Transportation themes 2014 to 2018:

What we heard about transportation planning

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nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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SUMMARY

The safe and secure transportation of used nuclear fuel is an important component of Adaptive Phased Management (APM), Canada's plan for the long-term management of used nuclear fuel. The ability to transport used fuel to the repository site safely and in a socially acceptable manner is a key factor that will need to be addressed in the selection of a preferred repository site, along with the safety of the repository site and the ability to implement the project in partnership with those in the area.

Although the transportation of used nuclear fuel to a repository site is not expected to begin before 2040, it is a focus of interest and conversation in dialogue with communities, interested individuals and groups about Canada's plan for the long-term management of used nuclear fuel. Since 2014, the Nuclear Waste Management Organization (NWMO) has published each year a rolling summary of the ongoing conversations with communities about this important topic. This 2018 report is intended to help fuel further discussion.

The communities involved in the site selection process are keen to explore the safety and security of the transportation as an integral part of exploring the APM project. Over the course of these conversations, communities express a strong sense of responsibility to all Canadians and future generations to ask and have answered the key questions important to advancing the project.

As communities, interested individuals and groups explore the basis for confidence in safety of the transportation of used nuclear fuel, the NWMO is learning about the questions that need to be addressed. We are also learning about the testing that needs to be performed, and the values, objectives, and processes needed to guide planning of the transportation of used nuclear fuel.

To date, the NWMO has engaged thousands of Canadians to hear their comments, questions, and concerns, and to provide information on transportation topics as part of ongoing learning and engagement on the project and advancement of the site selection process.

In response to the interest of communities involved in the siting process, in late 2016, the NWMO published a discussion document to contribute to the ongoing dialogue on transportation. This document was designed to explore areas of interest being raised by communities through encouraging dialogue on five important questions.

As a complement to ongoing discussions with communities involved in the siting process, in 2017 and 2018, the NWMO carried out public attitude research to further understand principles, values and objectives to ground future transportation planning. This included focused conversations on the discussion document, and deeper exploration of emergent themes, including the environment, oversight, inclusivity, and financial sustainability.

Across all these conversations, whether they be at open houses as part of the site selection process, at conferences or gatherings to encourage learning about Canada's plan, or focused dialogue, several themes or touch points are emerging.

These include:

- The primary consideration is safety and the protection of people, including workers, people transporting the used nuclear fuel and people along the route.
- We must protect the environment during transportation, including drinking water, watersheds and other environmentally sensitive areas.
- We must have in place strong procedures to secure shipments from threats such as terrorism or theft.
- Emergency response plans must be developed and be in place in case of emergencies along transportation routes. First responders and other emergency response personnel need to be equipped and supported.
- The costs associated with the transportation of used nuclear fuel must be fully covered through electricity rates, and not fall on taxpayers and future generations.
- Transportation plans need to be independent of politics and changes in government. Jurisdictional roles, responsibilities and authorities must be clearly articulated and understood.
- Transportation planning needs to account for and be able to respond to changes in technology to ensure that best practices and evolving technology are being implemented with respect to safety and environmental protection.
- People will have concerns. Education, communication and engagement are fundamental to overcoming fears and misconceptions about nuclear energy and the transportation of used nuclear fuel. Fears and misconceptions should not stand in the way of implementing the project and the greater public good.

Understanding and addressing these interests and concerns will help chart a path to collaboratively planning and implementing a safe and socially acceptable transportation plan.

The discussion that follows is organized in several key sections:

- *Section one* outlines the key transportation themes from conversations with communities, interested individuals and groups to date;
- *Section two* outlines learning from discussions specific to the five key questions featured in the NWMO's discussion document;
- *Section three* is a discussion and reflection on the common ground emerging from thousands of conversations over the course of this and previous years, and outlines the path to implementing a socially acceptable transportation plan; and
- *Section four* describes ongoing efforts to advance conversation and learning, and to prepare for the APM transportation program.

KEY TRANSPORTATION THEMES

The dialogue on transportation continues to focus on a number of core and evolving themes. Face-to-face conversations, questions, comments, and other engagement reflected an interest in knowing more about the project in general, especially health and safety aspects, and the transportation of radioactive material, including how routes would be selected, security, logistics, and emergency preparation.

As conversations continue, and more communities, individuals, and groups become involved, there is substantial agreement on the themes and questions that need to be addressed in transportation planning. Themes include health and safety, transportation as a component of Canada's plan, and transportation's role in site selection. As conversations continue, several themes are emerging as distinct lines of conversation: environment, informing people and building confidence, and planning for the future.

The key transportation themes are presented as a rolling list of questions and areas of concern to be updated annually. This reflects the continuity of discussions, the ongoing common ground in priorities, key questions and concerns that must be addressed from the public perspective, and the deepening of discussions over time.

Questions and areas of interest about APM transportation planning (2014-18)

- **Theme 1: Health and safety**
- **Theme 2: Environment**
- **Theme 3: Transportation as a component of Canada's plan**
- **Theme 4: Transportation and role in site selection**
- **Theme 5: Informing people and building confidence**
- **Theme 6: Planning for the future**

Theme 1: Health and safety

Plans to ensure the safety of people during transportation

There is a high level of interest in learning more about the NWMO's plans to protect the safety of people and the environment during transportation, and how the integrity of the used fuel containers will be ensured. Generally, there is a desire to learn more about and understand radiation, including the health effects of exposure. Once the nature of the hazard is established, people are interested in how safe transportation of used nuclear fuel would be ensured for the communities along the route, as well as for staff, including truck drivers and loading/unloading personnel. People also look for information about the safety track record.

1. What is radioactivity? Where does it come from? What is a half-life?
2. How does radiation affect people? Is natural background radiation harmful to my family?
3. What is the relationship between a milliSievert (mSv) and a Becquerel (Bq)?
4. How does the radioactivity level in this waste compare to levels in other minerals? What types of radiation and doses can be expected from this waste?
5. Are low doses of ionizing radiation harmful to health?
6. How will the truck driver and loading/unloading personnel be monitored for radiation exposure? Will they receive high doses?
7. How will communities along the transportation route be affected? Will people along the route be exposed to radiation and their health be affected?
8. In the unlikely event of a breach in shielding, how much radiation would be released? Would it be harmful to my family, children and/or fetus?
9. What is the demonstrated track record for safe transportation in Canada and around the world?
10. What other type of dangerous goods are travelling by road or rail today, and how does used nuclear fuel compare to those goods?

Theme 1: Health and safety

The Used Fuel Transportation Package (UFTP)

Many questions focus on the design of the UFTP such as the choice of container shape and fabricating material, the purpose of the impact limiter, and the integrity of the container in case of an accident involving water, fire or terrorist attack.

One of 32 bolts that holds the lid of the UFTP in place.

1. How does the design of the UFTP shield radiation? Why is shielding different for the transportation package and that proposed for the deep geological repository?
2. How much does each package weigh, and can they be transported by road?
3. What are the package standards? Do all the proposed APM packages meet the same safety standards?
4. Is the container certified for transporting nuclear fuel waste? Did you test the transportation containers with used nuclear fuel inside them?
5. Do the package certification tests adequately reflect real-world scenarios? Are the containers robust enough to handle fires in enclosed spaces (i.e., tunnels)?
6. Can the UFTP survive extreme heat for short periods of time, double or triple the temperatures used in the transportation video, as would be necessary if an incident involved compressed natural gas?
7. What independent testing has been done on the container? Has its integrity been tested against an attack using military-type weapons?
8. Why is redwood used for the impact limiter?
9. Why is the container square? Is this the strongest shape?
10. Would metal seals between the lid and body of the package be stronger than rubber ones?
11. How will the waste be placed inside? Will it be encased in anything first?
12. Would the UFTP be emplaced in the repository/go underground?
13. Will the current transportation package design be relevant in 30 years? Or might we be dealing with a different model?
14. How many times will the waste need to be packaged, unpackaged and repackaged from the nuclear power plant to the repository site? Can/will dry storage containers be transported?
15. How often can a package be reused?
16. How many packages will be required?

Theme 1: Health and safety

Emergency response plans and scenarios

Many want information on how the NWMO will plan for emergencies along transportation routes, especially regarding communication with local authorities and emergency response personnel. Radiation risks to first responders during the unlikely event of a breach of the UFTP are top of mind, and people often probe to better understand the hazard and how it might be practically managed during a variety of hypothetical scenarios. People are starting to ask about specific accident scenarios, wanting to understand how the NWMO will consider those scenarios in our transportation planning.

Local firefighters take part in a mock auto extrication exercise at the Bruce County Fire School.

1. What accident scenarios are being planned for, and how will they be addressed? Are you looking at worst-case scenarios in your planning?
2. What would emergency response planning and training protocols look like for my community or region? Will there be evacuation plans?
3. Exactly how far would emergency workers have to stand from the UFTP to remain safe?
4. Is safety affected by extreme winter weather and road conditions in the North, e.g., snowstorms, winter road closures that often last days at a time, and sudden extreme weather?
5. What kind of contingency plans will be in place if roads are closed?
6. If an accident downed a high-voltage wire and it fell on the UFTP and shorted to ground through the container, could the electrical arc open the UFTP?
7. How will you ensure there is a “safety culture” at the NWMO?
8. Where would the dispatch centre be located? When would planning for dispatch centre protocols begin?
9. How will you sort out jurisdictional mandates and organizational responsibilities among first responder organizations?
10. Can used nuclear fuel spill out of the transportation container, and if it did, what would be involved in cleaning it up?
11. How would a rail accident in a remote location (i.e., far away from access roads) be handled, including recovery?
12. How would an accident where a truck/train fell off a bridge into water be managed (e.g., a scenario that includes multiple impacts to the package)?
13. How will the NWMO support the community with emergency response planning?
14. How will first responders be trained, and how will different agencies be co-ordinated in case of an emergency?
15. Will used nuclear fuel be transported with other kinds of dangerous materials such as fuel, chemicals, etc.?
16. Will emergency responders in communities be trained and receive the equipment they need?
17. Will costs associated with emergency preparedness be covered by the NWMO rather than left to communities along the route?

Theme 1: Health and safety

Security en route

In 2017, the security of shipments and how loads would be secured from malicious threats (e.g., terrorism or theft) emerged as a distinct area of interest, separate from concerns about accidents. People wanted more information about potential security measures, albeit with the understanding that advance notice and details of security arrangements must be concealed from malicious actors.

1. What kinds of threats need to be considered and planned for?
2. How will the NWMO track vehicles en route, monitor environmental and road conditions, and train truck drivers?
3. Would an emergency "rapid response" team travel with the shipments or be deployed along the route?
4. Would a truck convoy be accompanied by an escort, like with oversize loads?
5. How does transportation of highly enriched uranium by another organization differ from that of the CANDU fuel by the NWMO?
6. Will there be security guards accompanying the shipments?

Understanding logistics: Transportation modes and routes

People are interested in how the used fuel would be moved from its current location to a repository, and the kinds of logistics involved in moving these materials. Questions also include the routes and modes (e.g., road, rail or water) that are being considered, and whether the NWMO has selected preferred routes and modes yet.

1. What modes of transportation are being considered? Is transporting over water being considered?
2. How many shipments are anticipated per day, week and month? Will shipments occur only during daylight hours? How long will this take?
3. Will existing roads have to be upgraded, and will new roads be needed? Will four-lane or two-lane roads be required?
4. What impact will the used fuel transportation program have on existing infrastructure?
5. What other infrastructure upgrades will be needed (i.e., communication systems in remote areas)?

Understanding logistics: Transportation modes and routes (continued)

6. Does transportation planning consider increased traffic on our highways?
7. How will traditional and environmental knowledge of the area be used to inform transportation mode planning, e.g., local topography and wildlife areas that might affect road and rail infrastructure improvements?
8. The roads get very dangerous during the winter. Is truck transport really the smart thing to do?
9. Can the existing rail system accommodate the NWMO's transportation requirements?
10. Will the NWMO own the trucks and employ the drivers, or will they be contracted?
11. Are transportation packages intermodal (i.e., can they be transferred from rail to road, or vice versa)?
12. Has the NWMO selected a preferred transportation route? Will there be alternate routes?
13. Why would the NWMO consider shipping the waste long distances instead of choosing a site close to where it is currently stored? How many containers will need to be shipped?
14. Would the UFTP be expected to stop at truck weigh stations?
15. Will the NWMO rebuild any highways or rail lines?
16. Will routes be designed to avoid populated areas?
17. Will road routes consider seasonal requirements such as half loads during the spring?

Theme 2: Environment

Protecting the environment along the route

Integral to health and safety is protection of the environment. Ensuring environmental protection is top of mind for many. Once the nature of the hazard is established, people want assurance that attention is given to the protection of land and water alongside the route.

1. What is the effect of transportation on the environment during normal transportation operation?
2. Where does radiation go when it is released into the environment? Does it accumulate on surfaces? Does it bio-accumulate?
3. What is the carbon footprint of the transportation program?

Protecting water along the route

Ensuring water quality and protecting water are top of mind subjects for many, with the focus of concern split between the areas near the repository and along the transportation route. People want to understand the potential for the APM project to endanger local water sources, and how this will be prevented, particularly in the case of a transportation accident en route. They want details about how the NWMO will maintain the safety of water, particularly in the Great Lakes and local sources of drinking water.

1. If the UFTP became submerged at depth during a transportation accident, would the water body and watershed be safe?
2. How would the UFTP be retrieved? What equipment would be used? Is this equipment available in my area, and are people trained to use it? How would this equipment be dispatched?
3. If cleanup were necessary, how would this be done? Who would be called in to do the cleanup? Does the NWMO have sufficient funds to cover the cost of cleanup and rehabilitation?
4. How will the safety of local drinking water sources, including the Great Lakes, be preserved?

Theme 3: Transportation as a component of Canada's plan

Building understanding of APM and used nuclear fuel

Building knowledge and a deeper understanding of other aspects of the project is important context. This includes the design and radioactive characteristics of the used fuel bundles, the history of nuclear power in Canada, the NWMO's mandate, and how waste is currently safely managed on an interim basis at Canada's nuclear power plants.

1. Is used nuclear fuel a liquid, gas or solid?
2. Is the bundle still radioactive? How hazardous is it, and for how long?
3. What are the effects of exposure to a fuel bundle, with or without barriers, and how will the NWMO ensure that site workers and the communities along the transportation route are safe during transportation?
4. Can the bundles explode spontaneously?
5. Are the ceramic pellets durable, or will they break and release radiation?
6. How many fuel bundles will ultimately be transported?
7. Can the bundles "go critical," i.e., spontaneously start a nuclear reaction?

Theme 3: Transportation as a component of Canada's plan

Covering costs

People have an interest in how Canada's plan is funded, and in particular, details related to the cost and funding of transportation.

1. Who will pay for transportation of wastes?
2. Who will pay for infrastructure upgrades and maintenance? Taxpayers or the NWMO?
3. What is the cost of the transportation vehicles and UFTPs that will be used to move used fuel bundles to a deep geological repository?
4. Will the cost be a major factor in selecting a preferred site?
5. How will funding be assured over the very long term?
6. Will the cost of long-term wear and tear on infrastructure be considered in determining the best mode and route for transportation?
7. Do the estimated costs of transportation consider differences in using public modes (i.e., roads) versus private infrastructure (i.e., rail)?
8. What are the implications for taxpayers and/or electricity ratepayers, now and into the future?
9. Who will be responsible for community costs related to emergency response and training of emergency response personnel?

Oversight

There is a strong interest in understanding the checks and balances that are in place to ensure safety, financial surety, and that all applicable laws and regulations are adhered to.

1. Who will oversee the transportation of used nuclear fuel?
2. What regulations are in place?
3. How will the NWMO respect Indigenous jurisdiction with respect to transportation?
4. How will the NWMO address the United Nations Declaration on the Rights of Indigenous Peoples in the storage of hazardous materials in Indigenous territories?
5. What is the role of [federal and/or provincial] governments? Who are the ultimate decision-makers?

Transportation of used fuel, nuclear waste and other dangerous goods in other jurisdictions

As the learning and dialogue about the transportation of used fuel continue and deepen, the NWMO is finding that people are becoming more aware of how used nuclear fuel, nuclear waste and other dangerous goods are being transported in other jurisdictions. There is a strong interest in understanding what we can learn from other international and Canadian experience.

1. Do other countries transport used nuclear fuel? If so, how do they do it?
2. Have there been any accidents transporting used nuclear fuel in other countries?
3. What are the distances that used nuclear fuel travels in other jurisdictions?
4. I have heard that nuclear fuel is already transported in Canada. How many shipments occur in Canada each year?
5. Does used nuclear fuel get transported between Canada and the United States? Will Canada ever take used fuel (with enriched uranium) from the United States?

Theme 4: Transportation and role in site selection

Transportation as a factor in site selection

People have questions about how transportation considerations will influence decisions on a preferred site.

1. Are the current sites being considered because they are close to major highways that could be used to move the used fuel?
2. What factors are considered in choosing routes? Is weather considered? Can one-lane highways be used? What about bridges?
3. Is transporting used nuclear fuel on a shorter distance safer than transporting on a longer distance?
4. Considering that the risks involved with the transportation of spent nuclear fuel will be a highly controversial issue, and that it may travel through communities that derive no benefits from the nuclear industry, to what degree (big or small factor) will the geographical proximity of a possible site play in the selection of the preferred site?
5. How will transportation be addressed in regional studies?

Involving others in the conversation about transportation

People want to understand how transportation decisions will be made, and who will be involved and how.

1. When and how will transportation route communities be engaged, and how will this be managed?
2. What is the timing of the selection of a preferred transportation route? When will communities along the route be identified?
3. Will local first responders be engaged and be provided with opportunities to better understand the project?
4. How will you include Indigenous communities along potential routes in transportation planning?
5. Will a broad used fuel transportation committee be established that would include all communities located along the used nuclear fuel transportation route and that would be responsible for communicating and disseminating information to the communities about risks and emergency response?
6. What benefits and supports will be available to these communities, and how might they be involved in decision-making? Should transportation route communities receive a benefit, and should they need to agree?
7. How will public outreach and support be maintained over the long term?
8. Will communities along potential route(s) have a veto?
9. Will communities have input on transportation modes?

Theme 5: Informing people and building confidence

Informing people and building confidence

People consider education is key, and expect the NWMO to build the needed awareness and understanding among those along the potential route and the public at large. It is the NWMO's responsibility to ensure that people are provided with fact-based information, and have time to ask questions and have those questions answered.

1. People along the route are going to be fearful because they are not informed and will not want used fuel going through their communities.
2. This is waste that our generation has generated. It is the NWMO's responsibility, as part of Canada's plan, to take the time to educate people about used nuclear fuel early so that this plan can be implemented.
3. People need enough time to think about information provided, ask questions and have those questions answered. Early engagement is key.
4. Informing/educating people along the route is a challenging and complex task.
5. Some people and organizations will oppose the transportation of used fuel. The NWMO needs to inform and engage with those people and organizations early.

Theme 6: Planning for the future

Adapting to changes in technology

People reflect on the fast changing landscape of technology. People have questions about how the plan will adapt in light of continued evolution of technology.

1. Will the project use driverless trucks/trains if that technology is available in the future? How will you ensure the cyber safety of the vehicles?
2. Would the NWMO consider using electric vehicles or any other type of reduced emission vehicle that is available in the future?
3. Would you consider other modes of transportation apart from road or rail if new technology makes those modes safer and more efficient?
4. Is there a plan to review the transportation package design before shipments of fuel start moving to ensure the most recent technology is being used?

Managing changes in regulations and/or changes in government

People are also interested in understanding whether and how transportation planning could be impacted by changes in regulations and/or government.

1. Could changes in government affect this project financially and in terms of approvals?
2. If regulations change before shipments start moving, will transportation planning be impacted?

WORKING TOGETHER TO DEVELOP A TRANSPORTATION PLANNING FRAMEWORK

In response to the interest of communities involved in the siting process, in late 2016, the NWMO published a discussion document to contribute to the ongoing dialogue on transportation. This document was designed to encourage discussion on five key questions and to explore areas of interest being raised by communities. Input from this dialogue is being used to develop a draft planning framework for further discussion.

Discussion questions

To get the conversation started, we suggest beginning with the following five questions. We can add to these questions along the way as we reflect and discuss together.

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

The discussion document is available at www.nwmo.ca/transportationplanning.

Throughout 2017 and 2018, the discussion document was shared with communities, and at municipal association events and conferences such as the Ontario Good Roads Association annual conference and Association of Ontario Road Supervisors trade show. Siting area communities, both municipal and Indigenous, continued to express interest in learning more about the NWMO's transportation planning. Therefore, during events such as open houses, community liaison committee meetings, community briefings and presentations, and tours of the Oakville proof test facility or interim storage facilities, NWMO staff took the opportunity to distribute the document and engage people on our key concepts.

In 2018, a short pamphlet was developed to further stimulate conversation about transportation planning through summarizing key themes emerging from conversations to date. This pamphlet, titled *Working together to develop a transportation planning framework: What we are hearing*, has become part of the package of material that is shared in engagement activities in order to encourage further discussion.

As a complement to this ongoing dialogue, in 2017 and 2018, the NWMO commissioned Hill+Knowlton Strategies to lead focus groups, workshops and public dialogue sessions. This work involved a cross-section of citizens from Ontario, Quebec and New Brunswick in discussion on the five questions outlined in the discussion document. Reports from this work are available on the NWMO website at www.nwmo.ca/reports.

The following pages provide some of the key highlights from this work.

The NWMO engages with community members on the topic of transportation at a number of community events, including open houses, community fairs and conferences.

Highlights from 2017 and 2018 public attitude research project

Basic requirements of the APM transportation plan

When discussing what needs to be addressed in a future APM transportation plan, safety emerged as a foundational component and one that should guide all others. Security – associated largely with deliberate actions, e.g., terrorism or sabotage – was equally important. Impact on the environment must be considered through ensuring safety and security of transportation. Effective communications, including targeted Indigenous and community engagement and public education campaigns, was also a top priority for participants. In addition, a plan should reflect lessons learned from Canadian and international experience in nuclear waste management; emphasize environmental protection; and outline oversight, accountability, and clear roles and responsibilities, including emergency response and regulatory oversight.

There was wide agreement that the project should be managed cost-effectively, but not at the expense of safety or security, and the plan should not impose financial liability on future generations of taxpayers. Funding to implement the transportation plan should be protected and reserved for this purpose.

Principles and objectives

Upon reflection on the principles and objectives in the discussion document, participants reacted positively to the possible list, and recommended that future discussions consider the following: provisions for monitoring and measuring the plan's objectives, and for exceeding rather than simply meeting regulatory requirements; incorporating environmental protection as a stand-alone principle; incorporating security as a stand-alone principle (versus a subset of safety); and challenges associated with determining who should be involved in the planning process and how.

Participants discussed at length the principle of inclusiveness, suggesting that the NWMO clearly articulate how decisions pertaining to transportation planning will be made, and by whom. Participants asked that the NWMO recognize more explicitly the role of municipalities, Indigenous communities and the federal government in the planning framework. Lastly, participants emphasized the need for flexibility in the plan to accommodate change, "new technology, regulations, and social expectations."

Ensuring the development of the plan is sufficiently inclusive to facilitate good decision-making

Participants recognized that defining who needs to be involved in the development of the transportation plan to ensure good decisions are made is a complex exercise. Most initially indicated that "everyone" should be involved, and some believed that communities along prospective routes should be granted an opportunity to "consent" to the plan. However, as discussions progressed, the majority of participants concluded that this approach was unfeasible given the nature and scope of the project, and agreed that the interest and rights of affected communities must be balanced with pragmatism and the greater public good.

Participants discussed how the transportation plan should address Indigenous rights, treaties and unresolved land claims. Participants noted that decision-making must take into consideration the Government of Canada's duty to consult with First Nations and Métis, and that local decision-makers (Indigenous and non-Indigenous) have a duty to represent the needs and interests of their constituents. Indigenous participants emphasized the importance of "respecting First Nations' and Métis' connection to the land" through dialogue and learning from Indigenous traditional knowledge.

The science behind the plan

Participants supported the research and technological program that the NWMO has committed to completing to facilitate the development of Canada's plan. They provided suggestions for planning such as more exhaustive, "Canadian model (e.g., extreme cold testing) container testing;" analysis of jurisdictional capacities and regulatory frameworks; and an economic impact analysis for modes of transportation.

Considerations for the selection of modes and routes

In discussions focused on the criteria for selecting transportation modes and routes, participants expressed an expectation that we thoroughly analyze the pros and cons of various modes and routes, and make the best possible decisions based on science, safety and security considerations, adequacy of infrastructure, and proximity to population centres.

Specific to modes, criteria included assessment of potential environmental impacts; analysis of merits and risks of operating larger loads with fewer trips, and vice versa; the frequency and nature of required material handling and transfers; and adaptability to future innovations in transportation. Specific to routes, criteria included proximity to sensitive environmental areas; potential for traffic congestion and impacts on commuters; and the trade-off between longer routes that traverse less densely populated areas versus shorter routes that go through more densely populated areas. In both cases, participants recommended an assessment of political and social acceptance as part of the selection criteria.

Right direction?

Participants indicated that topics raised in the discussion document were a helpful starting point for discussion and that the NWMO was generally heading in the right direction. Participants noted how well the NWMO's considerations reflected their own unprompted suggestions.

And finally, participants stated that while the NWMO "has done a good job at engaging communities," further efforts are required "now, not later" to build the NWMO's profile, counter fear and misconceptions about used nuclear fuel, and obtain enough public "buy-in" to move efficiently through the planning phase into implementation. Early and ongoing education would be foundational to the development of a socially acceptable transportation plan.

REFLECTION ON LEARNING TO DATE

Through thousands of conversations over the course of this and previous years, there is general alignment on an emerging set of themes and issues across different communities, groups, individuals, and regions.

Based on what we are hearing, we can consider a number of emergent thematic touch points in the course of engagement going forward. These themes, and the work to address them, begin to chart a path to collaboratively planning and implementing a safe and socially acceptable transportation plan.

NWMO staff talks about transportation with attendants at the Dryden Fall Fair.

Demonstrating safety

The NWMO continues to broaden our outreach and engagement with communities, interested individuals and groups, and First Nation and Métis peoples. Safety continues to be the pre-eminent theme for people new to the process. They want to learn more about safety associated with the transport of used nuclear fuel from interim storage locations to a repository. Interests range from learning more about: radiation associated with used nuclear fuel; where used fuel is currently stored; used fuel container packaging; measures to protect residents of inhabited areas along the route, truck drivers or rail personnel, workers loading/unloading UFTPs, and emergency responders; and measures to protect land, waterways and wildlife alongside the route.

For those familiar with the process, the safety case is well-understood, which has allowed dialogue to deepen and become more participatory in nature. The NWMO has heard that communities are interested in understanding how the NWMO is incorporating accident (or "what-if") scenarios into our safety planning and decision-making. An example of a scenario might include a multi-vehicle collision along a transportation route. As a result of these "what-if" scenario discussions and as part of our technical transportation work, the NWMO has prepared risk assessment presentations that show how these scenarios are being considered. Communities and other groups that have seen these presentations or had more detailed discussions with the NWMO's technical experts about risk assessment have expressed high levels of confidence in the NWMO's safety case and indicated that it shows the NWMO is taking people's concerns seriously.

As a component of safety and further to the accident scenario discussion, people also want to know about emergency response plans in case of emergencies along transportation routes. People told us it is important that work addresses how we would equip and support municipal and Indigenous first responders and other emergency response personnel, including plans for advanced training and capacity building. People want assurance that additional costs associated with route emergency preparedness are not borne by the community, and that there are plans for involving emergency response providers and other relevant specialists and authorities.

Security

People are interested in the practicalities of transporting used fuel securely. People express interest in understanding procedures to secure shipments from threats such as terrorism or theft. People appreciate the complexities that arise in the context of sharing advanced information on a shipment schedule or route. For example, people noted "tensions between the public's desire to be informed about used fuel shipments, and the need to keep advanced notice and details of shipment arrangements out of the hands of malicious actors." That said, they further noted a distinction regarding communications plans with authorities and emergency response providers.

Education as a responsibility

We heard that people consider education, communication and engagement to be fundamental to gaining public acceptance of the transportation of used nuclear fuel. People felt that all Canadians should have some measure of awareness and understanding of Canada's plan, and that those who are more directly affected by transportation have the opportunity to understand potential impacts on them. Specifically, we heard that the NWMO has a responsibility to inform and educate people along the route in order to ensure that their questions are fully answered and concerns are addressed. People stressed the importance of engaging early and providing multiple opportunities for people to ask questions and receive answers. We heard that the involvement of experts such as emergency response providers, transportation specialists, scientists, and the various levels of government are important in the process of developing the plan. People also expressed an interest in learning more about how Indigenous peoples would be involved in decisions related to transportation.

Adapting to change

People told us that the NWMO's ability to adapt to change, especially with respect to transportation planning, is of utmost importance. We heard that transportation planning should reflect the most up-to-date knowledge and best practices internationally for the design of safe and secure transportation. People also told us that the NWMO should be prepared to adapt to environmentally sustainable forms of transportation (e.g., electric vehicles) if those opportunities exist in the future and should be actively investigating those options. From a political perspective, people had many questions about the sustainability of the overall APM project, including the transportation of used fuel, in times of political flux (e.g., changes in provincial, federal and international governments). We heard that it is important that transportation plans are independent of politics and changes in government, and that jurisdictional roles, responsibilities, and authorities are clearly articulated and understood, inclusive of independent regulatory and oversight authorities.

Environment

Environmental protection, and in particular, water protection emerged as important concerns for many people in conversations about transportation. People want to know that drinking water and watersheds along with other environmental aspects along a route will not be put at risk. People ask about plans to prevent environmental damage, and plans to mitigate and repair environmental damage in the unlikely event of a release of radioactive material. We are seeing a close linkage between safety and the environment in the way people talk about environmental protection, specifically on the topic of accident scenarios. When discussing accident scenarios, people have said that their

confidence in environmental protection would be linked to how confident they are in plans to protect people along the route and workers. Concern around the carbon footprint of the transportation and questions about what the NWMO will be doing to minimize and/or mitigate impacts emerged as a topic as well. Finally, people have started to ask about the NWMO's detailed plans to ensure environmental protection, and about the regulatory processes that will be in place to ensure the environment is considered at the planning stage and during transportation.

Oversight and funding

Related to environment and other regulatory processes, we heard that people want to have a clear understanding of how decisions are made, and who makes those decisions, both at the planning stage and during the transportation of used nuclear fuel. This includes understanding who will be responsible for transporting the used fuel, what regulatory processes apply to the transportation of used fuel before it is transported, and who oversees those processes. People also wanted to know who was responsible for making the decisions about modes and routes, and which organization would be responsible for the used fuel during transportation.

We also heard that people want to know more about covering costs associated with the transportation of used nuclear fuel to its legacy destination, including "who pays?", "are we creating a burden for future taxpayers?", and "what about the cost of building and maintaining infrastructure?"

Looking forward

We heard that people believe future success relies on social acceptance of transportation, and that this requires overcoming people's natural tendency towards nimbyism, the public's inherent fear and misconceptions about nuclear energy, and the fact that most Canadians do not know the NWMO. Looking forward to future engagement on the topic of transportation planning, it appears that exposure to fact-based information, combined with the opportunity to ask questions and discuss the issues with others, can significantly increase comfort and confidence levels in Canada's ability to transport used nuclear fuel safely and securely. People have said that early and ongoing engagement and education on the transportation of used nuclear fuel is of prime importance to successfully building social acceptance of a future plan, and that we should consider how to engage the public at large to know more about Canada's plan for the long-term management of used nuclear fuel.

These and other thematic touch points are emerging as common ground over the course of conversations, and are beginning to chart a path to collaboratively planning and implementing a safe and socially acceptable transportation plan.

ENCOURAGING CONVERSATIONS AND INFORMATION EXCHANGE

The NWMO continued to encourage active dialogue and learning on transportation throughout the course of 2018. A complete list of activities is available in an appendix to this report.

Ongoing engagement on safety

In 2018, engagement activities designed to share information on the basis of confidence in safety continued. Information exchange and dialogue on transportation safety was promoted through the use of standing exhibits in community offices, and a multi-module travelling exhibit used at open house events, along with visits by transportation specialists and other staff to answer questions and engage in conversation. To facilitate dialogue, the 3D model of the UFTP was featured at a variety of events throughout the year. Information and discussion sessions often had available videos demonstrating how UFTPs have been tested to withstand various accident scenarios. The NWMO's demonstration and proof test facility in Oakville, Ont., also features transportation material and activities, and is a popular tour destination for communities and others as part of a multi-faceted learning program developed by them.

These tools were used extensively in siting areas, and in Métis, First Nation, and municipal community and association events in which the NWMO participated. In addition, formal presentations were made to local municipal community liaison committees and the Municipal Forum, and staff attended dozens of community events and learning and sharing gatherings with Indigenous communities. Importantly, specialized audiences such as first responders and road supervisors were also engaged within local communities and at the broader regional level. The combination of multimedia-enabled exhibits and material have helped promote conversations with municipal and county road staff, as well as first responders and emergency management personnel.

The interactive kiosk and feature videos, fact sheets, backgrounders, and other materials were used extensively to put transportation planning into context and carry on conversations prompted by the transportation discussion document. Generally, conversations and learning about transportation safety are broadening as the overall engagement program expands to include neighbouring communities in the siting areas.

Implementing public attitude research on transportation planning

In 2017, we implemented a public attitude research project that engaged a cross-section of citizens in discussions about the five key questions outlined in the discussion document. These are:

- What are the basic requirements of any plan?
- Which objectives, principles and key questions should guide development of a transportation plan?
- How can we ensure the design and implementation of a transportation plan is sufficiently inclusive to ensure good decisions are made?
- What information will we need from technical specialists to develop the plan and support decision-making?
- What factors should be considered in future decisions about modes and routes?

The project implemented the following engagement activities:

- Twenty two-hour-long focus groups sessions in Ontario, Quebec and New Brunswick;
- Two workshops involving representatives of Indigenous and municipal communities participating in the siting process; and
- A 45-person public dialogue session involving a cross-section of citizens.

In 2018, we implemented another round of public attitude research with the intent of gaining a deeper understanding of some of the key themes that arose through earlier work. The project implemented the following activities:

- Fourteen two-hour-long focus group sessions in Ontario; and
- One 40-person public dialogue session involving a cross-section of citizens.

Perspectives and feedback from these discussions, as well as continuing conversations with communities involved in the siting process and others with an interest, will help guide development of a draft transportation planning framework for APM that will also be a subject of future engagement.

Building understanding through media and publications

We continue to make use of a range of information and engagement tools to deepen the conversation. This includes the *Assessing Radiological Dose to Members of the Public and Workers During UFTP Transportation*. This publication was originally developed in response to commonly posed questions about effects of radiation along transportation routes. It describes comparative exposure times, distances, and frequencies between workers and members of the public, and a passing UFTP along a hypothetical transportation route. For example, transport crew members receiving the highest dose would still receive only about 15 per cent of the dose of a typical jet airplane flight crew.

We also share the *Safe and Secure Transportation of Canada's Used Nuclear Fuel* report. This brochure provides information about used nuclear fuel transportation, current storage, the Canadian regulation and oversight regime, and future risk management strategies along a transportation route. And finally, we use the *Safe and Secure Transportation of Canada's Used Nuclear Fuel – Questions and Answers* report, a compact review and response to some of the most common questions we hear about transporting used nuclear fuel. Questions relate to public safety, security and emergency response, the different modes of transportation, and public involvement in transportation planning.

A range of short videos are also available through the NWMO website, including on international experience transporting used nuclear fuel, regulations for transportation of used nuclear fuel, and modes of transporting used nuclear fuel.

Public questions and comments have also been shared through the NWMO and community liaison committee websites, and through social media sites. We monitor publicly shared social media conversations as well, and find the focus of interest congruent with what we hear from in-person exchanges, though sometimes with a broader focus on international events.

The NWMO has added answers to commonly posed transportation questions on our website, which is designed to facilitate user-friendly searches for specific information such as brochures, technical reports, or answers to questions. A dedicated frequently asked questions search box is available from the www.nwmo.ca homepage, and there are more than two dozens transportation-related questions and answers for visitors to review such as "*What sorts of security measures will be in place?*" and "*What type of vehicles will be needed to transport used nuclear fuel?*"

CONTINUING DIALOGUE

Dialogue continues on transportation safety and future planning. The NWMO has observed that bringing accurate and balanced information into the discussion is important as there is substantial misunderstanding and misinformation on this topic. We also invite deeper conversation and greater reflection on the choices that face us as a society, and how we will ensure safety at every point in the long-term management of used nuclear fuel.

The NWMO has observed that as conversations continue, and more communities, individuals, and groups become involved, there is substantial agreement on the themes and questions that need to guide and be addressed in transportation planning. However, more conversation is needed to establish the social foundation for APM transportation.

The NWMO looks forward to continuing with this dialogue. We invite all interested Canadians to become involved by attending an open house, dropping by a community Learn More office, providing input to the questions posed in the transportation discussion document, or sharing their thoughts by visiting the NWMO website at www.nwmo.ca.

Hornepayne students visit the NWMO's mobile transportation exhibit.

APPENDIX A: 2018 TRANSPORTATION ENGAGEMENT SCHEDULE

Date	Event and location	Type of transportation information provided
January 17	Anishinaabe Nation in Treaty #3 tour of NWMO demonstration and proof test facility (Oakville facility) – Community liaison workers, Grand Council Treaty #3 environmental staff	Transportation of used nuclear fuel – Technical program presentation
January 21-23	Rural Ontario Municipal Association conference	Transportation handout materials: • Safe and Secure Transportation of Canada's Used Nuclear Fuel – Brochure • Safe and Secure Transportation of Canada's Used Nuclear Fuel – Questions and Answers • Planning Transportation for Adaptive Phased Management – Discussion Document
February 1-3	Kenora District Municipal Association conference	Transportation handout materials
February 4-7	Saskatchewan Association of Rural Municipalities conference	Transportation handout materials
February 22	Tour of Oakville facility with NWMO's academic associates	Transportation of used nuclear fuel – Technical program presentation
February 25-28	Ontario Good Roads Association conference	Transportation handout materials
March 22	Tour of Western Waste Management Facility with southern Ontario regional media	Transportation of used nuclear fuel – Technical program presentation
March 27	Tour of Western Waste Management Facility with Huron-Kinloss and South Bruce youth representatives	Transportation of used nuclear fuel – Technical program presentation
April 17	Tour of Oakville facility with NWMO Council of Elders and Youth	Transportation of used nuclear fuel – Technical program presentation

Date	Event and location	Type of transportation information provided
April 17	Tour of Oakville facility with southwestern Ontario community representatives	Transportation of used nuclear fuel – Technical program presentation
April 18-19	Tour of Oakville facility with Découverte (French language TV series on science and technology)	Transportation of used nuclear fuel – Technical program presentation
April 19	Tour of Western Waste Management Facility with South Bruce community representatives	Transportation of used nuclear fuel – Technical program presentation
April 25	Tour of Oakville facility with Quebec student group	Transportation of used nuclear fuel – Technical program presentation
April 25	Tour of Oakville facility with Power Workers Union representatives	Transportation of used nuclear fuel – Technical program presentation
May 2	Tour of Western Waste Management Facility with Huron-Kinloss community representatives	Transportation of used nuclear fuel – Technical program presentation
May 2-4	Northwestern Ontario Municipal Association conference	Transportation handout materials
May 2-4	Ontario Small Urban Municipalities conference	Transportation handout materials
May 9-11	Federation of Northern Ontario Municipalities conference	Transportation handout materials
May 14	Tour of Oakville facility with Natural Resources Canada	Transportation of used nuclear fuel – Technical program presentation
May 28	Tour of Oakville facility with Manitouwadge community representatives	Transportation of used nuclear fuel – Technical program presentation

Date	Event and location	Type of transportation information provided
May 31-June 3	Federation of Canadian Municipalities conference	Transportation handout materials
June 5	Tour of Oakville facility with Ignace community repre-sentatives	Transportation of used nuclear fuel – Technical program presentation
June 5	Tour of Oakville facility with Ignace Grades 7-8 students	Transportation of used nuclear fuel – Technical program presentation
June 6-7	Association of Ontario Road Supervisors conference	Transportation handout materials
June 13	Tour of Oakville facility with the Canadian Nuclear Safety Commission	Transportation of used nuclear fuel – Technical program presentation
June 19	Tour of Oakville facility with Lac des Mille Lacs First Nation representatives	Transportation of used nuclear fuel – Technical program presentation
June 20	Tour of Oakville facility and McMaster nuclear reactor with Manitouwadge community representatives	Transportation of used nuclear fuel – Technical program presentation
June 20	Seniors Information and Active Living Fair – Northern Tour 2018	Transportation handout materials
July 11	Tour of Oakville facility with Romanian nuclear and radioactive waste agency ANDR	Transportation of used nuclear fuel – Technical program presentation
July 18	Ignace open house on borehole and drilling plans	Transportation handout materials and UFTP testing videos
August 1	New Brunswick Indian Summer Games	Transportation handout materials
August 8	Transportation risk assessment presentation at Wabigoon Lake Ojibway Nation (daytime)	Risk assessment and exposure/dose presentation
August 8	Transportation safety case presentation with Aboriginal People of Wabigoon (evening)	Transportation of used nuclear fuel – Technical program presentation
August 9	Transportation safety case presentation with Eagle Lake First Nation	Transportation of used nuclear fuel – Technical program presentation

Date	Event and location	Type of transportation information provided
August 10	Transportation presentation as part of the Huron-Kinloss Nuclear Waste Management Symposium	Transportation of used nuclear fuel – Technical program presentation
August 15-18	Métis Nation of Ontario annual general assembly	Transportation handout materials
August 19-22	Association of Municipalities of Ontario annual conference and trade show	Transportation handout materials
August 23	Tour of Oakville facility with Eagle Lake First Nation (morning)	Transportation of used nuclear fuel – Technical program presentation
August 23	Tour of Oakville facility with Wabigoon Lake Ojibway Nation (afternoon)	Transportation of used nuclear fuel – Technical program presentation
August 23-25	Dryden Fall Fair	Transportation handout materials
August 24-26	Teeswater Fall Fair	Transportation handout materials
August 25	East Coast First Peoples Alliance	Transportation of used nuclear fuel – Technical program presentation
September 8	Mildmay Fall Fair	Transportation handout materials
September 12	Tour of Oakville facility with members of the South Bruce Community & Business Association	Transportation of used nuclear fuel – Technical program presentation
September 12	Tour of Oakville facility with New Brunswick Power (Indigenous groups)	Transportation of used nuclear fuel – Technical program presentation
September 15	Lucknow Fall Fair	Transportation handout materials
September 26	Métis Nation of Ontario – Dryden Council community meeting	Radiation primer and transportation presentation
September 28-29	Ripley Fall Fair	Transportation handout materials
October 18	Tour of Oakville facility with Huron-Kinloss residents	Transportation of used nuclear fuel – Technical program presentation
October 22	Tour of Oakville facility with Hornepayne residents	Transportation of used nuclear fuel – Technical program presentation
November 1	Union of New Brunswick Indians Aboriginal Natural Resources Committee meeting	Transportation handout materials

For more information, please contact:

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NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES