
ENVS 017: Design of Carbon Transportation Infrastructure

Hours: 32 hours

Delivery Mode: Online Asynchronous

Description

This course will give you the skills and knowledge you need to apply engineering design principles and standards to the design of carbon gathering and transmission pipelines. You'll develop an understanding of carbon pipeline transportation conceptualization and the considerations for techno-economic objectives, constraints, and processes. You will also cover mechanical, electrical, and instrumentation design and life cycle assessment.

Outcomes

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

- Describe the components, objectives, and constraints associated with liquid and gaseous carbon dioxide (CO₂) pipeline transportation and demonstrate an understanding of how to simulate and validate CO₂ pipeline design.
- Demonstrate an understanding of key considerations for designing a CO₂ pipeline, including routing and factors impacting equipment and materials choice to achieve reliability, safety, and cost specifications.
- Demonstrate an understanding of the key considerations for mechanical design of CO₂ pipelines.
- Demonstrate an understanding of electrical and instrumentation design requirements for CO₂ pipelines.
- Demonstrate an understanding of how to conduct life cycle assessment (LCA) for carbon pipeline and marine transportation and use outputs of LCA to inform and improve carbon transportation infrastructure design.

Pre-requisite

ENVS 011 — Introduction to Carbon Capture & Storage

Course Materials

The required learning materials for this course are provided 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: Carbon Dioxide Pipeline Transportation Conceptualization and Considerations for Techno-Economic Objectives and Constraints	15%
Assignment 2: CO ₂ Pipeline Design & Routing	15%
Assignment 3: Mechanical Design	15%
Assignment 4: Electrical and Instrumentation Design	15%
Assignment 5: Life Cycle Assessments for Carbon Transportation Infrastructure	15%
Quizzes:	25%
Total:	100%

Unit 1: CO₂ Pipeline Conceptualization for Techno-Economic Objectives

Outcome

Describe the components, objectives, and constraints associated with liquid and gaseous carbon dioxide (CO₂) pipeline transportation and demonstrate an understanding of how to simulate and validate CO₂ pipeline design.

Objectives

- Describe the components, objectives, and constraints associated with liquid and gaseous CO₂ pipeline transportation.
- Examine how to simulate and validate CO₂ pipeline design.

Unit 2: CO₂ Pipeline Design & Routing

Outcome

Demonstrate an understanding of key considerations for designing a CO₂ pipeline, including routing and factors impacting equipment and materials choice to achieve reliability, safety, and cost specifications.

Objectives

- Identify key factors in pipeline routing.
- Evaluate stakeholder engagement strategies.
- Analyze the influence of socioeconomic factors on route selection.
- Examine design factors that impact CO₂ pipeline efficiency, safety and economic viability, including equipment sizing, spacing and materials.

- Evaluate pumping and compression strategies for CO₂ transportation.

Unit 3: Mechanical Design

Outcome

Demonstrate an understanding of the key considerations for mechanical design of CO₂ pipelines.

Objectives

- Examine mechanical design principles for CO₂ pipelines, including material selection, corrosion, hydrogen embrittlement, leak detection, and fatigue.
- Review how to develop and document liquid carbon pipeline design work packages based on material and energy flow rates, hydraulics, pressure and temperature, purity, reliability, safety, and cost specifications.

Unit 4: Electrical and Instrumentation Design

Outcome

Demonstrate an understanding of electrical and instrumentation design requirements for CO₂ pipelines.

Objectives

- Describe the safety and emergency systems in carbon transportation infrastructure.
- Become familiar with electrical isolation and installation standards, and managing electrical interference.
- Review the key components, including the E&I design requirement documentation.
- Review flow metering, particularly in the context of compliance with emissions-reduction regulations.

Unit 5: Life Cycle Assessments for Carbon Transportation Infrastructure

Outcome

Demonstrate an understanding of how to conduct life cycle assessment (LCA) for carbon pipeline and marine transportation and use outputs of LCA to inform and improve carbon transportation infrastructure design.

Objectives

- Define a life cycle assessment (LCA) and explore its role in the context of carbon transportation infrastructure.
- Describe the emissions scopes as established by the Greenhouse Gas Protocol.
- Identify environmental impacts and management opportunities in the life cycle of CO₂ pipelines.

- Identify environmental impacts and management opportunities in the life cycle of marine CO₂ transportation.

Contact Information:

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

Continuing Education and Professional Studies

Southern Alberta Institute of Technology

Website: [Continuing Education and Professional Studies](#)

Email: ConEdAdvising@sait.ca