TETRA TECH RPS ENERGY | TRAINING

EC054: Geomechanics for Gas Storage Projects

Instructor(s):

Format and Duration
Self-Paced - 4 Hours

Summary

This course focuses on the significance of geomechanics in gas storage projects, addressing the associated risks, potential leakage, and the impact of pressure cycling on fracturing and formation integrity. Participants will be introduced to fundamental geomechanical concepts, including stress, strain, and rock failure mechanisms. The course will explore geomechanically induced changes in fault and fracture permeability, essential for understanding fluid movement in the subsurface. The course will also cover global induced seismicity, its causes, and associated magnitudes, using case studies from the Iona Gas Field in Australia and the Castor Gas Field in Spain. Finally, the introduction of Mechanical Earth Models (MEMs) will demonstrate how these models can provide critical insights into subsurface conditions, aiding in risk management and ensuring the structural integrity of underground operations.

Business impact: Geomechanical modelling is essential for the prediction of likely effects from planned or ongoing gas storage operations. It is applied to the assessment of pressure cycling effects, caprock integrity, fault reactivation, induced seismicity, fracture influence on fluid flow and drilling and completion parameters. This makes geomechanics a key tool for predicting hazards and mitigating risk as well as maximising the efficiency and productivity of a project.

Learning Outcomes

Participants will learn to:

1. Understand the role of geomechanics in gas storage projects and the geomechanical risks associated with gas injection, production and pressure cycling.
2. Gain insights into leakage and caprock breaches as warnings of potential hazards.
3. Learn fundamental concepts of stress, strain, and rock failure mechanisms.
4. Develop skills in flowrate fluctuations and flowrate correlation analysis.
5. Explore the causes and magnitudes of global induced seismicity, including seismicity induced from gas storage activity.
6. Consider real world case studies of induced seismicity associated with gas storage operations at Iona and Castor gas fields.
7. Explore the creation and application of Mechanical Earth Models (MEMs).

Training Method

This is a self-paced e-learning course, approximately 4 hours learning time, consisting of 4 modules. Within each module the learning materials are structured into short sections, each including interactive text and image content, animations, video, and audio. Each module has a scored quiz at the end to provide the learner with their learning progress.

Who Should Attend

This course is aimed at professionals in the gas storage industry who would like to understand the issues relating to geomechanics for gas storage projects.

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Course Content

EM0193 Importance of Geomechanics for Gas Storage Projects – An Overview

This module will consider the importance of Geomechanics in the context of a gas storage project. Key topics covered will include geomechanical risks associated with gas storage projects, the potential for leakage and breaches and the effect of pressure cycling on fracturing and formation integrity.

EM0194 Basics of Geomechanics for Gas Storage Projects

This module will introduce you to the fundamental concepts used in Geomechanics. The module will begin by looking at stress, strain and elastic moduli and the concepts and definitions related to them. The learner will develop an understanding of stresses in the earth and how to measure them and learn about effective, poroelastic and thermoelastic strains. Finally the module will consider the situations that may lead to rock failure and the differences between brittle and ductile failure.

EM0195 Induced Permeability and Seismicity – Gas Storage Projects

In this module, you will learn about geomechanically induced changes in fault and fracture permeability, crucial for understanding fluid movement in subsurface reservoirs. You will develop an understanding of the Earth's geomechanical state and the evidence that supports this. The module covers flowrate fluctuations and flowrate correlation analysis, equipping the participant with skills to analyse and predict flow behaviour. You will also learn about global induced seismicity, its causes, and the range of magnitudes associated with these events. The Iona Gas Field in Australia and Castor Gas field in Spain will be considered as case studies.

EM0192 Mechanical Earth Modelling (MEM) for the Gas Storage Industry

In this module, a Mechanical Earth Model (MEM) is introduced as a detailed, data-driven representation of the subsurface, combining geological, geophysical, and geomechanical information to predict the mechanical behaviour of rock formations. MEMs are important because they provide critical insights into subsurface conditions, helping to manage risks and ensure the structural integrity of underground operations.