Integrated Reservoir Management Technical Section

Solutions. People. Energy.℠

SPE Integrated Reservoir Management Technical Section (IRMTS)

Newsletter

JULY 2025
ISSUE 02

SPE IRMTS Newsletter

JULY 2025
ISSUE 02

Integrated Reservoir Management Technical Section

Solutions. People. Energy.℠

INSIDE THIS EDITION

The Chairman's Message

"Across disciplines and borders, we're building a community where integration drives innovation—and innovation drives asset value."

— Muhammad Navaid Khan, Chair, IRMTS

Dear Colleagues— Over the past few months, I have had the opportunity to reflect on what truly fuels our progress. It's the people behind the work! The IRMTS community continues to grow—not just in numbers, but in purpose, passion, and global reach.

In today's shifting landscape, sound integrated reservoir management continues to be a critical lever for maximizing performance and managing decision complexity. It helps us stay resilient, make informed choices, and unlock greater value, not just from the reservoir itself, but through the integration of people, disciplines, and data working in alignment.

This edition of the IRMTS newsletter brings that spirit to life. It features special segments, including a candid interview, as part of a newly introduced **'IRM in Action Series'** with a senior oil company executive who shares how integration supports real business decisions. We also highlight key takeaways from a recent webinar led by a world-class waterflooding expert, offering practical lessons from more than 40 years in the field.

The insights presented in this newsletter reflect the strength of our community. Behind this content is a team of experienced advisors, committed sponsors, dedicated volunteers, and young professionals who continue to drive knowledge sharing and collaboration across the industry. Their ongoing involvement through webinars, events, and global engagement is helping shape a platform where technical excellence and leadership grow side by side.

We're also looking ahead. At ATCE in North America, we plan to spotlight forward-looking IRM strategies through a dedicated Special Session and a collaborative reception with other SPE Data Science and Engineering Analytics (DSE) Technical Sections. Around ADIPEC in the Middle East, we're exploring new ways to connect with students and early-career professionals through more interactive and informal formats. Stay tuned for updates as these plans take shape.

To guide our future direction, I encourage you to complete the Reservoir Advisory Committee's online survey by July 21. Your input is crucial in helping the advisory group support IRMTS and other key SPE initiatives.

Take the Survey Now: https://lnkd.in/ghqtkqCg

Thank you for your continued support, insight, and trust. Let's keep moving forward—learning from one another and advancing integrated reservoir management with purpose.

THE SPE IRMTS ADVISORY BOARD

SPE Integrated Reservoir Management Technical Section is proud to officially present its advisory board members. Their presence is a true privilege, with numerous years of experience and technical expertise. As great assets to the section, with understated value as visionary leaders and pace setters in the field of integrated reservoir management, we are honoured to have them guide the section to greater impact.

Rahim Masoudi, PhD

Reservoir Technical Director, SPE
Chief Technical Lead,
EnQuest & Veri Energy

Ganesh Thakur, PhD

Distinguished Professor
Director of Energy Partnerships,
University of Houston
2012 President, SPE

Mohamed Al Marzouqi

Regional Director, SPE
Middle East and North Africa

Simeon Eburi

Reservoir Management Advisor,
Chevron
2021 - 2024 Regional Director, SPE
North America

IRM in Action:
Strategic Reflections from a Middle Eastern Energy Leader

Reservoir strategy is no longer confined to engineering calculations—it's a driver of business resilience, sustainability performance, and competitive positioning. As offshore development faces new pressures—from fluctuating markets to national decarbonization targets—integrated reservoir management (IRM) is evolving into a true strategic discipline.

In this edition, we speak with Ahmed Bin Amro, a senior executive at ADNOC, who shares how flexibility, digital integration, and environmental alignment are reshaping the way assets are planned, developed, and led.

Ahmed Bin Amro
Senior Vice-President
Offshore
Development
ADNOC

Ahmed Bin Amro leads integrated reservoir and field development strategies across offshore new and mature assets. With over 25 years of experience in reservoir engineering, EOR, and digital transformation, he has helped in positioning IRM as a strategic driver of value, sustainability, and resilience.

IRMTS: How has your leadership shaped reservoir strategy amid global volatility?

Bin Amro: In today's climate, reservoir strategy must be flexible, forward-looking, and digitally enabled. One of the key shifts we've made under my leadership is prioritizing development plans that can rapidly adapt to changing market conditions. Built-in contingencies back these plans, so we can scale activities up or down without losing momentum.

Equally important is embedding environmental sustainability goals (ESG) right from the start. We don't treat ESG as a reporting requirement; we view it as a lens through which all reservoir decisions are made. Development scenarios are evaluated for technical performance, long-term recovery, and emissions impact.

We've also deepened our reliance on advanced technologies like AI, machine learning, remote monitoring, and automation. These tools give us real-time visibility into reservoir behavior and support faster, better-informed decisions. When it comes to enhanced oil recovery, we focus on tailor-made EOR solutions designed to match the specific attributes of each reservoir.

It's this combination of flexibility, technology, and environmental awareness that defines our reservoir strategy today.

IRMTS: What levers are helping you optimize development costs while protecting reservoir value?

Bin Amro: For us, cost optimization is never about cutting corners. It's about making better decisions faster by integrating technology and planning at every stage.

We use digital twins to simulate reservoir behavior, which allows us to stress-test development options before committing resources. This gives us confidence and precision, especially in capital allocation. We've also incorporated AI-driven surveillance and automated workflows to reduce inefficiencies and downtime across the asset lifecycle.

Alongside this, we follow a lean execution model, standardizing project components where appropriate, while maintaining technical flexibility when the reservoir demands it. These levers—digitalization, integrated surveillance, and smart standardization—allow us to reduce costs while still protecting long-term reservoir performance.

IRMTS: How do you balance short-term production with long-term reservoir sustainability?

Bin Amro: It's a delicate balance, but one we manage deliberately. We operate with a dual-lens approach: on the one hand, we ensure we deliver on immediate production and operational targets. On the other hand, we keep a firm focus on reservoir integrity, recovery efficiency, and lifecycle health.

Our teams are equipped to respond quickly to short-term needs, but always with the bigger picture in mind. We use real-time data, adaptive modeling, and continuous surveillance to inform field decisions. That allows us to make short-term moves that don't compromise long-term outcomes. It's not just about balancing the two; it's about integrating them.

IRMTS: Can you share a leadership decision that significantly impacted a field or asset?

Bin Amro: One example I often point to is a mature field in Abu Dhabi that was initially developed with a conventional waterflood plan. While leading the EOR team, we explored alternatives and proposed a polymer-based recovery method that addressed specific challenges in injectivity and sweep efficiency.

We conducted a full technical and economic study comparing it to the existing waterflood, and the results favored polymer EOR. It allowed us to extend the production plateau by several years, improve recovery, and reduce the overall energy intensity per barrel. It also enabled CO_2 sequestration within the reservoir, supporting our sustainability goals.

That decision didn't just change the field plan—it redefined the asset's value profile. It was a great example of how a well-grounded reservoir decision can unlock commercial and environmental benefits at the same time.

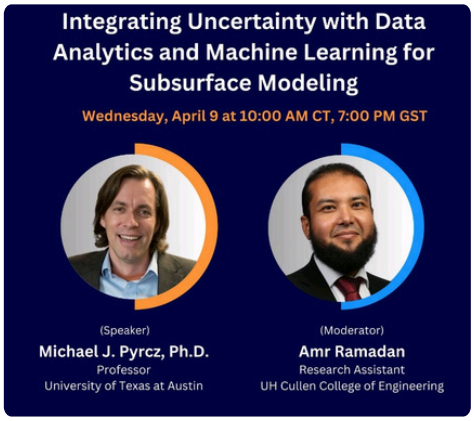
IRMTS: How do you align your reservoir strategy with national priorities while remaining globally competitive?

Bin Amro: We work to ensure our strategy is fully aligned with national energy and climate goals, particularly around emissions and efficiency. Our operating philosophy is simple: maximum energy, minimum emissions.

That means deploying green technologies, using low-impact infrastructure, and adopting digital solutions that reduce the need for physical interventions. We're also investing in carbon capture and storage (CCUS), both as a technical solution and a strategic differentiator.
At the same time, we continue to develop in-house capabilities and R&D that ensure we're not just compliant but competitive. We believe you can't lead in this space unless your reservoir strategy reflects both national responsibility and international excellence.

WEBINAR HIGHLIGHTS FROM Q2 2025

In this recently concluded second quarter, we had insightful webinars characterized by informative sessions with various professionals and experts from the fields of water flooding, AI and machine learning, production optimization, performance evaluation, and so much more. To watch the webinars on the SPE Energy Stream, please click on the SPE Energy stream icon.



In this webinar, **Professor Michael Pyrcz** discusses the challenges of uncertainty modeling in complex subsurface environments, emphasizing the importance of data debiasing, spatial correlation, and model consistency. The session covers various tools and methods for uncertainty modeling, including the spatial bootstrap technique, and highlights limitations of current machine learning approaches while stressing the need for better-tuned uncertainty estimates in reservoir modeling workflows.

In this webinar, **Greg Grimshaw, CEO of PE Limited**, shared insights into the evolution of optimization within the industry, drawing from the implementation of the **Digital Oilfield (Dof) system** across multiple fields. He highlighted current advancements in AI and large language models (LLMs) and their integration into oil and gas operations, particularly in operations and maintenance workflows.

Dr. Ganesh Thakur, Distinguished Professor at the University of Houston and former SPE President, presents a comprehensive approach to waterflooding success in both carbonate and sandstone reservoirs. The session highlights challenges and solutions in sweep efficiency, heterogeneity, reservoir surveillance, and the role of technologies like CO_2 flooding, intelligent completions, and AI/ML.

WEBINAR HIGHLIGHTS FROM Q2 2025

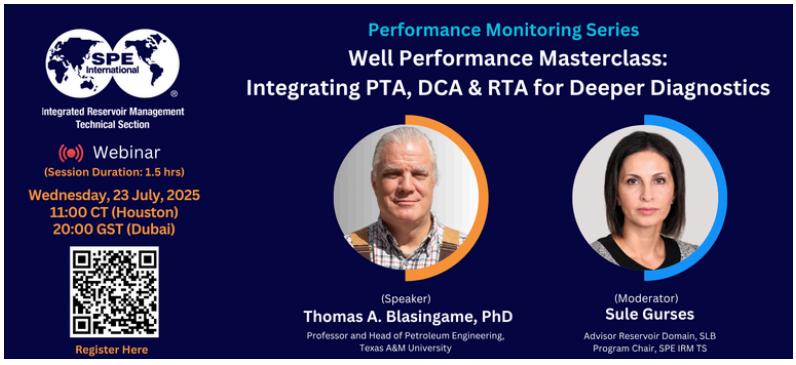
In this webinar, **Anshuman Tiwari, Reservoir Management Geophysicist** (bp), and **Ali Akak, Petroleum Engineer** (Shell), showcased innovative uses of 4D seismic and ensemble modeling to enhance reservoir understanding and decision-making. Case studies from Thunder Horse and Ormen Lange highlighted improvements in history matching, integration, and data-driven forecasting using intelligent, computationally enhanced workflows.

In this webinar, **Mr. Chris Hill, Principal SME - Production Geophysics at bp,** and **Dr. Mohamed Mahgoub, Specialist Geophysicist at ADNOC,** took us on a thought-provoking session exploring how 4D seismic data is being applied to maximize hydrocarbon recovery with a case study on the Kinnoull field and monitor carbon dioxide storage, looking at the best practices for higher repeatability of seismic acquisition in carbonate reservoirs—paving the way for smarter, more sustainable reservoir management.

Access the complete archive of past SPE IRMTS webinars by visiting the SPE Energy Stream platform.

Society of Petroleum Engineers | SPE EnergyStream The Industry's Digital Pulse

IN THE NEXT QUARTER



Join us this month for a webinar titled **"Well Performance Masterclass: Integrating PTA, DCA, & RTA for Deeper Diagnostics,"** led by **Dr. Tom Blasingame**, Professor and Head of Petroleum Engineering at Texas A&M University, as we explore advanced techniques for well performance evaluation.

PERSPECTIVE: EXPERT INSIGHTS

This article presents key reflections and insights shared by Dr. Ganesh Thakur during the SPE Integrated Reservoir Management Technical Section (IRMTS) webinar held on 06 May 2025. Dr. Ganesh Thakur (NAE, NAI) is a Distinguished Professor of Petroleum Engineering & Mechanical and Aerospace Engineering and Director of Energy Industry Partnerships at the University of Houston. He currently serves as President of TAMEST (2025–2026) and previously held leadership roles as President of SPE International and Vice President of Reservoir Management at Chevron. With a career spanning five decades, Dr. Thakur has made a lasting impact on global reservoir engineering and management through his visionary leadership, technical excellence, and hands-on field experience.

Waterflooding remains the most widely applied method of secondary oil recovery, playing a pivotal role in extending reservoir life and enhancing recovery efficiency. Despite advancements in enhanced oil recovery (EOR) techniques—such as polymer flooding, CO_2 injection, and chemical methods—waterflooding continues to be the method of choice in more than half of the world's producing fields. Its continued dominance stems from its technical maturity, economic viability, and operational scalability.

Against this backdrop, Dr. Thakur's insights offer a timely and critical evaluation of the evolving landscape of waterflooding. Drawing from global case studies and extensive operational leadership, he shared practical lessons and forward-looking strategies to help reservoir engineers, geoscientists, and asset teams maximize recovery potential. His central message is clear: **success in waterflooding is not defined by the rock but by the quality of engineering decisions and operational excellence.**

(Speaker)
Prof. Ganesh Thakur, NEA, NAI
Distinguished Professor & Director of Energy Industry Partnerships at University of Houston
President — TAMEST

(Moderator)
Muhammad Navaid Khan
Reservoir Engineering SME at ADNOC
Chair, SPE IRMTS

"The variability in waterflood outcomes—some fields achieve 60% recovery, others just 15%—is rarely only about geology," he stated. "Waterflooding still delivers. Taking a solution gas-drive reservoir from 20% primary recovery to 60% total recovery through a well-managed flood represents an extraordinary value proposition."

Underperformance often stems from poor reservoir characterization, limited surveillance, or inflexible execution. This article summarizes Dr. Thakur's key insights and features selected audience questions with expert answers to help practitioners make smarter, more adaptive waterflood decisions.

Insights from an Expert on Waterflooding Excellence

In his distinguished talk, Dr. Thakur shared invaluable insights derived from decades of reservoir engineering and management expertise, highlighting foundational principles critical to waterflood success. He structured these insights around four key pillars essential for optimizing waterflood performance.

The first pillar is reservoir heterogeneity and sweep efficiency. ***"If you don't characterize your permeability contrasts, your fractures, your stratification—you will not achieve uniform displacement,"*** Dr. Thakur cautioned. He emphasized detailed reservoir characterization, intelligent completions, and proactive zonal isolation as essential techniques for effectively managing reservoir complexity.

Building upon heterogeneity management, Dr. Thakur then underscored mobility ratio optimization, identifying it as a frequent cause of underperformance. He explained, ***"Most underperforming floods stem from this single issue: unstable displacement due to poor mobility ratio."*** Recommended solutions included precise adjustments in injection rates, optimized pattern designs, and the strategic application of polymer additives and water-alternating-gas (WAG) injection.

Next, Dr. Thakur addressed pressure management and **gas-oil ratio (GOR)**, highlighting their significance in evaluating waterflood effectiveness. He articulated clearly, ***"A good flood reduces GOR. It tells you gas is going back into solution. If GOR doesn't drop from a higher value, your flood is failing."*** Successful pressure management involves maintaining pressures above the bubble point and below fracture pressure, combined with strategic voidage replacement consistently exceeding 100%, with some exceptions for heavier oils.

The final critical dimension is wettability alteration in carbonate reservoirs, a commonly overlooked factor in waterflood design. Dr. Thakur observed, ***"In oil-wet systems, residual oil can be 45%. With a wettability shift, it can fall significantly below 20%, especially with WAG."*** He identified CO_2 flooding, low-salinity water injection, and targeted chemical treatments as transformative methods for significantly enhancing recovery.

Dr. Thakur further emphasized prudent capital investment aligned with operational understanding. Offering clear guidance, he stated, ***"CAPEX must be inversely proportional to uncertainty,"*** advocating pilots, transient testing, and EWT (extended well testing), and detailed dynamic simulations to minimize costly, irreversible reservoir and facilities mistakes.

Highlighting disciplined execution, Dr. Thakur discussed Chevron's CPDEP (Chevron Project Development and Execution Process), a structured, phased development methodology guiding teams from identifying opportunities through risk assessment, simulation-driven design, and adaptive implementation informed by vigilant surveillance.

Surveillance, indeed, formed the core of Dr. Thakur's operational philosophy. He described it as ***"the compass of waterflooding,"*** promoting essential surveillance tools such as ABC plots for rapid performance assessment, Hall plots for injectivity analysis, and advanced 4D seismic for visualizing real-time flood progression.

These principles were vividly illustrated through two real-world case studies. At the **Denver Unit in the Permian Basin**, adaptive management strategies such as tighter injection spacing and targeted CO_2 injection transformed the reservoir, achieving recovery rates exceeding 60%. ***"Denver Unit was a classroom in the field,"*** Dr. Thakur remarked, emphasizing how integrated surveillance and adaptive techniques significantly improved outcomes.

In offshore Nigeria's Agbami Field, advanced completions and robust surveillance from project inception exemplified operational foresight. "Agbami was an exercise in foresight," Dr. Thakur noted. "Surveillance was not optional—it was integral." This disciplined approach yielded exceptional production results while meeting rigorous environmental targets.

Looking forward, Dr. Thakur projected an inspiring vision for future waterflood management. He highlighted the increasing importance of artificial intelligence, machine learning, cross-disciplinary collaboration, continuous learning, mentorship, and integrated environmental responsibility as critical factors for ongoing success.

Concluding thoughtfully, Dr. Thakur offered a resonant reflection: ***"Waterfloods don't fail; we fail to manage them. Success requires disciplined, adaptive, and intelligent operations throughout the reservoir's lifecycle."***

Interactive Insights: Q&A with Dr. Thakur

Following his keynote, Dr. Thakur engaged with the audience in a comprehensive question-and-answer session, addressing key operational challenges and exploring deeper practical insights into waterflood management.

Q. In the case of losing oil to the gas cap, how can we recover some of that oil? Do you propose blowing down the gas cap and perhaps injecting water into it? (Assuming no regulations prohibiting such a thing, for example, at the end of reservoir life). Or are there no solutions to recover the oil lost to the gas cap area?

A. The first thing is to avoid this from happening by monitoring pressure near the GOC (gas-oil contact). I have seen a few cases where the recovery factors of the fields were severely negatively affected.

If the above situation has already occurred, we may attempt to make the gas cap drive effective by allowing a slow decline in reservoir pressure, which may result from the gas cap expanding as the reservoir pressure drops. This expansion provides the primary energy source for production. The gas cap drive mechanism is particularly effective in reservoirs with lower oil viscosities. It is essential to retain gas within the reservoir for as long as possible, as it serves as an excellent energy source.

Monitoring and/or production wells drilled into high-structural areas where the oil is located are crucial for maximizing this process, but this can only be done if it is economically justified. As a last resort, we may consider injecting water to recover some of the remaining oil. However, please be aware that these methods may yield limited success.

Q. Should VRR evolve over time by the waterflood life cycle? Is there any rule of thumb for each specific reservoir type or property regarding the time required in each phase of the waterflood lifecycle? For example, how long does it take for low perm or high perm to see an impact during the fill-up period, incline period, and decline period?

A. As we know, the Voidage Replacement Ratio (VRR) strategy is a critical aspect of reservoir management. It involves calculating the ratio of injected fluid to produced fluid at reservoir conditions, which is essential for balancing production and injection rates. Here are some key strategies and considerations for implementing VRR in oil recovery:

Optimizing VRR: Utilize advanced techniques to accurately calculate VRR, which is crucial for achieving optimal oil recovery rates. This includes accounting for reservoir complexity, external fluxes, well locations, and phase and reservoir flow behavior.

Production Balancing: Setting a planned production rate to balance with injected fluids to maintain reservoir pressure. This strategy is beneficial in scenarios where the production rate is not fully balanced with the injected fluids.

Lesser water Injection: Maintaining a VRR below 1.0 to activate additional recovery mechanisms, which can lead to improved oil recovery. This strategy is beneficial when the fluid injection volume is less than the volume produced, potentially leading to a pressure decline and gas evolution. This strategy is worthwhile to consider for heavier oils.

Gas Mobility and Reservoir Connectivity: Understanding the influence of gas mobility and reservoir connectivity on optimal VRR is essential for making informed decisions in reservoir management. This is important to understand, rather than rushing to achieve a VRR of 1.0, because we can inadvertently create early water breakthrough through higher permeability channels containing higher gas saturations.

Simulation Models: Utilizing simulation models to analyze field data can aid in determining the optimal VRR for various types of oil reservoirs, taking into account factors such as gas saturation and permeability distribution.

Hall Plot Analysis: The Hall Plot analysis can be used to interpret injection well data and determine the average injectivity performance, aiding in the management of VRR.

Implementing these strategies requires careful consideration of the specific characteristics of the reservoir and the operational context. Continuous monitoring and adjustment of VRR strategies are key to achieving optimal oil recovery and maintaining reservoir health. There is no shortcut to this process.

Q. Can alternate modes of waterflooding, such as cyclic injection, imbibition flooding, and pressure pulsing, be helpful, especially in carbonate reservoirs?

A. Waterflood cyclic injection is not commonly used; however, it is a technique sometimes employed to enhance oil recovery from heterogeneous and/or low-permeability reservoirs. Enhancing sweep efficiency in low-permeable zones of a reservoir that are not swept by traditional waterflooding processes can be beneficial. It can be cost-effective with a minor degree of success.

Q. With AI and machine learning (ML) enabling us to do more with less, what changes must the industry adopt to fully leverage these technologies and maximize the value of waterflooding operations?

A. I see great opportunities with AI and machine learning (ML) in maximizing the value of waterflooding operations. It is crucial to completely digitize all our data collection to utilize these techniques fully. The entire surveillance and monitoring operations can be automated using artificial intelligence (AI) and machine learning (ML). The SPE literature is already benefiting from useful publications, such as "AI Innovations in Waterflood Management and the Path to Autonomous Operations," a paper presented at the SPE/IATMI Asia Pacific Oil & Gas Conference and Exhibition in Jakarta, Indonesia, in October 2023, Paper Number: SPE-215236-MS.

Q. Referring to Case Study 1—Denver Unit, the initial phase of water injection followed by later CO_2 flooding in 1984, is this usually the best practice for optimum recovery? Additionally, if VRR (Voidage Replacement Ratio/IWR) exceeds 1, is there a uniform recommendation to maintain this ratio at a specific value, such as 1.2 or 1.3?

A. The Denver Unit waterflood transitioned to CO_2 flooding in 1984. It is an excellent example of the transition when the waterflood was working well and was well optimized. The reservoir, wells, and facilities were performing effectively, “hitting on all cylinders.” We mustn't rush to CO_2 flooding before achieving the optimum condition for waterflooding. Thus, the Denver Unit serves as a good case study for us to follow.

Please see the answer to the question above regarding the VRR. The choice between a VRR of 1 and 1.2 should be based on a thorough analysis of the reservoir's conditions, including gas mobility and reservoir connectivity, to ensure the best possible oil recovery and production balance.

In some cases, a VRR of slightly less than one may be desirable for heavy oil reservoirs. In other cases, a VRR of slightly greater than one may be better for maintaining well deliverability. However, the choice of a VRR value should also be balanced with maintaining the reservoir pressure and not exceeding it above the fracturing pressure.

Q. Was the injected gas used to lighten the oil while simultaneously sweeping with the water? How did it differ from WAG performance?

A. Assuming this question pertains to the Agbami case, a WAG process was not employed. Rather, a double displacement process, utilizing the structurally higher gas injection wells and the downdip or peripheral water injection wells, utilizes fluid densities, gravity, and the dip angle of the formation. Since the dip angle ranged from 10 to 30 degrees in different parts of the reservoir, the double displacement process was highly effective in enhancing oil recovery.

Q. SPE 24156 (Tanner et al.) indicates that the Denver Unit in the Wasson Field has an anisotropic permeability with a preference for the East-West (E-W) direction, which is consistent with the ENE-WSW orientation of Shmax in Texas. Rather than an inverted 9-spot, might not an E-W line drive have given even better performance? (The dolomites are often fractured.)

A. One great advantage we have with an inverted 9-spot pattern is that for every three production wells, we need only one injector (or a producer-to-injector ratio of 3:1). This approach minimizes the number of injection wells that need to be drilled, as long as the injectivity is adequate. Additionally, it is easier to transition from an inverted 9-spot pattern to a 5-spot pattern later, if desired. For a line drive to work more efficiently from a sweep point of view, the permeability in the E-W direction has to be significantly higher (several times) than in the N-S direction (or vice versa).

The dolomites in the Permian Basin exhibit some fractures, but they are not highly fractured; therefore, they generally behave well from a fluid flow perspective. In my opinion, what the operator followed was a reasonable approach.

Q. What are your views on the use of low-salinity waterflooding?

A. Low-salinity water flooding (LSW) is a promising technique for enhancing oil recovery (EOR) in both sandstone and carbonate reservoirs. Along with the few successful field applications of LSW, various studies in this field have been conducted primarily at the laboratory scale. When investigating the potential of this EOR technique to improve oil recovery and the mechanism by which it operates, no consensus has been reported on the dominant mechanism(s) in either sandstone or carbonate reservoirs. Both successful and unsuccessful field case studies exist.

Q. Regarding waterfloods of oil-wet reservoirs, my understanding is that waterflood efficiency is less favorable compared to water-wet reservoirs and that low-salinity water or smart water is often used to make a reservoir more water-wet (mixed wettability). Oil-wet reservoirs produce at much higher water cuts initially, and waterfloods require many pore volumes of water injection. Therefore, I am interested in knowing why you believe an oil-wet reservoir has good waterflood efficiency, assuming low heterogeneity.

A. Both water-wet and oil-wet reservoirs have been successful in yielding higher incremental recoveries by waterflooding. The two examples used, the Denver Unit and the Means San Andres Unit, are both slightly oil-wet reservoirs that have yielded high recovery factors despite their severe reservoir heterogeneities and dolomitic nature.

They have produced at higher water cuts, but still performed well, as they were managed skilfully (including VRR, pattern configuration, free gas saturation management, areal flood balancing, vertical sweep management, and staying below fracturing pressure, among others).

Reservoir wettability is a crucial parameter for waterflood performance; however, numerous other factors also contribute to the waterflood's performance, and these must be managed as well. If the other parameters are effectively managed, they can compensate for some deficiencies caused by unfavorable wettability.

Q. How important is it to incorporate water injection tracers for monitoring the sources of WBT (Water Breakthrough)?

A. I believe it is crucial to incorporate water injection tracers for the surveillance and monitoring of waterfloods from a qualitative perspective. If we start relying on rigorous quantitative analysis using tracers, it can become counter-productive and very time-consuming. Thus, I like the use of water injection tracers on a limited basis.

Q. Initial exploration and appraisal of vertical wells may not sufficiently capture reservoir heterogeneity. In practice, more fractures and faults are often encountered when drilling horizontal development wells. Would you recommend revising the Field Development Plan (FDP) based on these valuable observations? How can we persuade management to adopt a phased development approach, allowing us to thoroughly understand the reservoir before implementing a full-field water flood strategy?

A. In many cases, for a large reservoir containing billions of barrels of resources, where the reservoir characteristics may not be well-understood (e.g., many deepwater turbidite fields), it is a good idea to start with a phased-development approach, and even by including EWT (extended well testing) or EPT (early production testing).

One such example is the Kuito field in Angola by Chevron (Paper WPC-32117, 2002). It successfully employed a phased approach to manage the subsurface risks associated with complex turbidites. Obtaining early Phase 1 production data using a leased FPSO strategy validated the reservoir permeability model, improved understanding of reservoir fluid modeling, confirmed lateral and vertical connectivity assumptions, and validated the effectiveness of the well designs. A similar approach was also followed in the Nemba offshore deep-water field in Angola (OTC 8330; 1997).

The phased field development strategy has made it possible to effectively manage the development of the Nemba resource from both a subsurface and surface perspective by allowing the operator to minimize the geologic/production risk associated with a significant discovery; effectively manage capital, drilling and other resources; optimize production facilities based on a continually improving reservoir characterization; and accelerate the time to first production and initial project revenue.

THE RESERVOIR CHRONICLES: TRIVIA & TIDBIT

Interested in testing how much you know about integrated reservoir management? Or curious about the history of the reservoir management evolution? Then this is the section for you!

DID YOU KNOW?

In 1957, Mobil Oil of Canada launched a miscible displacement pilot in Alberta's North Pembina field, injecting LPG followed by separator gas in a 10-acre inverted five-spot to enhance recovery from the Cardium reservoir.

Initial performance was strong, but early gas breakthrough and rising gas-oil ratios (GORs) soon exposed sweep inefficiencies caused by permeability stratification. To counter this, engineers injected a 7,500-barrel water slug, followed by continued gas injection. The results were immediate: GORs dropped, sweep improved, and total recovery rose from 62.6% to 72% of effective oil in place.

Though unplanned, this sequence—gas, water, gas—was the first field evidence that alternating injection phases could control mobility and improve recovery.

And with it, the foundation for **water-alternating-gas** was laid.

Source: SPE-1308-G "The Pembina Miscible Displacement Pilot And Analysis of Its Performance"

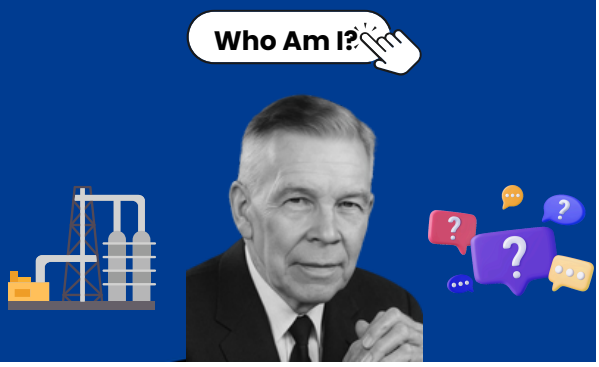
SPECULATE: QUIZ ZONE

Born in 1888, I laid the foundation for petroleum engineering as a discipline.

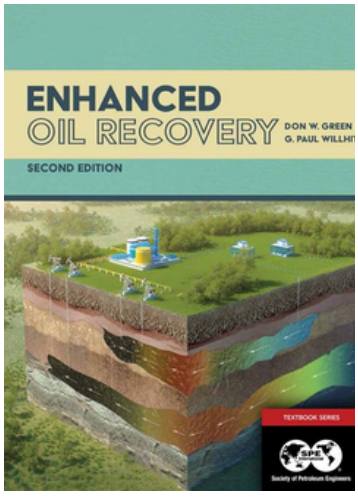
My legacy includes:

Designing the world's first petroleum engineering curriculum
Creating the industry's first data classification system
Authoring 170+ papers and 3 definitive textbooks
Guiding research, field development, and military training programs

I didn't just shape the field—I defined it.



PETROPAGES: BIBLIOPHILE BULLETIN



Enhanced Oil Recovery (Second Edition)
By Don W. Green; G. Paul Willhite
Society of Petroleum Engineers
DOI: https://doi.org/10.2118/9781613994948
ISBN electronic: 978-1-61399-894-6
Publication date: 2018

Building on the comprehensive, fundamental mechanisms and mathematical computations detailed in the First Edition, the new Second Edition of Enhanced Oil Recovery presents the latest insights into the applications of EOR processes, including

- Field-scale thermal-recovery such as steam-assisted gravity drainage and cyclic steam stimulation
- Field-scale polymer flooding including horizontal wells
- Field-scale miscible-displacement processes, such as CO_2 miscible flooding
- Laboratory-scale chemical flooding in the development and testing of surfactant formulations

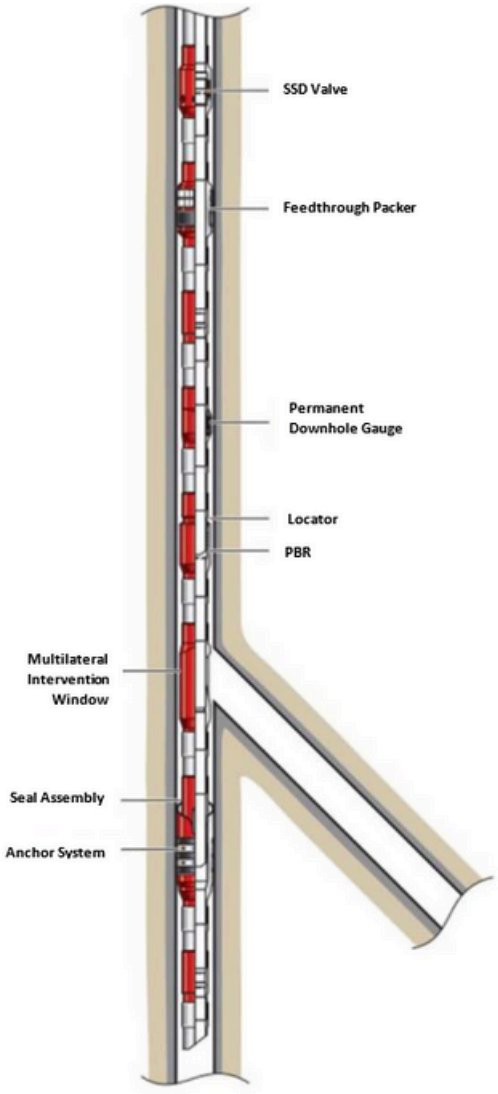
An invaluable tool for petroleum engineering students, Enhanced Oil Recovery also serves as an important resource for those practicing oil recovery in the field or engaged in the design and operation of commercial projects involving enhanced-or improved-oil-recovery processes. A prior understanding of basic petrophysics, fluid properties, and material balance is recommended.

Performance Monitoring: Spotlight Publication

Smarter Monitoring, Fewer Wells

A Novel Case Study from the UAE

This article contains highlights of paper OTC 35575, "Cost-Effective Reservoir Management Through the Application of Multilateral Technology," by M. Kelsey, T. Fanchin, and M. Janzen, Halliburton, et al. The paper has not been peer reviewed.



Retrofit Installation

Expandable Multilateral Anchor

Problem Definition and Engineering Upgrade

Observation wells play a crucial role in reservoir management by providing continuous monitoring of reservoir conditions. Observation wells can be costly when separate from production wells. A recent case study shows how converting an observation well into a dual-purpose observation/producer well using multilateral design allows cost-effective production and monitoring from a single well. This approach reduces the number of wells needed, lowers development costs, and maintains full reservoir monitoring.

The operator aimed to convert a 35-year-old observation well into a dual-purpose observation and production well, maintaining the integrity and accessibility of the existing mainbore while adding a new producing lateral.

Solution

A multilateral retrofit well design was implemented to convert a 35-year-old observation well into a dual-function well, enabling simultaneous reservoir monitoring and production from a newly drilled lateral within the same well slot. This approach reduced the need for additional observation wells and leveraged existing infrastructure for cost-effective field development. A cemented multilateral junction was installed, requiring both the mainbore and lateral to be cased and cemented to ensure integrity. A key component was a field-proven expandable anchor, used to accurately position and orient the junction while supporting intelligent completion systems, eliminating the need for extra trips or equipment. The anchor's large internal diameter and high tensile capacity enabled flexible completion options. A geometrically controlled window was milled using a track-guided system, and the lateral was drilled and completed with a cemented junction for stability and isolation. To support long-term operations, a multilateral intervention window allowed selective access to the mainbore and lateral, while providing hydraulic isolation during flowback. Permanent downhole gauges were installed for continuous reservoir monitoring, and a feed-through completion packer enhanced system integrity.

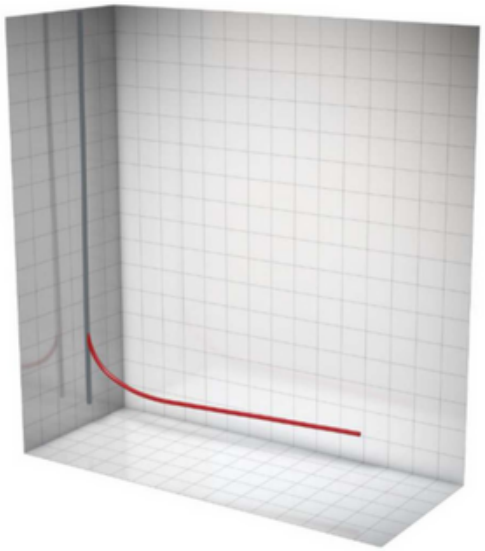
Performance Monitoring: Spotlight Publication

Smarter Monitoring, Fewer Wells

A Novel Case Study from the UAE

Installation

The process involved retrofitting an existing well with a multilateral junction to enable dual functionality—production and monitoring. After verifying casing integrity, an expandable anchor was set to control depth and orientation. A window was milled in the casing, and a new lateral was drilled. Specialized completions with packers and screens were installed to manage water production and isolate untargeted formations using staged cementing. A multilateral intervention window with an isolation sleeve was deployed, enabling rigless access to both mainbore and lateral. Finally, an intelligent completion system was installed to allow separate pressure and temperature monitoring in both laterals, improving reservoir management while reducing costs and interventions.



Producing Lateral Added to Existing Observation Well

Challenges

Key challenges in multilateral retrofit well design include maintaining well integrity during lateral addition, especially in variable formations requiring strong casing and cementing. Effective reservoir management is vital to ensure isolation and production from the lateral without affecting the mainbore's monitoring role. Drilling across different formations increases risks like losses, instability, or stuck pipe. Completion design must allow reliable interventions and access to the lateral while preserving mainbore integrity.

Intervention Window

Impact Highlights

The retrofit multilateral well design offered a cost-effective and efficient solution for field development by combining production and observation in a single well. It reduced CAPEX and OPEX, simplified completion, and maintained flexibility for future interventions. This approach minimized the need for additional observation wells while enabling robust reservoir monitoring and management. Advances in multilateral technology continue to enhance well integrity, operational efficiency, and production flexibility, making them key tools for optimizing reservoir performance and maximizing long-term value.

INNOVATION BRIEFS

Next-Gen Reservoir Management: Unlocking the Power of Internet of Things

As subsurface reservoirs grow more complex and production economics tighten, the oil & gas and water resource sectors are turning to digital solutions to enhance decision-making, reduce costs, and optimize recovery. Among these technologies, the Internet of Things (IoT) stands out as a foundational enabler of real-time, data-driven reservoir management.

The Internet of Things (IoT) refers to an interconnected network of physical devices—such as sensors, actuators, and controllers—that collect, transmit, and act on data in real time. In industrial settings, IoT enables remote monitoring, automation, and analytics by linking field assets to centralized computing systems via wired or wireless communication protocols (e.g., MQTT, Modbus, LoRaWAN, NB-IoT).

When applied to reservoir management, IoT creates a digitally enabled environment where real-time data from subsurface and surface operations can be integrated, analyzed, and acted upon. This leads to better reservoir visibility, informed decision-making, and operational efficiency.

Advanced reservoir management requires continuous monitoring of reservoir behavior, fluid movement, pressure dynamics, and well performance. IoT contributes by enabling:

- Real-time reservoir surveillance
- Automated control of injection and production systems
- Predictive analytics for equipment reliability
- Dynamic model calibration using live field data
- Regulatory compliance through continuous environmental monitoring

Real-Time Monitoring and Data Acquisition
IoT sensors are installed across surface and subsurface infrastructure, including wellheads, pipelines, downhole tools, and separators. They track vital parameters such as pressure, temperature, flow rate, and fluid composition at high frequency.
Data from these sensors is transmitted through field networks or satellite links to cloud platforms or SCADA systems. This real-time visibility helps operators detect anomalies early, optimize production settings, and react instantly to changes in reservoir dynamics.

Remote Automation and Control
With IoT-connected actuators and controllers, field equipment like pumps, chokes, and injection valves can be operated remotely. Control decisions can be made automatically based on sensor input or managed from a central control room.
This enables dynamic production adjustments and fast intervention during abnormal events. Operators can minimize site visits, reduce manual labor, and improve safety, especially in remote or hazardous locations.

Predictive Maintenance and Equipment Reliability
IoT systems also enhance equipment health monitoring. By analyzing operational trends—such as vibrations, current draw, or pressure cycling—predictive models can detect early signs of mechanical wear or failure.

INNOVATION BRIEFS

This allows for condition-based maintenance (CBM), reducing unplanned downtime and extending the life of critical assets like ESPs, compressors, and separators. Maintenance can be scheduled only when needed, saving both time and cost.

Reservoir Modeling and Optimization
Real-time field data can be streamed directly into reservoir simulation models and digital twins. This allows engineers to update reservoir forecasts, track pressure changes, and adjust injection/production rates in near real time. The result is a dynamic, closed-loop optimization process. Engineers can respond quickly to shifting subsurface conditions, enhance sweep efficiency, and improve hydrocarbon recovery without guesswork.

Environmental Monitoring and Compliance
IoT also supports environmental stewardship. Gas leak detectors, water quality sensors, and air monitoring devices can track compliance-critical metrics continuously.
These systems help detect methane emissions, monitor water reinjection quality, and ensure adherence to environmental regulations. Automated reporting also simplifies ESG documentation and regulatory audits.

Operational Efficiency and Cost Savings
By reducing manual intervention and enabling centralized oversight, IoT helps streamline operations. Site visits are minimized, troubleshooting becomes faster, and asset utilization improves. The overall result is lower operating expenses, increased uptime, and enhanced productivity. For organizations managing multiple assets, IoT enables more efficient scaling of field operations with fewer on-site personnel.

Overall, by integrating real-time data into centralized systems, IoT reduces costs, boosts asset reliability, and optimizes resource recovery while minimizing manual intervention and environmental risks.

Further Reading

- Real-Time Well Status Prediction Using Artificial Intelligence Techniques for Accurate Rate Allocation | SPE-220686-MS
- Labeling Job Type and Technology for Large Operational Datasets | SPE-218865-MS
- An Integrated Workflow for Data Analytics-Assisted Reservoir Management with Incomplete Well Log Data | SPE-223633-PA

SPE IRMTS in Pictures

The SPE IRMTS team has been actively engaging with the regional oil and gas community, participating in key industry conferences and networking events. Their presence goes beyond attending sessions—they are building relationships, connecting with peers, engaging with chapter sponsors, and representing the chapter with professionalism and purpose.

This collage highlights those behind-the-scenes efforts that often go unnoticed: meaningful conversations during coffee breaks, reconnecting with old colleagues, and meeting new industry professionals who share a passion for energy and innovation.

Such engagements are vital to strengthening the chapter's visibility and relevance. By maintaining strong industry connections, the team helps foster collaboration, supports knowledge-sharing, and promotes ongoing engagement within the SPE community.

These moments contribute significantly to the growth and impact of SPE IRMTS. The images speak to a spirit of connection and dedication that continues to drive our chapter's mission forward.

Thank You to Our Sponsors

PLATINUM TIER

KAPPA

fishbones

GOLD TIER

Core Lab

tNavigator® Rock Flow Dynamics

CONSOLIDATED SUPPLIERS

Strengthening Partnerships in Integrated Reservoir Management

SPE IRMTS recently held productive meetings with our valued sponsors—RFD, KAPPA, CORELAB, and FISHBONES—highlighting sponsor visibility across key channels, including webinars, the IRMTS website, newsletters, and LinkedIn, and reinforcing the value of continued collaboration.

At IRMTS, we value the ongoing exchange of constructive feedback with our sponsors, which plays a vital role in strengthening technical content and broadening engagement within the reservoir engineering community.

Sponsorship Opportunity

Would you be interested in supporting the SPE IRMTS? Reach out to our Sponsorship Champion, Maryvi Martinez Santiago, to explore opportunities to collaborate with us and amplify your organization's presence within the global energy community.

From the Editors' Desk

In today's dynamic operational landscape, the ability to do more with less is not just a competitive advantage—it's a necessity. As organizations navigate fluctuating markets, rising operational demands, and the push for sustainability, the focus on maximizing productivity while minimizing cost has never been more relevant.

In this edition, we spotlight innovative strategies, technologies, and success stories that showcase how businesses are achieving operational excellence. We have explored key advancements shaping the future of oilfield operations—from optimizing waterflood strategies to leveraging AI and IoT for smarter, real-time decision-making. We also highlighted a breakthrough completion innovation in multilateral drilling, offering a more efficient and cost-effective approach to accessing complex

But this journey is not just about cutting expenses. It's about building smarter systems, empowering teams, and creating value at every step. Productivity gains are most powerful when paired with agility, safety, and sustainability, ensuring long-term impact, not just short-term savings.

Looking ahead, the focus will be on driving wider adoption of these technologies and strategies within the oil and gas industry to enhance reservoir management, improve operational efficiency, and reduce costs.

We hope the insights shared in this issue inspire action, spark new ideas, and support your efforts to drive performance with purpose.

The SPE IRMTS Newsletter
Editorial Team

Engage | Exchange | Elevate

We're shaping the future of SPE IRMTS—together.

Help us better understand your **technical interests, knowledge needs, and preferred ways to engage.** Your input will guide upcoming initiatives, knowledge-sharing efforts, and community-building activities.

Let us know what excites you and how you'd like to contribute.
Whether it's **writing**, **mentoring**, **presenting**, or **simply sharing ideas**, every voice helps strengthen our technical community.

Society of Petroleum Engineers

Connect & Contribute

JOIN US

UPCOMING SPE INTERNATIONAL EVENTS

VISIT WWW.SPE.ORG/EVENTS FOR A COMPLETE LIST

Events

August 26–27, 2025
Asia Pacific CCUS Conference and Exhibition (25 APCC)
Kuala Lumpur, MYS

September 02–05, 2025
SPE Offshore Europe Conference & Exhibition (25 OE)
Aberdeen, Scotland, GBR

September 08–10, 2025
SPE Energy Transition Symposium (25ETS)
Sugar Land, Texas, USA

September 16–18, 2025
The Middle East Oil, Gas and Geosciences Show (MEOS GEO) (25MEOS)
Manama, BHR

Workshops

05–06 August 2025
SPE Workshop: Fiber-Optic Sensing Applications for Well, Reservoir, and Asset Management (25ADEN)
Westminster, Colorado, USA

09–10 September 2025
SPE Workshop: Unconventional Resources (25BWA5)
Brisbane, Queensland, AUS

Workshops

10–12 September 2025
SPE Workshop: Integrated Intelligent Well Completion (25ARIO)
Rio de Janeiro, BRA

16–17 September 2025
SPE/ARMA Workshop: Subsurface Storage from Characterization to Implementation (25JCON)
Conroe, Texas, USA

Call for Papers

2026 SPE Argentina Exploration and Production of Unconventional Resources Symposium
Deadline: 28 July 2025

KOGS 2026 (Kuwait Oil & Gas Show)
Deadline: 8 August 2025

Offshore Technology Conference (OTC) 2026
Deadline: 9 September 2025

2026 SPE Improved Oil Recovery Conference
Deadline: 15 September 2025