

ADVANCED WELL DAMAGE REMEDIATION & STIMULATION TECHNOLOGIES

General:

Discipline: Reservoir, Completion, Production

Level: Basic/Intermediate

Duration: 4 days

Instructor: Jairo Balcacer

Purpose:

This course will cover the formation damage mechanism throughout the different stages of the wells, since it is drilled until it is not considered economic to be producer. Detailed review of Darcy and Non-Darcy skin effects are considered as a tool used to evaluate the optimum decisions to implement damage remediation and/or well stimulation actions, which will lead to optimum well performance and so, optimum cost benefits. Class problems will be worked using MS Excel spreadsheets to analyse well performance due to different skin situations resulting from non-optimum damage remediation or stimulation operations.

Designed for:

This course is focused to instruct reservoir/completion/production and well intervention engineers on analytical procedures to evaluate both damage remediation and well stimulation operations, based on properly identified skin factors associated to different completions as well as reservoir and fluid conditions that may lead to poor well performance.

You Will Learn:

- Defining the formation damage induced from drilling through well intervention operations and how to evaluate the effect of defined skin numbers associated to different well conditions
- Guidelines to avoid formation damage
- Methods of ranking well inflow performance based on formation damage or stimulation (skin) numbers
- Economic evaluation of stimulation operations
- Sandstone and Carbonate damage remediation and stimulation
- Economic evaluation to rank well candidates to be remediated or stimulated

Course Content:

Before stimulation (damage remediation?) knowing the problem: Formation Damage

- Sources of formation Damage
- Drilling operations, cementing, perforating, fines movement
- Completion & WO fluids
- Scale, bacteria, pressure reduction, stimulation
- Water injection

Formation damage during well intervention operations

Well intervention fluid quality: guidelines to avoid formation damage

Well intervention techniques to minimize formation damage

Recognition of the pressure of formation damage

Example calculation using skin definition

Well inflow and Stimulation

Methods of determining well inflow performance

- Darcy's equation
- Forchheimer's equation
- Modifications to account for skin effects
- Methods of rating well inflow performance
- Methods of acquiring input data

Primary components of the total skin factor

- Reservoir skin effects
- Flow convergence skin effects
- Well entry skin effects
- Intra-well flow effects
- Multiphase flow effect

Estimating Skin Effects for Specific Flow Situations.

Simulation Techniques to Determine Skin Factors

Well stimulation economics

Selecting the candidate

Selection of type of treatment

Perforating for stimulation

Matrix Stimulation

- Potential formation damage
- Fluid selection
- Typical acid formulations
 - Hydrochloric acid
 - Organic acids
 - Mud acid
 - Selection of acid composition
 - Selection of treatment volume
 - Selection of injection rate
 - Selection of additives
 - Selection of treatment type
 - Selection of diversion technology
- Matrix stimulation field campaign

Carbonate Rocks

- Acid composition selection
- Treatment types
- Matrix treatment
- Acid wash or Acid Scale

Special Treatments

- Gravel packed wells
- Horizontal wells
- Naturally fracture formations

Alternative Acid Formulations**Hydraulic Fracturing**

- Hydraulic fracturing treatment selection guidelines
- Well inflow performance of fractured stimulation wells
- A propped hydraulic fracturing treatment

Example problem: Optimizing fracturing treatment

Cost and Benefit Analysis

Practical Operations and Post Audits Recommendations

Software applications:

- MS Excel spreadsheets
- Prosper

Text and Consulting books:

- “Reservoir Stimulation”, M. Economides and K. G. Nolte, Third Edition, WILEY
- “Production Operations, Vol 2”; T. O. Allens and A. P. Roberts, OGCI Publications
- “Production Enhancement with Acid Stimulation” Leonard Kalfayan, 2nd Edition, 2008, PennWell

