



NWMO Perspectives on Fuel Waste Acceptance from Advanced Reactors

Presentation to US NAS Panel on Merits and Viability of Different Nuclear Fuel Cycles and Technology Options and the Waste Aspects of Advanced Nuclear Reactors

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Presentation Outline

- About the NWMO
- Canada's Plan
- Advanced Fuel Wastes Perspectives



About the NWMO

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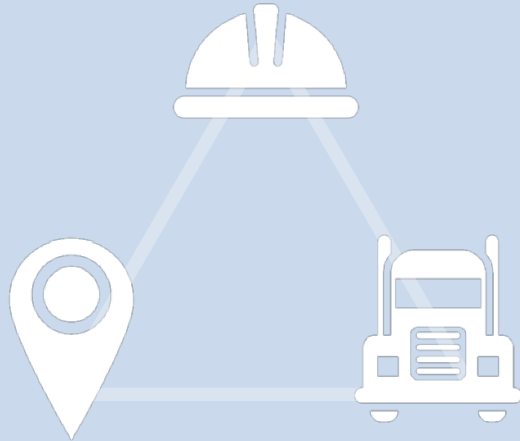
- Formed in 2002 as required by federal *Nuclear Fuel Waste Act*
- Charged with developing and implementing national solution for Canada's nuclear fuel waste
- Funded by the nuclear energy corporations
- Trust Funds established, funded by electricity users

Our mission is to develop and implement collaboratively with Canadians, a management approach for the long-term care of Canada's used nuclear fuel that is socially acceptable, technically sound, environmentally responsible, and economically feasible.

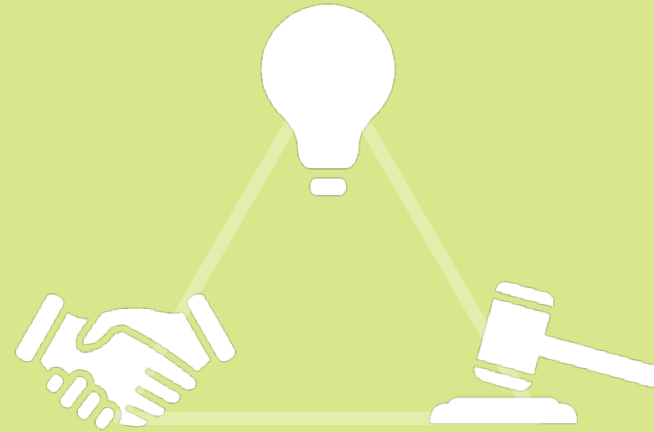
Adaptive Phased Management (APM)

APM emerged from dialogue with citizens and experts – best met key priorities

Technical Method



Management System



APM selected by Federal government in 2007

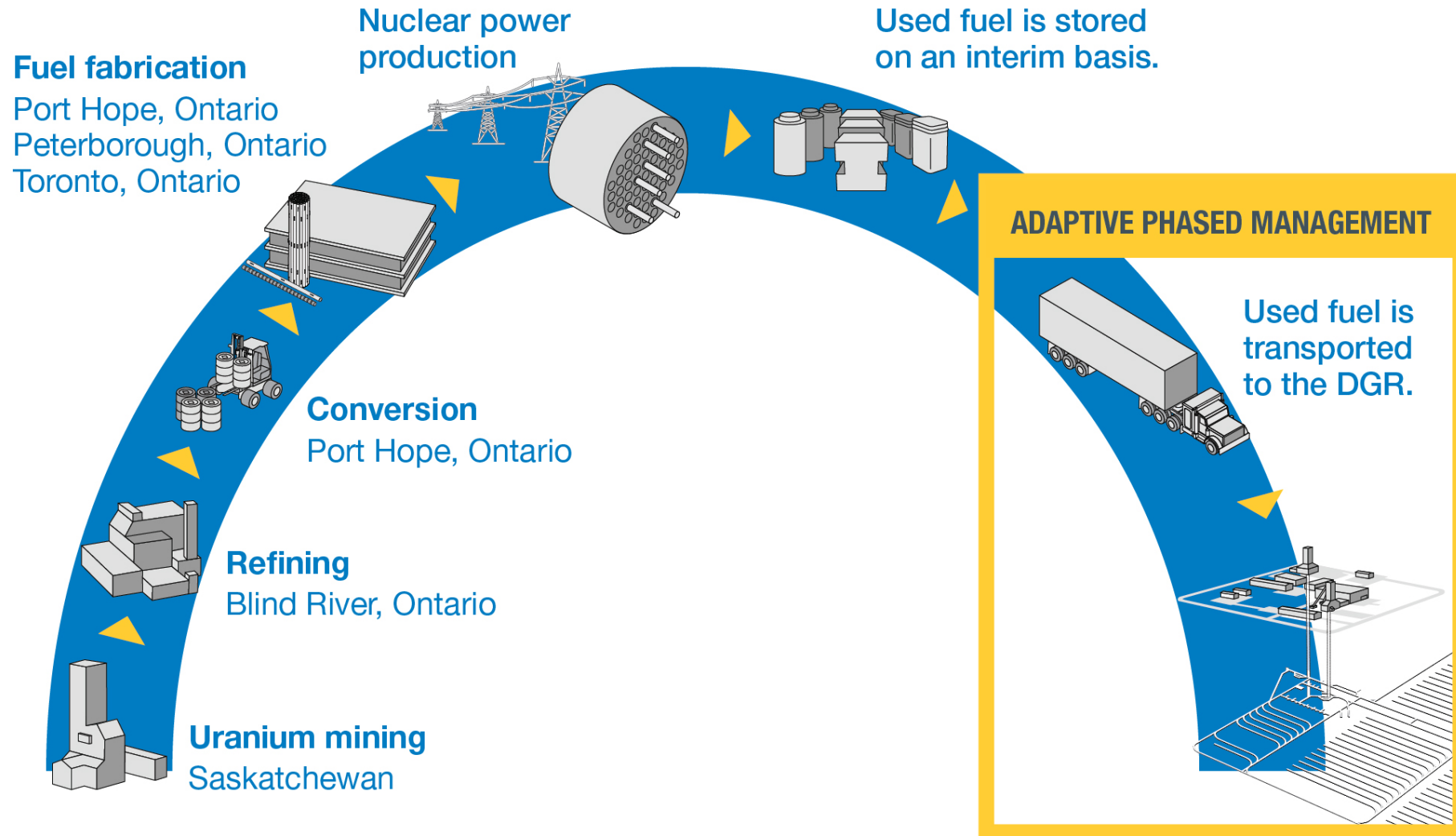
Timeline

2007	Federal government selects APM approach
2010	Site selection process started
2023	Preferred site is selected
~ 20 years	Detailed site characterization Licencing process Detailed design and construction
~ 40 years	Operations
~ 70 years	Extended monitoring
~ 25 years	Decommissioning / closure

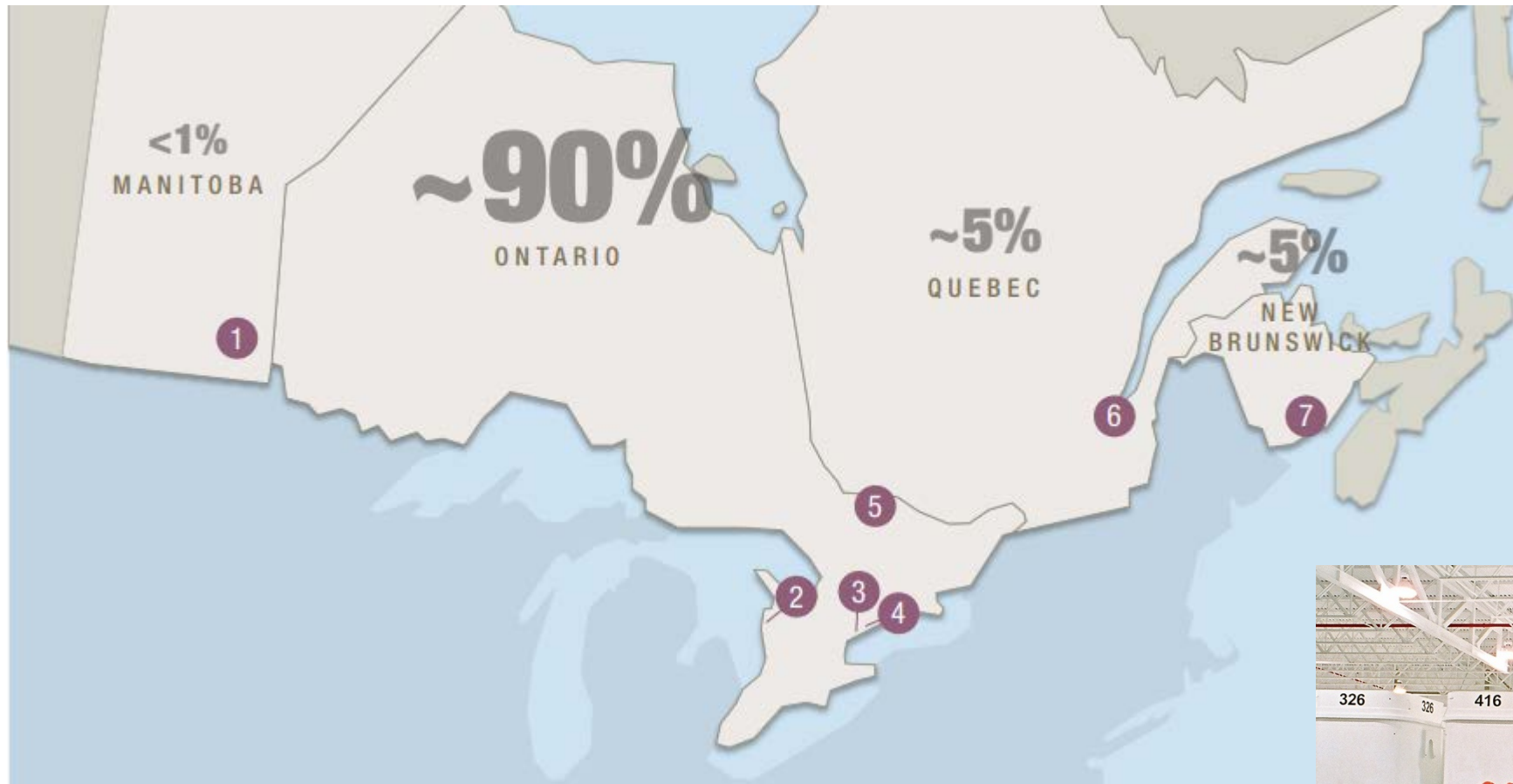


Canada's Plan

Nuclear Fuel Cycle in Canada



Nuclear Fuel Interim Storage



- Most used nuclear fuel is stored in Ontario
- About half is in dry storage



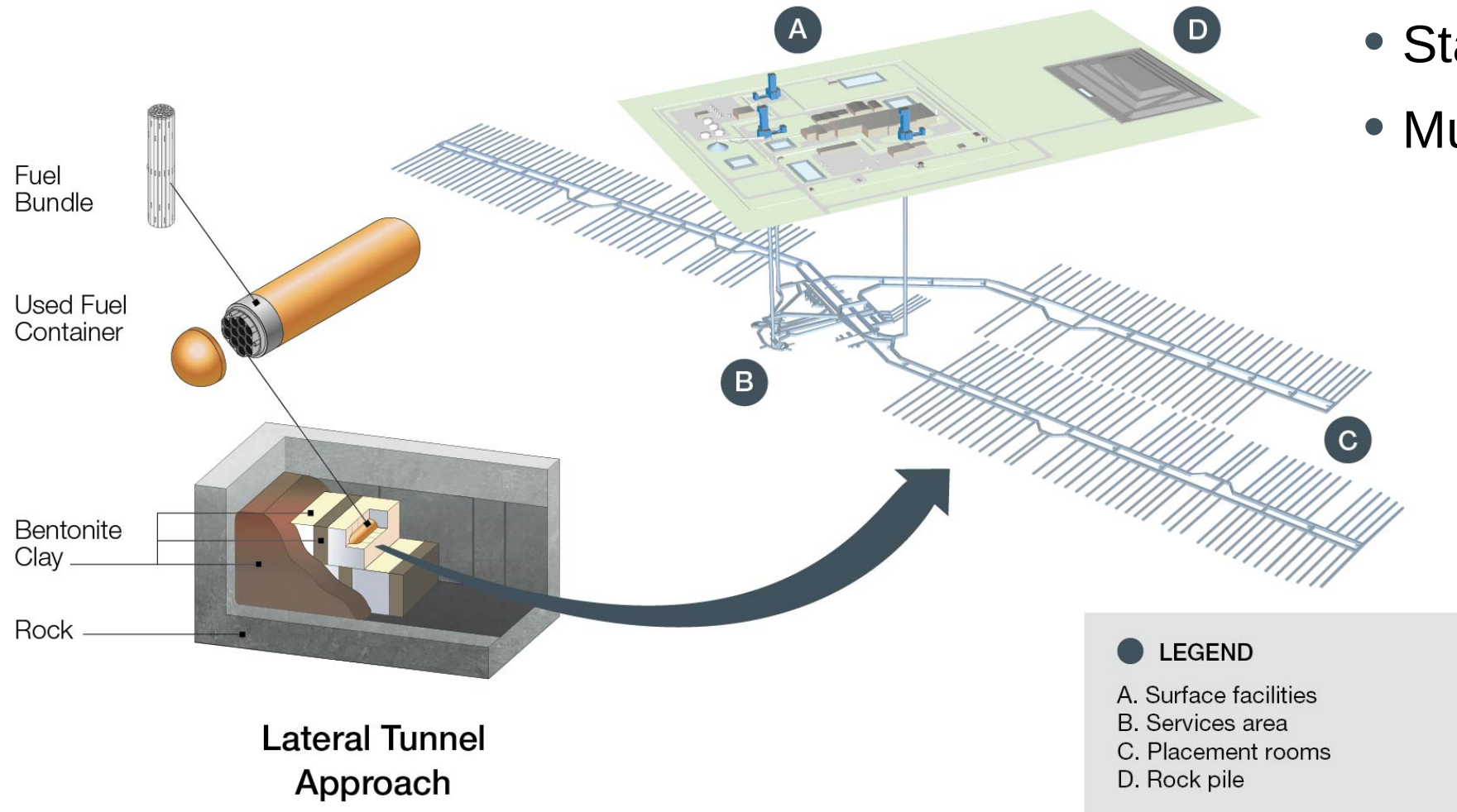
Nuclear Fuel Waste Inventory in Canada

- 99.9% UO_2 fuel bundles
- ~110,000 Mg or 5.5M bundles
- Most CANDU fuel is unenriched
- Small amount of research fuels



*Typical CANDU fuel bundle
Approx 50 cm long x 10 cm diameter
Approx 24 kg*

APM DGR Safety Case Basis

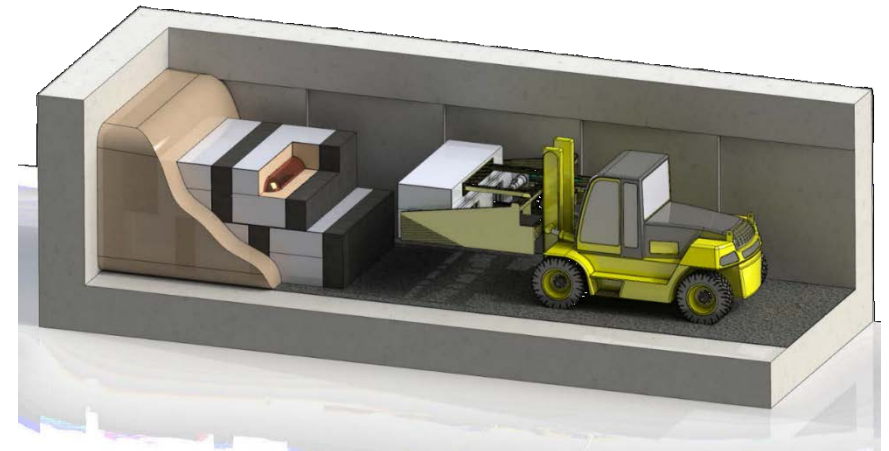


Engineered Barrier System

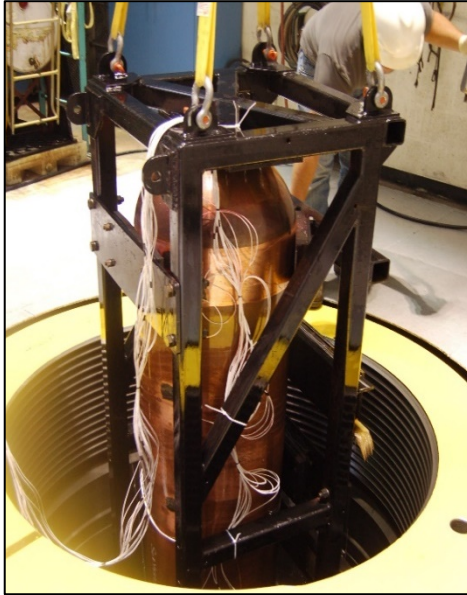
- UO_2 is a durable material under geologic conditions
- Optimized around the fuel bundles
- No conditioning or reprocessing
- Ship to DGR site in standard packages; capable of road transport
- Transfer at DGR site into disposal containers
- Sized to optimize fabrication, testing and emplacement



Approx 2.6 m long x 0.6 m dia.



Prototypes and Proof Testing



Full-scale containers have been fabricated and pressure tested



Full scale room mockup for emplacement trial

Full-scale bentonite blocks fabricated and handling equipment under test



Siting

- Presently evaluating two potential sites in Ontario
- Discussion with municipal and Indigenous communities
- Preliminary site characterization (boreholes, seismic survey, environment baseline...)





Advanced Fuel Wastes Perspectives

NWMO Role

- NWMO's mandate is the management of the long-lived nuclear fuel waste produced in Canada from nuclear facilities
- NWMO's planned DGR will accommodate the fuel waste from existing nuclear reactors.
- Decision on further nuclear facilities is with utilities / governments. But NWMO would be responsible for management of that fuel waste.
- There is interest in advanced reactors and in used fuel recycling.
- These will affect the nature of the wastes, but there will still be long-lived nuclear fuel waste that is best managed through geological disposal.
- NWMO is providing input to these discussions on how best to manage these wastes.

NWMO's Actions in Canada's SMR Action Plan

- Demonstration and Deployment:
 - Early engagement with SMR vendors on technical specifications and costs
- Capacity, Engagement, and Public Confidence:
 - Public and community engagement in used fuel from SMRs
 - Promoting diversity in the future SMR workforce

See <https://smractionplan.ca/content/nuclear-waste-management-organization-nwmo>

SMR Fuel Wastes

- A mature disposal concept has been developed in Canada for existing nuclear fuel wastes
- NWMO will apply the same standard of safety to managing nuclear fuel wastes from advanced reactors, including SMRs:
 - » Physical requirements (solid waste form)
 - » Characterization requirements (physical, chemical, radionuclides, etc.)
 - » Repository requirements (packaging, impact on DGR layout)
 - » Transportation requirements (transportable to the DGR site)

NWMO Early Engagement

- NWMO is in discussion with several SMR vendors and utilities
- Considering the overall system optimization
- Considering up to three scenarios:
 1. Accept fuel in durable form and sized to fit NWMO's standard Used Fuel Container
 2. Accept fuel in form and dimensions preferred by vendor
 3. Intermediate option?
- Developing quantitative information to support decisions

Additional Considerations

- Near-term First-of-a-kind SMR focus vs Fleet optimization
- Wasteform dimensions
 - Transport, surface handling, EBS design, emplacement
- Different proposed wasteform materials
 - Extent of long-term durability / radioactivity information
- Higher enrichment / burnup

Current Status

- NWMO discussions with SMR vendors and utilities are underway
 - Vendors / NWMO developing / assessing information on fuel wastes and scenarios
 - Current discussions are under Non-Disclosure Agreements
- NWMO continues its implementation of Canada's plan for safe, long-term management of nuclear fuel waste

Thank you