N473: Fiber-Optic Sensing: Diagnostic and Surveillance Applications and Deployment

Format and Duration
Classroom - 2 Days

Instructor(s): Dennis Dria

Summary

This course presents a broad exposure to fiber-optic monitoring through detailed case studies and leads the student through the steps of sensing system selection, design and installation.

Learning Outcomes

Participants will learn to:

1. For various development scenarios, assess where and when fiber-optic sensing can provide appropriate diagnostic data vs. other monitoring/diagnostic tools (i.e. when it works and when another technique has potential to provide superior results)
2. Select fiber-optic data acquisition systems to provide reservoir development model calibration and validation information, for various well placement and completion scenarios.
3. Design plan/workflow (high level) to effectively integrate FO data with other diagnostic data.
4. Evaluate fiber-optic sensing options vs. traditional reservoir/well surveillance methods
5. Select fiber-optic data acquisition systems suitable for different surveillance needs.
6. Design plan/workflow (high level) to effectively integrate FO data with other surveillance data.
7. Select fiber-optic well sensing system appropriate for well type and surveillance need.
8. Specify completion hardware and fiber-optic system components (fiber, cable, instruments) needed to accomplish surveillance and completion/stimulation diagnostic goals.
9. Modify completion designs to accommodate permanently installed fiber-optic sensing systems.
10. Design data acquisition protocols for specific well types.
11. Assess permanently installed fiber-optic sensing and fiber-optic intervention (“logging”) options, and recommend/justify when to use which options based on a particular well type and information need.

Training Method

N473 is a two day classroom based course. Training consists of lectures, class discussion, exercises and case histories.

Who Should Attend

This course sequence is for completion, drilling, production, surveillance, and reservoir engineers, geologists and geophysicists.

Course Content

The first day provides guidance for using in-well fiber-optic monitoring for completion and stimulation diagnostics as well as reservoir and well surveillance, with a special focus on unconventional resource plays. Fiber-optic sensing is a major diagnostic tool which can provide critical information to validate, constrain and calibrate various models (fracture growth, reservoir drainage, well placement, perf cluster and stage placement, etc.) used to optimize field development. After a well is brought on production, fiber-optic sensing can provide key surveillance information that has been historically acquired with cased hole logs and other traditional monitoring systems: inflow (production) profiles, waterflood management, stimulation/re-stimulation efficiency, water and gas breakthrough location, sand production.

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The second day provides the knowledge and tools to design and manage the execution of fiber-optic-instrumented well completions and well interventions, which will provide key data and information to optimize well completions and asset performance. Upon completion, the student will be able to properly recommend when and where to apply fiber-optic sensing to optimize field development and manage well and reservoir performance.

DAY 1

- Quick review of Fiber-Optic Sensing Basics
- Introduction to "Life-of-Field" monitoring with Fiber-Optic Sensing (FOS)
- Using FOS for completion and stimulation diagnostics, e.g.:
  - Role in field development,
  - Well placement strategy/optimization:
    - 2-D (single reservoir)
    - 3-D (multiple bench/stacked reservoirs/"cube" development)
  - Stage and cluster efficiency
  - Frac monitoring/mapping
  - Frac "hits"
- Life-of-field surveillance
  - Production monitoring/multiphase inflow profiling
  - Injection/stimulation monitoring
  - Reservoir depletion
  - Well-well interactions
  - Artificial lift monitoring
  - Using the production well as an ad-hoc monitor well
  - others
- What FOS provides (where it works), what it misses (advantages/disadvantages vs. other monitoring tools)
- Integration (synergy) with other monitoring methods
  - Tracers
  - Geophone-acquired Microseismic and Vsp
  - Tiltmeter
  - OH and CH wireline
  - Others
- Work flows, recommended practices, project planning

Day 2

- Fiber-optic sensing (FOS) well architectures
  - Onshore
  - Offshore
- FOS system – component selection and specification
  - Fiber

  - Cables
  - Surface instrumentation units
  - Power/communication options
- Completion hardware
- Well design modifications needed to accommodate FOS
  - Hole size
  - Casing/tubing
  - RIH procedures
  - Cementing
  - Perforating
- Wellhead-to-office data transfer,data storage and interpretation considerations
- Installation operations
  - Project planning
  - Completion/FOS installation operations
  - Preferred/recommended practices
- Fiber-optic monitoring system commissioning