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
 - o 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
 - CO2 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