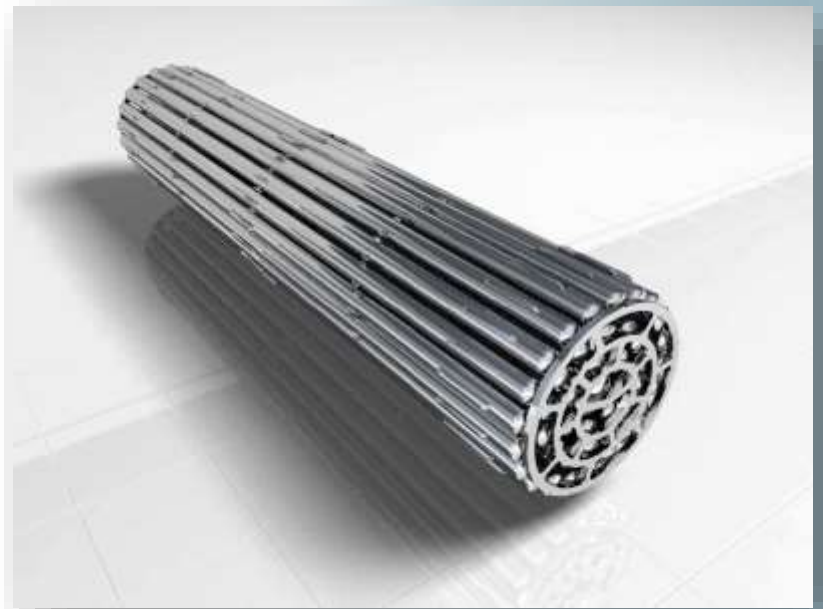


Nuclear Waste in Northwestern Ontario

WHY WE SHOULD BE CONCERNED



Background:

Canada's **Nuclear Waste Management Organization (NWMO)** is seeking a site in Ontario for disposal of high-level nuclear waste – used nuclear fuel bundles.

Only two potential sites are still under consideration for the location of a **Deep Geological Repository (DGR)** for high-level nuclear waste disposal: in Northwestern Ontario, a site near **Ignace**, and in Southern Ontario, a site in the **Municipality of South Bruce**.

Bore-hole drilling (part of preliminary assessments) to test the geological suitability of the site is currently underway in Ignace. The final vote for consent in the host community is in **2023**.



February 2020:
Potential nuclear
waste disposal
sites still under
consideration by
NWMO



What Is the NWMO?

The **NWMO** is a not-for profit organization established in 2002 by Canada's nuclear electricity producers in accordance with the Nuclear Fuel Waste Act (NFWA).

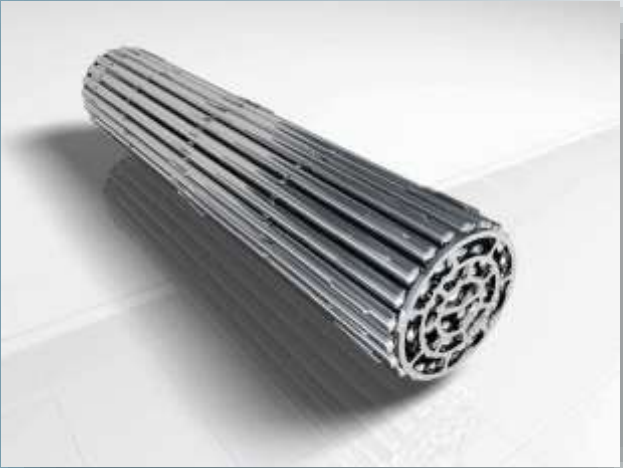
The funding members of the **NWMO** are Ontario Power Generation, New Brunswick Power Corporation, and Hydro-Québec.

What Is Used Nuclear Fuel?

- ▶ **Used nuclear fuel is a by-product created by nuclear power plants. It stays radioactive for a long time, and must be contained and isolated from people and the environment - possibly indefinitely.**
- ▶ Radioactivity of used nuclear fuel bundles decreases slowly over a very long period of time, so used nuclear fuel bundles require careful management for **many generations**.

Nuclear Fuel Pellets

Fuel **pellets** are made from uranium dioxide powder, baked in a furnace to produce a hard, high-density ceramic.



Fuel Pencils

Fuel pellets are contained in sealed corrosion-resistant zircaloy metal tubes, called **pencils**, which are welded together to create a nuclear fuel bundle.

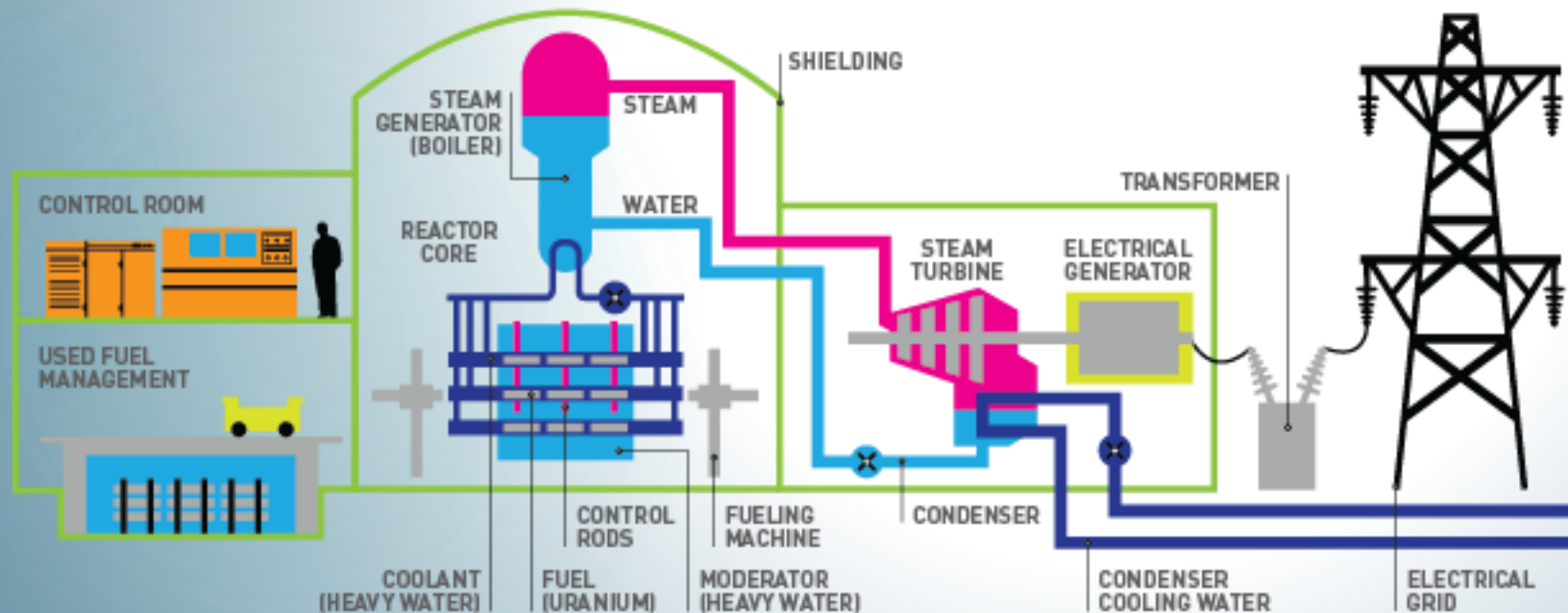
Fuel Bundles

Each zircaloy **bundle** is composed of fuel pencils. It is 0.5 metres long, 0.1 metres around, and weighs about 24 kilograms.

“The nuclear power industry in Canada has produced 3 million bundles of nuclear fuel waste to date [2014], weighing over 50,000 tonnes. They expect to double this volume over the next 30 years.”

Source: “Nuclear Waste Governance in Canada” PowerPoint presentation by Gordon Edwards, President, Canadian Coalition for Nuclear Responsibility, 2014.

CANDU REACTOR SCHEMATIC



Pickering Nuclear Generating Station

Source: Canadian Nuclear Association website

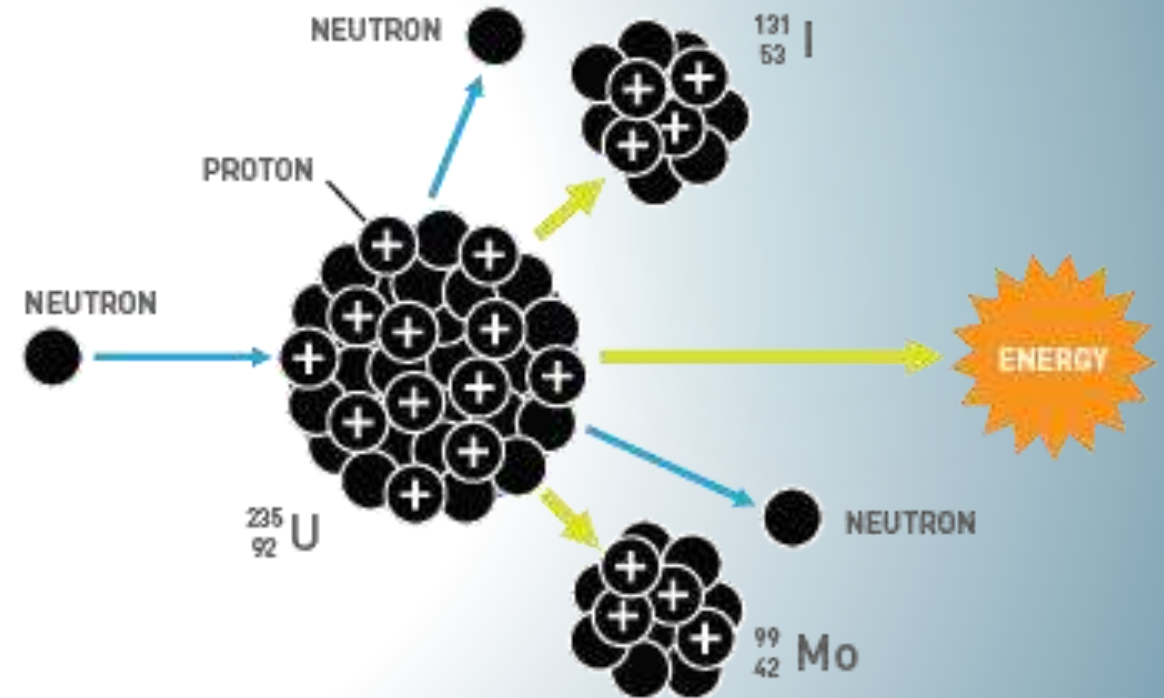
How Reactors Work

Nuclear fission

Uranium (both U-235 and U-238) is relatively stable before entering the reactor: it emits so little radiation that **unused** fuel pellets are safe to be near.

When a U-235 atom is bombarded with a neutron, it can split (or “fission”) into several pieces, ejecting two or three extra neutrons. This process releases heat, which can be converted into electricity.

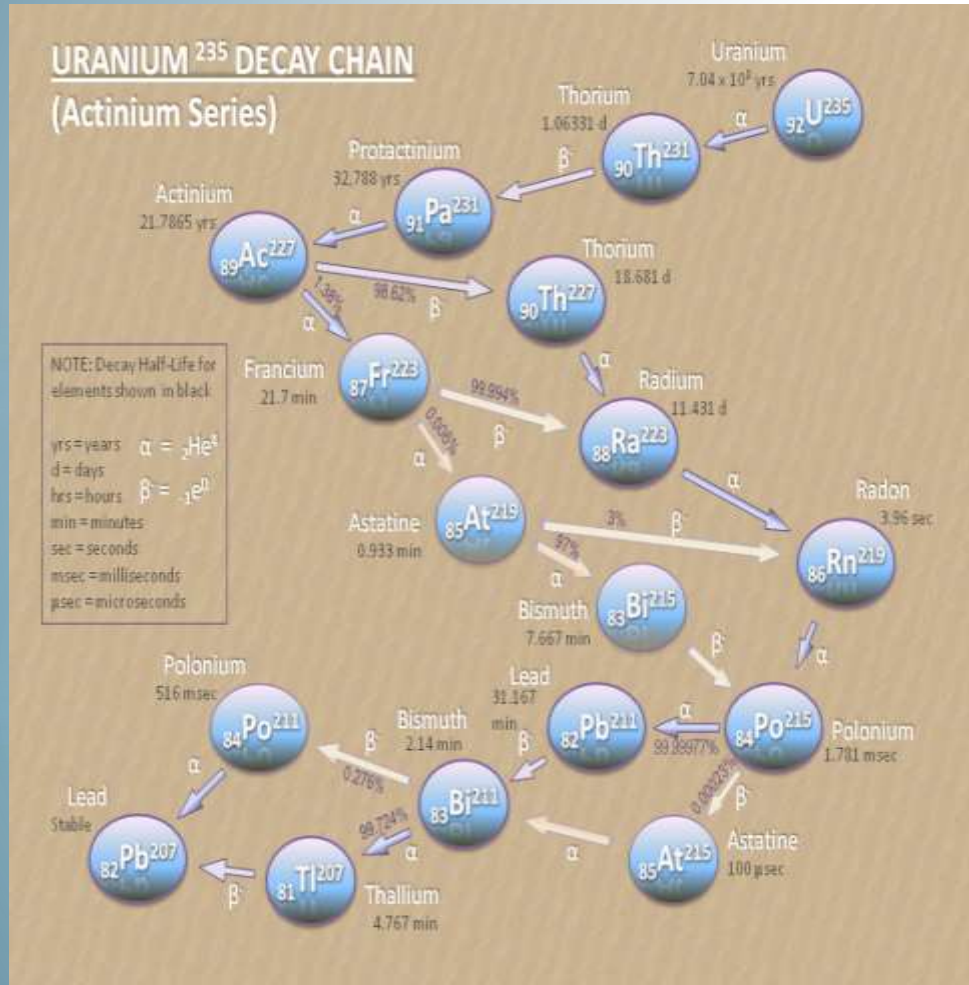
FISSION



Source (text & image): Canadian Nuclear Association website

The Uranium Decay Chain

During uranium's decay, the following elements are present.



Uranium 235

Thorium 231

Protactinium 231

Actinium 227

Thorium 227

Francium 223

Radium 223

Astatine 219

Radon 219

Bismuth 215

Polonium 215

Astatine 215

Lead 211

Bismuth 211

Polonium 211

Thallium 207

Lead 207 - stable

Current Storage of High-Level Nuclear Waste



STEP 1: Wet Storage

Irradiated fuel bundles are first placed in a **pool of water** called an irradiated fuel bay, for 8 to 10 years, during which radioactivity decreases somewhat.

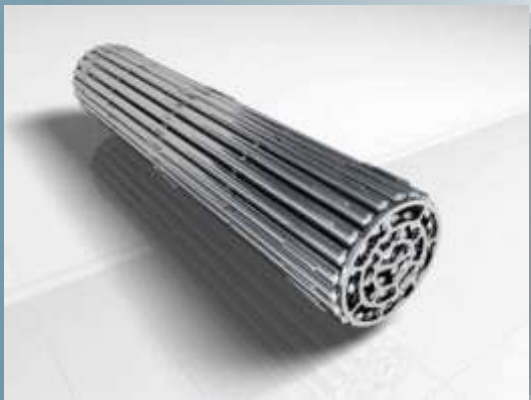


STEP 2: Dry Storage

Next, the waste is moved into **dry storage containers**, and warehoused at the nuclear generating station. Dry storage systems have a minimum design life of 50 years.

Since the 1960s, nuclear reactors in Canada have been producing high-level nuclear waste in the form of **used nuclear fuel bundles**. These bundles are currently stored close to the facilities that produced them.

90,000 used fuel bundles are produced per year.



Candu Fuel Bundle.

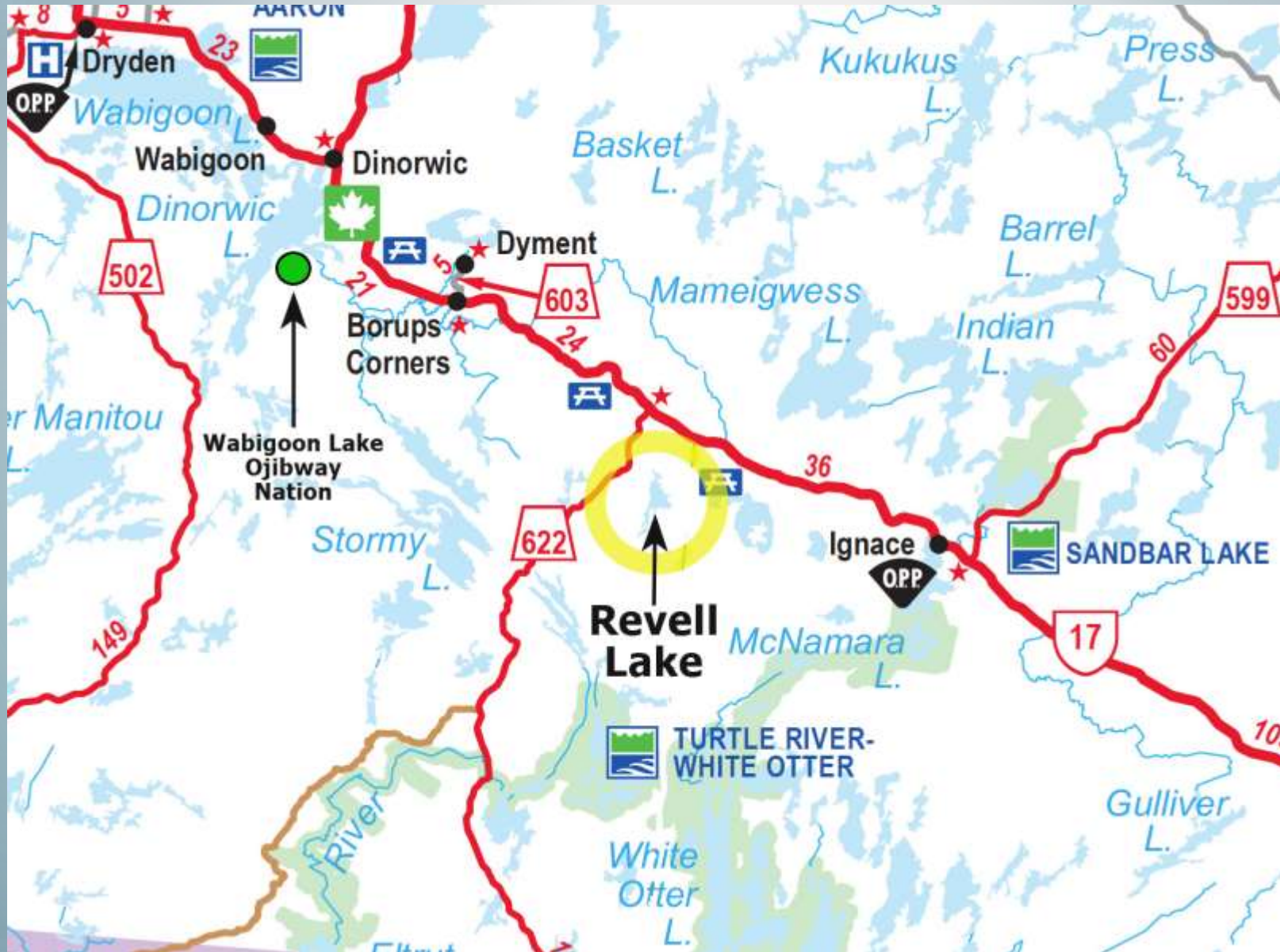
Source: Canteach website



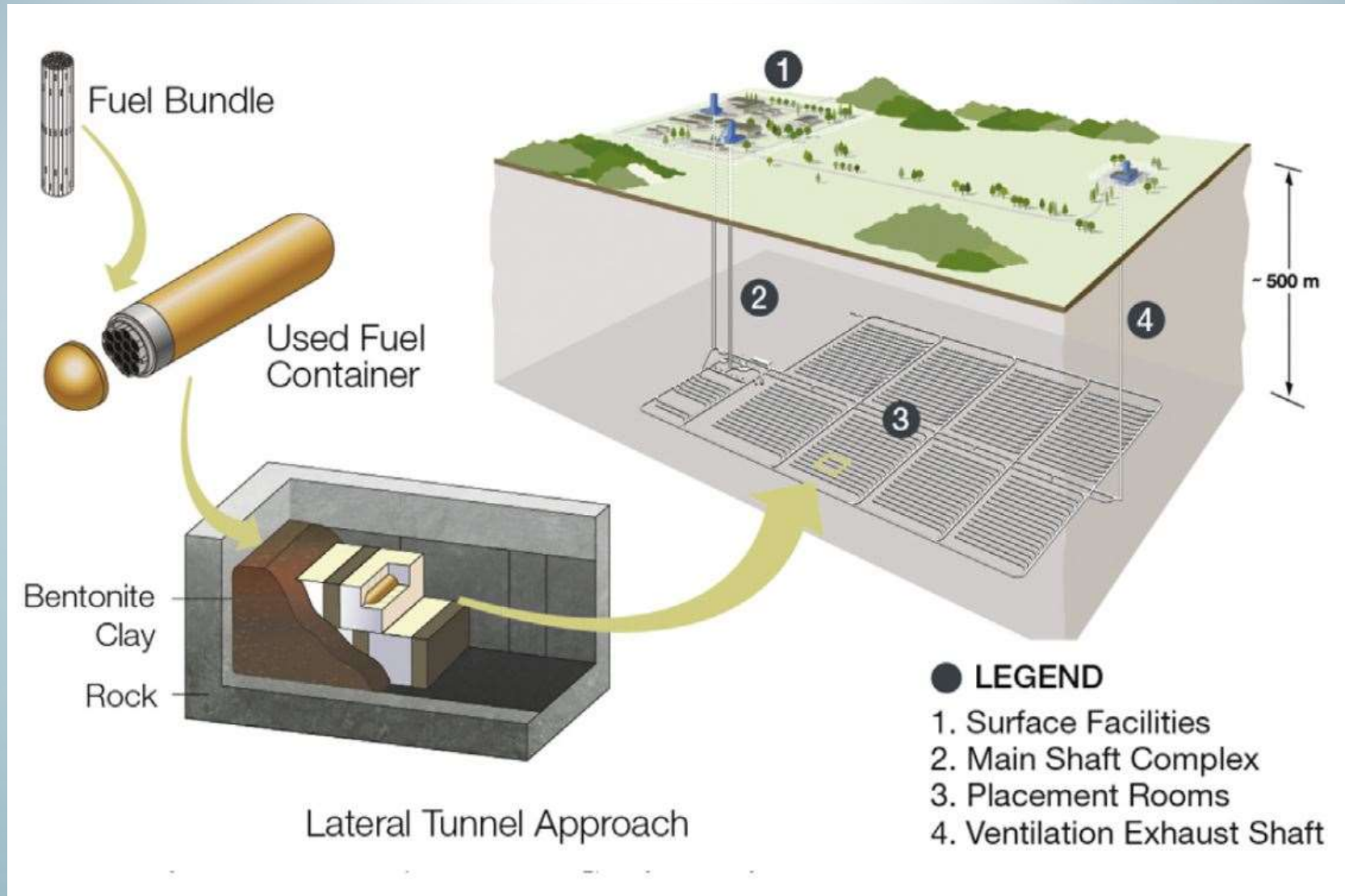
Canada's Interim Storage Sites for Used Nuclear Fuel

Location of Revell Lake

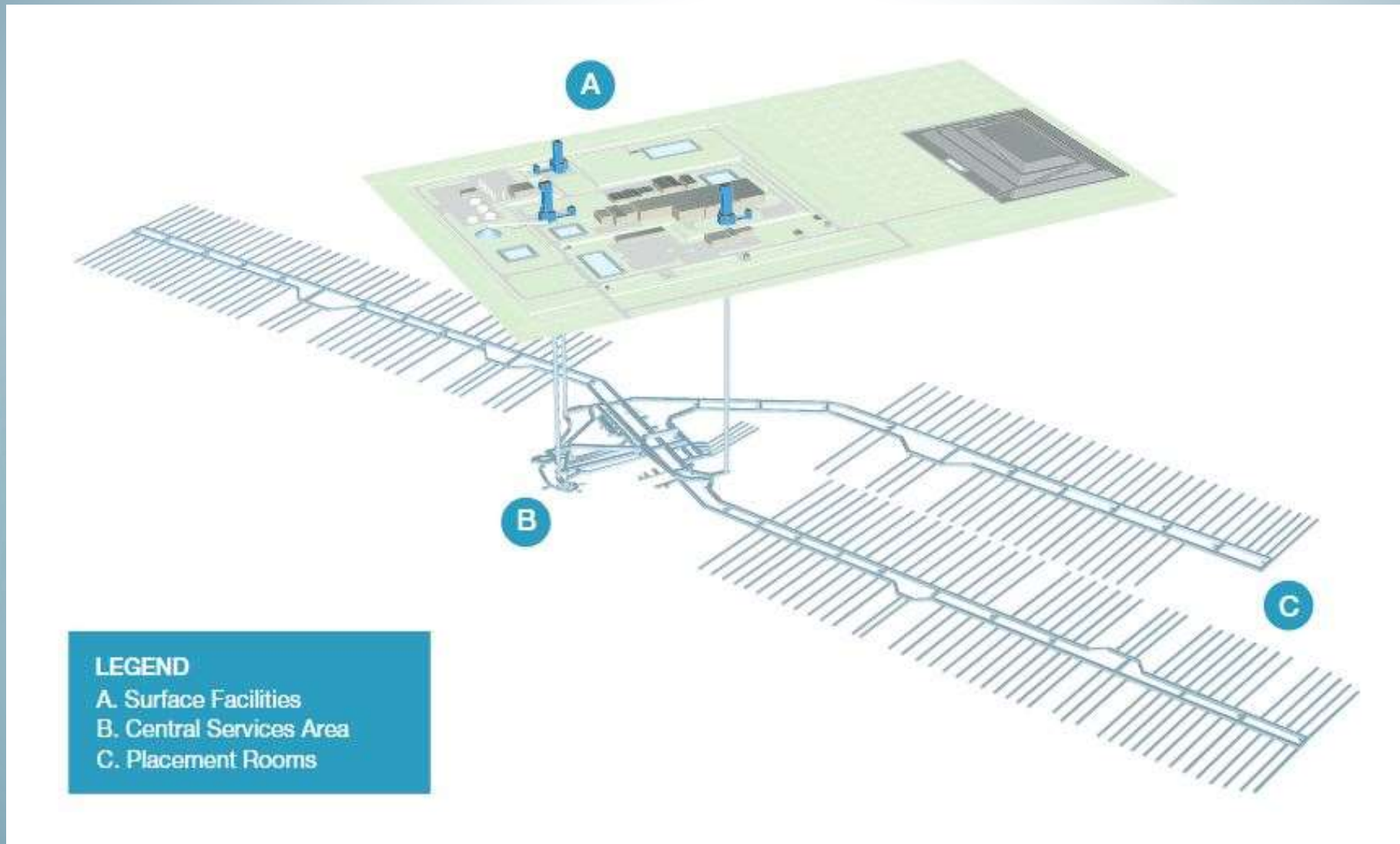
Approximately 30 km west of Ignace



Example of a Deep Geological Repository



Latest Conceptual Layout for the DGR



MAJOR CONCERN

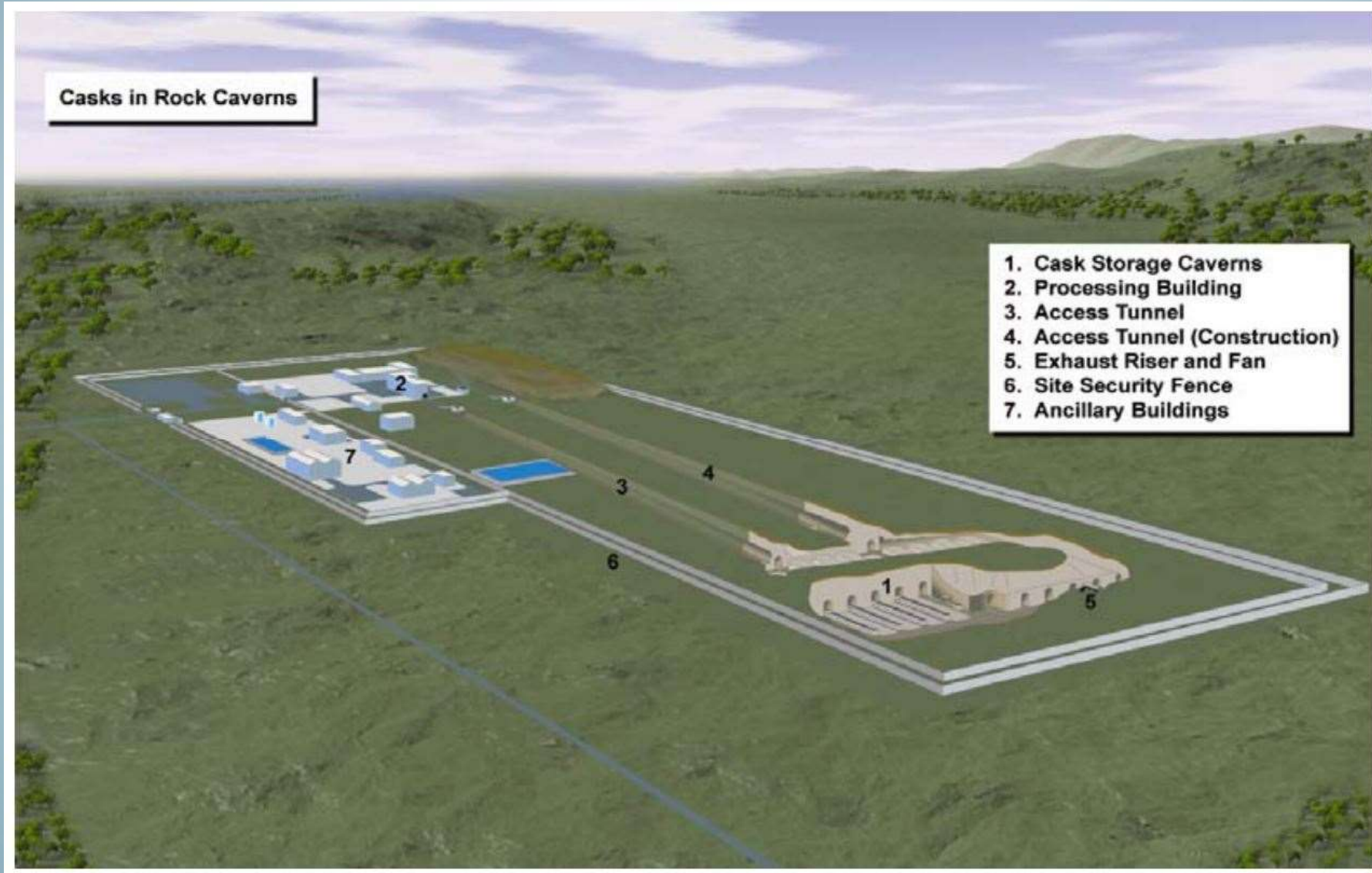
Quote from NWMO's: "Progress Through Collaboration - Triennial Report 2014-2016", pg. 43

"Provision for optional temporary shallow storage at the central site if needed.*"

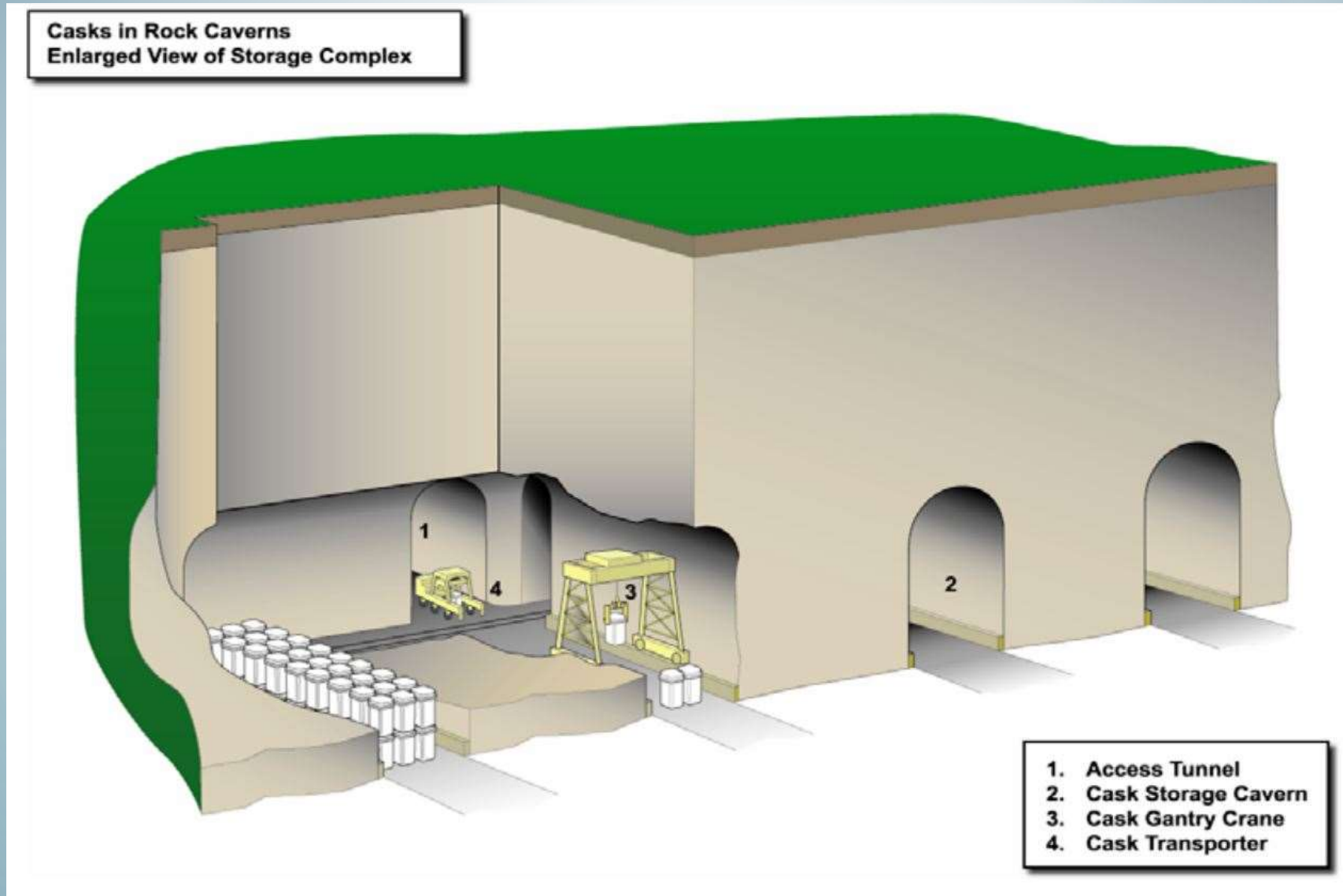
*Temporary shallow storage at the deep geological repository is optional and not currently included in the Nuclear Waste Management Organization's implementation plan.

If this provision, which continues to appear in **NWMO** documentation, is implemented, it may allow for **shallow storage** of high-level nuclear waste at the central site before the DGR is even constructed.

Used Fuel Storage in Shallow Rock Caverns at Central Facility

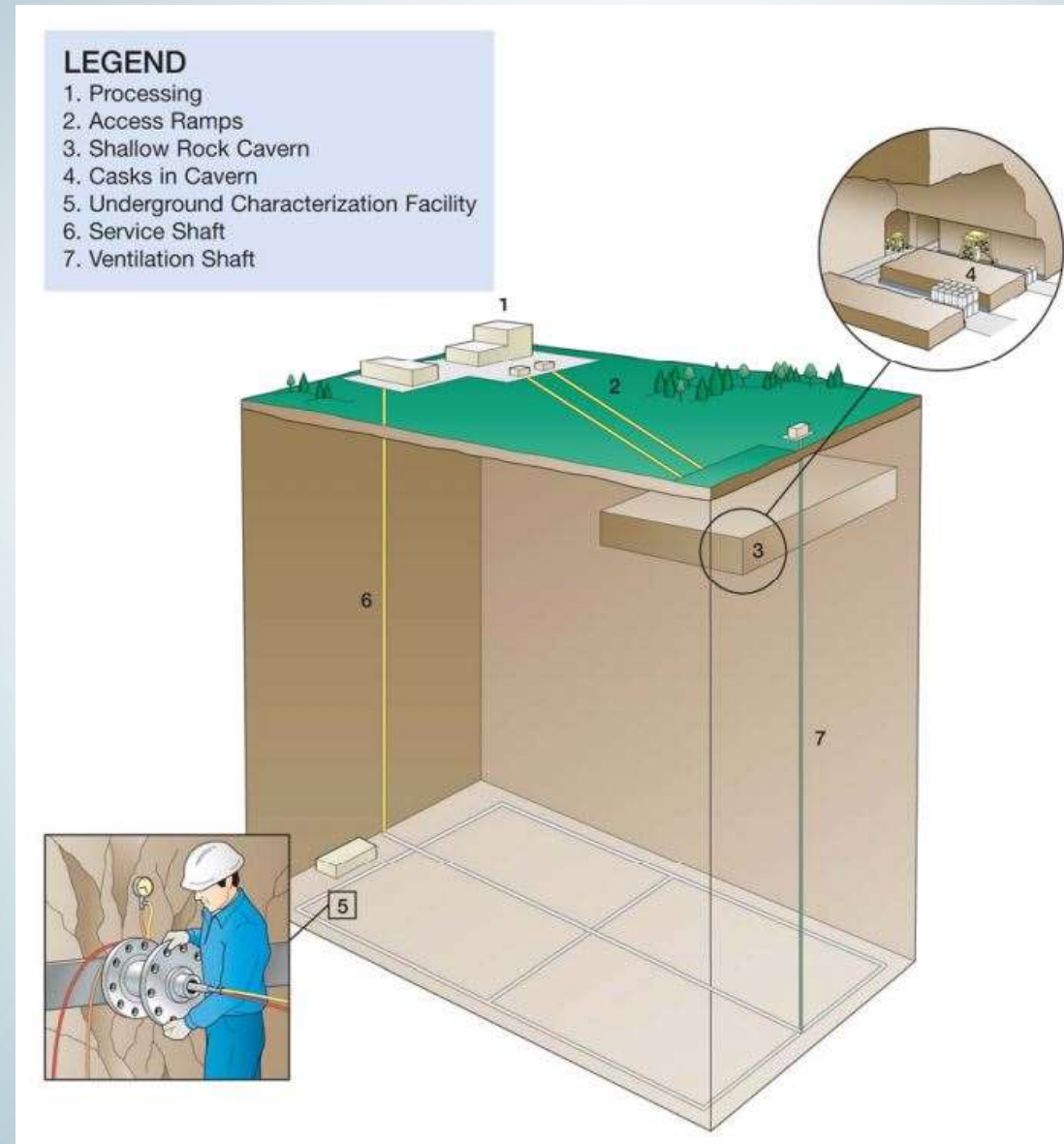


Demonstration of Used Fuel Containment and Isolation Technology



Source: NWMO 2005 Background Papers: 6-18 ADAPTIVE PHASED MANAGEMENT: TECHNICAL DESCRIPTION

Phase 2 – Central Storage and Technology Demonstration



Illustrative Overall Work Schedule for Adaptive Phased Management

	Approximate Time Period After Government Decision (year)														
Activity	10	20	30	40	50	60	70	80	90	110	200	300	325	???	
Phase 1: Preparing for Central Used Fuel Management															
Store used fuel (UF) at reactor sites															
Conduct further research & development (R&D)															
Conduct siting studies															
Continue site characterization															
Environmental Assessment															
Construct shallow rock caverns															
Construct Underground Characterization Facility (UCF)															
Phase 2: Central Storage & Technology Demonstration															
Transport UF from reactor sites to central facility															
Store UF in shallow rock caverns															
Monitor geosphere															
Conduct R&D in UCF															
Demonstrate technology in UCF															
Confirm site suitability															
Construct deep repository															
Construct packaging plant															

Source: NWMO 2005 Background Papers: 6-18 ADAPTIVE PHASED MANAGEMENT: TECHNICAL DESCRIPTION

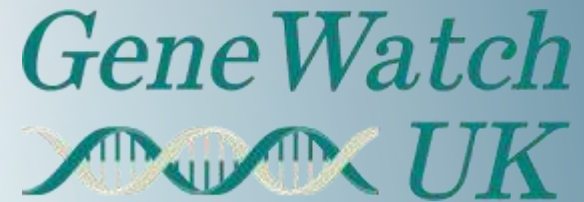
Concerns Raised by GeneWatch UK in 2010 (1)

- ▶ **Copper or steel canisters could corrode** quicker than expected
- ▶ **Intense heat** from radioactive decay, along with corrosion and gas generation, could compromise backfill material
- ▶ **Build-up of gas pressure** could damage barriers and force radionuclides through rock fractures
- ▶ **Chemical effects** are poorly understood re: formation of compounds that could hasten transport of radiotoxic elements such as plutonium
- ▶ **Fractures and faults** may be unidentified or misclassified – radionuclides could be released into groundwater



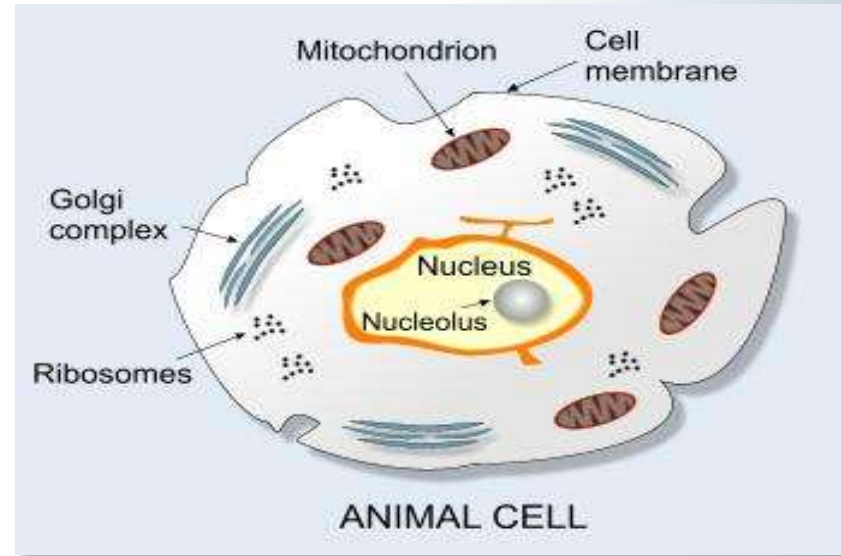
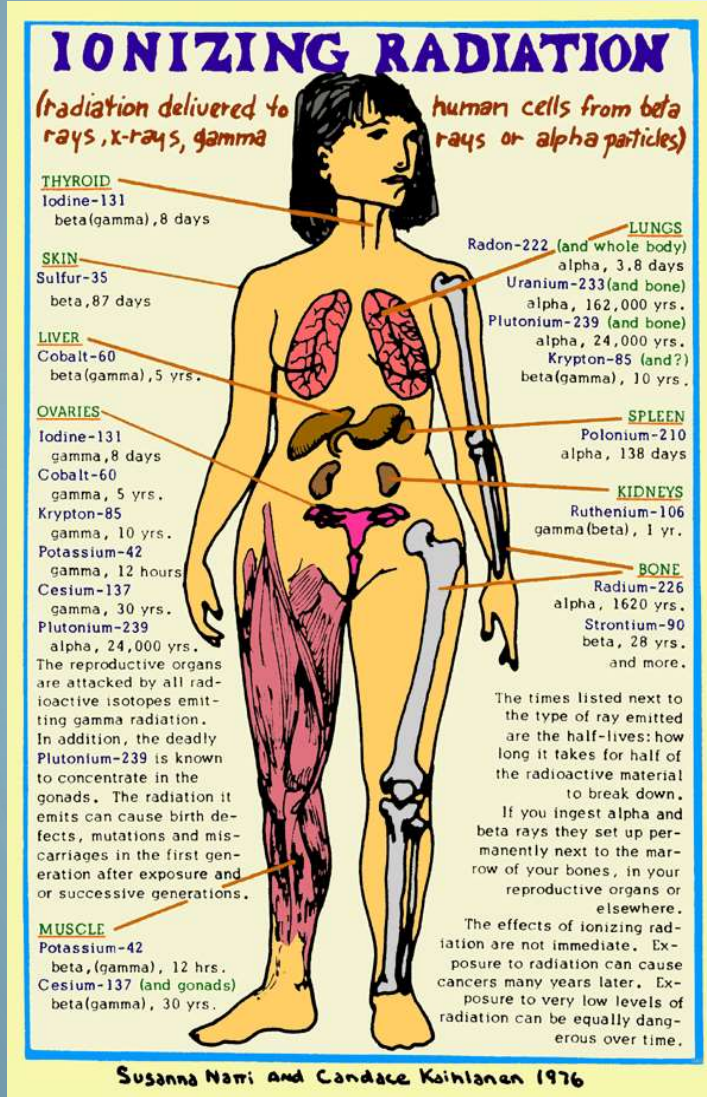
Concerns Raised by GeneWatch UK in 2010 (2)

- ▶ Excavation of repository will **damage adjacent zones of rock** – could create fast routes for radionuclide escape
- ▶ **Future glaciations** could cause faulting of rock, barrier rupture and penetration of surface water
- ▶ **Earthquakes** could damage containers, backfill and rock
- ▶ **Future generations** could unknowingly dig a shaft into the rock around the repository, or a well into contaminated groundwater above it



GeneWatch UK is a not-for-profit policy research and public interest group that investigates how genetic science and technologies will impact on our food, health, agriculture, environment and society.

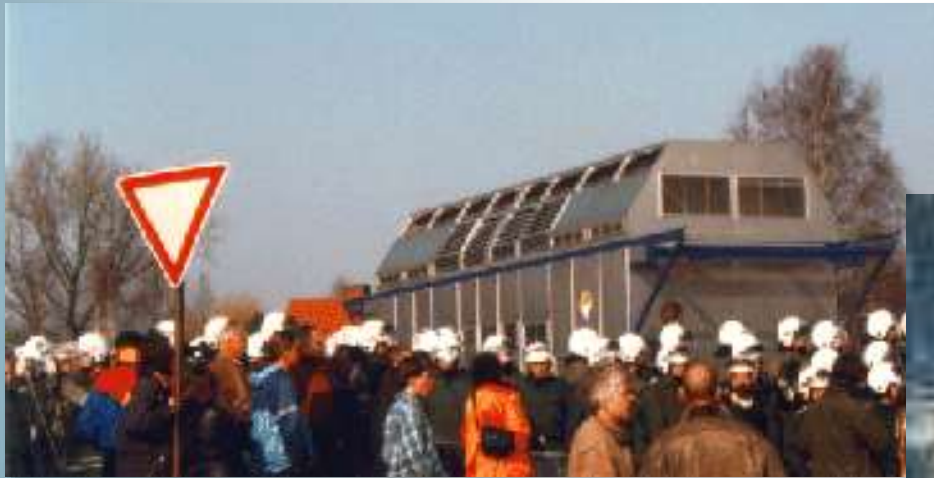
Even low levels of exposure to radioactivity can cause health problems



The BEIR VII report reaffirmed the conclusion of the prior report that every exposure to radiation produces a corresponding increase in cancer risk.

Source: BEIR VII Phase 2 Report on Health Risks from Exposure to Low Levels of Ionizing Radiation, US National Research Council, 2006

Transporting the waste increases the risk



Transportation Options and Number of Shipments

Transportation Modes for Used Nuclear Fuel

Projected used fuel shipments in Canada
based on 4.8 million fuel bundles

- **Road:** about 620 road shipments
or
- **Rail:** about 62 per year
or
- **Water:** about 2 per month

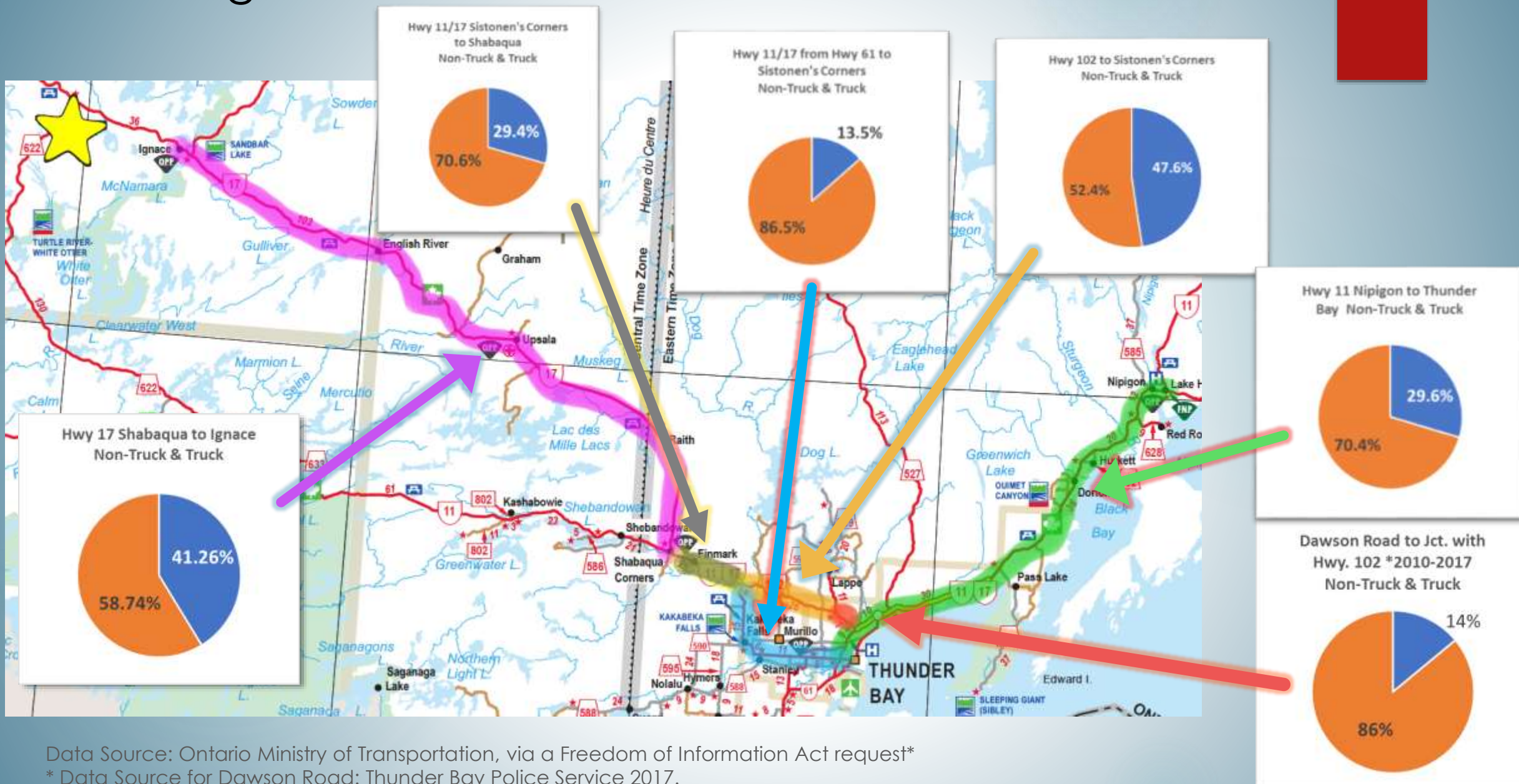


Note: if recently updated estimates of 7.2 million used fuel bundles are correct, and all nuclear waste is shipped to Northern Ontario by road, this will entail **about 930 road/truck shipments per year, or 2-3 trucks per day.**



Transport truck collision near Ignace, Ontario on October 26, 2017

Percentage of Non-Truck vs. Truck Collisions, 2010-2015



Data Source: Ontario Ministry of Transportation, via a Freedom of Information Act request*

* Data Source for Dawson Road: Thunder Bay Police Service 2017.

Note: Hwy 69 to Hwy 11 (E. JCT) Nipigon – 22.7% Truck Collisions – average 35.5 truck collisions per year; 156 per year for all collisions

MTO Truck Collision Statistics - Nipigon to Ignace

Location Description	<u>2016 - 2017</u>		
	All Collisions	Truck Collisions	% Truck Collisions
Hwy 11 (E. Jct.) - NIPIGON to Hwy 61 (THUNDER BAY)	318	59	18.50%
Hwy 11/17 Hwy 61 (THUNDER BAY) to Hwy 11 (W. Jct.) (S) End of Overlap SHABAQUA	189	30	15.87%
Hwy 17 (W. Jct.) (S) End of overlap SHABAQUA to East St. (N & S) IGNACE	196	81	41.33%
	397	124	32.02%
Averages per year: 2016 - 2017	198 total collisions per year	62 truck collisions per year	32% of total are truck collisions

Source: Ontario Ministry of Transportation, via a Freedom of Information Act request

Rolling Stewardship: A Better Approach?

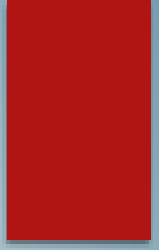
Gordon Edwards, in his paper “Nuclear Waste: Abandonment versus Rolling Stewardship,” contrasts the two approaches.

The Concept of Abandonment

1. Humans have never permanently disposed of anything.
2. Assumes a permanent solution to waste problem exists.
3. Monitoring the waste ceases after abandonment.
4. Retrieval is difficult or impossible.
5. Containers will inevitably disintegrate.
6. If leakage occurs timely corrective action is not likely.
7. Abandonment will eventually result in amnesia.
8. Difficulty in communicating to unknown future societies.
9. No intention to truly solve the problem of nuclear waste.

The Concept of Rolling Stewardship

1. Humans can contain waste securely for decades at a time.
2. Recognizes a solution to the problem does not yet exist.
3. Continual monitoring of waste is essential.
4. Retrieval is anticipated and actively planned for.
5. Periodic repackaging is an integral part of the process.
6. If leakage occurs timely corrective action will be taken.
7. Rolling Stewardship is based on persistence of memory.
8. Information is readily transmitted to the next generation.
9. Ongoing reminder that the problem remains to be solved.



Do I want to be one of the small handful of people who decided for the first time in Canadian history, that it is perfectly good practice to abandon long-lived human-made radioactive waste materials?
Do I truly believe that our present knowledge of science, technology and nature is sufficient for me to be certain of the validity of this course of action for the next 100,000 to 1,000,000 years?

Gordon Edwards – “Oral Intervention from Gordon Edwards”

At its October 15, 2019 meeting, the Council of the Township of Gillies, near Thunder Bay, passed the following resolution:

RESOLUTION 2019/336

Moved by Councillor Jones; Seconded by Councillor Groenheide

WHEREAS the roads infrastructure in Northwestern Ontario is already under strain from heavy truck and vehicle traffic;

AND WHEREAS communities in Northern Ontario do not benefit from the use of Nuclear Power;

AND WHEREAS communities that use Nuclear Power should be responsible for storing Nuclear Waste;

AND WHEREAS there is a potential safety risk when transporting nuclear waste through highly populated areas;

THEREFORE BE IT RESOLVED THAT the Council for the Township of Gillies urges the Nuclear Waste Management Organization to find storage solutions for nuclear waste at the originating nuclear reactors sites rather than transporting the waste across the province and/or country

For more information...



The screenshot shows the homepage of the Environment North website. At the top is a banner image of a rocky shoreline next to a body of water. Below the banner is a navigation bar with the text "ENVIRONMENT north" and links for "Home", "About", "Links", and "Contact". On the left side, there are four vertical buttons: "Become a Member" (with a tree icon), "Events Calendar" (with a calendar icon), "Participate in Government Consultations" (with a building icon), and "Find us on Facebook" (with the Facebook logo). Below these buttons are logos for "Environment North" and "Ontario Trillium Foundation". The main content area features a presentation announcement for Saturday, October 19, titled "Nuclear Waste in Northwestern Ontario - Why We Should Be Concerned". The announcement includes the time (11:00 am) and location (Mary J.L. Black Library). A large graphic with the text "SAY NO!" and a radiation symbol with a red prohibition sign is prominently displayed. Below this graphic, it says "TO NUCLEAR WASTE IN NORTHWESTERN ONTARIO" and "Why We Should Be Concerned" as a presentation by Dodie LeGassick of Environment North at the Mary J.L. Black Library on October 19, 2019. On the right side, there is a search bar and two paragraphs of text. The first paragraph repeats the presentation details. The second paragraph, dated September 23, 2019, mentions that board member Dodie LeGassick was at the Hymers Fall Fair answering questions about nuclear waste disposal.

ENVIRONMENT north

Home About Links Contact

Become a Member

Events Calendar

Participate in Government Consultations

Find us on Facebook

Supported by a grant from Ontario Trillium Foundation

Presentation on Saturday October 19:
"Nuclear Waste in Northwestern Ontario - Why We Should Be Concerned"
11:00 am at the Mary J.L. Black Library - All welcome!

SAY NO!

TO NUCLEAR WASTE IN NORTHWESTERN ONTARIO

"Why We Should Be Concerned"
a presentation by
Dodie LeGassick of Environment North
MARY J.L. BLACK LIBRARY
October 19, 2019

Search

PRESENTATION: Oct. 19 -
"Nuclear Waste in Northwestern Ontario - Why We Should Be Concerned" - Mary J.L. Black Library
October 19, 2019
Plan to attend Dodie LeGassick's presentation at Mary J.L. Black Library on Saturday, Oct. 19 @ 11am.

"Say NO" to Nuclear Waste
September 23, 2019
Board member Dodie LeGassick was at the Hymers Fall Fair answering questions and discussing concerns about the potential disposal of nuclear waste in Northwestern Ontario.

Presentation: Nuclear Waste in Northwestern Ontario

environmentnorth.ca