GMN technical meeting - meeting details

Major Topic: **Real time Pore Pressure Prediction** *(75% focus)*
Minor Topic: **XLOTs** *(25% focus)*

Start: 09:30 29 November 2018
Finish: 14:00 30 November 2018

Venue: Repsol Exploracion S.A., Mendez Álvaro,44, 28045-MADRID

Host: Repsol Exploracion S.A

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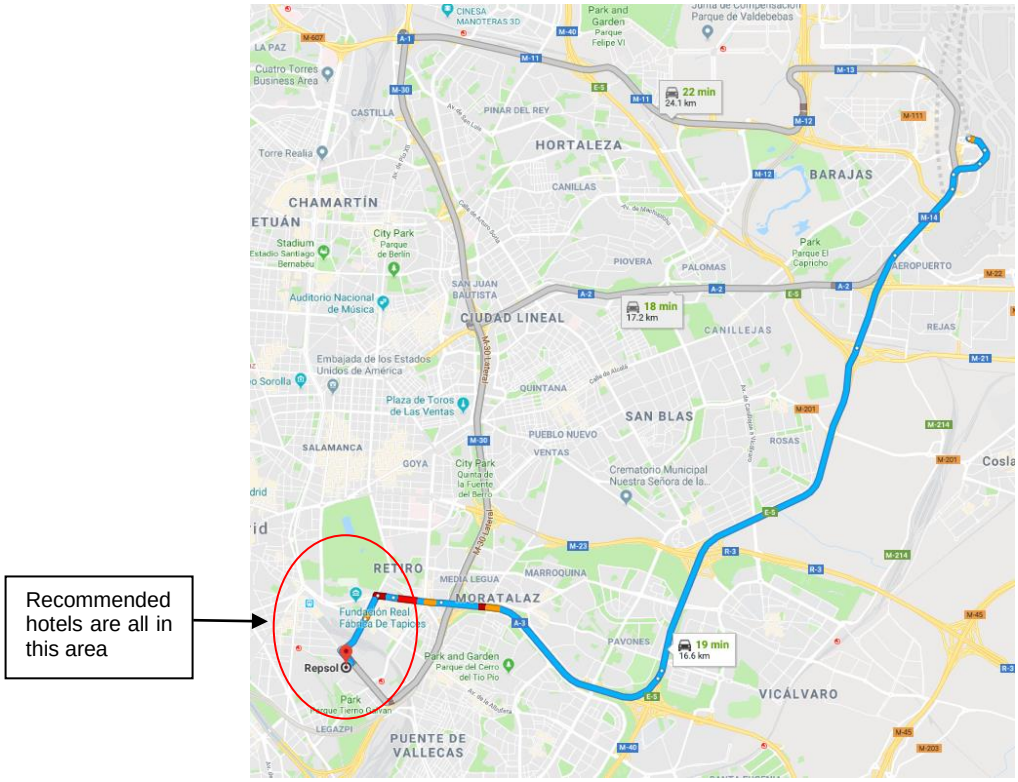
Hotels: https://goo.gl/maps/bUmuffZnohK2

Hotel Rafael. https://goo.gl/maps/HMrTJJ7WHUq - approx £107 per night
AC Attocha: https://goo.gl/maps/4KTBfKbJWdT2 - approx £128 per night
NH Attocha: https://goo.gl/maps/UJHJVpV2nX72 - approx £103 per night
NH Paseo del Prado: https://goo.gl/maps/6DbJSARmQnA2 - approx £156 per night

Note: The NH Paseo del Prado comes highly recommended by our host; the nearby Ritz is currently undergoing refurbishments

Dinner - Thursday: **TBC**. Please advise OTM in advance of any dietary requirements

Travel to Meeting:



Thursday 29th November			
Arrival with tea/ coffee			*09.30*
1	Safety notice	Repsol	10.00
2	Welcome and objectives for the meeting	Debbie McIntosh, OTM	10.05
3	Introductions	All	10.15
4	Real-time Pore Pressure Prediction in Total	Total, Matt Dougherty	10:30
5	Real Time Pore Pressure Prediction	Woodside, David Tassone	11.00
Tea/ Coffee			*11.30*
6	Managing geological uncertainty and the lower for longer world	Shell	11.50
7	PPFG Monitoring while drilling and model updating: Two case histories	Eni, Giulia Gallino	12.20
Lunch at venue			*12.50*
8	Question session on Pore Pressure/XLOTS	Repsol	13.35
9	Real-time pressure detection: Have there been any significant improvements over the last 10 years?	Nexen, Stephan Petmecky	13.50
10	Pore pressure detection using RT methods, a case study: Verification of pre-drill model with onsite observations	OMV, Oliver Knoop	14.20
Tea/ Coffee			*14.50*
11	Guest Speaker	Mike McLean	15:10
12	Breakout discussions on topics brought out during Mike McLean presentation	Group discussions / All	15.55
End of day 1			*17.00*
Dinner			*19.00*

Friday, 30th November			
Arrival with tea/ coffee			*08.30*
13	Real time pore pressure detection – the value of data is greater than its cost	Repsol, Toby Harrold	08.50
14	Enhanced engagement for a more rewarding Real Time Pore Pressure (RTPP) experience. Short XLOT presentation.	Tullow Oil, Benjamin Quaillet	09.20
15	XLOT procedures	OMV, Mira Persaud	09.50
Tea/ Coffee			*10.20*
16	How XLOTs can reduce uncertainty	Wintershall, Georg Roser	10.40
17	XLOT: Casing/liner shoe integrity testing – who is actually responsible	Nexen, Stephan Petmecky	11.10
18	Roundtable discussion / discussion on questions from Day 1	Group Discussion	11.30
19	Meeting wrap up to include discussion on: • Additional members • Future topics • Host for next meeting • GMN administration Any follow-up action as a result of the meeting	Debbie McIntosh, OTM All	12.30
Lunch at venue			*13.00*
End of Day 2			*14.00*

Attendees for GMN Meeting

	Company	First Name	Last Name
1	Eni S.p.A	Pamela	Tempone
2	Eni S.p.A	Giulia	Gallino
3	Nexen Petroleum UK Ltd	Stephan	Petmecky
4	OMV Exploration & Production	Oliver	Knoop
5	OMV Exploration & Production	Mira	Persaud
6	OTM Consulting	Debbie	McIntosh
7	Repsol	Toby	Harrold
8	Repsol	Pascal	Rouille
9	Repsol	Marius	Tilita
10	Repsol	Harald	Stockhausen
11	Repsol	Germán	Saceda
12	Repsol	Juan Manuel	Jimenez
13	Repsol	Sara	Martinez
14	Repsol	Mark	Hafle
15	Shell	Dean	Thorpe
16	Shell	Tom	Sinclair
17	Total E&P	Matthew	Dougherty
18	Tullow Oil	Benjamin	Quaillet
19	Wintershall Holding GmbH	Georg	Röser
20	Woodside Energy Limited (Remote)	David	Tassone
21	Independent Pore Pressure & Geomechanics Specialist	Mike	McLean

Apologies

	Company	First Name	Last Name
1	Total E&P UK Ltd	Garath	Yardley

Topic

Two topics are planned for the next Geopressure Management Meeting. Members may choose to talk on either or both topics depending on their experience. The breadth of these topics is to give all companies the opportunity to contribute.

The main discussion topic for the meeting (which is expected to take up around 75% of the time) is:

Real time Pore Pressure Prediction

1. Introduction

Real time pore pressure is a key part of the role of pore pressure specialists but is often far more uncertain than post drill studies where final data is available and is more critical when operational decisions need to be made. This session is aimed at sharing best practices from both the office and at rig site to impact the interpretation and decision making. There are a number of elements that people can discuss that would be helpful for all attendees:

1) Expectations of a real time PPFG service:
    a. Within the company: From pore pressure specialists, from G&G teams and drilling teams executing the wells as well as the wider exploration community
    b. From external contractors delivering the service at rig site or remote
    c. From partner oil companies in the operations
2) Company practices in following wells. What type of setup do different operators use and what has been most effective?
    a. 24hr real time at rig site
    b. Relevant time from office / rig site for key sections
    c. Daily follow up / on demand service
    d. Extended mud logging service
    e. Internally resourced studies
    f. Real time operations centres
3) Roles and responsibilities: How rigorous are we in defining these prior to drilling? Are specific contacts from other teams identified? Any specialist training before operations?
4) Software and data streaming solutions: How are practitioners getting their data and what platforms are they using for following? How does this integrate with the drilling / G&G software?
5) What data do people focus on? Sonic, resistivity, gas? How do teams integrate the drilling parameter data? Any success in more complicated analysis vs simple breaking of trends to match gas response?
6) Key case studies where Real Time PPFG has been successful and helped execution in terms of safety and money saved.

XLOTs

2. Introduction

Extended LOT´s are very important in getting good estimates of minimum stress in wells to define the fracture gradient, kick tolerance, safe drilling and future well planning on a prospect / basin. They are not performed as often as we would like so this session would be to discuss:

1) How often practitioners are getting them done? How difficult is it to persuade people to perform them? What are the best approaches to getting the project team to buy into the value of performing them?
2) Why are drillers reticent to performing them? Repsol will bring a friendly driller who can comment here but if others have success stories, this would be great.
3) Do we have a standard procedure for performing the XLOT or does it vary between operators? Do we need a Standard?
4) How do we go about interpretation? Does anyone perform specific analysis to explain the regular anomalous build-up curves? How do people address the fact that the plan is normally to report a value as soon as possible and resume drilling? Does anyone repeat their tests if uncertain?
5) Case studies showing interesting / insightful LOT´s and how they impacted operations.

3. Presentations

Each company is asked to prepare slides for approximately 30 minutes of presentation and 10 minutes for Q&A.

As witnessed at previous meetings, the demographic of the group continues to evolve and with this we politely request that presentations are sourced from each company's global resource pool and not only from the North Sea (unless of course your company only holds North Sea acreage). The meeting is a technical forum and these presentations are intended to provide a background to stimulate the discussion period. Please ensure you include case studies; and come armed with company and other industry experiences, to bring the lessons learnt and best practices to life more effectively.

4. Organisation

Please advise OTM who will be attending if you have not done so already, as there is a limit on numbers in the reserved meeting room.

We also need to know if you require remote access (teleconference/ videoconference) to the meeting including all names of those who wish to attend remotely.

5. Abstracts

Pages 7 onwards

5.1 Real-time Pore Pressure Prediction

Matt Dougherty, Total

Pore pressure prediction and monitoring whilst drilling is critical to safe drilling operations, and the economy of a well. As such, in Total, a strong focus is placed on the methodology used to assess formation pressures in real-time. As compaction disequilibrium is generally the key mechanism for overpressure in the regions Total operates, Eaton is the preferred methodology for shale pressure prediction. The magnitude of the pressures encountered are calibrated using gas, mud and drilling indicators in real-time, supplemented where possible with data from formation pressure while drilling. Estimations of pressures within the reservoir are driven by the geological model and calibrated in real-time using the more empirical methods already mentioned; gas, FPWD, etc.
Real-time pore pressure follow-up while drilling is common place in Total, and as such there is a wealth of experience to draw from. Well 'X' is an example of such a well whereby significant uncertainty existed pre-drill, and the identification of which pressure scenario was present was critical to way forward in terms of drilling strategy, and ultimately cost.

Giulia Gallino, Eni

The PPFG monitoring while drilling constantly deals with uncertainty.
The first uncertainty is related to the prediction model (in terms of reliability of the interval velocity data, assumptions about relationship with the offset wells, as well as the calibration parameters for PPFG conversion).
The second is linked to the events and logs recorded while drilling, which have to be integrated with gas readings, cuttings and drilling parameters. The most common logs recorded while drilling (like GR, resistivity, sonic and formation pressure measurement) need to be QC in order to assess their reliability.
The third is related to the data elaboration and PPFG calculation (shale point selection, log curve filtering effects that can produce misleading results if compared with the trend at well scale) and to the assumption of pressure equilibrium/disequilibrium between shales and sands.
All of these uncertainties make the difference between the PPFG monitoring while drilling and a post drilling PPFG evaluation, when the whole dataset down to the well TD is available.
The presentation deals with all the mentioned uncertainties, by describing two cases of PPFG monitoring while drilling. The former considers a deep water well in Cenozoic sediments (Oligocene-Miocene) characterized by a so narrow mud window that made mandatory the use of MPD (Manage Pressure Drilling). The latter concerns a shallow water well drilled at the edge of a shelf, in young (Miocene) clastic sediments with few reference wells for the deepest targets and high uncertainty associated with the pressure regime of the area.

Stephan Petmecky, Nexen

Real-time pressure detection: Have there been any significant improvements over the last 10 years?:
The presentation briefly summarizes key real-time pressure detection methodologies and possible changes in their application over the last 10 years. It also assesses whether truly new technologies have recently been introduced and how they might have impacted pressure detection work.
A closer look will be taken at Managed Pressure Drilling (MPD) approaches. Its advantages and (possible) disadvantages will be discussed based on recent experiences from an HPHT well in the North Sea.
Time permitting, the challenges regarding the selection of real-time PPFG service providers, which should provide high quality and experienced off-shore personnel, will be described.

Oliver Knoop, OMV

Pore pressure detection using RT methods, a case study: Verification of pre-drill model with onsite observations .
O. Knoop* (OMV), R. Knezevic (OMV), A. Hollerer (OMV), Th. Kühn (OMV), A. Meledeth (OMV)
SUMMARY of extended abstract:

An approach to overpressure prediction is described applicable for in-field appraisal and near-field exploration drilling. Given the tight economic environments, besides the standard methods for pore pressure monitoring (logging-while-drilling measurements, e.g. acoustic, resistivity, density) there are numerous other observations which can be made by technical staff at the drilling site.

This work describes how a pore pressure model, built from relevant offset wells having similar overpressure, performs when well-established theories are applied to it. Each of these methods is rated for the individual field/reservoir, and the ability to sum up to a “level of awareness/likelihood” when approaching a possible overpressured zone.

This case study is based on the exploration leg of a production well that drilled into an over -pressured compartment that led to a well-control situation with significant non-productive-time (NPT). Data analysis performed after well reached its total depth showed that the overpressure was already “visible” approximately 150 m above the actual kick-depth with increasing clarity. Increasing hints highlighted and added up to the probability of overpressure up to 50 m ahead of the eventual kick-depth (Figures 3 & 4).

Using full logging data-set allows the identification of the transition-zone and the evolving overpressure. Using acoustic, resistivity and density data, a pore-pressure model was generated (Eaton- and Equivalent-depth method). This pore-pressure model was then validated with available drilling data and mudlogging observations.

The abstract shows some data examples, representative for two different fields (7 wells) analyzed. Selected examples of field data are matched with the referring theory (see Figures 1-4).

For clarification, the area of the transition zone is marked red. The section in green marks the area of the well where first signs of overpressure appeared, but remained misinterpreted, likely due to the similarity with the reservoir section previously drilled (marked in yellow).

In addition to the below examples, at least 2 more case-studies will be presented in which these techniques were applied and successfully implemented, using both, drilling-parameters as well as LWD-data (Resistivity & Acoustic).

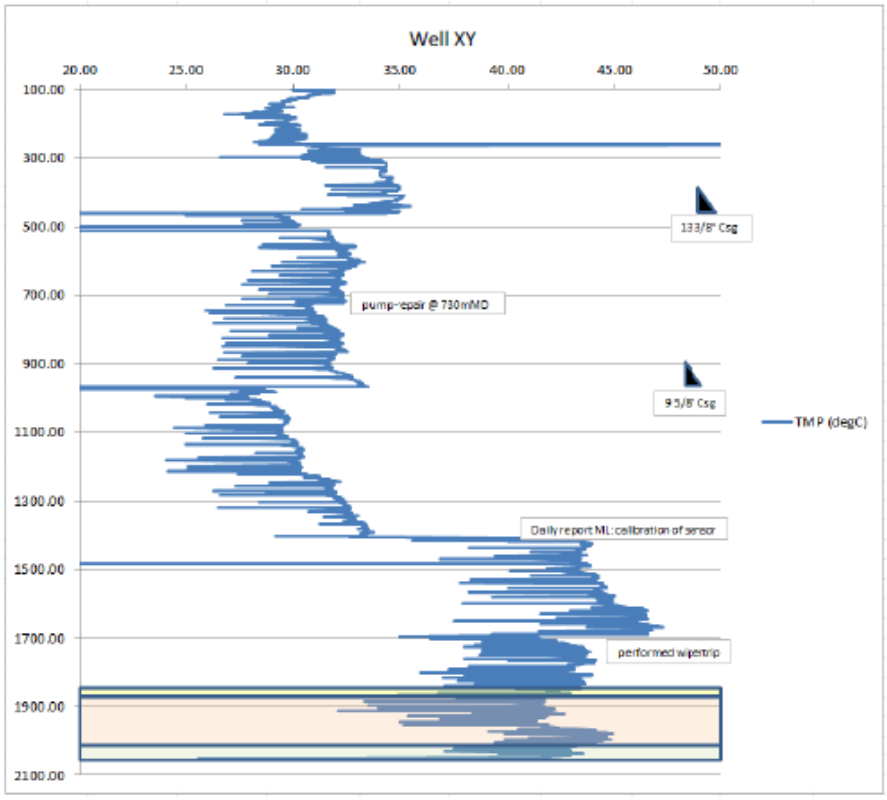


Figure 1: Full temperature data with cross-checked events from e.g. daily reports and casing-setting depths.

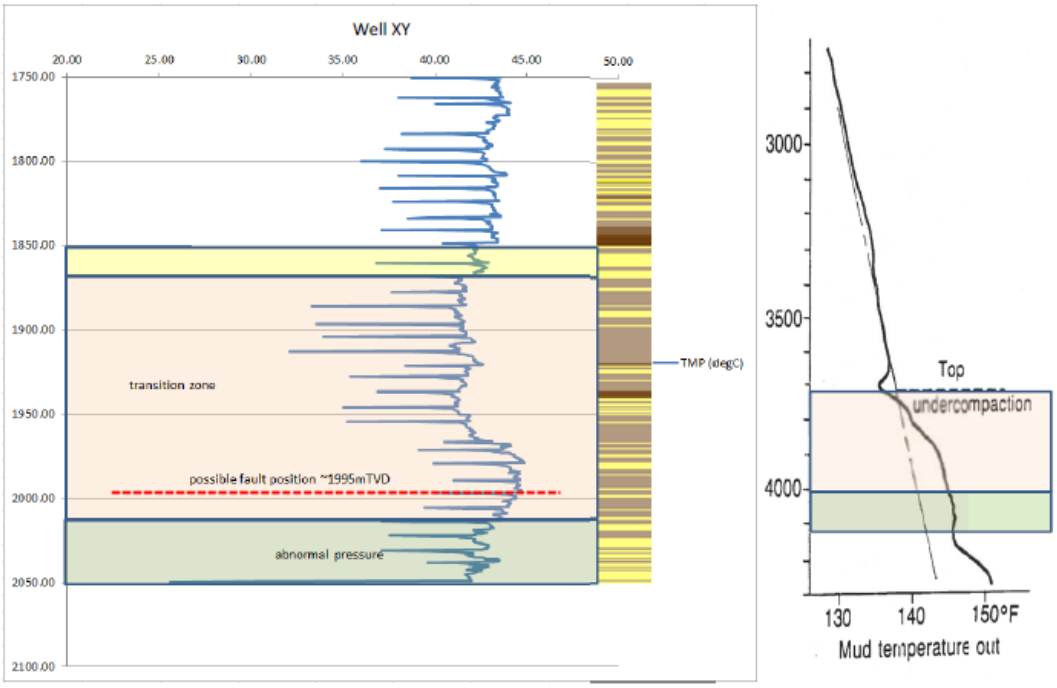


Figure 2: Deviation from normal temperature gradient (not referring to any surface events) visible within area of interest and related established theory. Green area is shifted in comparison to theoretical behavior due to compartmentalization (Fault @ red line, specific fault related feature)

In addition all available data was analyzed with regards to the behavior in the area of interest (see Figures 3&4).

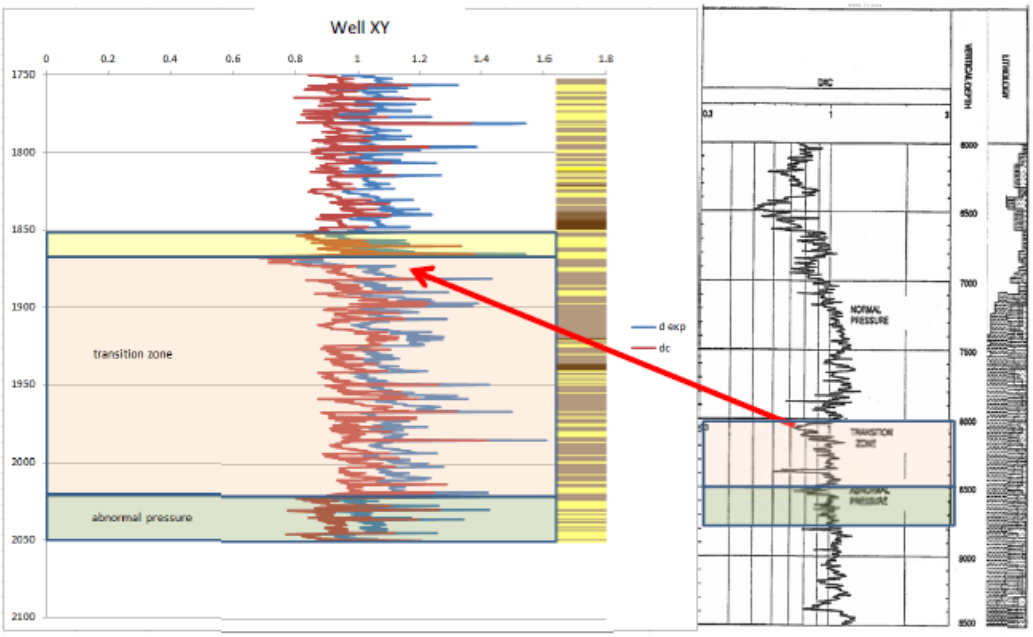


Figure 3: Area of interest with regards to Dexp/Dc and the related established theory (Rehm B and McClendon, 1971)

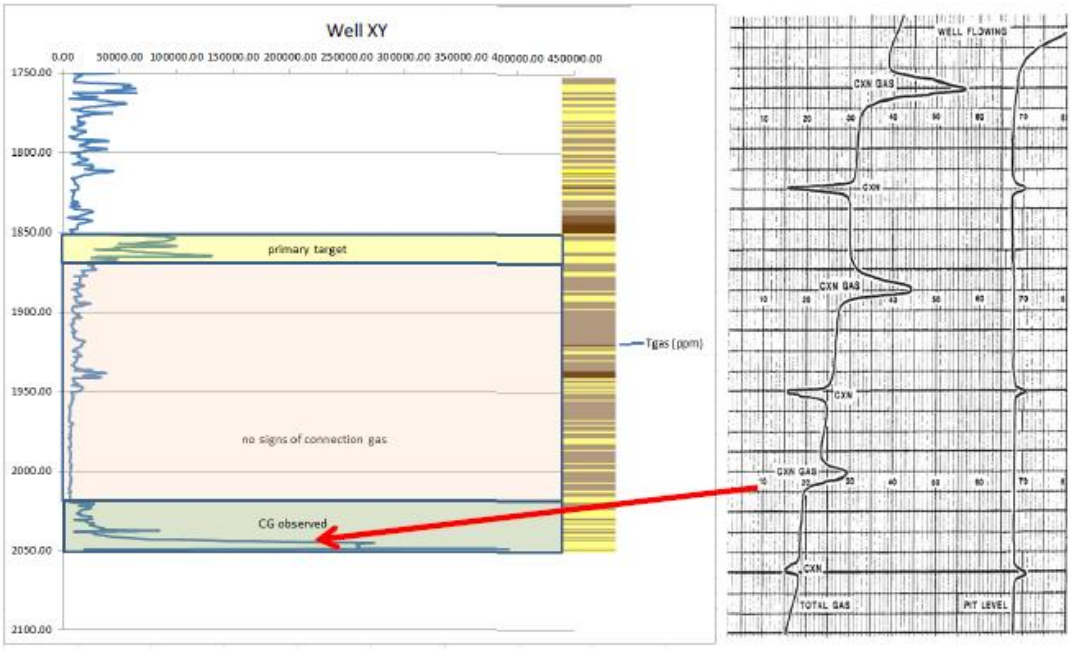


Figure 4: Area of interest with regards to connection-gas and the related established theory

Conclusion:
Describing the field-related “behavior” with regards to approaching of an overpressured zone, it becomes possible to create a paradigm-catalogue which helps to avoid well-control situations for this region/field during field-development drilling.

References:
Eaton, B. A. (1972). The Effect of Overburden Stress on Geopressure Prediction from Well Logs. Society of Petroleum Engineers. doi:10.2118/3719-PA
Hottmann, C. E., & Johnson, R. K. (1965). Estimation of Formation Pressures from Log-Derived Shale Properties. Society of Petroleum Engineers. doi:10.2118/1110-PA
Rehm B and McClendon R (1971). Measurement of formation pressures from drilling data SPE 3601, AIME Annual Fall Meeting, New Orleans.

Benjamin Quaillet, Tullow Oil

Nowadays, with the telecommunications and computer processing boom RTPP is a given for oil companies, but the landscape has changed in the last decades…
Companies providing RTPP are still around of course; more than ever actually, with cleverer software, enormous data handling capabilities and integrated services; but at the end of the day this safety critical element remains the full responsibility of the operator and the drilling partnership whatever the level of service purchased. Over the years Tullow has tried to take on a more active and responsible approach to get the most value out of the RTPP services whilst staying in control. Pre-drill, Tullow engages with the RTPP provider to offer them asset knowledge, geological models and well execution plans to try and avoid an incorrect or “off course” RTPP prediction. During execution, Tullow PP experts often shadow the RTPP provider making sure they understand how the RTPP prognosis is being generated. The Tullow PPFG focal point engages with the RTPP provider and all the other stakeholders in the execution phase thus making the most of the vast amounts of real-time data being gathered and the technical knowledge available around the table to deliver guidance or take appropriate PPFG related decisions.

Toby Harrold, Repsol

As pore pressure practitioners we are often required to deliver pore pressure and fracture gradient estimations when a well is in a delicate condition and difficult decisions must be made. When this happens, sometimes we find ourselves without the data to reduce the uncertainties to an acceptable limit as cost pressure/hole conditions have removed LWD or rig site services. We present three cases where the value of data has been successfully argued to understand the pore pressure & fracture gradient and allow correct decisions to be taken. The aim is to share success stories but also to learn where others have gathered specific data to solve complex problems.

5.2 XLOTS

Mira Persaud, OMV

In the past, OMV has mostly measured formation integrity tests (FITs) and leak-off tests (LOTs). Since there is now more need for geomechanical assessments and the characterisation of the regional stresses, for example for caprock integrity studies, more and more extended leak-off tests (XLOTs) are being performed. As a part of this, OMV is developing standardised procedures for XLOTs in permeable and impermeable formations. We will present parts of the workflows and procedures and show some examples of existing XLOTs.

George Roser, Wintershall

How XLOTs can reduce uncertainty: Drilling wells has become a lot more complicated nowadays. Obstacles like depletion, more complex reservoirs, and, seemingly contradictorily, cost savings measures drive complexity of wells drilled today. Geomechanics studies are being included more and more often during well planning. However, there is still an unbalance between the wish for such studies and the willingness to spend money on relevant data acquisition. Even today, extended Leak-off tests (XLOT) are rarely performed in the Oil and Gas Industry. Concerns about creating a fracture in the wellbore on purpose usually supersede the positive effects of gathering valuable rock mechanical data. This talk is aiming to give a short overview about the nature of the XLOT and the differences to more commonly performed LOTs and FITs. Examples from the Wintershall world are shown on how missing XLOT data increases uncertainties in PPFG studies and how including XLOTs can help to considerably reduce both, these uncertainties and risk during drilling operations.

Stephan Petmecky, Nexen

Casing/liner shoe integrity testing – who is actually responsible?: Recent examples of shoe tests will be presented to discuss improvement opportunities regarding test planning, execution, interpretation and reporting.