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Gas Generation and Migration in Deep Geological Radioactive Waste Repositories

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Abstract

The option of disposal nuclear waste in a deep geological repository (DGR) is currently being studied in several countries (e.g., Canada, China, France, Germany, India and Switzerland). The long-term performance of a DGR in rock generally relies on the protection of multiple barriers, including engineered and natural barriers. Significant amounts of gases could be generated in DRGs from several processes, such as degradation of waste forms or corrosion of waste containers. These gases could migrate through both engineered and natural geologic barrier systems. The increased pressure of the gases, if large enough, could cause microcracks or macrocracks to form, affecting the integrity of the barriers and the geosphere as a barrier to long-term contaminants. In addition, these gases could have a significant impact on the biosphere and groundwater. Thus, assessing the long-term safety of a nuclear waste repository in a deep geological formation requires a good understanding of the mechanisms of gas migration, the prediction of the gas migration as well as their effects on the integrity, mechanical (M) and hydraulic (H) stability of the repository. In this keynote lecture, the mechanisms of gas generation and transport in DGRs for radioactive waste will be discussed. In addition, techniques for modeling and predicting gas transport in GDRs will be presented. Finally, modeling studies of gas migration in a potential Canadian DGR will be addressed.