Carbon Capture – Reservoir Storage and Risk Elements: Insights from the Field, NE England, UK (G550)

Tutor(s)

Richard Jones: Managing Director, Geospatial Research Ltd.

Overview

This course is framed around demonstrating the principles of CO_2 storage capacity and risk elements of a prospective CCS play. Starting from basic geoscience principles, the course focuses on reservoir capacity estimation, injectivity and containment risks. The principles will be illustrated using well-exposed outcrop examples from NE England including clastic reservoirs from a variety of depositional settings (typically Carboniferous, Permo-Triassic, or Jurassic), sealing lithologies (mudrocks and evaporites) and structural controls on reservoir connectivity and containment (fractures, juxtaposition and fault zone complexity).

Duration and Logistics

A 5-day field course with fieldwork and practical sessions supported by classroom lectures. The course will be based in the historic city of Durham in NE England with easy access to coastal and inland locations in the counties of Durham, Northumberland and Yorkshire.

Level and Audience

Fundamental: The course is intended for subsurface scientists, including geologists and engineers, with a knowledge of petroleum geoscience, who are working on or new to, CCS projects.

Exertion Level

The course requires an **EASY** exertion level. Outcrops include coastal outcrop sections and inland exposures all with easy access. There will be some walks along beaches and easy paths to get to the outcrops with a maximum distance of around 5km (3 miles) or less, elevations vary from sea level to up to 500m (1600 ft). Temperature variations in late spring and summer are typically between 10 and 25°C (50–80°F).

Objectives

You will learn to:

1. Characterize a variety of reservoir types (considering potential impacts of stratigraphic, depositional and structural heterogeneities, porosity and permeability) with respect to their suitability for carbon capture and storage.
2. Estimate reservoir capacity through stratigraphic and structural analysis, and porosity estimation.
3. Understand fluid transport parameters – injection/flow rate and reservoir permeability.
4. Assess containment potential for CO_2 (evaporitic and shale seals, faults and fractures).
5. Evaluate fracture networks with respect to storage capacity, injection rates and containment risk.

Course Content

Course Details

This course will focus on the assessment of reservoirs with the potential for carbon storage in the subsurface, with emphasis on identifying suitable prospects. Key risk elements will be discussed, including reservoir capacity, sustainable injection rates and seal integrity. There will be some evening sessions that address specific topics around the subsurface storage of CO2.

Please note: the course is designed to be broad in technical coverage but can be tailored to suit specific company needs, including increased focus on particular target reservoir units.

Day 1: Arrive in Durham

Classroom:

- Introduction to the field area (including virtual outcrop models)
- Lectures on the critical similarities and differences between CO2 and hydrocarbon behaviour in subsurface systems.
- Field course HSE briefing
- Capacity estimation: reservoir geology

Fieldwork:

- Durham City north riverside sections

Overnight in Durham

Day 2: Reservoir

Fieldwork:

- Outcrops of the Carboniferous at Stainmore
    - Formation capacity estimation and containment (faults)
    - Reservoir geology: sandstone reservoir heterogeneity, porosity and architecture
- Howick foreshore
    - Compartmentalization risk: fault zone morphology
- Inland outcrops near Rothbury, Fell Sandstone
    - Reservoir characterization for CO2 storage: reservoir heterogeneity, porosity and architecture, play fairways.

Overnight in Durham

Day 3: Containment risk

Fieldwork

- Jurassic mudrocks and sandstones, Whitby, North Yorkshire, Saltwick Nab and/or Port Mulgrave
    - Containment and sealing lithologies and key characteristics (shales)
    - Fracture networks: low permeability mudrock fracture systems.
- Possible visit to Boulby Potash Mine (also potential discussion of hydrogen storage)

Overnight in Durham

Day 4: Seals

Fieldwork:

- *Z*echstein evaporites of northeast Durham
    - Sealing lithologies and key characteristics (evaporites), fracture networks, reservoir complexity

Overnight in Durham

Day 5: Putting it together!

Fieldwork:

- Cullercoats and the 90 Fathom Fault Zone
    - Capacity estimation, injectivity, containment (faults)
    - Reservoir geology; fault zone morphology, reservoir compartmentalization

Classroom:

- Wrap-up lecture and discussion

End of course and return home