Applications are invited for a fully-funded (3 years, 8 months) PhD to commence in 1st February 2023.

Applications are invited from UK citizens and EU citizens resident in the UK for a fully-funded ~4-year PhD research studentship hosted in the Rock Mechanics Laboratory, School of Environment, Geosciences & Geography at the University of Portsmouth. The project is supported by the Nuclear Waste Services (NWS) Research Support Office (RSO) @RSO_GDF_UK, and will join a UK-wide cohort of research students working on technical/scientific challenges related to the development of a Deep Geological Disposal Facility.

Research will be conducted in partnership with the British Geological Survey (BGS) and Ramboll. The University of Portsmouth and Ramboll have developed a strong working relationship over the last 10 years; a 6-month placement for the PhD student will be provided by Ramboll in year 3 of the project.

The PhD will be based in the Faculty of Science and Health, and will be supervised by Dr Philip Benson, Dr Nick Koor and Dr Arash Azizi.

Successful applicants will receive a bursary to cover tuition fees and project costs for four years, including a tax-free stipend in line with the UKRI rate (£17,668 for 2022/23).

The work on this project will involve:

- Rock testing using laboratory rock physics
- Geological engineering design
- Model development using the numerical finite element package “Plaxis”
- A 6-month placement in year 3 of the project provided by Ramboll

Whilst some experience on the above is an advantage, the student will receive training in these aspects of the project as needed.

Project description

Engineering solutions for deep geological disposal of radioactive waste requires a challenging combination of knowledge: on one hand, how structures such as tunnels and caverns within a rock mass modify the local/regional stress state, and on the other hand, how these structures respond to in-situ stresses over century to millennium timescales. In all cases, pre-existing discontinuities (faults, fractures, interbedding and joints) and complex lithology (e.g. clay-rich zones and/or mudstone-halite interbeds) may significantly modify these responses which in turn are again modified by the presence of fluids and/or temperature.

To design structures with long-term stability this project will test a series of natural Mercia Mudstone samples using high force hydraulics to simulate real-world stress fields. Samples will be monitored via strain meters and microseismic sensors in the presence of temperature and fluids. Data from these calibrations will build a new understanding of the short-term (weeks to months) to long-term (centuries) stability of structures by integrating

these new data into an initial geological model to incorporate the effect of destabilizing discontinuities and extrapolate to design scale and timescales. The project will also explore feedback(s) between rock mass damage evolution at elevated temperature/stress, and how water flows through the rock structure.

The project will be guided by a multidisciplinary team with expertise in rock physics, geology, and geological engineering. The team includes researchers at the University of Portsmouth, the BGS (providing access to recovered rock cores from the Mercia Mudstone Group), and engineering design experts at Ramboll. In addition, as an NWS RSO student:

Students will be expected to attend the annual conference, presenting a poster or presentation, depending on scheduling and stage of their PhD.
NWS encourage PhD students to participate in the RSO outreach training programme @RSO_GDF_UK. This gives students and opportunity to meet and network.

General admissions criteria
You'll need a good first degree from an internationally recognized university (minimum upper second class or equivalent, depending on your chosen course) or a Master's degree in an appropriate subject. In exceptional cases, we may consider equivalent professional experience and/or Qualifications. English language proficiency at a minimum of IELTS band 6.5 with no component score below 6.0.

Specific candidate requirements
Applicants should:
Hold a good first degree and/or a MSc in a numerical degree subject such as (but not limited to) Geophysics, Civil Engineering, or Engineering Geology;
Be a UK / EU citizen;
Have good social and team working skills as the successful candidate will be part of a cohort. A working background in laboratory rock mechanics testing is beneficial but not strictly required as this training will be provided;

How to Apply
We'd encourage you to contact Dr Philip Benson (philip.benson@port.ac.uk) to discuss your interest before you apply, quoting the project code.

When you are ready to apply, you can use our online application form. Make sure you submit a personal statement, proof of your degrees and grades, details of two referees, proof of your English language proficiency and an up-to-date CV. Our 'How to Apply' page offers further guidance on the PhD application process.

If you want to be considered for this funded PhD opportunity you must quote project code SEGG7250522 when applying.

Funding Notes
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