Flow Assurance

Course Description

This course is aimed at leaders, managers and engineers working on oil and gas field projects and operations who wish to develop their understanding of flow and fluid issues between sand face and separator, and of how to manage those issues. Particular emphasis will be given to the interrelatedness of flow assurance with many other engineering disciplines and with key project and operational decisions.

The course assumes basic engineering education and experience. It will build on fundamental principles to develop an understanding of what flow assurance is, and how to successfully address flow assurance issues in oil and gas field development projects and operations.

Course Objectives

- To describe fluid-related issues, how to obtain appropriate fluid samples to assess risk of those issues, and ways to manage the issues.
- To describe flow-related issues, and ways to manage the issues.
- To provide an understanding of what key project decisions need flow assurance input.
- To investigate methods and software to assist in flow assurance engineering.
- To discuss how to get flow assurance engineering work done efficiently and effectively.
- To identify interfaces with related engineering disciplines, and to describe the necessary information exchange with flow assurance.
- To provide insights into how to assess and deal with operational flow assurance issues.
- To illustrate with field examples.
- To have attendees participate in case studies to reinforce key learnings.

Who Should Attend

- Oil and gas field development project managers, and operations managers, of fields with long flow lines between wellheads and processing facilities. The course will give them an overview of the potential complexity of the flow and fluid issues and how these can affect decisions in many related areas.

- Aspiring flow assurance engineers and production chemists, particularly with a chemical engineering, process engineering or petroleum engineering background. The course will give them an appreciation of the breadth of flow assurance and how to ensure that flow and fluid issues are addressed safely and cost effectively.
- Engineers in related disciplines (particularly subsurface, completions, petroleum, subsea, process, materials, static mechanical). The course will give them an understanding of the issues for which they need to work alongside flow assurance engineers.
- University chemical and petroleum engineering lecturers and researchers who wish to understand one application of their discipline.

Course Content

Each session will comprise presentation material, examples, and attendee participation in case studies.

Day 1

Introductions, course aims, find out expectations of attendees

1. **Overview of oil and gas field development**
   - Introduction to oil and gas fields
   - Nature of reservoir fluids
   - Pressure-temperature path from reservoir to processing to export
   - Fluid processing near wellhead or remote?
2. **Flow related issues**
   - Multiphase flow regimes and their characteristics
   - Change in pressure – effect of fluid properties and flow line diameter, length and elevation change
   - Change in temperature – effect of fluid flow velocity, flow line diameter, length and insulation
   - Types of slug flow, and how to manage them
   - Erosion, sand deposition

Day 2

3. **Fluid related issues**
   - Causes of blockage – hydrates, wax, scale, asphaltenes, napthenates
   - How to manage causes of blockage – engineering and chemical solutions
   - Corrosion, and how to manage – material selection or chemical solution
   - Obtaining fluid samples, and undertaking laboratory analysis, to assess risk of fluid related issues occurring in the expected pressure-temperature envelope
4. **Developing an oil or gas reservoir, from a flow assurance perspective**
   - Production profiles
   - Reservoir area extent
   - Location, capacity and economics of processing facilities

- Onshore field layout options
- Offshore field layout options
- Differences between greenfield and brownfield projects
- Balance between managing flow assurance risks, ease of intervention, and CAPEX

Day 3

5. **Methodologies and software for flow assurance engineering**
   - Prediction of fluid properties
   - Steady state fluid flow modelling – line sizing, characterisation of slugging
   - Transient fluid flow modelling – start-ups, shutdown and cooldown, change of flow rate, slugging
   - Detailed localised flow modelling using CFD
   - Understanding the extent and effect of uncertainty in input data, and level of accuracy of modelling, on conclusions drawn from modelling
   - Designing production system networks
   - Production optimisation through an operating system
6. **Getting flow assurance work done**
   - Selecting flow assurance engineering resources
   - Specifying the work required
   - Ensuring correct input data
   - Checking for correct use of software
   - Testing output for obvious issues
   - Drawing conclusions and recommendations

Day 4

7. **Input to key project decisions**
   - Flow line sizing, configuration and layout, and setting overall field production capacity
   - Selection of slugging management option(s)
   - Selection of hydrate management option(s)
   - Specification of chemical injection system configuration
   - Requesting additional instrumentation and monitoring
   - Interface with subsurface
   - Interface with process
   - Interface with subsea, pipeline and riser
   - Interface with static mechanical
   - Interface with material selection
   - Interface with instrument, control, electrical
   - Planning for start-up
8. **Flow assurance in operations**
   - Calibration and checking of instrumentation
   - Benchmarking and updating of software models
   - Awareness of current fluid flow rates and properties
   - Risk assessment of effect of operational changes and equipment outages

- Benefits of online simulation and monitoring
- Anticipating challenges resulting from moving through production profile

Day 5

9. **Analysing and recovering from flow assurance operational issues**
    - Philosophy for investigation of flow and fluid related incidents
    - Hydraulic behaviour, particularly slugging and flow/fluid distribution
    - Hydrate formation and blockage
    - Wax deposition
    - Pigging
10. **Summary of key points, and review of objectives**