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## N983: Pipeline and Process Engineering

Instructor(s): Ivor Ellul

### Format and Duration

Classroom - 4 Days

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### Summary

Application of the learnings of this course will provide participants with a working knowledge of the design and operation of crude oil and gas transportation, processing, and distribution systems. It will cover the theory of single and multiphase flow in pipelines and the respective design processes associated with single and multiphase flow; the separation of crude oil, de-watering and the handling and break-up of emulsions; the recovery of liquids from gases; and the storage and distribution of hydrocarbon gases and liquids.

### Learning Outcomes

Participants will learn to:

1. Identify the principles behind the flow of single and multiphase fluids in pipelines.
2. Design single and multiphase pipelines under both steady-state and transient conditions.
3. Recall the requirements for the field treatment of produced fluid.
4. Recognize the principles of liquid/liquid and gas/ liquid separation, and the types, functionality, and components of different separation equipment.
5. Design horizontal and vertical separation systems with appropriate sizing.
6. Perform equilibrium flash calculations and work out the GOR, compositions, and densities of the produced oil and gas.
7. Optimize the operating pressure of separation units for maximum hydrocarbon liquid recovery and understand the resultant influence on well deliverability.
8. Demonstrate the principles behind emulsion treatment.
9. Distinguish the different methods (such as absorption and adsorption processes) used in the field for treatment of natural gas and gas condensates and perform appropriate calculations using the different approaches.
10. Identify the processes used for the storage and distribution of hydrocarbon products.

### Training Method

This is a four-day classroom-based course comprising a mixture of lectures, discussions, case studies, and practical exercises.

### Who Should Attend

This course is intended for staff who have had limited or no exposure to pipeline operations and process engineering. The broad coverage of the topic ensures it is suitable for entry-level engineers as well as mid-level engineers that are new to petroleum engineering or operations.

### Course Content

There will be four days of instruction, with just under half a day devoted to each of the following topics:



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### 1. Introduction, Workflow, and Single Phase Systems

- The hydrocarbon transportation, processing and distribution lifecycle
- Workflows in transportation, processing and distribution
- The transport equations
- Single phase flow in pipeline networks

### 2. Pipeline Design – the Engineering Approach

- Nomenclature and units
- The engineering equations
- Transmission line gas flow
- Liquid systems
- Designing of pipeline systems

### 3. Multiphase Systems

- Empirical methods
- Mechanistic formulation
- The transient two-phase equations
- Two-phase flow regime description
- Thermal calculations

### 4. Flow Assurance

- Hydrodynamic flow assurance
- Chemical-thermodynamic flow assurance
- Wax
- Hydrates
- Asphaltenes
- Scale
- Design Integration

### 5. Surface Production Operations I

- Field processing of gas-liquid mixtures
- Gas-oil separation
- Emulsions
- Vapor-liquid equilibrium
- Gas handling facilities overview

### 6. Surface Production Operations II



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- Heat exchangers and line heaters
- Condensate stabilization
- Acid gas treating
- Gas dehydration and processing
- Compressors
- Pressure vessels and pressure relief
- Storage tanks
- Safety systems
- Prime movers
- Electrical systems

### 7. LNG Systems

### 8. Tutorials