HYDRAULIC FRACTURING SHALE FORMATIONS

Properly designing and applying large hydraulic fracturing treatments is essential to successfully developing oil and/or gas from shale formations. The design work has been dominated by service companies but in recent years an increasing number of developers and investors have recognized the value of learning more about the technology and this has led to significant improvements in the design, application and cost effectiveness of these expensive treatments. Major findings from these efforts include the fact that the most cost effective treatment is very often different from what is predicted from computer simulation and the fact treatment designs must be significantly altered to accommodate some of the subtle changes in shale properties that occur within every shale basin. Fortunately, major improvements have been made in understanding how and when these changes should be made and so fracturing technology continues to be refined at a rapid pace.

This five-day workshop course outlines the technical and non-technical factors, from initial design through final flow-back, that control the success of fracture treatments in shale. The course covers the key reservoir properties that must be considered in designing a hydraulic fracture and also covers the latest and emerging advancements in fracturing technology. Emphasis is placed on successful practical methods that can be used to evaluate treatment designs and to anticipate how a fracture treatment will impact a specific shale formation. These concepts will be reinforced through class problems, which will require participants bring a simple calculator or calculator app.

**Why You Should Attend?**
The course will provide a solid foundation for understanding the current techniques used to apply, evaluate and optimize hydraulic fracture treatments for shale. The course will also cover: the treatment process from planning through flowback; treatment design concepts; rock property measurements essential to identifying an appropriate design; quality and cost control measures, unique terminology, and the reasons the treatment designs vary so much from one shale basin to the next.

**Who Should Attend?**
The course is intended for those familiar with the technical aspects of characterising, designing, or evaluating oil and gas properties. This includes Reservoir Engineers, Production Engineers, Completions Engineers, Geophysicists, Geologists, Technical Support staff, Academics, Researchers, Supervisors, Managers, Government Representatives, and Energy Policy makers.

**Pre-requisites:**
A good understanding of the engineering and geologic concepts applied in evaluating conventional or unconventional plays.

Participants in the course will gain a better understanding of the:
- Unique terms and concepts involved in current hydraulic fracturing treatments
- Five different technical objectives for creating a hydraulic fracture in shale
- Fluid, equipment, proppant and other design options
- Common mistakes and misunderstandings in treatment design
- Data and concepts required to select the appropriate treatment interval
- Methods that are being applied in the current major plays and why they vary by play
- Treatment design and calibration field tests
- Methods for evaluating a treatment and common evaluation mistakes
- Risk and cost management for hydraulic fracturing
Course Outline:

**Day One – Hydraulic Fracturing Concepts**
- Introduction and Course Plan
- Class Problem: Pre-Course Exam
- Shale O&G Essentials
- Class Problem: Gas Resource Types
- Well Preparation for Treatments
- Rock Mechanics
- Fracture Theory
- Net Pressure Concept
- Treatment Stages
- Class Problem: Stage Design

**Day Two – Fracturing Process and Design**
- Practical Treatment Design
- Class Problem: Frac Length Selection
- Fracture Interval Essentials
- Class Problem: Calibration Tests
- Five Fracturing Objectives
- Proppant Options
- Required Equipment
- Proppant Transport
- In-situ Stress Considerations
- Class Problem: Calculating Stresses

**Day Three – Treatment Adjustments**
- Shale Windows
- Fracture Conductivity
- Class Problem: Adjusting Fracture Width
- Sweet Spots
- Dull Spots
- Options for Frac Fluids and Additives
- Case Study: Eagle Ford Shale
- Multi-Frac Technology
- Class Problem: Selecting Pump Rates
- Fracturing in Horizontal Wells
- Class Problem: Fracturing Horizontals
- Case Study: Bakken Shale Oil

**Day Four – Monitoring and Evaluation**
- Calibration Field Tests
- Net Pressure Analysis
- Class Problem: Slurry Pressure Changes
- Microseismic Monitoring
- Tracers and Fiber Optics
- Risk Control
- Class Problem: Quality Control Measures
- Flowback Analysis
- Production Curve Analysis
- Class Problem: Fracturing Terminology
- Cost-Benefit Analysis
- Case Studies: Montney and Horn River

**Day Five – Treatment Optimization**
- Well Performance Variability
- Case Studies of Frac Trials
- Fracturing Design Options
- Production Correlations
- Class Problem: Eagle Ford Correlations
- Re-frac and Infill Issues
- Case Studies: Barnett and Marcellus
- Class Problem: Post-course Exam
- Quick-look Proppant Design
- Emerging Technologies
- Course Review

Course Instructor:
Steve Hennings, M.S., P.E.