# Society of Petroleum Engineers
# Distinguished Lecturer 2017-18 Lecture Season

## Integrated Historical Data Workflow: Maximizing the Value of a Mature Asset

**Anne Valentine**
**Schlumberger**

## Abstract

Industry studies show that mature fields currently account for over 70% of the world's oil and gas production. Increasing production rates and ultimate recovery in these fields in order to maintain profitable operations, without increasing costs, is a common challenge.

This lecture addresses techniques to extract maximum value from historical production data using quick workflows based on common sense. Extensive in-depth reservoir studies are obviously very valuable, but not all situations require these, particularly in the case of brown fields where the cost of the study may outweigh the benefits of the resulting recommendations.

This lecture presents workflows based on Continuous Improvement/LEAN methodology which are flexible enough to apply to any mature asset for short and long term planning. A well published, low permeability brown oil field was selected to retroactively demonstrate the workflows, as it had an evident workover campaign in late 2010 with subsequent production increase. Using data as of mid-2010, approximately 40 wells were identified as under-performing due to formation damage or water production problems, based on three days of analyses. The actual performance of the field three years later was then revealed along with the actual interventions performed. The selection of wells is compared to the selection suggested by the workflow, and the results of the interventions are shown. The field's projected recovery factor was increased by 5%, representing a gain of 1.4 million barrels of oil.

## Biography

Anne Valentine is a Principal Instructor for Production Engineering at Schlumberger. She has 35 years of experience in Canada and France in well and reservoir performance analysis, particularly related to waterflooding, unconventional reservoirs and candidate recognition for production enhancement. She built her expertise in performance analysis workflows and software through working on the Cold Lake heavy oil field as a reservoir and field engineer at Esso Resources Canada Limited, then consulting for Halliburton before joining Schlumberger in 2001. A graduate in Chemical Engineering from Queen's University in Canada, she has co-authored papers on analysis techniques for polymer floods, waterflood optimization and shale gas forecasting.

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# Robust Kick Detection;
# First Step on our Well Control Automation Journey


## Brian Tarr
**Shell International Exploration and Production Inc.**



## Abstract

In 2010 Shell began investigating how to automate the initial response to a well control incident. The first phase of the project was to develop a rig system that could reliably detect an influx across a broad spectrum of floating rig well construction related rig operations. The results of a fault tree style sensitivity analysis pointed to the high value of improving sensor data quality (both accuracy and reliability) and the importance of improving kick detection software for alarming (both in terms of coverage and how the driller is alerted to respond to a confirmed kick condition). Based on the analysis results, a Smart Kick Detection System functional specification was developed and used to upgrade the kick detection system on an offshore rig.

Early in the project it was realized that focusing on adding robust kick detection during connections was important but especially challenging due to the associated transient flow and pit volume signatures. A separate in-house initiative was therefore kicked-off to develop new software based on pattern recognition technology and machine learning. The resulting IDAPS (Influx Detection at Pumps Stopped) software has now been implemented as a real-time monitoring application for all Shell operated deep water wells. Further developments in smart kick detection are coming, ultimately leading to rigs being equipped with automated kick detection systems that are relied upon to detect a kick and secure the well in case the driller fails to act.


## Biography

Brian Tarr is a Senior Well Engineer based in Houston, Texas. His long career has included assignments in both drilling and completion operations and he has managed several significant technology projects related to well construction process safety, including the first surface BOP implementation for a deepwater subsea develop (offshore Brazil) and the design and construction of compact, modular, subsea capping stacks (for deployment in the North Sea and offshore S.E. Asia).
Mr. Tarr has previously served as both a review committee chairman and a technical editor for the SPE Drilling and Completion magazine. He has also been active in both IADC and API well control related committees, including contributing to the 2nd edition of the IADC Deepwater Well Control Guidelines and to API RP 96, Deepwater Well Design and Construction. He has a Master of Petroleum Engineering degree from Heriot Watt University, Edinburgh Scotland, and is a registered professional engineer in Texas.

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## Improved Recovery of Mature Water Floods:
## Can we have a sizeable impact?


## Carlos A. Glandt



**Abstract**

Mature waterfloods suffer from extended periods of ever increasing high water cuts. Although there are well established conformance technologies to arrest or mitigate these trends they have rarely been adopted across the field as part of a routine surveillance plan.

This presentation discusses two technologies that provide key information to design conformance jobs. They are Capacitance-Resistance Modeling (CRM) and interwell tracer tests. CRM, based on injection-production data only, provides a) interwell connectivities that are key to understand water distribution, and b) the ranking of injectors' contribution to oil production, that immediately leads to injection optimization. Interwell tracer tests provide fluid flow paths and swept volumes required to design in-depth conformance treatments.
With the assistance of local laboratories, conformance experts, and Service Companies the surveillance engineer can lead an in-house multidisciplinary team to design and execute low cost conformance jobs, contracting out, if necessary, only field operations (mixing and pumping). In-house learnings will also contribute to lowering total costs.
Low costs result in low economic risks, a lower-level, faster approval process, which facilitates field wide deployment. Arresting and reversing the WOR trend should be a priority of the Surveillance Plan of mature waterflood operators, with the associated sizeable impact on production and reserves.


**Biography**

Dr. Glandt has more than 35 years of Reservoir Engineering experience in areas such as Field Development, Heavy Oil, Waterflooding, EOR, Smart Wells, and others. He worked at Shell for 28 years both in the US and internationally, covering a wide range of technical assignments and managerial responsibilities. He was manager of EOR R&D, Smart Wells Global Implementation, Reservoir Engineering Skill Pool for the R&D Organization, and Technical Manager for the Cedar Creek Anticline asset in Montana.

After retiring from Shell Dr. Glandt was Director of Development of YPF, the leading Argentinean oil company, and is now Sr. Consultant for QRI of Houston with assignments in projects around the world.
He holds an Engineering Degree from the University of Buenos Aires and a PhD from Princeton University, both in Chemical Engineering.

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# Illuminating insights into well and reservoir optimisation using fibre-optic Distributed Acoustic Sensing

**David Hill**
**OptaSense Ltd**

## Abstract

In these times of low oil and gas prices, the drive to provide 'more for less' has never been greater. One key component in achieving this is the ability to accurately monitor the production rates along a wellbore and across a reservoir. Ideally a range of different measurements should be available on-demand from all points in all wells. Clearly conventional sensors such as downhole pressure and temperature gauges, flow meters, geophone arrays and production logging tools can provide part of the solution but the cost of all these different sensors limits their widespread deployment. Fibre-optic Distributed Acoustic Sensing, or DAS for short, is changing that. Using an optical fibre deployed in a cable from surface to the toe of a well DAS, often in combination with fibre-optic Distributed Temperature Sensing (DTS), provides a means of acquiring high resolution seismic, acoustic and temperature data at all points in real-time. Since the first downhole demonstrations of DAS technology in 2009 there has been rapid progress in developing the technology and applications, to the point where today it is being used to monitor the efficiency of hydraulic fracture treatments, provides continuous flow profiling across the entire wellbore and is used as a uniquely capable tool for borehole seismic acquisition. With optical fibre installed in your wells and DAS acquiring data, there is now the ability to cost effectively and continuously monitor wells and reservoirs to manage them in real-time in order to optimise production.

## Biography

David Hill is the Chief Technology Officer at OptaSense, a QinetiQ company, based in the UK. He has over 30 years of research and development experience in the field of acoustic sensing, 20 years of which have been spent developing fibre-optic based sensors. He holds a PhD in Physics, specializing in fibre-optic sensing, from the University of Kent in the UK and has filed over 30 patents and authored numerous papers. Since jointly founding OptaSense he has led the development and exploitation of fibre-optic Distributed Acoustic Sensing (DAS) in the oil and gas industry. In 2009 he was the first person to use fibre-optic Distributed Acoustic Sensing (DAS) to acquire signals on a downhole fibre. Since then he has continued to develop a range of downhole applications for the technology.

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# Creating Geologically Realistic Models Used for Reservoir Management


## Dave Stern
**ExxonMobil Upstream Research Company**



## Abstract

To make sensible reservoir management decisions, it is necessary to predict future reservoir performance. This allows testing and optimization of reservoir management strategies before making large investments. When displacement mechanisms change or geologic description is different from current well locations, this prediction is usually done with reservoir simulation models. Because geologic features determine the connectivity and productivity of the reservoir, it is important to ensure that models realistically represent the reservoir description in order to provide plausible predictions. Challenges associated with constructing these models include:

1. Uncertainty in the geologic description – measurements are sparse, and do not always resolve the relevant features. It isn't always known which features are relevant to reservoir performance.
2. Geometry and stacking of geologic objects like channels and lobes are difficult to represent in cellular models
3. Multiple descriptions may exist that are consistent with available data

This presentation describes how reservoir models are used in making reservoir management decisions, and outlines a strategy for creating realistic reservoir models. Examples are provided of applying some elements of this strategy.


## Biography

Dave Stern is a career researcher at ExxonMobil's Upstream Research Company (URC) He joined URC in 1984 with a PhD in Chemical Engineering from University of California at Berkeley and a BS in Chemical Engineering from MIT. Research areas include experimental measurement of gas injection performance, development and use of simplified models for reservoir management, gridding and scale-up, and history matching. He led a team that developed tools for construction of simulation models from detailed geologic models, worked with software developers to implement that technology, and trained the rest of the corporation in its use. Dave is the author of an SPE distinguished author paper on practical aspects of gridding and scale-up, describing learnings from that experience. Dave also led a team that developed tools and methods for history matching, with emphasis on preserving geologic realism during the history match process. The team worked with software developers to implement the tools, and trained the rest of the corporation in their use. He is currently a Reservoir Engineering Advisor to a large project that develops and maintains software for reservoir modeling and simulation.

Dave is a career-long member of SPE, and has served as session chair or discussion leader in SPE forums on gridding and scale-up, reservoir modeling for asset teams, and data analytics.

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# Oil and Gas Operations – Integrating the Realities of the Social License

**Fernando L. Benalcazar**
**APDProyectos Cía. Ltda.**

## Abstract

Oil and gas are essential parts of a sustainable future. Though these are finite energy resources and sources of greenhouse gas emissions, the world continues to require their production. For this reason, it is imperative that we consider improved industry practices.

To begin, the audience will be presented with the most basic principles of sustainability pertaining to oil and gas operations, including SPE's position on this matter. When oil is discovered at a location, decisions and guarantees cannot be made without considering the project's life cycle. Our commitments must be demonstrated consistently along each stage of a project in direct consideration of a sustainable future.

Next, several case studies relating to sustainability, integrating the realities of the social license to operate and operations will be presented to the audience, detailing the required steps for the successful execution of any project facing challenging conditions.

The presentation will conclude by underlining that the inclusion of internal and external stakeholders will only enrich the project and, therefore, pave the road to success. It is our responsibility to create a culture of operational professionalism and reliability through active participation. In order to counterbalance the world's energy demand, we must produce oil and gas while considering that the more efficiently the energy is produced, the more affordable the energy will be. The oil industry is not only committed to its own sustainability but also to the sustainability of our planet.

## Biography

A Senior Adviser with APD Proyectos, Fernando L. Benalcazar has been in the oil industry for 24+ years and has provided project management and support for numerous international projects in Syria, France, Canada, the US, Oman, Venezuela, Colombia, and Ecuador. Benalcazar focuses on operation excellence, sustainable development, and stakeholder engagement. He also specializes in health, safety, and environment (HSE), local content, capacity building, and new ventures. He has authored or coauthored more than 12 technical papers and holds a MS degree in civil engineering from Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering (COPPE) at the Federal University of Rio de Janeiro, Brazil. He holds a Certified Safety Professional (CSP) designation in the US and has served on SPE's Sustainability Technical Committee since 2012. Benalcazar was the chair of a SPE Applied Technology Workshop and of two Latin American and Caribbean regional conferences. He has acted as a member of SPE Ecuador's Board since 2011 and is currently President-Elect. Benalcazar has been a chairperson for the environmental focus area of the SPE International HSSE-SR Advisory Committee since 2015.

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## Wellbore Integrity Restoration; New Life for Old Wells


### Greg Galloway
**Weatherford**



## Abstract

As wellbores age, the potential for loss of wellbore integrity due to challenges such as, corrosion, stress, fatigue and other factors increase. Stimulation and tertiary recovery methods such as CO2 floods, as well as the introduction of disposal into depleted zones can negatively affect the wellbore by introducing conditions outside of the initial well design criteria. In a given field, many if not all wells will experience similar issues because the well design and life-of-well conditions are similar. Restoring wellbore integrity is a viable alternative to plugging and abandoning these compromised wellbores.

Both current and potential issues in production casing and tubing strings can be identified through a number of methods ranging from abnormal annular pressures to cased-hole logging techniques designed to measure the in situ casing dimension, cement presence and bond quality.

Once the wellbore condition has been identified, decisions can be made on the best method to restore that wellbore's integrity. These solutions range from cement squeezes to seal the leak, to patches of various configurations to repair leaking connections, or long sections of the affected casing, to cementing a new string of casing or tubing into the wellbore.

This presentation will focus on identification of wellbore conditions and methods you can employ to restore wellbore integrity, thereby restoring production, maximizing recoverable reserves and preventing potential damage to people or the environment.


## Biography

Greg Galloway is Product Line Manager for Weatherford's Solid Expandable Systems. His career has focused on drilling optimization and increased efficiency and has been involved in the early development of several oilfield technologies. He is Vice-Chairman of the AADE Deepwater and Emerging Technologies committee where he also served as Chairman. Greg held roles with SPE as a board member, has served on many industry programs, workshop steering committees, and session chair.

Greg has a Petroleum Technology Degree, has authored over 30 technical papers and is named inventor on over 25 patents related to drilling optimization, drilling with casing, expandable tubulars and particle-impact drilling.

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## Isotropy: A Perilous Assumption in Shale Geomechanics

**Hamed Soroush**
**Dong Energy**

**Abstract**

By definition, anisotropy is variation of material properties with direction. Preferred orientations of minerals, layering, cleavage, schistosity, foliation, and micro-fractures are the main sources of rock anisotropy. Although anisotropy can be seen in many rock types, shales always exhibit strong anisotropic properties at any scales as they are composed of thinly layered sequences of aligned microscopic clay platelets. Anisotropy has a pronounced effect on the physical and mechanical properties of shale, including acoustic wave propagation, deformation, strength, failure mode, fracturing etc. These changes in the mode of deformation and failure, in turn, influence the outcomes of the routine geomechanical analyses such as wellbore stability, well design, hydraulic fracturing, porosity-permeability evolution, and reservoir performance. Dependent on the inclination of the anisotropy with respect to the principal stress direction, and of course, wellbore trajectory, the importance of anisotropy on rock behavior can vary significantly. Ignoring anisotropy may impose significant additional cost to the oil and gas industry, both conventional and unconventional, and sometimes can even lead to the failure of drilling and production operations. This presentation aims in explaining shale anisotropy, characterization methods and its importance using some interesting field case.

**Biography**

Hamed is an internationally recognized expert in the field of petroleum geomechanics. He holds BSc in Mining Engineering, MSc in Rock Mechanics and PhD in Petroleum Engineering with around 20 years of industry experience in geomechanics working for different consulting, service and operating companies. Hamed is currently working for Dong Energy as Principal Geomechanics Specialist and Team Lead based in Copenhagen, providing project coordination, support and training for geomechanics and petroleum engineering applications.
He is a well-known geomechanics instructor giving short courses for SPE, EAGE, AAPG and PETROLERN and has served as steering committee on several conferences and workshops. Hamed's interest in the last 5 years has been around shale gas geomechanics and shale anisotropy effect. He served as SPE Distinguished Lecturer in the 2012–2013 program.

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## The Future Role of Oil


## Iskander Diyashev
**Petroskills**



**Abstract**

One idea: Our industry is in the new era of greater competition and must become more efficient to continue to prosper.

Only about 15 years ago "peak oil" theories were quite popular and accepted by the general public. Another school of thought, based on the concept of resource triangle, stated that as technology develops and as prices increase, vast amounts of hydrocarbon resources will become commercial. Oil and gas prices did increase and this led to the unconventional oil and gas revolution. Recent analysis of resource potential based on technical data collected for North American basins (S.A.Holditch et al) showed that we may think of hydrocarbon resources as being essentially infinite for practical purposes.

However the cost of the resource development, as expressed by the production activation index (the CapEx required to create production stream of 1 stb/day) increased over the decade from about 1000-10,000 USD/bopd range for conventional oil, up to 15,000 USD /bopd, and more in some cases. Maintaining production levels with unconventional resources requires continous drilling. The rapid rate of decline of unconventional wells translates to roughly a three-fold increase in the cost of generating a unit of energy compared to conventional wells. At this order of magnitude of energy cost, other sources of energy and combinations of technologies become competitive with conventional fossil fuel based energy and transportation.

3/4 of all the oil that we produce is used for 3 purposes: ground transportation, heating and electricity generation, and jet fuel. In this lecture we will discuss competitive technologies, their technical limitations, their progress in application and market penetration trends. These competitive technologies are solar power, electric automobiles, and magnetic levitation trains. The high energy density of gasoline made conventional internal combustion engine cars prevalent at the turn of the 20th century. But today, the higher energy efficiency of electric cars and improvements in battery technology are making electric vehicles competitive. We review how the future may look like and how our industry may adapt and change. As the transition starts there will probably be long term demand destruction trend in OECD countries.

It is likely that the industry will experience significant downward oil price pressure as alternative technologies become more competitive. We need to train young engineers in energy engineering rather than just petroleum engineering.


**Biography**

Iskander Diyashev is an instructor for Petroskills since 2008. The PetroSkills Alliance is a training organization for the 30 member companies representing more than 40% of the world's oil production.

Iskander Diyashev had taught numerous classes in fundamentals of petroleum, reservoir, and production engineering. The advanced level classes that Dr. Diyashev has instructed include oil and gas reserves evaluation, well test design and analysis and gas reservoir management.
Prior to his current job with Petroskills, Dr. Diyashev worked in various engineering and leadership roles for S.A. Holditch and Associates, Schlumberger, Sibneft, Geo-Alliance and NRK-Technology.
Iskander served on the SPE International board of directors in 2006-2008, and participated in various SPE technical and organizing committees for SPE conferences.
Iskander holds Ph.D degree in Petroleum Engineering from Texas A&M University (1998) and BS and MS degrees in Physics (Molecular and Chemical Physics) from Moscow Institute of Physics and Technology.

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# Measuring Land Drilling Performance


## John B. Willis
**Occidental Oil & Gas Corporation**



## Abstract

"Drilling" often refers to all aspects of well construction, including drilling, completions, facilities, construction, the asset team, and other groups. Good performance measures drive performance and reduce conflict between these groups, while bad performance measures mislead and confuse. The first key to success is how to communicate drilling performance in terms that answer the questions of executives and managers, which requires a business-focused cross-functional process. The second key to success is to drive operational performance improvement, which requires a different set of measures with sufficient granularity to define actions. Over the past 10 years, a very workable system has evolved through various approaches used in drilling more than 16,000 wells in the US, South America, and the Middle East. The system has delivered best-in-class performance. It has proven that an effective performance measurement system which addresses both executive requirements and operational requirements can both deliver outstanding results, and also communicate those results, with remarkable value to the organization. The basic principles are widely applicable to areas other than drilling.


## Biography

John Willis is Drilling & Completions Manager for Occidental Oil & Gas Corporation Permian Resources Delaware Business Unit. His responsibilities include drilling, fracturing, completions, and well servicing in the Delaware Basin. Prior to this role, he served as Chief of Drilling for Oxy for 6 years, responsible for standards, operational support, global systems, the drilling data system, and tools for drilling performance measurement. He also served as Drilling Manager in Oman and Drilling Manager in Libya. His experience prior to Oxy includes other drilling roles, service company roles related to project management and software development, and he operated a consulting and software business. He has Chaired two SPE Forums, served on Forum Steering Committees, and Chaired the 2003 SPE/IADC Drilling Conference.

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## Developments in Heavy-Oil EOR for the Era of Low Oil Pricing


## Jose Gonzalo Flores



### Abstract

In low oil-price environments, it is customary to cut expenses, reduce staff and postpone most, if not all, capital investments. While this strategy may be financially sound in the short term, it completely disregards the essence of the oil business, that is the timely replacement of reserves. The problem further complicates in the case of heavy oil projects, where costs are higher and the product price is even lower.

This presentation confronts the audience with the dilemma of reducing cost and at the same time sustaining production and increasing recoveries. The balance resides in the quality of decisions, such as when and where to invest, and that results meet budgets, a common issue in our industry. In the most complex and financially challenging case of Enhanced Oil Recovery (EOR) projects, decision quality in combination with “fit-for-purpose” technology implementations offer the most promising middle-point, this is the central idea in this presentation. By providing 8 examples of innovative technologies to help reduce uncertainty, cost and time for commercial EOR oil, and 3 successful case studies, the audience will gain confidence in the proposition that is perfectly viable to double recoveries in the next 15 years. Finally, EOR is a business, as such, it needs to compete favorably in cost and time with other alternatives present in a company’s E&P portfolio, particularly in low-price environments. A strategy, illustrated by an example, on how to divert from the traditional engineering approach in favor of a managerial decision approach will help engineers justifying viable recovery projects.


### Biography

Jose Gonzalo Flores is an independent consultant and instructor in the areas of production and reservoir engineering of heavy oils. Previously, he worked for Schlumberger and Occidental Petroleum Corp. covering a 30-year period, in roles involving the structuring, leading, advising and field implementation of production optimization and improved recovery projects, and as instructor for NExT, globally. Flores holds a B.S. degree from the Universidad Nacional de Ingeniería, Lima, Peru, and M.E. and Ph.D. degrees from The University of Tulsa, Tulsa, Oklahoma, all in Petroleum Engineering. He is considered an expert in the areas of reservoir and production enhancement and strategies to increase the recovery factor in heavy oil and mature fields, and has over 45 publications in the literature. Flores is a member of the SPE, and regularly serves in steering and technical roles in conferences, forums and workshops. Currently, he serves in the SPE Editorial Review Committee and as co-chair of the 2016 SPE Latin America Heavy Oil Conference.

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## Surfactant chemistry and its impact on oil and gas recovery in shale plays

**Liang Xu**
**Halliburton**

**Abstract**

In current low oil price environment, it has become critical to enhance production and add reserves, considering that only a limited number of wells are being completed via hydraulic fracturing in shale plays. Surfactant is a fracturing additive that can potentially enhance initial production and sustain long term production, without making significant changes to fracture design and pumping schedule on location. However, surfactant must be carefully selected in order to make wells flow better. A typical assumption for the use of surfactants is that traditional surfactants will work appropriately across a large gamut of fields, but our experiences show that inappropriate application leads to lower efficiency of the oil recovery and thereby a diminished return on production. Operators should strive to understand how surfactants extract the oil in the first place and then select surfactants cautiously in order to maximize recovery and minimize risk.

This presentation presents a concise overview on surfactant chemistry and its most relevant parameters to hydraulic fracturing. In particular, the key characteristics of surfactant additives was discussed in terms of conventional wisdom and newer chemistry. Insights were also provided into potential syngeries between surfactant and other additives such as friction reducer, scale inhibitor, biocides and proppant, thereby leading to a better fracturing fluids design. When properly selected, surfactant containing fracturing fluids tend to lead to better well cleanup and higher ultimate oil recovery.

**Biography**

Liang Xu is technical manager for frac fluid additives at Multi-Chem, a Halliburton Service. He has been working in the oil patch about ten years. He's responsible for developing fracturing additives including surfactant, friction reducer and proppant transport, etc. He was the recipient of the MVP award for surfactant technologies from Halliburton Academy and his RockOn surfactant technology was voted the best production chemical in 2013 by World Oil. He has authored or co-authored over fifteen SPE papers and several issued patents. He holds a PhD in chemical engineering from the University of Houston.

# Society of Petroleum Engineers
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## Operational decision making: What makes a decision 'good'?

**Margaret Crichton**
**People Factor Consultants Ltd**

**Abstract**

So often, decisions are assessed as 'good' or 'bad'. These assessments are typically made in retrospect, based on the outcome of the decision and made by people other than the actual decision maker. Most operational decisions are made in time-pressured, dynamic, chaotic, uncertain environments, therefore it is essential that decision makers appreciate the range and effects of variables that can influence their decision making. But what affects whether a decision is considered to be good or bad? This presentation describes the decision making process, the influences on that process, as well as the biases that affect decision making, supported by a case study. By gaining a greater understanding of the decision making processes of both individuals and teams, decision makers can avoid the traps that might befall them, and focus on the effectiveness of a decision at the time it was made. A key take-away from this presentation is the recognition of the importance of situation awareness as the first stage in the decision making process, as well as the impact of stress, in order to increase the confidence and competence of decision makers.

**Biography**

Margaret Crichton (MA(Hons), MSc, PhD, CPsychol, AFBPsS, MCIEHF) is a Chartered Psychogist, a Visiting Professor at The Robert Gordon University, Aberdeen, and is on the Committee of the SPE Human Factors Technical Section. Her primary interest is human factors, especially non-technical skills (NTS) such as decision making (especially under stress), situation awareness, and communication, and she undertakes projects to research NTS problems and recommend solutions. She works predominantly with organisations that have a high priority on safety and reliability, such as oil and gas (drilling and production), nuclear power production, power distribution, emergency services, and Governments. She regularly speaks at conferences and has published extensively in academic and practitioner journals, and books.

# Society of Petroleum Engineers
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# Moving Beyond Stereotypes and Bias: Multiculturalism Starts Within


## Maria Angela Capello
**Kuwait Oil Company (KOC)**



## Abstract

In today's global oil and gas industry, operators and service companies need to develop and utilize local talent in overseas projects, as well as mobilize experienced employees to foreign worksites, ensuring that the best skills are in the right place. Organizations and individual employees increasingly face tough decisions when potential contracts or jobs are in countries with different cultural settings.

When we move to new locations outside our comfort zone, we may experience a culture change, and our proven strategies to achieve success do not seem to work anymore. We realize that our technical skills are not sufficient to flourish in the new setting. There are fundamental changes even in basic concepts, like time, accountability, teamwork, commitment, and transparency, to name just a few.

Three main abilities are critical to master work and life in a different cultural setting: curiosity, flexibility, and the capacity to re-learn. Internal reflection is the key, as no recipe will provide the correct answers in every situation. Shifting our own perspectives about other cultures, stepping aside from bias and stereotyping to embrace multiculturalism within – that is the winning strategy. As a result of adopting this multicultural approach, you can enjoy a more progressive career path, acquire a competitive edge in international industry relations, and help your company – and SPE – expand business worldwide.


## Biography

Maria A. Capello is a senior advisor in field development and organizational enhancement strategies for the energy sector, and was instrumental in launching innovative implementations in Latin America, USA, and the Middle East. She is currently coordinating the standardization of reservoir management best practices across KOC and the Professional Women Network for the eight companies in the Kuwait Petroleum Corporation holding. Previously, she worked at Halliburton and PDVSA. Maria is Italian-Venezuelan, studied in the USA, and has lived in Kuwait for the past 10 years, developing her career on three continents. She is a geophysicist with a BS from the Universidad Simon Bolivar in Venezuela, an MS from the Colorado School of Mines (USA), and is certified in Business and Training. Maria is an SPE Distinguished Member and received a Regional Service Award. She is a Lifetime Member of SEG and served as Vice-President in 2005-06.

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## Minimizing Environmental and Safety Risks to Sustain Resource Recovery – A Case Study

**Marina Voskanian**
**California State Lands Commission**

## Abstract

Management of environmental and personnel hazard risks is one of the most critical components of a corporate business plan worldwide, and can significantly impact the ability to achieve the maximum potential from a resource. These risks can be effectively managed only through tested, proven, and state-of-the-art prevention methods. This principle is central to a resource development strategy. Well planned risk mitigation practices described in this presentation can help assure uninterrupted resource development and recovery, and avoid premature termination of production, loss of revenue and significant human and environmental cost. In California, risk mitigation efforts on state offshore oil fields have been practiced for decades. Its oil spill and safety hazard prevention programs have played a significant role in sustaining the States resource development and production. This lecture will highlight the elements of California's effective risk mitigation practices and its benefits. State-of-the-art pipeline and facility inspection and testing procedures, blowout preventer inspection and certification, utilization of advanced well drilling technologies, and structural assessment of offshore platforms, are significant components of this program. The success which these risk prevention programs have had can be a template which domestic and international developers and regulators can follow. By way of contrast, this lecture also presents a case study highlighting the consequences of a poorly planned and executed risk mitigation plan involving an oil spill into the ocean from an onshore pipeline by a major pipeline company. The environmental impact from this event has had widespread financial consequences, but the lessons learned from it can be universally beneficial if applied correctly.

## Biography

Ms. Voskanian is the Division Chief of the California State Lands Commission and directs the leasing and management of State lands for the efficient extraction of oil, gas, geothermal, and other minerals. Marina has been employed with the State since 1987, and prior to that, worked 11 years for Exxon, Southern California Gas, and Phillips Petroleum. Marina received several Certificate of Excellence Awards from the State. An active SPE member, she served as the SPE Western Regional Director from 1992-96. She received several other SPE awards: 1991 Regional Service Award, 2000 Distinguished Member and Distinguished Service Award, 2013 Western North American Region HSE Award. She is a three time SPE Distinguished Lecturer, and selected again as Distinguished Lecturer for 2017. She was honored at SPE's 2016 Annual Meeting in Dubai, where she was awarded SPE's Health, Safety, Security, Environment, and Social Responsibility Award. In 2013, she was nominated by the US Secretary of Interior to the US EITI Advisory Board for six years and also serves as the 2016 Chairperson of the Baldwin Hills Conservancy Board. Marina is a

Registered Petroleum Engineer and received her graduate degrees in petroleum engineering from USC where later she served as a part-time lecturer for 15 years.

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# Automated Interpretation of Wireline and LWD Formation Testing Dynamic Data

**Mark Proett**
**Aramco Services Company**

## Abstract

Wireline (WL) and Logging-While-Drilling (LWD) formation tester measurements provide a link between the static petrophysical measurements and dynamic rock-fluid properties for enhanced formation evaluation. However, despite the significant advancements in these services, there are still barriers. The analysis of Wireline (WL) and Logging-While-Drilling (LWD) formation testing has traditionally been performed by a skilled testing analyst using specialized software and theoretical models to generate results and assess the data vitality. This can be a time-consuming process involving analyzing over 100 pressure transients. In practice, the petrophysicists and geoscientists rarely have access to a detailed analysis in the time frame required and typically revert to other methods. Some of the methods are ad hoc, but there is a growing consensus that several convenient, simple, and effective real-time measurements can be used for an objective evaluation of the dynamic data. This talk demonstrates a straightforward automated process that has been developed by which real-time measurements, which are routinely recorded, are used to automatically generate the results. Basic principles are used to develop quality parameters and a test rating system that can guide the analyst in the objective determination of the vitality of the results for each test. In this way, the highest quality testing results are used for fluid gradients and log correlations to improve the integration of the dynamic data into the petrophysical analysis. This also enables standards to be established for real-time data acquisition that can save testing time while improving data and quality. This automated method is being applied routinely and several field examples are used to illustrate the utility and time savings of this new workflow.

## Biography

Mark Proett is a Sr. Petroleum Engineering Consultant for Aramco Services Company, Upstream Group in Houston. Mark is best known for his publications advocating the viability of the formation testing-while-drilling (FTWD) introduced in 2002. He has been awarded 61 US patents and authored over 60 technical papers, most of which deal with sampling and testing analysis methods. He has been an SPWLA Distinguished Speaker and SPE Distinguished Lecturer. In 2008 Mark received the SPWLA Distinguished Technical Achievement Award and in 2013 the SPE Gulf Coast Regional Formation Evaluation Award. Mark has a Bachelor of Science in Mechanical Engineering from the University of Maryland and his Master of Science from Johns Hopkins University.

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# Petrophysical Rock Typing –
# A Solution for Modeling Heterogeneous Reservoirs

**Mark Skalinski**
**Chevron**

## Abstract

Rock typing provides a vehicle to propagate petrophysical properties through association with geological attributes and therefore is critical for distributing reservoir properties such as permeability and water saturation in the reservoir model. The conventional approach to rock typing have significant gaps in: incorporating diagenetic processes, transferring rock types from the core domain to log domain, accounting for multiple pore systems and using appropriate methodology to distribute Petrophysical Rock Types (PRTs) in the static reservoir model. Presented PRT Workflow addresses these issues in a comprehensive and consistent manner.

The objective of this approach is the determination of PRTs, which control static properties and dynamic behavior of the reservoir while optimally linking to geological attributes (depositional and diagenetic) and their spatial interrelationships trends. The ultimate goal is to determine and predict rock types in the log domain, which enables the linkage between available core information and the 3D reservoir model.

This PRT approach is novel for the fact that it: 1) integrates geological processes (depositional, diagenetic and mechanical), petrophysics and earth modeling aspects of rock typing in one comprehensive workflow. 2) integrates core and log scales and therefore provides consistent input to reservoir models in log domain 3) uses a novel pore typing method addressing multimodal pore systems and 4) provides a flexible “road map from core to 3D model for variable data scenarios This presentation introduces the rationale behind this integrated workflow and demonstrates its workings and agility through application examples to several carbonate fields. The workflow can be applied to any heterogenous reservoir.

## Biography

Mark T. Skalinski is currently a Senior Research Consultant in Petrophysics at Chevron Energy Technology Company (ETC). He holds M.Sc. and Ph.D. degrees in Geophysics from the University of Mining and Metallurgy (AGH) in Kraków, Poland. His previous assignments include: Tengizchevroil in Kazakhstan, Chevron Canada Resources, CABGOC in Angola, Husky Oil in Calgary, ONAREP in Morocco, and AGH University in Kraków. Mark’s interests includes: rock typing methodology, multi-mineral modeling, carbonate workflows, application of statistical methods in Petrophysics and integrated field studies.

Mark served as the guest editor for Petrophysics Journal and Distinguished SPWLA Speaker and is a reviewer of several technical journals. He is author or co-author of more than 50 papers and conference presentations He is a member of SPE, SPWLA, and AAPG.

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# Optimizing liquid recoveries from shales through geologic, geomechanical, fluid and operating considerations

**Milind D. Deo**
**University of Utah**

**Abstract**

Production of oil in the United States nearly doubled to about 10 million barrels a day over a five year span primarily due to increased production of liquids from shale plays. The technological advances that led to this increase were impressive, but there were also some system failures. Improving production of liquids from low-permeability, shale plays requires an integrated understanding of the interaction of fluid thermodynamic and formation geologic and geomechanical properties. Reservoir simulation and response surface methods helped establish the important factors that control liquid recoveries. Matrix permeability and hydraulic fracture spacing are at the top of the list, and six out of the eight factors were geologic. A transient material balance method was used successfully in the Permian Basin for the calculation of reservoir permeability early in production. Liquid rates and recoveries improved when the wells were operated at higher bottom-hole pressures, which is now being recognized and implemented by some producers. A dicrete-element geomechanical model to determine the morphology of hydraulic fractures is used to guide the fracturing process. A method to accurately simulate large multi-fracture, multi-well areas to optimize fracture and well spacing is described. Recovery of liquids from shales could be improved by operating the wells at higher pressures, and by optimizing fracture and well spacing.

**Biography**

Milind Deo is the Peter D. and Catherine R. Professor and Chair of Chemical Engineering at the University of Utah in Salt Lake City. He is also an affiliate senior scientist at the Energy and Geoscience Institute, a large consortium of upstream companies at the University of Utah. He has a B.S. from IIT Madras in India and Ph.D. from University of Houston in Chemical Engineering. He was a post-doctoral fellow at Stanford University before joining the University of Utah faculty in1989. His research interests are in reservoir engineering, enhanced oil recovery, carbon dioxide injection for EOR and sequestration, flow assurance and geothermal energy production. He was the Associate Dean for Academic Affairs in the College of Engineering, before taking over as the Department Chair. He has supervised the Ph.D. dissertations of 29 students and the Masters work of about a dozen students. He is the Fellow of the American Institute of Chemical Engineers and has been recognized for Reservoir Description and Dynamics by the Rocky Mountain North America Region.

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# Adopting New Technologies to Enhance Stimulation Efficiency: Temporary Diverters


## Mojtaba Pordel Shahri
**Weatherford**



## Abstract

Fluids introduced into a wellbore for stimulation applications typically take the path of least resistance and therefore frequently go into areas where there are open flow paths. In many cases, these are neither areas you want to stimulate to enhance production by using a refracturing operation in unconventional reservoirs, nor areas from which formation damage needs to be removed by using an acidizing operation in carbonate reservoirs. Recently developed solid particulate degradable diverters promote efficient plugging, which helps to create nearly impermeable seals and aids fluid diversion. These solid particulate materials are capable of degrading over time from a solid polymer state to a clear, nondamaging, liquid monomer solution, eliminating the need for mechanical removal after intervention. This presentation describes how different advanced modeling (analytical and numerical), experimental, and field data mining approaches can be used to design and optimize different stages of fluid diversion. Application of lessons learned and engineered design key practices are shown by means of case studies.


## Biography

Mojtaba P. Shahri is a Senior Geoscientist in the Weatherford RD&E department in Houston, Texas. His current research interests include completion and stimulation design and optimization. He has authored more than 45 technical papers and holds 7 pending US patent applications. Shahri received SPE Star, SPE Henry DeWitt Smith, SPE Nico van Wingen, SPE-GCS Exemplary Volunteer, and SPE Regional Young Member Outstanding Service Awards. He holds a Ph.D. degree in petroleum engineering from the University of Tulsa and is a registered Professional Engineer.

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## Essential Pre-Requisites for Maximizing Success from Big Data

**Muhammad Khakwani**
**Saudi Aramco**

**Abstract**

Big Data is an emerging technology in Information Management that holds promising returns on investment, as it can provide advanced analytics capabilities. It is well suited for large enterprises, and when used properly, it can lead to breakthroughs in analytics, deriving information from data that was previously not possible. However, a Big Data project cannot be approached using traditional IT system design and methods. Its success relies on teamwork and collaboration among petroleum engineering subject matter experts, senior IT professionals, and data scientists. To ensure that Big Data initiatives do not deliver poor results or disappoint, Big Data projects require significant preparation, which dramatically increases the chances of success. This presentation provides practical information about how to get started and what to consider in your plan, and it gives useful tips and examples for planning and executing a Big Data project. At the end of the presentation, attendees will know what Big Data is, what it offers, how to plan such projects, what the roles and responsibilities are for the key project members, and how these projects should be implemented to benefit their organization. Big Data analytics offers enterprises a chance to move beyond simply gathering data to analyzing, mining, and correlating results for insights that translate into business solutions.

**Biography**

Muhammad S. Khakwani is a Senior Information Systems Consultant and the leading Data Architect for Upstream data at Saudi Aramco. He has more than 25 years of experience in the IT industry working for large enterprises in Canada and the United States, and for the last 17 years in the Oil & Gas industry in Dhahran, Saudi Arabia. He has in-depth expertise in database design as well as data management, standardization, and governance. He has designed and implemented data warehouse solutions, formulated Real-Time data strategies, and devised controls for Data Security for Saudi Aramco. His current responsibilities include designing and managing the Upstream enterprise data model, as well as strategizing and managing policies related to the corporate Upstream database necessary to meet changing business needs at Saudi Aramco. He has a BS from University of Western Ontario, and an MIS from Webster University.

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# Breaking Down Conventional Barriers with Managed Pressure Drilling


## Patrick Brand
**Blade Energy Partners**



## Abstract

Managed Pressure Drilling (MPD) was introduced in 2000 as an adative drilling technology for pricely controlling the pressure profile in the wellbore. Utilizing applied surface pressure, MPD provides an addition degree of freedom in the design and drilling of wells. MPD has been utilized successfully in drilling projects to mitigate or eliminate problems associated with conventional drilling operations. MPD has been used for early kick detection, driling through narrow pore pressure/fracture pressure windows, reduction of the probability of lost returns, identifying and eliminating issues of wellbore breathing (ballooning), and pore pressure/fracture gradient mapping. An area that has great potential, but has gainned little attention, is the ability to utilize MPD for dynamic influx control. MPD changes the primary barrier envelope to well control, allowing small influxes to be managed through the MPD system. This lecture describes the current state of dynamic influx control and its limitations. It shows how conventional well control practices actually increase the probability of secondary well control problems, and thus risk. The basis for and practical applications of dynamic influx control are presented. Conditions under which dynamic influx control is practicable, and when conventional well control should be invoked, are discussed. Adoption of Dynamic Influx Control eliminates many problems associated with the current conventional methods of well control, allowing the control of the well to be regained safer, quicker and with less risk of secondary problems, including underground blowouts, stuck pipe, lost returns and secondary kicks.


## Biography

Patrick Brand is a founding partner of Blade Energy Partners and former Drilling Technology Advisor for Mobil. In his 36 years in upstream oil and gas, Patrick has made numerous innovative and fundamental contributions to MPD, including the development of Dynamic influx control, dynamic pore pressure and fracture pressure determination. Patrick is a former Chairman of the IADC UBO and MPD Committee and the SPE Re-Write committee for UBD. Patrick has over 20 archival publications on various technical subjects. Patrick is a registered professional engineer for the State of Texas. Education credits include a BS degree in Civil Engineering from Texas A&M University.

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# Ethane-Based EOR: An Innovative and Profitable Opportunity for a Low Oil Price Environment


## Patrick L. McGuire
**International Reservoir Technologies, Inc.**



## Abstract

After decades of research and field application, the use of CO2 as an EOR injectant has proven to be very successful. However, there are limited supplies of low cost CO2 available, and there are also significant drawbacks, especially corrosion, involving its use. Both simulation data and field examples demonstrate that ethane is an excellent EOR injectant. The rich gasses and volatile oils developed in the U.S. shale reservoirs have brought about an enormous increase in ethane production. In the U.S., ethane is no longer priced as a petrochemical feedstock, but is priced as fuel, and substantial quantities of ethane are being flared. Ethane-based EOR can supplement the very successful CO2-based EOR industry. There simply isn't enough low-cost CO2 available to undertake all of the potential gas EOR projects in the U.S. The current abundance of low-cost ethane presents a significant opportunity to add new gas EOR projects in the U.S. and elsewhere. The ethane-based EOR opportunity can be summarized as;

1. CO2-based EOR works well, and is well understood.
2. Ethane is better than CO2 for EOR.
3. Ethane is simpler than CO2 for EOR.
4. Ethane is now abundant and inexpensive in the U.S. This increases ethane availability and lowers ethane costs elsewhere.
5. Recent additions to the growing ethane infrastructure now deliver ethane to locations where ethane-based EOR targets are plentiful.

The take-home message: "Ethane-based EOR is a viable option in many areas, with a robust combination of low costs and high incremental recovery."


## Biography

Patrick L. McGuire is a reservoir engineer with over 40 years of experience. He holds BS and MS degrees in mechanical engineering. He is a noted expert on Enhanced Oil Recovery and has worked on gas injection and low salinity EOR opportunities across the globe. He worked for many years for ARCO and BP on the North Slope of Alaska, which is home to some of the world's largest EOR projects. He authored numerous technical papers on EOR, and holds seven U. S. patents. Mr. McGuire previously served as an SPE Distinguished Lecturer, and has addressed over 30 SPE Sections.

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# Coiled Tubing Real-Time Monitoring: A New Era of Well Intervention & Workover Optimization


## Pierre Ramondenc
**Schlumberger**



## Abstract

Coiled tubing is a unique fluid and tool conveyance means used to intervene throughout the entire well lifetime. Its flexibility of use is certainly one of the largest in the oil-and-gas industry, ranging from logging to stimulation to cleanout and even drilling. However, for the longest time, it was only seen as a rudimentary fluid conveyance system, despite its capability to service any well deviation.

With the development of instrumented tools for downhole point measurements and the use of fiber optics for distributed sensing, the recent advent of coiled tubing real-time monitoring has completely transformed this image. The access to live wellbore information—such as pressure, temperature, or flow—along with accurate depth control thanks to casing collar locator and gamma ray sensors have greatly enhanced fluid placement. Meanwhile, the ability to monitor the load, torque, and accelerations the bottomhole assembly is subjected to significantly improves the performance and possibility to use and manipulate downhole tools. Thanks to real-time monitoring, a whole new realm of optimization possibility was discovered.

This lecture describes the various real-time measurements that are available today during coiled tubing interventions and how they can be used to provide the industry with faster, safer, and more efficient operations while maximizing return on investment. A wide range of applications and examples will be discussed. Through them, one will be able to appreciate how coiled tubing has now entered a new era where the limits of operational optimization still have not been reached.


## Biography

Pierre Ramondenc is the Well Intervention Domain Manager for Schlumberger, with over 10 years of oilfield experience. He has been involved in all aspects related to coiled tubing real-time telemetry, from tools creation to intervention design and execution to data interpretation. Pierre has been responsible for defining most of the coiled tubing intervention workflows that leverage real-time data. He has authored over 15 technical papers and patent applications on the topic. Pierre holds MS and PhD degrees in Civil and Environmental Engineering from the Georgia Institute of Technology. He serves as technical editor of SPE Production & Operations Journal.

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# The Intersection of Environment and EOR: How Carbon Capture is Changing Tertiary Recovery

**Robert Balch**
**New Mexico Tech**

## Abstract

Increasing interest by governments worldwide on reducing CO2 released into the atmosphere form a nexus of of opportunity with enhanced oil recovery which could benefit mature oil fields in nearly every country. Overall approximately two-thirds of original oil in place (OOIP) in mature conventional oil fields remains after primary or primary/secondary recovery efforts have taken place. CO2 enhanced oil recovery (CO2 EOR) has an excellent record of revitalizing these mature plays and can dramatically increase ultimate recovery. Since the first CO2 EOR project was initiated in 1972, more than 154 additional projects have been put into operation around the world and about two-thirds are located in the Permian basin and Gulf coast regions of the United States. While these regions have favorable geologic and reservoir conditions for CO2 EOR, they are also located near large natural sources of CO2.

In recent years an increasing number of projects have been developed in areas without natural supplies, and have instead utilized captured CO2 from a variety of anthropogenic sources including gas processing plants, ethanol plants, cement plants, and fertilizer plants. Today approximately 36% of active CO2 EOR projects utilize gas that would otherwise be vented to the atmosphere. Interest world-wide has increased, including projects in Canada, Brazil, Norway, Turkey, Trinidad, and more recently, and perhaps most significantly, in Saudi Arabia and Qatar. About 80% of all energy used in the world comes from fossil fuels, and many industrial and manufacturing processes generate CO2 that can be captured and used for EOR. In this 30 minute presentation a brief history of CO2 EOR is provided, implications for utilizing captured carbon are discussed, and a demonstration project is introduced with an overview of characterization, modeling, simulation, and monitoring activities taking place during injection of more than a million metric tons (~19 Bcf) of anthropogenic CO2 into a mature waterflood.

Longer versions of the presentation can be requested and can cover details of geologic and seimic characterization, simulation studies, time-lapse monitoring, tracer studies, or other CO2 monitoring technologies.

## Biography

Dr. Robert Balch is the Director of the Petroleum Recovery Research Center located on the campus of New Mexico Tech. At the university he also holds Adjunct Professor positions in Petroleum Engineering and Geophysics and has been research advisor to more than 40 graduate students. During his 20 years at the PRRC he has been principal Investigator on a range of enhanced oil recovery projects focused on developing and applying solutions to problems at many scales using geological, geophysical, and engineering data. Dr. Balch is the Principal Investigator of the Southwest Partnerships Phase III demonstration project where 1,000,000 metric tonnes of anthropogenic CO2 is being injected for combined storage and EOR into a mature waterflood in North Texas. During the course of his work he has published more than 45 papers, is a frequent invited speaker, and has presented his research at more than 100 meetings or events. Dr. Balch has held an appointment as an Oil Conservation Commissioner for the State of New Mexico since June of 2011.

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# Fracturing without a Drop of Water - Lessons Learned Fracturing with LPG


## Robert Lestz
**eCorp International**



## Abstract

The practice of hydraulic fracturing has come under increased scrunity in recent years for a number of reasons. One technology developed to address the technical inefficiencies of fracturing also answered many of the environmental concerns. In 2008, fracturing with gelled LPG as an alternative to water was introduced to the industry to enhance well performance. LPG offered a non-damaging fluid which orginally came from the reservoir itself. Due to its favorable viscosity, miscible, surface tension, and phase behavior properties, longer effective fracture lengths and fluid recoveries appoaching 100% were envisioned. Furthermore, it eliminated the use of water and the related water handling costs and long term disposal issues.

Today this technology/service is no longer available to the industry as the sole provider has left the market. This presentation will review the hypothesis of why LPG is an ideal fracturing fluid and share historical successes, failures, and lessons learned along with ongoing efforts to advance the next generation of light hydrocarbon fracturing. Ideally members will take away a greater appreciation of the successes associated with LPG fracturing and an understanding that the business failure was not due to the technology but to its misunderstanding and misapplications.


## Biography

Robert is a petroleum engineer with 32 years of industry experience. He currently serves as the CTO for eCorp International. He co-invented the LPG Fracturing technology and worked at GasFrac as their CTO. He spent 22 ½ years at Chevron working in the areas of fracturing, artificial lift, completions, and well operations. He holds 5 patents and has additional patents pending. He previously served on the BOD of the Petroleum Technology Transfer Council, the US DOE Oil Shale Ad Hoc Group, ICoTA US Chapter President, and the advisory board of the University of Utah Institute for Clean and Secure Energy.

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## Lost Circulation- A Challenge We Must Address

**Salim Taoutaou**
**Schlumberger**

**Abstract**

Lost circulation is the most troublesome and costly problem in the drilling operations, cost of material, non productive and lost rig time and lost holes amounts for more than 2,000 M$/year.
Lost ciculation can be categorised into induced losses, and losses occuring in naturally fractured formation. Although some progress using different lost circulation materials and different placement techniques has been done; curing losses is still an art and not a science.
This presentation will cover the lost circulation challenges during the drilling, cementing and the consequences on the long term integrity of the well; and the solutions related to preventing the losses to occur as well as the mitigation meausres to combat the losses when they happen. In addition newly developed solutions, techniques and diagnostic tool to mitigate lost circulation will be presented.

**Biography**

Salim Taoutaou is the Cementing and Well Integrity Technical Advisor for Schlumberger in Paris. He manages the global development of the well integrity cementing domain strategy, providing optimal well integrity cementing solutions for clients. Through his 19 years in the oil and gas industry, he has held various positions in Africa, the North Sea, the Middle East and Asia Pacific. He has authored more than 43 international journal and conference papers, he is the holder of three patents and was the recipient of the SPE 2014 Asia Pacific Regional Technical Award in Drilling Engineering. He received a master's degree in mechanical engineering from Guelma University, Algeria.

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# Evaluating the Selection and Use of Polymers in Environmentally Conscious Areas


## Samuel Lewis
**Halliburton**



## Abstract

Environmental stewardship and sustainability are growing concerns around the globe and regulatory enforcement is spreading with these issues. One primary mode of enforcement is the establishment of ecotoxicological standards for chemical usage (for example biodegradation critieria). The current paradigm for biodegradability has been established using methods developed for wastewater treatment and consumer contact, however these lack the exposure context of oil and gas operations. These standards can be unsuitable in typical oil and gas use and nearly impossible to satisfy for polymeric materials which are widely used in the oilfield and designed to be very robust. This leads to great difficulties in achieving efficient performance and in some cases reverting to inefficient technologies or designing ways to partially achieve the environmental intent. The industry should solicit increased flexibility to allow relevant exposure scenarios in the required testing to appropriately evaluate the environmental impact of a substance. For instance, there is evidence that exposure scenarios such as sunlight in the case of surface release is a critical factor in evaluating the degradation potential of polymeric materials in particular. However, current requirements do not allow for such exposure when evaluating materials. Examples of these factors and some suggested methods to design and select polymeric materials in the current regulatory schemes will be discussed along with specific points of discussion for a future state of testing.


## Biography

Sam Lewis is a Senior Scientific Advisor for Chemistry in the Cementing Applied Sciences and Processes group at Halliburton. In this role, he is responsible for mentoring scientists and contributing to the development of strategic technology. He currently advises teams across multiple product service lines on environmental compliance and technology development/implementation while serving as a field advisor to locations around the world.

Dr. Lewis has a PhD in Inorganic Chemistry from Texas A&M University. He has over 100 US and international patents and has served on various committees within SPE, the Society of Plastics Engineers, and the American Chemical Society.

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## Waterflood Design and Operational Best Practices

**R. Scot Buell**
**Chevron Energy Technology Company**

**Abstract**

Reservoir engineers cannot capture full value from waterflood projects on their own. Cross-functional participation from earth sciences, production, drilling, completions, and facility engineering, and operational groups is required to get full value from waterfloods. Waterflood design and operational case histories of cross-functional collaboration are provided that have improved life cycle costs and increased recovery for onshore and offshore waterfloods. The role that water quality, surveillance, reservoir processing rates, and layered reservoir management has on waterflood oil recovery and life cycle costs will be clarified. Techniques to get better performance out of your waterflood will be shared.

**Biography**

Scot Buell has worked globally for 36 years as a petroleum engineer. He was a 2005-2006 SPE Distinguished Lecturer, is the author of 12 SPE papers, served as an SPE technical editor for 20 years, and has served as an SPE section Chairman, Forum Chairman, and Applied Technology Workshop Chairman. He has worked as an expert in the design of new waterfloods and the operation of existing waterflood projects in Asia, North America, Europe, and Africa. He provided technical leadership for 30 waterflooded reservoirs offshore West Africa for nine years. He currently serves as a corporate reserves auditor specializing in waterflood and EOR reserve estimates. He also serves as the principal researcher for thermal horizontal wells and thermal subsurface integrity management for Chevron Energy Technology Research Company. He holds a BS and MS in Petroleum Engineering and MS in Petroleum Economics, all from Colorado School of Mines.

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# Integrating Geomechanics with Operational Practices Improves Extended-Reach Drilling Performances


## See Hong Ong
**Baker Hughes**



## Abstract

Extended-reach wells present difficult drilling challenges, which if inadequately understood and addressed can yield significant downside risks and extensive non-productive time (NPT). These challenges are mainly due to complex well designs that combine high-deviation and extended-reach wellbores with difficult geology and hostile environments. Understanding the challenges and developing solutions are important to deliver the well with the proper casing specifications for production purposes.

Geomechanically, due to their long reaches and high deviations, borehole instability and lost circulations are particularly dominant in the overburden shale sections of extended-reach and horizontal wells. However, a good understanding of the rock failure mechanisms and an innovative use of the wellbore strengthening techniques can mitigate these geomechanical challenges through integration with good drilling practices such as efficient equivalent circulating density (ECD) management and effective hole-cleaning strategies. In addition, the long open-hole exposure typically experienced in these wells can cause chemical, thermal and/or fluid penetration issues that can further complicate the difficult drilling conditions. These secondary influences further stress the importance of incorporating geomechanical understanding in drilling fluids formulation.
This presentation focuses on the geomechanical challenges of drilling extended-reach wells. It highlights the need to integrate geomechanical solutions with appropriate drilling practices, particularly solutions based on good understanding of the intricate relationship between borehole stability, lost circulation, ECD, hole cleaning and bottom-hole assembly (BHA) optimizations in overcoming the drilling performance limiters. A case history will be presented as an example.


## Biography

See Hong Ong received his B.Sc., M.Sc. and Ph.D. degrees in petroleum engineering from the University of Oklahoma. He has more 30 years of world-wide experience in petroleum engineering and petroleum-related geomechanics research and applications. His professional career includes 17 years at Baker Hughes where he is serving in various advisory, technical and managerial capacities, and 17 years at PETRONAS where he had management and operational responsibilities. See Hong serves on many SPE technical program committees and has recently received the Regional Technical Award in Drilling Engineering. See Hong holds several US patents and has many publications in petroleum geomechanics.

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## Deep Water Cementing – From Challenges to Zonal Isolation - The Evolution of Cementing

**Shailesh Dighe**
**Baker Hughes Inc.**

**Abstract**

A fundamental understanding of the unique challenges encountered in deep water drilling is critically important to developing successful cementing solutions. The solutions that are developed and applied in deep water cementing have typically been the precursors to the practices applied in land and shallow water cementing operations. In recent years we have seen the hard lessons from deep water leading the oil and gas industry to an even more engineered and process driven approach to cementing.

The other fact we need to bear in mind is that the cement job performed during well construction phase will remain as an essential barrier that must last the active life of the well and far beyond, for it to be considered as a success.

Appropriate technology development, fit for purpose engineering design, practice of industry standard testing parameters combined with experienced and competent engineers is an significant part of a successful cement job. In addition, understanding the different phases that the cement will go through during its life, including potential failure modes helps us model and thus design cement for life of well.

The average attendee will better understand the hazards and challenges of deep water drilling such as shallow flow, depeleted zones as they apply to cementing along with evaluation methods used. Also discussed are test procedures and solutions to ensure a lasting, life of well approach.

**Biography**

Shailesh Dighe is the Cementing Technology Director - Baker Hughes, Pressure Pumping International. He is the author of five papers related to advances in cementing and has four cementing related patents pending related to HTHP cementing, Smart Cement and Depeleted Zone Cementing. He is a member of three API subcommitees and has been a Judge on various SPE Student Paper events.
He has experience in cementing from fabrication of cement plants, executing cement jobs on rigs to designing products & technologies thus providing him with a uniquie perspective on the complete process.
He holds a Bacholers in Mechanical Engineering & Masters Offshore Engineering (Drilling & Sub Sea).
He has taught Cementing at Baker, Schlumberger, various client schools as well as presented at Curtin University. He has worked from Australia to United States.

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# Using fractals to determine a reservoir's hydrocarbon distribution


## Steve Cuddy
**Baker Hughes**



## Abstract

In order to determine a field's hydrocarbon in place it is necessary to model the distribution of fluids throughout the reservoir. A water saturation vs. height (Swh) function provides this for the reservoir model. A good Swh function ensures the three independent sources of fluid distribution data are consistent. These being the core, formation pressure and electrical log data. The Swh function must be simple to apply, especially in reservoirs where it is difficult to map permeability or where there appears to be multiple contacts. It must accurately upscale the log and core derived water saturations to the reservoir model cell sizes.

This presentation clarifies the often misunderstood definitions for the free-water-level, transition zone and irreducible water saturation. Using capillary pressure theory and the concept of fractals, a practical Swh function is derived. Logs and core data from eleven fields, with very different porosity and permeability characteristics, depositional environments and geological age are compared. This study demonstrated how this Swh function is independent of permeability and litho-facies type and accurately describes the reservoir fluid distribution.

The shape of the Swh function shows that of the transition zone is related more to pore geometry rather than porosity or permeability alone. Consequently, this Swh function gives insights into a reservoir's quality as determined by its pore architecture. A number of case studies are presented showing the excellent match between the function and well data. The function makes an accurate prediction of water saturations even in wells where the resistivity log was not run due to well conditions. The function defines the free water level, the hydrocarbon to water contact, net reservoir and the irreducible water saturation for the reservoir model. The fractal function provides a simple way to quality control electrical log and core data and justifies using core plug sized samples to model water saturations on the reservoir scale.


## Biography

Steve Cuddy an Honorary Research Fellow at Aberdeen University where he holds a doctorate in petrophysics. He also holds BSc (Hons.) in physics and a BSc in astrophysics and philosophy. He is currently a Principal Petrophysicist with Baker Hughes and has 40 Years industry experience in formation evaluation and reservoir description. He has authored several SPE and SPWLA papers and carried out more than 200 reservoir studies.

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## Estimation of Shale Gas and Oil Properties Based on Field Data

**Tao Yang**
**Statoil**

**Abstract**

Reservoir fluid composition and PVT properties play important role in liquid rich shale development. Accurate estimation of reservoir fluid richness has significant impact on drilling target and well completion. Traditional PVT properties are widely used for reservoir management, production optimization, and economic evaluation.

Unfortunately PVT data from shale reservoirs is rarely available in public literature due to difficulty to obtain representative in-situ fluid samples in extremely low permeability reservoir. This makes understanding shale PVT a very challenging task. Statoil spent two years' time to collect large amount of PVT samples and measure PVT properties for Eagle Ford field. Wide range of reservoir fluids from dry gas, gas condensate, volatile oil to black oil had been collected and studies thoroughly.

Based on the large PVT database from more than 50 wells, a new methodology was developed to estimate in-situ reservoir fluid composition and corresponding PVT properties based on readily available field data. Only providing one of following field data (either API gravity of surface condensate/oil, gas-oil ratio, surface gas composition, or mud logging data) is sufficient to derive majority PVT properties, including reservoir fluid composition, saturation pressure, formation volume factors, and NGLs.

The new method proposed in this presentation is a technical breakthrough for shale gas and oil properties with many applications with significant improvements. Thanks to reservoir fluid self-consistency in shale plays, it is very practical to estimate reasonable PVT properties based on existing field data without large sampling and laboratory programs.

**Biography**

Tao Yang is reservoir technology specialist at Statoil. He holds BSc and PhD degrees in chemical engineering. Before joining Statoil, Tao Yang worked at Pera a/s - a leading reservoir engineering consulting company in Norway. From association with Prof. Curtis Whitson (Recipient of SPE Anthony F. Lucas Gold Medal 2011), he gained vast industrial experiences from global reservoir engineering consulting projects for more than 200 fields.

Tao Yang has publications in prestigious journals and reviews papers for several technical journals (technical editor of SPE Reservoir Evaluation & Engineering and editorial board member of Journal of Petroleum Science and Engineering). He served as co-chairman and steering committee member for numerous workshops and conferences (including the successful SPE ATW Complex Reservoir Fluids in 2011, 2012 and 2014). He received the SPE Outstanding Technical Editor Award in 2009 and the SPE North Sea Regional Technical Award - Reservoir Description and Dynamics in 2011.

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# The Importance of Contact, Conductivity and Connectivity in Multi-Fractured Horizontal Wells


## Wadhah Al-Tailji
**StrataGen**



## Abstract

Over the past few years, significant advancements have been made in completion and stimulation designs in horizontal wells in unconventional plays, with the primary driver being the improvement of fracture contact area in these very low permeability reservoirs, to improve production volumes and recoveries. Fracture contact area with plug-and-perf or sliding sleeve systems have been intensified by increasing the density of contact points in the formation as well as proppant amount with great success. While these parameters have been optimized, other important parameters such as fracture conductivity and connectivity have been largely neglected. In the journey to improving contact area, proppant conductivity is often sacrified to save costs, and fracture stimulation treatments are overflushed in order to maximize operational efficiencies on multi-well pads. This presentation will highlight the importance of all of these parameters, and provides steps that can be taken to further optimize and enhance well producitivity and economics in the shale plays.


## Biography

Wadhah is a Technical Manager at StrataGen, where he advises clients on completions and stimulation optimization in unconventional plays such as the Eagle Ford Shale, using fracture and reservoir modeling, analysis of large datasets, and field supervision of hydraulic fracture treatments. Before joining StrataGen in 2010, he spent five years in field and region engineering roles at BJ Services Company in East Texas, where he was involved in stimulation and cementing services in formations such as the Cotton Valley Sands, James Lime, and Haynesville Shale. He has authored three SPE paper on the topics of stimulation evaluation and optimization in the Eagle Ford Shale, and holds B.S. and M.S. degrees in Petroleum Engineering from New Mexico Tech.

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# Shale Development –
# Does Cheap Energy Really Mean Flaming Tap Water?


## William Fleckenstein
**Colorado School of Mines**



## Abstract

Shale development in the US has been ongoing for at least the last decade, and many lessons can be learned from the US experience to help prevent air emissions and aquifer contamination in future developments around the world. Media reports and films such as "Gasland" imply that shale development is widely polluting fresh water aquifers and the atmosphere, with a wide range of estimates of contamination. This lecture examines the risk of contamination of aquifers through wellbores, either by hydrocarbon migration or hydraulic fracturing operations, and is primarily based on a comprehensive three-year study funded by the US National Science Foundation examining nearly 18,000 wells drilled in the Wattenberg Field in Colorado, plus other relevant studies. In the midst of the Wattenberg field is heavy urban and agricultural development, with over 30,000 water wells interspersed with the oil and gas wells, resulting in a natural laboratory to measure aquifer contamination. Lessons learned have universal applications with clear relationships established between well construction methods in both conventional and unconventional wells and contamination risks.


## Biography

William Fleckenstein is an adjunct faculty member at the Colorado School of Mines, where he served as Interim Petroleum Engineering Department Head 2012-2014, and he also serves as the managing partner in Fleckenstein, Eustes & Associates, consulting on projects worldwide. He holds BSc, ME, and PhD degrees in petroleum engineering and has 30 years experience primarily in drilling, completions and workovers, with direct experience on over 200 wells and involvement in horizontal wells and stimulations since 1990. Dr. Fleckenstein has numerous publications and patented technologies in multi-stage fracturing, annular seal testing, and downhole hydraulic rotation.