact/environmental assessment processes set the framework for the evaluation and comparison of concepts
- Recent experience suggests that the dominant success factors are not technical, but rather revolve around public acceptance through community, stakeholder and Indigenous engagement



Prepared by: Kinectrics

August 2021



Characterization

KINECTRICS

- Comprehensive <u>characterization of waste is important</u>:
  - On-going characterization at operating sites.
  - Timely characterization of decommissioned and to-be decommissioned sites.
  - Characterization to enable improved classification, free and conditional release.
- Creates opportunities for waste to be sent to alternate routes:
  - Decontamination for free release.
  - Conventional disposal of non-radioactive and free released waste.
  - Conditional clearance of waste for conventional/hazardous waste disposal.
  - Disposal as Very Low Level Waste (VLLW).
  - Waste minimization, re-use and recycling.
- A path for management of SMR waste, which includes an understanding of its characteristics

WM Hierarchy

KINECTRICS

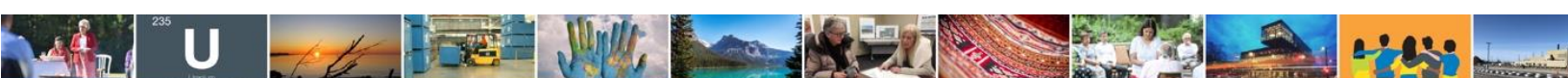
- <u>An integrated strategy based on WM Fundamentals.</u>
- Waste Prevention & Minimization.
  - Safe disposal of VLLW in properly designed hazardous waste disposal facilities.
    - Proposed criteria: 100x UCL outlined in NSRDR (COG TN 20-7079).
    - Minimum of 10% of operational waste and 60% of decom waste eligible (EPRI 1024844).
  - Effective use of disposal options available under existing regulations (UCL, CCL).
  - Sorting & segregation.
  - Decontamination for recycle/reuse, recategorization & release.
  - Volume reduction (incineration, compaction, melting, segmentation)
  - Avoidance.
  - Effective Planning and minimize exposure.

WM Hierarchy

- Waste Re-use & Recycling
  - Recycling/Re-use of metal and concrete back in the nuclear industry.
    - Shielding & containment, waste container fabrication, concrete reuse.
  - Recycling of D_2O. Detritiation and supply of H-3 to the ITER program.
  - Decontamination and release of maintenance equipment and instrumentation for reuse.
- Disposal
  - Conventional disposal of free released waste (UCLs in NSRDR).
  - Deploy effective ways for conventional disposal of conditionally cleared waste (Guidance CSA N292.5).
  - Near surface disposal for LLW.
  - Separate VLLW facility (engineered landfill).

Stakeholder Engagement

- Involve all key stakeholders.
  - Local, provincial, and federal governments; regulator; citizen groups; Industry- Waste owners and vendors; researchers; aboriginal groups; environmental groups and youth.
- Stepwise decision-making process.
- Key considerations/dimensions.
  - Foundations based on solid science.
  - Social dimension/consensus building, transparency, informed consent.
  - Political and economic considerations.
- Benchmarking best practices, OPEX and Lessons learned from other successful jurisdictions.
- Key behavioral principles: competence, commitment, consistency, fairness, respect & empathy.
- Successfully demonstration of an integrated strategy for existing radioactive waste in Canada, will build public confidence in a strategy for new technologies like SMRs.



Innovation

KINECTRICS

- Programs that support innovation projects with government funding.
- Collaborative projects working with industry service providers, utilities and academia.
  - Objective→ To broaden waste management knowledge in future leaders.
- ***Project examples:***
  - Removal of C-14 from resins and volume reduction of resins – convert ILW to LLW.
  - D_2O management and methods to detritiate heavy water.
  - Separation/Destruction methods for management of mixed wastes (e.g., PCB) & liquid waste.
  - Volume reduction of large metal components.
  - Decontamination of large components and concrete.
  - Waste sorting and segregation using innovative technologies.
- A path for management of SMR waste, that includes an understanding of its characteristics.

Enabling Facilities

KINECTRICS

- Canadian enabling facilities for the following:
  - Volume reduction of Large Metal Object (LMO) waste (e.g., SGs, HXs, Feeders).
  - Processing Mixed Waste (e.g., PCB and asbestos contaminated rad waste).
  - Processing large volume of downgraded D_2O from decommissioning.
    - Temporary storage.
    - Business case may not justify large scale processing followed by detritiation.
    - Other options: Immobilization with minimal volume and phytoremediation.
  - Processing large volumes of concrete waste.
  - Waste sorting and segregation.
- Overall objective of enabling facilities:
  - Volume reduction, recycling, waste minimization, reuse, de-risk, lower waste classification.

Developing an Integrated Strategy→ Q&A

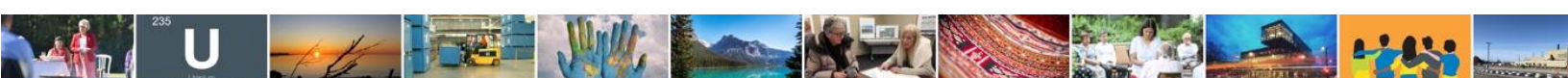
- **Q: What is most important when developing an integrated strategy for L&ILW**
- A: Develop a strategy that will establish broad public confidence and support through engagement and education.
- **Q: How to best deal with L&ILW over long term; what type of facilities? Rolling stewardship or disposal? How many facilities?**
- A: Over long-term, disposal is the safest and lowest cost option over rolling stewardship.
  - However, public (particularly NGO's) tend to have difficulty with not being able to monitor waste over time. If L&ILW are located together, disposal with some form of monitoring would be the most acceptable to the general public.
  - Rolling stewardship (at surface) does not solve long-term disposal need, passes on responsibility to future generations, comes with higher risk and is significantly more expensive.

Developing an Integrated Strategy→ Q&A

- **Q: How to best deal with L&ILW over long term; what type of facilities? Rolling stewardship or disposal? How many facilities (continued)?**
- A: Alternative approach:
  - Bifurcate L&ILW and deal with separately.
  - Build a separate facility for LLW (either near surface or on-surface with monitoring).
  - It is also very important to consider VLLW as a separate waste stream in line with international best practice in other jurisdictions.
- **Q: Who should be responsible for implementing the strategy?**
- A: Federal Government i.e., NRCan.
  - Given that there is no commercial entity, or utility, in Canada who would embark on commercializing L&ILW disposal for all of Canada, a strategy must be executed by the Federal Government. The 'polluter pays' policy of the current framework does not have a visible path to success.

Abbreviations

C-14: Carbon-14	NGO: Non-Governmental Organization
CCL: Conditional Clearance Limit/Criteria	NRCan: Natural Resources Canada
COG: CANDU Owners Group	NSRDR: Nuclear Substances and Radiation Devices Regulations
CSA: Canadian Standards Association	OPEX: Operational Experience
D_2O: Heavy water	PCB: Poly Chlorinated Biphenyls
EPRI: Electric Power Research Institute	Q&A: Question and Answer
H-3: Tritium	SG: Steam Generator
HX: Heat Exchanger	SMR: Small Modular Reactor
ILW: Intermediate Level Waste	TN: Technical Note
ITER: International Thermonuclear Experimental Reactor	UCL: Unconditional Clearance Limit
L&ILW: Low and Intermediate Level Waste	VLLW: Very Low-Level Waste
LLW: Low Level Waste	WM: Waste Management
LMO: Large Metal Object	



Prepared by: Hydro- Québec

August 9, 2021

Gentilly-2 : A brief history

- September 20th 2012
  Decision to cease commercial operation of Gentilly-2
- December 28th 2012
  Reactor permanent shutdown
- September 3rd 2013
  Defueled core state reached
- December 2nd 2014
  Safe storage state$_{POOLS}$ reached
- Juin 22nd 2016
  Issue of a decommissioning licence for Gentilly-2 facilities
- October 25th 2017
  Completion of spent resins transfer to WMF concrete vaults
- December 2022
  Safe storage state$_{DRY\ STORAGE}$ schedulded

Gentilly-2 : A brief history

- Year 2026
  Decommissioning licence renewal
- Year 2048 (to 2062)
  Spent fuel transfer phase to DGR (NWMO)
- Year 2057 (to 2062)
  Decontamination and Dismantling preparations and operations
- Year 2062 (to 2064)
  Preparing of final and complete restoration
- Year 2064 (to 2074)
  Environmental post-dismantling surveillance

NWMO suggested topic focus

What is most important to get right when developing an Integrated Strategy for Canada's Radioactive Waste ?

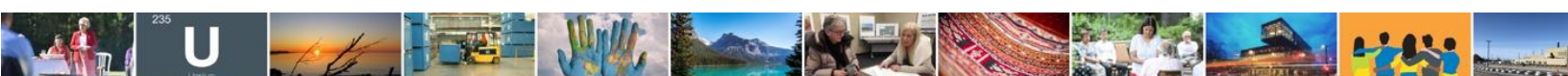
- Hydro-Québec recommends a broad framework allowing waste owners to consider all the strategies, methods, and acceptable technologies that can ensure safety. The policy should be flexible to ensure that all disposal strategies that satisfy these factors can be chosen.
- Also to be in line with the priorities of Canadians and Indigenous peoples (Social acceptance).
- And finally, to have consideration for all environmental, social and economic factors regarding the choice of waste disposal methods. More specifically, the characteristics of the waste, the volumes on a Canadian scale, the geology of potential sites, the Indigenous and public engagement and the role of host communities.

NWMO suggested topic focus

How do we best deal with Canada's Low-Level Waste and Intermediate-Level Waste over the long-term ?

- **What type(s) of facilities should we use ?**
- **Rolling stewardship vs disposal ?**
- **How many of them should we build ?**

- Every type of installation ensuring safety should be considered , as long as they offer the capacity to hold the entire waste volumes and inventory that canadian owners will have over time.
- Final decisions must be based on
  - Safety Case
  - Business Case
  - Social Acceptance



NWMO suggested topic focus

How do we best deal with Canada's Low-Level Waste and Intermediate-Level Waste over the long-term ?

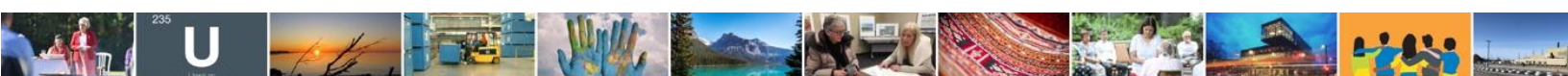
- **What type(s) of facilities should we use ?**
- **Rolling stewardship vs disposal ?**
- **How many of them should we build ?**

- Waste volumes currently stored at Gentilly-2 represent a very small fraction of Canadian radioactive waste inventory. Hydro-Québec plans to join another project that would be socially and environmentally acceptable rather than developing its own solution. A solution bringing together several partners must be considered. This solution could imply one or more disposal sites considering specific waste characteristics. In order to maximise safety and optimize economics, it would be better to have few different sites, even if this would mean more transportation.

NWMO suggested topic focus

Who should be responsible for implementing the strategy ?

- According to Hydro-Québec, an independent organism like NWMO would be the most relevant entity to be responsible for implementing a Canadian strategy. And thus replicate the actual process used for Nuclear Spent Fuel.




Question?

Prepared by: Ralliement Contre la Pollution Radioactive

August 10, 2021

Comments from Ginette Charbonneau du *Ralliement contre la pollution radioactive* on the report *Integrated Strategy for Radioactive Waste Initial Plan Development Characterization and Options* for intermediate level waste and low level waste

Date: Aug. 10, 2021

In the report we notice the lack of precision in the inventories of low-level waste (LLW) and intermediate-level waste (ILW) and the problem caused by different classifications of wastes used across Canada. The tables from page 36 to 40 are very instructive.

A more precise classification needed

The strategy should include a more precise classification and regulation of nuclear wastes. If Low -level waste (LLW) could be sorted into short-lived radionuclides (period of less than about 30 years) and long-lived radionuclides it would be possible to discard short-lived radioactive waste after a few hundred years, but this information is not available in the inventories. A more precise boundary between LLRW and ILRW should be provided. It is not acceptable that the inventories of ILW have changed in the past years because of poor inventories. SNSC should be less permissive with the polluters and strict rules of waste classification and description should be applied.

Projection of the future radioactive waste needed

There is no projection in this report about the future radioactive wastes in Canada. **This is essential for the planning of the strategy.**

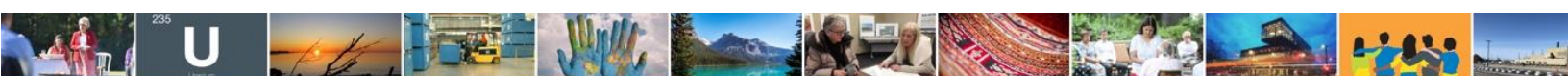
Focus on the radioactivity, not only on the volume of the radioactive waste

Volumes of the LLW and ILW are compiled, but not their radioactivity. It can be misleading because certain types of radioactive wastes, even in small volume, can have a very high radioactivity and thus a high risk for community health. It would be instructive to see graphs of the total radioactivity. Please add graphics and tables showing the radioactivity (in Becquerel) of the wastes inventory from different owners. It would give another interesting perspective.

For example, small volume of used cobalt-60 sources from all over the World will be placed in the NSDF but they represent 98 % of the radioactivity of the NSDF.

Adopt the principle of what is most dangerous should be addressed with highest priority

AECL focus mainly on low-level radioactive waste, which is easier and more lucrative, when there is no plan to deal with the much more dangerous intermediate-level radioactive waste. This is not the best risk management.



Intermediate-level waste management planning is URGENT in Canada. There is no strong recognition of this urgency in the report. AECL never had any plan for ILW waste and still do not have it in their 5-years plan. At the recent public meeting of AECL (October7, 2021), I asked the same question as last year about the lack of planning for the intermediate level waste management; the answer was: ***Yes it is true but we have to determine how much ILW there is.*** This is a very good excuse again to postpone it. It means they did not address it properly and do not have a strong commitment to address it. ILW is pilling up and is still in interim storage.

If there was a long-term repository for ILW, the decommissioning of NPD in Rolphton would be different and in-situ would not be the only bad choice available.

Lack of planning for long-term storage for ILW has opened the doors to all kinds of abuses:

- Cheating by including ILW into the category of LLW to store them in a Near Surface Repository
- Considering entombment of reactors instead of decommissioning
- Transporting ILW to interim storage instead of storing them in a long-term Deep Geological Repository with monitoring.

Important data missing

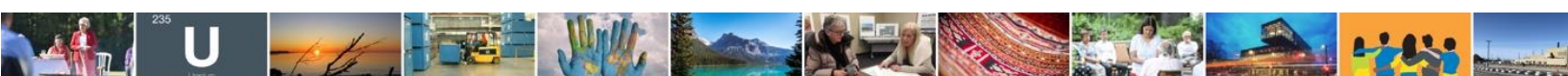
Very important issues for ILW are not covered in this report: radionuclide characterisation of the waste, inventory of short-lived and long-lived LLW and ILW, total radioactivity of the waste in several installations, decontamination and volume reduction practices, etc. The answers are not immediate but there would be a strong benefit to get them.

Volume reduction should be addressed in this study. In fact it is very important given the important volume of radioactive waste. Sorting of short-lived and long-lived radioactive waste would help to discard short-lived radioactive waste after a few hundred years.

You mentioned reactors to be decommissioned but you forgot the NRU and NRX reactors that have been summarily buried in the ground. The report should include SMR wastes expected in the future. **A strategy is required for all these reactors.**

Data is missing about the Small Modular Reactors wastes

No mention of the projected SMR waste; this is an unacceptable omission. The SMR wastes should be determined and evaluated at the prototype phase. Some SMR wastes are associated with salts and can be very reactive to air and water. It can be dangerous



to put them in a deep repository. During the SMR pre- licensing Vendor Design Review (VDR) process, the wastes generated should be addressed to determine their category, their reactivity and their volume. SMR wastes should be investigated further. The CNSC is currently conducting pre-licensing VDR review for about a dozen SMR vendor designs but **is not examining their future wastes**. Wastes generated by SMR are inherent to their design! Anticipated SMR waste types should be estimated in the scope of this strategy. SMR are also exempted from impact assessment and their wastes can be left in situ. So the population is not protected.

Data on international disused medical sources is needed

There is no mention of disused radioactive sources that can be LLW or ILW. More information about the disused sources is needed. L&ILW from international waste owners are not mentioned in the report. Because Canada has accepted international waste like the used medical sources, **it should be clear that Canada has a sound plan for their disposal.**

More bold and proactive attitude is needed

The report should also demonstrate a more bold and proactive attitude regarding the managing of radioactive pollutants.

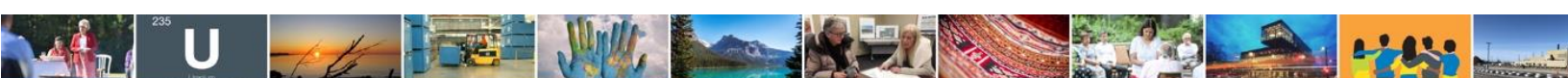
- **Managing radioactive waste is not enough: the increasing influx of radioactive waste should be halted**.
- **No importation of radioactive waste**
- **A perpetual monitoring of the radioactive wastes is mandatory**
- **Waste should be stored away from water**.

Wastes should always be monitored in a Deep Geological Repository

Even in a deep geological repository, long-lived radioactive wastes should not be abandoned; they should be monitored in perpetuity and recoverable in the event of a problem or in case a better technical solution is found. Maintenance of their containers will be required over thousands of years. If a problem happens it will reduce the dangers for the workers who will have to intervene. A safe geological storage for an extended period needs perpetual monitoring to be socially accepted and reduce the risks.

What are the current long-term management plans (current and anticipated)?

There is no graphic about the L&ILW having current long-term management plans (current and anticipated). You assume that there is a definitive plan for these wastes but some of these plans are not acceptable for the civil population. For example in-situ decommissioning is the worst example. The in-situ disposal is not accepted by the public



and it is against the rules of IAEA. It should not be presented as a current long-term management plan but as a lack of plan.

In-situ decommissioning should not be accepted as an adopted plan

Proper reactor decommissioning involves removal of all significantly radioactive materials to offsite facilities, and restoring the reactor site to unrestricted use. In-situ decommissioning is a form of "near surface disposal". The International Atomic Energy Agency (IAEA) says that "near surface disposal is primarily suitable for waste containing mainly short-lived radionuclides and only low concentrations of long-lived radionuclides."

IAEA Safety Requirements GSR Part 6 Decommissioning of Facilities says:
Entombment, in which all or part of the facility is encased in a structurally long-lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g. following a severe accident).

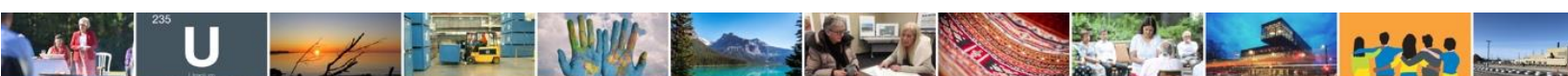
Near surface disposal is not appropriate for radioactive wastes with relatively high activity levels and long decay half-lives, such as are found in the federal government's "legacy" reactors. The IAEA concludes that "Entombment is not relevant for a facility that contains long-lived isotopes because these materials are not suitable for long term surface disposal."

The argument that decommissioning plans were not fully developed at the time of the construction of the federal legacy reactors does not justify their in-situ decommissioning. The federal government's legacy reactors are all located on major water bodies that provide drinking water for downstream communities. These are not appropriate sites for radioactive waste disposal.

For the proposed WR-1 and NPD in-situ decommissioning projects, CNL shall demonstrate that the original approved decommissioning strategy cannot be carried out. Failing this, the original strategy of complete decommissioning shall be retained.

As noted by the IAEA, in-situ decommissioning creates a radioactive waste disposal facility on the original site. This raises environmental concerns because selection criteria for waste disposal sites are different from those used in siting nuclear reactors.

In 1984 the U.S. Nuclear Regulatory Commission issued a report on *Long-Lived Activation Products in Reactor Materials*. The report says that some reactor components



exceed limits for near-surface disposal. Some of the radioactive activation products in the structural materials of nuclear reactors are very long-lived:

- carbon-14 with a half-life of 5730 years,
- calcium-41 with a half-life of 103,000 years
- manganese-53 with a half-life of 3,700,000 years
- nickel-59 with a half-life of 76,000 years
- molybdenum-93 with a half-life of 4800 years
- niobium-94 with a half-life of 20,300 years
- technetium-99 with a half-life of 211,000 years

Reactor components are also generally contaminated with plutonium-239, which has a half-life of 24,100 years. This means that it will take almost a quarter of a million years for 99.9% of the Pu-239 atoms to disintegrate. And when those plutonium atoms do disintegrate, they do not disappear, but are transmuted into new radioactive uranium-235 atoms with a half-life of 700 million years.

What about the costs involved?

The report must be completed to include important information about the costs for the different solutions proposed. We know that a report about costs will be provided at the end of October 2012. Bu here are some suggestions.

What is the cost of the proper packages/containers to be used for the transportation and confinement of radioactive waste?

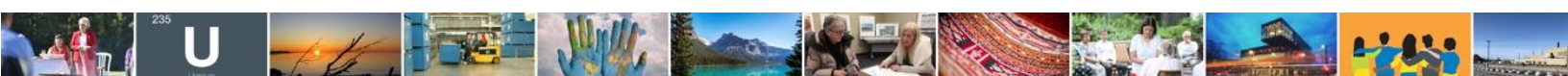
What is the projected cost of Rolling Stewardship?

What is the cost of a Deep Geological Repository with and without monitoring?

What is the cost of in-situ entombment compared to complete decommissioning?

What is the projected cost for SMR waste management?

Centralisation and decentralisation options should be analysed thoroughly after the costs will be defined.



Prepared by: CANDU'S Owner's Group

December 16, 2021

CANDU Owners Group Inc.

"Excellence Through Collaboration"

decays to a lower category for disposal. Proponents of new and advanced reactor technologies will continue to explore such opportunities.

The SMRTF acknowledges the commitment by the NWMO to receive all high-level waste produced in Canada requiring disposal. With respect to the low- and intermediate-level radioactive waste requiring disposal, the SMRTF notes that wastes from advanced reactor technologies may span a broader range of characteristics than that produced by CANDU nuclear power plants in Canada today. The SMRTF therefore requests that concepts being explored for management and disposal of low- and intermediate-level radioactive waste in Canada be flexible enough to accommodate an inventory with the wide range of characteristics envisaged by advanced reactor technology developers and proponents.

The SMRTF acknowledges that development of disposal capacity for low- and intermediate-level radioactive waste will take time and that the interim storage capacity for such waste will need to be accounted for in proposals for new and advanced reactor technology projects.

Sincerely,

Robin Manley
Vice President, New Nuclear Development, OPG &
Chair, CANDU Owners Group SMR Technology Forum (SMRTF)

COG SMRTF Members:

Bruce Power · Canadian Nuclear Laboratories / Laboratoires Nucléaires Canadiens · Énergie NB Power · Ontario Power Generation · SaskPower Powering the future

cc:
Heather Kleb, Bruce Power
Paul Thompson, New Brunswick Power
Ali Siddiqui, Canadian Nuclear Laboratories
Iain Harry, SaskPower
Sonia Iqbal, CANDU Owners Group
Carlos Lorencez, CANDU Owners Group

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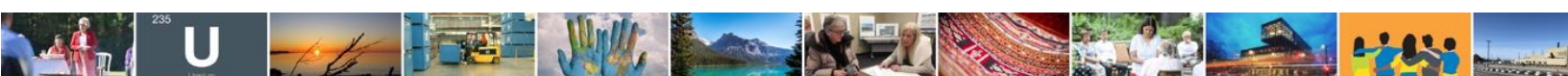

Prepared by: Atomic Energy of Canada Limited (AECL)

December 20, 2021

AECL Atomic Energy of Canada Limited EACL Énergie atomique du Canada limitée

UNRESTRICTED
ILLIMITÉE

2021 December 20

Record Number: DWM-1191345624-7764

Karine Glenn, P.Eng.
Strategic Project Director
Nuclear Waste Management Organization
22 St. Clair Avenue East, 4th Floor
Toronto, ON M4T 2S3

Re: Integrated Radioactive Waste Strategy for Canada

Dear Ms. Glenn,

In 2020, Natural Resources Canada (NRCan) launched a process to review and modernize Canada's Radioactive Waste Policy Framework. The Minister of Natural Resources subsequently asked the Nuclear Waste Management Organization (NWMO) to lead the development of an Integrated Radioactive Waste Strategy for Canada (which would exclude all projects currently in progress).

Atomic Energy of Canada Limited (AECL) has contemplated principles important for optimized radioactive waste management in Canada. This letter is therefore being submitted to the NWMO as an input for their work on this matter, to be considered alongside all the input received from their engagement activities. It should complement any other input provided by AECL as part of other engagement activities.

It is recognized that, as of the writing of this submission, NRCan is still in the process of reviewing and updating Canada's Radioactive Waste Policy Framework. For the purposes of this document, the current Radioactive Waste Policy Framework (1996) was used as an input and framework, including its main principle which states that radioactive waste owners are responsible for finding solutions for the management and disposal of their radioactive waste. As a waste owner, AECL takes its responsibilities seriously and is committed to working towards solutions that protect the public, workers, and the environment, and that offer best value to Canadian taxpayers. As we operate under a 'Government-owned, Contractor-operated' model, Canadian Nuclear Laboratories is currently responsible for the day-to-day management of our radioactive wastes on our behalf.

According to the direction provided to the NWMO by the Minister of Natural Resources, and for our planning purposes, we have excluded the following projects from our input as all are considered to be in progress:

- Low-level radioactive waste managed as part of the Port Hope Area Initiative in Ontario (this project is underway).
- Low-level radioactive waste that is planned to be disposed of in the proposed Near Surface Disposal Facility at the Chalk River site in Ontario (this project is undergoing an Environmental Assessment).
- Low and intermediate level waste that is planned to be disposed of in situ as part of the proposed WR-1 in situ disposal project at the Whiteshell site in Manitoba (this project is undergoing an Environmental Assessment).
- Low and intermediate level waste that is planned to be disposed of in situ as part of the proposed Nuclear Power Demonstration reactor situ disposal project in Ontario (this project is undergoing an Environmental Assessment).

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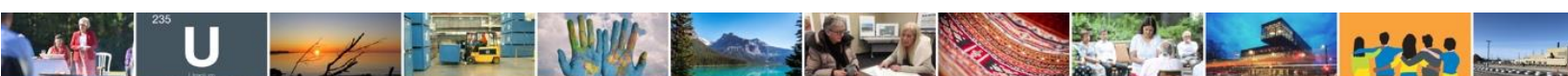


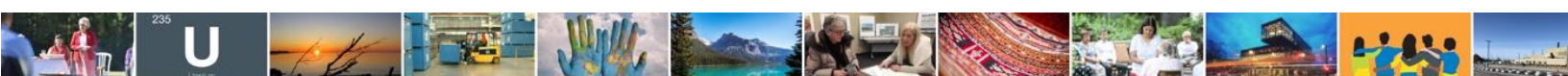
This means that all of our inventory of low-level radioactive waste is excluded from the scope of the Integrated Radioactive Waste Strategy, and that only the remaining intermediate-level waste (i.e. that which is not part of the WR-1 or Nuclear Power Demonstration reactor proposed in situ disposal projects) is being considered.

It is the view of AECL that the selection of a specific technology for disposal should be the responsibility of the project proponent. Choice of technology is not a matter of general preference, but very much influenced by the inventory under consideration, the site and geology, which leads to the development of a robust safety case that underpins the technology choice. The disposal facility is in fact a safety system that involves complex interplay between many features including the waste form, container, disposal facility engineered barriers and natural barriers associated with the geology and hydrogeology of the specific site. There are formal regulatory, siting and impact/environmental assessment processes that set the framework for the evaluation and comparison of concepts (covered under the sub-process of "alternative means") which include extensive engagement with the public and Indigenous communities.

The rigorous requirements of the *Canadian Environmental Assessment Act, 2012*, the *Impact Assessment Act* and licensing processes will provide the appropriate regulatory framework to assess the safety of any proposed facility, consistent with all the necessary national and international standards for safety to workers and the public, and protection of the environment.

AECL observes that there is a need to advance disposal projects in Canada to align with internationally accepted principles to not leave this burden to future generations, and to help with the social acceptance of nuclear activities, particularly in the context where Canada is considering new nuclear facilities such as small modular reactors. We would therefore recommend that any governance option considered as part of the Integrated Radioactive Waste Strategy consider the time to project implementation, with a view to minimizing it as much as possible. For instance, the facilitation of collaborative disposal projects between waste producers/owners where a facility could be proposed to receive radioactive waste for disposal from more than one organization could be a viable path forward.

As a responsible waste owner, consistent with the principles in the radioactive waste policy framework, AECL has been exploring disposal options for its intermediate-level waste. Options currently being looked at include other deep geological repository concepts suited to more modest volumes, including a "shaft" type concept that has been successfully implemented elsewhere and is anticipated to be both financially and technically feasible. AECL welcomes initiatives to identify and consider other options for disposal of its intermediate-level waste along with waste from other owners. Should a national solution be recommended, AECL would want to fully participate in a rigorous options analysis to ensure that options chosen can be technically and financially feasible, with a view to ensuring value for money for Canadian taxpayers. We would also note that AECL's inventory of intermediate-level waste spans a wide range of characteristics and is stored in a variety of approved containers. Flexibility will thus be needed in developing any industry-wide solutions so that ranges of waste forms and packages could be contemplated for acceptance.



Karine Glenn, P.Eng.
Strategic Project Director

UNRESTRICTED
ILLIMITÉE

Yours truly,

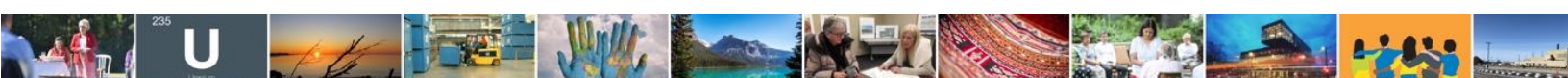
2021-12-22

X

Alastair MacDonald
VP, DWM
Signed by: Alastair Macdonald

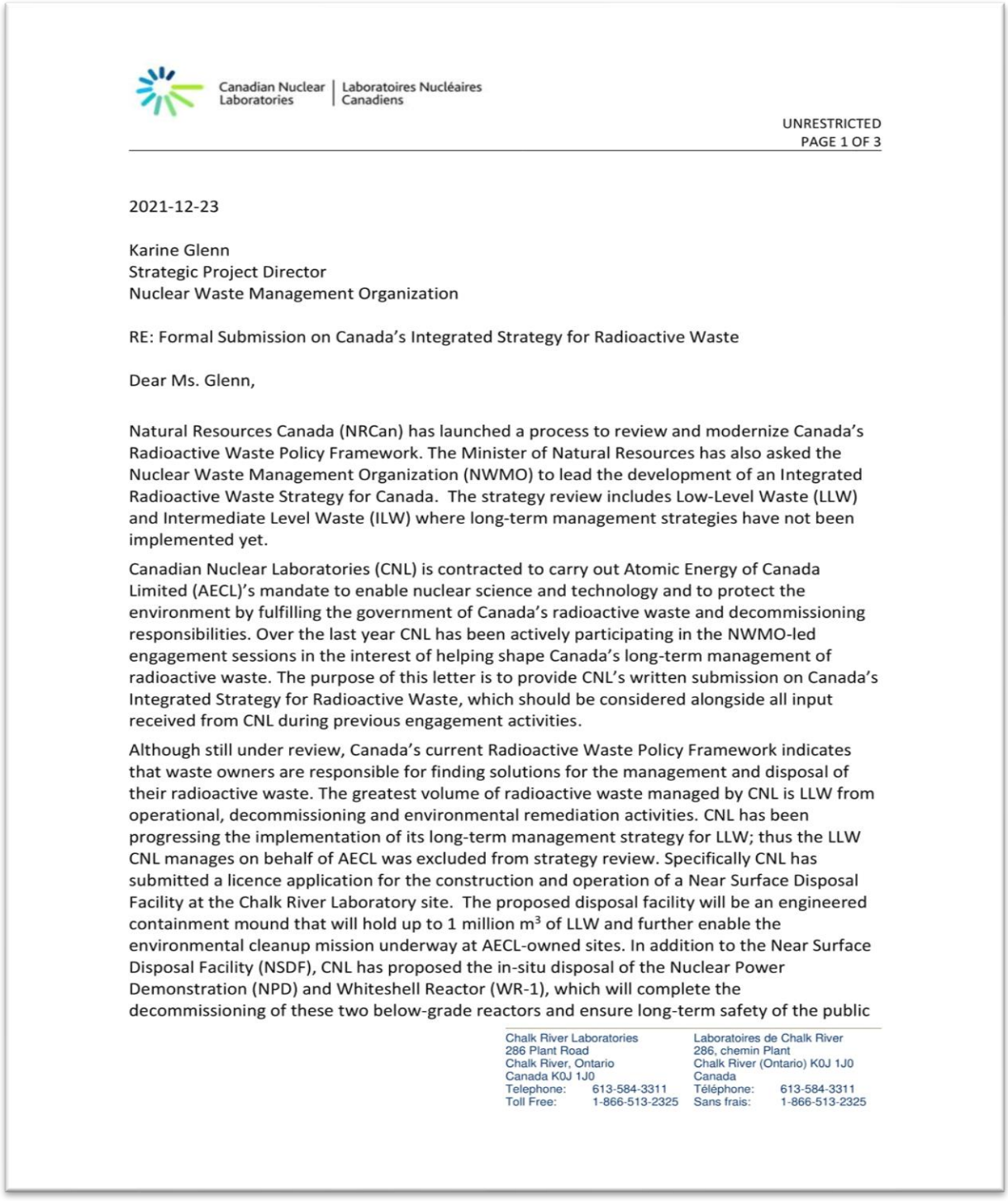
Cc:

Fred Dermarkar, AECL
Zack Smith, CNL
Paul McClelland, AECL
Meggan Vickerd, CNL
Maude-Émilie Pagé, AECL
Sarah Brewer, CNL



Prepared by: Canadian Nuclear Laboratories (CNL)

December 16, 2021



Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

UNRESTRICTED
PAGE 1 OF 3

2021-12-23

Karine Glenn
Strategic Project Director
Nuclear Waste Management Organization

RE: Formal Submission on Canada's Integrated Strategy for Radioactive Waste

Dear Ms. Glenn,

Natural Resources Canada (NRCan) has launched a process to review and modernize Canada's Radioactive Waste Policy Framework. The Minister of Natural Resources has also asked the Nuclear Waste Management Organization (NWMO) to lead the development of an Integrated Radioactive Waste Strategy for Canada. The strategy review includes Low-Level Waste (LLW) and Intermediate Level Waste (ILW) where long-term management strategies have not been implemented yet.

Canadian Nuclear Laboratories (CNL) is contracted to carry out Atomic Energy of Canada Limited (AECL)'s mandate to enable nuclear science and technology and to protect the environment by fulfilling the government of Canada's radioactive waste and decommissioning responsibilities. Over the last year CNL has been actively participating in the NWMO-led engagement sessions in the interest of helping shape Canada's long-term management of radioactive waste. The purpose of this letter is to provide CNL's written submission on Canada's Integrated Strategy for Radioactive Waste, which should be considered alongside all input received from CNL during previous engagement activities.

Although still under review, Canada's current Radioactive Waste Policy Framework indicates that waste owners are responsible for finding solutions for the management and disposal of their radioactive waste. The greatest volume of radioactive waste managed by CNL is LLW from operational, decommissioning and environmental remediation activities. CNL has been progressing the implementation of its long-term management strategy for LLW; thus the LLW CNL manages on behalf of AECL was excluded from strategy review. Specifically CNL has submitted a licence application for the construction and operation of a Near Surface Disposal Facility at the Chalk River Laboratory site. The proposed disposal facility will be an engineered containment mound that will hold up to 1 million m^3 of LLW and further enable the environmental cleanup mission underway at AECL-owned sites. In addition to the Near Surface Disposal Facility (NSDF), CNL has proposed the in-situ disposal of the Nuclear Power Demonstration (NPD) and Whiteshell Reactor (WR-1), which will complete the decommissioning of these two below-grade reactors and ensure long-term safety of the public

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and the environment. The validity of managing the LLW and ILW at these two reactors through this proposed approach is demonstrated through a robust safety case, and complies with all applicable regulatory requirements. CNL has also made significant progress on the Port Hope Area Initiative, which involves the cleanup of approximately 1.7 million m^3 of historic LLW from various sites in Port Hope and Port Granby. The historic LLW is being emplaced in engineered above ground mounds where the waste will be safely contained, with ongoing long-term monitoring and maintenance of the new facilities into the future.

Although CNL is currently implementing a long-term management strategy for all of the LLW it manages, as well as the NPD and WR-1 waste inventories, it has not yet progressed the development of an overall ILW disposal solution. Therefore the ILW that CNL manages on behalf of AECL is within scope of the NWMO strategy review. CNL's long-term forecast of the total volume of ILW continues to be refined through application of modern waste characterization and categorization practices as decommissioning and environmental remediation projects advance at AECL-owned sites.

CNL's experience in managing radioactive waste and in-depth knowledge gained on implementing long-term solutions that provides for the following considerations:

- **Disposal Technology Selection** – The selection of the disposal technology must be underpinned by an understanding of the waste inventory as well as influenced by the site characteristics. These components are critical to the development of a safety case in order to support the selection of the disposal technology. The disposal facility is a safety system that involves the interaction of many features including the waste form, package (if credited), engineered barriers, and natural barriers associated with the specific geology and hydrogeology of the site. Regardless of the design selected, safety must be demonstrated within the Canadian regulatory framework (i.e., there can be multiple solutions but all are safe). It may prejudice the regulatory review and approval processes for a future disposal facility if technology options are declared as preferred (or, alternatively, unsuitable) prior to having a clear understanding of the waste inventory (i.e., content and volume) and site characteristics.
- **Holistic Lifecycle Planning** – Until disposal solutions are available, waste owners are responsible for the safe storage and management of the radioactive waste streams they produce. One of Canada's strategic gaps in interim storage, is the uncertainty of timescales for disposal infrastructure availability, which can drive long storage timescales; thus robust waste packages and storage structures are needed. From CNL's perspective, a comprehensive waste strategy ensures the integration of the management of waste and better defines pathways for all managed wastes from generation to disposal. Furthermore, focusing solely on the disposal stage of radioactive waste neglects the opportunity for optimization and integration with the waste generators. Although the benefit is recognized, many waste owners do not currently package radioactive waste with disposal in mind. This

is primarily because the waste acceptance criteria for a future repository have yet to be established.

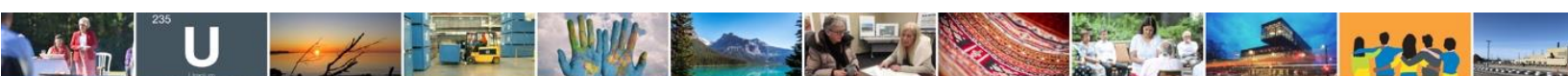
- **Building Confidence by Demonstrating Solutions -** There is a general desire to keep the number of waste repositories to a minimum, thus the option for co-disposal, either by waste category or waste owner, should be explored. Furthermore, the strategy should be flexible enough for collaboration with or among waste owners, should a national repository be a desirable outcome. Progression toward a disposal solution needs to be efficient such that the waste owners do not continue to experience further delay in having a defined pathway for long-term management. Any additional delay for a repository results in additional resources for handling and management of another generation of radioactive waste. Overall this has the potential to reduce confidence in the nuclear industry to address our "waste problem".

CNL appreciates the opportunity to provide input to NWMO and to participate in engagement activities such as the Radioactive Waste Summit as well as the roundtables and technical sessions held over the past year.

Regards,
Kristan Schruder on behalf of,

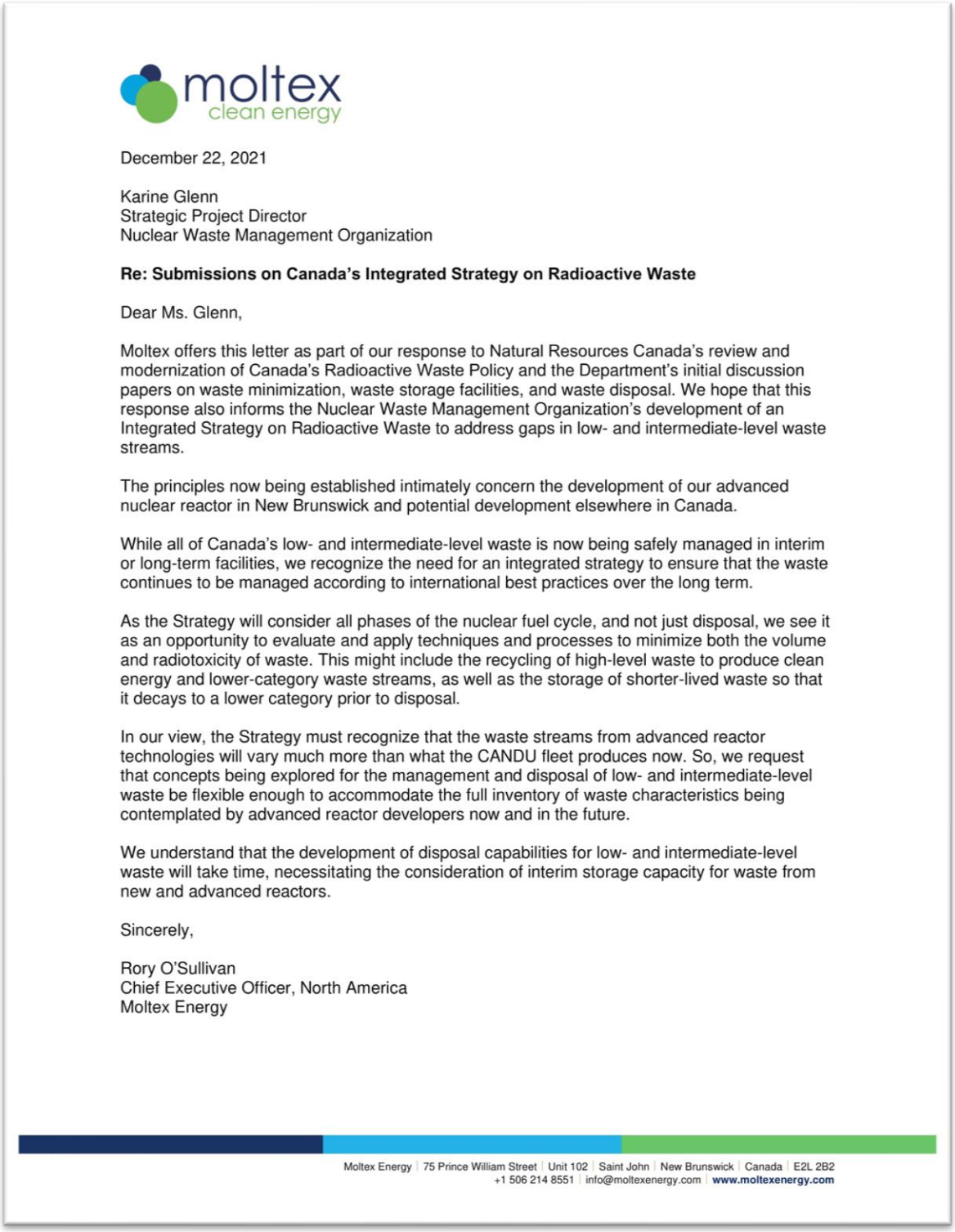
Zack Smith,
VP, Stewardship & Renewal Group

Cc:
Meggan Vickerd (CNL)
Sarah Brewer (CNL)
Ryan Clarke (CNL)
Fred Dermarkar (AECL)
Alastair MacDonald (AECL)
Paul McClelland (AECL)



Prepared by: Moltex Clean Energy

December 22, 2021



moltex clean energy

December 22, 2021

Karine Glenn
Strategic Project Director
Nuclear Waste Management Organization

Re: Submissions on Canada's Integrated Strategy on Radioactive Waste

Dear Ms. Glenn,

Moltex offers this letter as part of our response to Natural Resources Canada's review and modernization of Canada's Radioactive Waste Policy and the Department's initial discussion papers on waste minimization, waste storage facilities, and waste disposal. We hope that this response also informs the Nuclear Waste Management Organization's development of an Integrated Strategy on Radioactive Waste to address gaps in low- and intermediate-level waste streams.

The principles now being established intimately concern the development of our advanced nuclear reactor in New Brunswick and potential development elsewhere in Canada.

While all of Canada's low- and intermediate-level waste is now being safely managed in interim or long-term facilities, we recognize the need for an integrated strategy to ensure that the waste continues to be managed according to international best practices over the long term.

As the Strategy will consider all phases of the nuclear fuel cycle, and not just disposal, we see it as an opportunity to evaluate and apply techniques and processes to minimize both the volume and radiotoxicity of waste. This might include the recycling of high-level waste to produce clean energy and lower-category waste streams, as well as the storage of shorter-lived waste so that it decays to a lower category prior to disposal.

In our view, the Strategy must recognize that the waste streams from advanced reactor technologies will vary much more than what the CANDU fleet produces now. So, we request that concepts being explored for the management and disposal of low- and intermediate-level waste be flexible enough to accommodate the full inventory of waste characteristics being contemplated by advanced reactor developers now and in the future.

We understand that the development of disposal capabilities for low- and intermediate-level waste will take time, necessitating the consideration of interim storage capacity for waste from new and advanced reactors.

Sincerely,

Rory O'Sullivan
Chief Executive Officer, North America
Moltex Energy

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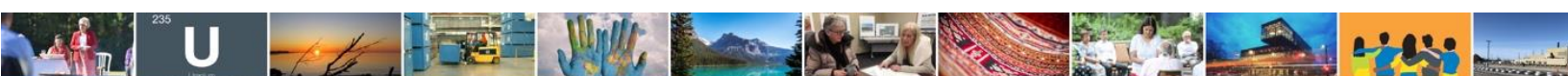

Prepared by: Durham Region

January 12, 2022

Sent Via E-mail

DURHAM REGION

January 12, 2022

Karine Glenn
Strategic Project Director
Nuclear Waste Management Organization
22 St. Clair Avenue East, 4th Floor
Toronto, ON M4T 2S3 Canada

Re: Canada's Integrated Strategy for Radioactive Waste (ISRW)

The Regional Municipality of Durham

Office of the Chief Administrative Officer

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durham.ca

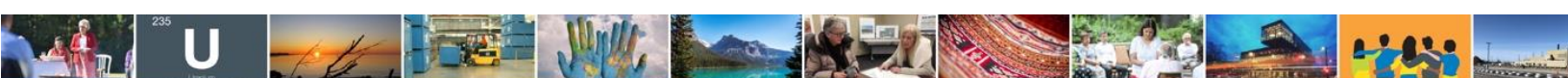
Elaine Baxter-Trahair
B.M.Edu.,MBA
Chief Administrative Officer

Dear Ms. Glenn,

As an upper-tier municipal government with eight local area municipalities, Durham Region is a proud and supportive host community to two nuclear generating stations: the Darlington Nuclear Generating Station and the Pickering Nuclear Generating station. As you know, Ontario Power Generation (OPG) has proposed to build Canada's first on-grid SMR on the Darlington site. In addition to the waste stored at the generating stations, there is additional storage at three licenced facilities in Durham: the Port Granby Long-Term Radioactive Waste Facility; the Darlington Waste Management Facility; and the Pickering Waste Management Facility. Over our long history as a nuclear host community, the Region has benefitted from strong collaboration. In December 2021, Regional Council approved a strategy to guide our participation in the nuclear sector. You will receive a copy of the final strategy, once it is available. A key priority is seeking new opportunities to work in partnership with other levels of government, Indigenous communities, industry, and academia to seize opportunities.

For context, the Region has been engaged in the Nuclear Waste Management Organization's (NWMO) consultations on storing Canada's radioactive waste since 2003. In 2021, Regional staff contributed to the development of Canada's Integrated Strategy for Radioactive Waste by participating in the spring 2021 Canadian Radioactive Waste Summit, as well as several of the technical workshops hosted by the NWMO.

If you require this information in an accessible format, please contact Accessibility Coordinator or call 1-800-372-1102 extension 2009.

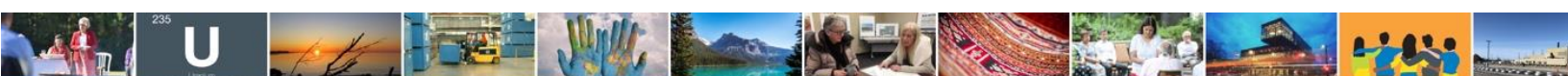


During the Summit, participants were asked to propose principles to guide radioactive waste management in Canada. Consistent with the Region's submission to the NRCan policy review and for your quick reference, the following key principles are recommended:

a) Clear language and communication as the foundation of trust and transparency
b) Scientifically sound, evidence-based decision-making
c) Free, prior, and informed consent of host communities
d) Host communities are engaged in the project as respected partners (e.g., through shared decision-making)
e) Waste management strategies are identified during the design process for new nuclear technologies and developed concurrently with the technology
f) Human health and environmental stewardship are prioritized (e.g., do no harm, precautionary principle, protect the future)
g) Polluter pays for environmental damages and waste management solutions
h) Accountability through independent, multi-disciplinary oversight

In its submission to NRCan, Durham Regional Council recommended that Canada's updated and improved radioactive waste policy should provide:

1) Formal recognition of host jurisdictions as respected partners in delivering solutions for radioactive waste and in managing the decommissioning process
2) Guidance for federal nuclear agencies and owners/operators of nuclear facilities on how and when to engage with host jurisdictions in accordance with the policy principles
3) Protection of host community well-being (health, social, economic and environmental) as a priority across all phases of a project that creates radioactive waste
4) Federal funding for Durham Region, the Municipality of Clarington, the City of Pickering and the Canadian Association of Host Communities (CANHC) to support additional activities required of a nuclear host community and their participation in future licensing processes
5) Mechanisms to compensate nuclear host communities for hosting radioactive waste on an interim or long-term basis
6) Clear definitions of interim storage and long-term storage
7) Federal support in advance of plant closure, during safe storage and during decommissioning phases to mitigate economic impacts and assist the host community with economic diversification and renewal
8) Meaningful engagement of existing nuclear host communities in the discussions about options for long-term waste management, including transportation methods and routes
9) A mechanism for licensing decisions to consider the need for social licence and assess socio-economic impacts on the host jurisdictions



10) Management of nuclear waste as a consideration throughout the facility life cycle of a nuclear project from the earliest stages, designing for minimization and reduction from the outset, and
11) A focus on development of nuclear waste expertise to position Canada as a global leader and capable of capturing the international economic opportunities and addressing climate change goals.

The Region also provided comments and recommendations on NRCan's discussion papers that are relevant to the development of the Integrated Strategy for Radioactive Waste, including the waste storage facilities discussion paper, decommissioning discussion paper, and waste disposal discussion paper. We invite NWMO to review the Region's comments and recommendations, as appropriate, and our staff would be pleased to discuss these with you at any time.

As a region, we are preparing for key decisions anticipated on the site of Canada's DGR, the deployment of new nuclear generation, and the management of radioactive waste. We believe the NWMO continues to have an opportunity to shift the focus from solving a waste disposal issue to one of putting Canada at the forefront of developing and delivering this technology. As a premier nuclear jurisdiction in Canada, we invite you to continue to engage regularly with Durham Region and other nuclear host communities on these opportunities.

I look forward to an ongoing dialogue and partnership on these important issues.

Sincerely,

Sandra Austin

Director, Strategic Initiatives
Office of the Regional Chair and CAO

sandra.austin@durham.ca

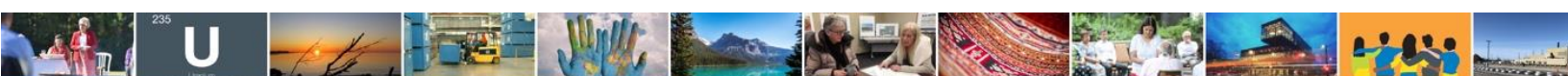
Appendix B – Promotion of Formal Submissions

Methodology, Parameters and Results

Formal Submissions were accepted as alternate way to provide input on the Integrated Strategy for Radioactive Waste. The process of submitting a submission was open to all Canadians and Indigenous peoples and could be made as an individual or on behalf of an organization. Submissions were accepted through the ISRW website, as well as by email (until December 31, 2021).

Emails and Owned Social Media

As it was important to encourage wide participation, the NWMO used various outreach and promotional tools, including social media (owned) and emails to ISRW distribution lists, to reach out to interested Canadians and Indigenous peoples to raise awareness of the Formal Submissions process and deadline (as well as deadline extension).
The NWMO also shared social media posts across their owned channels, with four owned social media posts in both English and French on Facebook and Twitter.



Glossary of Terms (Nuclear Waste Management)

Bulk Material: Material that is granular in nature, such as soil, demolished concrete, or construction/demolition waste.

Concrete Vault: Concrete vaults are a type of engineered near surface disposal facility widely used around the world for the disposal of low-level radioactive waste (LLW). Concrete vaults look like large concrete boxes and a repository would be made up of a series of these. Each one would have its own drainage system and an 'earthen cover system' engineered from multiple layers of soil and with grass or other plants growing on top. This disposal method can be used in a wide variety of soil conditions. It is also modular in its design, which means that additional vaults can be added to increase its capacity as needed.

Deep Borehole: Deep borehole disposal is an emerging technology for waste that requires isolation for more than a few hundred years. It may be suitable for the disposal of small volumes of intermediate-level waste (ILW). The series of narrow boreholes are created to a depth of about 500 to 1000 metres into which waste packages would be lowered, creating a stack deep underground.

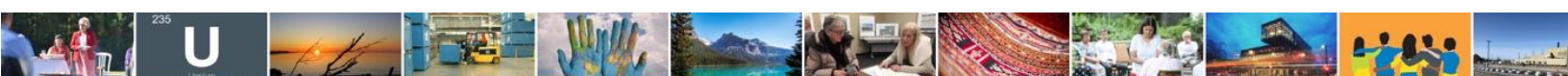
Deep Geological Repository (DGR): A deep geological repository typically consists of a network of underground tunnels and placement rooms for radioactive waste constructed several hundred meters below the surface. Repositories are designed to use a system of multiple barriers: engineered barriers such as waste containers and natural barriers like the rock itself work together to contain the waste and isolate it from people and the environment.

Disposal: The placement of radioactive waste without the intention of retrieval.

Engineered Containment Mound (ECM): Engineered containment mounds are a type of engineered near surface disposal facility that sees waste packages placed on a waterproof base and then covered over with thick layers of natural materials such as clay and soil. Layers of synthetic materials such as high-density polyethylene are also incorporated to prevent release of radiation to the environment. These facilities usually have wastewater collection and treatment systems as well. ECM is suitable for low-level waste which will not reduce in volume or compact over time.

High-Level Waste (HLW): High-level radioactive waste is primarily used nuclear fuel and/or is waste that generates significant heat via radioactive decay. HLW is associated with penetrating radiation, thus shielding is required. HLW also contains significant quantities of long-lived radionuclides necessitating long-term isolation. Placement in deep, stable geological formations at depths of several hundred metres or more below the surface is recommended for the long-term management of HLW.

Intermediate-Level Waste (ILW): Intermediate-level radioactive waste is generated primarily from power plants, prototype and research reactors, test facilities, and radioisotope manufacturers and users. ILW generally contains long-lived radionuclides in concentrations that require isolation and containment for periods greater than several hundred years. ILW needs no provision, or only limited provision, 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. Waste in this class may require disposal at greater intermediate depths of the order of tens of metres to a few hundred metres or more.

Long-Term Management: The long-term management of radioactive nuclear waste by means of storage or disposal.

Low-Level Waste (LLW): Low-level radioactive waste comes from operating reactors and from medical, academic, industrial, and other commercial uses of radioactive materials. LLW contains material with radionuclide content above established clearance levels and exemption quantities (set out in the *Nuclear Substances and Radiation Devices Regulations*), but generally has limited amounts of long-lived activity. 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.

Radionuclide: A material with an unstable atomic nucleus that spontaneously decays or disintegrates, producing radiation. Nuclei are distinguished by their mass and atomic number.

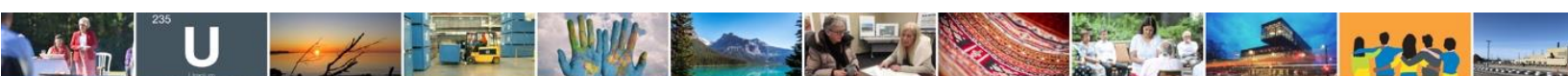
Rolling Stewardship: Rolling stewardship is an approach to managing radioactive materials for which there is no disposal solution in the near term. Under rolling stewardship, the radioactive waste is stored on the surface where human controls can safely contain, isolate, monitor, and secure it for many generations indefinitely i.e., roll the radioactive waste forward from generation to generation (a succession of stewards). This concept assumes that technology will eventually resolve the problem for the long-term management of the waste, potentially by destroying or neutralizing it.

Shallow Rock Cavern: The shallow rock cavern is an engineered near surface disposal method sometimes used for the disposal of low-level waste, or low- and intermediate-level waste (LLW or L&ILW). A series of rock caverns are excavated at a nominal depth of 50 to 100 meters below the surface in low permeability rock. They are accessed from the surface by a small system of ramps and tunnels

Small Modular Reactors (SMR): SMRs are advanced reactors that produce electricity of up to 300 MW(e) per module, which is less than current power generation reactors.

Waste: In the context of the What We Heard report, waste is assumed to be a radioactive waste unless specified otherwise (e.g., non-nuclear waste).

Waste Owner: The radioactive waste owner is the organization currently responsible for the radioactive waste.



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