

Moving forward together

An invitation to review a
draft planning framework
for the transportation of
used nuclear fuel



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Invitation from Laurie Swami

NWMO President and CEO

Canada's plan for the safe, long-term management of used nuclear fuel calls for its central containment and isolation in a deep geological repository for the very long-term. Sometime in the 2040s, once a facility is operational, the Nuclear Waste Management Organization (NWMO) will begin transporting used fuel from interim storage facilities to the repository.

Informing this work is the knowledge that our transportation solutions are technically sound and that we can do this safely. What we respectfully seek is public input and advice on how our transportation plan can best reflect Canadian and Indigenous peoples' values and priorities.

Canadians and Indigenous peoples have consistently told us that the transportation of used nuclear fuel must take place in a safe and environmentally sound manner. Currently, we are working with municipalities and Indigenous communities to identify a single, preferred location for the deep geological repository, to be located in an area with informed and willing hosts. We expect to identify this single, preferred location in 2023.

No matter the location, used nuclear fuel will need to be transported long distances, past communities and through traditional territories to arrive at a central location for its containment and isolation for many generations to come.

What follows is the next part of an ongoing journey where we will examine, discuss and engage with communities and those interested in Canada's plan to ensure we are incorporating public feedback, technical and scientific innovation, and international best practices. All with the goal to protect people and the environment, which is at the core of Canada's plan.

This document outlines what we have heard over the course of thousands of conversations on transportation. Building on this input, we have also outlined potential elements of a transportation plan that is reflective of these conversations to date.

I invite you to review the framework, identify where we have listened well, and what additions and changes need to be made. We hope you will join the discussion as we continue to develop Canada's plan together.



1. The task ahead

Within the next 25 years, the NWMO will start to move Canada's used nuclear fuel from licensed interim storage facilities to a deep geological repository. There, it will be contained and isolated for the long period of time it remains hazardous, protecting people and the environment for generations to come.

This used fuel transportation program is part of Adaptive Phased Management (APM), Canada's plan for the safe, long-term management of used nuclear fuel. Although used fuel will not be transported to the repository for many decades, it is not too early to begin planning for this important step.

During the past several years, the NWMO has been leading a dialogue with interested Canadians, Indigenous peoples and organizations to develop a planning framework for this next phase of Canada's plan. With this document, we describe the framework that is emerging through this dialogue, as well as a proposed approach to implementing it. We invite you to join the discussion as we review and continue to shape the plan together.

2. Our shared responsibility

During the last 50 years, we have drawn power on a large scale from nuclear energy. One of the by-products of this electricity production is used nuclear fuel, a solid material that is hazardous and needs to be contained and isolated from people and the environment, essentially indefinitely.

Used nuclear fuel is currently managed in licensed storage facilities, many of which are located at nuclear power plant sites. This storage is interim and requires active care to maintain. The concrete and steel containers that currently contain the used nuclear fuel need to be replaced every 50 to 100 years, and the buildings in which these sit need to be continuously monitored and maintained.

Canada's plan puts in place a long-term management plan that will safely and securely contain and isolate used nuclear fuel in a passive manner – a manner that does not require future generations to take care of a waste they did not produce or benefit from. Canadians have said it is unfair to put the responsibility for taking care of this waste on to future generations when we have the knowledge, capacity and resources to safely and securely put in place a long-term management plan today.

We are well on our way to implementing that plan. Planning for the transportation of used nuclear fuel is the next step.

Canada's plan

APM moves towards a goal that Canadians themselves identified: safe, secure, long-term containment and isolation of used nuclear fuel produced in Canada, with flexibility for future generations to refine the approach, and adapt to experience and societal changes.

Canada's plan involves placing our country's used nuclear fuel in a deep geological repository in a suitable rock formation using a multiple-barrier system. A fundamental tenet of Canada's plan is incorporating learning, including Indigenous and Traditional Knowledge, at each step to guide a process of phased decision-making. APM is designed to be flexible and responsive to new learning, societal priorities and evolving public policy.

Developing the long-term management facility for Canada's used nuclear fuel is a national infrastructure project. The facility will be sited in an area with informed and willing hosts. Canada's plan was developed through discussions with a broad cross-section of people nationwide.

Site selection

Since 2010, the NWMO has been working collaboratively with interested communities to identify a single site where Canada's used nuclear fuel can be contained and isolated over the long-term.

Twenty-two communities initially came forward to learn about the project and explore the potential to host it in their area. A series of increasingly detailed studies to assess potential to meet the project's rigorous technical, safety and social requirements have informed a gradual narrowing down process.

Current work focusses on two remaining siting areas that have strong potential to meet the requirements of the project. We are advancing detailed technical and social studies and continuing dialogue with First Nation, Métis and municipal communities in these areas to support learning about the project and a process of shared decision-making.

We expect to select a single, preferred site in 2023.

Partnership

We are implementing the site selection process using a partnership approach. Engagement, dialogue and collaboration help ensure that any community and area that is selected to host this facility is both informed about the project and willing to host it.

Ultimately, the preferred repository site will be one that can safely and securely contain and isolate used nuclear fuel for the time period required. The project will only proceed with interested municipalities, First Nation and Métis communities, and surrounding communities working in partnership to implement it.

Transportation

Transportation of used nuclear fuel is an important component of APM. Used nuclear fuel is currently safely stored in facilities licensed by the Canadian Nuclear Safety Commission (CNSC) at or near sites where it is produced. Placing all of Canada's used nuclear fuel in a single location will require transportation from these interim storage facilities to the deep geological repository.

Transportation will involve placing these solid used fuel bundles in a transportation package that is specially designed to protect people and the environment during transportation, including in accident conditions. These transportation packages will be transported by road and/or rail, depending on the location chosen for the deep geological repository.

Transportation of radioactive material is a well-established practice with a strong track record of safety. Transportation of used nuclear fuel is subject to stringent regulation and oversight. The NWMO will need to demonstrate to regulatory authorities and the public the safety and security of any transportation system before transportation to the repository can begin.

APM transportation is expected to begin in the 2040s and take about 40 years to complete.

A few facts at-a-glance

- Used nuclear fuel is a by-product created when nuclear power plants generate electricity. It remains radioactive for a long period of time, and must be contained and isolated from people and the environment, essentially indefinitely. CANDU used nuclear fuel (the fuel used by Canadian reactors) is not a liquid or a gas – it is a solid. It is not flammable, fissile or explosive.
- At the end of 2019, Canada had approximately 2.9 million used fuel bundles in temporary storage. If Canada's existing reactors operate to the end of their planned lives, including planned refurbishment, the inventory of used fuel that will need to be shipped to the repository could be about 5.5 million bundles.
- Canada's plan was developed for managing only Canada's used nuclear fuel. No used fuel from outside Canada will be placed in the APM repository.
- There is a great deal of experience in the safe movement of used nuclear fuel and other radioactive material both in Canada and around the world. In over 50 years, there have been more than 20,000 shipments worldwide of used nuclear fuel using road, rail and water transport without serious injuries, health impacts, fatalities or environmental consequences attributable to the radiological nature of the shipments.
- When the repository begins operation many years from now, used nuclear fuel will be delivered to the repository site at a rate that allows it to be placed in the repository as it is received.
- The transportation program may involve use of road ways, railways, or a combination depending on the site selected to host the repository.
- The transportation program is expected to extend over approximately 40 years or more, based on current anticipated volumes from nuclear facilities. If an all-road approach were taken, this might involve about 620 truck shipments each year, approximately one-to-two shipments per day. If an all-rail approach were taken, this might involve about 60 train shipments each year, approximately one shipment every six days.

3. Towards a shared vision: conversations about transportation

Planning and implementing the transportation program is an important component of APM, one that will require a shared vision. During the past several years, the NWMO has been leading a dialogue with interested individuals, organizations and municipal, First Nation and Métis communities to develop a framework to support this planning. A shared vision is emerging from these conversations. It has been an interesting and constructive journey.

The NWMO has been part of thousands of conversations as part of the process of learning about and reflecting on the transportation of used nuclear fuel and requirements of any socially acceptable APM transportation plan. People have often begun conversations by expressing fear, concern and opposition to even engaging in the discussion. We often heard, “No one asked my permission to create this waste in the first place,” “Dump it in your own backyard!” and “You are talking about a mobile Chernobyl.” However, as they learned more, people moved beyond their initial fear of asking questions, examining facts, and beginning to build a shared vision for how we might move forward together.

We have heard people reflect on our shared responsibility as a society for managing the used fuel we have created. When people begin to learn about our technical capacity to safely transport this material, and the fact that it exists today and has been around for about seventy years, often they move beyond their initial fear to then considering and addressing this challenge.

There are many aspects of a planning framework where, together, we appear to have strong agreement. There are other aspects on which we don’t all agree and need to talk further together. However, our many areas of agreement form a strong foundation to begin planning and continue those discussions.

The purpose of this document is to outline the shared vision and the questions that still need to be addressed, emerging from discussions with individuals, organizations and First Nation, Métis and municipal communities. Let’s continue the conversation and further refine this vision together.



The dialogue process 2016 - 2019

The NWMO posed five key questions to encourage dialogue. These were the questions raised by communities already engaged in learning about the project and the site selection process, and the focus of their ongoing conversations. Encouraging dialogue on these questions was designed to ensure that the starting concepts, issues and framework for transportation planning and decision-making comes from the public, Indigenous peoples and communities.

The emerging framework described in this document was distilled from what we heard through these conversations. For more detail about these discussions, see “Planning Transportation for Adaptive Phased Management: Dialogue to date” (available at www.nwmo.ca/Transportation).

- Question 1** What basic requirements or factors should form the starting foundation for the APM transportation plan?
- Question 2** Which objectives, principles and key questions should guide development of an APM transportation plan?
- Question 3** How can we ensure the design and implementation of the APM transportation plan is sufficiently inclusive to ensure good decisions are made?
- Question 4** What information will we need from technical specialists to develop the plan and support decision-making?
- Question 5** What factors should be considered in future decisions about modes and routes?



4. The framework emerging from dialogue

Over the course of the dialogue (2016 – 2019), we observed there are objectives, principles and expectations people appear to share when it comes to thinking about a framework for transportation planning. These areas of common ground are the starting point for the framework and are outlined in the discussion that follows.

We also heard from people about the challenges they see ahead, which will require us to work together over the coming years to develop ways to address them. Underlying this discussion, we heard a strong commitment to the importance of successfully implementing Canada’s plan, including the transportation program, and acknowledgement that hard work will be needed to engage broadly and find a way to work together. We heard that there is much work to be done. It is going to take time.



a. Basic requirements – what needs to be considered in transportation planning?

In developing a transportation plan, we heard that the plan will need to address several key areas.

Safety is first and foremost on this list, and in this respect we need to consider the public, workers and the environment.

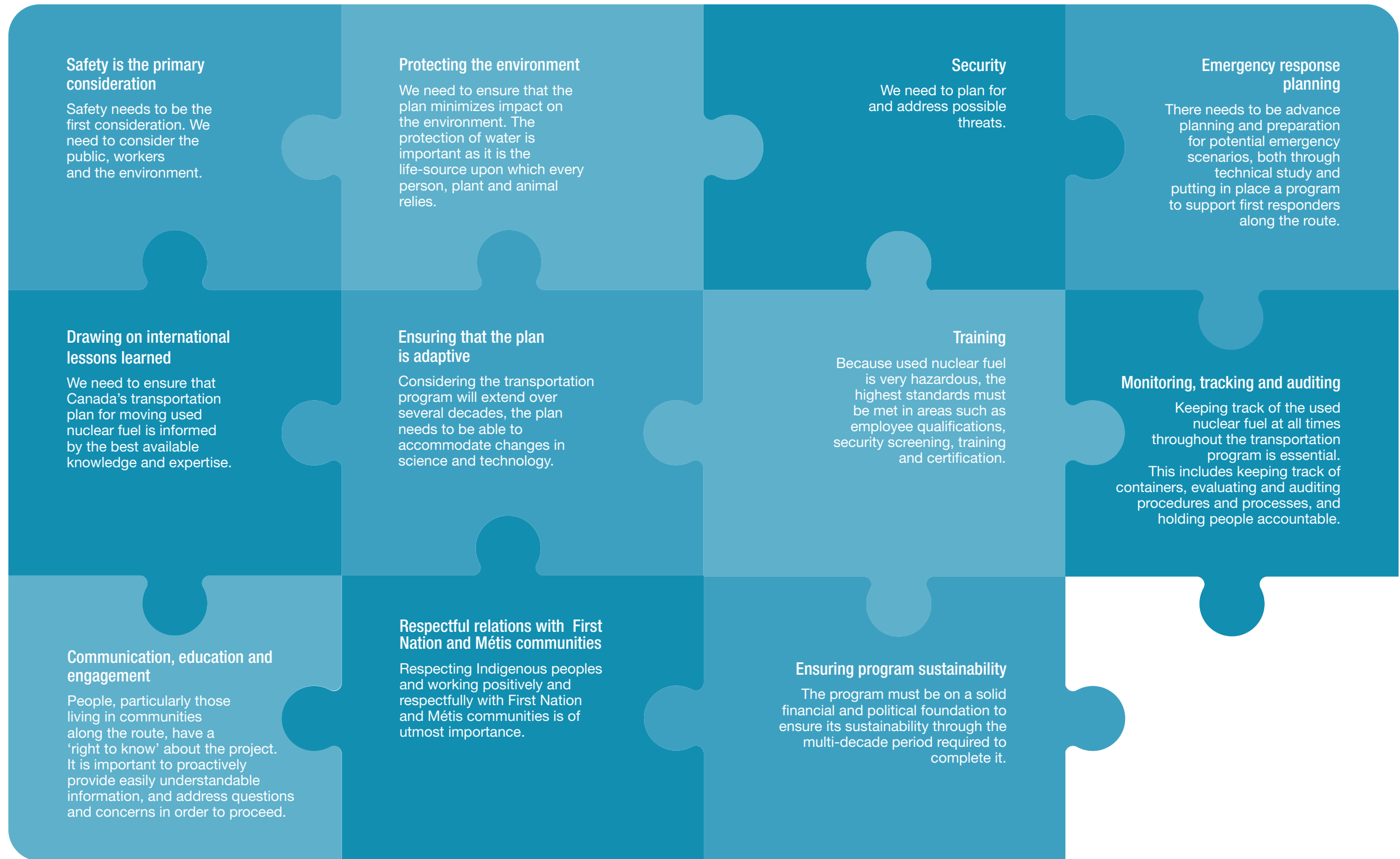
Beyond ensuring safety, minimizing impact on the environment is also considered key. This includes protecting water as the foundation for all life.

Planning for, and addressing, threats to security and potential emergency scenarios is important, as is adopting best practices for training, monitoring, tracking and auditing.

Ensuring that the program is both adaptable and sustainable is considered important to the successful completion of the transportation program given its long duration.

We heard that people have a basic ‘right to know’ about Canada’s plan and the transportation program, and proactive communication will be key to building awareness and confidence in the program. This is often balanced by an understanding that some details must be kept confidential for security reasons.

Engagement of First Nation and Métis communities that may be affected by the program is considered very important, given historical wrongs in Canada’s history and a desire to build more positive relationships going.



b. Objectives and principles

Through our ongoing dialogue we've heard the planning framework must be driven from objectives and a set of guiding principles that reflects the perspectives of Canadians and Indigenous peoples. These objectives and principles build on the basic requirements. The discussion that follows outlines what we heard.

Planning objectives

Protect the public and workers: Eliminate or minimize hazards associated with the transportation of used nuclear fuel. Safety and security form the umbrella under which all other objectives and principles must be considered. Safety includes protection of the public, workers and the environment from potential hazards associated with managing and transporting used nuclear fuel.

Security: Ensure the security of facilities, materials and infrastructure. Security is intimately related to safety but must be considered separately. The risk of malicious threat must be considered, factored in to planning and addressed in order to ensure public confidence. The plan must ensure the security of facilities, materials, infrastructure, workers and the public while transporting used nuclear fuel.

Protect the environment: Ensure that the environment is protected. We need to understand our potential impact on the environment and put in place plans to manage, if not minimize it. This includes risks to the environment through "spills," greenhouse gas emissions (carbon footprint associated with transporting the fuel) and other impacts (e.g., from improvements to transportation infrastructure). Events such as forest fires, snow storms and tornadoes that could impact transportation also need to be considered. Protecting water is very important.

Relationship with First Nation and Métis communities: Build respectful relationships with Indigenous peoples. Working positively and respectfully with First Nation and Métis communities, and understanding their unique perspectives, values and priorities is considered of utmost importance. The plan must also respect the constitutional rights of Indigenous peoples, reflect treaties, and consider that there may be unresolved claims between Indigenous peoples and the Government of Canada.

Project finances: Ensure economic sustainability of the project, without compromising safety, security and the environment. There must be financial surety in place in order to be confident that the full transportation program will be completed, and, over time, safety will not be compromised because of lack of funds. This includes a secure source of funding, and confidence there is sufficient funding to avoid the need to increase electricity rates and/or taxes in the future to cover costs.

Guiding principles

Safety: Safety should be the overarching principle guiding all APM planning and activities. Safety, security, and protection of people and the environment are central and must not be compromised by other considerations.

Regulatory requirements: Meet or exceed regulatory requirements for the protection of health, safety and the security of people and the environment. The plan must meet, and if possible exceed, all regulatory standards and requirements and respect Canada's international commitments on the peaceful use of nuclear energy.

Transparency is the key to building trust: Information used to make decisions about transportation planning must be readily available to the public. The NWMO must be transparent in its approach to its work, including its interaction with the public (e.g. in communicating potential risks). Transparency is understood to be key to gaining public trust, and therefore advancing the program. Information used to make decisions about transportation planning must be made public and readily available (e.g., transportation package certification, selection of transportation mode).

Balancing adaptability and continuity: The transportation plan needs to be flexible to continuously incorporate new learning, while maintaining continuity throughout changes in government. The planning framework must ensure that the transportation plan is flexible enough to continuously incorporate the latest and best science and technology, and provide continuity throughout the project; particularly with respect to project finances and changes in government. The program must be able to respond to changes in the regulatory framework, technology or infrastructure.

Evidence-informed decision-making: The plan must be informed by the best relevant available knowledge. This includes science, social science, local knowledge, Indigenous and Traditional Knowledge, and ethics. Knowledge holders in these areas need to be part of decision-making and involved in the process.

Incorporating Indigenous and Traditional Knowledge: Ensuring the insight from Indigenous Science, Traditional Knowledge and ways of life is interwoven throughout is important for a strong plan. This includes knowledge about the land and ecology. It also includes knowledge about developing and maintaining effective and meaningful relationships.

Responsible project management: The plan must be managed in a fiscally responsible way so that the cost of the project does not become a burden to current ratepayers or future generations. This will also provide confidence that future safety will not be compromised for cost considerations.

Informing and engaging: People, particularly those living in communities along the route, have a 'right to know' about the project and feel confident in its safety. It is important to proactively provide easily understandable information, and address questions and concerns, in order to proceed. Information needs to be provided at multiple levels of detail, from short descriptions that are easily understood by a lay audience to detailed technical reports for those who wish to review the findings in more depth.

c. Ensuring safety

Over the course of discussions, people talked a great deal about how they think about safety and how it needs to be addressed in transportation planning. Based on what we heard, a few factors are central to the public's vision and understanding.

First and foremost, a holistic approach is needed for safety that considers the public, workers and the environment (e.g. delicate ecosystems, animals, plants, water, and air). One Indigenous participant captured this sentiment in saying that he doesn't make a distinction between nature and people. So if one is hurt, all are hurt; we are all part of nature. This understanding of the need to 'look at the whole' was echoed in various ways by many people across the many discussions and appears to be a fundamental underpinning and point of agreement.

We heard that to ensure safety we need to take into account both radiation and non-radiation related impacts. For instance, we heard that measures are needed to protect people and the environment from the release of radioactive materials, and also from other impacts associated with the transportation program, such as greenhouse gas emissions. We need to consider the potential for injury from conventional traffic accidents, which may be influenced by the poor state of some roads. We also need to consider the risk of public inconvenience, for instance the potential for used nuclear fuel transportation to impact the flow of traffic, to slow traffic or contribute to traffic congestion, detours, wear and tear of roadways, and road closures.

Over the course of the discussions, we heard about the important role of science, including Indigenous Science, and evidence-based decision-making in the development and implementation of the transportation plan. We heard these technical specialists have a role to play in helping to build awareness and understanding of the program and broad public confidence in safety and readiness to proceed.

In discussions, people underlined three key streams of work they consider important to begin to establish safety:

- » Ensuring a strong scientific and technical foundation for the plan to ensure best knowledge and expertise informs the plan;
- » Ensuring a comprehensive testing program; and
- » Ensuring a strong program of regulatory oversight and review, being able to meet or exceed regulatory requirements, and having a strong emergency response program in place.

This needs to include work to address the sensitivities and concerns of First Nation, Métis and municipal communities with respect to the science behind the plan. In the case of container testing, this needs to include consideration of the lived experience of people with direct knowledge and experience with the transportation routes.

Being assured there is stringent container testing will be particularly important. This includes an understanding of the testing already conducted to date as well as using the Canadian used fuel transportation package in a series of new and contemporary testing. We heard the program also needs to explicitly consider transportation logistics during standard and extreme weather events (e.g. snow storms, forest fires, tornadoes) and factor these in to assessment and planning.

Key public expectations are outlined in the three tables that follow.

Ensure strong scientific and technical foundation for the plan

We heard that a strong scientific and technical program needs to address regulatory requirements and reflect best practices. The technical program needs to provide:

- A tested and certified transportation package;
- A plan to meet commercial vehicle and railroad safety and security requirements;
- A transportation security plan;
- An emergency response plan;
- A plan for periodic reviews;
- A program for hiring high-quality and well-trained workers and vehicle operators;
- A plan for training and joint exercises with provincial and community emergency responders; and
- Procedures for safe and secure operations.

We heard that program activities need to include:

- Identifying and technically assessing road and rail modes of transport and mode combinations;
- Developing approaches to handling used nuclear fuel during transport, including logistics for transporting used nuclear fuel from interim storage facilities to the siting regions;
- Assessing risks associated with a range of transportation accident scenarios;
- Identifying and technically assessing transportation package options to ensure protection of the public and the environment during normal operations, as well as accident conditions;
- Studying risk and approaches to controlling exposure to the public and workers;
- Outlining an approach for emergency response and shipment security;
- Constructing and testing all equipment required for loading, transporting and unloading used nuclear fuel transportation packages, including truck trailers and/or railcars;
- Developing package designs for transportation packages, considering scenarios based on local knowledge and/or experience;
- Reviewing and reporting on experience and best practices with transportation of hazardous materials; internationally, to identify lessons that can be applied;
- Completing public and worker dose assessments associated with various package designs and scenarios for licencing review, as well as develop a program of ongoing monitoring and testing once transport of used nuclear fuel begins; and
- Securing and maintaining CNSC design certificates for road and/or rail transport packages.

Comprehensive testing program

We heard through discussions that comprehensive testing of the container, and broadly sharing the results of this testing, is important to establish public confidence in safety. We heard strong public support for the testing program that is already in place. People also shared their expectations that a range of scenarios also be addressed.

Used nuclear fuel transportation packages are designed and tested to ensure protection of the public during normal operations, as well as during accident conditions. Testing is conducted to ensure the package can survive all plausible accident scenarios without releasing its contents. These tests are conducted in sequence to simulate stresses that would cause the most damage to the package and total cumulative effects. To learn more about these tests, please see www.nwmo.ca/Transportation:

- Free-drop test: The package is dropped from nine metres (30 ft) onto a flat, unyielding surface (such as a steel-reinforced concrete pad), striking the surface in the orientation that will result in the most damage to the package.
- Puncture test: After the drop test, the same package is subjected to a one-metre (40-inch) free drop onto a 15-centimetre (six-inch) diameter steel bar at least 20 centimetres (eight inches) long.
- Thermal test: The same package used in the drop and puncture tests is then subjected to a fully engulfing petroleum fire. The fire temperature must reach 800 degrees Celsius (1,475 degrees Fahrenheit) for 30 minutes.
- Immersion test: Using either computer analysis or physical testing methods, the package is subjected to external pressure that is the same as if it were immersed under 15 metres (50 feet) of water for at least eight hours to test for leakage. The package is also subjected to an enhanced water immersion test at 200 metres (650 feet) to test its ability to withstand extreme external pressures.

Beyond these tests, people said it will be important for them to see that a broad range of accident scenarios are considered, scenarios that mirror the lived experience of people who regularly travel these routes. These scenarios include:

- Train derailments in remote areas with limited access;
- Road or rail accidents resulting in the transportation container falling from a bridge over nine metres, similar to bridges in the area;
- Accidents resulting in the transportation container falling down a steep rock-face into a water source;
- Accidents where the entire vehicle rolls down a steep rock-face;
- Accidents involving fires burning at higher than 800 degrees Celsius or for a longer duration, for instance in a remote location in the midst of a forest fire;
- Road accidents involving a head-on collision with another truck carrying dangerous goods;
- Accidents resulting in the transportation package being under water for longer than eight hours, for instance in a remote location with retrieval challenges; and
- Train derailment with other dangerous goods in the vicinity, such as the Lac Megantic and Mississauga train derailment disasters.

Meet or exceed regulatory requirements for safety and emergency response

We heard through discussions that meeting, if not exceeding, stringent regulatory requirements is important to establishing public confidence in safety. We heard support for the requirements in place and the importance of building broad awareness of these requirements as well as sharing work that demonstrates the APM transportation program's ability to meet or exceed them. This includes the three areas detailed below, as understood by the NWMO.

Safety: Packages used to transport used nuclear fuel from interim storage facilities to the repository will need to be certified by the CNSC. Radiation levels from the package need to remain below regulatory limits at all times, including during transportation accidents. In order to confirm that the transportation package will do its job, packages must pass a series of performance tests specified in the regulations to demonstrate their ability to restrict loss of contents and to provide adequate shielding.

The safety of the transportation vehicle must also be demonstrated. Transport Canada, the entity that regulates the transport of dangerous goods, has a number of checks and balances to ensure that transporters adhere to a strict set of standards that a) are meant to prevent accidents (e.g. driver training requirements); and b) provide clear direction on how to manage accident scenarios (e.g. emergency planning requirements).

Security: Security provisions during transportation need to meet CNSC regulatory requirements, including the development and implementation of a transportation security plan. Components of a security plan are expected to include:

- A complete description of the material being transported;
- Threat assessment to identify any credible threats;
- Description of mode of transportation;
- Proposed security measures (e.g. escorts or continuous tracking);
- Communication arrangements between the NWMO and the carrier along the route;
- Response arrangements between the NWMO and any policy/response forces;
- Primary and alternatives routes; and
- Provisions for stopover during transport.

Emergency response: Emergency response planning requirements will need to be met, ensuring workers and first responders are trained before shipments can begin. The NWMO will need to work with local response agencies to co-ordinate planning and preparedness activities before transportation can begin.

Early conversations with first responders to develop the planning framework indicate existing supports are available (e.g. Canadian Transport Emergency Centre) and training covers incidents involving dangerous goods, including radioactive material. Access to training can be budget-dependent. The NWMO will need to work with first responders along transportation routes to understand specific information and training requirements, and ensure that all parties have appropriate information, resources, training and a clear understanding of roles and responsibilities in the event of an accident.

d. Protecting the environment

We heard the importance of ensuring that the plan protects the environment, or at least minimizes its impact. In the discussions, people talked about the need to consider both radiation-related and more conventional impacts on the environment.

We heard that the release of radioactive material into the environment needs to be minimized, if not eliminated. We heard concern about potential for an accident or act of terror to cause used nuclear fuel to enter the soil, water and/or contaminate the air. We heard that the plan should include measures to prevent environmental damage, as well as ensure that specialized resources and response mechanisms are in place to mitigate and repair damage to the environment should an incident occur.

We heard the plan needs to also take into account and minimize more conventional impacts over the course of day-to-day transportation operations. A frequent example given was greenhouse gas emissions from trucks, trains, or other vehicles that may be used. Another example often raised was disturbance to sensitive areas from road or rail work that may be needed to support the transportation program.

We heard the transportation plan must not only ensure safety by meeting or exceeding regulatory requirements, it should go beyond this through specifically minimizing impact of the transportation program on the environment. Seeking opportunities to incorporate green technology in day-to-day operations of the transportation program was an example mentioned by many.

The protection of water is important. Expressed in different ways by different people over the course of the discussion, the importance of water was pinnacle, as it is the life source or lifeblood of the earth upon which every person, plant and animal relies. People talked about the importance of larger water bodies and also streams and rivers as connectors.

Protecting the environment

We heard that the program must include:

Measures to prevent environmental damage from radiation contamination

- These measures need to prevent or minimize used nuclear fuel escaping from the cask into the environment, including acts of terrorism and sabotage

Measures to prevent environmental damage from non-radiological impacts

- Greenhouse gas emissions from the vehicles used
- Impacts that improvements to infrastructure (e.g. widening roads, building segment of dedicated rail lines, reinforcing bridges) may have on the local environment, especially around fragile habitats

Resources and response mechanisms to mitigate and repair damage should an incident occur

- Emergency response plans are in place
- Local first responders are trained and equipped for accident scenarios

Use of green technologies

- Incorporating green technology as it becomes available

We heard the following considerations are also important to take into account:

- Impact of environmental conditions along a route on safety, such as forest fires, snow storms and tornadoes;
- Use of off-sets to make up for negative impacts on the environment (e.g. planting trees, rehabilitating habitat);
- Implementing a system of environmental monitoring of radiation and of impacts of transportation on the environment (e.g. on wildlife, sensitive habitats); and
- Impacts related to the manufacturing of transportation equipment.

e. Being inclusive

Over the course of conversations, we heard it is important to be inclusive when designing and implementing the plan. We heard this is important to ensuring good decisions are made. We also heard this is needed to ensure the project proceeds, and isn't undermined by the natural fear and concern many people may have about moving a dangerous material they don't know anything about.

Those who engaged in this dialogue were largely of a common view: there is an important role for government, an important role for experts, and an important role for critics to ensure the best knowledge and expertise are applied and the plan is safe. However, safety is not in itself sufficient. People said Canadians need to be aware and informed, and prepared to see the program implemented. They need to learn about used nuclear fuel and the ability to transport it safely. They need to become informed, to be able to ask questions and have their questions addressed.

The rights of Indigenous peoples need to be respected. Beyond that we heard there is a special duty owed by Canadians, given past history and historical wrongs to Indigenous peoples, and this means they need a special role in planning for this type of program. Non-Indigenous participants voiced this sense of responsibility in a number of different ways, although many found it difficult to define what this best looks like. Instead, they suggested this would need to be worked out over time with the First Nation and Métis communities involved. Indigenous dialogue participants talked about formal rights and Crown duty to consult and consent. We also heard from some Indigenous participants about the potential for the program to develop new ways and new relationships built on mutual respect and seeking opportunities for collaboration, shared planning and co-creation.

Raising awareness, building understanding and addressing questions and concerns that people will inevitably raise appeared to be considered essential by most who engaged in the dialogue.

Building respectful relationships with communities, both municipal and Indigenous, and informing and engaging people are among the key objectives identified for the plan. We heard that being inclusive in developing and implementing the transportation plan is important, and there was much discussion about how best to achieve this. We heard people talk with each other and reconsider their thinking over the course of the discussion and in response to the back-and-forth exchange of ideas and thinking through implications of possible approaches. Through the conversation, people grappled with what can be practically achieved, and what is workable and justified given the need to advance Canada's plan.

After much consideration and discussion among individuals and groups in a variety of engagement and dialogue settings over the past several years, a set of principles emerged to guide our first steps in moving forward together. We heard broad agreement on these principles. We heard the way forward will be challenging but, with patience and time, we can and will move forward together.

Principles and activities

Over the course of discussions, people laid out a set of principles to guide first steps:

- **Awareness and understanding:** Canadians should have some measure of awareness and understanding about the transportation plan. Building awareness and informing people is a primary goal of the plan and, conversely, people have a responsibility to participate in this learning;
- **Focus on potentially affected communities:** People who are more directly affected by the transportation program should have greater opportunity to understand the plan and to be heard. Informing people and communities along the route should be a primary focus;
- **Special role for leaders and first responders:** Relevant government officials, municipal leaders, first responders and scientific and technical experts should be involved. This will help to ensure good decisions are made;
- **Right to be informed:** People have a right to be informed about the plan. Good information and a desire to be informed are important for good decision-making; and
- **Special role for Indigenous communities:** Indigenous communities need to play a role in the development of the plan. They have special rights. And, given the history of continuing and past wrongs as a country, it is imperative that positive and respectful relationships be built to advance the project.

People have also outlined some key activities as a starting point

Informing people: Engaging with communities along the routes is a high priority. The objective of this engagement should be to inform residents by providing information, answering questions and addressing concerns. ‘People have a right to know.’ This is seen as an important NWMO responsibility.

Assuaging fear: The NWMO needs to proactively alleviate fear about the transportation of used nuclear fuel before this fear becomes entrenched. We heard that over time, there is an expectation that community engagement should be able to reassure most community residents, and the broader public, about the project and the soundness of the transportation plan. It is a responsibility of the NWMO to inform people to move them out of a state of fear.

Building relationships: Building relationships, and establishing mutual trust and respect, are important. Building relationships with First Nation and Métis communities and organizations is important to ensure Indigenous values and priorities, questions and concerns, and insight from Indigenous and Traditional Knowledge inform the plan.

f. Selecting modes and routes

Any transportation plan for used nuclear fuel will need to provide a framework for making decisions about the method we will use (modes) and the transportation pathway we will use (routes). We may need to consider using a combination of modes, such as road and rail, depending on the location chosen for a repository. While we have not yet identified a preferred site, dialogue to date has identified factors that the public expects will be considered when we are ready for detailed decision making.

In selecting modes and routes, first and foremost we heard that safety and security must be the primary consideration. We heard the pros and cons of various modes and routes must be thoroughly analyzed and the best possible decision be made based on science, with a primary focus on safety and security. Considerations reflecting best practice and experience in Canada and internationally must be used. Local knowledge and lived experience related to specific roads and routes of people living in the area and travelling those routes must also be considered.

Many factors will need to be considered, and we heard we should look to transportation specialists to advise on how best to achieve or balance individual objectives when they may conflict.

Key considerations are outlined in the tables that follow.

Considerations for the selection of modes and routes

We heard that people expect best practice and experience to be taken into account in the selection of modes and routes in order to ensure safety and security. In exploring choices between modes and between routes, people also said it will be important for them to see that factors such as the following are being considered, some of which mirror the lived experience of people who regularly travel routes in the area:

- Risk of accident (e.g. based on historical accident and operational data);
- Risk of security breach (e.g. relative ease of access);
- Adequacy of transportation infrastructure (e.g. quality of roads and tracks) with some indicating that much of their transportation infrastructure needs maintenance and modernization;
- Potential environmental impacts (e.g. on wildlife and surrounding terrain);
- Weather and the ability to adapt to seasonal changes (e.g. snow, ice, rain and floods);
- Ease of containment and access by first responders in the event of an incident;
- Analysis of the relative merits of opting for bigger loads and fewer trips versus smaller loads and more numerous trips;
- The frequency and nature of handling and transfers (particularly for worker exposure); and
- Adaptability of modes to future innovations in transportation (e.g. autonomous automobiles).

People anticipate that not all objectives will be able to be equally met; there will need to be some balancing or trade-offs between objectives. In doing so, there ought to be no compromise in safety. We heard that most people expect that transportation routes would and should be selected by experts based on a consideration of trade-offs, and pros and cons, including:

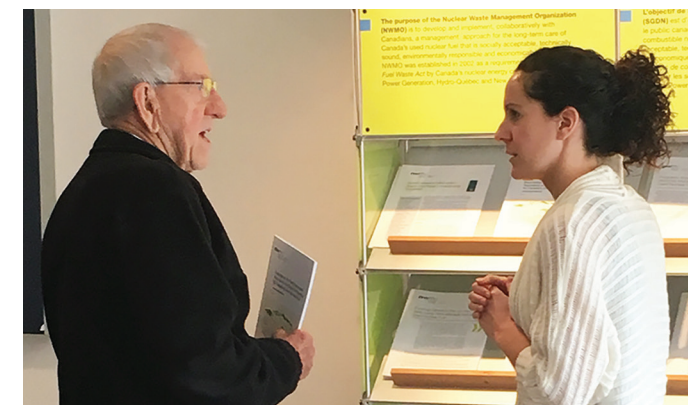
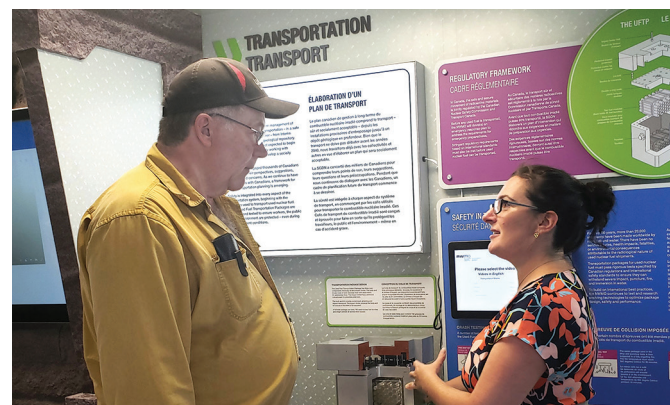
- Proximity to population centres and schools;
- Proximity to sensitive environmental areas;
- Response time for first responders/emergency response;
- Potential need to improve existing or build new infrastructure (e.g. extension of rail track);
- Conditions of the route during winter and inclement weather (e.g. days of rain and snowfall);
- Potential for traffic congestion and potential impact on commuters;
- Assessment of political and social acceptance;
- Trade-off between a longer route that goes through less densely populated areas versus a shorter route that goes through more densely populated areas; and
- The need to vary routes for security reasons.

g. The emerging framework

A framework of public expectations, principles and priorities for the APM used fuel transportation plan is emerging from these discussions and is outlined at a high level in figure 1.

Figure 1: The transportation planning framework emerging from dialogue

a. Basic requirements:	b. Objectives and principles:	c. Ensuring safety:	d. Protecting the environment builds on safety:	e. Being inclusive:	f. The process for selecting modes and routes:
<ul style="list-style-type: none"> » Safety as the primary consideration » Protecting the environment » Security » Emergency response planning » Drawing on international lessons » Ensuring that the plan is adaptive » Training » Monitoring, tracking and auditing » Communication, education and engagement » Building respectful relations with First Nation and Métis communities » Ensuring program sustainability 	<ul style="list-style-type: none"> » Attention to project finances » Ensuring transparency » Balancing adaptability and continuity » A focus on evidence -informed decision-making » Incorporating Indigenous and Traditional Knowledge » Ensuring responsible project management » A focus on informing and engaging 	<ul style="list-style-type: none"> » Ensure strong scientific and technical foundation for the plan » Comprehensive testing program » Meet or exceed regulatory requirements for safety and emergency response 	<ul style="list-style-type: none"> » Minimize, if not eliminate, impact on the environment 	<ul style="list-style-type: none"> » Right and responsibility to be informed and have questions and concerns addressed » Focus on potentially affected communities » Special role for First Nation and Métis communities 	<ul style="list-style-type: none"> » Involve experts in decision-making to build on best practice and experience » Acknowledge and take into account factors important to the public » Balance between multiple objectives without compromising safety



5. Proposed approach to implementing the framework

In the previous section, we have reported on what we heard from Canadians and Indigenous peoples, interested individuals and organizations on what will be important in planning and implementing the APM used nuclear fuel transportation program.

Based on what we heard, we understand we need to take an approach that embeds these principles and priorities in decision-making throughout planning and implementation of the transportation program. The approach needs to be flexible and adaptive and it needs to continue to involve people at key milestones along the way. In this section, we propose key elements of a potential transportation plan, or management system, for discussion. It includes:

- » A plan for working together through engagement, collaboration and shared decision-making;
- » A readiness checklist, to be used by the NWMO and the public together, to regularly assess preparations to initiate the transportation program; and
- » A roadmap of key milestones and steps, including collaboration and shared decision-making, putting in place a strong scientific and technical foundation for the program, and meeting or exceeding regulatory requirements.



a. Collaboration and shared decision-making

We understand from what we heard that there is a need to involve people in decision-making all along the way, to ensure the program continues to reflect the principles and objectives important to the public. Here, we outline potential milestones for continuing to shape and advance the plan together.

Key milestones

- 1. Refine the draft framework and milestones (2020 - 2021):** Dialogue and engagement to review and refine the draft framework and reflect on the proposed management system.
- 2. Review an early sample plan (2021 - 2023):** Dialogue and engagement to review an early sample transportation plan. This plan would be general in nature, as the repository site will not yet have been selected, but could be used to further explore expectations.
- 3. Review and refine site-specific transportation plan (2023 - initiation of transportation):** Dialogue and engagement to review an early sample site-specific transportation plan. This plan would need to continue to be refined over the years leading up to the initiation of the transportation program, but could be a basis for further exploring expectations. This might involve:
 - The NWMO working with people and organizations in the initial development of the plan, such as transportation specialists (e.g. Canadian and international scientists and engineers), federal and provincial government ministries and agencies (e.g. CNSC, Transport Canada, Public Safety Canada and provincial ministries of transportation) and Canada's nuclear power generators.
 - Interested communities, individuals and groups will need to have their questions and concerns considered and addressed as part of the transportation planning process, including first responders along potential routes and first responder associations/organizations, municipalities and municipal associations as a group with a shared interest, First Nation and Métis communities along potential routes and Indigenous organizations as a group with a shared interest; other interested individuals and groups. Communities that currently host interim storage facilities will also need to be involved in planning how used fuel is moved through their community.
- 4. Build awareness and communicate on plans as they are refined (2023 - initiation of transportation):** Dialogue and engagement to build awareness and understanding of the APM project and transportation plan, and confidence in safety. We heard this is a critical component of any plan and it will take time and effort to accomplish this. This may include activities such as face-to-face discussion and facilitating a dedicated virtual space for learning about the plan, asking questions, hearing from transportation specialists, and addressing frequently asked questions and concerns on an ongoing basis.
- 5. Monitoring and adapting (2023 onwards):** Ongoing review of evolving best practices, new and emerging technologies and standards, and reflection on the need to refine and adapt the program. Monitoring to include ongoing review of experience in implementing the transportation program once it begins, including impacts and mitigations, to support reflection and adaptation of the program during implementation.

We understand from what we heard that evidence-based decision-making is an important part of this process. We understand we need to continue to learn, and build on best practices and evolving international and Canadian expertise, science and technical developments as we implement the program. We understand that transparency, auditing and reporting are key.

Here, we outline components of a potential program for reporting and continuous improvement to working together to shape and advance the plan.

Ongoing reporting and continuous improvement

We heard that ongoing reporting and continuous learning is important for the program to be able to adapt over time as needed. Ongoing reporting and continuous learning might include the following.

- 1. Monitoring and reporting on evolving best practice:** Beginning in 2023 and on a triennial basis, the NWMO publishes a report with updates on best practice, new and emerging technologies and evolving state of the art, evolving standards, and how it is adapting the program in the spirit of continuous improvement.
- 2. Monitoring and reporting on ongoing impacts and mitigations:** Once used fuel transportation begins, the NWMO monitors and regularly reports on public and environmental impacts, reportable events, and action taken in a manner that is understandable and accessible to the public.
- 3. Monitoring and reporting on project finances:** Beginning in 2023 and on a triennial basis, the NWMO publishes a report of the status of finances for the transportation program including the project's cost and sources of funding.

b. Putting in place a readiness checklist

We understand there are a broad range of factors that need to be addressed before the NWMO and the public together will be ready to begin transporting used nuclear fuel as part of APM. Here, we outline our understanding of the factors and outcomes needed, in the form of a readiness checklist.

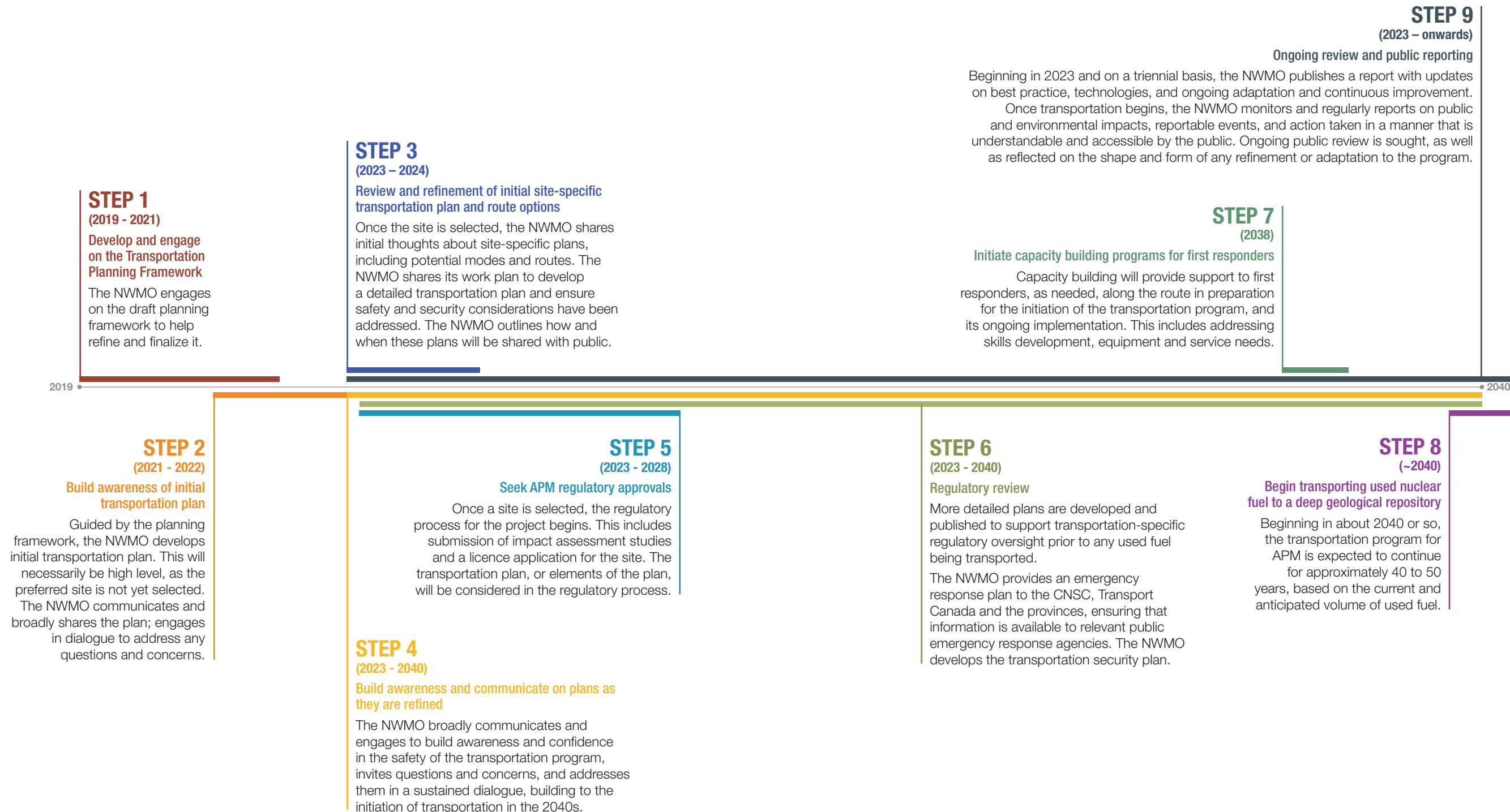
Using this checklist, we would regularly track and report on our progress in putting these necessary conditions in place. In this way, we would collectively gauge program readiness to begin with transport of the first used fuel bundle from interim storage facilities to the deep geological repository.

Readiness Checklist

- A site-specific transportation plan;
- A broad-based awareness and education program for the general public and communities along the transportation route;
- An ongoing engagement and dialogue with First Nation and Métis communities along the transportation route;
- Questions received about transportation are acknowledged, addressed and shared broadly;
- Awareness and training program for first responders along the transportation route;
- A tested and certified transportation package;
- Accident scenarios specific to transportation routes, including those that align with the lived experience of people in the area, have been covered by transportation package testing and safety has been demonstrated;
- A transportation security plan that takes into account threats of sabotage and terrorism;
- An emergency response plan that explicitly describes resources available along the route and roles and responsibilities in the event of an accident;
- An environmental management or protection plan that takes into account the carbon footprint of the transportation program and environmental response and remediation in the event of an accident;
- A confirmed plan to meet commercial vehicle and railroad safety and security requirements;
- A program for hiring high-quality and well-trained workers and vehicle operators; Procedures for safe and secure operations;
- A plan for periodic reviews of all required plans, certifications and procedures;
- A 'safety audit' program involving ongoing physical assessment of the roads, bridges, etc. of the route, to identify structural weakness; required repairs to the infrastructure of the selected route; and
- A program of reporting with updates on best practice, technologies and evolving state of the art, and ongoing activities to adapt the program in the spirit of continuous improvement.

c. Key milestones and steps

We understand from public discussion that we need to advance the plan through a sequence of steps, which include engagement, collaboration and shared decision-making; putting in place a strong scientific and technical foundation for the program; and meeting or exceeding regulatory requirements. This forms a basic road map to guide our working together with the public.



6. Regulatory decision-making

Canada has in place a stringent framework of regulation and oversight to review and approve transport of used nuclear fuel. Transportation of used nuclear fuel is regulated by the CNSC and Transport Canada. Used nuclear fuel shipments conducted as part of the APM transportation program will need to meet these requirements to ensure they are safe and secure. APM transportation operations will also need to meet federal, provincial, and local safety legal requirements, and will be inspected to ensure compliance.

Consistent with this framework of regulation and oversight, we understand that approvals for APM used nuclear fuel transportation will be given if requirements are met. Requirements focus on the strength of the transportation package and include the following:

- 1. Transportation package:** Used nuclear fuel transportation packages are designed and tested to ensure protection of the public during normal operations as well as during accident conditions. The CNSC, using internationally tested standards, has the responsibility for evaluating the transportation package and certifying its design, the registration of the use of individual packages, and monitoring the package maintenance process.
Prior to transporting used fuel in Canada, the CNSC's comprehensive regulatory framework requires a certificate for the transport package and a licence to transport. The CNSC evaluates applications to ensure that safety and security measures are technically and scientifically sound, that all requirements are met, and that the appropriate safety and security provisions are in place to protect people and the environment. Packages used to transport used nuclear fuel from interim storage facilities to the repository must be certified by the CNSC.
- 2. Radiological safety:** Packages used to transport used nuclear fuel must meet radiation level requirements prescribed by the CNSC's Packaging and Transport of Nuclear Substances Regulations, 2015. Regulatory requirements for the package ensure the public and workers are safe. The package is designed and tested to ensure that in the event of an accident, the radiological release will not exceed the regulatory limits. The CNSC's Radiation Protection Regulations have set an annual radiation dose limit for members of the public to limit exposure from nuclear-related activities.
- 3. Emergency response and training:** Transport Canada's Transportation of Dangerous Goods Regulations establish requirements for worker and driver training, emergency planning, safety marks, and documentation. Transportation planning needs to address these aspects and ensure that all equipment, packages, and activities for road and rail shipments meet regulatory requirements. The NWMO will need to demonstrate that all activities will be conducted by trained personnel, including emergency responders. The NWMO will also need to develop an emergency response plan and ensure workers and emergency responders are trained before shipments can begin.
- 4. Security:** Security provisions during transportation need to ensure CNSC regulatory requirements are met. Security measures are aimed at preventing diversion or sabotage of the transportation package, and include a combination of engineered, physical and monitoring measures to protect the cargo, and provide for detection, alarm, recording, and communication, in the event of an occurrence.

For more information on transportation regulation and oversight, see the NWMO's brochure *Safe and Secure Transportation of Canada's Used Nuclear Fuel*.

7. Next steps - refining and confirming the framework

Canada's plan for the long-term management of used nuclear fuel, known as APM, emerged from a dialogue with the public. The starting point for this plan is that this generation is taking responsibility for the management of the used nuclear fuel it has created and is not leaving it as a burden to future generations. Canada's plan requires us all to work together to implement it. Together, we can ensure APM transportation is implemented safely, and in a manner consistent with our collective values, priorities, and perspectives.

In this document, we have reported on what we are hearing about the broad framework within which APM transportation should be planned. Building on what we heard, we also describe a flexible and adaptive approach to implementing the transportation program, which continues to involve people at key milestones along the way, responsive to what people said is most important.

The planning framework, and proposed implementation approach, are described here for discussion. We invite you to join the discussion, review the framework and implementation approach, and help shape it going forward. In 2021 we will publish an updated document, including a refined framework and implementation approach that reflects this further discussion. We look forward to hearing from you.

Share your thoughts!

1. The framework: In the document, we have outlined what we heard from the public, from interested individuals and organizations, and from Indigenous peoples on what will be important in planning and implementing the APM used nuclear fuel transportation program. We have described the framework emerging from these discussions.

Have we accurately heard and reflected the priorities and objectives shared to date? Does the transportation planning framework include what is most important? What needs to be added/ changed? What needs further discussion over the coming years?

2. The implementation approach: Based on what we heard, we understand that a flexible and adaptive approach, which continues to involve people at key milestones along the way, needs to be taken to implement the program.

Is the proposed implementation approach responsive to what people said is most important? What needs to be added/ changed? What needs further discussion?

3. Looking forward: Please share your thoughts on additional considerations that need to be addressed.

8. Share your thoughts

The dialogues continues. Please share your thoughts as we refine this plan together.

1. The framework: In the document, we have outlined what we heard from the public, from interested individuals and organizations, and from Indigenous peoples on what will be important in planning and implementing the APM used nuclear fuel transportation program. We have described the framework emerging from these discussions.

Have we accurately heard and reflected the priorities and objectives shared to date? Does the transportation planning framework include what is most important? What needs to be added/ changed? What needs further discussion over the coming years?

2. The implementation approach: Based on what we heard, we understand that a flexible and adaptive approach, which continues to involve people at key milestones along the way, needs to be considered when implementing the program. We have proposed:

Is the proposed implementation approach responsive to what people said is most important? What needs to be added/changed? What needs further discussion?

3. Looking forward: Please share your thoughts on additional considerations that need to be addressed.

Name: _____

Organization (if appropriate): _____ Date: _____





Address: _____

Email (optional): _____ Tel. (optional): _____

Would you like your comments posted on the NWMO website? Yes No

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