COURSE OVERVIEW DE0858
Underbalanced Drilling
(E-Learning Module)

Course Title
Underbalanced Drilling
(E-Learning Module)

Course Reference
DE0858

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

During the past decade, operators have steadily increased the use of underbalanced drilling (UBD) because of its many advantages. Traditional UBD methods included using air to increase the drilling rate, using aerated mud to reduce lost circulation, and using foam to clean sand from wells.

Underbalanced drilling (UBD) is the practice of drilling a well with the wellbore fluid gradient less than the natural formation gradient. It differs from conventional drilling in that the bottomhole circulating pressure is lower than the formation pressure, thereby permitting the well to flow while drilling proceeds.

As reservoir pressures decline, underbalanced drilling and workovers become an important reservoir protection procedure. So, a new wave of technological advances has propelled UBD from its traditional applications to a wider range of situations, which also heightens its value.

With the advent of horizontal drilling, UBD became important in avoiding differential sticking and protecting the reservoir from damage. The continued development of flow drilling, gaseated systems, foams, engineering equations, and better surface-control systems has made UBD a standard tool, instead of a special application.

This E-Learning course is designed to provide participants with a detailed and up-to-date overview of underbalanced drilling. It covers the underbalanced drilling technology, wellsite underbalanced drilling equipment and underbalanced drilling applications; the regulatory barriers to underbalanced drilling and the reasons for underbalanced growth; the completion techniques and the effect of skin on production rates and the various types of flow regimes; the closed loop circulation system, choke manifold, improved hole cleaning, foam drilling benefits and the common drilling problems associated with underbalanced drilling; the drilling fluid selection, operating procedures, general classifications of air drilling techniques and detection of low pressure bearing zones; and the mechanics of air drilling, other disadvantages to of air drilling, bit performance, equipment required for air drilling and air requirements.

During this course, participants will learn the aeration procedure, downhole fires & explosion, low density fluids, aerated drilling fluids and the common mud products used; the recommended equipment, air drilling equipment, equipment layout, flaring from choke manifold, dusting and volume requirements; the underbalance drilling benefits, effect of pressure differential, penetration rate and the effect of underbalanced drilling on cutting structure of roller cone bits; the formation evaluation, formation damage and temporary overbalanced, spontaneous inhibition, gravity-induced invasion and wellbore glazing; and the post-drilling damage, mechanical degradation, environmental benefits and volume requirements.

Course Objectives

Upon the successful completion of this course, participants will be able to:-

- Apply and gain an in-depth knowledge on underbalanced drilling
- Discuss underbalanced drilling technology, wellsite underbalanced drilling equipment and underbalanced drilling applications
- Identify the regulatory barriers to underbalanced drilling and the reasons for underbalanced growth
- Carryout completion techniques and recognize the effect of skin on production rates and the various types of flow regimes
- Interpret closed loop circulation system, choke manifold, improved hole cleaning, foam drilling benefits and the common drilling problems associated with underbalanced drilling
- Apply drilling fluid selection, operating procedures, general classifications of air drilling techniques and detection of low pressure bearing zones
- Minimize formation damage and discuss the mechanics of air drilling, other disadvantages to of air drilling, bit performance, equipment required for air drilling and air requirements
- Describe aeration procedure, downhole fires & explosion, low density fluids, aerated drilling fluids and the common mud products used
- Determine recommended equipment, air drilling equipment, equipment layout, flaring from choke manifold, dusting and volume requirements
- Explain underbalance drilling benefits, effect of pressure differential, penetration rate and the effect of underbalanced drilling on cutting structure of roller cone bits
- Improve formation evaluation, reduce formation damage and recognize temporary overbalanced, spontaneous inhibition, gravity-induced invasion and wellbore glazing
- Identify post-drilling damage, mechanical degradation, environmental benefits and volume requirements

Who Should Attend

This course covers systematic techniques on underbalanced drilling for drilling, petroleum and reservoir managers, superintendents, supervisors, engineers, foremen and technical field staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 1-2013 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Fee

As per proposal

Course Contents

- Introduction to Underbalanced Drilling Technology
- Introduction
- Course Description
- References
- What is UBD?
- Additional Definitions
- Why Drill Underbalanced?
- Historical Perspectives
- Wellsite UBD Equipment
- UB Drilling – Jobs
- Under-balanced Drilling in the United States
- Underbalanced Drilling Wells by Region
- Formation Pressure is Equal to Greater than Circulating Pressure
- UBD Applications
- Barriers to UB Drilling
- Regulatory Barriers to Underbalanced Drilling
- Barriers to UB

- Operators Barriers
- Operators Problems
- Reasons for UB Growth
- Technical Improvements
- Working On
- Completion Techniques
- Reasons for UB Drilling
- Effect of Skin on Production Rates
- Physical Limits to UB Drilling
- Production Limits to UB Drilling
- Types of Flow Regimes
- Fluid Phase Continuity
- Generalized “Fluid” Systems
- Control Equipment
- Rotating BOP
- Closed Loop Circulation System
- Choke Manifold
- Equipment
- Equipment – Gas Source
- Equipment – Lots More
- Air Drilling
- Air Drilling Dusting
- Air Drilling Benefits
- Air Drilling waited upon Large Portable Compression
- Misting
- Foam Drilling
- Improved Hole Cleaning
- Foam Drilling Benefits
- Gaseated or Aerated Drilling
- Aerated Fluid
- Parasite String
- Jet Sub
- Parallel Casing String
- Common Drilling Problems Associated with UBD

- Flow Drilling
- Drilling Fluid Selection
- Surface Pits
- Operating Procedures
- Mudcap Drilling
- Snub Drilling
- Closed Systems
- Other Surface Equipment
- Electromagnetic MWD Tools
- Factors Leading to Increased UBD
- Closed Loop System
- General Classifications of Air Drilling Techniques
- Advantages
- Bit Performance
- Detection of Low Pressure Bearing Zones
- Drilling through Loss of Production Zones
- Low Mud Material Cost
- Minimize Formation Damage
- Dust Drilling
- Hole Cleaning
- Particle Dynamics
- Erosion
- Corrosion Control
- Mud vs. Air
- Mud Operation
- Air Operation
- Mud-MIST Drilling
- Mechanics of Air Drilling
- Other Disadvantages to of Air Drilling
- Bit Performance
- Equipment Required for Air Drilling
- Air Requirements
- Unloading & Drying the Hole
- The Aeration Procedure

- Downhole Problems
- Downhole Fires & Explosion
- Introduction to Low Density Fluids
- Definitions
- Advantages of Air
- Disadvantages
- Air Drilling
- Aerated Drilling Fluids
- Advantages of Aerated Drilling Fluids
- Use of Aerated Fluids
- Stable Foam
- States of Aggregation of Phases
- Stiff Foam
- Preformed Stable Foam
- Mist
- Rheological Properties of Foams
- Stiff Foam Drilling
- When to Use Stiff Foam Drilling
- Advantages
- Common Mud Products Used
- Mixing Procedures
- Suggestions
- Procedures
- Recommended Equipment
- Underbalanced Directional Drilling
- Air Drilling
- Mist Drilling
- Foam Drilling
- Aerated Fluid Drilling
- Flow Drilling
- Air & Mist Drilling Advantages
- Air & Mist Drilling Disadvantages
- Downhole Fire
- Foam Drilling

- Air Drilling Equipment
- Equipment Layout
- Blooie Line
- Flaring from Choke Manifold
- Dusting
- Blowout Preventer
- Drilling with a Flare
- Downhole Equipment
- Volume Requirements
- Foam Drilling
- Foam
- Gasified Liquids
- Flow Drilling
- Drilling Fluids
- Surface Equipment
- Rotating Head versus Rotating BOP
- Closed System
- Return Line
- Separator
- Underbalance Drilling Benefits
- Increased Penetration Rate
- Chip Hold Down Effect
- Effect of Pressure Differential
- Gas Drilling vs. Mud Drilling
- Penetration Rate as a Function of the Differential Pressure
- Penetration Rate in Impermeable Rocks
- Field Example Switching from Air to Mud
- Increased Bit Life or Use Less No of Bits?
- Effect of UBD on Cutting Structure of Roller Cone Bits
- The work Done by the Bit
- The Volume of Rock Excavated per Revolution
- The Mechanical Specific Energy is Given
- What does this Mean?
- Reduced Differential Sticking

- Example
- Minimized Lost Circulation
- Improved Formation Evaluation
- Reduces Formation Damage
- Formation Damage Mechanisms during Drilling (Overbalanced)
- Formation Damage Mechanisms during Drilling (Underbalanced)
- Temporary Overbalanced
- Spontaneous Inhibition
- Gravity-induced Invasion
- Wellbore Glazing
- Post-drilling Damage
- Mechanical degradation
- Earlier Production
- Environmental Benefits
- Less Need for Stimulation
- Underbalanced Drilling (UBD)
- Air, Gas and Mist Drilling
- Volume Requirements
- Example problems