



# Practical Wellsite Petrophysics Seminar

**Tuesday 18th September 2012**  
**The Geological Society, Burlington House, London**

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## **Wellsite Petrophysics in the Context of Safe and Successful Operations**

Mike Millar, London Petrophysical Society

This one-day seminar will focus on wellsite operations, practices and techniques which can be used to fulfil well objectives and enhance the value to our companies. But prior to getting to wellsite there is the important job of planning the well.

In the oil and gas industry we are in business to find and produce hydrocarbons. The difficulty of course is knowing where to drill and how to get the hydrocarbons out and to market safely and commercially, and petrophysics plays a significant role in achieving these objectives. We are in business to make money without hurting anybody or anything. Our well planning and wellsite operations should ensure that we drill the well safely without accidents or injury to personnel, and with no damage to equipment or the environment. Also that we achieve the well objectives within the approved budget identify and mitigate against potential drilling hazards.

Petrophysics is in a unique position to be involve at every stage of the planning and execution process of drilling a well through, HSSE & objective planning; selection of measurement tools & protocols; and contractor management (LWD, wireline, core & fluids).

The Roles of Petrophysics before, during and after the well include defining the potential, designing the well, delivering the data and evaluating the results. Delivering the data is the main focus of the day, so we are going to put that into context by looking briefly at some of the things that go into planning a successful and safe wellsite operation.

Wells cost money and have associated risk and at every stage safety should be at the forefront of our decisions

## **Mud Logging's Contribution to Petrophysical Analysis**

Mark Herkommer, Geoservices, a Schlumberger Company

Mud logging is one of the oldest types of services provided at the wellsite during drilling operations, having its origins with the development of hydraulic rotary drilling systems. The information obtained by mud loggers is two-fold: geological (formation evaluation) and engineering (drilling performance). Traditional mud logging records drilling parameters, gas events, and geological description of cuttings. Technological advances in analytic chemistry, instrumentation, imaging and data processing have advanced the goals of mud logging. Newer techniques, such as extended depth of field microscopy, gamma ray measurement from cuttings, gas isotope logging, and X-Ray diffraction lead to new services that can enhance traditional mud logging and formation evaluation. Each of these technologies participates in improving the quality and accuracy of formation evaluations performed by mud loggers.

## **Coring & Core Handling: The Good the Bad and the Ugly**

Hamish Reid CorPro

It is well known that core provides the only physical measurement of reservoir characteristics. Over the past decade, advanced core handling techniques have been developed to improve core quality during acquisition, transport, analysis and storage to guarantee the success of any formation evaluation programme. This presentation aims to provide the audience with an insight into the new developments in core handling and will review the areas which urgently require development and improvement.

The overall objective of coring and core handling is to capture and retain meaningful representative data from the core. Often the companies who extract the core look at things from a drilling perspective where success is based on a fast, efficient recovery of the core which can often lead to poor data recovery. We will look at a process whereby the capture of accurate data is at the forefront of the planning process to ensure that the core is extracted, preserved and packaged correctly for maximum results in the laboratory.

Jean-Valery Garcia is Managing Director of Kirk Petrophysics, an established and leading provider of core-related wellsite, laboratory and data management services. JV has been in the industry for over 14 years and has worked on all aspects of coring from extraction to advanced handling and analysis techniques.

## **Intelligent Drilling – An Introduction to LWD Operations**

Rebecca Nye, Region Petrophysicist, Weatherford

As a whole, LWD technology has developed at an outstanding pace in the last decades, thus enabling the exploitation of data while drilling for making real-time decisions. For instance, geosteering is major product of the continuous development and improvement of LWD technologies; we can now make educated decisions in changing the wellbore trajectory depending on real-time data. The advances in LWD tools has also lead us to be able to obtain all the required data while drilling many wells, therefore reducing or even eliminating the need to run wireline or pipe conveyed wireline.

In this presentation I will discuss where LWD tools sit in the bottom-hole-assembly (BHA), how we achieve the real-time data and how the most common tools function without being wired to surface. Also, I will look at basic tool physics, applications and how LWD differs to Wireline. With so many different LWD tools now on the market the presentation will focus on a typical quad/penta combo (GR, RES, NEU/DEN, DT and FPWD).

Using examples from around the world I will also demonstrate how not to utilized LWD and how you can ensure LWD provide valuable, robust and reliable data, in real-time and from memory.

## **The Role of Professional Log QC**

Adrian Leech, Gaia Earth Sciences Ltd

**“Rubbish in, Rubbish out” – Some notes to help turn electrical measurements into useable Petrophysical estimations.**

Ian Whyte, Tullow Oil

**Abstract;**

While it may take only a few hours to acquire at wellsite, log data lives on for a very long time. A huge number of estimations and planning will be executed using this data and often the “customer” for the data will either not know how to quality control the data he/she is using or will simply have absolute faith that the data is of good quality.

The evaluations we perform on log data can only ever be of as good quality as the data itself. While it may be possible to derive log with different calibrations etc, many errors causing bad data to be acquired are not recoverable after the event. As such it is mission critical that log data be properly quality controlled at time of acquisition.

The aim of this presentation is to share some experiences of poor data being acquired, how to identify this and what could be done to correct the situation.

## **Collection and Measurements of Reservoir Fluids Properties – Today and Tomorrow**

Graeme Davidson, Schlumberger Reservoir Sampling and Analysis

Traditionally, reservoir fluid samples have been collected during DST and Open Hole operations and shipped to PVT laboratories for compositional and PVT analysis. Over the past two or 3 decades there has been increasing drive to collect samples during open hole logging operations to give an early indication of fluid properties and/or to reduce environmental impact from flaring during DST. This has led to rapid improvements in the technology and processes available for open hole sampling. Following on from these improvements analysis has moved from the lab towards the wellsite and also downhole.

The presentation covers the current state of sampling and analysis and gives an indication of what is coming. It also covers the challenges in quantifying, at an early stage, trace elements such as H<sub>2</sub>S and Mercury in the reservoir fluid, and the answers being developed to improve these measurements.

The laboratory still plays an important role in fluid analysis and characterization so ensuring the samples collected are safely packaged and transported to the lab is a critical part of the process.

## **Integrated Cased Hole Solutions Throughout the Life of a Well**

Beverley Heeley, Halliburton

Traditionally, cased hole logs were used as a diagnostic tool to evaluate wells which may be underperforming, declining in production or producing excess water. The cased hole log was typically brought in to solve the problem. In this presentation, we highlight integrated cased hole technology and applications, which should not only help maximize the wells full potential, but also help avoid 'problems' occurring altogether throughout the life of a well.

A discussion on applications will be presented which will lead to three case studies highlighting different scenarios in which cased hole logging was a vital part of the decision making. Each case study represents a different stage in the lifecycle of the well, ranging from the early stages, when the well has just been completed, through to the workover and intervention stages. Association of Pulsed Neutron and Production Logging provides early and continuing understanding of reservoir performance. Another key element is to fully understand the integrity of the casing and cement during the construction and abandonment of a well.

Through proper monitoring of the well, reservoir engineers can anticipate changes in the reservoir and in production, saving valuable time and money and thus establishing the economic justification for a proactive approach cased hole logging.

## **Wellbore Stability monitoring and prediction**

Paul Hoddinott, BG-Group

Over the past 10 years or so the importance of Geomechanics and Wellbore Stability studies to drilling wells safely and efficiently has been recognised by the oil and gas industry. Wellbore Stability analysis builds on the important work carried out by asset teams who interpret pore pressure and fracture gradient envelopes to aid drillers in the safe drilling of wells. Geomechanical models are built to incorporate all pertinent drilling data and petrophysical logs to calibrate to drilling events and well behaviour.

Pre-Drill these data are gathered from appropriate offset wells to develop a Wellbore Stability plot for determining suitable mud weights and casing depths, and for making predictions on drilling events during subsequent drilling.

During well drilling operations well and LWD/Wireline logging data is updated on the Wellbore Stability plot on a regular, ongoing basis in near to 'real time' and distributed to and discussed with asset teams and drillers to support the operation. During significant drilling events and while logging data has been acquired the geomechanical model is calibrated to these data to reflect actual drilling experience. For example, formation pressures are calibrated to the Pore Pressure profile and sonic, density and resistivity logs may be used to constrain pore pressure over mudstone intervals. Leak-off Tests (LOT) may be calibrated to the Fracture Gradient and the Collapse curve (an indicator of how UCS/rock strength relates to wellbore stresses and well trajectory) may be related to mechanical cavings and tight spots encountered while drilling.

This calibrated geomechanical model can then be used to make more accurate predictions on the well and be used for advising on recommending potential changes on mud weight and other drilling practices, to continue to drill the well in a safe and efficient manner. Drilling wells efficiently is also important to enable thorough logging data acquisition of the well to be performed. These petrophysical data are not only important to petrophysicists and subsurface teams but also to pore pressure specialists, geomechanical modellers and well engineers for planning drilling of future wells.

Post-Drill a full update is made to the geomechanical model integrating all well and logging data, and reviewing calibrations to the data. The finalised model is distributed to well teams and reviewed with lessons learned to apply to future well drilling campaigns.

At BG Group Geomechanical models are worked up by a team of specialists in the "ICE" Centre ("Interactive Collaborative Environment"). All wells being drilled around the world are monitored daily by the ICE team and mudlogging data on operated wells is monitored on a 24/7 basis.

## **Minimizing Risks Associated with Wireline Deployment**

Ian Draper, Baker Hughes

### **Abstract:**

When planning Formation Evaluation on a well a key question is should you acquire the data on Wireline or with LWD? Previous LPS seminars have addressed the advantages and disadvantages of each method, for example the Basic FE V seminar "Push or Pull" held in December 2008.

A key input into that decision is the risk of acquiring the data on Wireline. As wells have become deeper and more deviated the risk has increased. Mitigating this risk are new technologies developed by the service companies that allow wells to be logged on Wireline that would have been impossible 10 years ago.

This presentation will discuss the hazards associated with Wireline and the new technologies developed to reduce them. It will also discuss how to optimise which technologies are selected to control the cost to the operator while keeping the risk at acceptable levels.

At the end of this presentation those attending will have a basic understanding of the hazards that might be encountered during a Wireline logging job and what decisions could be taken to reduce risks on subsequent runs.

### **Biography:**

Ian Draper is a Global Account Manager at Baker Hughes responsible for Wireline Services, based in Chiswick, London.

Prior to moving to London he held various Operational and Technical positions in the Caspian, Middle East and Asia Pacific. He has over 20 years experience in Wireline logging.

Ian holds a BEng (Hons) degree in Mechanical Engineering from Imperial College and an MSc in Applied Geophysics from Birmingham University. Ian currently serves on the LPS Committee.

# **Practical, Impractical & Necessary Wellsite Petrophysics**

John Bennett, Perenco