WELL CEMENTING

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**Course Overview**

This course has been written for Drilling Engineers (typically graduate level) who require an understanding of cement job planning and operations before they undertake cement job design with their cementing contractor. Understanding cementing is important as it has many functions, not least as it’s a barrier, provides support to casing and is a preventative aid regarding unwanted water production from the reservoir.

The following media during the course are used:-

1) Lectures (the Trainer began his career 35 years ago as a Drilling Engineer and has designed many cement jobs in the traditional way for land rigs, jack-ups, platforms and semi-submersibles);
2) PowerPoints (written by the Trainer);
3) Videos (particularly for Primary Cementing);
4) Digital Film;
5) Calculations & Manuals
6) Simulators (Single Stage, Two Stage, Stab-in Simulation, Liner Simulation)

Provision is also made for delegates to discuss any cementation aspect of their up-coming wells which are pertinent to their employer’s projects in order to attain success not just first time — but every time.

Reference is made to API Spec 10A: Specification for Cements & Materials for Well Cementing.

**Aims & Objectives**

By the end of the course, delegates will understand those key drivers behind good cement job design so that they are able, in conjunction with their cementing contractor, to design quality cement jobs for their well. They will also be able to select the appropriate equipment (e.g. number and type of centraliser) for their well and will be aware of the adverse effects of things like poor operational planning etc.

Consultancy services can be provided both before the course (e.g. certain wells / problems can be looked at), during the course (e.g. certain problems can be reviewed) or after the course (e.g. advice / well review) should delegates require.

**Who Should Attend**

Drilling Engineers; Senior Drilling Engineers; Drilling Supervisors; Superintendents
Your Dedicated Coach

Michael Gibson (PhD)

✿ **Overview**

- Seasoned professional with 35 years’ worldwide experience on drill-ships, semi-submersibles, tender-assist units, platforms, jack-ups and land rigs.
- Extensive experience both onshore and offshore in engineering and operations for Operators and Drilling Contractors on exploration, appraisal & development wells.
- Extensive risk assessment, advisory, planning and rig-site work experience ranging from Drilling Engineer through to Drilling Supervisor, Superintendent & Drilling Manager.

✿ **Training**

Training experience worldwide ranges across Operators, Drilling Contractors and Service Companies both in-house and public in the following areas:

- HPHT
- Stuck Pipe Prevention & Fishing
- Deepwater Well Engineering
- Deepwater Operations
- Directional Drilling
- Horizontal & Multilateral Wells
- Accelerated Drilling Programmes for Drilling Contractors
- Graduate Drilling Engineering for Operators
- Optimised Drilling Practices
- Well Planning & Engineering
- Well Construction
- Well Control (Advanced, Understanding, Deepwater & HPHT)

✿ **Consultancy**

Engineering & Operations Advisor to Operators, Drilling Contractors, Banks & Insurance Companies worldwide re Drilling & Field Development, Risk & Blowouts

- Hazard Analysis
- Offshore Operations
- Technical Advisor for HPHT Developments
- Well Control
- Technical Advisor for Deepwater Operations

✿ **Project**

- Project Manager for HPHT Field Development; Standard Field Development
- Production Optimisation
- Risk Mitigation
- Brownfield Re-development
- Deepwater
- Well Control
- Management Systems

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INTRODUCTION TO OIL / GAS WELL CEMENTS

During this introductory session you will gain an understanding of why cementation is so important on oil/gas well projects and why it’s a very specialised area. We will cover the following subject areas:-

- What is cement? How does oil/gas well cement differ from more standard (building construction) cement
- How is cement made?
- The different types of oilfield cements
- Why we use the cements that we do in the oilfield
- Why it’s so important to design an optimal cement job

INTRODUCTION TO OILFIELD CEMENT CHEMISTRY

In this section of the course we look at the definitions and the key areas associated with the following:-

- Primary Cementing
- Secondary (or remedial) Cementing
- Planning
- Common Cementing Problems
- Cement Types

WHAT ARE WE TRYING TO ACHIEVE?

In this section we discuss what we are trying to achieve as regards oilfield cementation – principally, an excellent bond with both formation and casing and top-quality hardened cement slurry between the casing and the formation.

CEMENT PROPERTIES

In this section we will review the following:-

- Yield
- Slurry Density
- Mixwater
- Thickening Time
- Compressive Strength
- Water Loss
- Permeability

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CEMENT ADDITIVES
In this section we will review the following:
- Accelerators
- Retarders
- Density Reduction
- Density Increase
- Fluid Loss Additives
- Dispersants (Friction Reducing)

CEMENT TESTING
In this section we will review the following:
- Compressive Strength
- Water Content
- Slurry Thickening Time
- Slurry Density
- Water Loss
- Rheology
- Typical Cement Test Sheet
- Typical Cement Squeeze Sheet
- Typical Cement Plug Sheet

SPACERS
In this section we will review the following:
- Why Spacers are important both in front of and behind the slurry
- The Advantages of Turbulent Flow
- The Importance of Mud Removal

EQUIPMENT
In this section we will review the following:
- Casing Shoe
- Float Collar
- Centralisers
- Scratchers
- Cement Heads
- Jet Mixers
- Liquid Additive Systems
- Latest Generation Touch-Screen Mixing Units
- Cement Plugs

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CEMENTING PRACTICES
In this section we will review the following:

- Primary Cementing
- Stage Cementing
- Inner String Cementing
- Liner Cementing
- Squeeze Cementing (High Pressure, Low Pressure, Running, Hesitation, Bradenhead, Packer Squeeze)
- Cement Plugs & Placement
- Hydrostatic Drop After a Cement Job

CEMENT JOB EVALUATION
In this section we will review how to evaluate the quality of a cement job through:

- Losses during the job
- Plug bumping (or otherwise) on the correct number of strokes
- Cement Bond Logs

CEMENT JOB CALCULATIONS
In this section we will carry out a range of calculations regarding different types of cement jobs e.g.:

- Conductor (typically 30” OD) cementation
- Surface casing (typically 20” OD) cementation
- Intermediate casing (typically 13 3/8”) cementation
- Production casing (typically 9 5/8”) cementation
- Liner (typically 7”) cementation
- Balanced plug
- Abandonment plugs
SIMULATION
We are fortunate enough to have simulators available to us for this course to help us understand operations and what’s happening down-hole. We have the following Simulators:-

- Cement Slurry Simulation / Design
- Single Stage Simulation
- Two Stage Simulation
- Stab-in Simulation
- Liner Simulation

![Example of Simulation Screen](image)

API SPEC 10A
In this section we will cover API Specification 10A: Specification for Cements and Materials for Well Cementing

BALANCED CEMENT PLUG
Balanced cement plugs are very important downhole. They are used for example for directional kick-off plugs or for abandonment plugs. The trick is to carry out the right calculations so that the plug doesn’t drop to the bottom of the hole if set off bottom.

THE IMPORTANCE OF GOOD CENTRALISATION
Good centralisation is important for good cementation. If the casing to be cemented is not centralised, then mud becomes trapped and we have a poor cement job. Ideally, stand-off should be as close to 100% as possible. The minimum stand-off as recommended by API is 67%.

![Good casing stand-off is essential.](image)
TWO STAGE CEMENTATION

Two stage cementation is utilised when fracture gradient at TD is low. The 1st stage sets, allowing the 2nd stage to be put in place courtesy of the “Bomb” and “DV Collar”. Two stages reduces the amount of hydrostatic on the weak formation.

DOWNHOLE CHALLENGES

In this section we will look at key downhole challenges which can prevent high quality cement jobs from occurring, for example:-

- Not circulating enough BU hole volume
- Leaving gelled mud downhole
- High dog-leg severity values
- Poor centralisation
- Incorrectly reported downhole temperatures
- Incorrectly reported downhole pressures
- Incorrect calculations (including pump pressure efficiency)
- Spacers not being displaced in turbulent flow
- Incorrect flow regime
- Weak formations (here we will look at Light Weight Cements)
- Subsea Plug Launchers
- Problems with Jet Mixers & remote Liquid Additive Systems

Jet Mixer (Line Drawing)
IDEAS (Independent Drilling Engineering Associates) is a thinking company. It focuses its in-depth and holistic knowledge, breadth of experience and expertise onto operators, drilling contractors and service companies’ drilling engineering and related work requirements, to provide top quality fast turnaround bespoke work packages on either an ad-hoc or long term basis, 24 hrs per day / 365 days per year, worldwide.

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Email : ________________________________________

Independent Drilling Engineering
Associates Singapore
18 Sin Ming Lane
#08-26 Midview City
Singapore 573960
Tel: +65 6659 0272
Email: info@wellideas.com
Website: www.wellideas.com

Independent Drilling Engineering
Associates Scotland
1 Mill Court
Gourdon Montrose DD10 0NL
Scotland, United Kingdom
Tel: +44 1561 360358
Email: info@wellideas.com
Website: www.wellideas.com

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