# D959: Hydraulic Fracturing for Conventional, Tight and Shale Reservoirs *(Distance Learning)*

Tutor(s): Mike Smith / Carl Montgomery

| 4 Days | Competence Level: Skilled |
|---|---|
| Virtual Course | |
| Computer Usage | |

## Summary

**Business Impact:** The course empowers attendees to evaluate if **sub-surface fracturing plans** are too big, too small, or just right. Either **reducing costs**, **enhancing value**, or **providing assurance of quality operations**.

This course addresses the multi-disciplinary technical and economic variables involved in the design and implementation of hydraulic fracturing. This flows from a reservoir evaluation of why/how to frac, to geoscience to quantify many design variables, to frac design and post-frac economic evaluation. Fracture mapping and implementation of multi-stage hydraulic fractures in horizontal wells are included.

Any subsurface activity is inherently the operator's responsibility and in today's environment that certainly includes stimulation, specifically hydraulic fracturing. This course prepares attendees to assume responsibility for, or intelligently evaluate stimulation design proposals from a service provider. Or, if not directly involved in detailed operations, this course prepares geologists and geoscientists to understand what input is required from them to optimize hydraulic fracturing.

## Learning Outcomes

Participants will learn to:

1. Recognize the multi-disciplinary nature of hydraulic fracturing involving geoscientist, reservoir engineering, geomechanics, materials selection …….
2. Assemble pre-frac data
3. Calculate predicted post-frac productivity
4. Estimate major frac design parameters (in-situ stress, modulus, fluid loss, and fracture tip effects)
5. Select appropriate fluid viscosity and pump rate
6. Select the economically optimized treatment size and proppant program
7. Select fracturing materials, base fluids, additives, and propping agents
8. Design and analyze pre-frac testing
9. Determine stage size/spacing for multiple-fractured horizontal wells

## Duration and Training Method

A virtual classroom course divided into 8 webinar sessions, comprising lectures, discussion, case studies, and practical exercises to be completed by participants during and between sessions.

## Who Should Attend

The course is designed for mid to senior level engineers and engineering supervisors/managers who are directly involved in hydraulic fracturing design and operations. It is also recommended for geologists, geoscientists and others who routinely supply input data for fracture design optimization.

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## Prerequisites and Linking Courses

There are no prerequisites for this course but some acquaintance with well completion operations, formation evaluation, and reservoir engineering principles and terminology is assumed.

Hydraulic fracturing is also addressed in N944 (Shale Gas and Shale Oil Completions Using Multi-Staged Fracturing and Horizontal Wells).

Related petroleum engineering courses include N484 (Reservoir Management for Unconventional Plays), N908 (Well Testing and Pressure Transient Analysis), N957 (Forecasting Production and Estimating Reserves in Unconventional Reservoirs), and N986 (Reservoir and Production Engineering of Resource Plays).

## Course Content

### 1. Overview

- Introduction
- Important Factors in Fracturing

### 2. In Situ Stress

- The dominant variable for fracture design
- Geomechanics - What controls in situ stress and how to estimate this critical parameter
- The role of geologic structure
- Proppant stress and how this affects fracture conductivity

### 3. Reservoir Aspects of Fracturing

- What controls post-frac productivity
- How to predict post-frac production
- How to determine what “type” of fracture is desired
- Horizontal Well Fracturing
    - Well spacing
    - Cluster/Stage spacing

### 4. Fracture Geometry

- Geomechanics aspects of fracturing
- Major parameters needed for treatment design
- PNet, Net Fracturing Pressure
- Horizontal Well Fracturing
    - Effect of fracture interference on fracture geometry

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## 5. Treatment Design

- How to estimate/measure major design parameters (Height, Modulus, Fluid Loss, and Frac Tip Effects)
- Data sources
- Selecting desired fluid viscosity and pump rate
- Treatment scheduling (viscous gel fracs, water fracs, tip-screenout fracs)

## 6. Pre-Frac Testing

- Step-Rate Test analysis
- Injection/Decline (DFIT) Analysis
- Fluid efficiency

## 7. Materials

- Proppant and Fracture Conductivity
- Fluids and fluid selection process