COURSE OVERVIEW PE0319
Hydrates
(E-Learning Module)

Course Title
Hydrates (E-Learning Module)

Course Reference
PE0319

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

This E-learning course is designed to provide participants with a detailed and up-to-date overview of hydrates. It covers the environmental advantages of natural gas; the distribution of natural gas from well head through consumption; the natural gas composition and resources; the natural gas processing, generic raw gas and product slate, natural gas components, product specifications, pipeline quality gas and trace components; the combustion characteristics, heating value, Wobbe number, API gravity, Brent crude oil specification and purification; the nature of hydrates and prediction of hydrate formation using gas gravity (relative density); and the hydrate inhibition, dehydration by absorption, dehydration by adsorption, mercury removal, gas processing and treatment.

During this course, participants will learn the purpose of de-hydration unit and de-hydration schematic; the design of gas handling system and facilities; the hydrate and water content of gas and high CO_2/H_2S gases; the hydrates in natural gas systems and prediction of sweet natural gas hydrate conditions; the glycol dehydration systems and the freezing points of aqueous glycol; the hydrocarbon recovery, low temperature separation and propane refrigeration; the refrigeration process alternatives, expansion process, refrigerated J-T process and straight refrigeration process; and the non-associated gas phase envelope, turbo expanders, thermodynamics and solids formation.

Course Objectives

Upon the successful completion of this course, participants will be able to:-

- Apply and gain an in-depth knowledge on hydrates
- Explain why it is necessary to process raw natural gas and determine pounds of air pollutants produced per billion Btu of energy
- Identify the environmental advantages of natural gas and the natural gas in the world
- Discuss the distribution of natural gas from well head through consumption
- Recognize natural gas composition and the composition of natural gas resources of the lower-48 United States
- Classify natural gas and employ natural gas processing as well as identify generic raw gas and product slate, natural gas components, product specifications, pipeline quality gas and trace components
- Describe combustion characteristics, heating value, Wobbe number, API gravity, Brent crude oil specification and purification
- Discuss the nature of hydrates and predict hydrate formation using gas gravity (relative density)
- Illustrate hydrate inhibition, dehydration by absorption and mercury removal including gas processing and treatment
- Explain the purpose of de-hydration unit and review de-hydration schematic
- Illustrate the design of gas handling system and facilities
- Identify hydrate and water content including water content of gas and high CO_2/H_2S gases
- Determine hydrates in natural gas systems and predict sweet natural gas hydrate conditions
- Describe glycol dehydration systems and identify the freezing points of aqueous glycol
- Carryout hydrocarbon recovery, low temperature separation, propane refrigeration
- Apply refrigeration process alternatives, expansion process, refrigerated J-T process and straight refrigeration process
- Discuss non-associated gas phase envelope, turbo expanders, thermodynamics and solids formation

Who Should Attend

This course provides an overview of all significant aspects and considerations of hydrates for those seeking a complete and detailed overview of the various operations that take place in the oil and gas fields. This includes managers, engineers, supervisors and other technical staff. Further, the course is very useful for new recruits and for those who just started to handle responsibilities related to oil and gas operations.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 1-2013 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Fee

As per proposal

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Contents

- Why it is Necessary to Process Raw Natural Gas
- Overview
- Pounds of Air Pollutants Produced Per Billion Btu of Energy
- Environmental advantages of natural GAS
- The World Picture for Natural Gas
- Major Natural Gas Reserves by Country
- World Natural Gas Production
- Natural gas in the World
- Figure-1 World Energy Consumption by Fuel
- The Distribution of Natural Gas from Well Head Through Consumption
- Natural Gas in the United States
- Origin
- Composition
- Natural Gas Composition
- Composition of Natural Gas Resources of The Lower-48 United States
- Natural Gas Classification
- Natural Gas Processing and Principal Products
- Generic Raw Gas and Product Slate
- Natural Gas Components
- Product Specifications

- Pipeline Quality Gas
- Trace Components
- Combustion Characteristics
- Heating Value
- Wobbe Number
- API Gravity
- Brent Crude Oil Specification
- Purification
- Introduction
- Inlet Liquid Handling Facilities
- Dehydration
- Hydrates
- The Nature of Hydrates
- Prediction of Hydrate Formation Using Gas Gravity (Relative Density)
- Hydrate Inhibition
- Dehydration by Absorption
- Glycol Absorption Unit
- Dehydration by Adsorption
- How the Molecules Reach the Interior of the Adsorbent?
- Dehydration and Mercury Removal
- The Purpose of the De-hydration Unit
- Process Introduction
- Process Description
- De-hydration Schematic
- Gas-Handling Facilities
- Natural Gas Components
- Design of Gas Handling System and Facilities
- GAS Impurities
- Gas Processing & Treatment
- Hydrates and Water Content
- Water Content of Gas
- Water Content of High CO_2/H_2S Gases
- Water Content
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- Hydrates in Natural Gas Systems
- Prediction of Sweet Natural Gas Hydrate Conditions
- Example 20-3
- Example 20-4
- Example 20-5
- Example 20-6
- Hydrate Inhibition
- Example 20-8
- Solution Steps
- Methanol
- Gas Dehydration
- Glycol Dehydration Systems
- Freezing points of Aqueous glycol
- Glycol Dehydration Case Study
- Glycol Losses
- Further Discussion
- Example-9
- Solution steps
- Example 20-10
- Other Considerations
- Hydrocarbon Recovery
- Low Temperature Separation
- Advantages of the choke valve (JT)
- Temperature Reduction Curve: (Fig 4.12)
- Valve (J-T Refrigeration)
- Propane Refrigeration
- Fig 16-10 Refrigeration Process Alternatives
- Refrigeration
- Refrigeration Compressor
- Solid Desiccant- Short Cycle Units (HRU's)
- Silica Gel
- Adsorption Efficiencies
- 2 TOC
- 2TOC Recovery

- 3TOC
- 3TCC Recovery
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- 3TOC w/ TGC
- 3TOC w/ TGC Recovery
- 3TCC w/ TGC Recovery
- Figure 16-15 J-T Expansion Process
- Figure 16-16 Refrigerated J-T Process
- Figure 16-6 Straight Refrigeration Process
- Figure 16-7 Recovery Efficient, Propane Plus
- Figure 16-8 Recovery Efficiency, Ethane Plus
- Non-Associated Gas Phase Envelope
- Turbo Expanders
- Thermodynamics
- Solids Formation
- Gas Dehydration & TEG Regeneration Units First Impression
- Glycol Units
- Reasons for Dehydrating Gas
- Choice of Glycol
- Gas Dehydration
- Problems encountered
- Wet gas
- Corrosion
- Treatment
- K-437
- Summary
- Gas Sweetening Units / Amine Units
- Amine Units
- Typical Alkanolamines
- Gas Scrubbing Unit
- Problems
- Summary
- Hydrostatic
- Introduction

- Types of Water Used
- Problems Encountered
- Recommendations
- Discharging Hydrotest Waters
- Treatment
- Similar Applications
- An Overview of production Chemistry Flow Assurance Engineering
- Production Chemist Flow Assurance
- How Production Chemistry Interfaces and Communication
- Brain of a Production Chemist
- Hydrates
- Hydrates – Fire Ice
- What is Needed for Hydrates to Form
- Hydrate Formation Curve
- Hydrate Curves with Different Gas Composition
- Hydrate Curves at Different Salinities
- Hydrates Form in Black Oil System
- Water + Gas Phase Diagram
- Where can Hydrates Form
- Why are Hydrates a Problem
- Hydrate Blockages in Oil & Gas Flowlines
- Hydrate Solids in a Sphere Receiver
- Hydrates in Gas and Black Oil Developments
- Steady Operations
- Cooldown Times
- How to Avoid Hydrate Formation
- Effect of Insulation on Cooldown Times
- Thermal Pipeline Solution
- Hydrate Dissociation on Pressure Reduction
- Hydrate Inhibitors
- Alcohols and Glycols
- MeOH Requirement
- Salts
- Low Dosage Hydrate Inhibitors

- Subcooling
- Deepwater Hydrate Inhibitor Operations
- Hydrate Prediction Methods
- ARCO Orwell Hydrate Blockage
- Pompano Gas Pipeline Hydrate Plug
- GoM Black Oil Well
- New AALDHI Application
- Low Dosage Hydrate Inhibitors
- General
- Anti-agglomerants
- Kinetic Hydrate Inhibitors
- Emulsifying Surfactants
- Thermodynamic Hydrate Inhibitors
- Gas Dehydration & Glycol Regeneration
- The Successful Field Application of a New Kinetic Hydrate Inhibitor
- Overview
- New Kinetic Hydrate Inhibitor
- Field Cases
- Summary
- Physical Characteristics
- Environmental Impact of ec6424a poly(vima/vcap)
- FreeFlowtm Field Trials On-Land Applications
- Ec6424a on-Land Field Trial in Alberta, Canada
- On-Land Field Trial in - Canada
- Ec6423a On-Land Field Trial ii in Alberta, Canada
- On-Land Field Trial ii – Canada
- On-Land Field Trial iii - east Texas
- Freeflowtm Field Trials Offshore Applications
- Ec6424a Offshore Field Trial i in GOM
- Offshore Field Trial i – GOM
- EC6441A Offshore Field Trial ii in GOM
- Offshore Field Trial ii - GOM
- Ec6424a Offshore Field Trial iii in GOM
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- Ec6441a Offshore Field Trial iv in GOM
- Offshore Field Trial iv- GOM
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- Introduction
- The Chemistry of Gas Hydrates
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- Development of the Freeflow ® Low Dosage Hydrate Inhibitor
- Advantages of using Freeflow® Hydrate Inhibitors
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- Conclusion
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- Separation
- Metering
- Gas Gathering
- Processing
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- Hydrogen Sulfide
- Non-Combustible Inert Gases
- Removal of Water
- Liquid Desiccants
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- Solid Desiccant Dehydrators
- Methanol Injection
- Removal of Hydrogen Sulfide (h2s)
- Chemical Reaction Processes
- Membrane Separation Process
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- Principles of Gas Processing Operation
- Cryogenics
- Lean Oil Absorption

- Fractionation
- Glycol Dehydration Unit Operation
- Liquid Desiccants
- Glycol Dehydration Process
- Gas Flow
- Glycol Flow
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- Dew Point Temperature
- Dew Point Depression
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- Inlet Gas Temperature
- Water Vapor Content of Natural Gas at Saturation
- Inlet Gas Pressure
- Gas Flow Rate
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- Glycol Concentration
- Glycol Circulation Rate
- Glycol Dehydration Unit
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- Contactor Column
- Tray Contactor Column
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- Gas – Condensate – Glycol Separator
- Filters
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- Dissolved Contaminants Removal
- Regenerator
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- Heat Exchangers
- Glycol/Gas Heat Exchanger
- Glycol Conditioning Reducing Glycol Losses
- General
- Temperature and Pressure Conditions

- Inlet Gas Temperature
- Inlet Glycol Temperature
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- Still Overhead Temperature
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- The Main Problems Associated with Foaming
- Principles of Amine Sweetening
- Acid Gases in Natural Gas
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- Basic Process
- Process Flow and Components
- Overview

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- Filters
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- Fire and Explosion
- Ignition Sources
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- Hydrogen Sulphide (H2S) Awareness
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