

Gas Hydrates and Flow Assurance of Reservoir Fluids

Description

This 5 day course covers various aspects of flow assurance (i.e. gas hydrate, wax, asphaltene, scale, corrosion, emulsion) with particular emphasis on gas hydrates. In each case the nature of the problem is discussed and the various testing techniques, risk evaluation, and preventive/remedial options are covered. In general, the focus is on the practical aspects of Flow Assurance to include: PVT phase behaviour, finding the relevant data in PVT reports, identifying the associated risks and complimentary requirements, evaluating the test results and their application to the field conditions, identifying the parameters that should be monitored during the life of the reservoir.

Gas hydrate issues are the main focus of the course, including: hydrate formation conditions, inhibitor design strategies, the application of thermodynamic and low dosage hydrate inhibitors, and, hydrate blockage removal techniques. Particular emphasis is placed on predicting gas hydrate formation conditions for different production scenarios and the design of appropriate hydrate prevention strategies. The importance of laboratory techniques and protocols for evaluating the performance of thermodynamic and low dosage hydrate inhibitors (LDHIs) will be discussed.

Key Learning Points

1. The range of flow assurance challenges and how to evaluate the risk of occurrence.
2. Methods for avoiding flow assurance problems and how best to screen and select mitigation and remediation options.
3. Find out how to model various scenarios in the production flowline system.
4. Discuss and identify appropriate solutions for the range of flow assurance problems that can arise.

Practical Applications

- Hydrate inhibitor injection rate calculations for both thermodynamic and kinetic inhibitors.
- New approaches for avoiding gas hydrate problems, e.g., hydrate safety margin monitoring and early detection systems and Cold Flow will be discussed.
- Participants will visit the Heriot-Watt University and Hydrafact PVT, Flow Assurance and Hydrate laboratories (only in Edinburgh). The application of computer models and empirical techniques in exercises and tutorial sessions will provide further hands on experience.
- Case studies - apply learning and theory to solve various flow assurance related operational problems. Delegates are encouraged to participate with examples and case studies from their own experience in group and/or one-to-one discussions.

- A one month license for our hydrate prediction software (HydraFLASH) will be provided to the participants for simulating various scenarios and going over the course materials, exercises and tutorials during/after the course.

Materials Provided

- Printed course materials will be provided in a booklet.
- Heriot-Watt University *Certificate of Attendance* will be issued to each delegate upon successful completion of the course.

Target audience

Petroleum, production, process, drilling engineers / operators / technicians / managers.

Course requirements

Experience in drilling, production or process engineering would be useful, but not essential.

Main content

- Introduction to flow assurance and its importance in design and operation of oil and gas facilities
- Phase behaviour of pure, binary and multi-component systems
- Introduction to PVT report, identifying key data
- Basic PVT, bubble point, dew point, flash calculations and phase envelope
- Calculating the amount of condensed/produced water
- **Gas Hydrates**
 - Conditions necessary for their formation
 - Hydrate dissociation versus hydrate formation
 - Calculating hydrate formation point at a given pressure or temperature
 - Hydrate phase boundary for gas and oil systems in the presence of condensed water
 - Hydrates in low water content systems, dehydration requirement for avoiding gas hydrates, water dew point and its effect on hydrate stability zone
 - Using inhibitor in low water content gases
 - Evaluating gas hydrate risks in various scenarios, including drilling, well intervention, cleaning, testing, start-ups, normal operations, shut-downs
 - Effect of salt(s) on the hydrate stability zone
 - Options available to avoid gas hydrate problems
 - Calculating amount of thermodynamic inhibitor required
 - Combination of salt and thermodynamic inhibitors
 - Calculating inhibitor loss to hydrocarbon phases
 - Calculating inhibitor injection rates, effect of inhibitor purity
 - Methanol versus glycol
 - Calculating inhibitor injection rates, effect of inhibitor purity
 - Low Dosage Hydrate Inhibitors (LDHI), advantages and disadvantages
 - The required conditions for Anti-Agglomerants (AA) application

- Testing and evaluation of Anti-Agglomerants
- Ideal conditions for application of Kinetics Hydrate Inhibitors (KHIs)
- Conventional and new testing techniques for Kinetic Hydrate Inhibitors
- Addressing challenges associated with KHI application, KHIs and shut-in conditions, KHI in produced water re-injection, KHI in MEG regeneration
- KHI removal, recovery and reuse
- New techniques for improving reliability of hydrate prevention strategies
- Hydrate safety margin monitoring
- Detecting early signs of hydrate formation
- Kinetics of hydrate formation and dissociation
- Hydrate deposition
- Risk of hydrates in CCS (Carbon Capture and Storage) and prevention options
- Under-inhibited systems, transportability of hydrate slurry
- Techniques for removing hydrate blockages, risks involved and how to minimise them
- **Tutorials, case studies and exercises**
- **Waxes**
 - Introduction to waxes
 - Conditions that could lead to wax formation
 - Testing techniques to evaluate the risks associated with wax precipitation and deposition
 - Techniques for avoiding and/or mitigating wax problems
- **Asphaltenes**
 - Introduction to asphaltenes
 - Conditions that could lead to asphaltene formation
 - Testing techniques to evaluate the risks associated with asphaltene precipitation and deposition
 - Risk of asphaltene in EOR
 - Techniques for avoiding and/or mitigating asphaltene problems
- **Scales**
 - Introduction to scales, various types of scale
 - Risk of scale in water flooding
 - Testing techniques to evaluate the risks associated with scale precipitation and deposition
 - Risk of halite in gas reservoirs and/or gas storage
 - Techniques for avoiding and/or mitigating scale problems
- **Corrosion**
 - Introduction to corrosion, various types of corrosion
 - Risk of corrosion in oil and gas production
 - Testing techniques to evaluate the risks associated with corrosion
 - Techniques for avoiding and/or mitigating corrosion problems
- **Emulsion**
 - Introduction to emulsions
 - Conditions that could lead to emulsion formation
 - Techniques for evaluation risk of emulsions
 - Options for reducing the problems associated with emulsion

Instructor

Professor Bahman Tohidi

You can email [Prof. Tohidi](mailto:Prof.Tohidi) if you have any questions about the course content, or if you wish to see a specific topic to be added to the course.

Booking

If you are interested in attending this course please email the CPD Manager at info@hydrafact.com

Cost

£1,900

Delivery options

The course can be tailored based on your specific requirement with respect to duration and contents and delivered in your offices.

3-day option

Prof. Tohidi also offers a 3-day gas hydrates and flow assurance short course: Applied Gas Hydrates - a problem based learning approach. This has been developed for participants who have an existing background knowledge in the subject and assumes that some of the introductory elements of the 5-day course material is not required. Please contact us if you are interested in the 3-day option.

Delegate feedback

"The programme is well prepared and detailed"

"Cases studies were very good"

"Great to have detailed presentations on the latest state of knowledge for my day-to-day work"

"Many thanks"

"Class discussions were very useful"

"The instructor's answers to the questions were excellent"

"Excellent course pace"

"The class exercises and practical sessions were very useful"

"The course significantly improved my knowledge of gas hydrates and my performance in my current job"

"The instructor's methods in presenting the course was excellent"

"Knowledge gained, detailed explanation of hydrates and the urge to look towards a more economical way of managing hydrates"

"Very knowledgeable instructor with interesting points to make in addition to the slides" "Bahman is a real expert in this field and his ability to answer technical questions was excellent"

"Good balance of general hydrate information with special/relevant technical information"

"Good introduction to hydrates. Very knowledgeable instructor"