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Uranium behaviour in evaporite-bearing units of the Mercia Mudstone Group: implications for nuclear waste disposal concepts

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The Mercia Mudstone Group (MMG) is one of the rock formations currently being evaluated in the UK as a potential host for a Geological Disposal Facility (GDF). It comprises interbedded mudstones, siltstones, sandstones and evaporitic units such as gypsum, anhydrite and halite. The influence of these evaporitic minerals on uranium mobility under repository-relevant geochemical conditions remains largely unexplored.

The aim of this study is to determine uranium sorption and partitioning within evaporite-bearing MMG lithologies from the Churchtown borehole (Blackpool, NW England). Working collaboratively between the University of Manchester, RADER (NNUF) and UKNNL, a series of batch sorption experiments were performed on end-member evaporite-bearing lithotypes using a high salinity groundwater simulant. Aqueous analyses (pH monitoring and ICP-MS) were used to quantify uranium uptake and solution chemistry, while solid-phase characterisation techniques (XRD and SEM, including post-experimental XRD) were used to assess mineralogical changes and potential sorption/precipitation mechanisms.

The results represent the first data quantifying uranium behaviour in evaporite-bearing MMG units under conditions relevant to the UK GDF programme. Research findings will inform development of reactive-transport models of uranium behaviour in evaporite-bearing mudstones.