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SOCIETY OF PETROLEUM ENGINEERS

SPE NEWS

COPENHAGEN SECTION

CONTENT

Welcome to a new season in the SPE Copenhagen Section

It gives me great pleasure to welcome everyone back after a glorious Danish summer vacation period and to present my first SPE program as the new section chairman. There is nearly always a compulsion to reinvent the wheel, tinker with and change everything when you are handed something by someone else. But with a balanced budget, large membership, healthy turnout and exciting new program I think you will agree that we are in good shape with our current format.

It has been through the tireless work of the Copenhagen section SPE board and Hans Horikx's leadership over the past couple of seasons that have meant meeting attendances have been at their highest ever and I hope we can continue to build on this and energize both the existing SPE members as well as inspire and stimulate our newer and future members.

And it is at this point I would like to thank Hans Horikx for his work and vision as chairman and for his support during the coming season as he will continue on the board. I would also like to say a special thank you to Susanne Poulsen who has been an active board member for close to 10 years, acting tirelessly as newsletter chairman and treasurer. And will now take a well earned break with her ever growing family but we hope to see her at some of the events. And thank you also to Anthony Hughes and Kimmy Bauer for their precious time and efforts. And it is with great pleasure that I welcome Jennifer McBeath, Pernille Silberg and Mette Juncker Hansen to join us on the board for the coming season and beyond.

The 2014-2015 season looks to be a memorable and exciting one with our first meeting being held at the Danish technical University (DTU) on the 23rd September. So pencil the meetings in to your Filofaxs or sync your iPhone calendars and come a long to meet and greet old friends and colleagues or meet the next generation of oil and gas professionals in Copenhagen. 2014-2015 will also see some exciting distinguished lectures on topics as varied as conformance engineering to openhole logging. And all of this will be carried out against the backdrop of a Danish general election and all which that entails for the oil and gas business in Denmark.

And don't forget about all of the resources available from our parent SPE organization. From the Annual Technical Conference and Exhibition (ATCE) in Amsterdam at the end of October to the many technical courses on offer around the world. And in a continued attempt to engage with the next generation of petroleum professionals as SPE Leadership Academy to help young professionals in soft or nontechnical skills deemed critical for career advancement.

I look forward to seeing you and welcoming you all in person at the end of the month and kicking off this new season.

Anders Krag Norman
SPE Copenhagen
Section Chairman

FUTURE MEETINGS

FOR MORE INFORMATION REGARDING THE PROGRAMME SEE PAGE 6

SPE

COPENHAGEN SECTION

THE BOARD · 2014-2015 SEASON

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HANDLING COMPLEXITY IN COMPOSITIONAL RESERVOIR SIMULATION

"Keep it simple, but not simpler" is a principle usually adopted in the daily practice of petroleum engineering. The principle partly explains the wide use of black oil simulators, where the complex hydrocarbon fluid is simplified to just two components: gas and oil. However, the black oil formulation becomes too simple for reservoir processes with strong compositional effects, for example, development of gas condensate or volatile oil reservoirs and enhanced oil recovery processes like gas injection. In these scenarios, compositional reservoir simulations with more detailed fluid descriptions and more rigorous phase equilibrium models must be used. Moreover, oil and gas exploration under extreme conditions and the increasing utilization of unconventional resources like heavy oil and shale gas have posed new challenges for compositional reservoir simulations. First, it should be evaluated whether advanced thermodynamic models in more complex forms are needed to address ever more complex phase behavior. Second, with more complex thermodynamic models involved, phase equilibrium calculation, which is already computationally heavy, can become more costly.

COMMPLEX (full title: Compositional Reservoir Simulation Involving Complex Phase Equilibrium), a new Joint Industry Project (JIP) at Center for Energy Resources Engineering, Technical University of Denmark, is dedicated to answering the above challenges. The project is sponsored by ExxonMobil and ConocoPhillips

with current focus on production of heavy oil using hybrid steam and solvent injection, and production of liquid rich shale (LRS). Both topics, somewhat by coincidence, belong to development of unconventional resources, where the involved new production methods call for a better understanding and description of their particular challenging phase equilibrium problems. Heavy oil production with steam and solvent is recently introduced as an alternative to the successful SAGD (Steam Assisted Gravity Drainage) process with the purpose of reducing energy use and water consumption. The new hybrid injection process also results in complicated equilibrium between multiple hydrocarbon phases. In addition, the mutual solubility between water and other phases may not be neglected at the high temperatures of steam injection. For LRS, a major challenge is to understand the phase equilibrium in confinement down to nano scales, and to evaluate its influence on shale gas/oil production. It is expected that capillarity and adsorption can significantly change the phase behavior but the impact on LRS production is generally unknown.

The research team at CERE, coordinated by Senior Scientist Wei Yan, plans to test several advanced thermodynamic models, including two recent models CPA and PC-SAFT with stronger theoretical basis. Comparison of various models will be made in a compositional simulator so as to evaluate their influence on the simulation outcome. Thanks to Professor Michael L. Michelsen, the research team has strong expertise on robust and efficient phase equilibrium calculation algorithms. It will be used in the endeavor to realize faster compositional simulations even with more complex thermodynamic models.

Finally, challenging phase equilibrium problems can be found in simulation of other processes like gas injection or CO2 sequestration. The scope of the project can be further expanded provided that more companies join the study.

Pictures by
Christian Ove Carlsson

ABSTRACT

Scientific Computing for Optimization and Control of Oil Reservoirs

In this presentation we illustrate the role of scientific computing and feedback control for optimisation of the operation of oil reservoirs to maximise their net present value despite the significant uncertainties present. We introduce optimisation based control and model predictive control under the paradigm of Economic Model Predictive Control. We demonstrate the mechanism of Economic Model Predictive Control to improve the oil recovery and net present value of oil reservoirs using simulated oil reservoirs. Finally, we describe how we intend to implement and evaluate Economic Model Predictive Control for real oil fields in collaboration with our industrial partners in the OPTION project. ◄

NEW EXPERIMENTAL FACILITY FOR HIGH PRESSURE HIGH TEMPERATURE PVT STUDY AT DTU

High pressure and high temperature (HPHT) reservoirs are at the frontier of current oil and gas production. Development of these reservoirs requires rock and fluid properties at the extreme pressure and temperature conditions. Within the framework of the NextOil project, a HPHT PVT system up to 200°C and 150 MPa has been recently established at the CERE laboratory (DTU), making it possible to obtain high accuracy thermophysical and phase equilibrium data for both well-defined systems and real reservoir fluids. The system can carry out not only routine PVT study but also special ones like measurement of Joule-Thomson coefficients and study of asphaltene precipitation when coupled with additional modules. We will present the experimental design and the main functions of this system. The data from this PVT system is expected to be used for specific HPHT reservoirs as well as for improving the generic thermodynamic models for HPHT applications. ◄

LOW FIELD NMR OF FLUID SATURATED POROUS MEDIA

The presentation will be focused on applications of the Low field Nuclear Magnetic Resonance (NMR) in petroleum engineering. NMR spectrometry is commonly used to determine petrophysical properties of reservoir rocks. NMR spectrometry may determine the presence and quantities of different fluids (water, oil, and gas). Low field NMR may also be used to estimate porosity and pore size distributions of rocks and of other porous media, and thus, in many cases, to predict permeability. Moreover, this technique can be applied to illustrate changes such as precipitation and dissolution within the pore space of the medium due to injection of different fluids. In the laboratory, NMR spectrometry can also be used to quantify the recovered oil and water fraction during water flooding experiments. ◄

AFTER DINNER

NEW DANISH HYDROCARBON RESEARCH AND TECHNOLOGY CENTRE, DTU

Bo Cerup-Simonsen started 1 July as a Director for the new Danish Hydrocarbon Research and Technology Centre based at DTU.

Bo Cerup-Simonsen has a background both in the world of research and in the industry. He holds a MSc in Mechanical Engineering from DTU, has made Ph.D. there and afterwards was employed at DTU from 1997 to 2003. Afterwards he has been employed in the industry for more than ten years – most recently, as a Director for Maersk Maritime Technology. This was a highly specialized competence center of the Maersk Group that delivered the design and technology of the world largest container ship, Triple-E. DTU and Blue MBA education at CBS has relied upon his qualification as a bridge-builder between research and industry, and he has participated at the governmental development team for The Blue Denmark. ◄

BIOGRAPHY

John Bagterp Jørgensen, Associate professor at DTU Compute

John Bagterp Jørgensen has a PhD in Chemical Engineering. He is a co-founder of several start-up companies within simulation, control and optimisation. Currently, he is an associate professor at DTU Compute (Department of Applied Mathematics and Computer Science) and a faculty member of CERE (Center for Energy Resources and Engineering). His research interests are within computational methods for optimisation based control with applications to financial systems, medical systems, process systems, and oil production. His methods and software are used in several industrial applications. ◄

Teresa Regueira, Post-doc in CERE (DTU)

Teresa Regueira finished her PhD in the research group of Thermophysical Properties Laboratory in the University of Santiago de Compostela (Spain) in 2013. The topic of her PhD was the high pressure thermophysical behaviour of reference and new lubricants. She got expertise on experimental determination of density in broad ranges of temperature and pressure, determination of solubility through isochoric and visual synthetic techniques and study of the high pressure rheological behavior of lubricants. Since August 2013 is a post-doc in CERE (DTU) working on the NextOil project on the experimental determination of the physical properties and phase equilibrium for high pressure high temperature reservoir fluids. ◄

Konstantina Katika, PhD student of Petroleum Engineering at DTU

Konstantina Katika is a PhD student of Petroleum Engineering at the Technical University of Denmark. She received her Master of Science degree in Geotechnical Engineering and Master of Engineering degree in Civil Engineering from University of Patras, Greece. Her PhD project focuses on petrophysical and rock mechanical tests to identify the effect of injected water of varying salinity and ionic composition on the physical properties of rocks. More specifically, low field Nuclear Magnetic Resonance (NMR), elastic wave propagation, and electrical resistivity of chalk and greensand. The research aim is to formulate proposals for pilot water flooding in Danish North Sea oil reservoirs. ◄

COPENHAGEN MEETING

TUESDAY 23 SEPTEMBER 2014

SEPTEMBER

PROGRAMME
17:00 - 18:00
Drinks

18:00 - 19:00
Presentation and SPE News

19:00 - 21:00
Dinner

LOCATION
DTU
Auditorium 101 B and
DTU Faculty Club (dinner)
Anker Engelundsvej 1
2800 Kgs. Lyngby

SPEAKERS
Dr. Teresa Regueira Muniz;
Konstantina Katika,
Dr. John Jørgensen, DTU

TOPIC
DTU Research projects

DINNER SPEAKER
Dr. Bo Cerup-Simonsen, DTU

TOPIC
Hydrocarbon Research
& Technology Centre

ENTRANCE FEE
None

REGISTRATION
Please indicate your attendance by Thursday 18 September by signing up on the internet www.spe-cph.cere.dk

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www.spe.org

SPE MEETING SCHEDULE 2014-2015

September 23	MAIN SPEAKER	AFTER DINNER
TOPIC	**DTU Research Projects**	Hydrocarbon Research & Technology Centre
SPEAKER	Dr Teresa Regueira Muniz; Konstantina Katika, Dr John Jørgensen	Dr Bo Cerup-Simonsen
LOCATION	DTU	
SPONSOR	DTU	
October 22	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Safety in Operations – A leadership journey**	Process Safety in Wells
SPEAKER	Ben Ring, Shell	David Roberts, Shell
LOCATION	Shell	
SPONSOR	Shell	
November 26	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC		
SPEAKER		
LOCATION	Maersk	
SPONSOR	Maersk	
January 27	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Obtaining a high quality Ocean Bottom Seismic (OBS) survey on the South Arne Field**	
SPEAKER		
LOCATION	Moltkes Palae	
SPONSOR	Hess	
February 21	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Holistic Diagnostic Approach: The Key to Successful Conformance Engineering**	
SPEAKER	Julio Vasquez, Halliburton	
LOCATION	Charlottehaven	
SPONSOR	Chevron	
March 17	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**The Siri platform repair project – reviewing 5 years of challenges**	
SPEAKER	Jørgen Rentler Næumann, DONG	
LOCATION	DONG	
SPONSOR	DONG	
April 10	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**“Lessons Learned in Technology Development… …and Perforating ‘Smart’ Wells”**	
SPEAKER	Curtis G. Blount, ConocoPhillips	
LOCATION	Admiral Hotel	
SPONSOR	Welltec	
May 16	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**Comparing Formation Evaluation Measurements Made Through Casing with Openhole Logging Measurements**	Annual General Meeting
SPEAKER	James Hemingway, Schlumberger	
LOCATION	GEUS	
SPONSOR	GEUS	
June 20	**MAIN SPEAKER**	**AFTER DINNER**
TOPIC	**SPE Summerparty**	
SPEAKER		
LOCATION		
SPONSOR	Schlumberger	

THE SPE COPENHAGEN SECTION STUDENT SCHOLARSHIP

The SPE Copenhagen Section Student Scholarship can be applied for once a year by students working with petroleum engineering or closely related topics. The total amount that can be applied for is 15,000 DKK. The scholarship can be applied for by filling in the application form, which can be downloaded from the website **www.spe-cph.cere.dk** from October 2014. The application form should be returned to the secretary of the SPE Copenhagen Section:

Ken Wesnaes, A/S Dansk Shell, Mikado House
Rued Langgaards Vej 6-8, DK-2300 København S

The letter should be marked:
SPE Student Scholarship.

The application should be returned no later than **1st December 2014**

Inspiring tomorrow's

SHELL ECO-MARATHON IS ENGAGING STUDENTS TO

Across the world Shell has teams of talented engineers striving to find innovative solutions that will set Shell apart from its competitors. Adding to and replenishing these teams of engineers is the life-blood of Shell's continued success. Over the past 30 years however, there has been a significant decrease in the number of students considering engineering as a career. Shell understands that the company's future is dependent on the next generation of engineers and is investing heavily in fostering this talent and the Shell Eco-marathon is one of these initiatives.

Through the Eco-marathon platform, Shell is able to challenge students from around the world to think outside the "traditional transportation" box. Working with them to take currently available mobility options such as vehicle design and fuel types, and explore new, more efficient solutions. The competition invites teams of students to design and develop energy efficient cars, and then put them to the test. The competition is a playing and testing ground for students in a real-life situation.

Working for months in advance, students work in teams to design the most efficient vehicle in a select category. The vehicles are put to the test over the three days of the competition, each team vying for their car to travel the furthest distance on the equivalent of one litre of fuel. The origins of the challenge date back to 1939, when two Shell Oil Company employees in Wood River, Illinois, U.S, made a wager on who could go the longest distance with a set amount of fuel. From this friendly bet, the Shell Eco-marathon has grown into a global competition held across three continents: Europe, Asia and the Americas. This year the competitions were held in Houston, Texas; Manila, Philippines; and Rotterdam, Netherlands and attracted a total of more than 5,200 students from 147 countries. For several years the event have had Danish participation from teams at Aalborg University and DTU.

Over the years, as mobility challenges and technology have evolved, so too has the competition. Today, there are two different groups the teams of students can enter – the 'Prototype' group focuses on maximising energy

HELP ADDRESS FUTURE TECHNICAL NEEDS

efficiency and less on the 'creature comforts' that a car usually affords. While the 'Urban Concept' group focuses on the design of a practical, roadworthy, yet energy efficient vehicle. The teams also have to select an energy source category, such as: conventional petrol; diesel; biofuels; fuel made from natural gas; hydrogen; and, electricity. Whilst there is a winner for each category and fuel type, the most coveted category remains the Prototype petrol category. And, the results are staggering, at this year's competition in Rotterdam, the winning team from France travelled 3,314.9 km/l, a distance that would easily take you from Lisbon, Portugal, to Warsaw, Poland.

"It is like a technical Roskilde Festival."

The Da-nish results this year were impressive with DTU winning the Urban Concept category using Ethanol (GTL) driving 599 km/l and Aalborg University being second in Urban Concept using fuel cell electricity driving 64.7 km/kWh.

While engineering skills are at the centre of the competition, Shell is also keen to ensure students get a full experience across various skill-sets and technologies. For the first time this year, Shell invited global partners to participate in the competition by providing technology and support for the teams. The partnership with The Linde Group provided pi-votal expertise on hydrogen; Michelin provided special tyres that reduce the amount of friction the cars experience on the track; and, the technology that HP provided helped the students to improve communications with the car. It is amazing to see the teams come together, besides learning they have a lot of fun and as one of the Danish students expressed: It is like a technical Roskilde Festival.

SPE STUDENT CHAPTER VISITED MÆRSK OIL

On March 30, 2014, 20 students of the DTU SPE Student Chapter attended a workshop at Maersk Oil headquarter at Esplanaden. The event started with breakfast, followed by a presentation by Lee Milligan, Global MITAS Recruiter for Maersk Oil, about an introduction to Maersk Oil company and Maersk Oil recruitment program for graduates, MITAS. Subsequently the students were offered a unique insight into the career opportunities offered to reservoir engineers in a presentation given by Hans Horikx, Chief Reservoir Engineer at Maersk Oil and Gas. The students were divided into teams and they had to compete in order to solve the case study, which was an example of a reservoir engineering scenario. The event ended with lunch, where more than 10 reservoir engineers from Maersk Oil joined to network with the students.

CERE Student, Birgit Haastrup, wins the master category at the SPE European Regional Student Paper Contest in London

In the beginning of June, the SPE European Regional Student Paper Contest was held in London at Imperial College. The abstracts of 23 students from the European Region had been accepted in three different categories: Bachelor, Master and Doctorate. Participating in the master category from DTU was Leonardo Meireles with the project "Effect of divalent ions on solid-fluid interface, as observed by NMR transverse relaxation time" and Birgit Haastrup with the project "Enzyme penetration tests on chalk cores". Other topics entered in the same category were wide ranging, from the modelling of surfactant flooding to the building of a better experimental set-up for testing corrosion inhibitors.

Birgit Haastrup came first in the master category, qualifying for the International Student Paper Contest at ATCE 2014 in Amsterdam and Leonardo Meireles came third in the same category.

SPE STUDENT CHAPTER GENERAL ASSEMBLY

On June 4, 2014, 24 students of DTU SPE Student Chapter participated in the General Assembly Meeting for the election of new board members for 2014-2015. Amalia Halim, the previous SPE student chapter president, summarized the student chapter activities during the last semester. As the new board, the following people and positions were elected:

- President: Farhad Varzandeh
- Vice President: Finlay Bertram
- Secretaty: Nasos Stefanakis
- Treasurer: Unnur Margret Unnarsdottir
- Event Manager: Kim Edelholt Kristiansen
- Event Manager: Gianluca Lubelli

After the election, the members enjoyed themselves with a barbecue.

ABSTRACT

Safety in Operations – A leadership journey

Drawing on the experiences of the Pearl GTL (Gas to liquid) project in Qatar, the presentation will highlight the key elements of driving a step change in safety performance: A clear vision of success, underpinned by a committed leadership team; a structured and rigorous process to drive the desired change, but which adapts over time as the journey unfolds; and dedicated resources to help drive the process.

BIOGRAPHY

Ben Ring, Shell VP Upstream for Denmark, and Shell Country Chairman for Denmark, Greenland and Iceland since July 2013

Ben studied Mechanical Engineering at Bristol University and followed this with post graduate studies in law. He then worked for Linklaters as a trial lawyer in London and Hong Kong, specialising in engineering and infrastructure disputes.

He joined Shell in 2005 after completing an MBA at IMD in Switzerland. His first posting was to Qatar where he worked for five years in a number of roles including: Business Analyst for the Qatar Country Chairman; Business Development Manager; and lastly, Deputy Construction Manager and Integration Manager, both on the Pearl GTL project.

In 2010 he moved to Shell's headquarters in The Hague where he ran Upstream International's Strategy & Portfolio team. Since July 2012 he was a Senior Deal Lead in Upstream International's New Business Development team, based in The Hague.

Ben is married, has three young children, and enjoys triathlons and yacht racing. ◄

ABSTRACT

PROCESS SAFETY IN WELLS

Traditional Safety programs have focused on Personal Safety. This is important, and the progress made has been tremendous in the industry. Process Safety is even more critical, as the potential exists for catastrophic events. This requires that new focus and thinking processes be developed.

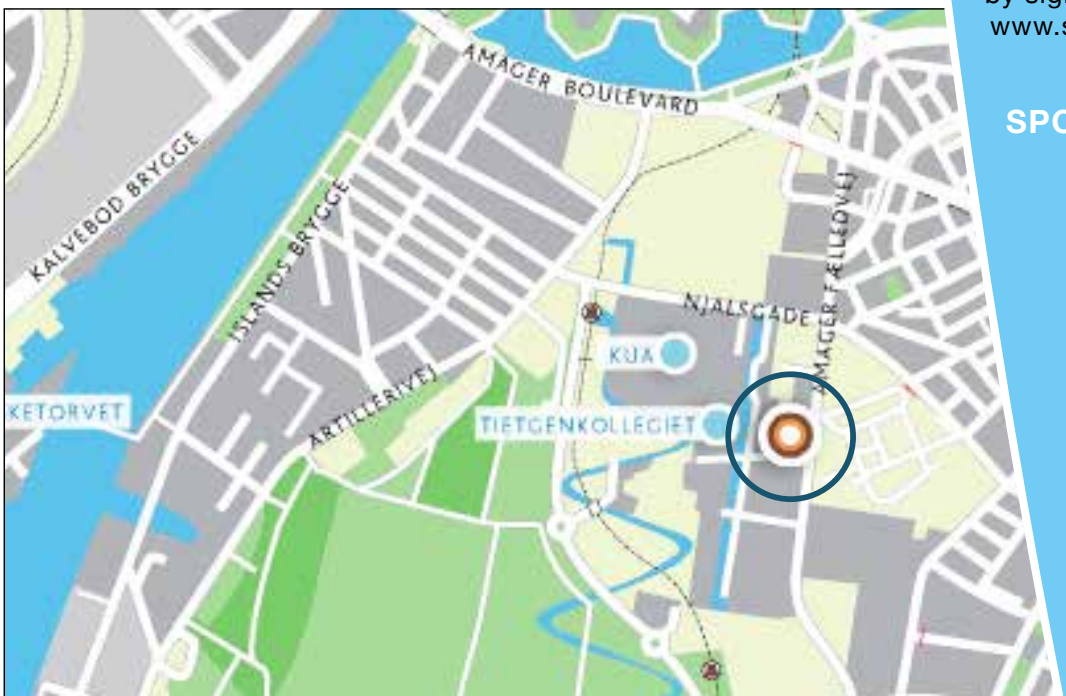
In Well planning and operations, Process Safety is all about keeping the hydrocarbons in the pipe, the well or the reservoir. After the events in the Gulf of Mexico in April 2010 put the industry in the spotlight, efforts to improve Process Safety in our Wells Business have been stepped up. Improvements have been made in corporate standards and reporting, at job design and planning stage, and at site level during the execution phase. The presentation will share some of that work. ◄

BIOGRAPHY

David Roberts, Shell

David Roberts studied Mechanical Engineering at the University of Sheffield in the UK. He joined Shell in 1992 as a Drilling Engineer, and has had assignments in the Netherlands, UK, Peru, Oman, USA, Canada and now Denmark.

Through his career he has worked on both rig sites and the office completing a variety of Drilling Supervisory and Engineering roles, in a variety of environments. David has recently transferred to the Copenhagen office in the role of Wells Manager, and is responsible for Shell's support in the wells area for the DUC operations. He is married and has 2 daughters, all of whom have accompanied him to Copenhagen. ◄



COPENHAGEN MEETING

WEDNESDAY 22 OCTOBER 2014

OCTOBER

PROGRAMME

17:00 - 18:00
Drinks

18:00 - 19:00
Presentation and
SPE News

19:00 - 21:00
Dinner

LOCATION

Mikado House
Rued Langgaards Vej 6-8
DK-2300 København S

SPEAKER

Ben Ring,
Shell VP Upstream for Denmark
Shell

TOPIC

Safety in Operations
– A leadership journey

DINNER SPEAKER

David Roberts, Wells Manager
SHELL

TOPIC

Process Safety in Wells

ENTRANCE FEE

None

REGISTRATION

Please indicate your attendance
by Thursday 16 October
by signing up on the internet at
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