N646: Hydraulic Fracturing Shale and Tight Rock: Technical Design and Analysis

Instructor(s): Steve Hennings

2 Days	Competence Level: Awareness
Classroom Course	

Summary

Hydraulic fracturing has been applied in the oil & gas industry for more than fifty years and massive hydraulic fracturing has been applied for over thirty years. With the current focus on unconventional reservoirs, where hydraulic fracturing is essential to commercial success, the activity level and cost of hydraulic fracturing has grown dramatically in recent years.

Significant advancements have been made in monitoring, understanding and improving these treatments but unfortunately it is still not possible to precisely forecast fracture placement and performance using even the most advanced computer simulation models. However, a number of valuable and practical methods have emerged to integrate engineering and geologic information to optimize, and better understand, these essential and costly modern treatments.

This two-day course explains the key elements of hydraulic fracturing and why the proper treatment varies as reservoir type and reservoir properties change. The course also outlines the most effective practical methods to design, monitor, evaluate and optimize the profitability of these treatments.

A number of short class problems, requiring a simple calculator, are included to reinforce evaluation and design concepts.

Learning Outcomes

Participants will learn to

1. Characterize and rank-order the key reservoir properties influencing hydraulic fracturing treatments.
2. Define how production rates correlate to specific hydraulic fracturing options.
3. Apply simple equations to design fracture treatments and outline the limitations of these equations.
4. Define the symbols, slang and options associated with the hydraulic fracturing of horizontal wells.
5. Construct a treatment plan, including quality checks, risk mitigation, monitoring and required equipment.
6. Assess geologic factors creating variability in hydraulic fracturing mechanics, objectives and effectiveness
7. Apply simple equations to quantify the appropriate fracture design and fracture spacing.
8. Review the factors that define the appropriate interval to complete and stimulate.
9. Apply simple equations and concepts to forecast hydraulic fracture geometry.
10. List the recent and emerging technologies in hydraulic fracturing and their potential benefits.

Duration and Training Method

Two classroom days providing 1.6 CEU (Continuing Education Credits) or 16 PDH (Professional Development Hours)

Who Should Attend

The course is intended for petroleum engineers, geoscientists and others involved in designing, evaluating or modifying hydraulic fracture treatments. Those involved in managing these activities would also be

expected to benefit from this course.

A more comprehensive review of the technologies involved in characterizing and evaluating these reservoirs, with less in-depth coverage of hydraulic fracturing, is provided in the three-day course titled "Shale Oil & Gas for Petroleum Engineers and Geologists". In addition, a more introductory review of shale development and fracturing is provided in the two-day "Introduction to Shale Oil and Gas" course.

Course Content

Day One
1. Overview
    a. Source Rock
    b. Reservoir Characteristics
    c. Development Teams
2. Slang and Symbols
    a. Hydraulic Fracturing
    b. Five Objectives
    c. Mechanics
    d. Stages
    e. Stage Planning
3. Well Preparation
    a. Frac Terminology
4. Fracturing Equipment
    a. Fleet Layout
    b. Determining Horsepower
5. Insitu Stresses
    a. Calculating max stress
6. Sweet Spots
7. Oil & Gas Windows in Shale
    a. Geology Terminology
8. Horizontal Wells
    a. Fracs in Horizontals
    b. Eagle Ford Parameters
9. Calibration Field Tests

Day Two
10. Proppant Transport
    a. Settling Velocity
    b. Fluid Additives
11. Treatment Planning
    a. Procedures
    b. Onsite Inspection
12. Forecasting Rates
13. Gas Storage

a. Adsorption Contribution

14. Design Options
    a. Simulation
    b. Field Trials
    c. Correlations
    d. Eagle Ford Correlations – 325