CONCRETE VAULT
FACTSHEET

At a glance

- Simple, modular design.
- Expandable according to need.
- Suitable for low-level waste in various packages, including waste that may become compacted over time, such as clothing and paper products.
- May be constructed in several types of soil.
- Operating in the Czech Republic, France, Japan, Slovakia, Spain and the UK.
- Designed to last for around 300 years.

Concrete vaults are widely used around the world for the disposal of low-level radioactive waste (LLW). Compared to other solutions, a concrete vault repository is easy to construct and operate. It is also modular in its design, which means that additional vaults can be added to increase its capacity as needed. Because it provides structural support for the cover, either through the vault itself or by placing the waste in packages that vary by size and weight, waste that may reduce in volume over time may be emplaced in this type of facility. Engineers can design additional safety barriers, for example made of concrete, steel or compressed earth, as needed to enhance long-term safety. This type of repository could isolate the waste for at least 300 years.

A drainage system in each concrete vault collects water so that it can be monitored and treated as necessary before it is released. The monitoring system gives operators the information they need to take action as necessary to ensure the repository is working properly throughout all phases of its operation. For example, they can watch for any changes in the water samples and take action to prevent releases from impacting the environment.

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version 2 - 2021-04-14

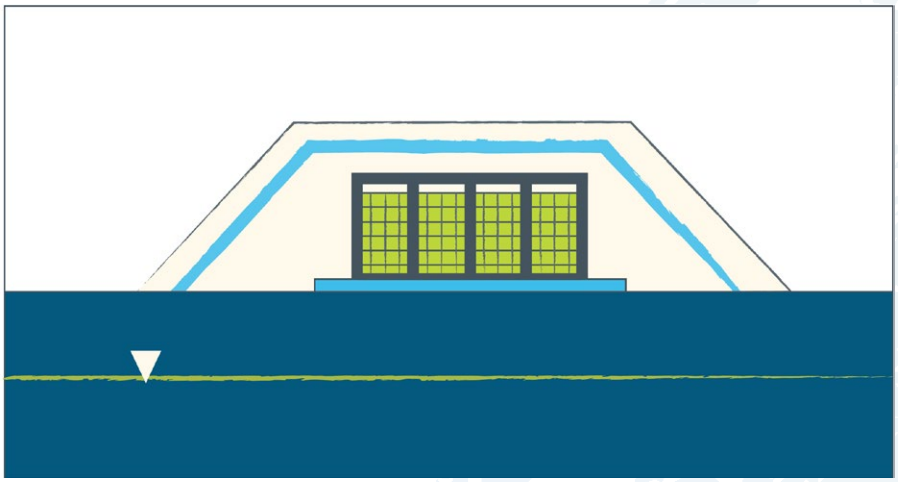
SURFACE CONCRETE VAULT

Concrete vaults look like large concrete boxes and a repository would be made up of a series of these. Each one would have its own drainage system and an 'earthen cover system' engineered from multiple layers of soil and with grass or other plants growing on top. This disposal method can be used in a wide variety of soil conditions. The concrete vaults could be on the surface of the ground and constructed so that the waste is kept dry during the repository lifetime.

Concrete vaults can be designed to be loaded either from the top or from the side. For a top-loading system, the waste packages are lowered into the concrete vaults by a crane. A mobile cover system is used to stop rain or snow from entering the vault while waste packages are being placed in the vault. In this concept, the waste packages need to be strong enough to provide the same support as a roof on a house. The space between packages is backfilled with a free-flowing material such as sand or grout. Once a vault is filled with waste packages, a concrete cover is built on the top.

For side-loaded vaults, waste packages are loaded using a forklift. While it is being moved, the waste is protected from the weather by temporary shelters. Side-loading concrete vault structures are designed to be self-supporting, so the waste packages themselves do not need to provide structural support in the long run. The spaces between the waste packages do not need to be filled, either. This provides easier access to the waste during operations or following closure, if needed.

In both cases, an engineered earthen cover system is built over the concrete vaults to minimize the amount of water that could get in and to protect the vaults from freeze-thaw and drying/wetting cycles. This type of cover is also similar to those used for conventional landfill disposal facilities in municipalities across the country.



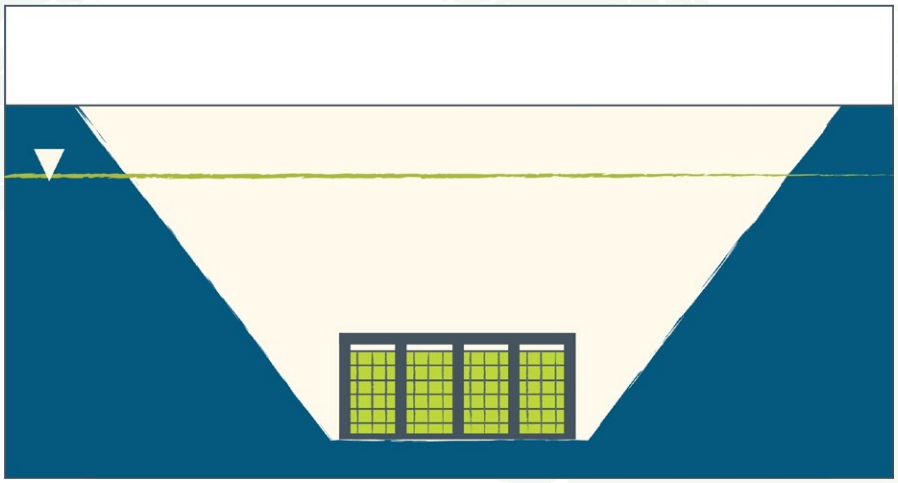
Above-grade concrete vault

BELOW-GRADE CONCRETE VAULTS

It is possible to build a concrete vault repository below ground level ('below grade'). These have the same components and features as a surface concrete vault, except they are accessed using ramps. This type of repository needs to be located in soil that has low permeability to water (e.g. thick silt till or clay soil). After closure, it requires little maintenance and is more resistant to intrusion.

As the vaults are constructed and filled with waste, low permeability backfill materials are placed and compacted all around and on top of the vaults. If necessary, an engineered earthen cover could be built at surface level to further limit the amount of water that could get in after the repository is closed.

During construction and operations, drainage systems will draw the water level down to the bottom of the vaults. After closure, the drainage systems will no longer operate, and the water level will naturally rise within the backfill material, around the outside of the vaults and up to the level of the water table. Over a long time period, water would eventually seep through the concrete walls of the vaults and gradually fill the vaults. The movement of any radioactive releases from the vaults would be reduced by natural soil conditions and the backfill. If needed, the drainage system could also be operated for a short period of time, such as 30 to 50 years, following closure. Groundwater quality would continue to be monitored for as long as necessary.



Below-grade concrete vault

INTERNATIONAL EXPERIENCE

An example of a surface concrete vault repository is the Centre de l'Aube facility in France which has operated since 1992. This facility can accommodate 1,000,000 cubic meters in 400 concrete vaults. The vaults are designed for a 300-year life and will be capped with an engineered earthen cover system once they have been filled. Similar repositories operate in Spain and the United Kingdom.

The Japanese repository located at Rokkasho has also been in operation since 1992. Rokkasho is an example of a below-grade concrete vault repository. The bases of the disposal vaults are about 14 to 19 meters below the surface of the ground in low permeability sedimentary rock. Similar below-grade repositories are in operation in Slovakia, the Czech Republic and Scotland.

Aerial view of the Centre de l'Aube Repository for short-lived L&ILW, France

Aerial view of Rokkasho LLW disposal centre, Japan