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Microbial processes in a radioactive waste repository

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The nuclear fuel cycle ends by spent fuel reposition in an appropriate facility. The long-term performance of a radioactive waste repository can be significantly influenced by geological, geochemical and also biological phenomena. Microbial processes may negatively affect canister (microbial corrosion) and buffer and backfill material (microbial induced chemical and mechanical changes) as well as the geosphere of the repository (biologically enhance migration of radionuclides). On the contrary, a positive effect of microbes is observed during the open phase of the repository, when microbial processes in the geosphere stop oxygen from reaching the groundwater, and also in the post closure phase, when microbes (denitrifying bacteria, manganese reduction b., iron reducing b., sulphate reducing b., sulphur reducing b., methanogens) reduce the available ions to a lower oxidation state. In both cases, ORP is kept at a low level, which restricts radionuclide migration. Moreover, migration of radionuclides can be restricted by accumulation or biosorption by microbes. Due to the fact that radionuclides can be toxic (or radiotoxic) for the microbes present, the study of radionuclide (or their stable equivalents) toxicity is very important.

In this study, the effect of different concentrations of non-radioactive Cs on the survivability of natural anaerobic bacteria was determined. The impact of Cs on bacteria was examined using molecular-biological methods and transmission electron microscopy techniques. Lower Cs concentrations (0.5 mM) promoted bacteria growth, while higher concentrations (1 mM) limited their growth, and 5 mM was lethal.

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