# Microbial Assessment of a Deep Geological Repository for Canada's Used Nuclear Fuel

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Deep geological repositories (DGR) for nuclear waste typically rely on both engineered and natural barrier systems to contain and isolate radionuclides. The Canadian Nuclear Waste Management Organization`s (NWMO) *engineered* barrier system consists of used fuel containers made of copper-coated steel, surrounded by highly compacted bentonite clay. The *natural* barrier system will be 500 m of overlying low-permeability host rock (i.e., sedimentary or crystalline) in a willing and informed host community.

Microbial processes play an important role in geochemical processes and therefore have the potential to impact a DGR if not considered in repository design. For example, sulphate-reduction can create sulphide that can cause corrosion of used fuel containers, and methanogenesis can generate methane that can create preferential transport pathways in the bentonite. Evaluation of microorganisms, and their potential activity, is therefore an important component of studies to demonstrate that the *engineered* and *natural* barriers can contain and isolate used nuclear fuel in a DGR.

The results of extensive experimental program by Canadian academics has demonstrated that bentonite compacted to 1.6 g/cm$^3$ is inhibitory to microbial growth. This provides evidence that the *engineered* barrier can prevent microbially induced corrosion of the containers.

The typical low permeability of the rock samples proposed for DGR construction means that groundwater is not present in sufficient quantities for standard microbial assessment protocols. As such, innovative methods to characterize microorganisms in low permeability, low biomass rock samples typical of the *natural* barrier system are under development. These methods will be used to investigate microorganisms in rocks under consideration in Canada to host a DGR.