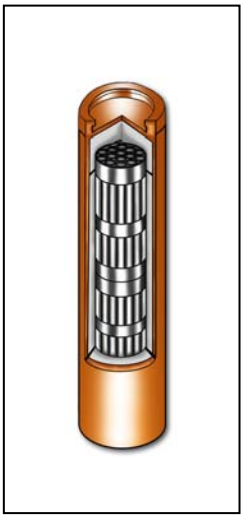
Fact Sheet: *Multi-Barrier Containment*

The containment of the used nuclear fuel will involve several barriers to the movement of radiation. Many of these barriers are engineered and are based on extensive research and experiences of not only other countries dealing with the storage of used nuclear fuel, but also knowledge gathered from archaeological discoveries. The other barriers are natural, and reflect the earth's ability to contain naturally occurring radiation. Once the used nuclear fuel is deposited in the deep geological repository (DGR), a massive underground storage facility designed to hold all of Canada's used nuclear fuel once completed, these barriers will work together to help ensure the waste is safely contained for many thousands of years.

Engineered Barriers:



The fuel pellets are made of very hard and high density ceramic, making it extremely durable and hard to break. They do not dissolve in water and are resistant to heat and wear. This is the first barrier in the multi-barrier system.

The fuel element and fuel bundle form the second line of protection. The fuel elements are the long, sealed tubes which house and isolate the fuel pellets. They are made of zirconium alloy, or Zircaloy, a metal that is strong and resistant to corrosion.

The used nuclear fuel container will be responsible for containing and isolating the fuel bundles and is the third barrier. Several hundred bundles will be placed inside a support vessel made of carbon-steel, which will have ability to provide mechanical strength to the used fuel container which will be made of thick copper. The used fuel containers are designed to last at least 100,000 years.

Under deep rock conditions copper is extremely durable and resistant to various types of corrosion. Copper is one of the few metals found in its native state in the geological environment, and studies on natural copper deposits and archaeological artifacts from First Nations people and other cultures indicate excellent environmental durability. The copper plates shown in these pictures were formed about 200 million years ago and show very little corrosion.

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Natural Barriers:

Compacted pellets of bentonite clay, a natural clay that can absorb up to 10 times its weight in water, will form the first natural barrier. If moisture were to approach the used fuel containers, the bentonite clay would absorb it and swell up, forming an effective seal. The placement rooms where the containers will be buried will also be filled in with backfill and sealants made up of a mixture of clay, sand, and rock to impede the flow of moisture.

To illustrate the long-term protection that clay can provide, take the ancient forest of Dunarobba, near Umbria, Italy, as an example. The trees there are about 1.5 million years old, and what is remarkable is that they have essentially been mummified in clay during that time, and the trunks remain in an upright position. The oldest of these trees are actually about 3000 years old, but a protective barrier of clay minimized water flow to the trees, preventing them from decomposing. Unlike fossilized trees, these trees are still made of wood.

The surrounding geology of the DGR will be another natural barrier. The host rock formation will likely be stable over a very long period and will not be substantially affected by natural disturbances such as seismic activity, geothermal activity, and glaciation. The depth of the repository will be approximately 500 meters, providing a significant separation between the used nuclear fuel containers and the surface. It will also be required to have no groundwater resources at the repository depth, and must contain no naturally exploitable resources that we know of today, so that the repository will unlikely be disturbed by future generations.

This image shows how the container may be placed into the host rock of the DGR.