OR/12/023 Conclusion and recommendations

Wragg, J, Rushton, J, Bateman, K, Green, K, Harrison, H, Wagner, D, Milodowski, A E, and West, J M. 2012. Microbial Impacts of CO2 transport in Sherwood Sandstone. *British Geological Survey Internal Report*, OR/12/023.

The effect of CO_2 on the activity of any indigenous or introduced microbial populations and resulting impacts on a storage facility, including the movement of the CO_2 plume, is an area of uncertainty. It is likely that impacts may only apply to storage schemes in specific geological settings (West et al, 2011[1]). Given these uncertainties, the precautionary principle suggests that the potential impacts should be quantified before projects are initiated. This pilot study is the first to investigate the changes in physical transport properties that are mediated by microbial activity within sandstone samples, under experimental conditions, simulating CO_2 saturated fluid movement in deep aquifer and reservoir environments in the North Sea. These short experiments utilised *P. aeruginosa* and indigenous microbial populations and showed, for the first time, that these organisms can survive exposure to saline fluids saturated with CO_2 albeit with limited biofilm development.

The impacts of CO_2 in the test system are twofold:

- The organisms do not seem to inhibit fluid transport under these conditions in these short experiments (2136 h/ 89 days). It is possible that the microbes require a period of acclimatisation to the extreme environmental conditions generated by the presence of CO_2 before any impacts can be detected;
- The presence of CO_2 appears to enhance the mobilisation of a number of chemical species.

Longer term experiments are considered necessary to determine whether the presence of CO_2 merely delays biofilm development and/or impacts on permeability or whether it causes long-term inhibition of microbial activity. Additionally, the role of impurities (such as H_2S, SO_X and NO_X) that may be present in the injected CO_2 could be involved in microbial energy production (West et al, 2011 [1]) and also needs to be studied. Thus, long-term experiments are needed to clarify the role of microbes on rock transport properties.

This initial study has also identified specific areas for further study, these are:

- Undertaking a double control experiment, where no acetate is added to the simulated groundwater, thus denying food and energy to any native microbes, and;
- Undertaking a simplified experiment using the pump set-up alone to determine whether the cleaning/sterilisation process in current use is fit for purpose.

References

1. ↑ [1.0] [1.1] WEST, J M, MCKINLEY, I G, PALUMBO-ROE, B, and ROCHELLE, C A. 2011. Potential impact of CO_2 storage on subsurface microbial ecosystems and implication for groundwater quality. *Energy Procedia*, 4, 3163–3170. doi:10.1016/j.egypro.2011.02.231.

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