

**Training Title**

**NATURAL GAS PROCESSING, GAS SWEETENING & SULPHUR RECOVERY**

**Training Duration**

**5 days**

**Training Venue and Dates**

REF PE060	Natural Gas Processing, Gas Sweetening & Sulphur Recovery	5	15-19 November 2021	\$6,250	Rome, Italy
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In any of the 5 star hotels. The exact venue will be intimated once finalized.

**Training Fees**

- 6,250 US\$ per participant for Public Training includes Materials/Handouts, tea/coffee breaks, refreshments & Buffet Lunch

**Training Certificate**

- Define Management Consultancy & Training Certificate of course completion will be issued to all attendees.

**TRAINING DESCRIPTION**

The Gas and Liquid Contracts that exist (or are being negotiated) will determine the objectives of the processes that you will have to incorporate into any new facility and how you have to operate any existing facility. There exists a variety of processes that will condition your Natural Gas and Hydrocarbon Liquids to satisfy the Contract requirements. The objective of this course is to make you aware of the options available to you so that you can evaluate all the processes that will satisfy your objective to determine which particular process is the best from a capitol cost and operating cost perspective.

**TRAINING OBJECTIVES**

Upon completion of this course, you will gain knowledge of the processes available to process your Natural Gas and Hydrocarbon Liquid Products

**WHO SHOULD ATTEND**

This course is designed for project managers, plant managers, plant supervisors, technical staff, and contractor personnel involved in project planning, process selection and operation of Natural Gas Production. The greatest benefit arises from considering all the processes that will accomplish your process requirements to determine which one is the best for your particular application from a capital cost and operating cost perspective. You will also be able to see which processes are available to you to de-bottleneck or modify

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existing processes. The practical techniques and examples provide useful insights that are valuable at any stage of project execution and operation.

### TRAINING METHODOLOGY:

A highly interactive combination of lectures and discussion sessions will be managed to maximize the amount and quality of information and knowledge transfer. The sessions will start by raising the most relevant questions, and motivate everybody find the right answers. You will also be encouraged to raise your own questions and to share in the development of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course. Very useful Course Materials will be given.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Group Work & Practical Exercises
- 20% Videos & General Discussions

### COURSE OUTLINE

Gas & Liquid Process Selection

Contract Terms

Basic Consideration

Gas Contracts

- ✿ Quantity
- ✿ Quality
  - o Heating Value
  - o Sulphur Content
  - o Maximum Temperature
  - o Water Content (H<sub>2</sub>O Dewpoint)
  - o Hydrocarbon Dewpoint (HCDP)
  - o Other (N<sub>2</sub>, He, Ar, CO<sub>2</sub>, Hg, O<sub>2</sub>)

Liquid Contracts

- ✿ Commercial Ethane
- ✿ Commercial Propane
- ✿ Commercial Butane
- ✿ Butane-Propane Mixes (LPG)
- ✿ Propane HD-5
- ✿ Natural Gasoline

Overall Production System

Solution Gas

Associated Gas

Non-Associated Gas

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## Gas Processing Module

### Gas Conditioning Module

- ✿ H<sub>2</sub>O Removal (Dehydration)
- ✿ H<sub>2</sub>S & CO<sub>2</sub> Removal (Gas Sweetening)
- ✿ Nitrogen Removal
- ✿ Mercury Removal
- ✿ Oxygen Removal

### NGL Extraction Module

- ✿ Products
- ✿ Absorption (Lean Oil)
- ✿ Adsorption (HRU)
- ✿ Condensation
  - o Mechanical Refrigeration
  - o Mixed Refrigerants
  - o Turbo Expander
  - o Twister
  - o JT Refrigeration

- Stabilization Module
- Product Treating Module

## Characterization of Natural Gas & it's Products

### Physical Properties of Pure Components

#### Ideal Gas Laws

- ✿ Boyle's Law
- ✿ Charles' Law
- ✿ Avogadro's Principle
- ✿ Dalton's Law
- ✿ Combined Ideal Gas Law

### Physical Properties of Mixtures

#### Equations of State

- ✿ Van der Waals
- ✿ Redlich-Kwong (RK)
- ✿ Soave Redlich-Kwong (SRK)
- ✿ Peng Robinson (PR)
- ✿ Benedict-Webb-Rubin-Starling (BWRS)

### Thermodynamic Properties

- ✿ Entropy
- ✿ Enthalpy

### Equilibrium Ratio (K Value)

### Separation

#### Types of Separators

- ✿ Horizontal

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- ✿ Vertical
- ✿ Spherical
- ✿ Centrifugal
- ✿ Cyclone
  - o Reverse Flow
  - o Axial Flow
  - o Recycling

- ✿ Filter
- ✿ Liquid Coalescer

#### Water Vapour Removal (H<sub>2</sub>O Dewpoint Control)

#### Water Content

- ✿ HC Liquids
- ✿ Natural Gas
- ✿ Effect of H<sub>2</sub>S & CO<sub>2</sub>

#### Hydrate Formation Temperature

- ✿ Effect of Propane
- ✿ Effect of H<sub>2</sub>S & CO<sub>2</sub>

#### CaCl<sub>2</sub> Dehydrators

#### MeOH Injection

#### EG Injection

#### IFPEX-1

#### TEG Dehydration

#### Solid Desiccant Dehydration

#### HCDP Control

#### Adsorption (HRU's)

- ✿ 2 TOC
- ✿ 2 TCC
- ✿ 3 TOC
- ✿ 3 TCC
- ✿ 3 TOC w/TGC
- ✿ 3 TCC w/TGC
- ✿ Purge Cycle

#### JT Refrigeration

- ✿ LTX
- ✿ LTS

#### Mechanical Refrigeration

- ✿ Variations

#### Twister

#### Refrigeration Compressors

- ✿ Compression Cycle
- ✿ Single Stage

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✿ Single Stage w/Economizer

✿ Two Stage

✿ Types

✿ Drivers

Gas Sweetening

Terminology

Safety Precautions

Types of Contaminants

Process Selection

Chemical Reaction Processes

✿ Amines

o Chemistry

o Typical PFD

o General Considerations

o Amines Used (MEA, DEA, DGA, MDEA, TEA, DIPA, Formulated Solvents)

o Control Variable

✿ Caustic Wash

o Chemistry

NGL Extraction

Low Temperature Mechanical Refrigeration

JT Refrigeration

Refrigerated JT Expansion

Adsorption (Lean Oil)

Turbo Expander

✿ Typical PFD

✿ Solid CO<sub>2</sub> Formation

✿ Solid Desiccant Dehydrator

✿ Inlet Compression

✿ Gas/Gas Exchangers

✿ Expander

✿ Re-Compressor

✿ De-Methanizer

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Gas to Liquids

Sulphur Recovery

Claus Plan

Modified Claus Plants

✿ Typical PFD – 3 Stage

✿ Process Considerations

✿ Mechanical Considerations

✿ Instrumentation

Tail Gas Clean-up

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- ✿ Incineration
  - ✿ Super Claus 99
  - ✿ Super Claus 99.5
  - ✿ SCOT
- Liquid Redox

**Note:**

**Pre & Post Tests will be conducted**

**Case Studies, Group Exercises, Group Discussions, Last Day Review & Assessments will be carried out.**



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