



# Training

## Hydraulic Fracturing

*Dr. Michael B. Smith*

### \* What Is Covered ?

The course emphasizes the multi-disciplinary nature of hydraulic fracturing, covering the "Reservoir Engineering" aspects, integrated with the "Fracture Mechanics" aspects, and coupled with "Operational" considerations. This integration is absolutely necessary in order to present how to recognize opportunities for fracturing from hard rock tight gas, to offshore "frac-pack" completions, how to estimate required data for planning and preparing preliminary job designs, how to design, perform, and analyze pre-frac tests, and finally how to arrive at an "optimum" final design. Along with an ***Introduction to Fracturing***, the course covers ***Reservoir Response, Rock Stresses, Fracture Geometry, Fracture Pressure Analysis, Fracture Fluid & Proppant Selection***, and ***Field Application & Quality Control***.

### \* How Is It Presented ?

The course is based on visual aids keyed to NSI's comprehensive manual. The manual contains the most up-to-date collection of state-of-the-art fracturing concepts/practices, and provides an excellent reference for later applications. The manual also includes multiple, detailed, ***solved*** case history examples ranging from Australian tight gas wells, to Gulf of Mexico "frac-pack" completions, to North Sea tip screenout (TSO) treatments. Practical applications during the week are built on two complete, detailed, ***real*** problems. Several "problems" are available insuring each attendee works on application similar to their current operating environment.

### \* What About The Instructor ?

Mike Smith, with a Ph.D. in Rock Mechanics from Rice University, has over 20 years experience in rock mechanics, well completions, and hydraulic fracturing. While with Amoco Production Company, Mike co-developed the framework for fracturing pressure analysis that revolutionized fracturing technology. Along with worldwide consulting, Mike has served as an SPE Distinguished Lecturer, authored multiple chapters in the recent fracturing SPE Monograph, and developed and presented SPE short courses on Fracturing Pressure Analysis. Most recently, Mike was presented the SPE Lester C. Uren Award for his contributions to hydraulic fracturing technology.

### \* How Do I Register ?

Contact NSI for detailed information or for registration or course fee information. Enrollment is strictly limited to allow maximum interaction during the week. Fee for the one-week course covers tuition, course manual, and use of computer & software for the week.

**For Details Please Contact NSI Technologies, Inc.**

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## You Will Learn

- The importance of the many variables affecting fracturing, and how to recognize critical parameters for specific applications.
- How to recognize wells/formations as good fracture candidates.
- A step-by-step procedure for estimating variables & developing preliminary treatment design goals and pump schedule designs.
- How to use fracturing pressure analysis to “check” the preliminary parameter estimates and to develop a final design pump schedule.
- How to evaluate/select appropriate materials (fluid/proppant) for fracturing applications.
- Combining all aspects of “fracturing” for fracture optimization.
- How to perform the critical field QC for good fracturing results.

## Topics Covered

- Reservoir Engineering: Fundamental “Reservoir Engineering” aspects of hydraulic fracture design, predicting well performance improvement, etc.
- Rock Mechanics: How in situ stresses are generated as a function of depth, reservoir pressure, and geologic structure. How is in situ stress measured?
- Fracture Mechanics: What are the major variables that control fracture growth, fracture geometry, and proppant placement. How do we recognize the critical parameters for a specific application?
  - > Height: What controls fracture height and how to estimate this?
  - > Modulus: What is rock modulus and how do we estimate/measure this critical variable?
  - > Fluid Loss: What controls fluid loss while pumping and how do we measure this (& when should we use fluid loss additive)?
  - > Toughness: How do we determine “Fracture Tip Effects”?
- Fracture Pressure Analysis: How to design (& then analyze) pre-frac tests to measure critical design parameter(s), be that fluid loss, height growth, or something else.
- Pump Schedule: What are the different “types” of fracture pump schedules, and how (& when) fracturing pressure data defines the final design pump schedule.
- Materials: What are the important properties for fracturing materials (fluid/proppant) and how should these properties be weighted and evaluated for specific applications?
- Field Procedures: Critical field operating procedures for job execution and QC. What tools are available (and how do they work) for post-frac evaluation?

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