TETRA TECH RPS ENERGY | TRAINING

EC053: Geomechanics for Geothermal Projects

Instructor(s):

Format and Duration
Self-Paced - 4 Hours

Summary

This course explores the critical role of geomechanics in geothermal projects, focusing on the associated risks, potential leakage, and the effects of cold water injection on thermal fracturing and formation integrity. Participants will be introduced to fundamental geomechanical concepts, including stress, strain, and rock failure mechanisms. Learners will analyse flowrate fluctuations and be introduced to flowrate correlation analysis, enhancing their ability to predict flow behaviour. Additionally, the course will address global induced seismicity and its causes, with a case study from Strasbourg providing real-world insights into the geomechanical impacts of geothermal energy activities. Finally, the introduction of Mechanical Earth Models (MEMs) will illustrate how these data-driven representations can help manage risks and ensure the structural integrity of underground operations during geothermal operations.

Business impact: Geomechanical modelling is essential for the prediction of likely effects from planned or ongoing geothermal operations. It is applied to the assessment of thermal induced fracturing, 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 significance of geomechanics and associated risks in geothermal projects.
2. Gain insights into leakage and caprock breaches as warnings of potential hazards.
3. Consider subsurface thermal effects of cold water injection and hot water production.
4. Learn fundamental concepts of stress, strain, and rock failure mechanisms.
5. Develop skills in flowrate fluctuations and flowrate correlation analysis.
6. Explore the causes and magnitudes of global induced seismicity including seismicity induced from geothermal activity by considering a case-study of Strasbourg.
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 geothermal industry who would like to understand the issues relating to geomechanics for geothermal projects.

Course Content

EM0189 Importance of Geomechanics for Geothermal Projects – An Overview

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This module will consider the importance of Geomechanics in the context of a Geothermal project. Key topics covered will include geomechanical risks associated with geothermal projects, the potential for leakage and breaches and the effects of cold water injection on thermal fracturing and formation integrity.

EM0190 Basics of Geomechanics for Geothermal 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.EM0191 Induced Permeability and Seismicity – Geothermal Projects.

EM0191 Induced Permeability and Seismicity – Geothermal 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, geomechanical modelling, and flowrate correlation analysis, equipping you 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. A case study of Strasbourg will be used to consider local induced seismicity, providing a real-world insight into the geomechanical impacts of geothermal energy activity.

EM0192 Mechanical Earth Modelling (MEM) for the Geothermal 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.