**Integration Group for the Safety Case (IGSC) Symposium 2024***MOVING TOWARDS THE CONSTRUCTION OF A SAFE DGR – GETTING REAL*

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| **Abstract Title: Is illitization a safety concern for bentonite backfilled Engineered Barrier System for a repository of high-level radioactive waste?**  **Lawrence Berkeley National Laboratory, USA,** [**lzheng@lbl.gov**](mailto:lzheng@lbl.gov) | |
| **Abstract (300-500 words):**  One of the safety concerns related to bentonite buffer is that bentonite may lose its swelling and adsorption capacity in the long run due to illitization, the transformation of smectite to illite. Illitization is evidenced in geological formation and it is generally believed that temperature and potassium (K) concentration play the key role. However, illitization has not been conclusively concluded in either small-scale laboratory experiments or large-scale mock-up and *in situ* or field tests. This presentation reviews laboratory tests, numerical modeling, and large-scale field tests conducted within US DOE’s Spent Fuel and Waste Science and Technology program, attempting to shed light on a variety of questions about illitization including (1) whether high temperature (up to 300 oC) significantly accelerates illitization; (2) what are the key geochemical factors (e.g. Na/K ratio, availability of Al, bentonite/rock interaction) affecting illitization; (3) how illitization affects the swelling stress and sorption or cation exchange capacity of bentonite; (4) what are the issues that hinder the reliable modeling of illitization. These studies showed that temperature becomes a relevant factor when the chemical conditions favors the occurence of illitization: sufficient K supply, low Na/K ratio, high Al/Si ratio. Whether K come from the dissolution of K-bearing minerals or groundwater of host rock affects how illitization proceeds. Models showed that stress reduction by illitization depends on the type of bentonite and varies spatially and temporally, using bentonite with high swelling capacity may alleviate the detrimental effect of illitization. Illitization does not necessarily lead to a remarkable reduction of sorption capacity. Illitization has not been observed in the large-scale field test, but this might be due to the limited test time with respect to the typical time of illitization expected in geological conditions. Reliable modeling of illitization has been challenging because thermodynamic data for smectite and illite contains large uncertainties. | |