



NUCLEAR WASTE
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Monitoring and Retrievability

Monitoring

Adaptive Phased Management (APM) embraces the concept of monitoring throughout all phases of implementation (NWMO 2005), and the Nuclear Waste Management Organization (NWMO) is continuing to conduct research on monitoring methods, tools and longevity of monitoring equipment required during implementation of APM (Simmons and Chandler 2003).

Within the context of APM, monitoring can be subdivided into two major categories:

- a) Monitoring of processes and parameters in the living environment and geosphere that support conclusions about the adequacy of a site for a deep geological repository to safely manage used nuclear fuel over the long term.
- b) Monitoring the deep geological repository system once used nuclear fuel has been placed in the repository to confirm that:
 - i) performance of the repository system is proceeding as expected; and
 - ii) conclusions related to the capability of the repository system to safely manage used nuclear fuel over the long term remain valid.

There are many processes and parameters that will be identified as part of the monitoring program during implementation of APM. Initially, monitoring provides:

- » baseline information that would be needed for an Environmental Assessment and licence approval at the preferred site for used fuel management;
- » design and layout of a deep geological repository; and
- » safety assessment of the deep geological repository.

Subsequently, monitoring provides both more detailed and longer-term data for analysis and confirmation of repository performance. Monitoring would also be used as an indication of a need to retrieve used fuel from the repository.

The development, testing and demonstration of monitoring instruments and equipment for a deep geological repository have been underway for many decades (Simmons and Chandler 2003; Dixon et al. 2004; Mayer et al. 2006; SKB 2007). In particular, the performance and longevity of hundreds of monitoring instruments and methods have been tested in underground research facilities including:

- » Underground Research Laboratory (URL), Manitoba, Canada;
- » Äspö Hard Rock Laboratory, Sweden;
- » Mont Terri Project, Switzerland; and
- » Bure Underground Research Laboratory, France.

Monitoring will continue to be an ongoing area of co-operative research, development and demonstration for the NWMO and other radioactive waste management organizations.

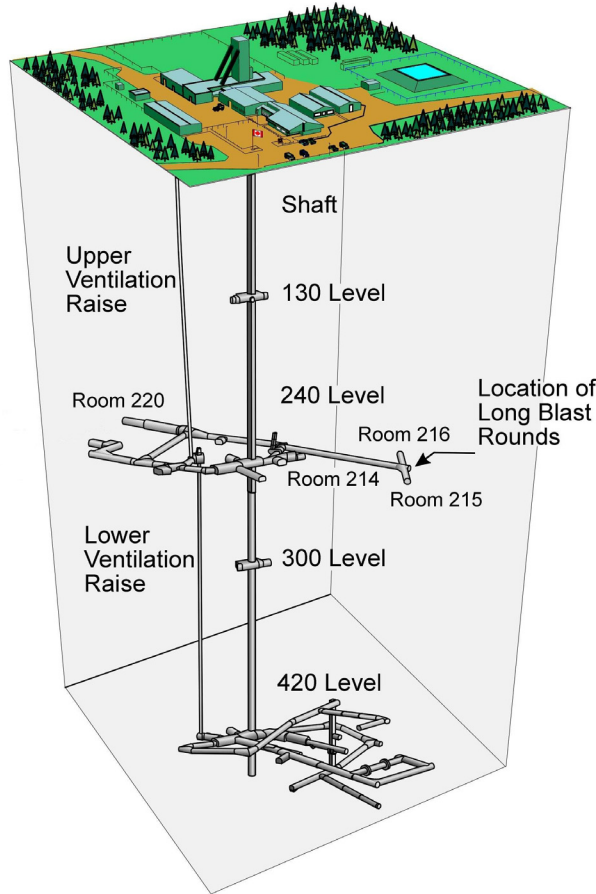


Figure 1: Underground Research Laboratory in Canada (courtesy AECL)

Figure 2: Äspö Hard Rock Laboratory for Underground Research in Sweden (courtesy SKB)





Retrievability

Adaptive Phased Management requires that used nuclear fuel be retrievable throughout all phases of implementation (NWMO 2005). This means used nuclear fuel can be accessed and safely removed from the repository.

Within the context of the APM approach, retrievability of used nuclear fuel can be considered during the two following stages:

- a) While in storage, used nuclear fuel can be easily retrieved because, by definition, “storage” means there is the intent to retrieve or recover the material.
- b) While placed in a deep geological repository, the intent is that the used nuclear fuel will not be retrieved and will remain safe in the repository.

However, should it be determined that used nuclear fuel should be retrieved for safety or other reasons, then APM will allow retrieval to occur.

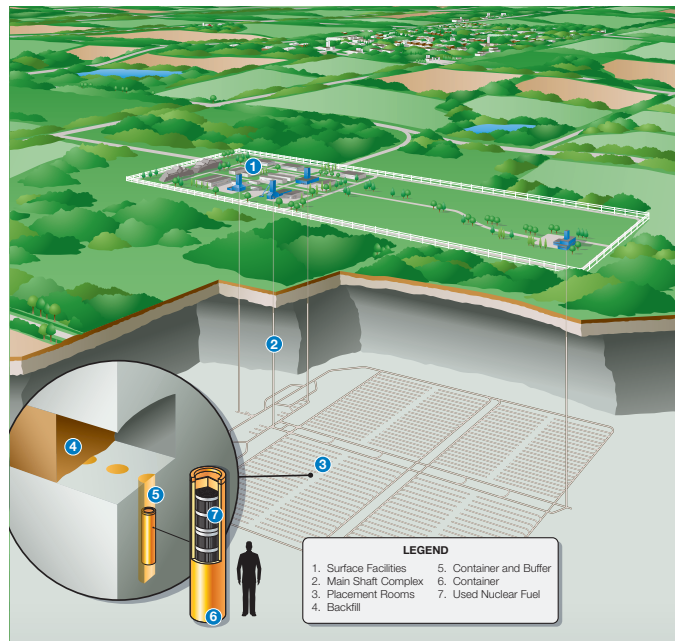


Figure 3: Monitoring and Retrievability in Adaptive Phased Management

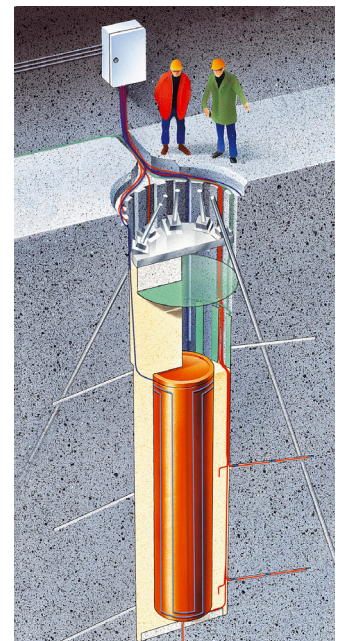


Figure 4: The Canister Retrieval Test at the Äspö Hard Rock Laboratory in Sweden (courtesy SKB)

Main Activities

- » Demonstration of long-term containment and isolation technology in underground laboratory at preferred site
- » Testing and demonstration of monitoring equipment – geology, groundwater, excavations, sealing materials, container corrosion, microbes, etc.
- » Testing and demonstration of retrieval of used fuel containers from the repository
- » Monitoring during placement in the deep repository
- » Extended monitoring of repository after container placement until a future society decides when to close deep repository and decommission facilities.



In developing the design of the deep geological repository, the NWMO will consider the potential need for retrieval and will address aspects of retrieval which require technology development and demonstration. However, any features designed to facilitate retrieval of used fuel will not compromise the ultimate safety of the deep geological repository.

The technology to retrieve used nuclear fuel has been developed at the conceptual level and demonstrated at surface and underground research laboratories such as the Äspö Hard Rock Laboratory in Sweden. The Canister Retrieval Test at the Äspö Hard Rock Laboratory is one example of full-scale demonstration of used fuel retrieval technology (SKB 2007). The NWMO will continue to study and develop technologies for the retrieval of used fuel during implementation of Adaptive Phased Management.

While used nuclear fuel will be retrievable throughout all phases of implementation of APM, it is expected that the process of retrieval will become progressively more demanding and resource intensive as the used fuel containers are sealed in the placement rooms and the access tunnels and shafts are eventually backfilled and sealed.

The future decision to close the deep geological repository will only be made once the society and government institutions and processes of the day agree that this should happen.

References

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