



Norway Council

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The First

SPE Norway magazine

*To gather members
To share knowledge*

In this Issue:

22,000 new O&G jobs by 2020

The National IOR Centre of Norway

Produced Water Sand Management

Tracer data to assess remaining oil saturation

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

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

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The editors are working on voluntary basis.

The electronic version of this Issue and previous Issues are available on SPE Norway web-site.

Front cover: Viatcheslav Liakhov, Tschudi Shipping

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25 YEARS

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Sustaining our Future through Innovation and Collaboration

11-13 April 2016 / Stavanger Forum, Stavanger, Norway

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to register



Society of Petroleum Engineers

Visit www.spe.org/events/hse/2016/ to register and learn more about the premier HSE-SE international event including sponsorship and exhibition opportunities.

A Note from the Editor

Dear SPE Norway members!

You are holding in your hands the fresh spring edition of our The First magazine.

It is to our utmost joy to see that several events organised under the umbrella of SPE International are held in Norway in cooperation with our local sections and attract visitors from around the world (SPE Bergen One Day Seminar, SPE Stavanger HSSE and SR). Knowledge sharing and skills transfer is more important than ever before.

We are also glad to see that our industry is collaborating with the academia (the article about the National IOR Centre of Norway) and investing into research and development of new innovative solutions that will enable the daily working process to become more productive and create increased value.

Enjoy the spring while reading our magazine and remember to send us articles, news and technical papers for next issues.



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Dr. Carlos Chalbaud from SPE International

Carlos Chalbaud, The North Sea Regional Director gave interview to the April edition of the SPE Review London sharing insights from his term as an SPE director, including successful expansion, the current state of the region, and future plans. We are honoured to be able to reprint the article in our magazine.



We asked Carlos about his work as North Sea Regional Director

‘It’s a multi-purpose role, with many different and fascinating facets.

‘For example, in addition to providing support and guidance to the current existing sections in the region, the role also involves development of SPE presence in the North Sea region – either by identifying places where SPE should be more present or by launching initiatives to improve the way sections operate.

New Sections

‘Referring to the latter, we recently established two new SPE sections, one in Ireland in 2014, and another section in Esbjerg (Western Denmark) in 2015. In both locations, we had a significant number of existing members who were not receiving many SPE benefits (due to the lack of a dedicated section), and we also found a significant potential in both locations for SPE to better serve the industry.

‘Additionally, we established an SPE Council in Norway, to cover the five existing SPE sections, with a mission to improve SPE

presence and influence in Norway, through a strategy developed jointly with Sections and SPE International.

Discussion Facilitator

‘On many occasions, the regional director also acts as a facilitator in discussions between the sections and staff working for SPE International, based in the SPE offices in London office or in Dallas.

‘Because the SPE Board of Directors (BoD) is the policy-making body, and the ultimate authority on all SPE matters, the SPE regional director’s role is also international. The



SPE BoD has a strategic focus and manages its workload through board committees focused in three main areas: events, members’ services and communications, and knowledge sharing.

As the director for the North Sea region, I need to represent the region’s concerns and activities – but always keeping in mind the common good of our global membership.

With a lower and for-longer oil price environment, what changes do you envision for SPE?

‘We’re moving from a period of growth to a period of consolidation, in which we are carefully looking at everything we do. In terms of membership, we will keep growing, probably not at the same rate, although we will keep trying to increase our presence in locations where the industry needs us.

‘Along with most organizations in the Oil & Gas sector, we are trying to reduce our costs as much as possible and optimize our operations. That is why you are, and will continue, to see more publications coming in an online version, along with changes in our events’ portfolio to adapt to current market needs. Our main focus is ensuring the high quality of the services we deliver to our members.

Hard decisions

‘The current times do require making hard decisions.

For example, we’ve had to significantly reduce the number of staff working for SPE and, in some cases, had to put on-hold some events that our members would like to happen, to ensure the continued security of the Society’s finances as a whole. In most cases, we try to change the format of the event in order to make it easier for our members to attend and to reduce the financial risk. So, for example, some conferences will become smaller workshops or symposiums, which may be easier to attend and to manage.

Of course, volunteering is becoming harder in some places, mainly driven by reductions in personnel. However, these are times when your personal network becomes ever more

important, and SPE involvement can become a differentiator in the marketplace. In the North Sea region we are seeing more people attending our events, particularly our small and mid-size events.

What’s next?

‘The North Sea is a mature region, which is going through major challenges linked to the offshore nature of most of its production. At the same time, in facing these challenges, we have become a reference in technology development, and a magnet for talent from all around the world.

‘After all, it was the starting point for the offshore industry, and many people have worked in the North Sea region at some stage in their careers. The very diverse nature of the North Sea means people gain significant knowledge and experience of new and developing technology. It also has an excellent reputation with universities, worldwide.

Supporting people

‘Of course, having said that, all locations in the region have been hit hard, including operational bases such as Aberdeen, Stavanger and Esbjerg. The Society is doing what is within its means to help those members who are now out of the workforce. Membership is free of charge for them, and we also run entrepreneurship workshops alongside some of our conferences. Attendees receive advice, and hear the experience of other peer members who have started their own consultancy or other related business.

What’s been the most rewarding part of being an SPE Director?

‘Definitely, the most rewarding part of the experience has been the interaction with so many enthusiastic and diverse people.

‘At the regional level, supporting and guiding the work of the sections has been very fulfilling. I saw how the possibility of having their own sector created such enthusiasm in both Ireland and Norway – people were very willing to give up their time to volunteer to develop and build the new section.

‘And the, I’ve gained so much from interac-

tion with all the other SPE directors. There’s almost 30 directors on the Board, from diverse backgrounds and perspectives, and from across the world. Being the youngest person there also encouraged me to make as valuable a contribution as I could ... and taught me to stay humble among so many high-profile individuals, and learn better how to listen.

‘I’ll be ending my term at the ATCE 2016. The Board of Directors recently approved the name of my successor, and I’m pleased to welcome Karl Ludvig Heskestad as the incoming North Sea Director for the 2017-2019. Karl Ludvig served with the Oslo section, he’s received last year the SPE North Sea service award and has been active with SPE International activities for several years.

Note: the SPE North Sea region covers five countries: Denmark, Ireland, Norway, The Netherlands and the UK. Its 9,000 professional members spread across 12 local sections, with 4,000 student members in almost 30 student chapters

Carlos Chalbaud is SPE Director, North Sea Region, and Senior Portfolio Engineer at ENGIE E&P.

He has extensive experience in reserves evaluation and reporting, and previously worked as subsurface team leader for Central North Sea assets and a reservoir engineer for Southern North Sea assets as well as for new venture projects in LatAm, Asia, Europe and Africa. In 2012, he received the SPE International Young Member Outstanding Service Award (YMOSA). He is also a recipient of the South and Central Europe YMOSA and the SPE London section award. He serves in the Board of Directors of the SPE representing the North Sea region since 2013.

Carlos holds a M.Sc. and a Ph.D. from IFP-School both in Reservoir Engineering.

The following article was prepared for the SPE Review London's April 2016 issue, and reprinted here with permission.

SPE Norway – Bergen



SPE Bergen Section is looking forward to some busy months ahead filled with technical and networking events. The first “big happening” this year is a technical conference taking place in Bergen in April, “**One Day Seminar**”. With an exceptional quality of the technical program, software demonstrations and an exhibition, we expect big interest from local and international Oil & Gas professionals. Just like every May, we will invite fellow industry colleagues to **SPE Bergen Sailing** networking event with Statsråd Lehmkuhl. The annual sailing is always a sell-out, and some 350 participants including students enjoy a full evening at sea with excellent food, drinks and networking. In addition, we have several **TechNights** coming up with speakers from Distinguished Lecturer Program as well as local company experts. **We encourage all industry colleagues to take active part in our events for both networking opportunities as well as a chance to gain new technical knowledge from industry experts across the world.**

Yours,
Board of SPE Bergen Section

SPE Norway – Oslo

On Feb 16, SPE Oslo members met to traditional Dinner Meeting with two outstanding Distinguished Lecturers. The evening was opened by Distinguished Lecturer, Xiao-Hue Wu from ExxonMobil Upstream Research Company, who presented *How to Predict Reservoir Performance with Subsurface Uncertainty at Multiple Scales?* He presented a goal-driven and data-driven approach for reservoir modelling showing that such a approach is driven by the practical limitations inherent in numerical approximations of Darcy flow equations as well as how fluid flow responds to reservoir heterogeneity. The second speaker, Sven Kristian Hartvig from Restrack, presented *Tracer Technologies to Assess and Monitor Water, Gas and EOR Projects* about which you can read more in our magazine. The presentation discussed that New and stable, oil-water partitioning tracers suitable for offshore oil reservoir PITTs have been recently developed and field tested (SPE164059), allowing measurement of remaining oil saturation in inter-well regions. PITTs can therefore now be used to assess inter-well saturations even under harsh conditions and in large reservoirs.



SPE BERGEN
ONE DAY
SEMINAR



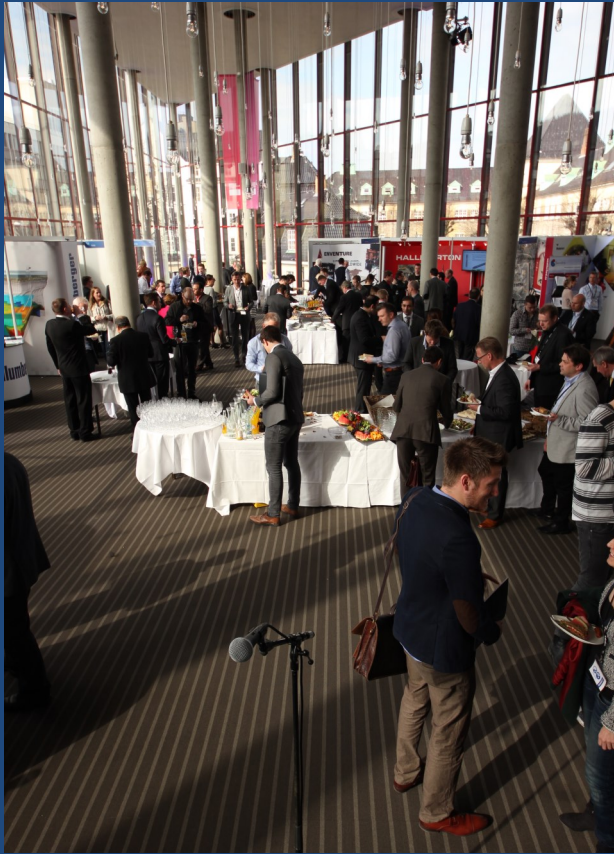
in Grieghallen, April 20

23rd international SPE Bergen One-Day Seminar will be taking place on the 20th April and will feature high-end technical presentations, alongside a substantial exhibition and a full-day software demonstration.

This is an excellent opportunity to expand your network and gain technical knowledge from leading experts across the industry.

TOP reasons to attend SPE Bergen One Day Seminar

- ◆ Four parallel SPE technical paper sessions with presentations
- ◆ Software demonstrations
- ◆ Discover, debate, and discuss the latest challenges and trends in the industry
- ◆ 40-50 exhibitors showcasing exciting new technology
- ◆ Informal setting with excellent opportunities for networking



In order to encourage industry professionals that are currently available and to offer them a possibility to further build their network and gain new technical insights, SPE offers them conference passes with 50% discount!!!

To learn more about the event visit event website:



SPE Norwegian Arctic Subsurface and Drilling challenges Workshop in Harstad

The annual event previously known as the SPE Workshop in Arctic Norway presented by the SPE Northern Norway Section, now organized by the Section and SPE International, took place 9-10 March 2016. Around 50 delegates from Norway, UK and the US attended the workshop held at Harstad Kulturnus, situated at the waterfront in Harstad with a beautiful view over the fjord to the island of Andørja.

The first session of the first day handled topics related to reservoir drainage strategy and reservoir management. The session started with key note speaker Anne-Minne Torkildsen from the Norwegian Petroleum directorate giving an uplifting view of the future of oil and gas in the Barents region with regards to remaining reserves and the importance of the area to still maintain a high production of oil and gas in Norway. The other speakers followed up with presentations ranging from data acquisitions and water injection to innovative well construction technologies, all aiming to tackle challenges spe-

cific to the Barents area. An interesting topic handled was the Castberg field development and the work done to make the project more financially robust. As per today the price per barrel has been reduced from above 80 \$ to below 45 \$.

After lunch the workshop continued with a session on drilling, well and hardware. The petroleum safety authority in Norway presented projects related to arctic drilling operations, while Dag Vanvik (PhD student NTNU) discussed well control challenges in karstified carbonates. Other presentations included inventive water treatment technologies, remotely operated cementing methods and the CAN (conductor anchor node) technology.

Since the workshop was blessed with good weather the participants got to see the Northern lights at the Aurora camp in the evening before enjoying dinner at Bark restaurant.

The session for day two was subsea field development. The first key note speaker Helge Hove Haldorsen, 2015 SPE President, gave an

energetic, yet optimistic speech with regards to the future of the industry. The next speaker, Jan A. G. Nilsen, encouraged the operators to continue the work on standardization. Reelwell presented their advances in horizontal drilling, while Statoil presented future development on Snøhvit. Other presentations included chemical PLT and how the industry would benefit from developing local suppliers.

All of the speakers delivered high quality, interesting presentations, making the workshop a success.

Elisabeth Slevolden
Statoil ASA



DNV GL BREAKFAST SEMINAR

The focus on decommissioning increases for ageing assets in mature basins. Join our next free breakfast seminar, where we focus on the importance of decommissioning in E&P transactions.

Program

Impacts on Decommissioning costs from HSEQ, regulative and technical risks in planning and execution - Steinar Nesse, Vice President, DNV GL

Decommissioning liabilities in NCS license transactions - legal challenges - Olav Hasaas, Partner, Kluge

Decommissioning liabilities - valuation uncertainties and the financial impacts on the deal - Daniel Rennemo, Partner, PWC

Event details

Date: Wednesday 20th April 2016
Time: 08:00 to 10:00
Location: Operahuset, Oslo

Registration for the free event is mandatory, please contact: kristin.overberg@dnvgl.com

www.dnvgl.com/oilgas



Young Talent 2016, UIT the Arctic University of Norway SPE Student Chapter

The 10th of March the students from UIT the Arctic University of Norway SPE Student Chapter arranged Young Talent Conference. It is the third time Young Talent is held in Harstad simultaneous with the SPE Northern Norway Sections Workshop. This year's topic was "Technical and other challenges in the North". We invited students from UIT the Arctic University Tromsø, Harstad and Narvik and from High Schools in Harstad. It was a challenge to engage students to participate at the conference, but we are glad that there was about 80 students who took the time to attend at our own student's conference.

We were lucky to get Helge Hove Haldorsen to open Young Talent this year. The former 2015 President at Society of Petroleum Engineers had an interesting presentation about how he sees the opportunities from now on and how much energy we will need in the future. There was other interesting presentation from Statoil ASA, Aarbakke Innovation AS, Reelwell AS, Kunnskapsparken Nord and Petroleum Safety Authority Norway. The Young Engineers from Statoil by Kristian Kjerkreit and Subsea7 by Jostein Johansen had some popular presentation where they talked about their educational background, how the first time in their jobs were and what challenges they faced.

During lunch the students had the opportunity to mingle and talk to the speakers and the other students from other Campus and schools. Some student had to travel several hours to get home, so we invited them for some Pizza and beverage when they arrived at the University.

Feedback from participants was excellent and the students on the committee also had the impression that the event was successfully.

The UIT the Arctic University of Norway SPE Student Chapter like to thank all the great speakers and the students for who took the time to

make this event a success. We also want to thank our Sponsors Sparebank1 Nord Norge, Lundin and SPE Northern Norway which made it possible to arrange this event and that we could invite students from different cities in Northern Norway. Thanks to the Students in the Young Talent committee and Lisa Rowland.

Børge Andreassen
Vice President



UIT the Arctic University of Norway, Harstad/Narvik SPE Student Chapter arrange visit at Qinterra Technologies, Narvik

March 2 UIT the Arctic University of Norway, Harstad/Narvik SPE Student Chapter arrange visit at Qinterra Technologies in Narvik. For the second year, we invited students to Qinterra for a tour at their office in Narvik. They held a business presentation for the students, about their strategy and technology. Qinterra Technologies is a specialist intervention technology company operating globally. They solve customers' intervention challenges by offering combinations of innovative and field-proven well intervention technologies and tools. Their adaptive technology is low impact, efficient and fit for purpose, focused on enhancing production and achieving better results with less risk, time and money.

They showed animation of how their products worked and they had some tools the students could see. We like to thank Qinterra for this visit, the feedback was good and we hope to do this again next year.

Børge Andreassen, Vice President



SPE International Conference and Exhibition on
Health, Safety, Security, Environment,
and Social Responsibility

SUSTAINING OUR FUTURE
THROUGH INNOVATION AND COLLABORATION

CELEBRATING
~ 25 ~
YEARS

11-13 April 2016
STAVANGER FORUM
Stavanger, Norway



Welcome to SPE Health, Safety, Security, Environment, and Social Responsibility Conference in Stavanger 11 - 13 April 2016!

SPE International is hosting the Health, Safety, Security, Environment and Social Responsibility conference in Stavanger. We expect this major event to make a significant impact on the city and we are still seeking volunteers for a number of different roles.

Please contact us at stavanger@spemail.org if you are interested in volunteering.

We guarantee lots of fun and new acquaintances!

More info about the conference is found here:

<http://www.spe.org/events/hse/2016/>

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SPE Norway – Stavanger



Tor Jørgen Verås
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- ◆ At the first monthly meeting of the year, Distinguished Lecturer Eve Sprunt discussed how couples may manage dual careers at management level in modern day society. This was our first non-technical presentation which attracted 40 attendants.
- ◆ In February, Bjarne Lyngnes and Evgeny Tolstukhin of ConocoPhillips drew an impressive number of 105 guests to their presentation of Integration of 4D Seismics in Reservoir Modeling. 40 guests stayed for the following dinner.
- ◆ On March 2nd SPE Stavanger YP hosted their first meeting of the year with Confessions of a Start-Up Junkie from serial-entrepreneur Nils-Henrik Stokke. Currently engaged in almost 10 start-ups and one of the innovative minds behind Stavanger's hottest start-up scene, Innovation Dock, as well as being the one behind Mathallen Stavanger, Nils-Henrik has done it all - from building a day-care center for intellectually disabled children to climbing the world's tallest free standing mountain with his 70-year old mother. His talk was also held at Norway's largest TEDx event in front of 700 people in Arendal late last year.
- ◆ On 22nd of March, Distinguished Lecturer Pete Naylor of BG Group visited with his talk Making Better Appraisal and Development Decisions: Using Decision Risk Analysis & Value of Information.
- ◆ May 27th SPE Stavanger will host the 42nd annual Barbecue and Dance for sponsors and invited guests. Of all our events, this is considered the highlight of the year.



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SPE Oslo Young Professionals!!!

The most challenging studies!!!

1. Fractured Carbonate Dolomite - Gas Condensate Development Study
2. A Multi-Fractured Horizontal Well Analytical Screening (Oil & Gas reservoir), North Sea
3. A Multilateral Screening Study
4. Risk assessments study - Well Positioning Optimization
5. Unconventional Simulation Study
6. Downhole Water Separation Study

in a Young Professionals' meeting with Dr. Branimir Cvetkovic

Modelling a Naturally Fractured Carbonate Reservoir with FMI Well Data

Dr. Branimir Cvetkovic is happy to have the chance to encourage Young Professionals by sharing with them his working life experience. Despite the low oil prices, the future still remains in need of energy. Thus this talk aims to motivate and inspire young petroleum engineers to meet the challenges of the future.

**April 26 at 6 PM
at Olivia Aker Brygge**

Stranden 3, 0250 Oslo

Branimir Cvetković holds a PhD in Petroleum Engineering from NTNU, Norway and Master of Science degrees in Physics and Computer Science from the University in Zagreb, Croatia. His work has focused particularly on the coupling of horizontal well with fractures and multilateral well to oil reservoir, and investigating well pressure rate responses with time in order to characterise reservoirs. Branimir's extensive work experience comprises different branches of the oil industry - oil companies (Maersk Oil, Copenhagen; Bayerngas Norway; INA-Naftaplin Croatia), service companies (Schlumberger (London, Gatwick, Milan, Budapest and Moscow); Aker-Kvaerner Oslo) and research institutes (Institute for Energy Technology, IFE Kjeller Norway; Institute for Petroleum Technology and Applied Geophysics, NTNU). He has been active in various industry forums (such as FORCE, Norwegian Petroleum Directorate) and has been an invited lecturer in petroleum sciences at several universities (University of Lorraine, France; University of Espirito Santo, Brazil; Al-Farabi University, Kazakhstan; Norwegian University of Science and Technology; University of Zagreb, Croatia; University of Moscow, Russia). Currently he is enjoying retirement and providing international consultancy and lecturing services in reservoir engineering through his company PETRO BRELLE ENERGY Norway.



**Ph.D.
Branimir Cvetkovic**
international consultancy and
lecturing services in reservoir
engineering

The Slippery Slope to Financial Restructuring of a Company

by Per Fossan-Waage, Director, PricewaterhouseCoopers



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Director

These days a lot of oil service and E&P companies go through troubled times. With the low oil price, the cash flow is not sufficient to service loan payments and interest. Below we have set out (in basic and not legal terms) the various stages in how the process of financial restructuring of a company may unfold, for interested readers. The focus of this article will be on financial restructuring, which can be defined as improvements in the capital structure of the firm so that it can once again service its debt.

While a financial restructuring may be the company's first priority, it will usually also need to do an *operational* restructuring, which is the *process of increasing the economic viability of the underlying business model*. It should be noted that to do just a financial restructuring will often not be sufficient, since the business model itself will need to be adjusted in view of the changed business landscape. By the way, the expression *refinancing* has nothing to do with financial restructuring. *Refinancing* is what companies do in good times when loans are renegotiated to take advantage of better interest rates, ie on the basis of company strength. While *financial restructuring* - as we will see below - is done on the basis of weakness.

In good times the company will enjoy a healthy cash flow from operations. It will be considered as a *going concern*. At this stage all the company's stakeholders are aligned with the common goal of keeping the company going and making good money. However, with a dropping oil price and deteriorating cash flow, the first thing the company will do is to start conserving cash, i.e. delay investments, reduce the work force and cut spending in general. This may work for a while.

Still, many Norwegian companies have taken on too much debt, and the reduced cash flow may no longer be sufficient to cover debt and interest payments. The company may soon find itself in a situation where it is in breach of loan covenants. In principle any long term loans will then fall due, i.e. the banks can demand immediate repayment. The banks will also find this situation very difficult. Even though the bank has collateral for its loans, it would be problematic for the bank to take over the assets. With lots of laid up vessels and rigs any sale of collateral would probably not provide enough return on the security. Therefore, when first signs of payment trouble come up for the company, the banks will usually be quite willing to provide necessary waivers, extensions and amendments to the loan contracts. (Waivers

will be that the bank accepts that the company is not able to reach various financial ratios as stipulated in the bank loans, meaning that the bank will forego its contractual right to demand payment). This is often regarded as a *soft restructuring* by the banks. The company may also have bond loans, and the process of amending such loans (in terms of extension of repayment etc) is more complicated as the company has to summon all the bondholders and have minimum 2/3s to approve the bond amendments. (This is done through Nordic Trustee, which represents all the bondholders through the bond agreements).

The real trouble starts when it is not enough to just wave/amend the loan covenants. The company's cash flow may be so meager that the interest has to be considerably reduced and deferred. The company will at this point still have a financial enterprise value (which can loosely be defined as the company's overall value of assets) that is higher than the debt, but it has no longer any capacity to service its loans, at least for a considerable period of time. At this stage more serious steps have to be taken, like having the interest costs or even the debt reduced. The company will likely terminate any debt repayments at this stage and ask all the lenders for a so-called *standstill*, where bank and bondholders are invited to discussions while they are also inquired to not demand the loans to fall due (ie a standstill).

In this dire situation the interests of the various stakeholders will really start to part ways. The various parties will take stock of the their relative positions vis-à-vis other stakeholders, ie. strengths and weaknesses (in other words a stakeholder analysis).

- ◆ Banks: To what extent do they have collateral and security? What would the assets be worth in a forced sale?
- ◆ Bondholders with security: What is this security worth for them, coming

- behind the banks?
- ◆ Bondholders without security: They are the ones with the most to lose.

The restructuring may now resemble a poker play, where the lack of a powerful hand of cards can be more than compensated with a better bargaining strategy.

In this situation the banks will not be interested in taking a hit, their loans are secured, and they can wait. The same goes (to a large degree) for bondholders with security. The banks will therefore expect the *unsecured bondholders* to take the largest hit (with lower interest, delayed repayments etc), these stakeholders are after all last in line for proceedings from any liquidation. However, these bondholders will usually not give in without a fight, and want compensation for any cuts in interest rates or debt owed them. They will therefore often require having their unsecured debt swapped to equity in the company. This in contrast to the banks that have loans that are secure and therefore do not want to become shareholders, as the banks want to stick to banking and not be directly involved in the company's business. Swapping debt to equity would be tantamount to exchanging a contractual right for payment with an uncertain claim on future profits, which not make sense for the banks with their secured loans. This situation is moreover posing a threat for the banks; if the unsecured bondholders take over too much of the share capital and gets control over the company, the company no longer will be under the control of industrial investors who know the business, but by financial investors (the bondholders turned into new shareholders) without any knowledge of the business. This is not at all a type of restructuring the banks would like to get into, and they would resist such a debt-for-swap transaction. At this point the enterprise value of the company will usually still be higher than if it had been liquidated, so it makes sense to keep negotiating.

As we can see, at this stage the interest conflicts are really mounting. Adding to the difficulties the board of the company has to tread carefully. If the company slips into too much debt and the business is carried out on the creditors' expense, the board may be held responsible. (The board also has to make sure that the company has sufficient equity and liquidity, and an obligation to act if there is a considerable loss of equity. Here we also see the importance of taking steps for financial and operational restructuring). From the board's point of view, however, if the initial share capital is indeed lost (which can be comparable to the enterprise value being lower than the overall debt) it makes perfectly sense to have some of the (usually unsecured)

debt converted to share capital. Because this will – overnight – establish the necessary solidity to the company and lift any responsibilities the board will have regarding sufficient equity.

In a final twist to the story, the shareholders will have the final word on this voluntary restructuring. The share capital may have been wiped out and shareholders lost every penny, but they will still have to vote for the proposed restructuring if the company should remain intact as a legal entity. Hence, what the banks and bondholders propose (and agree themselves) in terms of restructuring, will still have to be approved by 2/3 of the initial shareholders. This means that the restructuring package has to offer the shareholders something in return for them to vote in favor of the debt-to-equity swap. This explains why wiped-out shareholders still get some percentage points worth of shares in restructured companies.

What we are seeing now in the Norwegian capital markets is that the restructurings may be agreed with the stakeholders to buy the company and lenders time, in the hope of having higher oil prices within 2-3 years. If the oil price does not come up, we will likely see another round of restructurings within 3-4 years where debt-to-equity swaps really have to be implemented in full force.

Epilogue
Why would not the board take the company directly to a debt restructuring (forced or voluntary) in the courts, in line with the legal requirements? Like what US companies do in a so-called Chapter 11? The reason is that the Norwegian court-led process for a financial restructuring is not flexible enough, and only a negligible amount of companies go this route. (Unless if there is no hope for recovery, since then the board of the company has no other choice than star bankruptcy proceedings through the courts). These days a panel has been appointed by the Norwegian authorities to see if the Norwegian legal bankruptcy system should be made more flexible, like more in line with the US chapter 11 system.

About the author:

Per is a State Authorized Public Accountant and joined PwC in May 2013. Prior to PwC Per worked as listing officer at Oslo Børs for several years, where he was in charge of a number of IPOs as well as the E & P companies' oil reserve reporting. He has also worked as Chief Accountant for Frontline and CFO for Northern Oil, an E&P company listed on Oslo Børs. He works as Director at PwC CMAAS and has over the years been involved in a variety of capital market transactions. He is responsible for several of PwC's internal and external publications as well as seminars covering the capital markets, including facilitating the SPE Oslo Section's full-day E & P seminar at PwC, together with Oslo Børs.

Norwegian Decommissioning Insight

Text provided by Jennifer Phillips, Communications Adviser with Oil & Gas UK



During the 16th North Sea Decommissioning conference held in Oslo in February, the Oil & Gas UK introduced the Norwegian Continental Shelf Decommissioning Insight. The report can be downloaded [here](#).

Norway’s decommissioning market has the potential to be the second largest in the North Sea after the UK Continental Shelf, and its possibilities are captured in a report from the trade body that represents the UK offshore oil and gas industry.

Working together with Norwegian operators, Oil & Gas UK has produced what is the organisation’s first Norwegian Continental Shelf Decommissioning Insight. The publication gives a forecast of decommissioning activities for the region over the next decade, providing both operators and the supply chain with market intelligence on potential business opportunities and insight into how to optimise the work.

“Decommissioning activity on the Norwegian Continental Shelf is at an earlier stage of maturity than the UK sector and therefore, up until now, only limited information about timing and scale of activity has been publicly available,” says Oonagh Werngren, Operations Director with Oil & Gas UK, which produces a similar annual decommissioning insight for the United Kingdom Continental Shelf.

“As the North Sea decommissioning market could extend beyond national borders it is important that both operators and the wider supply chain have access to information about upcoming activity and utilise forecasts from across different North Sea regions to enhance business.”

Oil & Gas UK worked with five key operators on the Norwegian Continental Shelf to gather and analyse data. The report is based on the decommissioning activity forecasts of those five companies.

“Our report shows there are 23 decommissioning projects forecast from 2015 to 2024

on the Norwegian Continental Shelf. Projects included range from small subsea tie-backs to full scale integrated platform removals. Almost all of this activity is forecast in the Norwegian North Sea – the most mature region of the Norwegian Continental Shelf.

“However the majority of decommissioning projects are in the early scoping stages and therefore forecasts could change as project plans are further refined.”

The Norwegian Decommissioning Insight is the latest in a series of documents Oil & Gas Norway’s decommissioning market has the potential to be the second largest in the North Sea after the UK Continental Shelf, and its possibilities are captured in a report from the trade body that represents the UK

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“However the majority of decommissioning projects are in the early scoping stages and therefore forecasts could change as project plans are further refined.”

The Norwegian Decommissioning Insight is the latest in a series of documents Oil & Gas UK has published to help industry prepare for forthcoming decommissioning projects and comes in the wake of publication of the latest annual UK Decommissioning Insight in 2015.

Other decommissioning documents published by Oil & Gas UK include reports on the Adoption of Novel Solutions in Decommissioning, and the management during the removal process of the marine organisms that colonise oil and gas structures submerged in the North Sea.

The trade body also produces advisory material on a wide range of decommissioning areas such as guidelines for comparative assessment

and on well abandonment cost estimation. Ms Werngren adds: “While decommissioning activities are steadily growing, the industry’s efforts are focused on maintaining offshore production in the North Sea for as long as it’s safe and economically possible to do.

“Historically, estimates of the lifetime of fields have varied with oil prices, but the overall trend shows that the productive lives of fields on the Norwegian Continental Shelf are being extended through technological advances and enhanced oil recovery techniques.

“To sustain the health of the sector, we must help an efficient decommissioning market emerge alongside, and as part of, the industry’s continued and sustained programme of capital investment in new developments.

“There will come a time when the costs of further recovery can no longer be sustained by income from the field and the surrounding region is considered to have insufficient prospectivity to support future operations, and so the decision is taken to cease production and decommission the assets. The actual timing of these decisions is uncertain and will depend



Harald Pettersen - Statoil ASA

on a number of factors including the oil price, production trends, operating and maintenance costs, and the installation’s technical condition.”

The Norwegian Decommissioning Insight provides details on well plugging and abandonment activity, revealing that of the remaining 3,000 wells, almost 10% are forecast to be decommissioned between 2015 and 2024. Almost all of this activity is in the Norwegian North Sea region of the basin.

Pipeline decommissioning; topside preparation, topside and substructure removal and onshore recycling and disposal are also covered by the report.

“As the Norwegian decommissioning market matures we would hope to expand this dataset further,” adds Ms Werngren.

“With the Norwegian Petroleum Directorate estimating that decommissioning expenditure during this period could reach NOK 160 billion, the activity represents a significant emerging business in the sector.”

The collection and analysis of the data by Oil & Gas UK on behalf of the industry has the support of the Norwegian Petroleum Directorate and Norsk Olje & Gass.

Norwegian Decommissioning in Numbers

- ◆ 23 decommissioning projects are forecast from 2015 to 2024 on the Norwegian Continental Shelf.
- ◆ 284 wells are estimated to be plugged and abandoned over the next decade - close to 10% of the total well stock on the Norwegian Continental Shelf that will eventually require decommissioning.
- ◆ 95% - or 269 - of these are platform wells: often simpler and cheaper to plug and abandon than subsea wells.
- ◆ 26 pipelines with a total length of 360 kilometres are forecast to be prepared for decommissioning from 2015 to 2024.
- ◆ 14 platforms are estimated to be removed, or partially removed, within the survey time frame.
- ◆ The total tonnage forecast to come onshore over the next decade is 166,850 tonnes. This equate to nearly 105,300 tonnes of topsides, just over 59,000 tonnes of substructures and just over 2,500 tonnes of subsea infrastructure.

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22,000 New Oil Jobs within 2020

Text provided by Maiken Ree, Communications Advisor, Norsk Olje og Gass

From 2018 to 2020 there will be 22 000 new positions in the oil and gas industry, a report from the International Research Institute of Stavanger suggests.

Turning point: We are in the midst of a demanding restructuring. Forecasts show that this will turn around in 2018

We never guarantee jobs. Nevertheless, based on the new figures, we can confirm that those who choose Sciences- or Technological Studies are very likely to be welcomed with open arms by the oil and gas industry, once they have graduated, says Karl Eirik Schjøtt-Pedersen, CEO of the Norwegian Oil and Gas association.

The most recent prognoses show that job losses will hit bottom at the beginning of 2018. After this, it is expected that the trends will turn. According to the report, the oil and gas industry needs to recruit 13 000 new employees from 2018 to 2020. In addition, 9 000 will retire in the same period, and will need to be replaced. Overall demand for new

recruitment therefore amounting to 22 000 employees.

Stabilisation in 2018 - growth in 2019

The report estimates that before we reach the bottom in 2018, a further 12 000 positions will be cut back. We also know that on average about 4 000 people retire every year within this industry. Thus, the real number of vacant employees will be significantly lower. However, one of the underlying projections in this report is that the oil price will turn upwards during 2017.

“- Norway is in the midst of a demanding restructuring. We have known for quite some time that the trend will be pointing downwards in 2016 and 2017. Therefore, it is very positive how this report shows it will turn in 2018. According to the IRIS figures, we will be back to the same level as we currently are

in 2020. The report shows a need for 22,000 new personnel from 2018 to 2020, which is a very important signal,” says Schjøtt-Pedersen.

Read more about Norwegian Oil and Gas’ on our web page: [norskoljeoggass.no](https://www.norskoljeoggass.no)

You can also find the whole report on <https://www.norskoljeoggass.no/Global/2016%20dokumenter/Utvikling%20i%20direkte%20petroleumsrelatert%20sysselsetting%202014%20til%202020%20IRIS%20notat%202016.pdf>



Photography: Tommy Ellingsen

Joining Forces to Recover More – The National IOR Centre of Norway

The National IOR Centre of Norway's goal is to develop new knowledge and technology in order to increase recovery beyond projections under today's field operation plans.

The National IOR Centre of Norway was awarded by The Ministry of Petroleum and Energy after a national competition announced by the Research Council of Norway, and started in December 2013. The Centre consists of three research partners: The University of Stavanger, IRIS, and IFE. In addition, the Centre works closely with its user partners: ConocoPhillips Skandinavia AS, BP Norge AS, Det Norske Oljeselskap AS, Eni Norge AS, Maersk Oil Norway AS, DONG Energy A/S, Denmark, Statoil Petroleum AS, GDF SUEZ E&P NORGE AS, Lundin Norway AS, Halliburton AS, Schlumberger Norge AS, Wintershall Norge AS .

Collaboration

"The slogan for The Centre is *joining forces to recover more*, and this is what I believe is important in order to be able to suggest innovative, cost efficient -and environmentally friendly technologies for IOR purposes," says

Centre Director, professor Merete Vadla Madland (to the left on the picture below). The Director emphasizes the need to build a true national research team, in order to reach their overall goal of maximizing the recovery rate on the Norwegian Continental Shelf

"In addition to the user- and research partners in The IOR Centre, we also collaborate with several renowned scientists and research institutions from all around the world," says Madland.

The research

The Centre is divided into two themes: Theme 1 - mobile and immobile oil and EOR methods, and Theme 2 - Reservoir characterization to improve volumetric sweep. Each theme is divided into a total of seven tasks, each with a designated task leader. Approximately 40 projects are currently active in The National IOR Centre of Norway.

"The plan is to ensure that the projects are

integrated, and keep a steady flow of communication across the themes as well as amongst the individual researchers and experts in the oil –and service companies - to ensure that we benefit as much as possible from all the research we do," says Madland.

"Take the tracers, for instance. At IFE, a group of researchers are working on developing new tracers for The National IOR Centre of Norway. These tracers will be used to help determining how much oil is left in the fields, and where it is located. This information can be used in the IORSim, as one of the parameters that will help increasing the oil recovery rate," says Madland.

The yard-test

"We have a very good working relationship with our user partners, and they have proven to be very valuable when it comes to providing data and support to our R&D activities. In



addition, two service companies contribute with in-kind research and in 2015 Halliburton participated in a large scale yard-test at the IRIS facilities," says Director of Theme 1, professor Aksel Hiorth.

"When a polymer solution moves from the platform down to the reservoir, it will move through valves and constrictions. The polymer solution is then exposed to great forces; which in turn lead to a stretching of the long polymer molecules, and sometimes these forces are so great that they break, and the viscosity decreases. This means that you can lose a lot of the EOR effects before the polymer solution reaches the reservoir," says Hiorth.

The Centre, along with Halliburton, have tested standard valves and two special valves from Matek-Samson and SNF.

"The test have been successful; we have confirmed that a standard valve will reduce the polymer viscosity by approximately 60 percent. We have also identified three possible solutions to the problem."

The IORSim

The modeling project of the IORSim started

immediately after The Centre's startup in 2013. The existing reservoir simulation tools available on the market did not have the capabilities to simulate many of the IOR processes.

"The IORSim contains a geochemical model that for example makes it possible to simulate how the ion composition of pore water changes from injector to producer, and how this composition can affect the flow characteristics of oil and water," says Hiorth.

The IORSim is thought to be used as an application that can be connected to an industry standard reservoir simulator (e.g., Eclipse) to predict the effect of the IOR chemicals.

"This way, we can benefit from existing reservoir models that are history matched to the companies' production, but also include the latest IOR effects studied in The National IOR Centre."

The IORSim can now be used on some realistic fields, such as Norne, and we are working together with Schlumberger to provide a good and effective feedback, meaning that the IORSim can predict how much oil flow properties change due to IOR effects. This

information is sent back to the reservoir simulator.

Environmental impact and economic potential

"We will contribute to the implementation of environmentally friendly technologies for improving oil recovery on the Norwegian continental shelf," says Madland.

"All researchers in The Centre have to give detailed reports on how their research will affect the environment and of course also in addition the cost perspective is an important issue," she continues.

The researchers in The National IOR Centre of Norway are working with many different aspects of IOR – from pore to core to field.



<http://www.uis.no/research-and-phd-studies/research-centres/national-ior-centre-of-norway/>

Tracer data to assess transport directions, flow and sweep efficiency and remaining oil saturation in hydrocarbon reservoirs

by Olaf Huseby, VP Technology & Interpretation and Ole Divino Randmel, Sales Engineer, Restrack



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Inter-well tracer testing is proven as an efficient reservoir surveillance technology and has been used extensively worldwide the last 2-3 decades. Most of the interwell chemical tracer technology in use today was developed by the Institute for energy technology (IFE) located at Kjeller outside Oslo. IFE also developed an extensive tracer service based on the tracer technology research. This service was commercialized in 2013 through Restrack. Restrack delivers a full portfolio of integrated tracer services, based on IFE's research. The portfolio include inter-well gas & water tracing, single well tracer tests (SWCTT) and partitioning inter-well tracer tests (PITT). The tracer service is provided to international and national oil companies world-wide.

Tracers for oil or gas reservoirs must fulfil several important characteristics. They must be thermally, chemically and biologically stable under reservoir conditions and not adsorb on rock surfaces. In addition, suited tracers must be unique in the reservoir environment, have excellent analytical sensitivity and be environmentally acceptable. Typical chemical tracers are fluorinated benzoic acids for water (Galdiga and Greibrokk, 1998), or perfluorocarbons for gas (Dugstad et al., 1992; Kleven et al., 1996).

Tracers follow reservoir fluids and therefore reflect reservoir flow dynamics. An obvious, and important information provided by tracer data is mass transport connectivity. Further interpretation, using so-called residence time distribution (RTD) analysis will give the allocation of injection fluids in offset producers as well as quantitative information on sweep volumes and flow heterogeneity (conduits and thief-zones). Partitioning inter-well tracer testing (PITT) has recently been field-proven for inter-well applications (Viig et al. 2012; Hartvig et al., 2015) as a reliable tool to monitor the relative flow of oil and water and to measure remaining or residual oil saturation (Sor). Tested in both carbonate and sandstone reservoirs, new PITT tracers and methodologies provide a unique tool to measure oil saturations on a field-scale. Comparing PITT tracer results to results obtained using the well-known push-and-pull single well chemical tracer test (SWCTT), show that PITT results agree very well with SWCTT results. This enables saturation assessment on field-wide scale, with a significantly reduced production interference.

Field example 1: Verification of water flow in Snorre by tracers and 4-D seismic.

To understand sand layer communication and to what degree the faults act as barriers or not, a significant tracer program (with more than 50 individual injections) has been executed at Snorre. The tracer program started early in

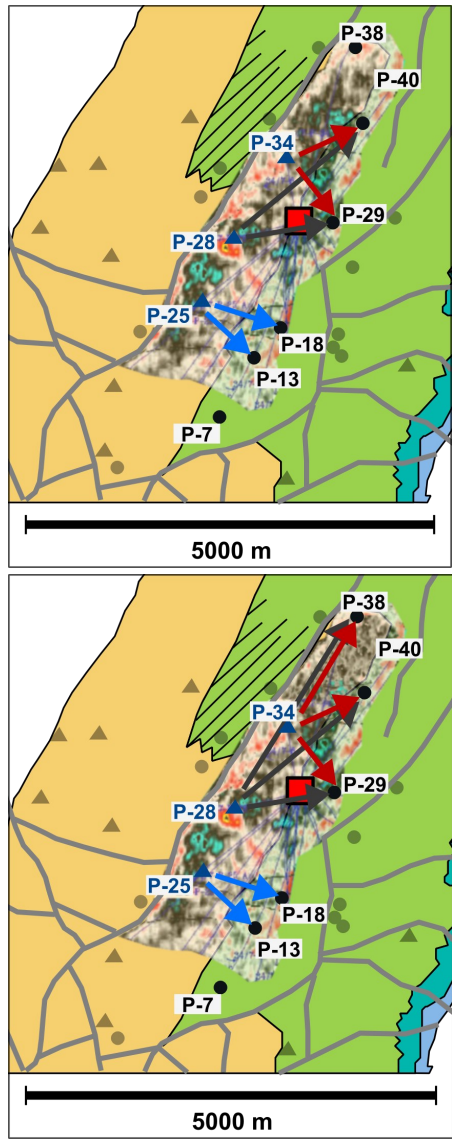


Figure 1. Map of Snorre with CFB. The seismic image shows dimming effects interpreted from the difference between the two first seismic surveys at Snorre (upper figure) and the two subsequent seismic surveys (lower figure). The black represents strong dimming and indicate the water front. Tracer breakthrough (indicated by arrows) correspond well with the fronts from the dimming.

1993, about 1/2 year after production start, and still continues today.

In the Snorre field, 4-D seismic surveys and corresponding interpretation show clear dimming (seismic amplitude decrease) as oil is substituted by water (cf. Figure 1). These surveys were performed after five years of production (Figure 1, upper) and after an additional four years of production (Figure 1, lower). The dark colour in Figure 1 corresponds to reservoir areas where oil has been substituted by water.

Comparing with the 4-D seismic data the tracer data are in excellent agreement with the water front inferred from the seismic study. In addition, the tracers add significant information, revealing that the water in the P-38/P-40 area originates from two sources, namely P-34 and P-28.

Field example 2: Quantification of flow and sweep efficiency from tracer data.

To monitor a polymer EOR project in the Wintershall operated Bockstedt field, located onshore Germany, a tracer campaign was executed. A tracer deployed in injector B-83 was monitored in the offset producers B-81 and B-56 (cf. the Bockstedt pilot area illustrated in Figure 2). To assess the sweep volume, the flow allocation from the injector towards individual producers and to quantify the heterogeneity of the flow, residence time distribution analysis was used. This is a systematic methodology to infer information about the reservoir flow dynamics and to quantify the nature of the fluid flow in the reservoir. Briefly, the distribution of residence times for a tracer mass is given as the product of production rate and tracer concentration:

$$\varepsilon(t) = C(t) \cdot Q_p(t) / M$$

The temporal moments for each well j

$$m_0 = \int_{-\infty}^{+\infty} \varepsilon_j(\tau) d\tau,$$
$$m_1 = \int_{-\infty}^{+\infty} t \cdot \varepsilon_j(\tau) d\tau, \dots$$

of this distribution can be used to calculate the fraction produced tracer mass in each producer ($M_0 = m_0$) as well as the average residence time ($\langle T \rangle = m_1 / m_0$). The swept pore volume is given from the average residence time and the injection rate by $V_s = Q_i \langle T \rangle$. Further, the partial integrals of the two first moments, denoted flow capacity

$$(F(t) = \int_0^t E(\tau) d\tau / m_0)$$

and storage capacity ,

$$\Phi(t) = \int_0^t E(\tau) d\tau / m_1$$

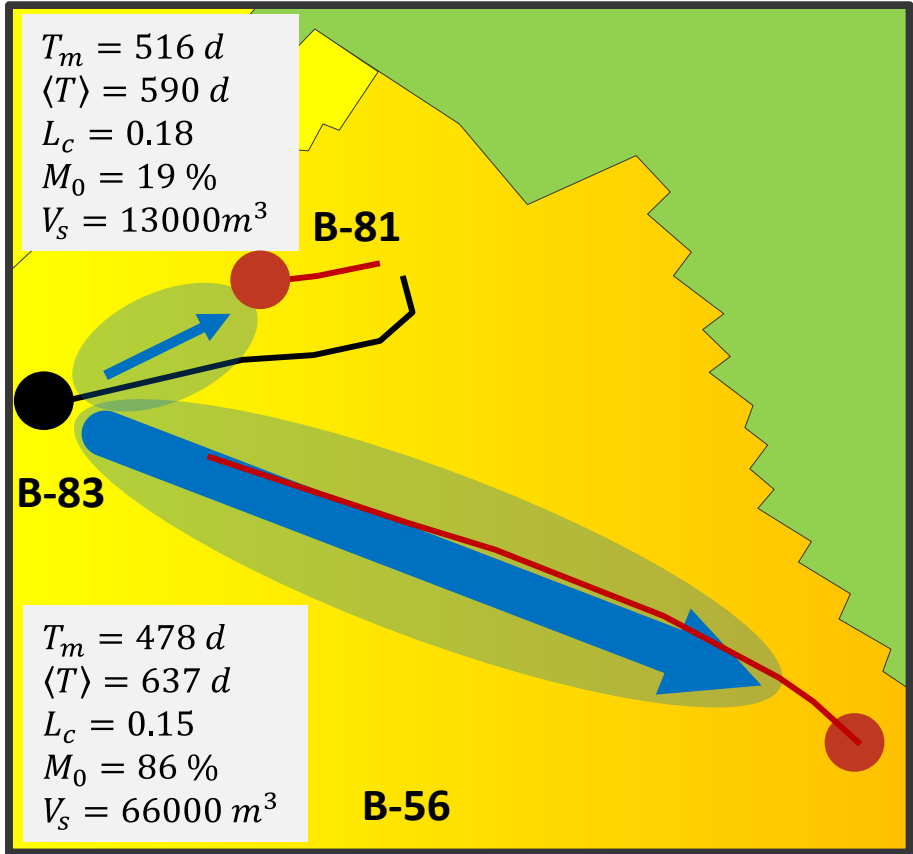


Figure 2. Map of Bockstedt pilot area investigated using tracers. The fraction of produced over injected tracer mass (M_0) is given by the arrow widths and the magnitude of the sweep volume (V_s) is indicated by the area of the ellipses in the figure. The most common (the mode T_m) and the average ($\langle T \rangle$) residence times are also given – in addition to the estimated heterogeneity index (Lorentz coefficient L_c) for the flow.

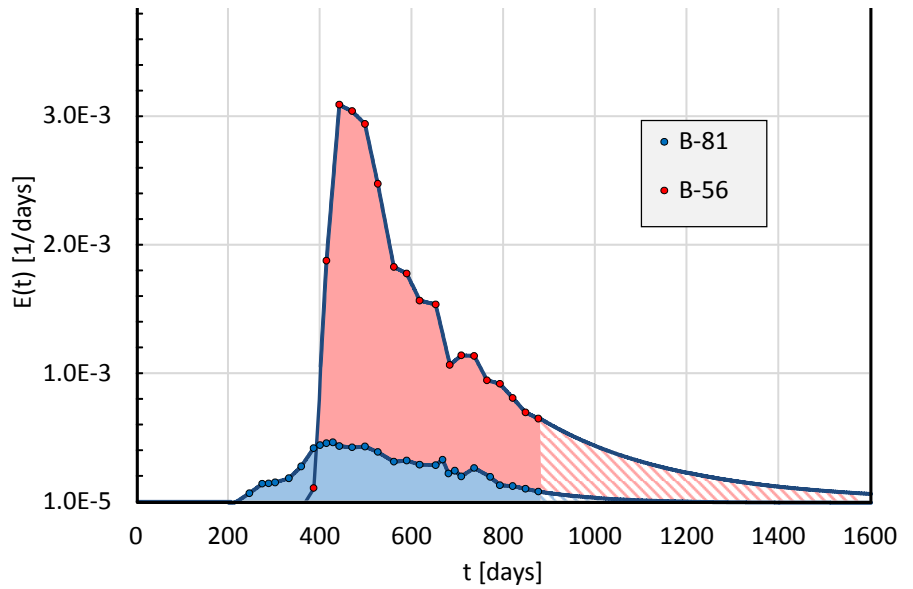


Figure 3. Tracer response in Bockstedt wells B-81 and B-56. The shaded regions above 860 days are extrapolations of the data. Individual measurements are given as points.

can be used to calculate the so-called Lorentz coefficient (L_c) that is a measure of how heterogeneous the flow is. L_c ranges from 0 for completely homogeneous flow to 1 for completely heterogeneous flow.

From the fraction of produced over injected tracer mass (zeroth moment of the residence time distribution) about 1/5 of the water injected in B-83 in travel towards B-81. These fractions correspond to the area under the tracer curves in Figure 3.

The sweep volumes can be compared to the physical pore volume and used to assess the sweep efficiency. A good sweep manifests itself with a relatively small. From sweep volumes and L_c in the pilot area in Bocksted, we can conclude that the area between the injector and both the producers is well swept, in agreement with the fact that the reservoir is a relatively homogeneous sandstone reservoir.

Field example 3: Quantification of remaining oil saturation using partitioning tracers.

The partitioning inter-well tracer test (PITT) is a non-intrusive low-cost test that can provide measurement of oil saturation in the region between injectors and producers in an oilfield. Lack of stable partitioning tracers has previously limited the application of PITTs in petroleum reservoirs. A recent field test in the Total operated Lagrave oil field proved the stability and reliability of six new partitioning tracers at reservoir conditions.

In PITTs remaining oil saturation is given by:

$$S_o = \frac{T_p - T_w}{T_p + T_w(K - 1)}$$

Where T_p and T_w are retention times for the partitioning and water tracers, respectively, and $K=C_o/C_w$ is the oil/water partition coefficient.

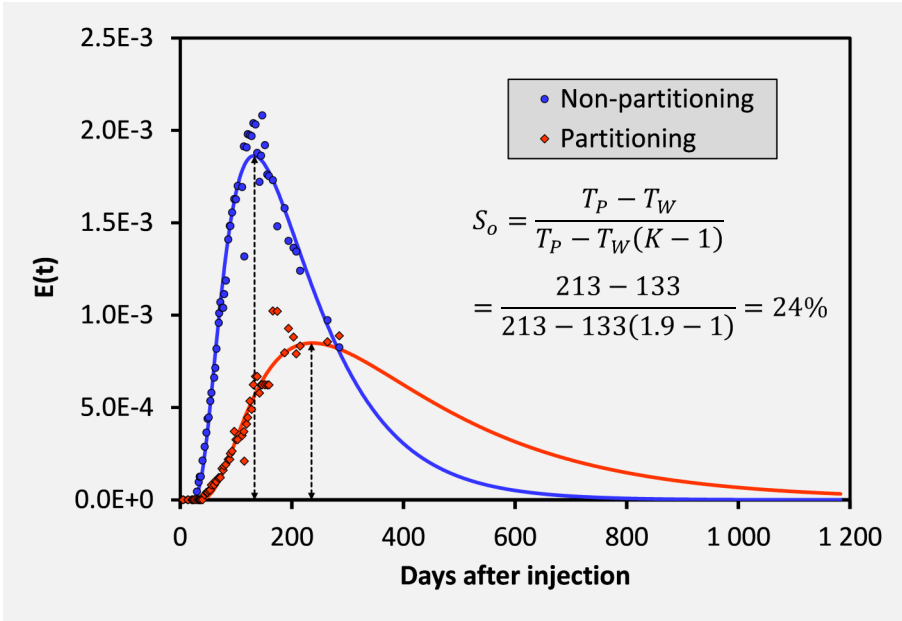


Figure 4. Tracer response of partitioning and non-partitioning tracers in Lagrave well LAV-1. The difference in arrival times and the partitioning coefficient K yields a saturation of 24% between injector and producer.

cient. Based on retention times the six new tracers yielded $S_o = 24 \pm 1\%$. This result was later verified and corresponds very well to saturation measurements on core samples.

Produced Water Sand Management

by Giedre Malinauskaite, SPE Bergen Member of the Board, Marketing Manager FourPhase



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The amount of produced water increases as an oil field matures. While the worldwide average for water cut is around 75%, for some reservoirs it may increase to 98%. Managing the increasing volume of produced water is one of the main challenges the petroleum industry is dealing with today. With increasing environmental regulations, more and more produced water is being reinjected.

PWRI (produced water reinjection) typically leads to a decrease in operational cost, an increase in hydrocarbon recovery and a decrease in surface disposal of water. But like all other operations, reinjection of produced water poses some challenges. According to SPE, 70% of oil fields produce sand, or other types of sediments. The removal of solids from the water, prior to reinjection, is a key operation operators have to deal with. Presence of solids in reinjection water can result in injectivity decline (blocked pores), failure of water injection pumps and shut downs. Excessive amount of solids cause serious damage to the rotary equipment (PWRI pumps), valves as well as the system pipe work. Consequentially, water injection would be unsustainable with frequent equipment failures.

called QuadFlow, is designed for permanent installation with focus on minimal logistical impact, and with emphasis on safe and quick installation. QuadFlow is a cost efficient and effective tool for protecting your top side equipment from unwanted solids and eliminating damage to PWRI pumps that can result in costly downtime. The QuadFlow uses next generation cyclone technology that has a proven solids separation efficiency of 99.8% for particles ≥ 20 micron.

With space being a premium on many offshore installations the QuadFlow unit is designed to be compact – measuring 2.0 x 2.5 meter footprint. In addition to market leading solids removal technology, FourPhase has a solutions driven team of experts with more than a hundred years of combined experience – FourPhase is a trusted expert in solids management.

Contact us for more information on how our solids removal system can help solve solids challenges related to produced water reinjection.

According to BP, damage to the produced water reinjection system, caused by solids present in reinjection water, is the main source of production deferrals on ETAP (Eastern Trough Area Project)*. On ETAP solids erode pumps, isolation and choke valves resulting in 1 mmbbls/yr in deferred production, £2M maintenance costs and a demand of 600 POB per year. According to BP, with the water cut (WC) and gas oil ratio (GOR) increasing, and reservoir depleting, the risk of deferrals and integrity failures is also likely to accelerate making solids management one of the main issues to be addressed.

From an economic perspective, effective sand management in produced water – whether it is reinjection, discharged, or processed water – means more efficient operations, less downtime and decreased maintenance costs. Avoiding solids in the produced water system helps minimize injectivity loss over time and maintain PWRI pumps utilization. In order to eliminate failure of water injection pumps due to entrained solids, minimize erosion on piping and down time it is important to implement an effective sand management strategy.

The FourPhase surface solids removal system,

**Sand Management on ETAP: A multi-discipline approach, 6th European Sand Management Forum 26th March 2014



Useful links



Petroleum Engineering Certification



Thank you!

