

# Advanced Well Completion Design



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## **Introduction:**

This course provides in-depth information on the impact of work overs and completion design in maximizing field production and increasing recoverable reserves. It also emphasizes the importance of a team concept as a determining factor in operations success. Participants will gain a greater understanding of how to apply advanced technologies to designing and executing work over jobs, and how to select the best operations method to perform the task in the safest, most efficient manner.

### **This training course will feature:**

- Develop a high level completion strategy for wells in a variety of situations
- Select tubing, packers, and completion flow control equipment

## **Objectives:**

### **By the end of this BTS training course, participants will be able to:**

- Appraise/design a suitable flow barrier strategy and suitable intervention strategy
- Make recommendations on installation and retrieval practices for tubing, packers, etc. in different well types
- Identify key features/applicability of the main sand control, frac. pack and well stimulation options

## **Who should attend?**

Drilling Engineers, Senior Drilling Engineers, Drilling Supervisors, Drilling Superintendents, Petroleum Engineers, Completion Engineers, Tool Pushers, Reservoir and Senior Reservoir Engineers, Geologists, Production and Completion Engineers, Foremen, Work over Engineers, Petroleum Engineers,

Completion Engineers, Tool Pushers, Reservoir and Senior Industry Personnel, Lifting Personnel, Maintenance Engineers, Technologists, Mud Engineers, Well Site Supervisors, Drilling Contractors, Drilling Supervisors, Completion Engineers, Completion Supervisors, Drilling Managers, Drilling Technical Support Personnel, Trainee Drillers, Rig Engineers, Affiliate Technical Directors, Asset Managers, Petroleum Engineers, Production Technologists, Production Personnel, Production Operators, Maintenance Supervisors, Drilling and Well Servicing Personnel, Drilling Manager, Drilling/Well Engineers, Completion and Well Service Engineers, Drilling Supervisors, Rig Manager, Drillers, Industry Personnel

## **Course Outline:**

### **Basic Well Completion Design, Practices and Strategies**

- Completion and work over operations
- Design considerations
- Reservoir considerations
- Mechanical considerations

- A wellhead provides a means of support
- Types of completions
- Reservoir completion methods
- Upper completion methods
- Examples of completion methods
- Example of well performance sensitivity to reservoir pressure
- Multiple zone single string completion
- Dual zone dual string completion
- Triple zone dual string completion
- Reservoir drive mechanism
- Sources of reservoir energy
- Well completion design
- Design considerations
- Team integration
- Data gathering
- Productivity index
- Example of an IPR curve

- Vertical lift performance
  - Well outflow and inflow systems
  - Typical vertical lift performance (VLP) for various tubing sizes
  - Matching VLP curves with an IPR curve
  - Completion design examples
  - Gas lift
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- Gas lift completion designs
  - Electrical submersible pumps
  - Y block
  - Coiled tubing deployed ESP
  - Turbine driven submersible
  - Jet pumps
  - Progressive cavity pumps
  - Beam pumps
  - Packer type gas anchor
  - Hydraulic Piston pumps
  - Reciprocating plunger pump

## **Packer Selection and Tubing Forces**

- Packers types
- Packers Generic Mechanisms
- Permanent and Retrievable Packers
- Locator Seals and Anchor Seals
- Applications for Permanent and for Retrievable Packers
  
- Setting Packers
- Dual Packers
- Compression Packers
- Tension Packers
- Inflatable Packers
- Packer Selection Process
- Packer/PBR (polished bore receptacle) or Tubing Anchor?
- Packer Selection – Which type?
- Packer Selection Process
- Packer Selection Guide – Typical Application
- Running the Completion String – Retrievable Packers

## **Wellheads, Chokes, Sub-Surface Safety Valves and Flow Control Equipment**

- Corrosion and Erosion Inflow and Tubing Performance
- Types of wellhead
- A sketch of a wellhead
- A sketch of a Christmas tree
- Single string surface production tree
- Dual string surface production tree
- Tubing hanger
- A sketch of a casing head
- Pressure testing the tree
- Production chokes
- Spool and hanger
- Tree hook – up
- Wellhead, tree and flow line
- X mas tree selection
- Tree saver

- Well integrity team
- Tubing / Annulus program
- Barrier system
- Well & tree maintenance
- Safety valve program
- Data management
- Well integrity diagnostic report
- Why is well integrity important?
- Well integrity checklist
- Attached documentation
- Well barrier envelope
- Recommendation testing

## **Well Integrity Life Cycle**

- Definition of well integrity
- Failure case history
- Surface casing failure
- Annulus pressure build up
- Well integrity management system

- Well quality
  - Risk assessment considerations for well integrity
  - Outflow potential
  - Well effluent
  - External environment
  - Application of risk assessment
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- Risk based maintenance & inspection matrix
  - Well Quality and integrity
  - External well integrity maintenance
  - Internal well integrity maintenance

### **Deviated, Multiple Zone, Subsea, Horizontal, Multilateral and HPHT Completion**

- Tubing design
- Tubing movement
- Piston effect
- Buckling effect
- Temperature effect
- Floating tubing
- Landing Conditions

- Casing failures
- What causes sand production?
- Drilling and completion requirements
- Fluid selection
- Solids free fluids
- Polymers bridging material
- Perforating
- Perforating damage
- Gravel control
- Gravel and screen selection
- Gravel sizing
- Slot sizing
- Inside gravel packing
- Open hole gravel packing

## **Sand Control**

- Sand formation properties and geology
- Why sand is produced?
- Why Sand Control Production?
- Erosion
- Sand bridging

- Placement methods
  - Hole enlargement
  - Carrier fluid concept
  - Chemical consolidation
  - Consolidated packs
  - Expandable screens
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- Expandable screens and borehole interactions
  - Expansion methods
  - Open hole gravel packs( OHGPs)
  - Cased hole gravel and frac packs
  - Choosing the appropriate method of sand control

## **Well Stimulation Methods**

- Acidizing
- Fracturing
- Acid frac

## **Wire line, Coiled Tubing and Snubbing Operations**

- Snubbing operations
- Rig assist snubbing system
- Push / pull snubbing machine
- Rig assist unit (Hydraulic)
- Well control during normal operations

- Slip operating sequence ( Light pipe running in )
- Annular BOP
- Stripping BOP sequence when running in

## **Coiled Tubing**

- Coiled tubing use
- Sand trap system
- Debris catching
- Under reaming
- Mechanical scale removal
- High pressure jet washing
- Fishing and milling
- Removing and recovering obstructions
- Cutting pipe
- Milling
- Zone isolation
- Retrievable packer
- Stimulation and fracturing

- Sand control completions
- Circulating gravel pack system
- Multi-Lateral wells drilling and completions