ENVS 015: Measurement, Monitoring & Verification (MMV)

Hours: 60 hours
Delivery Mode: Online Asynchronous

Description

Dive into this 60-hour online course and learn with the support of an industry-experienced instructor about the fundamental characteristics and properties of CO_2 and implications for long-term carbon sequestration; regulations, approaches and technologies; site planning, modelling and monitoring; data analytics and verification. This course has been designed to upskill personnel to apply their skills and knowledge to the emerging field of MMV of sequestered carbon including those with experience in:

- Subsurface and reservoir modelling and monitoring
- Geoscience
- Well planning
- Data analytics
- Regulatory reporting and compliance

Outcomes

Upon completion of this course, you will be able to:

- describe the fundamental characteristics and properties of CO_2 and implications for long-term underground carbon sequestration
- demonstrate an understanding of the regulations, principles and objectives associated with monitoring, measuring and verifying sequestered carbon emissions
- demonstrate an understanding of the dimensions required for carbon sequestration project and site-specific MMV plans including monitoring techniques to track the behaviour of injected CO_2 and demonstrate containment
- describe the different approaches and technologies used for monitoring and measuring atmospheric, biospheric, hydrosphere and geospheric conditions around underground carbon storage sites
- demonstrate an understanding of the importance of modelling to predict the performance of injected carbon behaviour
- describe how to conduct data analytics to verify that CO_2 sequestration sites are conforming to regulatory permits
- describe emissions accounting and reporting requirements

Pre-requisite

ENVS 011 – Introduction to Carbon Capture & Storage

Course Materials

All of the required learning materials for this course are provided in class or on the course website.

Required Technology and Software

Ensure that your computer meets SAIT's Minimum Technical Requirements to access materials in Brightspace and for online learning success.

Assessments

NOTE: This course qualifies for a SAIT Micro-credential. Please visit our SAIT Micro-credential page to learn more.

- Students who earn a D (50%) or higher will pass this course, and
- Students who wish to earn a micro-credential and receive a shareable digital badge must successfully complete this course with a final grade of A- (80%) or higher.

Assessments	Value
Assignment 1: Characteristics of Carbon and Implications for Long-Term Carbon Sequestration	12%
Assignment 2: Regulations and Policies for CCS Monitoring, Measurement, and Verification	12%
Assignment 3: Project and Site-specific MMV Planning	12%
Assignment 4: Current and Emerging Technologies for Measurement and Monitoring	12%
Assignment 5: Modelling and Monitoring of Storage Sites	10%
Assignment 6: Data Analytics and Verification	12%
Quiz 1	5%
Quiz 2	5%
Quiz 3	5%
Quiz 4	5%
Quiz 5	5%
Quiz 6	5%
Total:	**100%**

Unit 1: Characteristics of $C0_2$ and Implications for Carbon Storage

Outcome

- Describe the fundamental characteristics and properties of CO_2 and implications for long-term underground carbon sequestration.

Objectives

- Describe the characteristics of carbon dioxide (CO_2)
- Discuss the Greenhouse Effect and its impact on the Earth's temperature
- Explore Carbon Capture and Storage (CCS) as a strategy for storing CO_2
- Review considerations for safe and permanent underground storage of CO_2

Unit 2: Regulations and Policies for CCS Monitoring, Measurement, and Verification

Outcome

- Demonstrate an understanding of the regulations, principles, and objectives associated with monitoring, measuring, and verifying sequestered carbon emissions

Objectives

- Describe Measurement, Monitoring and Verification (MMV) plans
- Explore current regulatory frameworks and emerging policies
- Discuss Alberta Energy Regulator (AER) directives
- Examine MMV plans in use in Alberta
- Review the MMV plan for the Quest Carbon Capture and Storage facility
- Explore regulations for MMV outside of Alberta

Unit 3: Project and Site-specific MMV Planning

Outcome

- Demonstrate an understanding of the dimensions required for carbon sequestration project and site-specific MMV plans including monitoring techniques to track the behaviour of injected CO_2 and demonstrate containment

Objectives

- Describe how to establish a baseline for MMV planning
- Describe how to predict the performance of injection facilities, the geological sequestration site, and the surrounding environment
- Identify test procedures and quality control required for MMV planning
- Discuss how risk management planning is incorporated into MMV planning

Unit 4: Current and Emerging Technologies for Measurement and Monitoring

Outcome

- Describe the different approaches and technologies used for monitoring and measuring atmospheric, biospheric, hydrosphere and geospheric conditions around underground carbon storage sites

Objectives

- Describe the geosphere, atmosphere, biosphere, and hydrosphere
- Review geosphere technologies, including 2D seismic surveys, 3D seismic surveys, Vertical Seismic Profile (VSP) surveys, Distributed Acoustic Sensing (DAS) surveys, Distributed Temperature Sensing (DTS) surveys, Pressure-Temperature Gauges, Electrical Resistivity Tomography (ERT) surveys, observation wells, injected fluid composition and volume, and well core sampling
- Explore biosphere technologies such as soil gas sampling, soil sampling, soil flux sampling, and surface casing vent flow metering
- Discuss hydrosphere technologies, including water sampling and dissolved gas sampling
- Examine atmosphere technologies like gas emissions monitoring, gas concentration measurement, meteorological data, emission factors, remote sensing, and real-time monitoring

Unit 5: Modelling and Monitoring of Storage Sites

Outcome

- Demonstrate an understanding of the importance of modelling to predict the performance of injected carbon behaviour

Objectives

- Explore how models and simulations are used to monitor CO_2 storage locations
- Discuss how static or dynamic models can be used to describe the properties and surrounding pressures of a reservoir
- Examine modelling fluid flow, including the Darcy flow equation
- Review the two-phase flow problem, including the Finite Difference (FD) Method, the Finite Element (FE) Method, and the Invasion Percolation (IP) Method

Unit 6: Data Analytics and Verification

Outcome

- Describe how to conduct data analytics to verify that CO_2 sequestration sites are conforming to regulatory permits
- Describe emissions accounting and reporting requirements

Objectives

- Compare measured and predicted performance
- Ensure sequestration sites are operating and conforming to permit
- Emissions accounting and reporting
- Discuss TIER Regulations in Alberta

Contact Information:

For more information about this course or others, please contact:

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