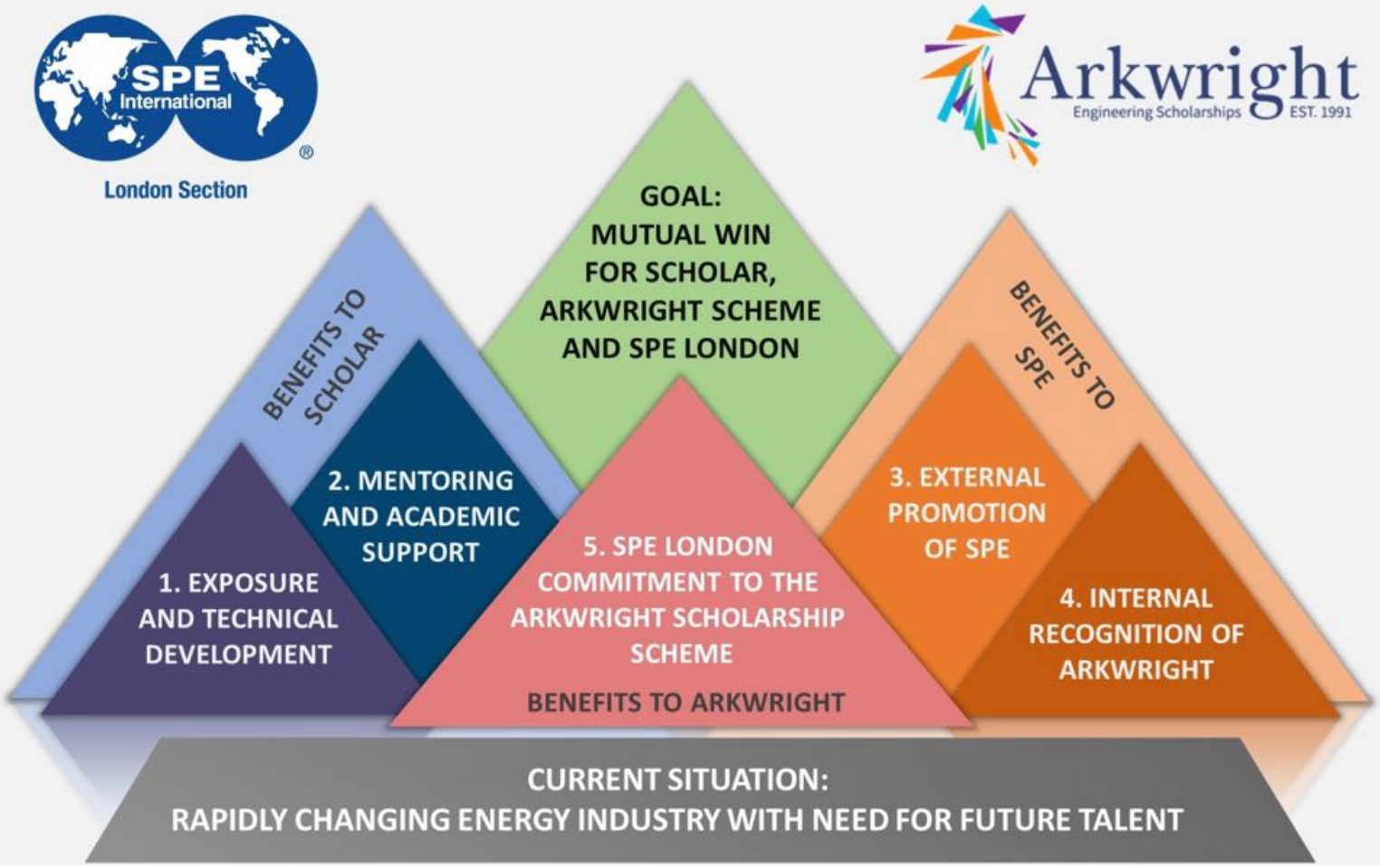
September / October 2019

# SPE Review London

The official e-magazine of the Society of Petroleum Engineers' London branch




## Future Talent: Developing an Arkwright Legacy

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SPE International
London Section

BEHIND THE SCENES MEET THE BOARD EVENTS

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**ABOUT US**

The Society of Petroleum Engineers (SPE) is a not-for-profit professional association whose members are engaged in energy resources, development and production. SPE serves more than 143,000 members in 141 countries worldwide. SPE is a key resource for technical knowledge related to the oil and gas exploration and production industry and provides services through its global events, publications, events, training courses and online resources at www.spe.org. SPE London section publishes SPE Review London, an online newsletter, 10 times a year, which is digitally sent to its 3000+ members. If you have read this issue and would like to join the SPE and receive your own copy of SPE Review London, as well as many other benefits – or you know a friend or colleague who would like to join – please visit www.spe.org for an application form.



**CONTACTS**

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# In this issue



## FEATURES



## WHAT'S HAPPENING?



Share your experiences and stories online http://london.spe.org/home

# Behind the Scenes: SPE Review Editorial Board

### Jonathan Ovens

After graduating from Cambridge University with a Ph.D in Physics, Jonathan joined Shell in 1986. Reservoir Engineer – hydraulic fracturing, pressure transient analysis and reservoir simulation.
1997 - 2012: independent consultant: North Sea, North Africa and the Middle East. Experience: Exploration and Development planning to Reserves Evaluation.
2013: Senior Reservoir Engineer at JX Nippon E&P (UK) Ltd.
2009 and 2015 served with SPE Europec Technical Committee.
Member of the SPE London Board.

### Josh Beinke

Graduated from University of Adelaide in 2008 with a Petroleum Engineering degree. Worked various roles with Chevron, Origin Energy and Santos, including as a Production Engineer on the Gorgon Field during First Gas. Following move to Europe in 2016, consulted on European and African assets (specialising in data room and field development advisory) before current position working in Amsterdam as a Production/Exploitation Engineer with Vermilion Energy.

### Ffion Llwyd-Jones

Editor and business writer, with 15+ years experience in North America/ UK.
Editor for several trade and consumer magazines (print and/online).
Provides industry-related case studies, and detailed, research-driven B2B Designer reports and technical white papers.
Accomplished photographer, and videographer.
Educated in Canada, and in the UK, with BA (Hons) from The Open University.

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INEOS THE WORD FOR CHEMICALS

# Letter from the SPE London Chair

Welcome to the September/October issue of SPE Review London! I hope you are all settling in your work routines after the busy summer.

Usually September is the first month when we have events. This year we started earlier with a Young Professionals seminar (Kappa Distributed Temperature Sensing Analysis Day) on 7 August and a Business Development group networking social on 18 September. The London Board has been working on a full calendar of events covering a wide range of topics for the coming session! As I write this letter we are conducting a first Young Professionals – Senior Professionals workshop where we cover best practices in modelling, business deals, M&A asset valuation and other topics. Future events include SPE Upstream Finance and Investments Conference on 29 October and the Annual full-day seminar 'Introduction to oil and gas, exploration and production' on 28 November. Try to attend as many of these meetings as possible as they all allow for the free flow of information and are great networking events.

To address one of the challenges facing SPE and the industry in the short term – protecting SPE's technical reputation as a trusted source of information – the London section will continue to strengthen the core of our society (technical quality of events, knowledge transfer, support incoming talent into the society). To stay relevant, we will introduce new topics and types of activities, especially in the field of digitalization and big data – if you have additional ideas how to develop it, please get in contact. The success of our industry's digital transformation depends on having all disciplines working and collaborating together.

The industry has gone through many changes and our younger members look for an easily consumable format of technical content. The new SPE International app does just that as it provides new methods of knowledge transfer!

Also, SPE North Sea (which London is part of) will be merging with the SPE South, Central and Eastern Europe to create one mega-region: SPE Europe: https://www.spe.org/europe/.

Nominations for the London Board are still open (positions of a Secretary and Membership chair, in particular). Please write to us and we will provide further information: SPELondon@spemail.org.

In closing, I once saw the definition of an engineer as "Somebody who makes precise guesswork based on unreliable data provided by people with questionable knowledge. Never wrong. Likes tables." A wizard. Or a magician.

Cheers!
Maxim Kotenev, SPE London Chair

# SPE YP London: DTS Analysis Day

On 7 August, SPE YP London Section arranged a 'Distributed Temperature Sensing (DTS) Analysis Day' in collaboration with KAPPA Engineering. Ten industry professionals, with a wide range of industry and academic experiences attended the event at KAPPA's office in Reigate.

The day began with a review of heat transfer principles and mechanisms (conduction, convection and radiation), and the mathematics behind the calculations.

A short coffee break was followed by a review of the different temperature sensing technologies (including distributed temperature sensing) and measurement principles. This included the description of the tools and their specifications, and the physics behind their measurements. A 'round table' discusssion allowed participants to share experiences in acquiring and interpreting temperature data, including the reliability and efficacy of such measurements in different stages during the life of a well and a field.

After lunch, participants engaged in multiple hands-on exercises on temperature data interpretation, which included determining flow profile from DTS measurements, determining multiphase flow profile from PLT and analysis of warm back data during fall off for a water injector. These exercises were done using Emeraude. Transient numerical thermal simulation in Rubis and Steam injection modelling in Emeraude were also part of this hands-on session.

The event received great feedback from the attendees, and SPE London section extends thanks to KAPPA Engineering for the use of its facilities.

# SPE London Evening programme Autumn 2019

**Join us for the London Section evening meetings!**
Lectures by renowned industry professionals, including Distinguished Lecturers, plus drinks and networking buffet. Look out for email alerts with registration and ticket details, or *check out the SPE London website events page*. We look forward to seeing you at the next event!

## Schedule: October-November 2019

**29 October 2019**
**Drilling Optimization Revisited: How Close are We to Drilling Optimization While Drilling (DOWD)?**
Speaker: Vassilios Kelessidis, Disinguished Lecturer
**Simulating CO2 Injection and Storage in the Cloud**
Speaker: Paolo Orsini, Open Geosim

**26 November 2019**
**Marginal Fields How to Maximize Profit and Minimize Risk**
Speaker: John Pringle, Distinguished Lecturer
**Decommissioning**
Speaker: Martha Vasquez, BCG

# BP-ICL Annual Mentorship Scheme

By Elizaveta Poliakova, President at SPE Imperial Student Chapter

**BP and Petroleum Engineering/Geoscience MSc students from Imperial College continue their networking sessions with the Annual Mentorship Scheme. This year, we are proud to share that it has been the 15th year since the programme commenced.**

The idea of the Mentorship Scheme between SPE Imperial and BP was initiated by Rudolf Ulma, Imperial Alumni and Reservoir Engineer at BP. These visits are designed for experience sharing between Reservoir and Petroleum engineers at BP and postgraduate and PhD students at Imperial College London (ICL). These sessions also provide professional insights on Reservoir Engineering roles within the company.

> *"The BP visit was a truly invaluable experience as it gave us the chance to speak to several experienced senior engineers. They spoke about not only their day to day tasks as an engineer, but also their experiences in the field and why they chose a career in the oil and gas industry. I would definitely recommend this visit to future MSc students."*
>
> Lisa Mistry, Petroleum Engineering MSc student at ICL

This year, we organised two visits to BP's Sunbury office, in November and July. Both times, the mentorship scheme involved a unique opportunity to meet members of the Subsurface Team, followed with a tour to the Petrophysical Research laboratories.


The desire to have close communications between the industry and academia is what makes this event successful.

We believe that close links between students and professionals is very important for those early in their careers to understand more about the role of a petroleum engineer.

Friendly environments, a warm welcome of the team and informal talks are the main highlights of these sessions. Networking happens naturally in smalls groups ensuring that every attendee has an opportunity to interact with every subsurface engineer at the event.

It was a fantastic experience and SPE Imperial has received extremely positive feedback from all attendees. The Student Chapter is looking forward to future visits!

# Developing an Arkwright Legacy

**In April 2019, the SPE London board backed a commitment to sponsor an Arkwright Engineering Scholarship student, commencing September 2019 for two-years. Details of this scholarship scheme, and an overview of the potential benefits, were explored in SPE Review London April 2019. In the run-up to the first scholarship period, these benefits have been explored in detail to develop a cohesive long-term strategy for SPE.**

Benefits associated with SPE London sponsorship of the Arkwright Engineering Scholarship Scheme are founded on five core commitments – visualised and described below. These are fully interdependent commitments and the outcome, when all pursued, is a tripartite, mutually beneficial win for the Scholar, Arkwright and SPE London.

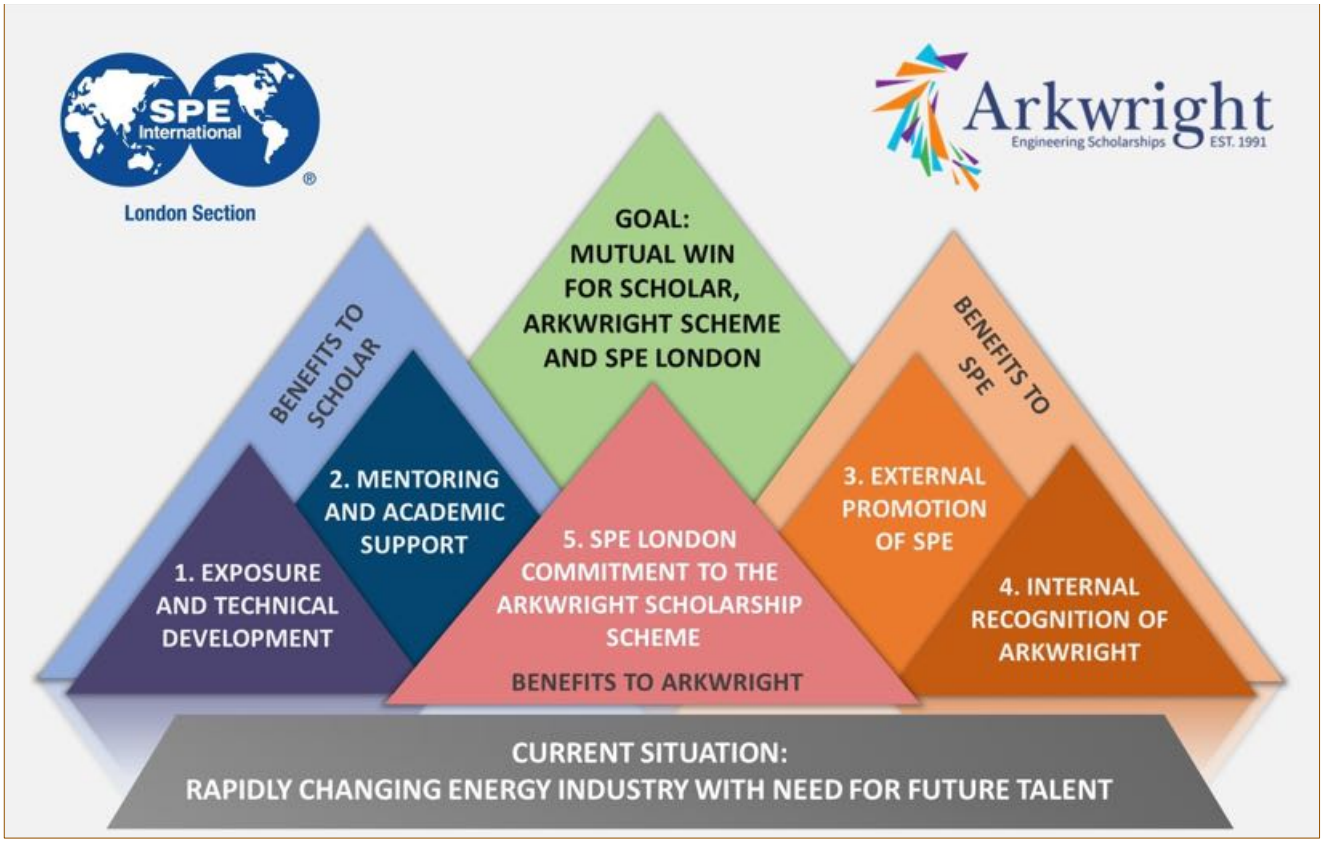
## Benefits to Scholar

### – Exposure and Technical Development

The sole purpose of the Arkwright Engineering Scholarship scheme is to identify outstanding technically-minded 'A' Level students, and inspire them to become future leaders in engineering.
As an organisation, SPE London is in a prime position to offer the very best technical exposure and developmental experience possible – through attendance of monthly Distinguished Lecturer seminars, networking at events and access to a wealth of shared resources in SPE Connect.
And the ultimate offering from the SPE London is the potential to provide work experience to scholars, either through external sponsoring organisations, or the kindness and generosity of the membership.

### – Mentoring and Academic Support

Holding an Arkwright Engineering Scholarship is a fantastic platform to stand out from the crowd and have the best possible opportunities in higher education.
Provision of mentoring and academic support can be achieved through leveraging the wealth of knowledge from professionals across SPE London. By harnessing the collective advice and experience across the



# Developing an Arkwright Legacy... continued

membership, we can succeed in mentoring and steering students to the course and university of their choice. And with successive sponsorship each academic year, there is potential to develop a pipeline of legacy scholars who are able to share experience and build capacity in future generations.

## Benefits to SPE

### – External Promotion of SPE London

Future growth of the oil and gas industry is subject to increasing criticism – particularly among the younger generations. However, demand for fossil fuels is forecast to grow consistently to 2050. The dual challenge of an ever increasing global fossil fuel demand and a need to reduce carbon emissions combine to present one of the most complex and critical challenges our industry faces during the 21st century.

As ever, a huge challenge requires the smartest and most collaborative minds to solve – and is critically reliant on promoting SPE and attracting the best students to consider a career within the energy industry.

And SPE London's involvement in the Arkwright Engineering Scholarship scheme represents a platform by which SPE London can showcase our commitment to developing future talent and fresh perspectives to secure a sustainable future for the petroleum industry.

### – Internal Recognition of Arkwright

SPE London in its current form is a world-leading group of diverse backgrounds, knowledge and experience. This experience, through the commitments proposed in this article, can provide world-class opportunities for SPE Arkwright Scholars.

However, the ultimate beneficial outcome from the Arkwright Scholarship arises through recognition of the significant benefits that sponsorship of the programme brings to the society.

Through continued, successive sponsorship of the scheme, SPE London can develop a legacy of past scholars, integrated within the SPE community, allowing collaborative relationships, and knowledge sharing across generations, that would otherwise not exist.

## Benefits to Arkwright

### – SPE London Commitment to the Arkwright Engineering Scholarship Scheme

Arkwright believes that a strong future for the UK economy depends on the quality of young people who choose to pursue engineering careers. The Arkwright Engineering Scholarship Trust is the largest scheme of its kind that identifies and develops this future engineering talent.

The Arkwright programme has more than 800 current scholars and a network of 5000 alumni – of which 92% have gone on to study engineering at university or through higher-level/degree apprenticeships. And one of the keys to Arkwright's success is the partnerships with sponsors, such as SPE London, who provide amazing opportunities for industry engagement.

**About Arkwright**: 2016 was the Arkwright Engineering Scholarships 25th Anniversary. For over a quarter of a century Arkwright has identified, inspired and nurtured future leaders in engineering, computing and technical design. Arkwright Engineering Scholarships are a The Smallpeice Trust (registered charity) programme and is the most prestigious scholarship scheme of its type in the UK. Every Arkwright Engineering Scholarship is sponsored by an industrial company, university, charitable trust, trade association, professional institution, armed service, worshipful company, industry regulator or personal donor. **Scholarship nominations are now open for Arkwright Engineering Scholarships 2020.**

**Offer to SPE London Membership**

This article highlights the commitment and vision from the SPE London section in promoting engineering study to facilitate careers within the energy industry with an emphasis on the oil and gas sector. SPE London is keen to partner with oil and gas businesses who share this passion for developing engineering talent to tackle the complex and critical oil and gas challenges of the 21st Century.

To discuss how your business can partner with SPE London, contact:
Adrian Southworth: OleumVentures@icloud.com / Richard Prior: richardprioruk@outlook.com

# Challenging, fun, career-boosting, educational - why not explore the great opportunities with the SPE London team?

**LOVE TO ORGANISE?**
Volunteer with the events section of SPE London – you'll learn lots, be valued for your ideas, and have fun!

**GOT GREAT IDEAS?**
How about sharing and contributing as an SPE London Board member?

**YOUNG PROFESSIONAL?**
Learn, explore and meet your fellow YPs at SPE London

**FIND OUT MORE!**
**Get in touch with our Editor, Jonathan Ovens via LinkedIn.**

# Hydrates and Well Testing: A Practical Discussion

Paul Nardone, Director at Well Test Knowledge International, has over 30 years of industry experience, specialising in well testing and completions. He is the author of 'Well Testing Project Management', one of the few practical well-testing books available, and has been the key focal point for planning well-test operations for many operators. With his experience spanning every aspect of well test and completions, including supervision of numerous field operations both onshore and offshore, Paul discusses the circumstances leading to hydrate formation during well tests, and the practicalities of removing or avoiding them altogether.

*A hydrate inside a section of pipe*

**Hydrates are ice-like solids that form when hydrocarbons and water mix under certain conditions of temperature and pressure. These solids can form at temperatures well above the freezing point of water and often present a hazard during well tests.**

## The Hazard

During production of hydrocarbon gas, hydrates can form rapidly, producing solid plugs in tubulars, pipe- work, chokes and other well test equipment. It is also possible to form multiple plugs and to trap pressure be- hind or between plugs. If a plug with trapped gas under pressure subsequently starts to melt and break loose, the plug itself would become a solid projectile driven by the force of the pressure behind it.

Hydrates need not form a complete plug to be a problem, for example, when flowing the well on a smaller choke size, hydrates can gradually build up to form a skin along the inner walls of the pipework, when the choke is later increased to produce at a higher rate, the temperature of the fluid rises at which point the hydrate starts to melt, chunks of the hydrate material break free and become projectiles carried in the flow-stream which can cause damage further downstream.

Hydrate solids are prone to forming around chokes, valves, or diameter changes where gas undergoes expansion and cooling. The same mechanism can cause freezing across the pressure control valve at the gas outlet of the separator. Plugging at this valve would render control of the separator impossible.
Below the rotary table hydrates might form at or near the sea bed where ambient temperatures are low, especially in deepwater. Problems also occur around pressure control equipment used for wireline operations; especially when manipulating valves following the introduction or removal of tools, or following a pressure test.

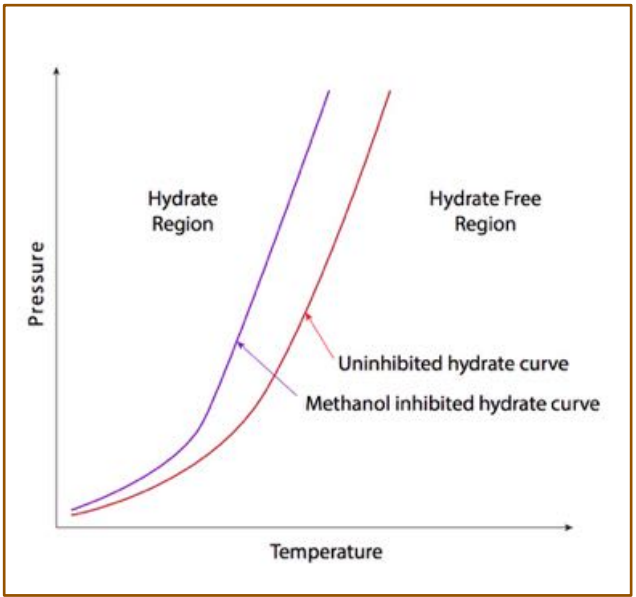
Starting up a well test either initially, or after a shut down, or after having performed a pressure test following a leak, are occasions where water may have accumulated in low lying sections of pipework or valve cavities; cold gas coming in contact with this water may initiate hydrate formation at entirely unexpected locations. Consider that cooling might take place across the choke manifold, but contact between cold gas and water might not occur until some point further along in the facility. In other words hydrates might form wherever water can accumulate, i.e. low lying pipework, valve cavities pipe elbows, inside a meter, at the bottom of a vessel or any other low lying point in the system where water may be present.

# Hydrates and Well Testing ... continued

Hydrates can also cause problems for instrumentation, plugging the ports or moving parts in level control devices, meters, and valves. Without instrumentation the operators of the test equipment are without the means to monitor conditions inside the equipment.

### Prediction – Hydrate Modelling

Hydrate studies often provide a useful planning reference on which to base prevention measures.
A modelling study, takes as inputs, the gas composition, and the reservoir temperature. It also examines the pressure & temperature profile along the well bore at initial conditions and as the well goes into production. The out-put is a hydrate curve, for each phase of operation, from startup through to maximum stable production. These curves indicate the conditions at which the onset of hydrate formation could occur. Using this information engineers can anticipate where and when to target preventative measures. For example, if hydrate formation in the landing string is a significant risk then adequate subsea chemical injection will be required. Injection rates and chemical inventories will be influenced by the modelling results. The procedures might also consider the selection of choke sizes so as to operate at pressures outside of the hydrate formation region.



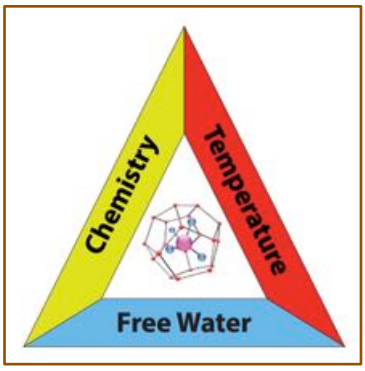

*The plot illustrates a hydrate curve indicating the conditions of pressure and temperature at which hydrate formation could occur for a particular gas. Also illustrated a curve for the same gas with methanol injection. Note, that in order for hydrate to occur, free water must also be present.*

### Prevention – The Hydrate Triangle

Gas well tests are frequently executed very successfully without encountering any of the dire problems referred to above. Over the years several techniques have been developed to manage the hydrate hazard. To borrow a concept from the fire triangle. Break the hydrate triangle of chemistry, temperature or free water and hydrates will not form.

### Temperature

Steam heat exchangers, usually situated just after the choke manifold, have been used for years to elevate the temperature of produced fluids; although effective up to a point, traditional heat exchangers are not that efficient owing to the velocity of the gas in the pipeline and the poor heat transfer characteristics of dry gas.




A technique known as double choking, or staged choking, is often very effective at raising the downstream gas temperature. Instead of allowing the full pressure drop to occur across the choke manifold, a secondary choke is situated somewhere downstream of the choke, ideally after the heat exchanger. By staging the pressure drop between the two chokes very significant control of temperature can be achieved.

### Chemistry

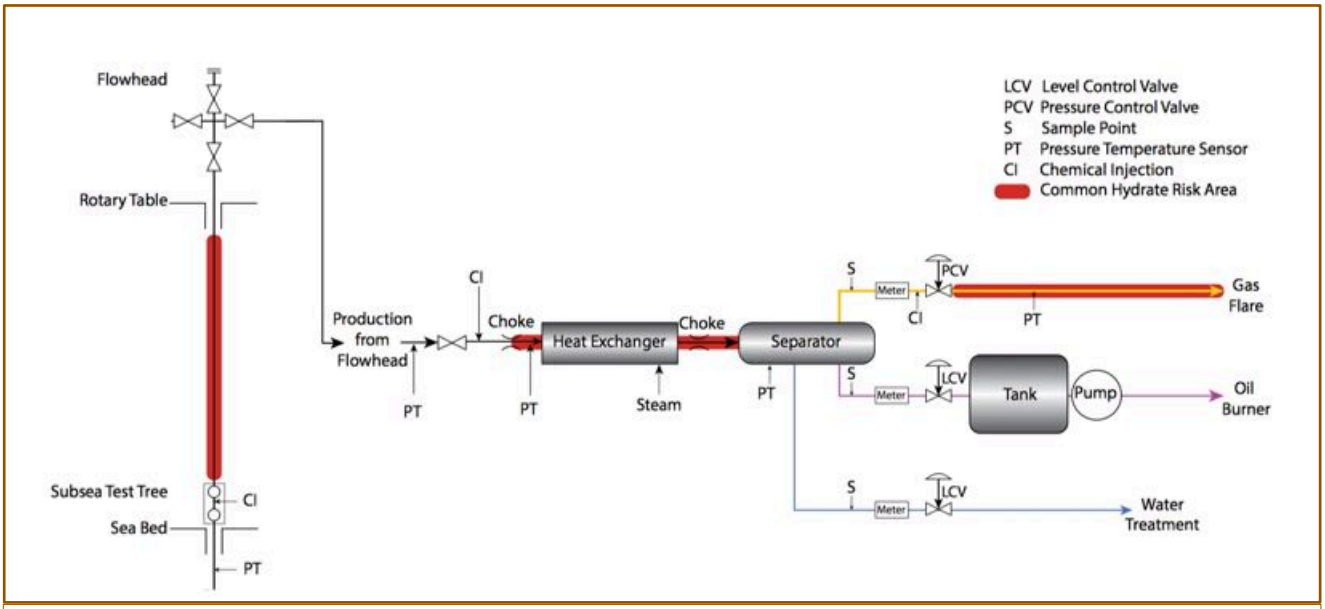
Certain chemicals inhibit the formation of hydrates Glycol and Methanol being the most common. Typically for well testing methanol is preferred and is injected into to the flow stream just before the gas undergoes expansion and cooling. At surface, the injection point is usually just before the inlet of the choke manifold. Secondary injection points may be added further downstream, for example, on the separator gas outlet just before the pressure control valve.

Some operators advocate the use of glycol in place of methanol on the grounds it is a safer fluid to handle.

# Hydrates and Well Testing ... continued

Certainly in production plants, glycol is very common because it can be stripped from the gas and re-used. Historically however, methanol is generally preferred for well test operations and many consider it to be more effective this is a desirable attribute given the greater range of fluid uncertainties when working in a well test environment. The lower viscosity of Methanol lends itself better for injection into long umbilical lines.
Well test operation utilise glycol where large volumes are required, for example, to pressure test equipment that may subsequently be exposed to cold gas.

Apart from the hazards associated with handling methanol an additional drawback is sample contamination. Since representative samples are often one of the main objectives of a well test, contamination from




*A simplified well test P & ID set up for a gas test. Chemical (Methanol) injection points, and pressure / temperature sensor locations, indicate a typical setup to manage areas where hydrate formation might be expected.*

methanol must be taken into consideration during planning. Sometimes the only way to ensure methanol free samples is to place a sample carrier in the lower DST string close to the reservoir and upstream of any methanol injection point. Advances in sampler technology have been such that representative samples of gas can be acquired down-hole, above the dew point, yielding high quality samples.

### Free Water

As illustrated in the hydrate triangle, even if the conditions of pressure and temperature are present for hydrates, the formation of hydrates is still dependent on the presence of free water.
Water in the system can come from a number of sources. Some water of condensation will be present from the produced gas and some may be present in the production equipment left over from pressure testing.
It is good practice to avoid, where practicable, the use of fresh water in the well test package. Pressure testing with sea-water is preferable or use of a water glycol mix.

Following the pressure test, drain as much fluid from the test equipment prior to the introduction of hydro-carbons. The use of saturated completion brines in the workstring also inhibits hydrate formation.

### Subsea Operations

Below the rotary table is also a high risk area with respect to hydrate formation. In particular in deepwater where seabed temperatures are often the lowest point of temperature in the system at startup.
A great deal of heat can be lost from the production fluid to the sea, the marine riser acts like a radiator conducting heat away from the production string.

Vacuum Insulated Tubing (VIT) and riser fluids with insulating properties and saturated brines are sometimes

# Hydrates and Well Testing ... continued

used in cases where severe hydrate problems are anticipated in this part of the system.
Methanol can also be inject at the subsea test tree and even below the mudline to inhibit hydrate formation.

## Detection

Hydrates can occur in many different parts of the package as already discussed. Because it takes the form of a solid ice like structure, it creates restrictions in the pipework and equipment. The presence of hydrates are most likely to be noticed through unexpected changes in system pressure, often accompanied by a change in flow rate. During the early part of a well test, unloading and cleaning-up the well, the production conditions are already in a changing state, even so, unexpected changes in pressure or flow rate can be observed provided close monitoring of production conditions is being maintained.

It is highly recommended that a central data acquisition station is in place to monitor the production conditions continuously. A graphic display of all parameters is better than a digital display because changes and trends are much easier to detect on a graphic plot.

Pressure and temperature sensors must be positioned where they can readily indicate to the observer an inconsistent behaviour.

If hydrates do start to form, it is important to be able to react quickly to remedy the situation. Good communications must be maintained between the data acquisition station and the personnel attending the equipment.

Close monitoring of the system includes pressure and temperature data from below the rotary table. Completions and well tests nowadays often have access to real- time downhole gauge data. The formation of hydrates in the landing string can be detected more readily where this facility is available.
This has in fact been seen in practice on several operations where increasing subsea pressures occurred along with a drop in surface flow rates indicating the formation of hydrates in the landing string. An increase of methanol injection to the subsea injection has been seen to remedy the situation.

## Removal

Contingency planning must consider the scenario where severe hydrate plugging has occurred. In particular, the appropriate response by personnel to a situation where a hydrate plug has formed and has trapped pressure behind it. If the well is shut in, and pressure downstream of the plug is immediately bled to zero, then when the plug subsequently starts to melt it is likely to be propelled with some force and could cause damage to production equipment.

The well should be shut in, but pressure maintained across the plug. This is a safer situation since there is less chance of the plug releasing and becoming a dangerous solid projectile inside the pipework. Depending on where the plug has formed, different measures might be taken to help remove it. If the plug has formed in the landing string, methanol could be injected above and allowed to settle on top of the plug. The marine riser can be circulated with warmer fluid to help heat up the landing string.

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**Well Test Knowledge International (WTKI)**, provides professional consulting services in well testing (including analysis), completions and related areas of petroleum engineering. Training courses are also provided. Formed in 2012, WTKI has offices in Australia and the UK, and global consultants working under the two directors: Nick Last and Paul Nardone, both renowned in their fields of expertise.

Recent and current consulting projects have taken us from our original Australian home base to Singapore, Papua New Guinea, Thailand, Vietnam, Malaysia, Brunei, Bangladesh and South America, covering many topics. Our scope is internationaland our training client base includes service companies, operating companies of all sizes, and regulatory agencies. Contact us at Rita.Nardone@wtki.co.uk

# Introduction to Exploration & Production 15th Annual Seminar 28 November 2019

## WHAT is this seminar about?

The 'Introduction to E&P seminar' provides an introduction to the full life cycle of oil and gas fields, in addition to covering the basics in exploration, geoscience, drilling, operations, reservoir management and commercial terms.

This seminar is about communicating complex ideas to a non-technical audience. This will be the 15th year the seminar is in London. Technical Assistants, engineers and managers often suggest this seminar to non-technical staff so they can better understand the content of reports and budgets.

## WHO is this for?

*Staff and contractors: graduates, legal staff, investors, analysts, accountants, finance, logistics, IT, technical assistants, secretarial, procurement, recruitment and HSE.*

The seminar is aimed at people working in financial and E&P environments, who are new to the industry or would benefit from an understanding of the technical processes and the key elements in oil and gas projects. The seminar is also appropriate for people working indirectly with oil and gas companies, or providing support services.

Presentations will be at a basic level.

## WHY should you attend?

You will learn about:

Key industry issues

All stages of the E&P cycle

M&A and Private Equity

Fracking

**Now in its 15th year in London!**

## Get your tickets!

**Limited Places:** **Book NOW via this Eventbrite link (opens in Eventbrite)**

£199 Earlybird tickets (before 1 October) for members and non-members

£249 tickets after 1 October for members and non-members. 15% discount on this for bookings of 5 or more. 20% discount for 10+ full-priced tickets. (Email katespe@aol.com for discounts.)

*EventBrite booking fee in addition to the price above*.

**Location:** Geological Society, Burlington House, Piccadilly, London, W1J 0BG

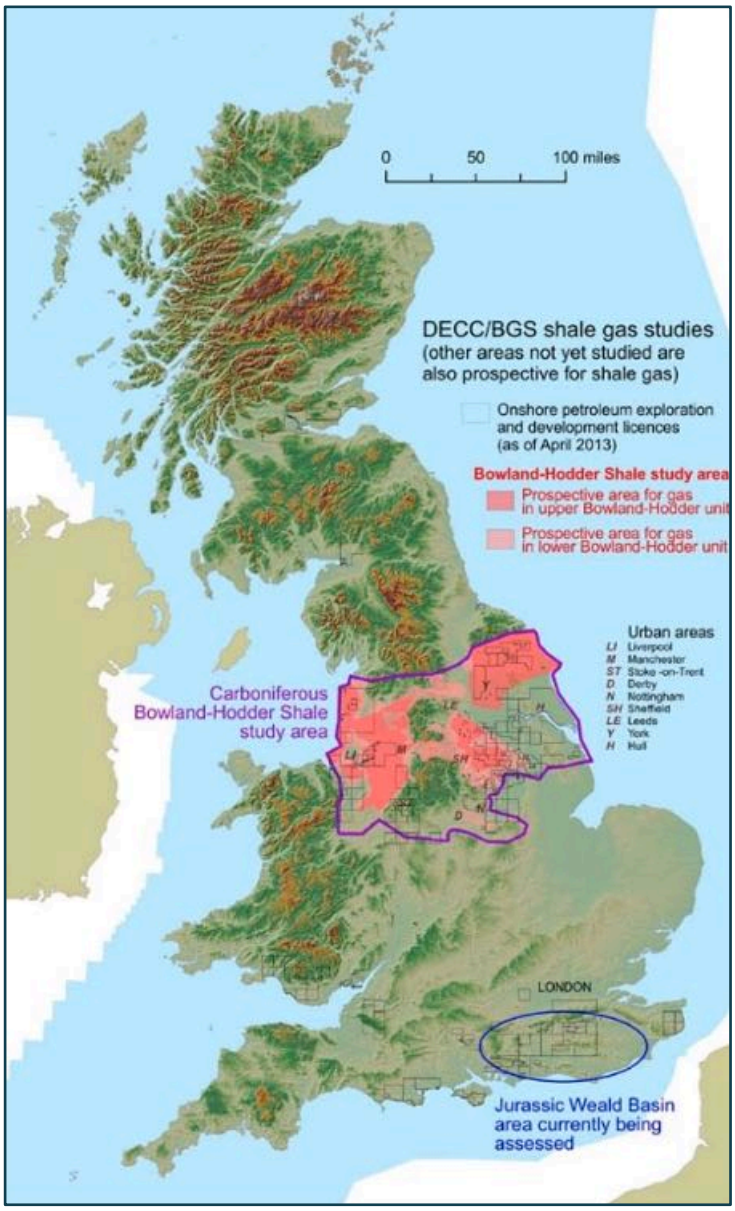
**Questions?**

katespe@aol.com

# UK shale reserves: rocky road to new hydrocarbons industry?

Even by the standards of the UK fracking industry's difficult history, 2019 has been a fraught year.
Justin Reynolds (Communications Officer, Block Energy, an AIM-listed oil and gas startup) looks at the challenges facing the UK's nascent fracking sector.

Operations at Cuadrilla's Preston New Road, the UK's only active shale gas site, were suspended when a series of tremors over the August Bank Holiday weekend culminated in a minor earthquake. Though registering a magnitude of only 2.9 the quake was well above the limits set by tough industry regulations that require work to stop for 18 hours every time drilling triggers seismic activity of more than 0.5. The timing could not have been worse, with Cuadrilla already working against the clock to prove the environmental and commercial viability of its operations before planning permission expires at the end of November.




**Bowland-Hodder Shale study area.**
©Reference: Andrews, I.J. 2013. The Carboniferous Bowland Shale gas study: geology and resource estimation. British Geological Survey for Department of Energy and Climate Change, London, UK.

The suspension was accompanied by reports that Sir Jim Ratcliffe, owner of Ineos, the other major firm with an interest in UK shale, is considering shifting the company's focus to the US due to chronic frustration with "archaic, glacially slow, inordinately expensive and virtually unworkable" British regulations.
It is unclear when or ever those limits will be eased: the UK's nascent fracking sector faces profound challenges to establish itself as a new hydrocarbons industry amidst persistent concern about quakes and increasing public concern about climate change. In the words of a recent FT commentary, time seems to be "running out for the UK's fracking industry".

That fragility has been further exposed by the publication of new research by the University of Nottingham's Faculty of Engineering and the British Geological Survey (BGS) arguing that UK shale gas reserves are substantially lower than previously thought - perhaps just one sixth of official estimates.

Those expectations have been based on a 2013 study by the BGS and the Department of Energy and Climate Change which suggested that the Bowland, Britain's largest and most economically viable shale zone, stretching from Lancashire, across the Pennines and down into the Midlands may hold more than 1,300 trillion cubic feet of gas, enough to meet the UK's current demand for gas for up to 50 years.

According to the new paper, Shale gas reserve evaluation by laboratory pyrolysis and gas holding capacity consistent with field data,

## UK shale reserves ... continued

published in the August edition of Nature Communications, and summarised on the University of Nottingham and The Conversation websites, the 2013 study severely overstates the Bowland's potential.

Introducing the new report, Dr Christopher Vane, Head of Organic Geochemistry at the BGS, said: "With no published production data for the UK or detailed characterisation of the Bowland shale, the initial 2013 estimates were based on a desktop study, using data from USA shales, estimating the shale gas resource as opposed to the actual reserve. This meant key differences in the composition of the shales in the UK compared to the USA could not be taken into account at the time. The new estimates are derived from actual UK shales, using gas generation absorption data, which is further supported by field data."

The study, the result of more than 10 years' research, simulated oil and gas generation in shale gas reservoirs under laboratory conditions through the use of a high-pressure water technique. It argues that the earlier survey over-estimated the Bowland's gas holding capacity by overlooking the effect moisture has on reducing the amount of gas held within shale.

The report estimates that the maximum reserves for the Bowland Shale are actually closer to 200 standard trillion cubic feet than 1,300 trillion. Assuming that it would be economically viable to recover some 10% of those reserves, the industry could generate no more than 10 years' of Britain's gas supply at current demand. The research complements a challenge to the official estimates published two years ago by Professor John Underhill at Heriot-Watt University. Commenting on the new paper, Professor Underhill said: "The seismic data and geological map of the UK shows that a significant uplift, tilt and faulting affects the UK, which was initiated by active plate margin forces over 55 million years ago. Areas that were once buried sufficiently deeply with temperatures at which oil and gas maturation occurs, lifted to levels where they are no longer actively generating petroleum. The resultant uplift has also led to the shale gas targets being depressured and highly deformed by folds and faults that cause the shales to be offset and broken up into compartments. This has created pathways that have allowed some of the oil and gas to escape."

Unlike US shale plays like the Marcellus, Bakken, Barnett, Wolfcamp and Haynesville, which lie at present day depths with temperatures and pressures ready to expel their oil and gas when fracked, the uplift and faulted structure of the UK basins, including the Bowland, are unlikely to be suitable for extensive hydraulic fracturing.

"It would be extremely unwise to rely on shale gas to ride to the rescue of the UK's gas needs only to discover that we're 55 million years too late," he added.

The report has been fiercely contested by industry representatives UK Onshore Oil and Gas (UKOOG). Chief Executive Ken Cronin said: "Nottingham in their research have analysed a limited amount of core from one Bowland shale well drilled in 2011 which was subsequently decommissioned without hydraulic fracturing or flow testing. There was no calibration with the US or no interaction with the company who drilled the well … One of the largest lessons learned in the USA shale revolution is that shales are not homogenous and well location, even within a single basin, can be paramount to the success of the well. It appears that no basin variation factors have been significantly considered in this generalised study."

He added that the industry continues to test the Bowland Shale's geology through 3D seismic surveying, core drilling, hydraulic fracturing and flow testing, referring to an analysis published earlier this year of data from Preston North Road which indicated "high gas content, low processing requirements and excellent rock properties for fracturing in the Bowland basin", the results bearing comparison with the Barnett shale in Texas.

As two of the authors of the Nottingham report, Professors Will Meredith Colin Snape, themselves state, the only "truly foolproof way of assessing how much gas is buried below the UK, and how much is economically

## UK shale reserves ... continued

recoverable, could only come from widespread test drilling."

And the UKOOG's wider arguments about the promise of shale as a source of natural gas and a guarantor of the UK's energy security retain force.

UK demand for gas has increased by 50% in the past three decades, with two-fifths its electricity produced from natural gas last year. Natural gas currently meets more than 80% of UK heating needs, and continues to provide the energy source or raw material to make a wide range of products and plastics.

Indeed, insofar as gas burns more cleanly than coal, and is lower in carbon dioxide emissions, it has been possible for the industry to burnish its green credentials by presenting it as critical transitional fuel. (But the limits of that strategy were exposed earlier this summer when Equinor, Britain's biggest supplier of imported gas, was warned by regulators over advertisements on the London Underground implying gas is a 'low-carbon energy' source - gas releases some 40 times more CO2 than nuclear or wind power.)

And shale's potential importance for the UK's energy security was highlighted by the missile attacks on Saudi Arabia's Abqaiq refinery - in the absence of shale the UK may have to import at least 70% of its gas by 2030 as North Sea supplies decline.

But whatever the scientific merit of the Bowland Shale study, the economic and security arguments for fracking, and the precise impact of shale gas to climate change, the UK industry's future would seem to be primarily dependent on evolving political sentiments, and most urgently the outcome of the general election expected in the next few months.

An incoming Labour government would extend the fracking ban that already exists in Scotland to the rest of the UK. And the industry's prospects would be uncertain even under another Conservative administration. For now the party remains cautiously supportive, the carefully worded policy of the Department for Business, Energy & Industrial Strategy stating that shale gas 'could be an important new domestic energy source reducing the level of gas imports while delivering broad economic benefits … It could also support our transition to net zero emissions by 2050.'

Boris Johnson and business secretary Andrea Leadsom have both expressed support for the industry in the past, a cheerleading 2014 Telegraph article by Johnson urging David Cameron's government to give "the British people their mineral rights, and get fracking at last." But that encouragement must be set against the government's broader aim to achieve net zero carbon emissions by 2050, a pledge signed into law as one of Theresa May's final acts as Prime Minister.

That uncompromising commitment to carbon neutrality means natural gas can only be used either to generate electricity when combined with carbon capture and storage, or, assuming the technology develops, to produce hydrogen for transport or domestic heating. And it is unclear whether natural gas will remain competitive as the cost of renewables with storage continues to fall. Given the scale of the roll-out needed for carbon capture UK gas consumption may fall sharply over the next 30 years, with conventional gas from the North Sea sufficient to meet demand.

**The full value of the Nottingham study for illuminating the extent of the UK's shales reserves will become clearer over time. But political pressures may well mean the gas they contain is never released, no matter how much - or little - there may be.**

# Annual Young Professionals/Student Paper Contest

On 25 September the SPE London Student Section held its Annual Young Professionals/Student paper contest at London South Bank University.

A total of eight papers were presented with students coming from as far afield as Edinburgh, East Kilbride, London and Portsmouth.

The judges, from the SPE London Section, chose three winners:
- ✯ Brian Willis (Astrimar Ltd)
- ✯ Keim Nguyen (London South Bank University)
- ✯ Elhand Imanovs (Imperial College)

We look forward to publishing their papers in SPE Review London over the coming months.

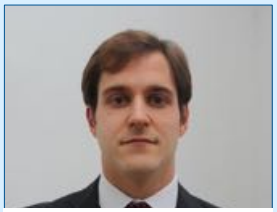

*Brian Willis is congratulated by Tim Lines*

*Keim Nguyen with Tim Lines*

*Tim Lines congratulates Elhand Imanovs*

# Meet the SPE London Board

SPE is a non-profit professional society with 164,000members in 143 countries. The SPE London Section, with an average 2,000 members and seven associated student chapters, is an active section with an aim to connect, engage and promote the exchange of knowledge within the London energy community of technical and commercial professionals. The SPE London Board is the policy-making and governing body, consisting of volunteers who devote time to overseeing many of SPE London's administrative and operating responsibilites.



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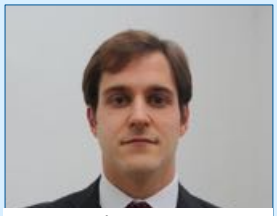

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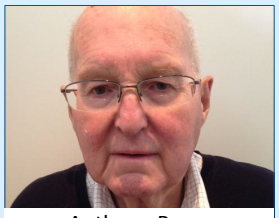

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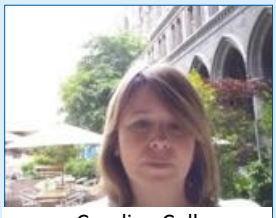

Carolina Coll
Director

# What's happening?

## SPE local and international events and on-demand webinars

21-25 October **SPE Forum: Understanding the Reservoir Beyond the Wellbore** Phoenix, Arizona, USA

Predicting the properties of reservoirs beyond the wellbore has been the cornerstone of reservoir characterization. The outcome provides the framework for efficient management and optimization of hydrocarbon reservoirs. Proper reservoir characterization affects all reservoir types and all stages during the life of a field. Far-field characterization encompasses seismic, electromagnetic, and other geophysical surveys. This characterization can be facilitated in various configurations such as cross-well or surface-to-wellbore, accomplished while drilling, in open and cased wells, and while producing hydrocarbons. However, there is a trade-off between resolution and the distance of investigation from wells. This forum will uncover methods that could improve reservoir understanding with the aid of characterization between wellbores. It will expand the discussion from measurements to predictive modeling and include possibly disruptive innovations.

29 October **SPE Upstream Finance and Investments Conference** London, UK

This October, leaders and experts from the petroleum and finance industries across the globe will unite in London to share valuable insights, high-level discussion and debate on issues within oil and gas and finance and investments. Upstream Finance and Investments Conference will focus on how to position the oil and gas industry in a volatile price environment while achieving supply-demand balance, promoting technological growth and providing prudent investment on exploration.

05-06 November **SPE Workshop: Production Optimisation in Gas and Oil Assets** The Hague, The Netherlands

The Production Optimisation in Gas and Oil Assets workshop is a high-quality event where experts, operators, and service companies share their latest developments, successes, and failures on late-life production topics. This workshop aims to improve and accelerate the development of activities to optimise late-life production in gas and oil wells and assets.

12-12 November **SPE Workshop: European Region Stimulation** Milan, Italy

This workshop aims to address all types of stimulation practices used in the North Sea and continental Europe. To achieve a fruitful discussion, this workshop is designed to address both the very specific technical challenges and the fundamental questions pertaining to stimulation in a sensitive land and offshore environment. Optimising stimulation treatments in these economically challenging times, in both a technical and environmental arena, requires special considerations. The participation of major and independent operating companies and service companies will allow a wide sharing of views, experiences, and opinions on how to proceed toward successfully meeting all well objectives.

28 November **Full Day Seminar: Introduction to Oil and Gas, Exploration & Production** London, UK

The 'Introduction to E&P' seminar provides an introduction to the full life cycle of oil and gas fields. It covers the basics of exploration, geoscience, drilling, operations, reservoir management and commercial terms. The speakers will also discuss key issues faced by the industry. Engineers and Managers often suggest this seminar to non-technical staff, so they can better understand the content of reports and budgets. This seminar is about communicating complex ideas to a non-technical audience. Presentations will be at a basic level and attendees will get an overall view across all upstream disciplines. The seminar is also for people working indirectly with oil and gas companies, or providing support services.

Recorded: 1.5.2019 **Using Machine Learning to Optimize Completion Design** Online webinar

As the industry moves to more complex multi-pad, multi-well completion designs, intelligent completion optimization will require more sophisticated algorithms to improve the decision-making process.

Recorded: 15.5.2019 **The Future Role of Oil** Online webinar

*0.15 credits offered.*

Presented by Dr. Iskander Diyashev, SPE Distinguished Lecturer.

Recorded: 5.1.2019 **Does the Oil and Gas Industry Have the Right Organizational Culture for Digital Transformation?** Online webinar

Interview with Helen Gilman.