Paper abstracts by our members

New Horizons — Iran welcoming the Norwegian companies

Gullfaks 4D — Matching pressure and production history
The new 2016-2017 SPE Norway season has started. A lot has happened in the past season and despite of the continuous low oil prices, our optimism is still high. We are here to tell you about exciting SPE programmes over Norway, to share experts’ experiences and just to inform you about interesting stories in the Oil&Gas from all over the world. We are very excited that SPE President is contributing to our magazine. D. Nathan Meehan tells us about SPE today and his Norwegian connections. Thank you for this! We would like to thank all of the authors for sharing their experience with SPE Norway.

Two of our sections received awards — SPE Oslo 2016 President’s Award for Section Excellence and SPE Northern Norway 2016 SPE Gold Standard. Congratulations!!! We wish all sections, SPE members and followers a pleasant and productive 2016-2017 season! Enjoy your reading and don’t forget to send us feedback!

On behalf of "The First" editorial team,
Vita Kalashnikova

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SPE President — D. Nathan Meehan

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Iran is welcoming Norwegian companies
by Vita Kalashnikova

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The most valuable commodity on Wall Street: Information
by Per Fossan-Winge, Director, PricewaterhouseCoopers

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The electronic version of this issue and previous issues are available on SPE Norway websites.

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The First is SPE Norway Regional publication and is distributed to a multidisciplinary audience. Circulation: 200 printed copies, 4,500 electronic copies

The editorial team takes no responsibility for accuracy or content of the articles provided. Technical articles, professional overviews and SPE section news have no editorial fee.

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The First

Through Tubing Acoustic Logging for Well Integrity and Flow Allocation

by Rita-Michel Greiss and Chris Rodger, TGT Oilfield Services

Introduction
In the ever-growing competitive market place in today’s oil and gas industry, operators are proactively exploring new and improved means of working in a smarter manner and reducing costs. Within this challenging higher priced environment the health of the well is critical for sustained production and maximizing recovery as we seek to exploit ever more difficult reservoirs. The ability to be able to key behind casing promptly and accurately identifying well integrity and reservoir issues is fundamental in making smarter business decisions to ensure longevity of field life and optimal sustainable production performance.

This article explores some of the challenges of Well Integrity and Reservoir Flow Allocation facing the industry and how the combination of sonic and temperature logging can provide Oil and Gas professionals with additional information to make informed well decisions.

Well Integrity

Integrity remains at the forefront of well safety throughout the well’s lifecycle from drilling through to latter stages of plug-back, abandonment and decommissioning. The basis of well and completion integrity not only encompasses safety, but also the overall productivity of reservoir and well performance.

Several well integrity studies and surveys conducted in Norway over the years have revealed that the industry needs to revise its philosophy on barrier integrity. Barrier control is an important health, safety, and environment (HSE) factor, critical in avoiding major incidents caused by completion component leaks or during loss of well control situations. Monitoring isolation and running diagnostics when signs of failure manifest are essential for maintenance of a healthy well and production strategy. While conventional spinners and temperature logging can assess first barrier leaks, there is a technology gap for measuring leaks occurring behind first barrier or for identifying fluid movement between production / injection zones that should be isolated. Fluid can move between such zones via cement channels, bypassing packers or through the formation itself.

Spectral Noise Logging for Well Integrity

The latest generation of high bandwidth, high definition Spectral Noise Logging (SNL-HD) provides unprecedented investigation into the isolating status of completion components, identifying previously undetectable failures in tubing, GLM, SSD, packers and casing leaks. Combining noise logging with temperature logging allows identification of various well component failures, diagnosing critical elements such as the source of sustained annuli pressure (SAP), and identifying complex or multiple annuli communications. The Spectral Noise Log (SNAL) log combined with a temperature log provides the engineer with substantial information on the acoustic pattern of flow within the well. A typical SNL log gives the well engineer a plot of the noise spectrum and intensity with depth indicating behind casing fluid flows, leaks and annulus communications. (See case study below – figure 1.)

Well integrity Case Study – B Annulus Pressure.

In the example below, it was observed by the engineer that there was gas build up in the B Annulus, which resulted in measured surface pressure of 65 psi. TGT Oilfield Services were contacted and requested by the Operator to investigate and identify the source of gas contributing to this casing pressure that was observed at the surface. An integrated well survey including High Precision Temperature (HPT) Logging and Spectral Noise Logging (SNL) was developed to investigate this. The following results were as follows:

Two sources of gas were observed from noise under shut in conditions at depths X7268 to X7524 and X7621 to X7808 (figure 1, shut-in panel)

- Bleed-off survey (figure 1, Bleed-Off SNL Panel), indicated upward movement of gas from the two gas-bearing zones.
- 'Channelling' noise was observed from the source of gas to the shoe, followed by lower frequency noise as the gas travels between the 13 3/8 in and 9 5/8 in casing to surface. Temperature profile gradient change indicates the source of the gas entering the B Annulus.

Reservoir Flow Allocation

Reservoir management is a complex process, with many challenges associated with uncertainties in reservoir dynamics, such as flow allocation and accurate material balance.

SPE 112533 Well – Integrity Issues Offshore Norway, 2008
5 SPE 163993 Leak Detection by Temperature and Noise Logging
6 SPE 161712 Innovative Noise and High Precision Temperature Logging Tool for Diagnosing Complex Well Problems
7 SPE 171251 – Identification of Behind-Casing Flowing Reservoir Intervals by the Integrated High-Precision Temperature and Spectral Noise Logging Techniques (2013)
8 SPE 177166-MI – Integrated Formation Micro-Imager (FMI) and Spectral Noise Logging (SNL) for the Study of Fracturing in Carbonate Reservoirs (2015)
Summary and Conclusion

Evidently the changing economic landscape has and will continue to force the oil and gas industry and related businesses to explore the full advantage of the technological tools available and their importance under various applications to address industry issues. As can be clearly concluded proper well integrity monitoring is paramount in preventing failures and accidents at wellsite.

TGT highly effective leak detection methodology of combining High Precision Temperature and Spectral Noise Logging (HPT-SNL) can monitor processes behind the casing, enabling and ensuring identification of leaks in the tubing, casing and cement. This same technology of the HPT-SNL, utilised in a different application and mode, can aid in reservoir flow description revealing insightful information such as: source of water breakthrough, identification of thief zones, and identification of bypassed oil and additional revenue.

The addition of Spectral Noise Logging aids in the understanding of the true inflow profiles of producer wells and injection profiles of injector wells operating in an asset, information that is critical for production technologists, well integrity engineers, reservoir engineers and petrophysicists alike.