Course Objective

This course covers natural gas process plant operations used to generate products that meet desired product specifications and will help in improving the knowledge and understanding of participants involved in the design, installation, evaluation and operations of gas processing plants and related facilities.

The participants will learn how to apply physical / thermodynamic property correlations to design and evaluate gas processing facilities. The plant systems covered are receiving facilities, separators, dehydration, acid gas removal processes, condensate stabilization, dew-point control, compression, NGL recovery, fractionation, refrigeration

At the end of the course, the participants will be able to recognize and address design and operating problems in gas processing facilities and this will help them in adopting effective techniques which will result in optimal performance.

Topics Covered

Audience

This course is intended for the following:

- Process Engineers
- Production Engineers
- Plant Operations Personnel
- Facilities Engineers
- Project Engineers
- Field Engineers
- Maintenance Engineers & Supervisors
- Mechanical Engineers

Prerequisite

Knowledge of the oil and gas production system

Activities

Day 1

- Physical properties of hydrocarbons
- Key properties of gas systems
    - Pressure
    - Temperature
    - Viscosity
    - Compressibility
    - Gas constant
    - Standard conditions
- Example problems

Day 2

- Commercial terminology for dealing with gas contracts
    - Heating value
    - Wobbe index
    - H2S content
    - Sweet/sour

- Qualitative phase behavior
    - Phase
    - Phase map
    - Dew /bubble point
    - Retrograde condensation

- Vapor liquid equilibrium
    - Total pressure, partial pressure
    - Dalton's law
    - Cox chart
- Example problems

Day 3

- Water hydrocarbon phase behavior
    - Hydrocarbon dew point
    - Water dew point

- Basic thermodynamic concepts
  - First law
  - Second law
  - Energy balance
  - Mass balance

- System energy changes / rate processes
  - Phase change
  - Sensible heat
  - Latent heat

- Example problems

Day 4

- Process control fundamentals
  - Proportional control
  - Proportional Integral control
  - Proportional Integral Derivative control
  - Offset
  - Proportional band
- Fluid hydraulics
  - Single phase
  - Two phases
  - Friction factor
  - Flow regime
- Example problems

Day 5

- Separation equipment
  - Stokes law
  - Horizontal separator
  - Vertical separator
  - Slug catcher
  - Line drips
- Example problems

Day 6

- Gas dehydration
  - Water content of natural gas
  - Factors affecting water solubility
  - Solubility in presence of sour components
  - Dehydration processes typically utilized
  - Typical dehydration specifications
  - Dehydration using TEG
  - Dehydration using mole sieves
  - Hydrates
  - Hydrate mitigation systems

Day 7

- Heat transfer
  - Types of heat transfer – conduction, convection and radiation
  - S&T heat exchangers
  - Double tube heat exchangers
  - Air fin coolers
- Pumps
  - Centrifugal
  - Reciprocating
  - Multiphase
  - Sealing systems
  - Lube systems
  - System curves
  - Pump curves
  - Fan laws
- Compressors
  - Reciprocating
  - Centrifugal
  - Seal systems
  - Lube systems
  - Rerating for changing process conditions
  - Surge / stonewall conditions
- Example problems

Day 8

- Refrigeration
  - Typical loads in refrigeration systems
  - Refrigeration cycle
  - Design factors affecting refrigeration rates
  - Economizer in refrigeration systems
  - Cascade systems in refrigeration cycles
- Fractionation
  - Concept of ease of separation / relative volatility
  - Tray vs packed towers
  - Reflux impact on product specifications
  - Impact of reflux / reboiler rates on product specifications
- Example problems

Day 10

- Process safeguarding
  - Relief sizing for gas operations
  - Depressurization
  - Fire sizing of relief valves
  - Fireproofing
  - Isolation guidelines
  - Example problems