

8-9 APRIL 2014 • HOTEL NH EUROBUILDING • MADRID



2014 SPE/IADC Managed Pressure Drilling & Underbalanced Operations CONFERENCE & EXHIBITION

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07.00 Conference Registration, Coffee Service & Open Exhibition*Madrid IV & Benelux Room***08.30 Welcome Opening & Introduction***Madrid I-III***09.00 Panel Session: On Your Mark, Get Set, Train!****Moderator: Dan Munoz, Chairman, IADC Well Control Committee; Director Special Projects (QHSE), Transocean**

In general, drilling rigs have remained unchanged for decades. With the new technology today, crews from 20 years ago would struggle to adapt to these changes. Automation controls are being utilized in place of the traditional manual controls, new methods of drilling are being advanced and the industry must hire, train and drive employees toward competency in a timely fashion, while minimizing costs and maximizing productivity.

- **Austin Johnson**, Technology Engineer, Managed Pressure Operations (SPE/IADC 168947)
- **Ryan Haggins**, Global Technical Instructor, Weatherford (SPE/IADC 168959)
- **Petar R. Radulovic**, Manager – Global Drilling Training Initiatives, Diamond Offshore Drilling, Inc.
- **Ken Smith**, Manager Dual Gradient Drilling Implementation, Chevron

10.30 Networking Break & Open Exhibition*Madrid IV & Benelux Room***11.00 Case Histories – Benefits of Underbalanced Drilling Operations****Session Chair: Shantur Tapar, Engineering Manager – MPD Products, National Oilwell Varco**

The First Application of Whole Process Underbalanced Drilling in Ultra-deep Horizontal Well in Tarim Oilfield Xue-Qing Teng, Chief Engineer-Tarim Oilfield; Pei Yang, Ning Li, PetroChina (SPE/IADC168954)

Based on the analysis of difficulties encountered by traditional overbalanced drilling methods such as serious lost circulation, horizontal wells cannot reach the design sections, serious damage to the reservoir, the feasibility analysis and construction plan of the whole process underbalanced drilling in Y block is proposed. The first whole process underbalanced drilling of horizontal wells in Tarim Oilfield was conducted and completed. Finally 6 layers of reservoirs are being discovered, the cumulative thickness is 16m, which increases the rate of oil and gas discoveries. Compared with the on-site well, the efficiency of drilling is greatly improved, no lost circulation and no complex situation encountered; the ROP increases 74% compared to the adjacent wells in the same layers.

Case Studies and Best Practices for Installation of Open Hole Multistage Completion Systems in Wells Drilled Underbalanced Daniel Snyder, Technical Sales Engineer, Brittany Miller, Lonnie Jeffers, Packers Plus Energy Services; John Bonar, Atlas Energy (SPE/IADC 168952)

Four case study situations will be covered and where open hole multistage systems were installed in underbalanced conditions and the areas in the United States where they are encountered. This presentation will present the four major types of underbalanced wells where open hole multistage completion systems have been installed: air drilled and nitrogen fractured, low bottom hole pressures, lost circulation scenarios, and those drilled underbalanced for reservoir benefits. With over 1,000 systems completed in underbalanced situations, this presentation will provide a detailed evolution of operational best practices for these wells.

12.00 Luncheon & Open Exhibition**13.30 MPD – Made Simple through Technology****Session Chair: John Kozicz, Technology Manager, Transocean**

Simplicity of New System Opens Doors for Wide Use of MPD Helio Santos, President, Paul Sonnemann, Erdem Catak, Thomas Barbato, Safe-Kick; Emmanuel Franco, Guilherme Vanni, Petrobras

The simplicity of this new MPD system opens up the possibility of MPD being used on many more wells than with current MPD systems, as the rig crew will be able to do the many of the required tasks, with the user-friendly and straightforward approach of the system, reducing the number of people needed to run an MPD job.

Fit-for-Purpose Modeling for Automation of Underbalanced Drilling Operations

Ulf Jakob Flø Aarsnes, PhD Student, Department of Engineering Cybernetics, Norwegian University of Science and Technology; Florent Di Melgio, MINES ParisTech; Ole Morten Aamoe, NTNU; Glenn Ole Kaasa, Statoil AS (SPE/IADC 168955)

Recent advances on the development of a simplified fit-for-purpose model of the distributed gas-liquid dynamics, suited for advanced control of UBD operations will be presented and the main modeling assumptions will be described. An automated calibration procedure that enables the model to retain accuracy despite its relative simplicity and the results are illustrated with a realistic case study. The simplification of the model enables real time coupling of the model with measurements. This is used to produce estimates of unmeasured quantities, such as gas distribution, and to perform reservoir characterization.

A New Continuous Flow System (CFS) for Managed Pressure Drilling

Justin Cunningham, Global Product Line Manager-Continuous Flow Systems, R.K. Bansal, Geoff George, Eisenhower DeLeon, Weatherford (SPE/IADC 168957)

Continuous circulation of drilling fluid offers many benefits including better control on downhole pressure in relation to pore and fracture pressures and wellbore cleaning. The concept of continuous circulation has been known to the industry from a long time but has gained much higher significance in recent years as monitoring and control of downhole pressure has become possible in real time. Continuous circulation provides an uninterrupted stream of data from sensors mounted downhole and on surface equipment even while making a connection thereby, never losing the site of downhole pressure.

15.00 Networking Break & Open Exhibition*Madrid IV & Benelux Room***15.30 Overcoming Operational Issues****Session Chair: Sara Shayegi, Senior Well Engineer, Shell International**

The Use of Single & Multiphase MPD Techniques on Numerous Wells and Hole Sections Have Made Possible to Drill The Un-drillable in Mexico Fields Juan Carlos Beltran, Latin America Area (LAM), DPM Engineering Manager, Corrado PM Lupo, Marcos Chavarria, Schlumberger (SPE/IADC 168949)

Single & Multiphase MPD techniques used to overcome operational problems in more than 200 HPHT, HPLT & LPHT wells in Deep reservoir, have delivered very interesting results and helped to improve the drilling camping in most of the Mexico Fields, enabling also the elimination of NPT compared to wells previously drilled conventionally.

Successfully Drilling Sidetrack # 7 With MPD/UBD Combination After Six Failed Conventional Drilling Attempts

George Medley, Executive Vice President, Bobby Elmore, Sagar Nauduri, Bob Goodwin, SIGMA Engineering Corp. (SPE/IADC 168944)

Conventional drilling methods initially utilized to drill an east Texas HPHT well are presented in this case history, ultimately failed after six attempts were made by an independent operator to drill a "straightforward" horizontal wellbore. The

subject HPHT well proved extremely challenging with reservoir BHT of 334°F and approximate 13,900 psi reservoir pressure. The well was plagued by several drilling problems including multiple well-control incidents, a casing failure, surge-swab issues, stuck pipe incidents, trip problems, directional control issues, and finally a blowout.

Case History of the First Application of Managed Pressure Drilling in the Jurassic HPHT Formations in a North Kuwait Well Mishary Al-Mudhaf, Sr. Drilling Engineer, Fayez Al-Fayez, Manoj Mishra, Salah Al-Azmi, Kuwait Oil Company

KOC has embarked on a new project to develop the high quality light oil and associated gas found in the Jurassic reservoirs of the North Kuwait oilfields. The project required the drilling of over 120 new deep wells, the majority of which are deviated or horizontal. In order to gain more information on the reservoir characterization and to try and identify if reservoir performance would be enhanced it was decided to run a trial using Managed Pressure Drilling (MPD) techniques to drill the reservoir sections. The planning, designing and implementation of this project will be discussed.

Overcoming a Challenging Narrow Window of 0.35 ppg – Successful Automated MPD & MPC Application in Offshore Malaysia – A Case History Freddy Rojas, MPD/UBD Engineering Manager, MI-SWACO, Trigu-nadi B. Setiawan, Warjanto Saikam, Lee Jin Ming, Mohammed Mousa, W. Nor Afiqah, Ahmad Zahir, Sagi V. R. Raju, PETRONAS Carigali; Dylan Richards, Andi Presetia, MI-SWACO (SPE/IADC 168945)

This program was the second attempt (well re-visit) at drilling target sands that were unable to be reached while drilling the well during the original program. The first attempt to drill the 6" hole experienced a loss-gain scenario in the first of the three sand targets which was penetrated 80m below the shoe. After many failed attempts to control the losses, it was decided to plug and abandon the 6" open hole and temporarily suspend the well. After a year of suspension, a new drilling approach of using a statically underbalanced mud weight in combination with an automated MPD system was introduced as the best solution to re-visit the program and drill the well objectives. During the planning stage, different scenarios were analyzed based on coal and sand FG and PP predictions. A thorough risk assessment was conducted prior to finalizing an MPD plan using a statically underbalanced mud while drilling, running the liner, and during managed pressure cementing.

17.30-19.00 Welcoming Reception & Open Exhibition

Madrid IV & Benelux Room

WEDNESDAY, 9 APRIL 2014

07.30 Conference Registration, Coffee Service & Open Exhibition

Madrid IV & Benelux Room

08.30 Welcome & Introduction

08.35 IADC UBO/MPD Committee Update

Martin Culen, 2014 Chair, IADC Underbalanced Operations and Managed Pressure Drilling Committee; Regional Managing Director & Training Director, Blade Energy Partners

09.00 Control the Well Before It Controls You

Session Chair: Frédéric Jacquemin, Director DGD Program, Pacific Drilling

Verification of Pore and Fracture Pressure Margins during Managed Pressure Drilling Brian Piccolo, Technology Engineer, Christian Leuchtenberg, Alex MacGregor, Managed Pressure Operations (SPE/IADC 16858)

A PDS has been developed to ascertain geo-margins and adjust wellbore pressure in order to prevent the onset of a well control event. The system is based on

the premise that a small ID choke, in parallel with an MPD choke, can induce narrow wellbore pressure oscillations while keeping average wellbore pressure constant. During this process, the PDS analyzes the relationship between flow rate and choke pressure to verify geo-margins. When wellbore pressure has neared a boundary limit, the MPD choke can be manipulated to proactively maintain a safe wellbore environment.

Addressing UBO and MPD Challenges with Wired Drillpipe David Pixton, Senior Fellow, Andrew Craig, NOV IntelliServ; Reza Asgharzadeh Shshavan, John Hedengren, Brigham Young University (SPE/IADC 168953)

Field experience with wired drillpipe in the UBO and MPD realm, including monitoring and/or dynamic control of borehole pressure during various operations will be outlined. Then improvements to the wired drillpipe system that extend its operating envelope will be presented, followed by a discussion of a novel predictive control technology based on data provided by wired drillpipe. Specific case studies will be shared from prior experience and will explore future improvements to deliver increased value.

A Case Study: First Field Application of Fully Automated Kick Detection and Control by MPD System in Western Canada Koray Kinik, MPD Field Engineer, Ferhat Gumus, Nadine Osayande, Weatherford (SPE/IADC 168948)

A brief introduction of the MPD process will be given followed by the implementation of automated early kick detection. Background information addressing a case history event from Western Canada and a technical review of the event will be made. Thereafter an in-depth investigation of the event supported by dynamic well control simulations will be presented. Under the light of the findings the presentation will be finalized by a comparison of MPD and conventional well control methods from a well control standpoint.

10.30 Networking Break & Open Exhibition

Madrid IV & Benelux Room

11.00 Benefits of MudCap Drilling

Session Chair: Mike Vander Staak, MPD/UBD Engineering Advisor Global Drilling, Hess Corporation

MudCap Drilling: New Variations, Drivers, Limitations, and Lessons Learned – Case Histories Bob Goodwin, Senior Operations Manager, Sagar Nauduri, George Medley, SIGMA Engineering Corp.; Kurt Shipley, Linn Energy (SPE/IADC 168956)

Multiple case histories of wells planned and drilled using Mud Cap Drilling variations focusing on Variations, Candidate ID, and Lessons Learned will be outlined. The ultimate goal of this work is to serve as a basic applicability and screening guide for MudCap Candidates. The MCD variations discussed are: Floating MudCap Drilling (FMCD), Pressurized MudCap Drilling (PMCD), and Dynamic MudCap Drilling (DMCD).

MPD Toolbox for Floating Drilling Units Ivar Kjøsnes, Advisor Drilling Technology, John-Morten Godhavn, Dag Ove Molde, Sturle Gaassand, Statoil; Børre Fossli, Roger Stave, AGR

The controlled mud level technology is further developed to allow for new applications of the system. By combining different technology elements, several benefits can be achieved. Introduction of riser mounted annular elements extends the use and improves the safety of the technology. Introduction of a Rotating Control Device further improves the efficiency and safety of the technology. Finally, by connecting to the choke line below the slip joint the technology can be used for riser gas handling and for safer use of drilling methods without mud return to surface such as Floating Mud Cap Drilling and Pressurized Mud Cap drilling

12.00 Luncheon & Open Exhibition

13.30 To MPD or Not, That is the Question

Session Chair: Kristin Falk, VP Engineering, Product Development & Training, AGR Enhanced Drilling

Natural Gas Recycle and Recovery UBD System Dramatically Reduces Drilling Cost and Environmental Impact Alek Ozegovic, SDS Engineering Manager – Mena, Weatherford

The reliability and the repeatability along with the engineering economic analysis for those wells successfully drilled with R&R system in western Canada will be demonstrated.

MPD Application on ERD Well in Offshore Peninsular Malaysia – Reducing Cyclical Fatigue Forces Across the Weak Formations by Managing the ECD Intan Azian A. Aziz, Drilling Manager, Mahzan B. Mohamad, Firdaus B. Sapidihi, M. Syafeeq, B. Ebining Amir, Le Van Hung, Petronas; Freddy Rojas, Jose Tang, Dylan Richards, Irwan Rubianto, Edwin Brahmanto, Schlumberger (SPE/IADC 168951)

MPD was introduced in this well to reduce the cyclical fatigue forces across the weak formations by maintaining the BHP constant at all times. The well was successfully drilled with lower MW and was able to achieve high flow rates and eventually improved the hole-cleaning. The MW was designed 2ppg's below the wellbore stability point while the ECD was maintained between 0.3ppg window during entire drilling and tripping operations. Scheduled MPD rollover from light to heavy MW and vice-versa were followed in order to maintain ECD within the pre-established window. This paper aims to elaborate the application of Automated MPD on this specific ERD case from conceptual, planning to finally execution. Also, it is intended to share the challenges observed and mitigations taken during the execution phase.

Experiences from 1st Use of Pumped Riser Technology Gjertrud Skaar, Principal Researcher, Dag Ove Molde, John-Morten Godhavn, Per Christian Stenshorne, Kjell Rune Toftevåg, Statoil

Experiences with technology qualification and first use will be presented. The first use is planned Q4 2013/Q1 2014 at a depleted field offshore Norway, where the purpose is to reduce downhole pressure while drilling by reducing the mud level in the marine drilling riser in order to mitigate losses. A drilling rig has been modified to prepare for the pumped riser application.

Planning Managed Pressure Drilling with Two-Phase Fluid in a Depleted Reservoir Saad Saeed, GBA-Regional Manager (ESSA), Mark Juskiw, Isabel Poletzky, Halliburton; Martyn Parker, TAQA (SPE/IADC 168946)

The Bergermeer Rotliegend sandstone reservoir has been depleted by production. This has substantially reduced reservoir pore pressure and well deliverability. Pressure depletion has been accompanied by a decrease in minimum in-situ stress, resulting in a substantially sub-hydrostatic drilling fluid density required to enable drilling. As a result, Managed Pressure Drilling (MPD) using two-phase fluid has been chosen as the enabling technology for drilling and completing initial wells for the Bergermeer Gas Storage Project. This paper documents the key planning considerations required to drill and complete a highly depleted reservoir using two-phase MPD techniques.

15.30 Networking Break & Open Exhibition

Madrid IV & Benelux Room

16.00 MPD – A Look Into the Future

Session Chair: Brian Grayson, GPLM Secure Drilling Services, Weatherford

Riser Isolation Device for MPD on Floating Drilling Units Roger Stave, Senior Technology Advisor, AGR Enhanced Drilling; Ivar Kjøsnes, Statoil

A new Demo 2000 development project has been started where the aim is to develop a specially configured Riser Isolation Device. The Riser Isolation Device is a simple and robust "choke" that can be used within a Marine Drilling Riser in combination with a subsea mud pump that generates and controls a differential pressure across the "choke". This Riser Isolation Device will enable managing ECD and bottom-hole pressure on floating drilling units. Initial engineering and testing results will be presented.

Field Trials of a New Continuous Circulation Sub Jim Weir, Mechanical R&D Engineer, Shantur Tapar, National Oilwell Varco

There is an increasing need to drill difficult reservoirs in a cost effective way. Managed Pressure Drilling (MPD) is one of the techniques that have allowed access to a significant number of challenging reservoirs. Over the past few years MPD has made it possible to drill wells which have narrow pore and fracture pressure gradients. The full-scale proof of concept testing and field trials of a new approach to a side-entry sub system for continuous circulation will be presented.

17.00 Adjournment

Unassigned Papers of Note: The following paper proposals will be included in the conference if a scheduled paper becomes unavailable. In addition, these presentations will be made available in the SPE/IADC conference proceedings, should the author so desire.

Dual Gradient Screening Tool: Depth Ratio (DRx) Matrix Method Sagar Nauduri Drilling Engineer – MPD Specialist, Kent Fortney, George Medley, Shifeng Tian, SIGNA Engineering Corp. (SPE/IADC 168950)

Depth Ratio Matrix Method or "DRx Tool" was developed as a simple screening tool for Dual Gradient Drilling applications based on evaluating multiple pressure profiles for DGD. The DRx tool with the "pDRx matrix" serves as a quick and easy evaluation guide for any potential DGD application. This can help evaluate both normal gradient drilling and pressure regression profile applications.

A Simple Transient Flow Model for MPD and UBD Applications John Emeka Udegbunam, Research Fellow, Kjell Kåre Fjelde, Steinar Evje, Gerhard Nygård, University of Stavanger (SPE/IADC 168960)

An introduction or background information to the work will be presented. This will be followed by description of the work flow, showing the transient modeling process and how the numerical scheme can be used for well control procedures. The result section will contain presentation and interpretation of the model predictions for managed pressure drilling, under-balanced operations and dual gradient drilling. Finally, a summary or conclusion of the work will be presented.

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Padre Damián 23, 28036 Madrid, Spain
Phone +34 91 353 73 37 • Fax +34 91 353 00 17
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- Emerson Process Management
- Expro
- M-I Swaco
- Managed Pressure Operations
- National Oilwell Varco
- Pruitt Rotating Control Devices
- Safekick
- Strata Energy Services
- Weatherford
- The Well Academy
- Wild Well Control

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