

Implementing Canadian Plan for the Long-Term Management of Used Nuclear Fuel



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nwmo

NUCLEAR WASTE
MANAGEMENT
ORGANIZATION

SOCIÉTÉ DE GESTION
DES DÉCHETS
NUCLÉAIRES

History of Long-Term Management of Used Fuel Programs

- » **1978:** Porter Commission on Electricity Planning in Ontario
- » **1980:** Governments of Canada and Ontario initiate Canadian Nuclear Fuel Waste Program
- » **1989:** Concept of geological disposal referred to an Environmental Assessment Panel
- » **1998:** Panel reports findings and makes recommendations
 - ◆ Geological disposal technically safe
 - ◆ Public acceptance not demonstrated
- » **2002:** *Nuclear Fuel Waste Act* requires NWMO be formed

2002 Nuclear Fuel Waste Act



- » Nuclear Energy Corporations to:
 - ◆ Form and fund NWMO
 - ◆ Contribute to trust funds

- » NWMO
 - ◆ Establish an Advisory Council
 - ◆ Conduct study of alternatives and make recommendation
 - ◆ Implement government decision
 - ◆ Define contributions to trust funds
 - ◆ Report annually to parliament

- » Government of Canada
 - ◆ Approves NWMO recommendation
 - ◆ Approves trust fund contributions

Progress Since 2002

- » 2002: NWMO established by OPG, HQ, NBP
- » 2005: Study of alternatives completed
 - ◆ Recommendation made for Adaptive Phased Management
- » 2007: Government accepts NWMO recommendation
- » 2008: NWMO issues implementation plan
- » 2010: NWMO initiates site selection process
- » 2018: Potential date for completion of site investigations

NWMO Study of Alternatives (2002-2005)

- » NWMO led three-year study – engaged nation-wide:
 - ◆ 18,000 Canadians including 2500 Aboriginal people
 - ◆ 120 information & discussion sessions
 - ◆ Initiated research – contributions from 500 experts

- » Canadians told us:
 - ◆ Safety and security is top priority
 - ◆ Take action now
 - ◆ International standards
 - ◆ Approach must be adaptable (e.g. potential for recycle)



Adaptive Phased Management: Canada's Plan for the Long-Term Management of Used Nuclear Fuel

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

A Technical Method

- » Centralized containment and isolation of used nuclear fuel in deep geological repository
- » Continuous monitoring
- » Potential for retrievability
- » Optional step of shallow underground storage

A Management System

- » Flexibility in pace and manner of implementation
- » Phased and adaptive decision-making
- » Responsive to advances in technology, research, Aboriginal Traditional Knowledge, societal values
- » Open, inclusive, fair siting process - seek informed, willing host community
- » Sustained engagement of people and communities throughout implementation

APM approved by Federal government June 2007

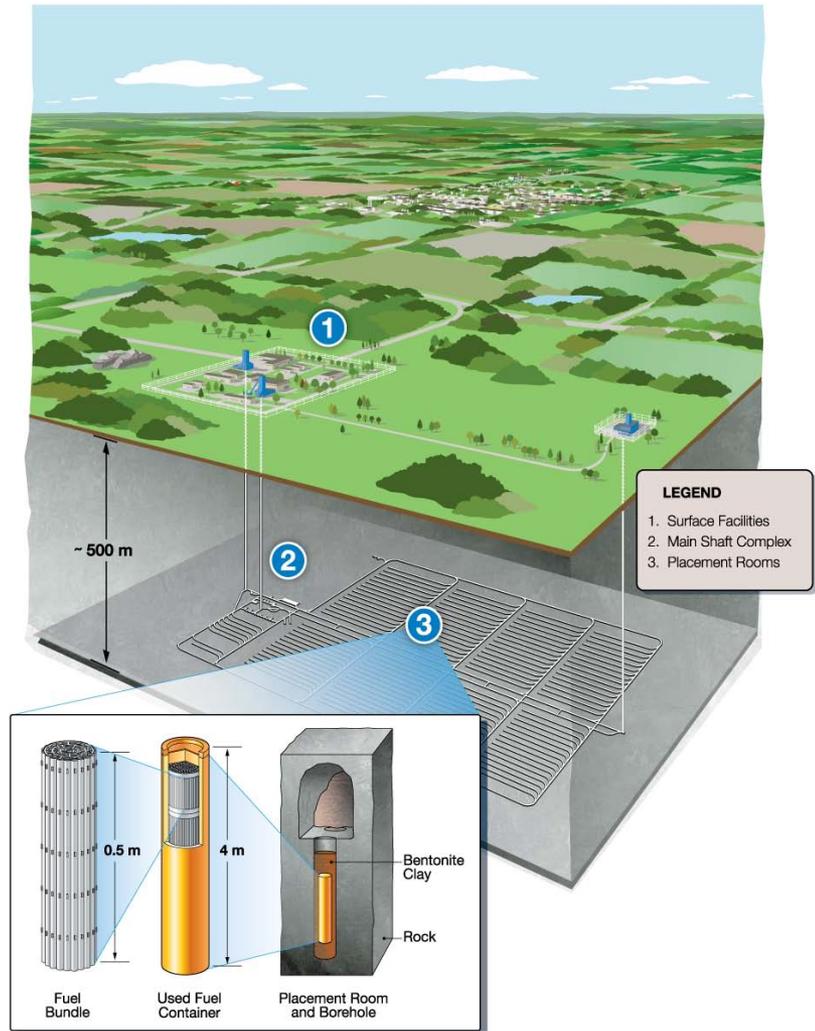
International Comparison



| Country | National Plan for High-Level Waste | Repository Target In-Service Date |
|-------------|------------------------------------|--|
| Finland | Geological Repository | 2020: Willing host community selected |
| Sweden | Geological Repository | 2025: Willing host community selected |
| France | Geological Repository | 2025 |
| Germany | Geological Repository | No date fixed |
| Japan | Geological Repository | 2040 |
| Switzerland | Geological Repository | 2040 |
| UK | Geological Repository | 2040 |
| Canada | Geological Repository | 2035 earliest |
| USA | Geological Repository | Blue Ribbon panel now reviewing |
| Belgium | No decision | Research on geological repository underway |
| Spain | No decision | Research on geological repository underway |

National Infrastructure Project

- » High technology, deep geological repository
 - ◆ Investment of \$16-24 billion
 - ◆ Will operate as centre of expertise
 - ◆ Sustainable over more than 100 years
- » Long-term partnership between NWMO and community
- » Fosters community well-being
- » Strongly regulated



2011-2015 Implementation Plan



- » Build long-term relationships with interested Canadians and involve them in setting future directions
- » Implement collaboratively the process for siting a deep geological repository
- » Further develop designs and safety cases for a repository in both crystalline and sedimentary rock formations
- » Ensure funds are available
- » Adapt plans in response to new knowledge and international best practices
- » Maintain an accountable governance structure
- » Build and sustain an effective organization

Ongoing Relationship Building



NWMO continues to:

- » Build awareness of the site selection process
- » Involve interested organizations and individuals in implementation of APM
- » Report out regularly on plans and progress

Building and maintaining relationships on many levels:

- » Communities and regions learning more about the site selection process
- » Municipal associations, community advisory groups
- » Aboriginal organizations, NWMO Elders Forum, Niigani
- » Reactor site communities
- » Diversity of interests – environment, industry, research, international
- » Federal and Provincial Governments

Collaborative Design of Process for Site Selection

- » **2008: Public dialogue on principles for siting**
- » **2009: Public review of draft site selection process**
 - ◆ Citizens panels, open houses
 - ◆ Multi-party dialogues with diversity of interests
 - ◆ National, regional Aboriginal organizations
 - ◆ Elders Forum, Aboriginal Working Group
 - ◆ Municipal Associations and Municipal Forum
 - ◆ Federal and Provincial government departments
 - ◆ Web-based dialogues
 - ◆ Nation-wide telephone survey
- » **2010: Published site selection process**
 - ◆ Published in May 2010, refined with public input
 - ◆ Marked initiation of siting process



Site Selection Criteria



» **Ensure technical safety – to protect humans and the environment, now and in the future:**

- ◆ Progressive and thorough site evaluation process
- ◆ Comprehensive technical site evaluation criteria

» **Beyond technical safety – to foster the well-being of the community:**

- ◆ Socio-economic criteria to assess the potential effects of the project on the community



How will the Site be Chosen?

- » Focus on safety
- » Meet or exceed regulatory requirements
- » Informed and willing host community
- » Community-driven
- » Shared decision-making
- » Involve surrounding communities, region and aboriginal peoples



NWMO Site Selection Process

Step 1

Becoming
aware &
informed

Steps 2, 3 & 4

Assessing interest & suitability

- Community visioning
- Screening
- Feasibility
- Detailed assessment
- Regional study & involvement
- Centres of expertise launched

Step 5

Community
assesses &
demonstrates
willingness

Step 6

Preferred site
identified

- Collaborative
agreement
established

Step 7

Regulatory
review &
approvals

- Site is selected

Step 8

National centre of
expertise established
& construction
of underground
demonstration facility

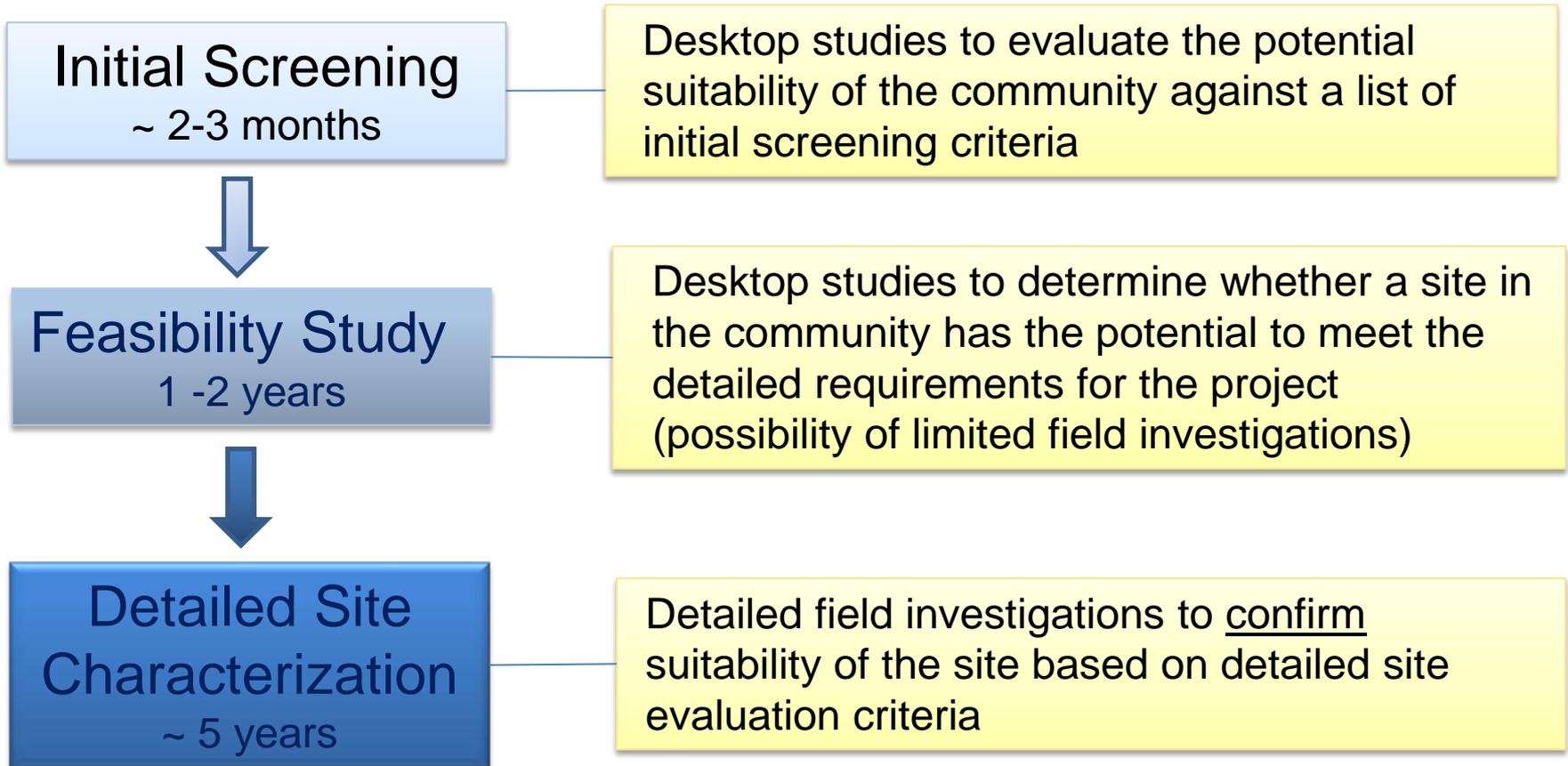
Step 9

Construction
of repository
begins...

Three Main Technical Evaluation Stages



Site evaluation process is driven by community's interest to participate:



Initiation of Site Selection Process

- » Site selection process initiated May, 2010
- » Supported by capacity-building program: *Invitation to Learn More*
 1. Briefings, information packages
 2. Access to independent expert advice
 3. Visit to interim storage facility to see how used fuel currently managed
 4. Support for community discussion of its long-term vision for sustainability
 5. Support for community to engage citizens in discussion of project
 6. Resources for small research projects by organizations, communities
- » On request of communities, NWMO provides initial screenings to explore potential suitability of the area

Status of Community Engagement

- » Since initiation of siting process earlier this year, NWMO has been responding to requests to Learn More:
 - ◆ Delivering detailed briefings on APM, site selection criteria and decision-making process
 - ◆ Responding to community requests for public information displays, kiosks
 - ◆ Arranging visits to OPG facilities to tour interim storage facilities
 - ◆ Supporting community engagement of independent expertise

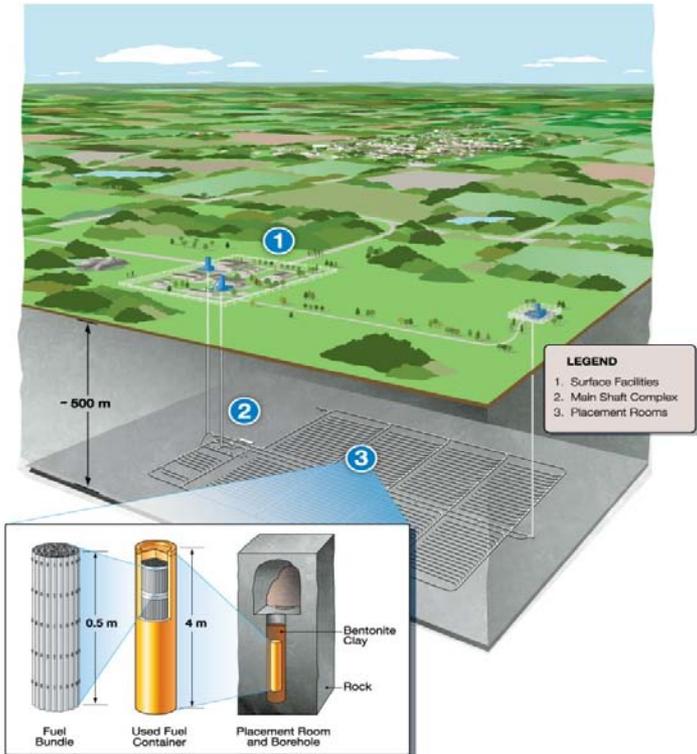
- » CNSC staff responding to requests of communities to meet for briefings on regulatory framework

- » NWMO delivering Initial Screenings on request of communities:
 - ◆ 4 communities
 - 2 in NW Ontario (Ignace and Ear Falls)
 - 2 in Northern Saskatchewan (English River First Nation, Pinehouse)

Repository Technical Development Program

» Main Objectives:

- ◆ Complete generic repository design development by 2018
 - Update reference conceptual design and safety case for crystalline rock by 2011 and submit to CNSC for pre-project review
 - Establish reference conceptual design and safety case for sedimentary rock by 2013 and submit to CNSC for pre-project review
- ◆ Further increase confidence in the deep geological repository safety case
- ◆ Enhance understanding of processes that may influence repository safety



APM Technical Program Areas of Work

» Engineering Design Optimization:

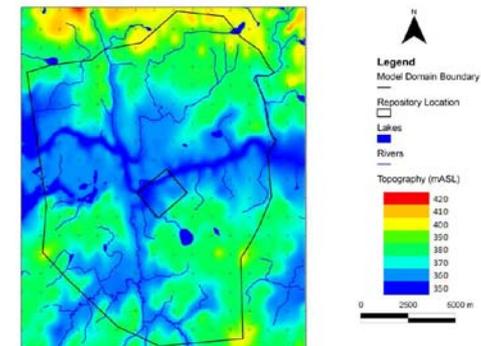
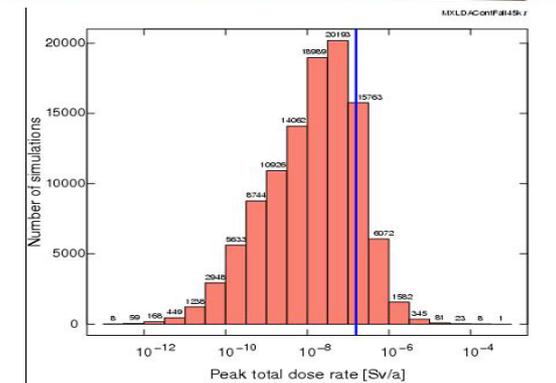
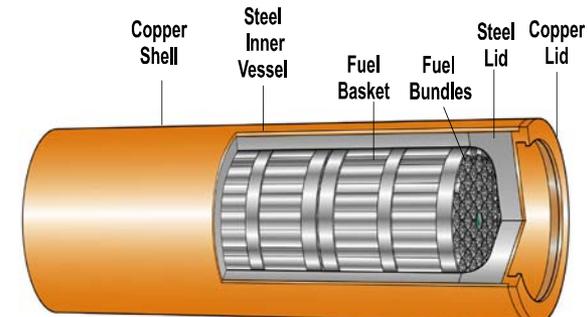
- ◆ container development: copper & steel
- ◆ packaging plant development
- ◆ repository design & facility layout
- ◆ sealing materials
- ◆ underground demonstration of technology

» Safety Case:

- ◆ 4th Case Study: DGR in crystalline rock
- ◆ 5th Case Study: DGR in sedimentary rock
- ◆ safety system model validation
- ◆ corrosion processes & lifetime prediction

» Geoscience:

- ◆ geosphere stability
- ◆ groundwater flow & coupled modelling
- ◆ glaciation & potential impacts on repository
- ◆ site characterization methods & techniques



Technical Program Participants

- » Exchange agreements with equivalent organization in Sweden, Finland, France and Switzerland
- » Joint Development Projects in repository engineering, geoscience and safety assessment:
 - ◆ Äspö Hard Rock Laboratory (Sweden)
 - ◆ Mont Terri Underground Laboratory (Switzerland)
 - ◆ Greenland Ice Sheet – Glaciation Modelling
 - ◆ Eleven Universities

Transportation System Development in Canada



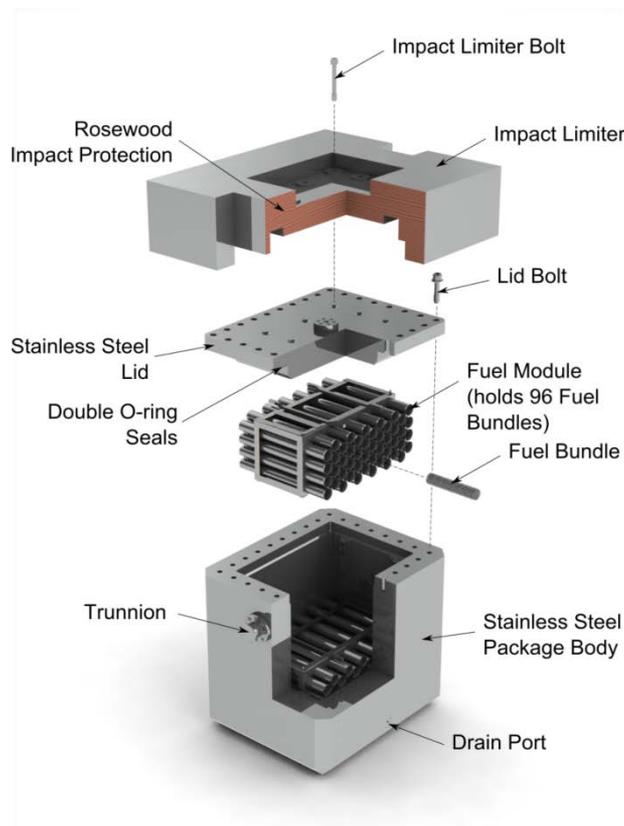
- » 1978 Canadian Nuclear Fuel Waste Management Program:
 - ♦ Repository technology developed by Atomic Energy of Canada Limited (AECL)
 - ♦ Transportation technology developed by Ontario Hydro (now OPG)

- » Demonstration transport cask developed in 1980s (designed, tested, certified and constructed)

- » Radiological risk assessment of transportation submitted in 1994 for public review (i.e., Seaborn Panel Hearings 1996/1997)

- » Transportation system costs produced in 2003:

- ♦ Approximately \$1 B for road, or mostly rail
- ♦ Approximately \$1.4 B for mostly water





- » Develop a framework for transportation feasibility studies assessment
 - ◆ Transportation infrastructure impacts, needs, and costs
 - ◆ Carbon footprint assessment
- » Prepare used fuel transportation logistics report
- » Update transportation radiological risk assessment (generic)
- » Briefings with governments and transportation organizations:
 - ◆ e.g. CNSC, Transport Canada, municipal leaders in nuclear communities, etc.
 - ◆ Communities involved in future assessments of transportation feasibility studies



Service arrangement between the CNSC and the NWMO

- » Pre-project review:
 - ◆ CNSC review of APM design concepts
 - ◆ Focused on conceptual designs and postclosure safety assessments for crystalline & sedimentary rock types
 - ◆ Agreement on process for pre-project review was reached

- » Meeting with communities at their request

- » Coordination among Federal Authorities on transportation issues