Research Support Office

Nuclear Waste Services

RSO Discipline Update: Engineered Barrier Systems

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Introduction

Majid Sedighi (DL)

Reader at UoM

Expertise in coupled THCM behaviour of geo-materials (e.g., bentonite)

Matthew Kirby (Lead SME)

Research Manager at NWS

Bentonite SME

Background in geochemistry

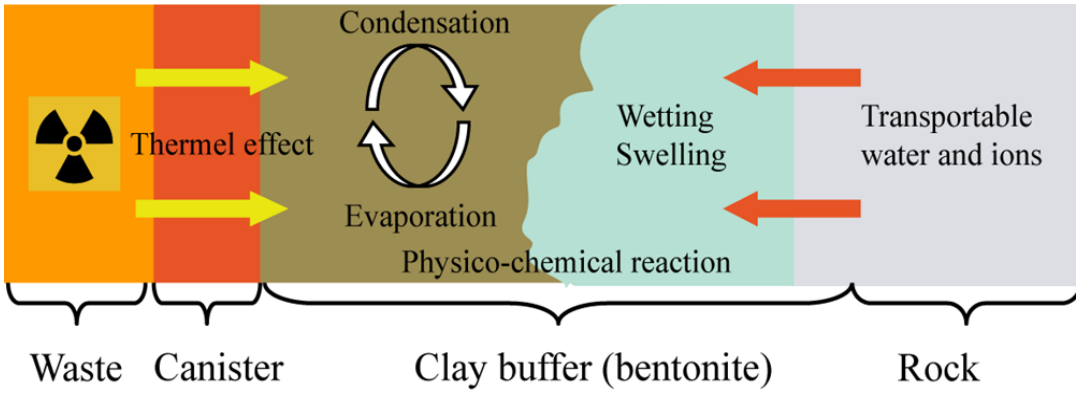
Sam Parsons, Research Manager, Coupled processes SME

Will Bower, Senior Radiochemist, Project lead for LHGW backfill development

Simon Norris, Principal Research Manager, NWS lead on gas, near-field processes, GDF-driven coupled processes

EBS Discipline Background

- To understand the performance of engineered barrier materials in UK geological environments to inform the GDF design and safety case.
- Focus is primarily on backfill materials and accessway seal materials.
- Key interest in coupled thermal-hydraulic-mechanical-chemical-biological processes occurring in different barriers, and at the interfaces of barrier components.
- Encompasses fundamental research on the molecular level through to understanding material behaviour from field scale experiments and analogues.



HotBENT experiment, Heater # 1 instrumented and partially backfilled. Reproduced from GTS website

EBS Discipline Updates

Research Support Office

Bentonite related PhD projects

University of Edinburgh

- Managing LHGW-derived gas via innovative Engineered Barrier System (EBS) materials

University of Manchester

- Bentonite microbial activity in geological disposal of radioactive waste

Imperial College London

- Modelling the behaviour of compacted bentonite at high temperatures
- Developing fundamental understanding of porosity evolution in compacted bentonite

University College London

- Long-term performance of a geological disposal facility in response to permafrost and climatic variation

EBS Discipline Updates

Research Support Office

Cementitious backfill related PhD projects

University of Strathclyde

- NRVB performance at high temperatures
- Advanced characterisation of hydrothermally aged cement

University of Manchester

- Mechanisms of radionuclide retention in aged cements
- Uranium and U-series radionuclide behaviour in phosphate-based cement systems

Note that some projects fall under other disciplines (e.g. materials, radiochemistry)

University of Leeds

- Hydrothermal aging of cement materials

ICL

- Long term performance of PO_4-based backfill cements in repository environments for DNLEU disposal
- Performance of aged cement grouts for encapsulating radioactive wastes

Forward vision

- The key focus going forward is to improve NWS fundamental understanding of how engineered materials perform in representative UK LSSR environments. This includes:
  - Performance of EBS materials in extreme geochemical environments
  - Suitability of EBS materials in interbedded environments
  - Potential impact of high organic content host rocks on EBS material performance

- EBS Materials of interest include:
  - Those utilised in UK illustrative LSSR concepts (bentonite, cementitious materials)
  - Whether EBS materials from UK illustrative evaporite concepts can be adapted to some UK LSSR environments (e.g. crushed salt)
  - Novel/new materials that can meet the desired safety functions of a barrier material

- NWS are also keen to continue understanding barrier performance above 100°C to support optimisation of the GDF footprint