



NERC Centre for Doctoral Training in Oil & Gas (2018 start)

Project Title: A regional analysis of caprock integrity in the North Sea

Host institution: Cardiff University

Supervisor 1: Dr. Tiago M. Alves, 3D Seismic Lab, School of Earth and Ocean Sciences

Supervisor 2: Dr. Davide Gamboa, British Geological Survey - Wales

Additional Supervisor (s): Mr. John Williams, British Geological Survey - Keyworth

Project description:

The project will focus on stratigraphic successions through the North Sea that constitute overburden strata of potential CCS reservoirs. A vast database of seismic and borehole data will be used in the project with the aim of characterising features and indicators of potential fluid migration pathways over selected reservoir targets for carbon sequestration. With this scope in mind, the project will fit NERC's *Data Driven Economy* Grand Challenge Theme, as Cardiff and the BGS possess some of the largest geological and seismic databases of caprocks in the North Sea, most of them concerning areas for future CCS. Detailed characterisation of the reservoirs and caprocks, including overlying secondary storage reservoirs will be obtained through mapping of 3D seismic data, further complemented by use of well logs. This will be followed by mapping of potential fluid migration networks associated with the distinct tectonic styles of the study region(s). Stress data obtained from boreholes and published information will be used to create fault reactivation and leakage models for the relevant stratigraphic sequences. In addition, stratigraphic heterogeneities in caprocks that influence the migration of leaking fluids will be taken into account for the establishment of a leakage risk model.

The project benefits from cooperation between the Cardiff University 3D Seismic Lab, one of the top basin analysis research centres in Europe, and the British Geological Survey. The student will benefit from state-of-the-art interpretation resources at Cardiff, and will have access to BGS's renowned expertise on CCS. BGS training courses will be attended by the successful candidate.

CDT Research theme(s): Extending the Life of Mature Basins

Research context: The North Sea has a long hydrocarbon exploration history and is one of the key economic drivers of the United Kingdom. In addition to a revitalised exploration interest associated with successful new discoveries, the North Sea is of key strategic interest for Carbon Capture and Storage (CCS) with theoretical storage capacities of circa 70 Gt of CO₂ (Bentham CO₂Stored). In addition to the oil and gas reservoirs in the North Sea, non-hydrocarbon bearing saline aquifers are major targets for CCS. Suitable reservoir formations must have adequate capacity, and permeability, and usually comprise of high-porosity sandstones. The storage complex must possess an impermeable caprock to avoid unwanted fluid migration from the storage reservoirs. With storage safety and integrity being paramount to CO₂ storage projects, it is crucial to assess seal bypass features that could potentially allow injected carbon dioxide to escape from the reservoir and reach the surface.

Research costs: The project supervision will follow a weekly schedule of meetings during the first year, with further sessions available if required by the student. As the project progresses and the student skills improve the supervisory meetings will decrease to a monthly basis, but informal meetings and sessions will be made available when required. These costs, as well as travel and conference expenses, will be covered by NPIF funds.

Career routes: This project suits a candidate keen on a career in exploration geology and geophysics, with strong focus on sedimentary basins. Potential career paths include O&G majors, consultancy companies, engineering and environmental companies with emphasis on CCS as a technique to enhance hydrocarbon recovery and balance national CO₂ budgets in future O&G production.

Submissions must conform to this single-sided A4 format. The Awards Committee reserves the right not to consider submissions that do not adhere to this condition.