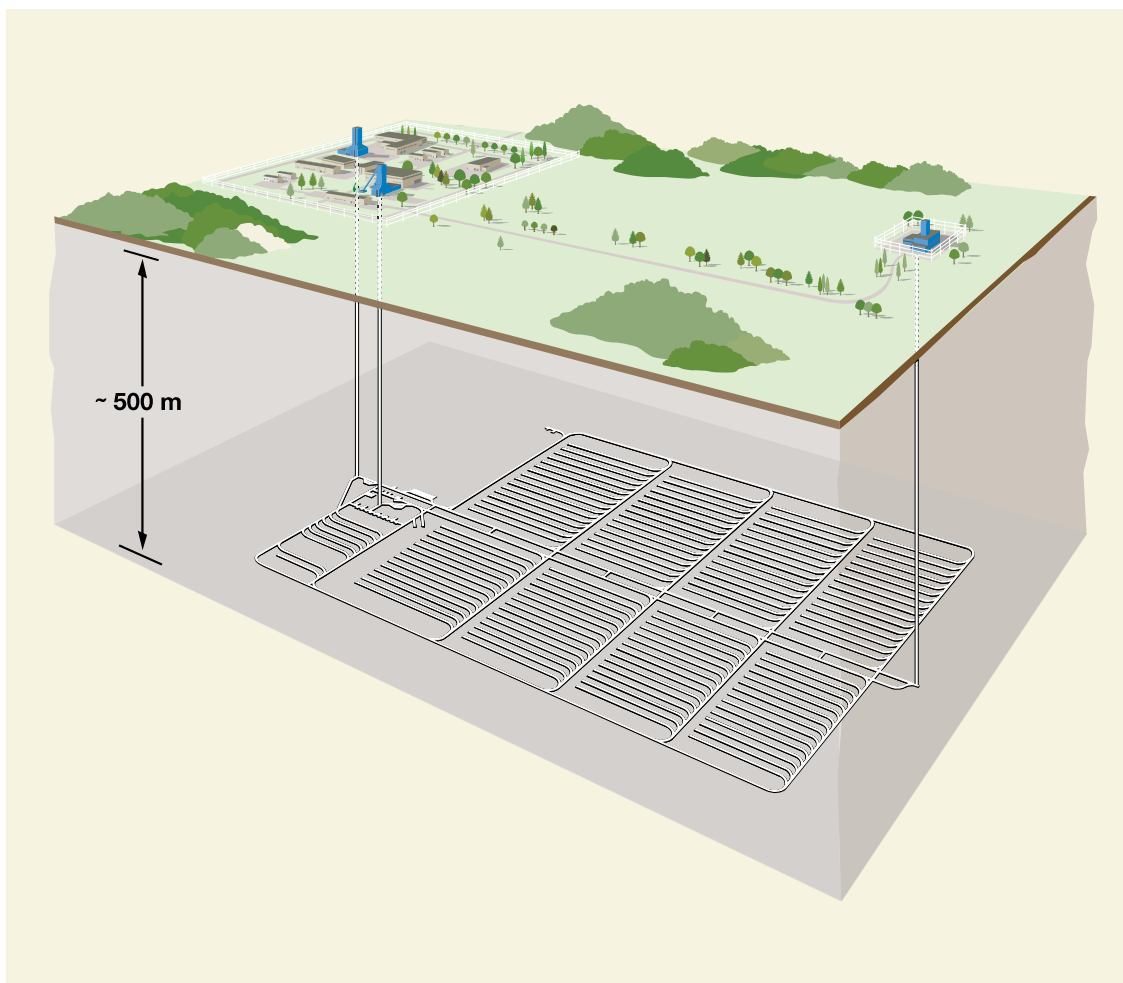


Description of a Deep Geological Repository and Centre of Expertise for Canada's Used Nuclear Fuel

2015



Nuclear Waste Management Organization

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Introduction



This document describes the many elements of Canada's plan for the long-term management of used nuclear fuel, including the deep geological repository, associated surface facilities and Centre of Expertise. More information is available on the Nuclear Waste Management Organization (NWMO) website (www.nwmo.ca).

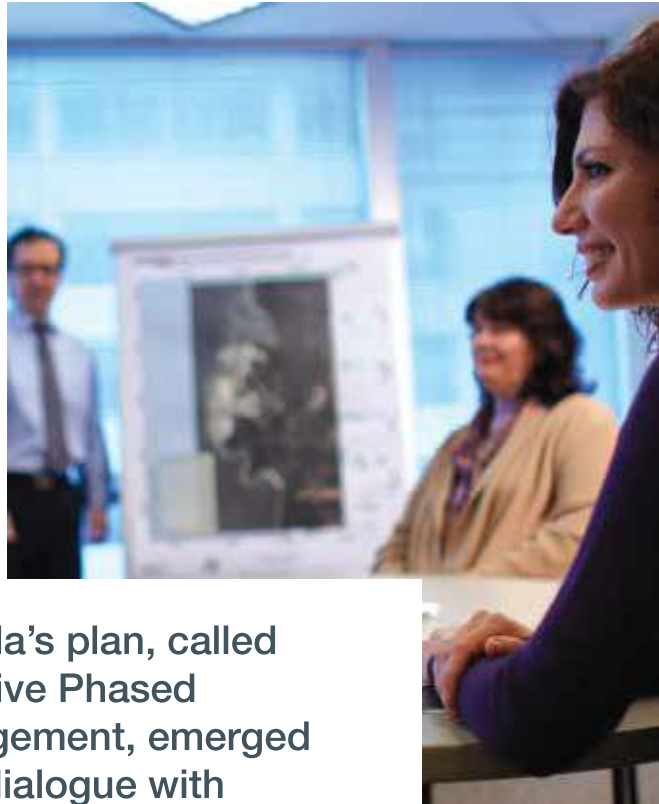
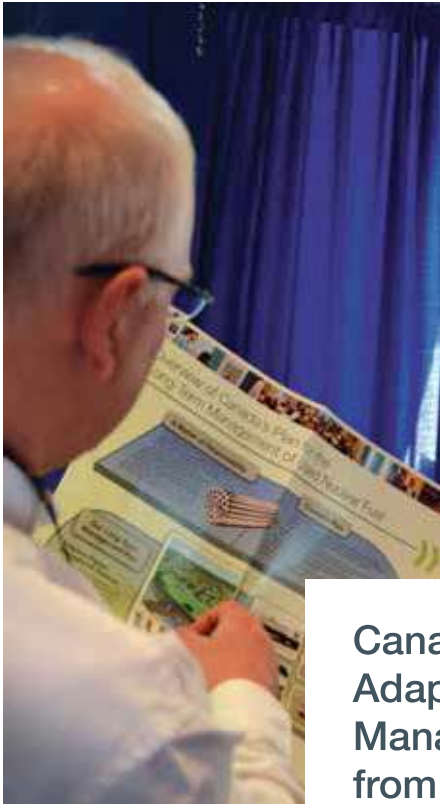
Canada's plan, called Adaptive Phased Management, emerged from dialogue with Canadians and specialists, and best meets the key priorities considered important by citizens. It is designed to be implemented collaboratively in an area with a suitable rock formation, and an informed and willing host. The process to select a site was developed collaboratively with Canadians.

A reference design has been developed by the NWMO as a basis for planning and costing, and is further described in this document. The NWMO is continuing to refine aspects of the reference design through technology development and demonstration programs conducted in Canada and internationally. The repository designs the NWMO is developing will act as a starting point for more detailed discussion with communities involved in the site selection process and with others who are interested in the project.

Some aspects of the repository design may be refined through discussions with the communities that initiated their areas' involvement in the process, First Nation and Métis communities in potential siting areas, and surrounding communities to better address their values, needs and preferences. Other aspects of the design can only be confirmed once a potential site has been identified, and site-specific technical and scientific studies have been completed. The NWMO will learn from these studies and will further refine the design to ensure protection of people and the environment, and to foster well-being in the area.

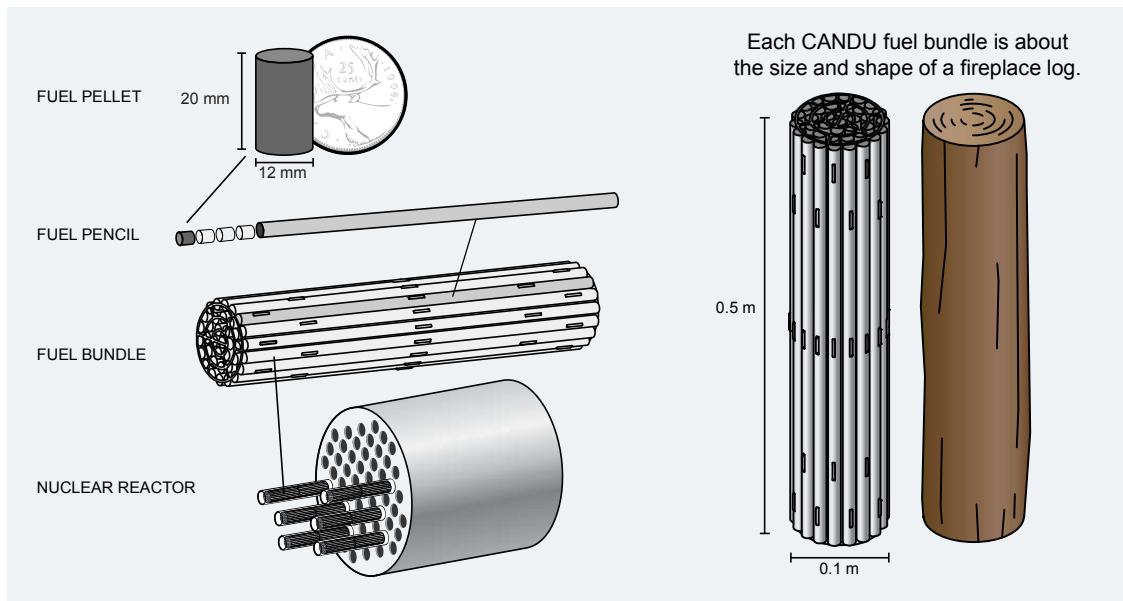
This document begins with a brief description of Canada's used nuclear fuel, the material that needs to be managed over the long term. It goes on to describe features of the facility, including the Centre of Expertise, surface facilities and underground facilities.

This is a large national infrastructure project that will bring about benefits for the community, region and province where it is implemented. This document describes the many phases of project implementation and its estimated economic impact, including expected project spending and job creation.



Canada's plan, called Adaptive Phased Management, emerged from dialogue with Canadians and specialists, and best meets the key priorities considered important by citizens.





Used Nuclear Fuel

What is Used Nuclear Fuel?

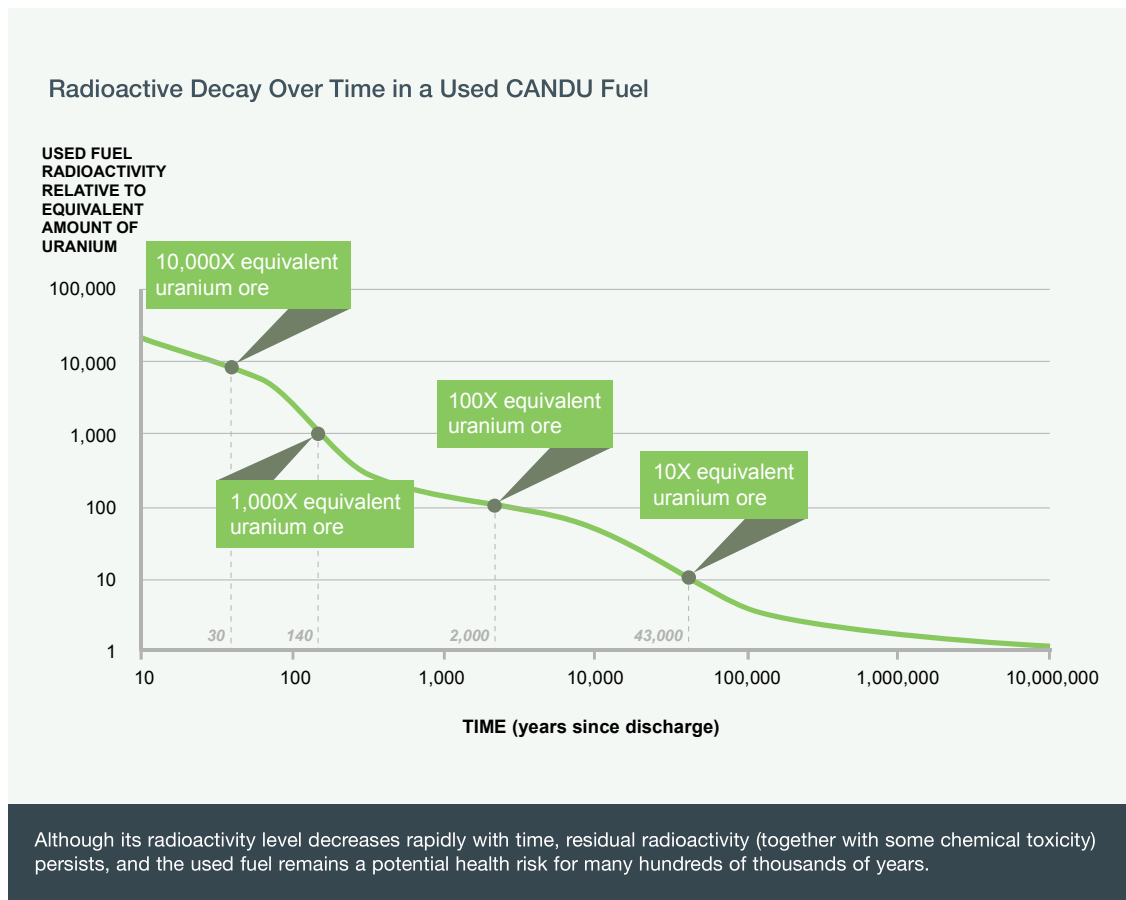
For decades, Canadians have been using electricity generated by CANDU nuclear power reactors in Ontario, Quebec and New Brunswick. As of June 30, 2015, Canada's commercial nuclear reactors have produced about 3,100 terawatt hours of electricity and just over 2.6 million used fuel bundles. This used nuclear fuel is safely stored at the sites where it is produced in facilities licensed by the national regulator – the Canadian Nuclear Safety Commission. In addition, there are small quantities of used research and development fuels in a licensed facility at Atomic Energy of Canada Limited's Canadian Nuclear Laboratories. If used nuclear fuel bundles could be stacked like cordwood, all Canada's used nuclear fuel could fit into about seven hockey rinks, reaching from the ice surface to the top of the boards.

CANDU nuclear fuel consists of uranium dioxide (UO_2) made from naturally occurring uranium. During fabrication, UO_2 powder is pressed into solid pellets and then baked into a ceramic form. The ceramic pellets are placed inside a tube made of a zirconium-tin alloy, with the completed assembly called a fuel element or fuel pencil. A CANDU fuel bundle consists of a cylindrical array of 28 or 37 of these fuel elements mounted together to form a bundle. Each CANDU fuel bundle has a length of about 0.5 metre and a diameter of about 0.1 metre, contains about 20 kilograms of uranium, and has a total mass of about 24 kilograms.

When CANDU fuel is removed from the reactor at the end of its useful life, it is considered a waste product. Used fuel is highly radioactive and requires

careful management, essentially indefinitely. Although its initial radioactivity level decreases rapidly with time, residual radioactivity (together with some chemical toxicity) persists, and the used fuel remains a potential health risk for a very long period of time. It will take about one million years for the radioactivity level to reach about that of an equivalent amount of natural uranium. The figure below provides information regarding radioactive decay over time in used CANDU fuel. Canada has a robust regulatory framework that governs the handling of used nuclear fuel. Used nuclear fuel is carefully managed and shielded at all times to ensure that no one is at any time exposed to an unshielded bundle.

For more about the nature of the hazard and health effects of radiation, please see Nuclear Waste Management Organization (NWMO) background information available at www.nwmo.ca.



How Much Used Nuclear Fuel Will Be Managed?

The *Nuclear Fuel Waste Act*, which was passed by the Government of Canada in 2002, requires the NWMO to manage all used nuclear fuel produced in Canada.

Currently, Canadian reactors produce about 90,000 used CANDU fuel bundles per year. If Canada's existing reactors operate to the end of their planned current lives, including planned refurbishments, the inventory of used fuel that will need to be managed in the facility could be about 4.6 million bundles, depending on future operating experience. The repository will need to be large enough to contain and isolate the inventory of used fuel from nuclear plants in Canada. Canada's plan was developed for managing Canada's used nuclear fuel. No foreign used fuel will be placed in the Adaptive Phased Management repository.

For design and safety assessment purposes, the NWMO has assumed a reference used fuel inventory of 4.6 million used CANDU fuel bundles from the existing nuclear reactor fleet in Canada.

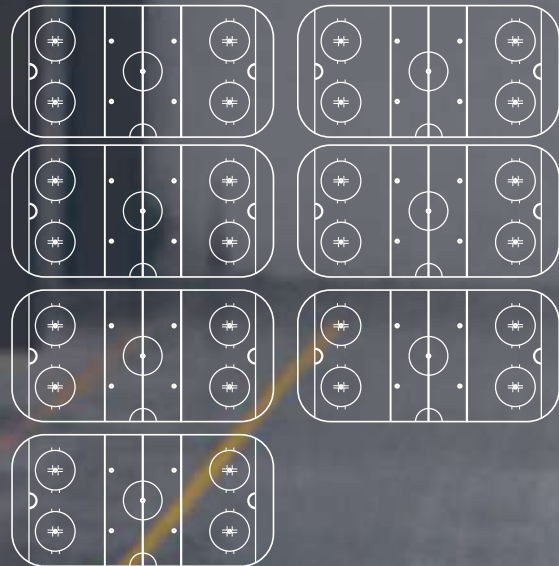
In the future, decisions regarding nuclear power generation made by provincial governments, nuclear plant operators and regulators may result in the creation of a larger inventory and perhaps different types of used fuel. For instance, the lives of existing reactors might be extended through additional refurbishment. Provincial governments may also decide to build new nuclear plants.

The specific amount of used fuel to be placed in the repository for long-term management will be agreed with the community using the best information available at the time, and through an open and transparent engagement process involving surrounding communities and others who are interested and potentially affected. Regulatory review processes and approvals, which are required by law before the facility can be constructed and operated, will be based on a specific fuel inventory and will also involve an open and transparent consultation process.

>2.6 million

There are currently just over 2.6 million used nuclear fuel bundles in Canada.

If stacked like cordwood, all this used nuclear fuel could fit into seven hockey rinks from the ice surface to the top of the boards. At the end of the planned operation of Canada's existing nuclear reactors, the number of used nuclear fuel bundles will total about 4.6 million.



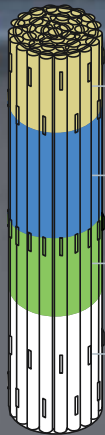
Summary of Nuclear Fuel Waste in Canada as of June 30, 2015

Total Bundles: 2,598,988

OPG (Owner)

Location
No. of Bundles

Current Status



Bruce A⁽²⁾
476,454

4 units operational

Bruce B⁽²⁾
636,392⁽⁴⁾

4 units operational

Darlington
489,696⁽⁵⁾

4 units operational

Pickering A & B
701,417

A – 2 units operational,
2 units permanently
shut down

B – 4 units operational

AECL (Owner)

Location
No. of Bundles

Current Status



Douglas Point
22,256

Permanently shut
down

Gentilly-1
3,213

Permanently shut
down

AECL Whiteshell
2,268

Permanently shut
down (see note 1)

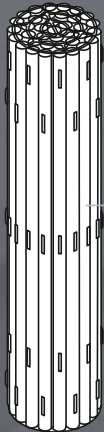
AECL Chalk River
4,921

Mostly fuel from NPD
(permanently shut down) and
with small amounts from other
reactors (see note 3)

HQ (Owner)

Location
No. of Bundles

Current Status



Gentilly-2
129,941

Permanently shut
down end of 2012

NBPN (Owner)

Location
No. of Bundles

Current Status



Point Lepreau
132,430

Operational

- (1) 360 bundles of Whiteshell fuel are standard CANDU bundles. The remaining bundles are various research, prototype and test fuel bundles, similar in size and shape to standard CANDU bundles.
- (2) Bruce reactors are leased to Bruce Power for operation.
- (3) In addition to the totals shown above, AECL also has some 22,000 components of research and development fuels such as fuel elements, fuel pellets and fuel debris, in storage at Chalk River. While the total mass of these components is small compared to the overall quantity of CANDU fuel, their varied storage form, dimensions, etc. require special consideration for future handling. There are also small quantities (a few kilograms) of non-CANDU fuel associated with several research reactors in Canada.
- (4) Total includes approximately 105,000 "long bundles."
- (5) Total includes approximately 145,000 "long bundles."

**Total of: - 19 units in operation
- 7 units shut down (including
prototype and demonstration reactors)**

AECL: Atomic Energy of Canada Limited
HQ: Hydro-Québec
NBPN: New Brunswick Power Nuclear
NPD: Nuclear Power Demonstration
OPG: Ontario Power Generation



Canada's Plan for Long-Term Used Fuel Management

Components of Canada's Plan

Canada's plan for the long-term care of used nuclear fuel is known as Adaptive Phased Management (APM). It emerged from dialogue with Canadians and experts, and best meets the key priorities considered important by citizens. The federal government selected APM as Canada's plan in June 2007.

The plan is consistent with the long-term management approach adopted by other countries with nuclear power programs, such as Finland, Sweden, Switzerland, the United Kingdom, and France.

Canada's plan is both a technical method and a management system.

Adaptive Phased Management at a Glance

Technical Method

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

Management System

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

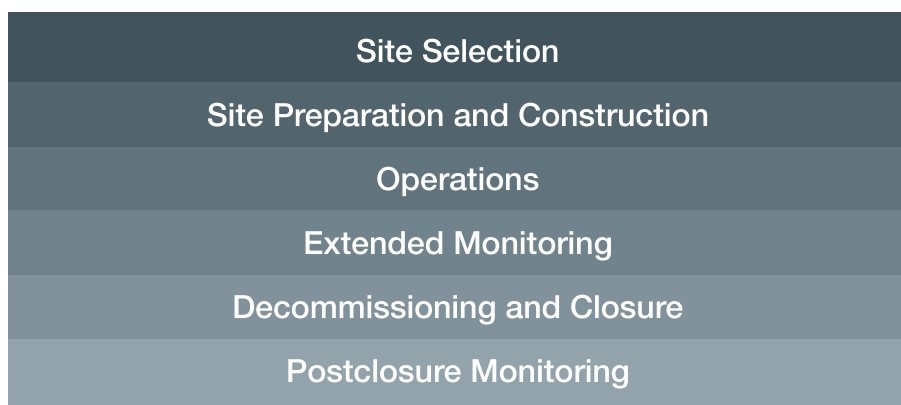
* Temporary shallow storage at the deep geological repository is optional and not currently included in the NWMO's implementation plan.

Phased Implementation

Canada's plan for long-term management of used nuclear fuel is designed with a risk management approach of deliberate stages and periodic decision points. It will meet rigorous safety and security standards throughout its design and implementation process to ensure health and safety of people and the environment. It has been designed to be flexible to allow for new learning and social priorities, and to be adaptable to other changes that may be encountered along the way.

The project will only proceed with the interested community, First Nation and Métis communities in the area, and surrounding communities working together to implement it.

Canada's plan for used nuclear fuel is a multi-generational project that will be implemented through a number of phases. These include:



The Nuclear Waste Management Organization (NWMO) initiated the site selection process in May 2010. Site selection may take about 15 years or more to complete, followed by a 10-year period to prepare the site and construct the facility. Used fuel transportation, handling and placement operations in the repository will occur over a period of about 40 years or more, depending on the inventory of used fuel to be managed. After that, the repository will be monitored for an extended period of time before decommissioning, closure and postclosure monitoring.

Facilities

Canada's plan for used nuclear fuel is an approximately \$21-billion (2010 \$) national infrastructure project, based on an estimated used fuel inventory of 4.6 million fuel bundles. It is funded by waste owners through trust funds required by the *Nuclear Fuel Waste Act (2002)*. Key APM facilities include:

- » National Centre of Expertise;
- » Used fuel container manufacturing plant and related facilities;
- » Used fuel packaging plant;
- » Sealing material compaction plant;
- » Deep geological repository;
- » Used fuel transportation package manufacturing plant; and
- » Used fuel transportation system, including development and maintenance of vehicles and ancillary facilities.

Transportation of Used Nuclear Fuel

Placing all Canada's used nuclear fuel in a deep geological repository will require transportation from the seven interim, licensed storage facilities where it is currently safely stored. These are located at nuclear power plants and research facilities.

Used nuclear fuel has been safely transported for over 50 years in Canada and internationally with no serious injuries, health impacts, fatalities, or environmental consequences attributable to the radiological nature of the shipments.

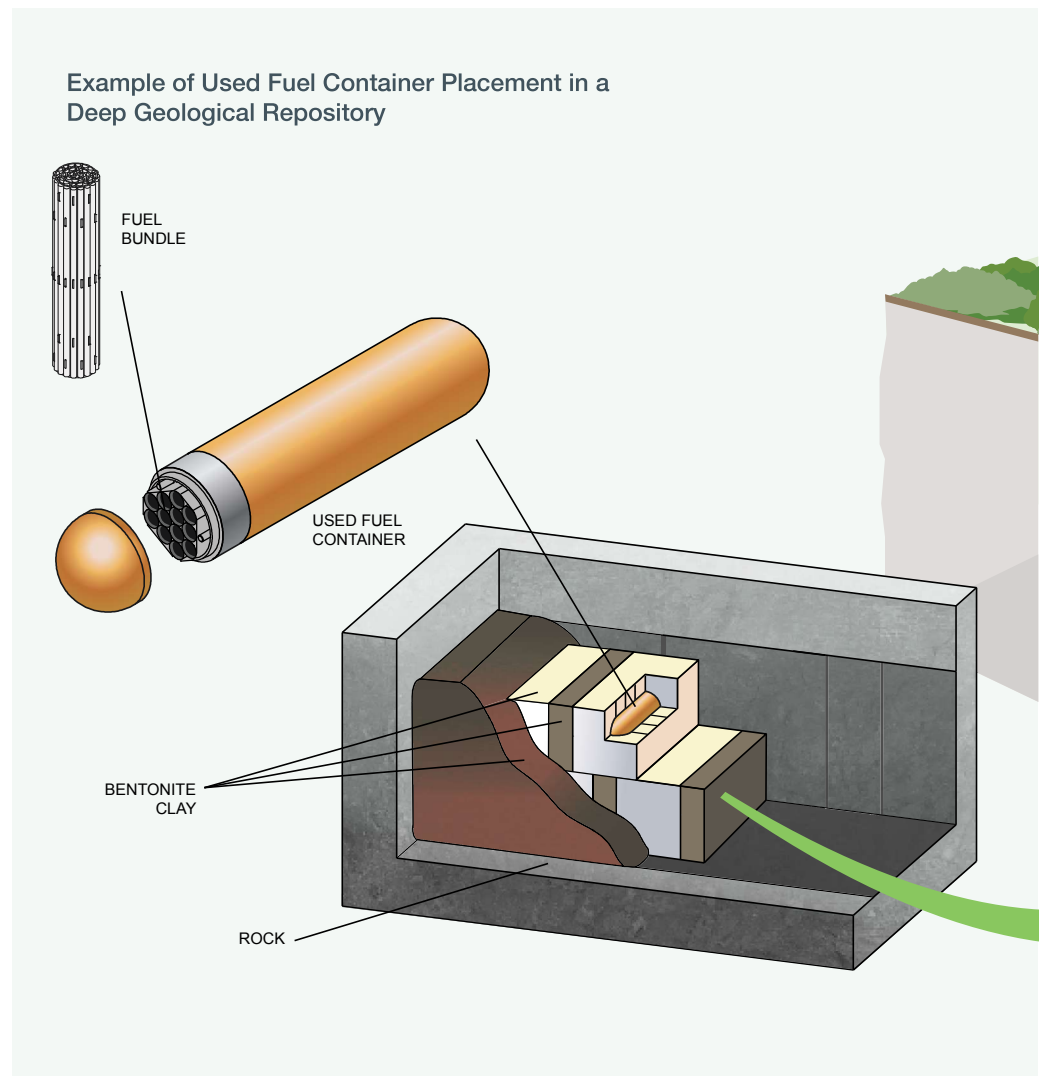
Transportation is subject to robust regulation and oversight. The NWMO will need to demonstrate the safety and security of any transportation system to the satisfaction of both regulatory authorities and citizens before transportation of used nuclear fuel to the repository can begin. Transportation of this material will need to meet stringent requirements laid out by Transport Canada and the Canadian Nuclear Safety Commission before a licence to transport can be issued. Once a licence is issued, it will be the subject of ongoing compliance monitoring.

For more information about this topic, including the design of robust transportation packages, the rigorous tests these packages must undergo, and the detailed regulatory framework governing the transportation of used nuclear fuel, please see the NWMO's brochure *Safe and Secure Transportation of Canada's Used Nuclear Fuel*, available online at www.nwmo.ca.



Examples of trucks that could be used for transportation of used nuclear fuel



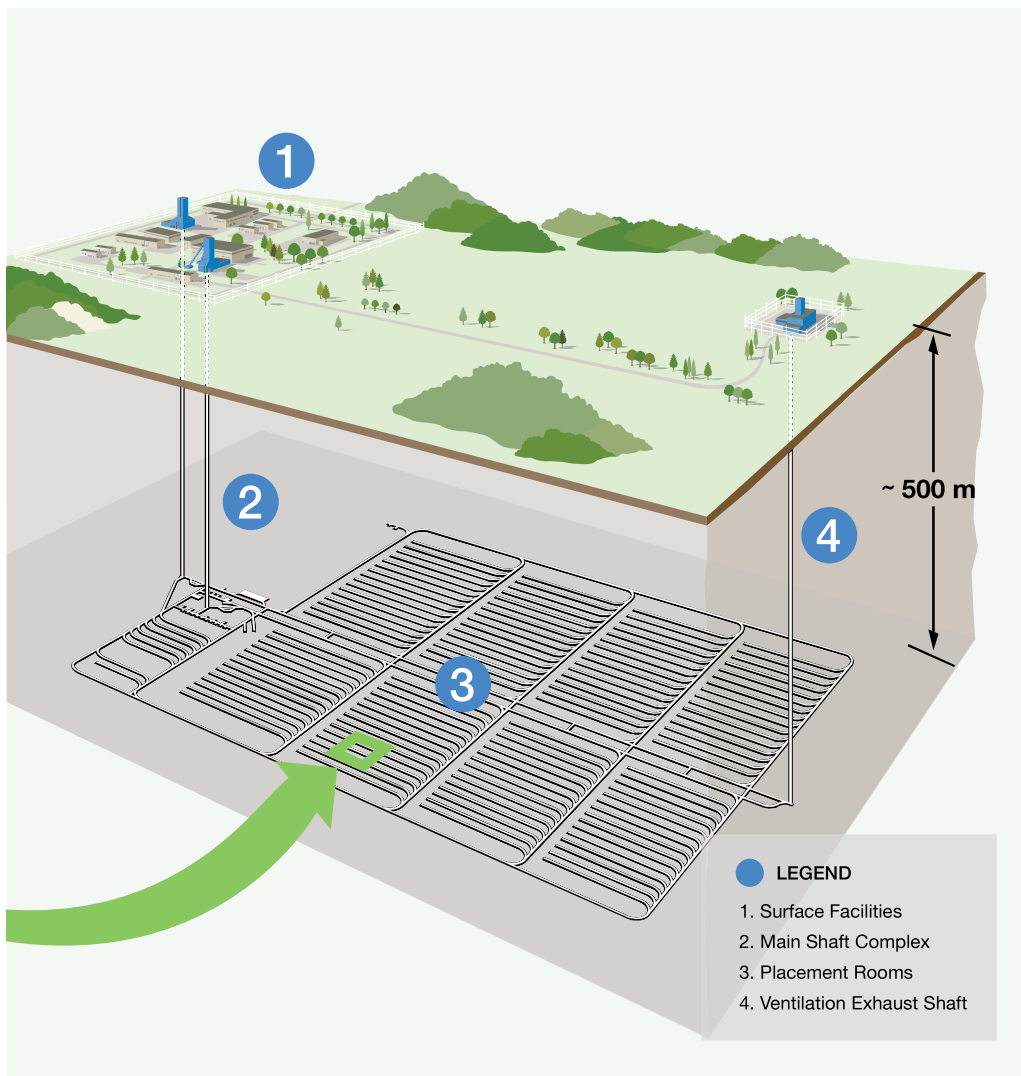


Description of the Facilities

Overview

Adaptive Phased Management (APM) facilities include a Centre of Expertise, a number of surface facilities and a deep geological repository for the long-term management of Canada's used nuclear fuel.

The **Centre of Expertise** will be home to active technical research, social research and technology demonstration programs involving scientists and other experts in a wide variety of disciplines, including geoscience, engineering, and environmental, socio-economic and cultural impact assessment.



The **surface facilities** will process approximately 120,000 used CANDU fuel bundles per year. Their primary function is to receive used fuel shipped from interim storage facilities, repackage the used fuel bundles into durable, corrosion-resistant used fuel containers, and transfer the containers underground for placement in the deep geological repository. The surface facilities require a dedicated surface area of about 650 metres by 550 metres for the main buildings and about 100 metres by 170 metres for the ventilation exhaust shaft.

The **deep geological repository** is a multiple-barrier system designed to safely contain and isolate used nuclear fuel over the long term. Based on the current reference design, it will be constructed at a depth of approximately 500 metres, depending upon

the specific geology and detailed characteristics of the site. It will consist of a network of placement rooms for the used fuel containers and clay-based sealing systems, as well as a series of access tunnels and shafts to ensure accessibility and monitoring. The layout of the underground repository will depend on a number of factors, including the characteristics of the rock types underground, refinements made to the final design of the engineered-barrier system, final safety considerations, and the inventory of used fuel to be managed. A conceptual layout for a repository would require an underground footprint of about two kilometres by three kilometres (about 600 hectares or 1,480 acres).

Used fuel containers are an important component of the multiple-barrier system, which is designed to safely contain and isolate used nuclear fuel over the long term. For the expected, normal evolution of the repository, used fuel containers will remain intact, and the radionuclides in the used fuel will remain inside the container. Safety studies have been prepared to examine other possible future events or “what-if” scenarios where used fuel containers and sealing systems deviate from their expected evolution in the repository. These studies are used to help demonstrate that the repository will protect the public and the environment.

Following placement of used fuel in the repository, the facility will continue to be monitored, and the used fuel will be retrievable for an extended period of time. The Nuclear Waste Management Organization (NWMO) will have to demonstrate that safety requirements have been met during the extended monitoring period. The duration of this monitoring period will be decided many decades from now and will be informed by input from the community.

Once a decision has been made to close the facility, the NWMO will need to seek the appropriate regulatory approvals prior to decommissioning. Any remaining equipment will be removed, and then the access tunnels and shafts will be backfilled and sealed. The nature and duration of postclosure monitoring will be informed by input from the community at that time. The NWMO will have to demonstrate that safety requirements will be met after closure of the facility.

Centre of Expertise

A Centre of Expertise will be established in or near the community, as determined with people who live in the area, to support detailed site evaluation. Its purpose will be to support the multi-year testing and assessment of the site on technical safety and community well-being related dimensions, which are key components of the site selection process. The Centre of Expertise will be home to an active technical and social research and technology demonstration program during this period, involving scientists and other specialists in a wide variety of disciplines, including geoscience, engineering, and environmental, socio-economic and cultural impact assessment.

An engineering test facility will be located within the Centre of Expertise. Activities in the engineering test facility will include container laser welding and copper coating development, bentonite clay buffer shaping and forming development, as well as the development of container placement equipment for the underground repository. The engineering test facility will also house production demonstration equipment to show the complete repository packaging and container placement process.



This artist rendering shows one possible design for a Centre of Expertise.

The Centre of Expertise would then be expanded to support construction, and later, operation of the deep geological repository. The Centre will become a hub for knowledge sharing across Canada and internationally. It may also serve as a training centre to prepare personnel to work on various aspects of project implementation.

Design details of the Centre of Expertise will be developed with the interested community, First Nation and Métis communities in the area, and surrounding municipalities with their preferences in mind. Discussion of design details also provides an important opportunity for involvement of youth. The Centre of Expertise could be designed as a focus for engaging members of the community to learn more about the project, and to view scientific and engineering work involved in site assessment, through public viewing galleries and interactive displays. The Centre could highlight and demonstrate the science and technology being used to determine whether the site is suitable and to encourage youth science literacy and capacity development. It may be developed as a meeting place and learning centre for the community, and as a destination that welcomes interested visitors from the region and beyond.

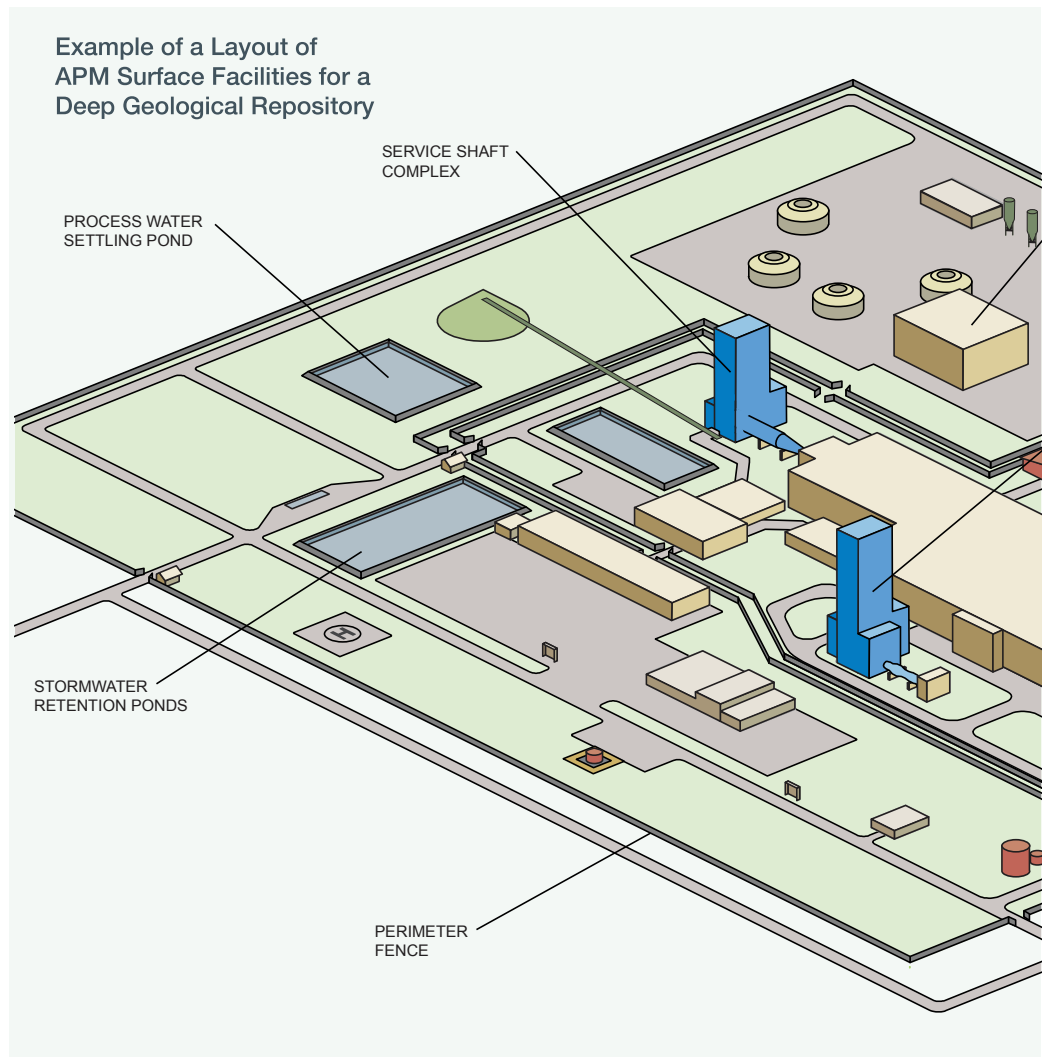
The technologies and monitoring processes involved in operating a deep geological repository may be of interest and have applications in the community beyond the repository. For example, repository technologies may have broader application in monitoring and protection of natural water systems in the area. The knowledge and expertise of scientists and technical specialists leading the implementation and operation of the repository could support environmental sustainability planning in the area. Opportunities to support and work collaboratively with the community to sustain and enhance the natural environment, the community and current land uses throughout the course of operation of the facility will be explored with the community. Opportunities to develop public spaces may also provide an opportunity for collaboration.

Should the First Nation and Métis communities in the area desire, the Centre of Expertise could feature a learning and demonstration area focused on how Aboriginal Traditional Knowledge is being applied to the project.

As with some other aspects of the project, the exterior design of facilities and the way they are incorporated into the surrounding landscape will be a subject of discussion and shared planning with those living in the area.



This artist rendering shows another possible design for a Centre of Expertise.



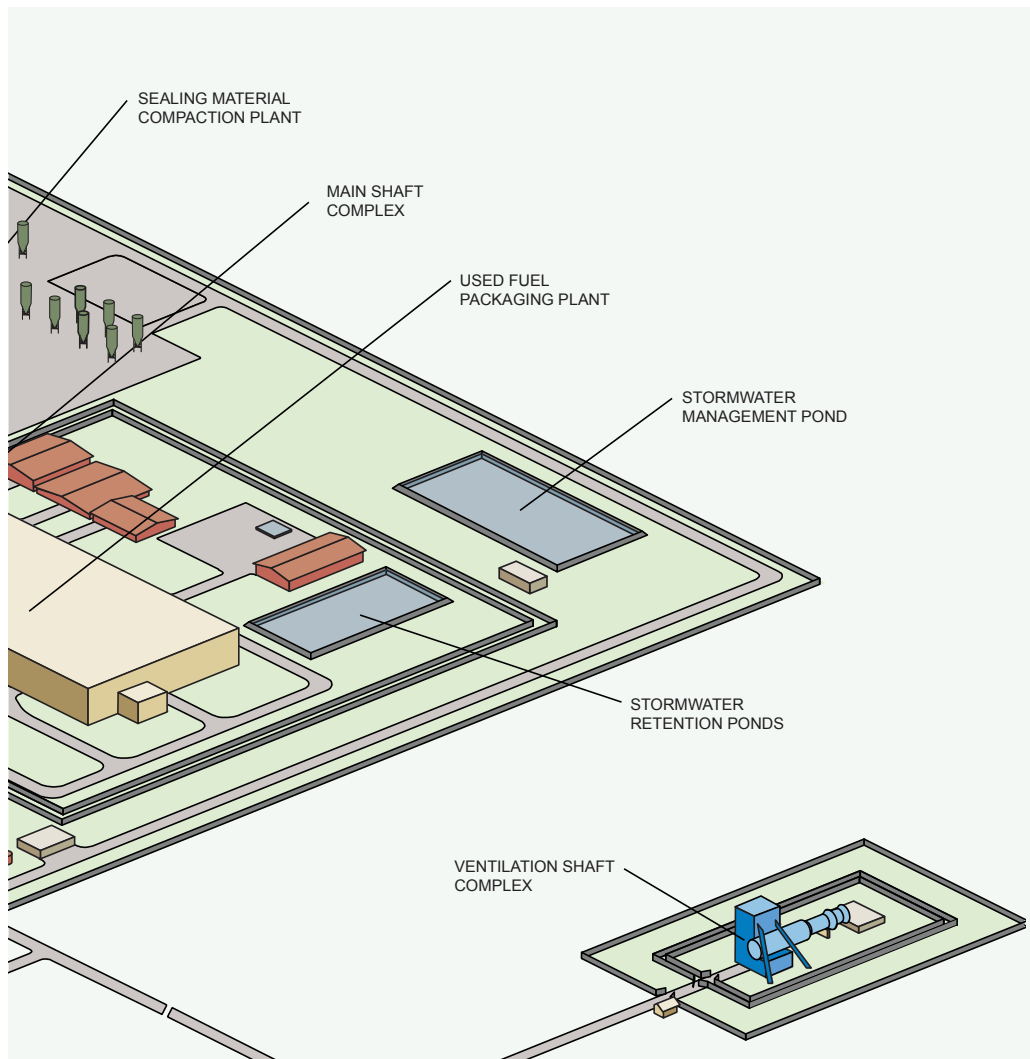
Surface Facilities

Surface facilities provide processes and equipment for receiving, inspecting, repackaging, and moving used fuel to the main shaft for transfer underground and placement in the repository.

The administration building would be the first building that visitors and most staff encounter when arriving at the facility.

For security purposes, certain areas of the surface will have restricted access. These restricted areas include the used fuel packaging plant, main shaft complex, service shaft complex, and ventilation shaft complex.

Other surface areas outside the restricted area would include the administration building, sealing material compaction plant and concrete batch plant. A management area for excavated rock from the underground repository would also be required. Its location (on-site or off-site) and footprint would be determined in collaboration with the community.



The surface facilities require a dedicated surface area of about 650 metres by 550 metres for the main buildings and about 100 metres by 170 metres for the ventilation exhaust shaft, which will be located approximately two kilometres away from the main buildings. The ventilation shaft location supports one-way ventilation flow from the main shaft through the underground repository and exhausting through the ventilation shaft. The NWMO expects that land above the underground footprint that is not required for surface facilities or to meet regulatory requirements would be available for other uses. The NWMO will have to demonstrate that regulatory or other requirements for safety that could limit those activities in the immediate area surrounding the surface facilities have been met.

A portion of excavated rock from the repository may be used in backfilling and sealing operations. The remaining rock may have a public or commercial use as aggregate for construction. The excavated rock management area is currently assumed to be located

off-site; its size and location will be determined in collaboration with the community and surrounding area.

An excavated rock management area could require a surface area of about 460 metres by 380 metres, with a height of 15 metres. The footprint, height and location(s) of excavated rock could be planned in a way that takes into account community preferences. The area will include a stormwater management pond to collect and manage surface water. Surface water run-off from the excavated rock management area will be controlled, monitored, and if required, treated to meet provincial water quality standards prior to discharge.

The concrete batch plant will produce the concrete mixes needed for specific functions in the repository, including the low-heat, high-performance concrete required for the bulkheads to be placed at the entrance of the filled container placement rooms and for other repository seals. At the sealing material compaction plant, raw aggregate materials and clay will be mixed to produce dense backfill blocks, light backfill, compacted bentonite blocks, and gapfill material required for used fuel container placement and for sealing of the placement rooms.

Water supply to the facility is assumed to be sourced locally and is expected to be about 130 cubic metres per day. It will be treated, if required, to provide potable water.

The total electrical power demand for the APM facility is estimated to be about 20 megawatts (MW). The site will be supported by several three-MW diesel emergency power generators and related equipment for use in the event of main line power failure.

During the 10-year construction phase, accommodation will be required for construction personnel. These workers could be housed in the community and surrounding area, or there could be a need to develop temporary infrastructure outside the main complex to provide sleeping quarters, kitchen, dining, laundry, medical, and recreation facilities. The NWMO will work with the community and surrounding area to plan for and contribute to development of community infrastructure required during construction and operation to house and integrate personnel into the area. Community preferences will be an important consideration in development of implementation plans that will meet the needs of communities.

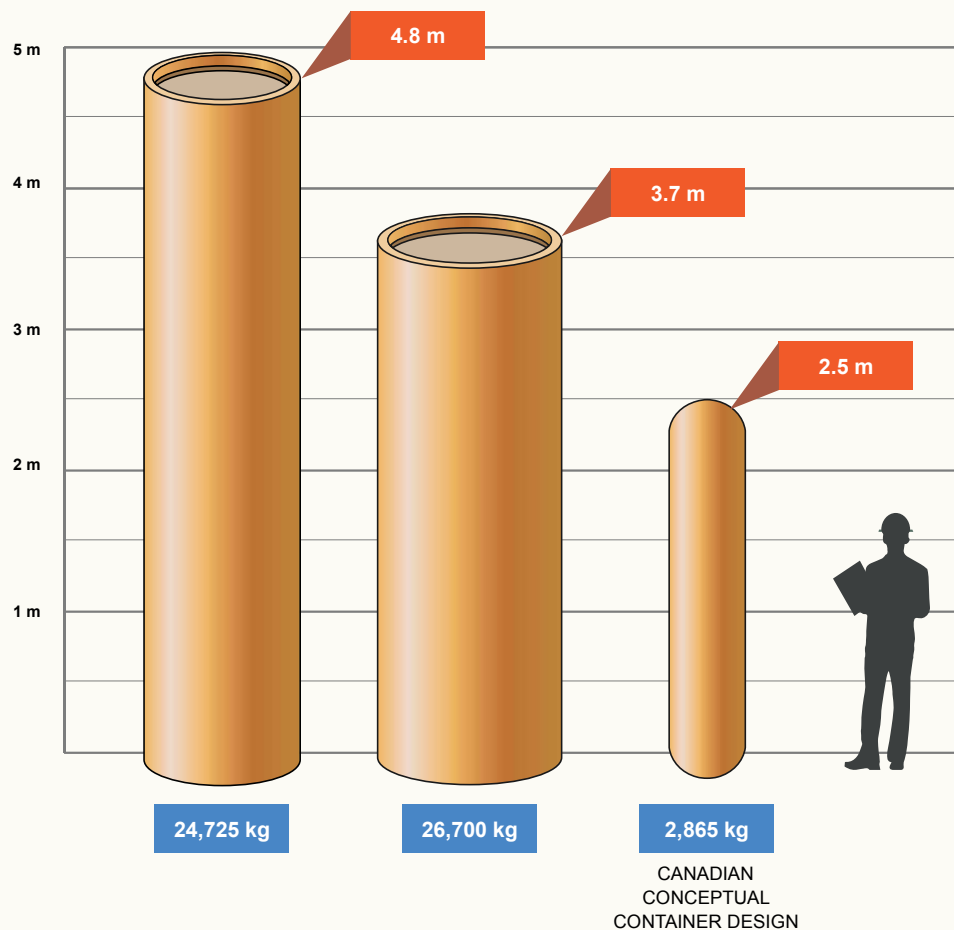
Used Fuel Container and Container Factory

The used fuel container is one of the principal engineered barriers in a multiple-barrier deep geological repository. The important features of the design are corrosion resistance, mechanical strength, ease of fabrication, capacity, and compatibility with surrounding sealing materials.

The used fuel container consists of an outer corrosion-resistant material and an inner supporting material. The container is designed to withstand mechanical and hydraulic pressures up to 45 megapascals. This means the container could withstand pressures at repository depth due to swelling of the bentonite clay buffer surrounding the container, from the rock surrounding the repository, and from three kilometres of ice above the site during a future ice age.

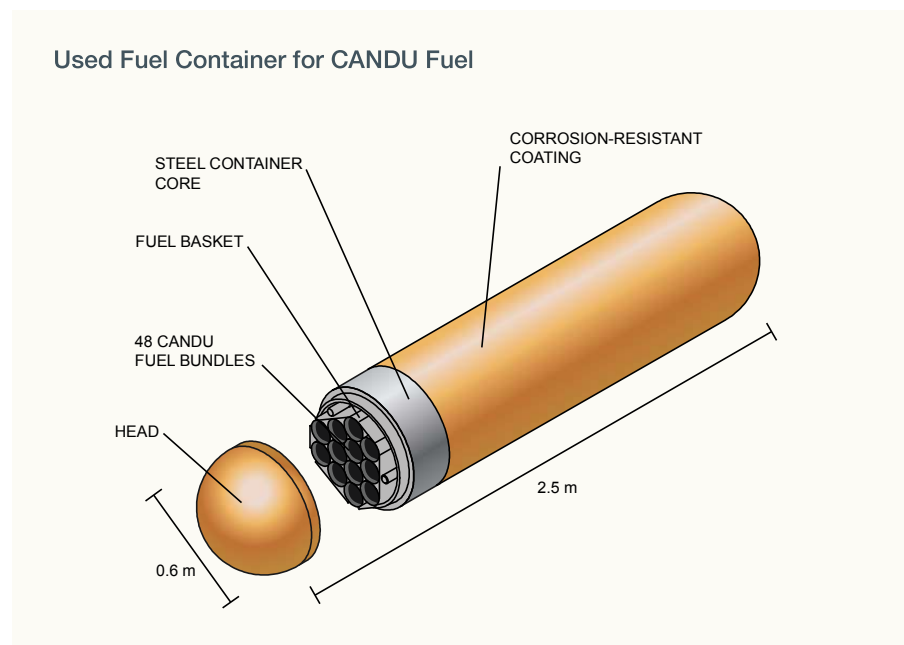
The NWMO examined several used fuel container designs and capacities for the deep geological repository. These particular container designs use steel for strength and copper for corrosion resistance. Due to the nature and size of CANDU fuel bundles, there are a number of options available in terms of container dimensions, capacity for used fuel, and placement configuration in the repository.

Various Designs for Used Nuclear Fuel Containers



The NWMO's current conceptual design is for a used fuel container with horizontal placement in the repository. This particular container, with a length of 2.5 metres, is illustrated in the figure below. The container holds 48 used CANDU fuel bundles (four layers of 12 bundles) in a steel basket within a standard carbon steel pipe, which is protected by a copper-coated, corrosion-resistant outer layer. The carbon steel pipe and copper coating technology for this container design are based on proven technology that is readily available in Canada. For a facility handling 120,000 fuel bundles per year, approximately 2,500 of these used fuel containers would be required per year of operation.

The used fuel container and supporting components will be manufactured at a container manufacturing plant, which could potentially be located in the host community or surrounding region, depending on interest.



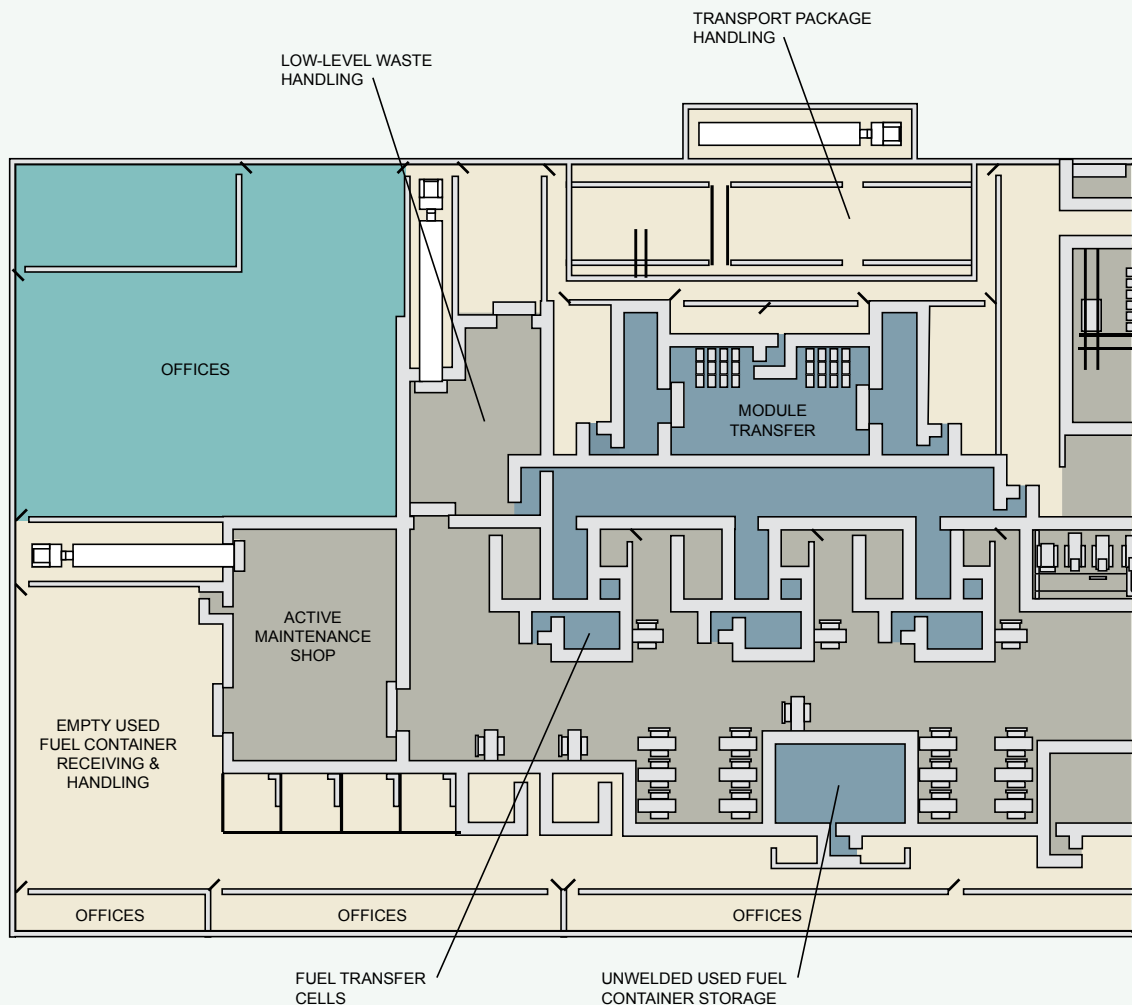


Fully assembled container placed in bentonite buffer box.

Used Fuel Packaging Plant

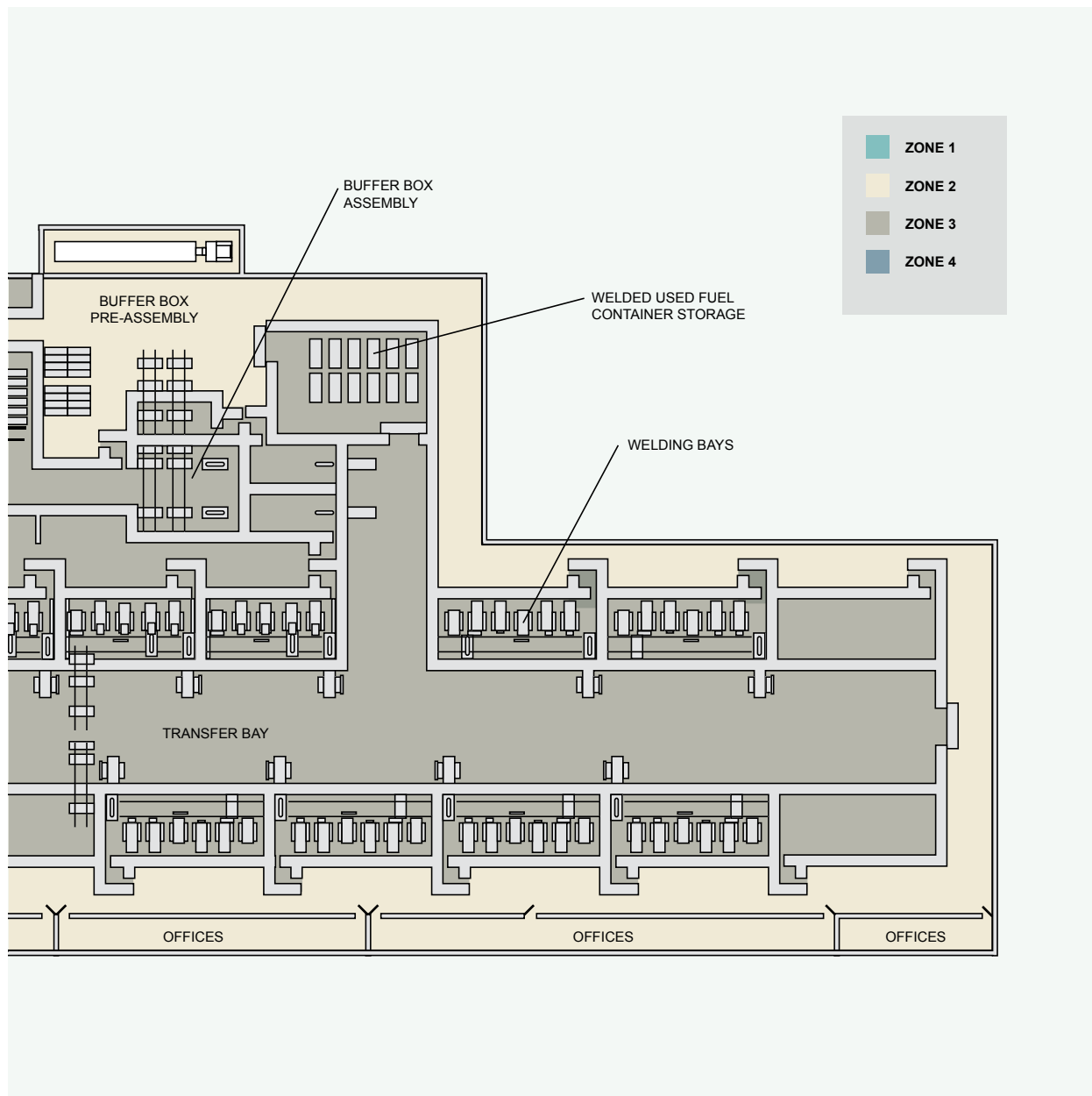
The used fuel packaging plant is an important component in the process of transferring Canada's used nuclear fuel from interim storage to a deep geological repository. It will be designed to receive and repackage used nuclear fuel into long-lived, corrosion-resistant containers for placement in the repository.

Example of a Layout for a
Used Fuel Packaging Plant



The used fuel packaging plant encompasses all necessary areas and equipment for:

- » Receiving used fuel transportation packages from interim storage sites;
- » Receiving empty used fuel storage containers;
- » Loading used fuel into storage containers; and
- » Sealing, inspecting and dispatching filled containers for underground transfer and placement in the deep repository.



There are also provisions for opening and repackaging fuel from any containers that may be rejected as unsatisfactory following non-destructive testing and examination.

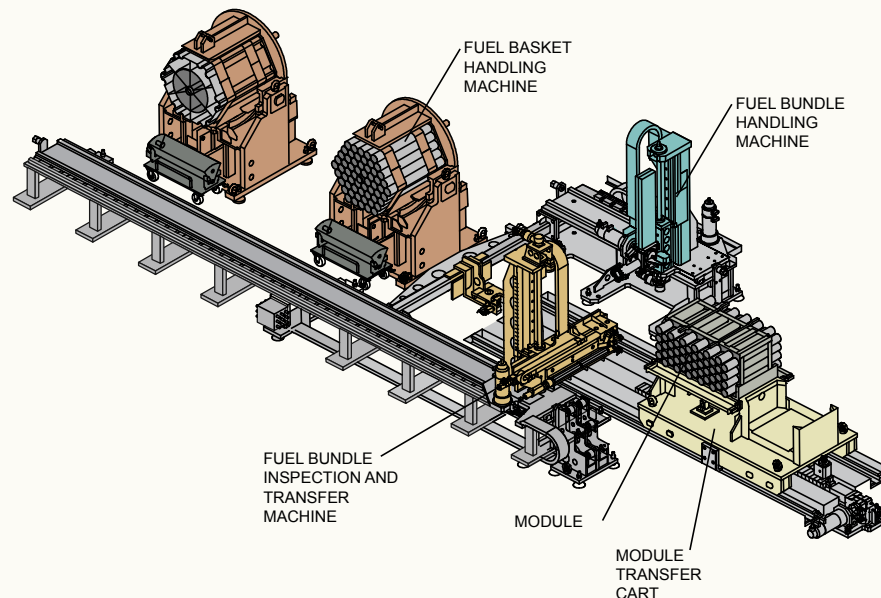
To ensure continuing reliable delivery of used fuel containers to the deep geological repository, the plant includes warehouse storage areas for used fuel transportation containers, empty used fuel storage containers and filled used fuel storage containers. It is intended that used nuclear fuel will be packaged and placed in the repository as it is received. As a result, there will only be minimal storage required for used fuel on the surface.

A conceptual layout of a used fuel packaging plant has been developed for planning and cost estimating purposes. The used fuel packaging plant will be a reinforced concrete structure that measures about 255 metres by 88 metres. It will have the capacity to package approximately 120,000 used fuel bundles per year into long-lived corrosion-resistant containers.

The packaging plant includes the following key features:

- » A transport package handling area to receive used fuel transportation packages;
- » A module handling area to unload fuel modules from the transport container;
- » A fuel transfer cell to transfer the used fuel into the used fuel containers to be used underground;
- » Processing stations to weld the lid and perform non-destructive testing of the filled container;
- » A buffer box assembly area to place bentonite around the container prior to transfer underground; and
- » Storage cells for empty and filled containers.

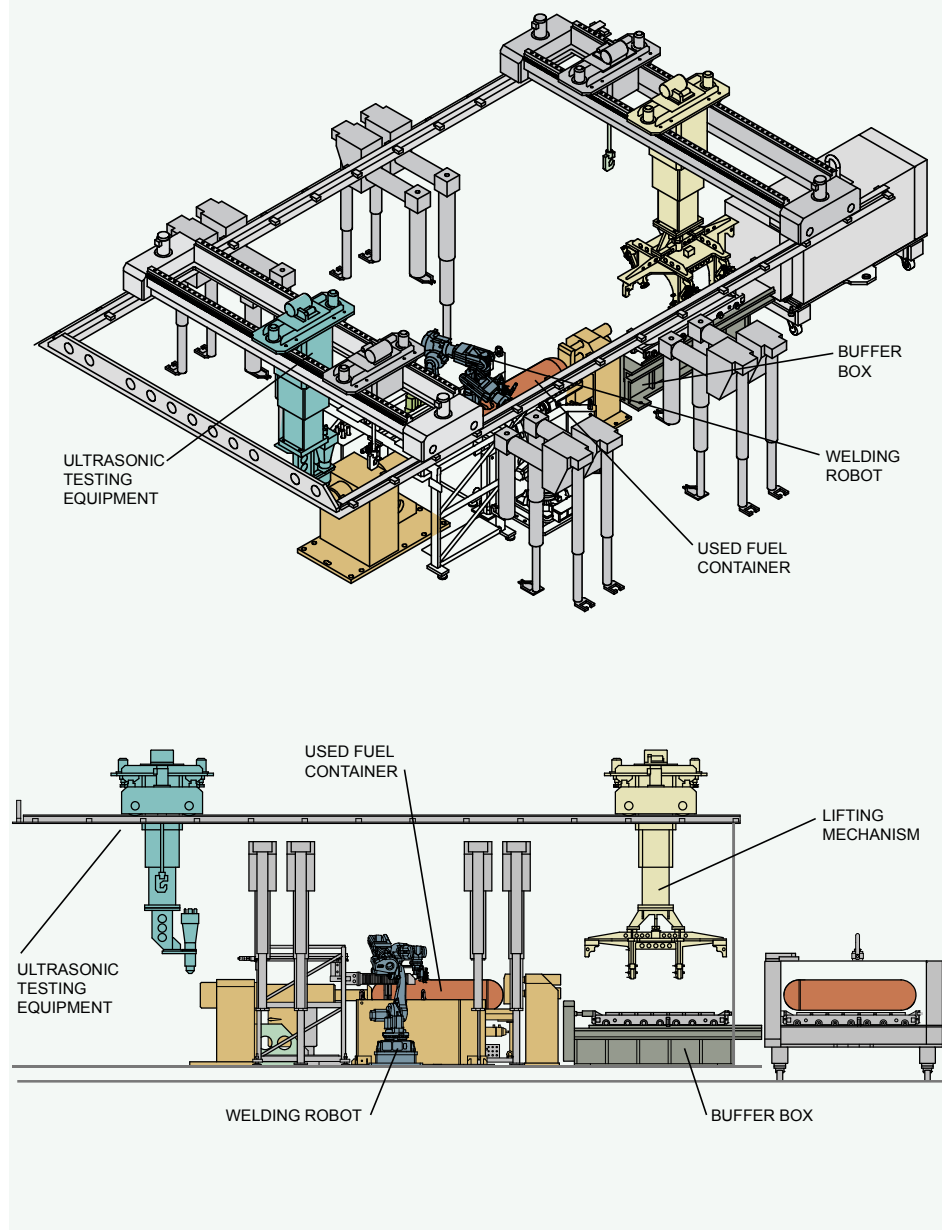
Example of a Used Fuel Handling Cell Under Development at the NWMO



If non-destructive testing or visual inspection of a container identifies any defects or features that cannot be repaired, the rejected container would be transferred back to the processing stations for retrieval and repackaging of the used fuel. The rejected container would be decontaminated as required and sent off-site for recycling.

Provisions would be put in place for safe handling and storage of wastes generated during the used fuel packaging process.

Example of a Processing Station for Welding Used Fuel Containers in the Packaging Plant



Sealing Material Compaction Plant/Concrete Batch Plant

The sealing material compaction plant and the concrete batch plant provide materials for clay-based and cement-based engineered barriers in the repository. These barriers will be used to backfill and seal excavation openings, and inhibit groundwater movement, microbial activity and movement of radionuclides in the area of the repository surrounding used fuel containers.

Sealing materials prepared at these plants could include:

- » Highly compacted bentonite clay blocks;
- » Dense backfill composed of bentonite clay and aggregate;
- » Light backfill composed of bentonite clay and sand;
- » Gapfill composed of bentonite clay pellets;
- » Shaft seal composed of bentonite clay and sand; and
- » Low-heat high-performance concrete.

A portion of the excavated rock from the repository may be used to manufacture crushed rock and sand for the backfill and concrete. These products will be stockpiled and stored on site for use in the sealing material compaction plant where presses will be used to prepare dense backfill blocks and gapfill material.

Bentonite bricks
manufactured in
Oakville, Ontario



Shafts and Hoists

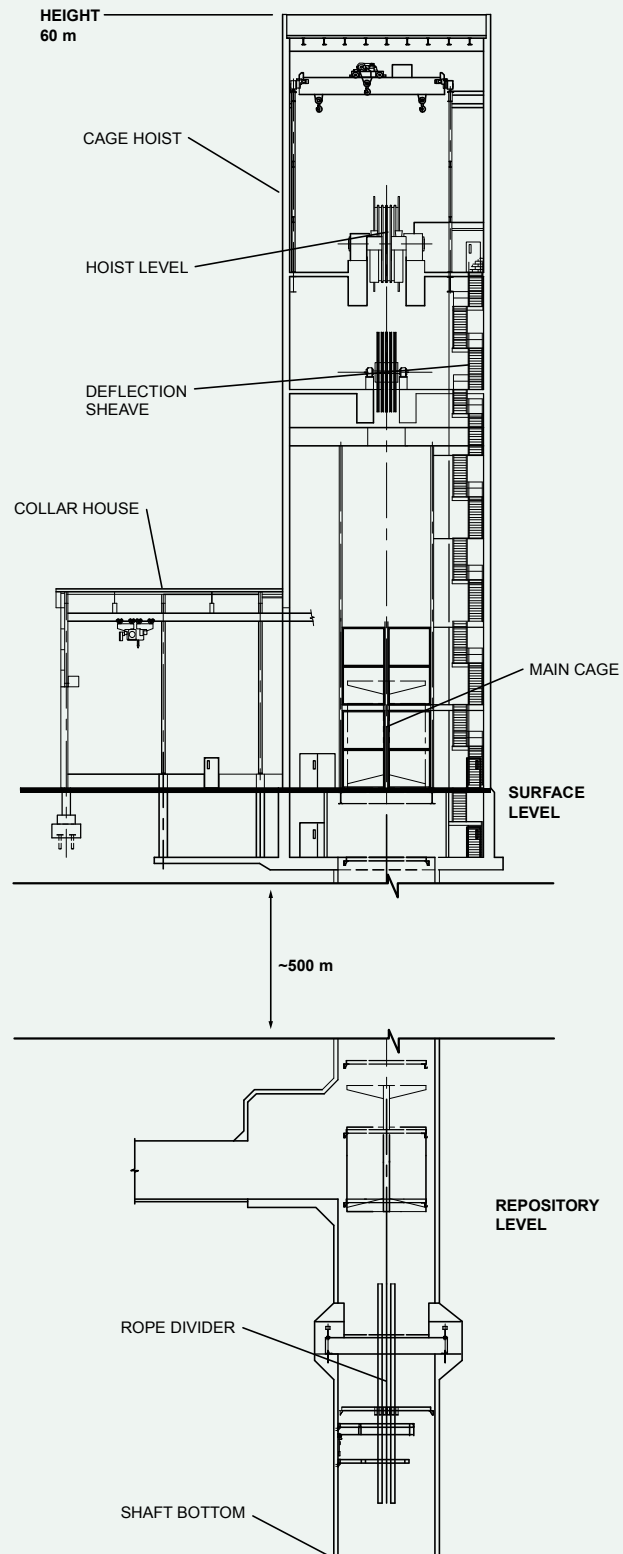
The reference design for the facility includes three shafts with hoists to enable the transfer of used fuel containers, rock, material, equipment, and personnel between surface facilities and the repository:

- » **The Main Shaft:** Conveys used fuel containers within a shielded transfer cask;
- » **The Service Shaft:** Conveys personnel, equipment, waste rock, and sealing materials; and
- » **The Ventilation Shaft:** Will handle the majority of the repository exhaust to the surface and will be equipped with a hoist for emergency exit for personnel. The exhaust shaft will be equipped with monitors and filters.

Headframes for the three shafts will be durable and easily maintainable structures that provide a high level of protection against weather-related disturbances. All shafts will be concrete-lined to help control inflow of water and to provide a durable, easy-to-maintain surface.

Once all Canada's used nuclear fuel is placed in the repository and a decision has been made to decommission and close the facility, the shafts will be sealed, and all headframes, liners and peripheral equipment will be removed.

Example of a Main Shaft Layout



Underground Facilities

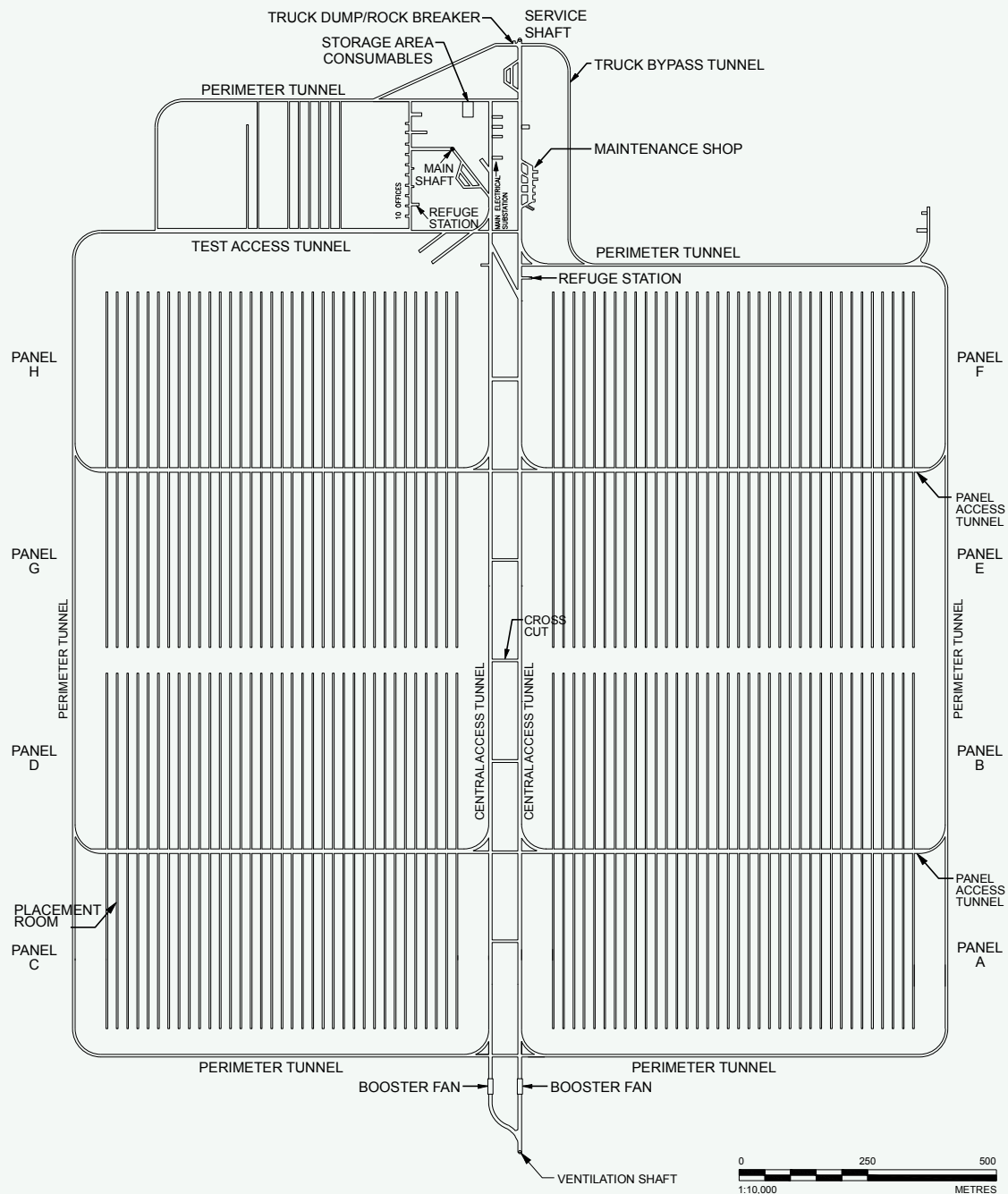
The underground facilities consist of a deep geological repository and associated infrastructure, including provision for underground verification and demonstration activities.

Deep Geological Repository

The deep geological repository is a network of tunnels and placement rooms for used fuel containers. It will be constructed at a single elevation at a depth of about 500 metres below ground surface; however, the depth may be higher or lower, depending on site-specific rock characteristics. Rock excavation would primarily be done using the controlled drill and blast method.

A conceptual layout for a repository would require an underground footprint of about two kilometres by three kilometres (about 600 hectares or 1,480 acres). The actual underground footprint at any particular site would depend on a number of factors, including the characteristics of the rock at the preferred site, the location of underground features in the rock, the final design of the repository, and the total inventory of used fuel to be managed.

Example of an Underground Layout for a Deep Geological Repository



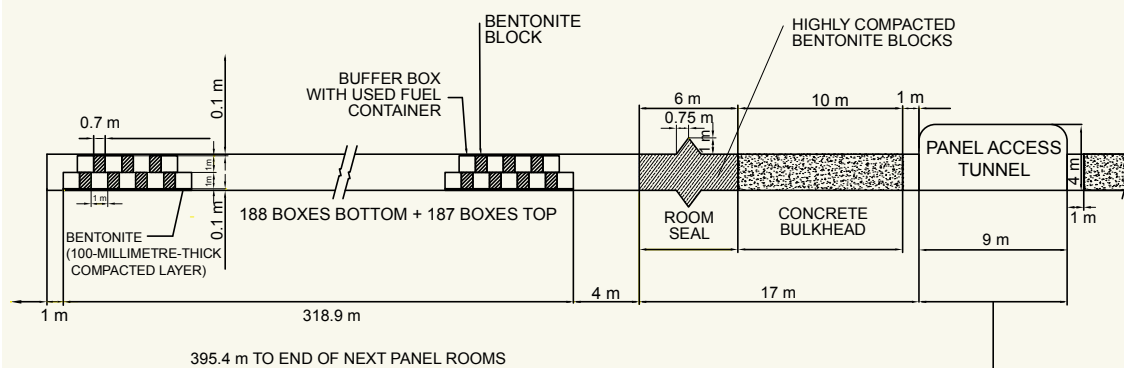
Used Fuel Container Rooms

Within each placement room, a used fuel container encased in a bentonite clay buffer box will be placed and separated from the next buffer box by bentonite clay spacer blocks. Containers will be staggered and stacked in two rows in a retreating manner. Any void space will be backfilled with pneumatically placed bentonite clay pellets until the room is filled.

Each group of placement rooms, also known as a placement panel, would require about three to four years to develop. Each placement panel would be excavated in parallel with container placement operations in other panels of the repository.

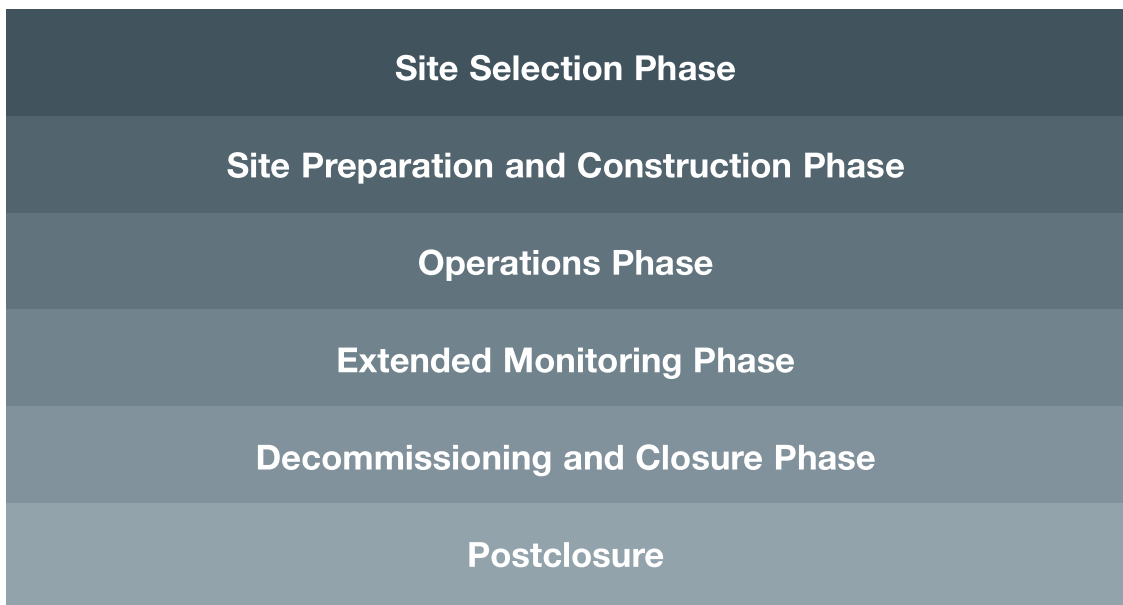
A six-metre-thick bentonite clay seal and a 10-metre-thick concrete bulkhead will be used to seal the entrance to the placement rooms. Monitoring equipment will be installed to confirm the performance of the repository system during placement operations and during the extended monitoring period.

Example of a Placement Room for Used Fuel Containers



Verification and Demonstration Activities

The repository design includes provision for underground verification and demonstration activities located near the main shaft and service shaft area. The purpose of underground verification activities is to confirm characteristics of the site. Demonstration activities would include placement and retrieval of used fuel containers, and long-term tests of the engineered-barrier systems.



Repository Project Phases

The Adaptive Phased Management (APM) project is designed to be implemented in phases over many decades. New learning and social priorities will be incorporated into Canada's plan for the long-term management of used nuclear fuel, driving refinement and adaptation of the plan throughout its implementation.

The Nuclear Waste Management Organization (NWMO) will have to demonstrate that the project meets or exceeds strict regulatory requirements to protect the health, safety and security of Canadians, as well as the environment, and also respects Canada's international commitments on the peaceful use of nuclear energy. Requirements set by regulatory authorities for this project will be addressed in the criteria used to assess the suitability of potential sites. The project will proceed only after all appropriate regulatory approvals are obtained at

each phase of the project.

More details on the required approvals throughout the project are described in the Regulatory Oversight section.

The major phases for the APM project are described next.

Timelines provided are estimates that were developed for planning purposes only. Actual timelines will be driven by a variety of factors, including the time it takes to identify a suitable site with an informed and willing host, the time required to assess technical safety, and the time required to obtain regulatory approvals.

Flexibility in the pace and manner of implementation is key to meaningful engagement of communities and demonstration of safety. The NWMO has committed that it will take the time necessary to do it right.

Site Selection Phase

The site selection process is designed to ensure safety, security and protection of people and the environment. Through a collaborative process in 2008 and 2009, the NWMO worked with interested Canadians to develop the decision-making framework for selecting a site for the project. The site selection process is built on a set of principles that reflects the values and priorities of Canadians on this issue. The process is laid out in the NWMO's May 2010 document *Moving Forward Together: Process for Selecting a Site for Canada's Deep Geological Repository for Used Nuclear Fuel*, available online at www.nwmo.ca.

The siting process includes a series of steps and is designed to be flexible and adaptive. Individual interested communities and areas will proceed through the process at a pace and in a manner that reflect their needs and preferences. At each step, the NWMO will share the findings of assessments. As studies become progressively more detailed and more information is known about areas involved in the siting process, the NWMO will focus its studies on areas with strong potential to meet project requirements and where communities continue to be interested in exploring the project.

In Step 1, the NWMO initiated the siting process with a broad program to provide information, answer questions and build awareness among Canadians about the project and process for implementing it.

In Step 2, communities identified their interest in learning more. The NWMO conducts an initial screening to evaluate potential suitability of the community and vicinity against a list of initial screening criteria.

In Step 3, preliminary assessments of potential suitability are conducted at the request of the interested communities. The NWMO conducts these feasibility studies collaboratively with communities to determine whether a site can be found that has the potential to meet detailed

project requirements. Preliminary assessments are conducted in two phases:

- » The first phase preliminary assessment involves desktop studies to explore potential to meet safety requirements. These assessments include studies of engineering, geoscientific suitability, environment and safety, and transportation. This phase also involves the interested community learning more about the project, and engagement and reflection on potential to foster well-being in the area and fit with the community's long-term vision.
- » The second phase preliminary assessment is conducted with a smaller number of communities and areas selected based on the outcome of Phase 1. Phase 2 activities focus on evaluating specific geoscientific uncertainties and provide additional information that can be used to assess and compare potential suitability of the communities. Technical studies and field investigations in this phase include activities such as geophysical surveys, geological mapping, environmental surveys, and borehole drilling and testing to better characterize and understand the specific natural environment. Phase 2 also involves more detailed exploration of the potential to foster well-being and sustainability in the community and the broader area. In addition, this phase involves exploring the potential for partnership with the interested community, First Nation and Métis communities in the area, and surrounding communities.

Involvement of the interested community, First Nation and Métis communities in the area, and surrounding communities is a key component in planning and implementing these detailed technical studies and field investigations.

Aspects of this work will need to be aligned with community input, including involvement of First Nation and Métis communities, to help identify socially acceptable study areas. It will be important to integrate Aboriginal Traditional Knowledge into this work.

At the completion of these preliminary assessments, a preferred site will be selected for more detailed site characterization.

Ultimately, the preferred site must meet robust technical requirements focused on safety. In order to select the preferred location for the repository, the NWMO would need to have a sufficient degree of confidence that:

- A deep geological repository can be developed with a strong technical safety case at that location;
- A safe, secure and socially acceptable transportation plan can be developed to transport used nuclear fuel to that location; and
- A strong partnership can be developed with the interested community, First Nation and Métis communities in the area, and surrounding communities.

More work on two sites may be required to develop sufficient confidence to select a single preferred site. The NWMO would complete any additional work before identifying the preferred site.

Once a preferred site is selected, in Step 4 there will be an escalation of activity on many fronts in the local and regional area. These activities include a range

of verification and demonstration activities and the initiation of the regulatory processes to support the future construction and operation of the deep geological repository and related surface facilities.

In this step, the Centre of Expertise will be established in or near the preferred site, as determined with people in the area, and detailed site characterization activities will begin. Initially, the Centre of Expertise will include an engineering test facility for developing container laser welding, copper coating, shaping bentonite clay buffer materials, and container placement equipment.

Detailed surface and subsurface investigations would build on work completed in earlier assessments. Activities will be similar to those carried out during geological investigation stages of typical mining projects, and would include environmental studies, borehole drilling and monitoring, and detailed geotechnical assessments of areas where the surface facilities and waste rock management area will be constructed. Detailed investigations could require roughing in access corridors to the candidate site. As with all other activities, the NWMO will work collaboratively with people in the area to plan and complete this work.

The site selection phase will also see further engineering design activity to support future construction of surface facilities and the underground repository in subsequent phases. Designs will be developed to reflect the specific location for the repository and facilities as agreed with the communities.

For planning purposes, the NWMO has assumed the site selection phase could take about 15 years or more to complete.

Site Preparation and Construction Phase

During site preparation, the activities will include clearing existing vegetation, grading the site, fencing, and installing initial project infrastructure such as that required for water management. Stormwater management would be developed to control potential effects associated with any sediment-laden run-off into local waterways. Diesel and propane fuel storage and grade level water storage tanks would be located at the site to facilitate construction activities.

Infrastructure development may include road access to the site and installation of a regional high-voltage power line to meet the facility's electrical demands, estimated to be about 20 megawatts.

Temporary infrastructure to support the workforce during early activities, including sewage treatment, water supply and conventional waste management facilities, would be made available at the project site until permanent facilities are established. Electricity for site preparation activities and early construction activities could be provided by diesel generators. In anticipation of the operations phase, the NWMO will work with the community and area to plan for and contribute to the development of community infrastructure to support the project.

Accommodation will be required for construction personnel. These workers could be housed in the community and surrounding area, or there could be a need to develop temporary infrastructure outside the main complex to provide sleeping quarters, kitchen, dining, laundry, medical, and recreation facilities. The NWMO will work with the community and surrounding area to plan for and contribute to the development of community infrastructure required during construction and operation to house and integrate personnel into the area. Community preferences will be an important consideration in development of implementation plans that will meet the needs of communities.

The next significant activity will be the initial development of underground facilities. It will begin with constructing shafts and developing underground tunnels and service areas. This phase will include potential development of the underground verification and demonstration facility.

After initial geological verification activities have been completed and reviewed, the initial placement rooms for the deep geological repository would be excavated (remaining placement rooms would be excavated during the operations phase of the project). A portion of excavated rock may be kept on site to use for backfilling during operations, with the remainder assumed to be transferred to a location to be determined in collaboration with the community. Remaining surface facilities will also be constructed at this time.

The NWMO will work with the community to develop the needed infrastructure to support the project and to provide the funding required to ensure the long-term well-being and sustainability of the community and the larger region in which it is located.

For planning purposes, the NWMO has assumed the site preparation and construction phase could require about 10 years.



Operations Phase

Used nuclear fuel will be loaded into specially designed and certified transportation packages and shipped from interim storage facilities to the repository site.

The used fuel packaging plant will receive empty long-lived, corrosion-resistant used fuel containers, and will receive and inspect transportation casks filled with used nuclear fuel. Within the packaging plant, used fuel bundles will be transferred from transportation casks to used fuel containers, and then sealed, inspected and dispatched for placement in the underground repository. The facilities will be designed to receive and process about 120,000 used fuel bundles per year. Several thousand used fuel containers will need to be manufactured at a container factory during each year of operation. The container factory could potentially be located in the host community or surrounding region, depending on interest.

Most steps in the packaging process are remotely operated, taking place in radiation-shielded rooms. Radioactive areas are maintained at a slightly negative pressure to preclude the spread of any residual radioactivity. Ventilation air is filtered and monitored before it leaves the facility. As with any nuclear facility, very small amounts of radiation may be released as part of normal operations. These releases are expected to be a very small fraction of regulatory limits. There would be no negative impact on people or the environment, and any exposure would be far below natural background levels of radiation.

The concrete batch plant and sealing material compaction plant will prepare the required clay-based and concrete-based sealing materials for the underground repository.

A safety analysis will investigate potential consequences of events and accidents during operations to verify and demonstrate robustness of the

repository design. While the specific events to be analyzed will be defined in the future, occurrences such as loss of power, loss of ventilation and dropping of a used fuel container will be assessed.

An environmental monitoring system will be established to monitor potential environmental effects, optimize facility performance and demonstrate regulatory compliance. The environmental monitoring program would include, at a minimum, the following components:

- » Groundwater monitoring;
- » Radiation monitoring;
- » Stormwater/surface water monitoring;
- » Air quality monitoring (above and below ground);
- » Meteorological monitoring; and
- » Seismicity and vibration monitoring.

Maintenance of equipment and facilities, including safety checks and inspections, would be routinely undertaken during this phase.

Water for the site would be sourced locally at the rate needed to meet the demands of site personnel, concrete production, sand production, and dust control. Water is not required for cooling used nuclear fuel at this facility.

Sewage collected from all serviced buildings will be treated to provincial standards in a sewage treatment plant, and any necessary approvals will be obtained before it is discharged.

Several ponds will be established for either process water or stormwater control. Water will be monitored and treated as required before being directed to a downstream process or discharged off-site.

The NWMO will monitor the deep geological repository throughout the operations phase, including a period of time after the last used fuel containers have been placed and before decommissioning

begins (see section on Extended Monitoring Phase). Activities could include emissions monitoring, environmental monitoring, repository performance monitoring, and maintenance activities.

The operations phase also includes continued excavation of additional placement rooms (beyond the initial panels to be built during the construction phase), which could involve drilling and blasting, removal of rock and continued operation of the excavated rock management area. Placement rooms will be filled, progressing from the perimeter tunnel to the central access tunnels.

The operations phase will require about 40 years, assuming a used fuel inventory of about 4.6 million CANDU fuel bundles. During this time, the NWMO will continue to work in partnership with the host community to ensure its needs continue to be met.

Example of a
geoscience
monitoring station.



Extended Monitoring Phase

Following placement of used fuel containers in the repository, the NWMO will continue to monitor long-term safety and performance of the repository system.

During this period, placement rooms would be backfilled and sealed, but access tunnels and perimeter tunnels would be left open and maintained to support in-situ monitoring activities.

The extended monitoring phase could last several decades (70 years has been assumed for planning purposes). The NWMO will have to demonstrate the site's long-term safety during the extended monitoring period. The actual duration of this period will be informed by input from the community.



Decommissioning and Closure Phase

Decommissioning activities would begin after sufficient performance monitoring data have been collected to support a decision to decommission and close the repository. It is envisioned that this phase would end when the repository is sealed and all surface facilities have been decontaminated and removed.

Main activities undertaken during the decommissioning and closure phase would include:

- » Decontamination, dismantling, and removal of surface and underground infrastructure and facilities;
- » Sealing of access tunnels, perimeter tunnels, shafts, and service areas;
- » Sealing of all subsurface boreholes and those surface boreholes not required for postclosure monitoring; and
- » Closure of any remaining facilities.

Once the repository is sealed, all buildings and facilities are removed, and the area is shown to meet safety requirements for the agreed-upon end-state land use. It is envisioned that the site would be landscaped to promote natural vegetation growth consistent with the community. An environmental management plan specific to this phase of the project would be implemented, along with continued worker safety programs.

It is anticipated that permanent markers would be installed to inform future generations of the presence of the sealed repository.

For planning purposes, the NWMO has assumed the decommissioning and closure phase will require about 30 years.

Postclosure Phase

The repository is designed to be passively safe after closure, with no need for human intervention and maintenance. However, while it will not require postclosure

monitoring, some monitoring is expected to be put in place. The nature and duration of any postclosure monitoring will be decided in the future.



Commission proceedings
at the Canadian Nuclear
Safety Commission.

Regulatory Oversight

The Nuclear Waste Management Organization (NWMO) is committed to meeting or exceeding all applicable regulatory standards and requirements for protecting the health, safety and security of people and the environment.

Implementation of a deep geological repository falls within federal jurisdiction and will be regulated under the *Nuclear Safety and Control Act* (NSCA) and its associated regulations. The Canadian Nuclear Safety Commission (CNSC), as Canada's independent regulatory authority, regulates the use of nuclear energy and materials to protect the health, safety, and security of Canadians and the environment; and to implement Canada's international commitments on the peaceful use of nuclear energy. The CNSC also disseminates objective scientific, technical and regulatory information to the public.

Under section 26 of the NSCA, activities associated with a nuclear facility can occur only in accordance with a licence issued by the CNSC. The repository for Canada's used nuclear fuel will be subject to the CNSC's comprehensive licensing system, which covers the entire life cycle of the repository from site preparation, to construction, operation, decommissioning (closure and postclosure), and abandonment (release from CNSC licensing). This stepwise approach will require a licence for each phase of the repository life cycle. The process for obtaining a "site preparation" licence is initiated by the NWMO. The NWMO would submit an application for a Licence to Prepare Site (and possibly construct) to

the CNSC. A licensing decision by the CNSC on a repository can be taken only after the successful completion of the environmental assessment, following the process established by the *Canadian Environmental Assessment Act, 2012*. More information about the CNSC's licensing process is available at www.cnscccsn.gc.ca.

The transportation of used nuclear fuel is jointly regulated by the CNSC and Transport Canada.

Although the CNSC is the main licensing authority, the CNSC administers its licensing system in co-operation with other federal and provincial government departments and agencies in areas such as health, environment, transport, and labour.

Relevant aspects of the NWMO's work will also comply with applicable provincial regulatory requirements. For example, some aspects of siting or construction of the project and the transportation of used nuclear fuel may be governed by provincial legislation:

- » Most provinces and territories include nuclear substances in legislation and regulations addressing transportation of dangerous goods within that province or territory.
- » Provincial governments are responsible for protecting public health and safety, property and the environment within their borders, which often includes provincial emergency preparedness legislation.
- » Provincial governments are responsible for the regulation of resource exploration and/or extraction (e.g., drilling and underground mining) and Crown land management (e.g., disposition of provincial lands).
- » Provincial legislation requiring assessment of potential environmental effects of an activity, plan or program may apply to some aspects of this work. Legislation governing endangered species, environmental protection, heritage protection or preservation, water resources protection, occupational health and safety, employment standards, or labour relations may be relevant.
- » Various permits, licences and approvals will be required, and provincial policies and guidelines may be applicable at the site selection stage.
- » Municipalities, which derive their authority from provincial legislation, may have requirements such as permits, codes, standards, and/or bylaws that also need to be addressed.



Project Economics

Adaptive Phased Management (APM) is approximately a \$21-billion (2010 \$) national infrastructure project that will bring about significant economic benefits to the area in which it is sited, including the interested community, and First Nation and Métis communities in the area, and to the host province. For the purpose of this discussion, the host province is assumed to be Ontario based on the status of Phase 2 communities in 2015.

It is a multi-generational project that will be developed and implemented in phases over a period spanning more than 150 years. The economic impact will include many direct, indirect and induced jobs involving scientists, engineers, tradespeople, and others in the siting region each year for many decades. Construction and operation of the facility will create wealth in the form of business profits and personal income throughout the siting area amounting to many hundreds of millions of dollars.

The economic impact of the project will include:

- » Direct jobs, which result from NWMO project expenditures for labour. Direct jobs are expected to occur predominantly at or near the project site;
- » Indirect jobs, which result from other NWMO project expenditures, including inter-industry purchases in the supply chain; and
- » Induced jobs, which result from income spending by direct and indirect labour.

The number of jobs generated in the siting area will depend in part on the location of the repository, and the capacity of the communities in the siting area, economic region and host province to support the project. The NWMO will explore with communities in the siting area the need for specific investments that can alter the amount of economic benefits captured in the area. For example, the NWMO could make investments in such areas as labour training, supporting infrastructure, business incubation, strategic hiring, and procurement.

The project may contribute to social and economic pressures that will need to be carefully managed to ensure the long-term well-being and sustainability of the community. To minimize social costs and help communities adapt to the opportunities and challenges of the project, the need for assistance, such as job training, affordable housing and infrastructure, would be examined. The NWMO will work with the community to develop the needed infrastructure to support the project and to provide the funding required to ensure the long-term well-being and sustainability of the community and the larger region in which it is located.

The economic analysis in this document summarizes the total number of direct, indirect and induced jobs in the host province, and the range of direct, indirect and induced jobs within a siting area where the project is implemented.

The economic models developed for the NWMO use financial and economic data to generate estimates of employment, income and Gross Domestic Product (GDP) associated with project spending. These models use economic multiplier information derived from Statistic Canada's Interprovincial Input-Output Model of the Canadian Economy.

Employment by Project Phase

The economic analysis completed to date estimated employment by project phase, excluding transportation. The actual numbers will depend on a range of factors, including the location, the specific plan for implementing the project, the cost, and the schedule. These factors can evolve over time, and investments can be made to maximize benefits for an area in a way that aligns with the vision and goals held by people in the area. For more information about the activities in each project phase, please see the previous sections on Repository Project Phases and Regulatory Oversight.

In the early stages of site selection, the work to be completed is spread across many potential siting areas. Toward the later phases of site assessment, about 30 to 95 direct, indirect and induced jobs per year could be created in the areas engaged in the process, and about 1,000 jobs per year, within the province. These will require a range of skills, including geosciences, drilling, engineering, equipment operation, technical support, environmental assessment, safety assessment, monitoring, engagement, social science, and communications. This phase of work is assumed to take about 15 years or more.

Once a site is confirmed and regulatory requirements are met, activity will ramp up significantly during subsequent project phases.

Site Preparation and Construction Phase

Site preparation and construction of the deep geological repository will:

- » Take approximately 10 years;
- » Create an average of about 800 direct jobs per year, predominantly located at or near the project site;
- » Create an average of about 2,800 direct, indirect and induced jobs per year in Ontario; and
- » Require a wide range of skills, including equipment operators, engineers, scientists, mining personnel, construction workers, tradespeople, and financial, administrative and public communication professionals.

Operations Phase

Operation of the facilities will:

- » Take approximately 40 years or more;
- » Create an average of about 700 direct jobs per year, predominantly located at or near the project site;
- » Create an average of about 2,400 direct, indirect and induced jobs per year in Ontario; and
- » Require a wide range of skills, including equipment operators, engineers, scientists, safety specialists, mining personnel, tradespeople, and financial, administrative and public communication professionals.

Extended Monitoring Phase

Extended monitoring will:

- » Be conducted in a manner and for a period of time determined by future society (a period of 70 years is assumed for planning purposes);
- » Create about 170 direct, indirect and induced jobs per year in the siting area and 300 per year in the host province; and
- » Require a range of skills, including geosciences, safety assessment and engineering.

Decommissioning and Closure Phase

Decommissioning and closure activities will:

- » Be conducted in a manner determined by future society;
- » Take approximately 30 years;
- » Create an average of about 260 direct, indirect and induced jobs per year in the siting area and an average of about 500 per year in the host province; and
- » Require a range of skills, including mining, construction, tradespeople, engineering, geosciences, safety assessment, and regulatory affairs.

Postclosure Phase

After closure, the repository is designed to not require active maintenance. However, there is expected to be ongoing monitoring, with the extent and duration to be decided at the time of closure.

Employment Summary





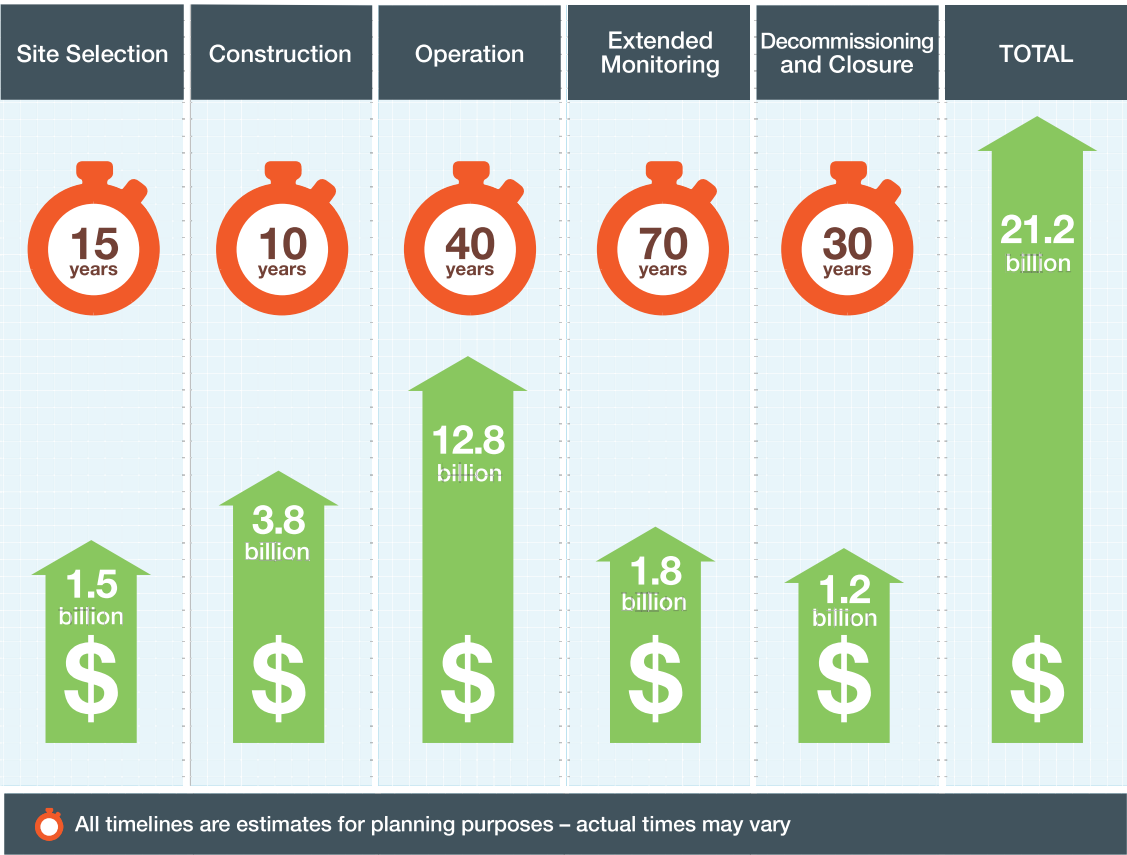
Expenditure by Project Phase

The APM project is a large national infrastructure project funded by used fuel owners. For planning purposes, a cost estimate for the deep geological repository and used fuel transportation system has been developed. It assumes an inventory of 4.6 million used CANDU fuel bundles. The specific amount of used fuel to be placed in the repository will be agreed with the community using the best information available at the time of licensing the facility, and an open and transparent consultation process involving surrounding communities and others who are interested and potentially affected.

The estimated project cost (which includes \$1 billion for used fuel transportation) is about \$21 billion (2010 \$), with a present value of \$7.7 billion (2010 \$).

The actual cost to site, license, construct, operate, monitor, decommission and close, and conduct postclosure monitoring of a deep geological repository, and the actual cost of the used fuel transportation system will depend on a number of factors, including the location of the facility, the surrounding infrastructure, the rock type and characteristics, the design of the repository, the volume of used fuel to be managed, and the period of extended monitoring following used fuel placement.

The cost estimate includes labour, materials and equipment, fuel, utilities, taxes, fees, accommodation, communication, contingency, and other expenses.





Working in Partnership

The site selection process outlines a road map for decision-making that involves many steps. Over the course of these steps, the NWMO, the interested community, First Nation and Métis communities in the area, and surrounding communities work together to identify a site to safely and securely contain and isolate used nuclear fuel and to reflect upon the suitability of the area to host the Adaptive Phased Management project.

This project will only proceed with the involvement of the interested community, First Nation and Métis communities in the area, and surrounding communities working together. Through working together, the project can be harnessed to maximize benefits to the area, manage any pressures that may come from it, and ensure it fosters the long-term well-being and sustainability of the area in a way that is consistent with peoples' vision for the future.

Learn More

This document is designed to help further the conversation with communities and others who are interested in learning more about the deep geological repository and Centre of Expertise to be constructed as part of Canada's plan for the long-term management of used nuclear fuel.

Conceptual designs described in this document will be refined over time through technology development and demonstration programs, through site-specific technical and scientific studies, and through discussions with potential host communities and those in the surrounding area.

Future updates of this document will reflect ongoing discussions and learning. We invite you to visit the NWMO website (www.nwmo.ca) for more information, to learn more about Canada's plan for the long-term management of used nuclear fuel, and to review future updates.

