Contribution ID: **397** Type: **Poster Presentation**

Inhibiting transport of radionuclides in porous media by combining in situ electrokinetics with colloidal silica grout

Tuesday, 23 May 2023 10:30 (1h 30m)

Nuclear energy will play a key role in the UK's strategy to achieve net zero carbon by 2050. However, the high cost and intergenerational burden of decommissioning and waste management remains high and there is a need to reduce the costs of decommissioning and clean-up. Nuclear site decommissioning involves the retrieval and handling of various radioactive waste forms. Removal of particulate wastes, such as contaminated concrete and soils, represents a potential hazard in terms of radiation exposure for the workforce and the surrounding environment. This may be due to the accidental release of airborne or groundwater-borne radioactive particulates during waste recovery and transport, or to the loss of radioactive debris upon retrieval. The development of innovative techniques to reduce hazard in decommissioning operations is therefore a critical aspect of site decommissioning.

This study explores the suitability of colloidal silica, in combination with in-situ electrokinetics, to remediate contaminated soils by promoting migration of radionuclides into grouted soil volumes, prior to their removal. Colloidal silica is an aqueous suspension of silica (SiO2) nanoparticles, with average particle size <100 nm. The creation of siloxane bonds (Si –O –Si), typically triggered by the addition of an electrolyte accelerator, leads to the formation of a solid-like network of silica nanoparticles in the form of a hydrogel. Previous work on colloidal silica gel has proved its potential to form low-permeability hydraulic barriers against fluid migration, and to inhibit the diffusion of radionuclides through the gel, making it a promising material for use in retrieval operations.

Here we present research to determine the potential for electrokinetics, in combination with colloidal silica grouting, as a low energy remediation technique for radioactively contaminated soils. Experiments were carried out using electric field gradients ≤ 1 V/cm, to satisfy the low-energy requirements that make electrokinetic remediation advantageous over other remediation methods. The effect of i) applied voltage and ii) groundwater chemistry on the mobility of two types of radionuclides, namely Cs and Sr, was assessed. These small-scale laboratory experiments demonstrate that electrokinetics can be used to mobilise radionuclides (Cs and Sr) within the ground and trap them within a relatively small volume of grouted soil that can be readily removed. As well as inhibiting groundwater flow, and thus advective migration of radionuclides in the soil, the grout also increases the sorption capacity in the ground, reduces the risk of airborne migration of radioactive particulates during excavation, and can be readily incorporated into cementitious or vitrified wasteforms.

Participation

In-Person

References

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

UK

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

Primary authors: LUNN, Rebecca (University of Strathclyde); Dr PAGANO, Arianna (University of Glasgow); Dr EL MOUNTASSIR, Grainne (University of Strathclyde); Prof. CUNDY, Andrew (University of Southampton); Dr BURRELL, Frances (University of Southampton)

Presenter: LUNN, Rebecca (University of Strathclyde)

Session Classification: Poster

Track Classification: (MS18) Innovative Methods for Characterization, Monitoring, and In-Situ Remediation of Contaminated Soils and Aquifers