

▲ Who should attend?

Graduate engineers involved in the **operation and/or design** of the Oil & Gas field processing facilities.

▲ Duration  
5 days

▲ Dates & Location  
**February 18 to 22, 2008**  
Rueil-Malmaison (Paris)

▲ Tuition Fees  
€ 1,940

▲ Course Coordinator  
**Mohamed SKHIRI**

Ref. **PROD / ADV1**

# THERMODYNAMICS APPLIED TO WELL EFFLUENT PROCESSING

To provide knowledge of the fundamentals of thermodynamics required for understand the operation and/or design of Oil & Gas field processing facilities.

On completion of the course, participants:

- know the composition, the properties and the characterization parameters of Oil & Gas well effluents.
- know the ideal gas law and the real fluid behavior and characterization methods.
- understand the principle of liquid - vapor equilibrium of pure components and mixtures.
- know the operating principle and performances of separation processes for mixtures.
- know the fundamentals of friction losses as well as gas compression and expansion.
- have a first experience in thermodynamic simulation and know the fundamentals of Equations Of State, their use and selection.

## COURSE CONTENT

### WELL EFFLUENT

0.5 day

Constitution and physical states of matter

Constituents of production well effluents: hydrocarbons, impurities, Water, sediments...

Different types of effluents (black oil, light oil, volatile oil, condensate or wet gas, dry gas) - Main characterization parameters: GOR, CGR, BSW, WOR, Water Cut, Bo, Bg, B'g...

Hydrates: different types, formation conditions

*Examples of compositions of crude oil and natural gas effluent*

### IDEAL GAS AND REAL FLUID BEHAVIOR

0.5 day

Ideal gas behavior

Behavior of real fluids : compressibility factor, Amagat's law, law of corresponding state with two and three parameters

**Equations of state (EOS):** conception, uses, examples, selection

### GAS COMPRESSION AND EXPANSION

1 day

Isetropic and polytropic compression and expansion of ideal gases - Case of real gases

Practical gas compression and expansion laws

**Application :** *compression of propane*

**Simulation using HYSYS software**

### LIQUID-VAPOR EQUILIBRIUM OF PURE SUBSTANCES

1 day

Vapor pressure curves: saturated and subcooled liquids, saturated and superheated gases, critical point, vapor pressure, boiling point,... - Volatility classification

Overall phase diagram of a pure substance

Enthalpy diagrams of pure substances

**Simulation using HYSYS software:** *propane cryogenic loop*

### LIQUID-VAPOR EQUILIBRIUM OF MIXTURES - MIXTURE SEPARATION 1 day

Phase envelopes: saturated and subcooled liquids, saturated and superheated gases, critical point, bubble curve, dew curve, cricondenbar, cricondentherm... - **Retrograde** phenomena Well effluent behavior from pay zone to surface processing installations

Case of dry gases, condensate (or wet) gases and retrograde gases

Case of light (or volatile) oils and heavy (or black) oils

Separation by flash (separator drum): pressure and temperature parameters, repartition of components in liquid and vapor phases, equilibrium coefficients

Separation by distillation: process parameters (pressure, temperature, number of trays, reboiling and condensing needs...), separation quality, product flow rates...

**Simulation using HYSYS software:** *separation by flash of a mixture of hydrocarbons (LPG), comparison to separation by distillation*

### FUNDAMENTALS OF FRICTION LOSS THROUGH PIPES AND FITTINGS 1 day

**Single-phase flow:** flow regimes (laminar and turbulent) and friction losses calculation through pipes and fittings

**Multiphase flow:** flow patterns (mist, slug, plug, bubble...flow regimes) and friction losses calculation methods

*Friction loss calculation exercises*

**Illustration using OLGA simulation software**

Advanced Oil & Gas Field Processing  
Module 2:  
**OIL AND WATER TREATMENT**

**Field Operations**  
Field processing

**E- 504**

**OBJECTIVES**

To provide technical knowledge of Oil and Water treatment processes, their operation and troubleshooting.

On completion of the course, participants:

- know the different problems posed by the undesirable components present in live crude oils, and the required treatments
- know the oil and water treatment processes, their operating conditions, and the influence of each operating parameter
- are able to design the main equipment used for oil processing
- know the main operating problems encountered in oil and water processing and the main available solutions
- have a first experience in the design of crude oil treatment processes

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**COURSE CONTENT**

**NEED FOR OIL FIELD PROCESSING - QUALITY REQUIREMENTS**

**0.5 day**

Constituents that pose problems for storage, transport, or commercialization/utilization  
Different specifications and quality requirements of crude oils.

Necessary treatments to reach these specifications.

*Examples of compositions of commercialized crude oils.*

**CRUDE OIL TREATMENT**

**2.5 days**

Crude **stabilization** (gas removal) by Multi Stage Separation (MSS)

Process principle

Different parameters: number of separation stages, pressures, heating and cooling needs...

Influence of these parameters on the quantity and quality (API grade) of the produced

oil

Foaming problems and main available solutions

Associated gas recompression - Typical associated gas compression schemes

**Applications: practice of separator summary design methods**

Crude **dehydration** (water removal) and desalting

Emulsion problems

Main dehydration processes

Crude oil desalting

**Applications: practice of desalter summary design methods**

Acid crude **sweetening** (H<sub>2</sub>S removal)

Cold stripping: origin of stripping gas, need for sweetening of stripping gas

Hot stripping

**Applications: practice of stripping summary design methods**

**Simulation using HYSYS software:**

*Study of an offshore crude oil field treatment unit, based on a Multiple Stage Separation (MSS) process scheme*

**Optimization of the operating parameters:** pressure and temperature of separators, suction and discharge conditions of associated gas compressors, pumping needs for export by pipe,...

*Identification and adjustment of the **controlling parameters**, for each of the stabilized oil product specifications (rate, RVP, impurity contents,...) in order to meet the different **quality requirements***

**INJECTION WATER TREATMENT**

**1 day**

Reason for water injection

**Quality requirements** and necessary treatments: chlorination, filtration, oxygen removal, sterilization...

**Operating principle** of each treatment

Main operating conditions of each treatment and **required performances**

*Examples of injection water treatment block flow diagrams*

**PRODUCTION WATER TREATMENT**

**1 day**

Quality requirements for reject water - **Environment** related constraints

Main necessary treatments: oil skimmers (API tanks, plate separators), floating oil separators, hydrocyclones...

Operating principle of each treatment and **required performances**

Comparison of the different available techniques - **Selection criteria**

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**5 days**

▲ Dates & Location

**February 26 to 29, 2008**

Rueil-Malmaison (Paris)

▲ Tuition Fees

€ 1,940

▲ Course Coordinator

**Mohamed SKHIRI**

Ref. **PROD / ADV2**

