BLACKBIRD FOR TRAINING

Waterflood Surveillance, Optimisation & Troubleshooting

26 – 30 July 2027
Kuala Lumpur (Malaysia)

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Waterflood Surveillance, Optimisation & Troubleshooting

Ref: 3255694_209124 **Date:** 26 – 30 July 2027 **Location:** Kuala Lumpur (Malaysia) **Fees:** 4900 GBP

Waterflood surveillance, optimisation and troubleshooting is the routine measurement of injected and produced volumes, pressures and water cut in a running waterflood, used to find under-performing patterns and correct them. This five-day course is for reservoir, production and well engineers who look after existing floods, and its final deliverable is a surveillance and optimisation plan for one pattern, with ranked actions and trigger values.

Introduction

The course rests on three methods. Buckley-Leverett fractional flow theory describes how a displacement front advances and why water cut climbs after breakthrough. The Hall plot, a chart of cumulative pressure against cumulative injected volume, tracks injector health over time. Chan diagnostic plots use the water-oil ratio and its derivative to tell coning from channelling. The level is practitioner: delegates are expected to know basic reservoir engineering. Teaching uses case studies on surveillance datasets from an onshore carbonate field and an offshore sandstone field, with each diagnosis built in a spreadsheet.

Course Objectives

- Define voidage replacement ratio, injectivity index and water cut, and set a trigger value for each in a surveillance plan
- Distinguish coning from channelling on Chan diagnostic plots and select the matching remedial response
- Interpret Hall plots and pressure surveys to tell injector plugging apart from out-of-zone fracturing
- Compare mechanical and chemical conformance treatments and justify a well's selection for water shut-off
- Apply root cause analysis to injectivity loss, scaling, corrosion and souring events in an operating flood
- Select between pattern rebalancing and infill drilling to raise sweep in an under-performing pattern

Target Audience

- Reservoir engineers responsible for flood patterns who must decide where injected volumes should be reallocated
- Production and petroleum engineers who track producer behaviour and must judge whether rising water cut signals channelling or normal breakthrough
- Well integrity and injection facility engineers who must choose between remedial work and continued operation of an injector
- Field surveillance and asset team specialists who must decide which wells need logging, tracer or pressure data next
- Production chemists and corrosion specialists who must judge whether a treatment addresses scale, corrosion or souring

Course Outline

Day 1: Surveillance Terms and Data Sources

- Voidage Replacement Ratio: Balancing Injected and Produced Volumes per Pattern
- Waterflood Key Performance Indicators: Injectivity, Water Cut and Pressure Targets
- Static vs Flowing Pressure Surveys: What Each Reveals About Pattern Support
- Production Logging and Time-Lapse Seismic: Locating Swept and Bypassed Intervals
- Surveillance Plan Design: Data Frequency, Ownership and Trigger Values per Well

Day 2: Diagnostic Plots Compared

- Hall Plot vs Injectivity Index Trend: Detecting Plugging or Fracturing at Injectors
- Chan Water-Oil Ratio Derivative Plots: Telling Coning Apart From Channelling
- Buckley-Leverett Fractional Flow: Predicting Water Cut Rise After Breakthrough
- Decline Curve and Water-Oil Ratio Extrapolation: Forecasting Remaining Oil per Producer
- Interwell Tracer Tests: Confirming Communication and Thief Zones Between Wells

Day 3: Conformance Control Options

- Sweep Efficiency Components: Areal, Vertical and Displacement Contributions to Oil Produced
- Mechanical vs Chemical Conformance: Packers and Plugs Compared With Gel Treatments
- Polymer Augmented Flooding: Mobility Ratio Improvement for Viscous Oil Patterns
- Surfactant Treatments: Lowering Interfacial Tension to Release Trapped Oil
- Candidate Selection Screening: Ranking Wells for Water Shut-Off Treatment

Day 4: Troubleshooting Injectors and Producers

- Injectivity Loss Causes: Suspended Solids, Oil Carry-Over, Bacteria and Formation Damage
- Scale vs Corrosion Failures: Mineral Deposits Compared With Metal Loss
- Reservoir Souring: Hydrogen Sulphide Generated by Sulphate-Reducing Bacteria
- Root Cause Analysis: Five Whys and Fishbone Diagrams Applied to Well Failures
- Injector Well Integrity: Annulus Pressure, Casing Leaks and Safe Operati[illegible]

Day 5: Pattern Optimisation in Practice

- Pattern Balancing vs Infill Drilling: Choosing Between Rate Changes and New Wells
- Injection Rate Reallocation: Using Voidage, Hall and Chan Results Together
- Life-Cycle Planning: Linking Secondary Flood Stages to Later Tertiary Methods
- Flood Risk Register: Integrity, Souring and Source Water Threats Ranked by Impact
- Surveillance and Optimisation Plan: Final Pattern Actions, Triggers and Review Points

Skills You Will Gain

- Voidage replacement tracking
- Hall plot interpretation
- Chan diagnostic plotting
- Fractional flow reasoning
- Conformance candidate screening
- Injector root cause analysis
- Pattern rebalancing

Why Attend This Course

- From reading field totals each month to tracking voidage, injectivity and water cut pattern by pattern
- From treating every high water cut well alike to telling coning, channelling and normal breakthrough apart
- From reacting to injector failures after they occur to tracing their root cause through well data
- From scattered field observations to a surveillance and optimisation plan with pattern actions and triggers

Conclusion

Put simply, operating a waterflood well means watching where the injected water actually goes and acting before it bypasses oil. The course separates three pairs that are often confused: coning and channelling, injector plugging and fracturing, and pattern rebalancing and infill drilling. It suits engineers and specialists already responsible for an operating flood who need a structured way to diagnose and correct it; those planning a new flood from the concept stage are better served by a longer, design-led course.

Course FAQs

What is waterflood surveillance?

Waterflood surveillance is the planned collection and review of rates, pressures, water cut and well test data from an operating flood. Its aim is to show where injected water travels, which patterns lack pressure support and where oil is being bypassed.

What is the difference between coning and channelling in waterflood troubleshooting?

Coning is water drawn up from an underlying aquifer towards a producer, while channelling is water moving from injector to producer through a high-permeability layer or fracture. On Chan plots, coning shows a falling derivative at first, while channelling shows a steadily rising one.

Which methods does the Waterflood Surveillance, Optimisation and Troubleshooting Course follow?

It follows Buckley-Leverett fractional flow theory for front movement, Hall plots for injector behaviour, Chan diagnostic plots for the source of produced water, and voidage replacement ratio tracking for pattern pressure support.

Is waterflood optimisation training right for a production chemist?

Yes, where the chemist supports injection water quality, scale or souring control. The troubleshooting content links chemical symptoms to well and pattern data, although the diagnostic plotting sessions assume some familiarity with production engineering terms.

What do delegates produce in waterflood surveillance training?

Delegates produce a surveillance and optimisation plan for one pattern: the data to be gathered, a trigger value for each indicator, the diagnosed problem wells, and ranked actions such as rate reallocation or a conformance treatment.