COURSE TITLE: CO_2 CAPTURE, PROCESSING & TECHNOLOGIES

Course Duration: 4 days Classroom course

Course Level: Intermediate / Advanced

Overview of Course:

Fundamental to achieving world targets to limit CO_2 emissions are the technologies to capture, process and sequester CO_2 from a variety of sources. In this course you will learn the technologies available to capture CO_2 from the full array of sources most relevant to Carbon Capture & Storage (CCS) schemes. These include CO_2 removal from natural gas, pre-combustion capture, post-combustion capture, oxy-fuel capture (including chemical looping) and capture from biogas.

After an introduction to global CO_2 emissions and emission targets, the physical and thermodynamic properties of CO_2 are covered and it is emphasised why these properties are important to understanding processing of CO_2.

The course will cover the various processes used to extract CO_2 from other mixed gases including solvents processes (chemical, physical & proprietary-hybrid); adsorption processes, membranes and cryogenic processes. Dehydration methods are discussed from compression/cooling through glycol dehydration and solid-bed absorption to membrane dehydration.

The challenges of material selection for processing CO_2 are examined. Basic corrosion mechanisms are introduced then the wide range of conditions seen in CCS systems are discussed. These include wet CO_2, the conditions in pre- and post-combustion capture, oxy-fuel processes, pipeline transport and injection wells.

The choices of equipment for compression and pumping of CO_2 is introduced including advances in shockwave compression.

The course rounds up with an overview of disposal system, covering injection into subterranean aquifers, depleted oil fields and depleted gas fields.

DESIGNED FOR YOU, IF YOU ARE...

- A Process or Facilities Engineer, either a Graduate or a more experienced Technical Professional needing to develop an understanding of the processes available for capturing, processing and sequestering CO_2.
- An environmental engineer working in an energy-related, chemical or manufacturing industry where CO_2 emissions require regulation
- A consultant engineer working on projects for gas production or in energy-related or industrial projects where carbon capture forms part of the project requirements
- A middle or Senior Manager in the energy industry who is engaged in projects where carbon capture forms part of project requirements

- Anyone looking to gain a broad understanding of the techniques and challenges associated with capturing and processing CO_2 for a wide variety of sources.

HOW WE BUILD YOUR CONFIDENCE

This course will take the participant step by step through the many gas treating processes. It teaches the fundamentals of each process providing pros and cons of the processes and operating experiences. The course is highly interactive and participants are encouraged to share their own experiences and problems to the benefit of all.

The course uses many exercises to help embed the course material and give participants a hands-on opportunity to work through project examples and calculations.

THE BENEFITS FROM ATTENDING

By the end of the course, you will have gained an understanding of the properties of CO_2 and the challenges in extracting and processing it from a wide variety of sources. You will have a sound knowledge of the variety of commercial process that are available to treat CO_2 and will understand the important criteria in selecting the best process for a particular application.

You will have gained this from seasoned professionals who have been involved directly with the processes and have real life experiences to offer not just textbook knowledge.

TOPICS

- CO_2 emissions and emission targets
- Properties of CO_2
- Post-combustion CO_2 capture
- Pre-combustion CO_2 capture
- CO_2 capture from Oxy-firing and chemical looping
- CO_2 capture from Biogas
- Direct Air Capture
- Solvent absorption processes (chemical, physical, hybrid)
- Solid bed processes,
- Membranes
- Cryogenic processes
- CO_2 dehydration
- Removal of contaminants from CO_2
- Corrosion and materials selection
- Compression and pumping equipment selection
- Fluid flow and pipeline design
- CO_2 injection for EOR, disposal in aquifers, depleted oil fields and depleted gas fields

DAILY AGENDA

Day 1: Introduction to CO_2 and CO_2 Capture

World CO_2 Emissions & Emission Targets

- World Natural Sour Gas Reserves

Properties of CO_2

- Thermodynamic Properties
- Water Content
- Hydrates & Hydrate Inhibition

Exercise 1 : Hydrate Inhibition

Introduction to Corrosion

CO_2 Extraction & Capture

- Introduction to CO_2 removal Processes

Exercise 2 : How much CO_2?

Day 2: CO_2 Capture and Processing

Solvent Processes

- Chemical Solvents
    - Amine Processes
    - Hot Potassium Carbonate
- Physical Solvents
- Hybrid Solvents
- Solvent Selection
    - Solvent Selectivity

Exercise 3 : Solvent Selection for CO_2 Removal

Adsorption Processes

Membranes Separation

- Types of Membranes
- Membrane Flow Schemes

Exercise 4 : Membrane Scheme for CO_2 Extraction from Gas

Cryogenic CO_2 Separation

- Ryan Holmes
- CFZ

Day 3: CO_2 Extraction

Extraction from Natural Gas

Exercise 5 : Amine Circulation Rate

Post-combustion Capture

Pre-combustion Capture

Oxy-firing processes

- Chemical Looping

Capture form Biogas

Direct Air Capture

Capture from Seawater

Dehydration of CO_2

- Compression & Cooling
- TEG Dehydration
- Adsorption Dehydration

Exercise 6 : Mol Sieve Dehydration

- Membrane Dehydration

Contaminant Removal from CO_2

Day 4: Material Selection, Pumps & Compressors,CO_2 Sequestration

Material Selection

- Corrosion Challenges in CCS
- Corrosion Mechanisms
- Materials Selection
    - Wet CO_2
    - Flue Gas
    - Amine Environments
    - Pre-Combustion Capture Processes
    - Post-Combustion Capture Processes
    - Pipelines
        - Control of Ductile Fractures
    - Injection Wells

Exercise 7 : Materials Selection

Pumps & Compressors

- Shockwave Compressors

Fluid Flow & Pipeline Design

CO_2 Sequestration

- EOR
- Aquifer Injection
- Injection into Depleted Oil Fields
- Injection into Depleted Gas Fields

Exercise 8 : CCS Project : Proven vs Experimental

Course Round-Up

INSTRUCTOR:

Phil Tudhope is currently Director of a consulting company, specialising in technical and project management training for graduates and more senior technical staff. He has a first-class honours B.Sc. in Mechanical Engineering from Bristol University and is a Chartered Engineer, Fellow of the Institution of Mechanical Engineers and Associate Member of the Institution of Chemical Engineers.

Phil has over 40 years' experience in Project Management, Technical Development and Change Management in the oil & gas industry and proven technical and managerial capabilities to achieve results with a strong business focus and to effect significant positive change. He is a specialist in front-end (feasibility & concept selection) phases of upstream oil & gas developments with midstream (LNG) experience and project execution experience and has the ability to perform analysis and development work as well as lead and motivate teams.

Amongst other roles, he was Specialist Front End Advisor at Petronas Carigali, Chief Process Engineer at BG Group and Head of Upstream Engineering at Shell Technology India. He has experience worldwide in differing political, social and remote environments, having worked overseas for 28 years including the Far East, USA, Europe, the Middle East and India.

Phil is an experienced instructor including the development and delivery of technical and project management courses.