esanda
Oil and gas training specialists

MEXICO
2019

Hydraulic Fracturing Fundamentals

MEXICO CITY 11 – 15 FEB 2019

Course Overview

This course will provide theoretical and practical understanding of hydraulic fracturing techniques and their application in different environments. Detailed lectures will be conducted on fracturing concepts that are industry recognized, covering aspects of fracturing design, application and analysis as well as the strengths and weakness of the various approaches to fracturing.

Learning Objectives

Upon completion, the participant will:

- Acquire knowledge to identify stimulation candidates
- Understand basic analysis of design, planning and execution of frac treatments
- Understand the aspects involved in the design of a frac treatment
- Be able to plan and supervise a frac treatment in general terms
- Understand post-frac analysis and evaluation basics.

The course is based on the basic concepts applicable to conventional fracturing as well as a review of practices in unconventional formation environments using innovative frac and completion techniques. As such, the use of powerful and unique features will be learned:

- Candidate selection and screening
- Optimizing designs for formation types
- Effective placement, packing of the fracture with proppant, also known as TSO design and placement
- Safe placement of the completion (avoiding unplanned job terminations: screenouts or planning TSO when desired)
- Real-time, on-location, Minifrac and Mainfrac analysis
- Mainfrac Treatment analysis and evaluation
- Pre and post frac QA-QC

The above is accomplished by focusing on resolving the major issues in Propped fracturing Stimulation:

- Can the treatment be placed safely and effectively to completion?
- Was the placement effective? (Is the proppant opposite and along the payzone?)
- Is rock stimulated area achieved in unconventional environment such as shale rocks

The course is designed for

Production, operations, completions engineers, and supervisors, who are or will be actively involved in hydraulic fracturing design, application and analysis, and desire a more in-depth understanding of the theoretical and practical aspects. Attendees do not require previous fracturing knowledge, or Hydraulic Fracturing experience.

Emerging advanced technologies
Over the last decade, the field of hydraulic fracturing has experienced tremendous technological development, which is slowly implemented in field operations. Some developments to be covered are listed in new practices /technologies in multistage environment in the outline below.

Actual case studies
To reinforce the learning experience and gain confidence in the application of the technology, actual case studies from around the world, will be demonstrated in the classroom.

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Course outline

Well stimulation basics

Restoring flow capacity

Creating new flow capacity

Objectives - why fracturing

Adding value - Basic economics

Formation damage

Types of stimulation

Restoring matrix

Bypassing damage

Creating rock contact

Stimulation techniques - frac generations

Passing wellbore damage

Massive frac treatments – low perm environment

TSO - Frac and pack

Multiple frac environments

Frac design and evaluation

Improving productivity

Interconnecting formation permeability

Improving ultimate recovery

Secondary recovery

Candidate recognition and optimization

Stimulation Objectives and Types

Stimulation Candidates

High vs low perm fracturing

Minifrac – Mini fall off

G function, pressure decline analysis

Leak off coefficient, fluid efficiency

Effective wellbore radius

Rock mechanics

Orientations, stresses, Hardness, Permeability

Zone Height; Presence of Barriers, Drainage Radius

Rock mechanical behaviour

Frac width

Modelling-propagation models

PKN, KGD, RADIAL

3D

Conventional fracturing fluids

Base fluid requirements

Viscosity, friction, fluid loss

Impact of Volume, Pump Rate

Effect of temperature, share, crosslinking rates

Types of frac fluids

Water based fluids; PSG, HPG, CMHPG, HEC, CMHEC, Xantam

Crosslinking systems; Borate crosslinker, Organometallic crosslinkers

Oil based multiphase/emulsions, foam fluids, applications, benefits

Non-polymeric frac fluid technology

Visco-elastic surfactants

Linear, cross linked fluids

Chemicals; polymers, xlinkers, stabilizers-iron, clays, scale-, activators, breakers, delay agents

Mixing systems

Batch mixing

Continuous -on-the-fly- mixing systems

Proppants

Proppant selection

Types, comparison

Issues on transport; settling rates and velocity

Conductivity damage

Final proppant pack polymer concentration -PCF

Retained conductivity

flow capacity areas, skin, pseudo skin

wellbore, critical matrix

Type of damage

scales, organic deposits, silts and clays, emulsion, water blocking, wettability changes

Fracturing optimization

Reservoir deliverability

Production systems

Pumping parameters

Fracturing fluid and proppant

Treatment size

Economic benefit

Acid fracturing

Bottom-hole pressures above pressures

Acid reaction with formation rock

Frac etching

Formation integrity

Fracturing economics

Costs, vs production gains

Post treatment decline

Impact on treatment values; optimum frac length, width, perm

Well performance

Future value of money

Fracturing execution

Equipment size, type, Location limitations

Design, and validation through MiniFRAC analysis

Calibration treatments

Real time data acquisition

Onsite QA/QC

Evaluation

Design and analysis of diagnostic injections

Fluid efficiency, fracture entry friction

Fracture modelling

Pressure matching

Current and new practices

re-fracturing, benefits, applications, constrains

Unconventional reservoirs-shale environment

Stimulation Multi-stage horizontal well applications

Description of multistage completion types

Extended reach applications