Geologic Carbon Storage for Geoscientists and Engineers (G551)

Tutor(s)

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Overview

This course empowers attendees to develop and apply their skills to the growing industry of Carbon Capture Utilisation and Storage (CCUS). Attendees will be guided through the lifecycle of a CCUS project with an emphasis on key concepts, processes and workflows of the CCUS industry. Focus will be on developing the geoscience and engineering skills needed to progress a project.

Duration and Logistics

Classroom version: A 3-day course comprising a mix of lectures, case studies and exercises. The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

Virtual version: Five 4-hour interactive online sessions presented over 5 days.

Level and Audience

Intermediate. The course is intended for petroleum geoscientists, reservoir engineers and first-level leaders looking to adapt their skills to carbon capture and storage.

Objectives

You will learn to:

1. Outline the regulatory, policy and financial drivers and constraints for CCUS.
2. Describe the subsurface requirements for a successful storage project, including similarities and differences with oil and gas exploration.
3. Understand the workflow and perform the key tasks for defining, developing and permitting a CCUS project, including site selection, characterisation, risk assessment and monitoring for operational and post-operational phases.
4. Apply your subsurface knowledge and skills in oil and gas development to the concepts, processes and workflows of the CCUS industry.
5. Estimate CO2 storage capacity in saline aquifers at reservoir and basin-scales.

Course Content

Section 1: Introduction

Activities

- Discussion: What do you know about CCUS?

Lectures

- Climate change and the role of CCUS
- Sources of CO2 (natural and man-made)
    - What is CCUS?
    - Basics of sources, capture, transport and storage (saline, depleted field, etc.)
      Where are we now and where are we going? The history of CCUS, current global projects and public perception
    - Basic concepts of permanence, migration pathways and project monitoring
- Outlook for CCUS

Activities

- Discussion: What do you see as the future for CCUS?

Section 2: Policy and regulation overview

Lectures

- Global state of regulation
- ISO
- Regional / local standards
    - EU CCUS directive
    - 45Q
    - Australia
- Permitting and project development

Section 3: Business drivers

Lectures

- Business drivers
    - Tax incentive
    - Cap and trade
    - Penalties / carbon take-back obligation
- Cost of capture and separation (not all sources are equal)
- Permitting overview – key considerations

Exercises

- Build a CCUS business model from a choice of sources, storage sites, existing infrastructure and surface constraints.

Section 4: Subsurface characterization

Activities

- Discussion: How do you think CCUS is similar or different to petroleum geoscience and engineering?

Lectures

- Comparison with petroleum geoscience
- Trapping mechanisms
- Pressure
    - CO_2 density and storage window
    - Area of Review (AoR) and pressure propagation
- Play elements
    - Reservoir – injectivity, capacity, depositional systems
    - Confining systems – seals, baffles and faults
- Risks: faults, legacy wells and other key risks
- Prospecting / screening
- Applied geophysics
    - Seismic characterization and monitoring
    - Legacy data and new acquisition
- Well design and location

Exercises

- Storage prospect screening.

Section 5: Modeling

Lectures

- Geomechanics
- Pressure propagation
- Frac strength
- Fault reactivation
- AoR, sensitivities, controlling factors
- Fundamentals of fluid flow
- Capacity estimation
    - Static Capacity Estimation
        - Quick exercise – use online resources
    - Dynamic simulations (visualizations, considerations, software available)
        - Cranfield experience – time to breakthrough discussion
- EasiTool
    - Basic scenarios
    - Sensitivity analysis option

Section 6: Risk, safety and shallow monitoring

Lectures

- The importance of environmental monitoring
- Safety and risk
- Environmental impact and underground sources of drinking water, soil and the biosphere
- Public perception
- Permitting
- Shallow-focused monitoring
- Plume monitoring
    - Leakage detection
    - Attribution
    - Latest advances
- Regulations versus technology

Exercises

- Attribution game.

Section 7: Project development, permitting and public acceptance

Lectures

- Successes and failures to date, look ahead
    - Key considerations
- Designing and permitting a project