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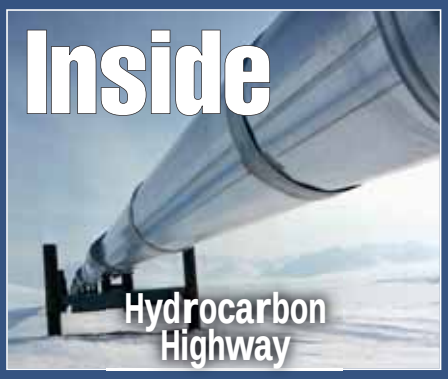
Saudi Aramco Celebrates 100th Patent



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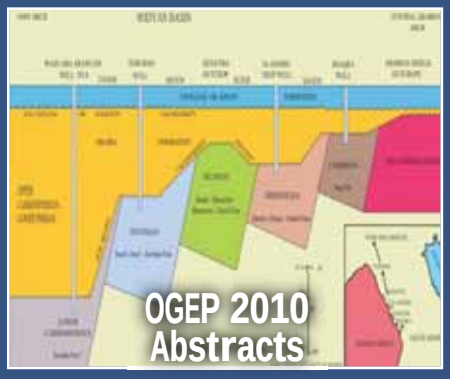

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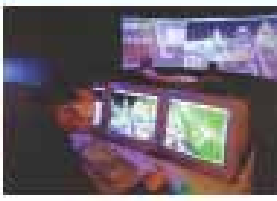

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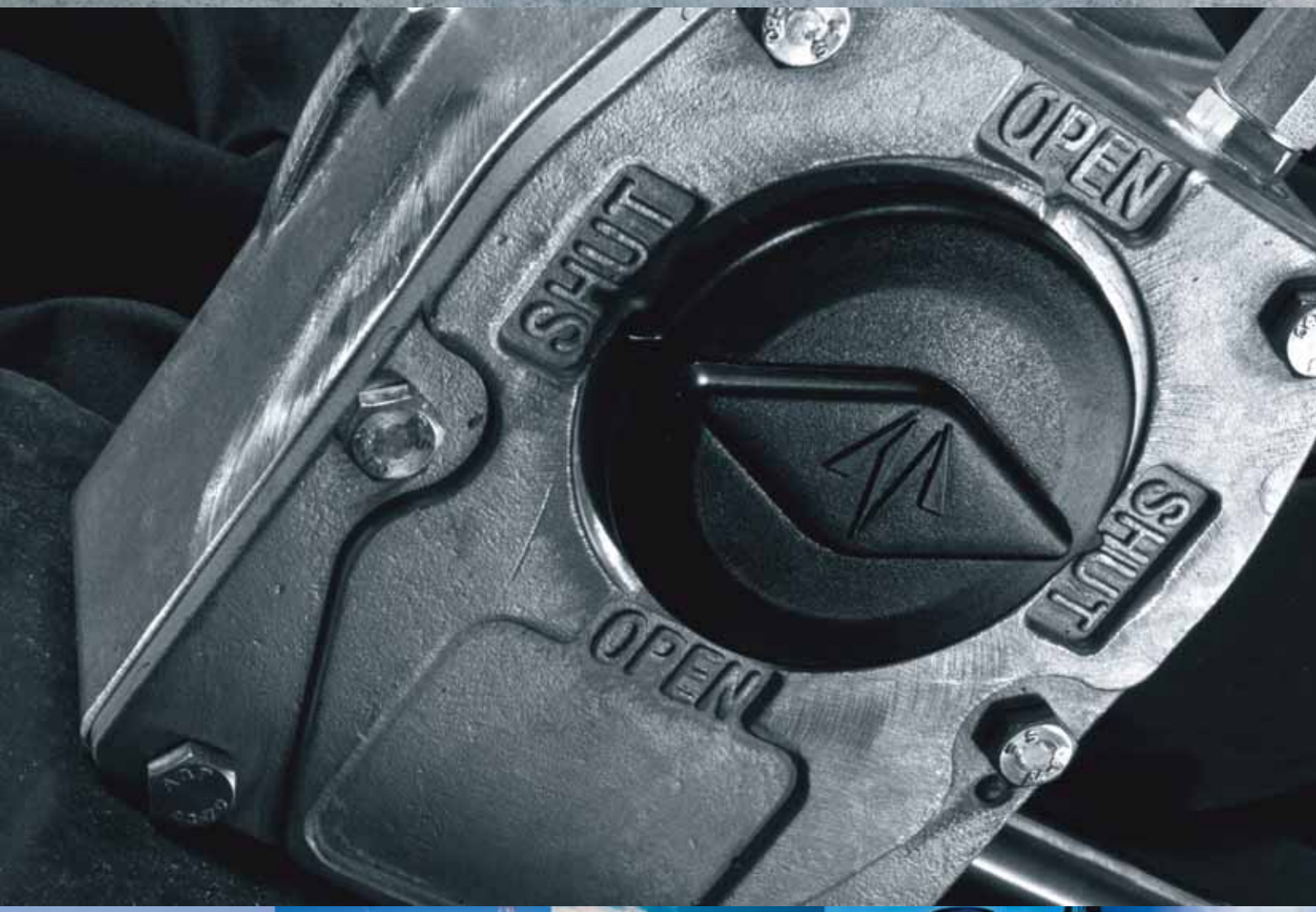

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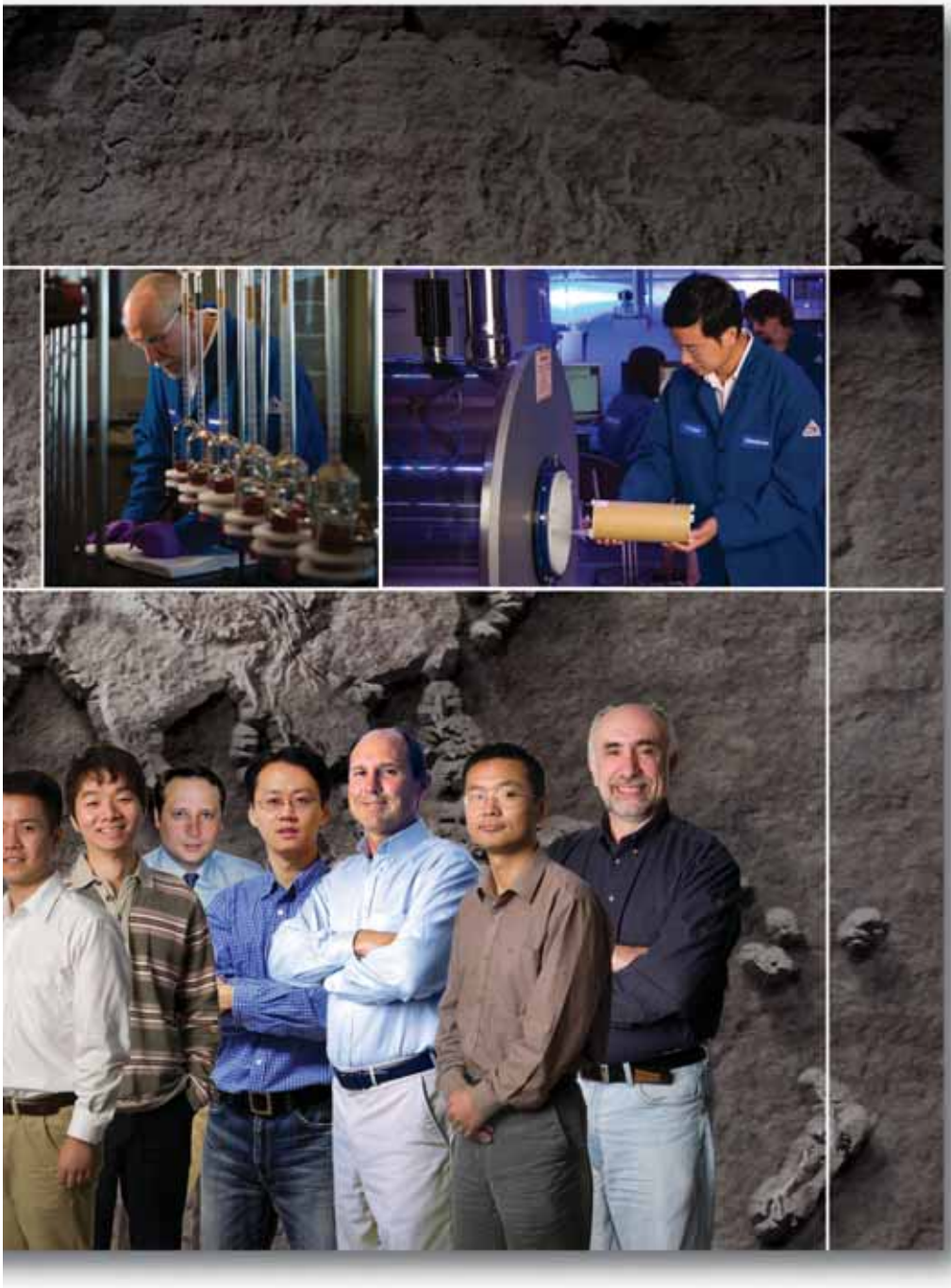

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Hydrocarbon resources (crude oil and gas) are the main source of world energy, and as the international demand increases, the technical challenges increase to meet that demand. Hydrocarbon production optimization at minimum cost and the need to serve the national petroleum industry has been the driving force behind the establishment of the Oil and Gas Research Institute (OGRI) at King Abdulaziz City for Science and Technology (KACST). OGRI is a governmental research and development entity. Its applied research activities concentrate on the upstream sector of the petroleum industry. Fields of interest cover most of the petroleum science and engineering aspects through four main divisions:

- Reservoir Characterization and Numerical Simulation,
- Drilling Engineering,
- Rock Mechanics,
- Production and Enhanced Recovery.

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Saudi Aramco Celebrates Inventions

By Sara T. Al-Bassam,

Inventors were the center of attention at the 100-Patent celebration at the Plaza Conference Center. Patent-earning employees are shown above wearing red ribbons.

DHAHRAN – The company on Nov. 24 celebrated its 100th patent, which was granted in March, but since March, 25 more patents have been granted, heralding an age of innovation like none before.

The story of how that came to be is one of hard work, teamwork and talent, said president and CEO Khalid A. Al-Falih. "Each one of us here is part of a transformation that is preparing the Kingdom for the post-industrial world and setting the stage for a true knowledge society and economy. The centerpiece of that is innovation, technology and learning. It's all about the human element – the human being."

The groundwork has been laid for a patent surge. "Why we're here today is a product of decades and generations," Al-Falih said. "It's the continuation of the spirit that conquered difficulties from the explorers who came to the Kingdom, from our forefathers who left their villages and did something that made all our lives today more prosperous."

Although employees have been producing patents since 1950 – with Edward Van Dornick's oil and gas separator – it wasn't until 2000 that a process was put in place to help them do so. In fact, 110 of the 125 patents granted to Saudi Aramco were granted since the introduction of the Intellectual Assets Management (IAM) system, indicating that all those ideas needed was harvesting.

"Ideas have been there all along, from the very beginning of time," said Mohammed A. Alansari, coordinator of the Technology Program and one of the key figures behind IAM.

"Value and wealth have previously been associated with physical assets,"Alansari said. "Nowadays, the real value is derived mainly from intellectual assets. Corporations that recognize the true importance of intellectual capital are going to be more successful, and the future value of intellectual capital is going to depend on our willingness and commitment to manage these assets."

> “Saudi Aramco is bringing the best talent from all over the world, putting it together and creating true energy… energy of ideas, energy of hope and energy of development.”

Rashid Khan, supervisor of the IAM Group, said: “We didn’t capture (the ideas) as well as we could have before the process. The process is our structural capital – it enables us to capture a number of inventions.”

The discoveries of today’s inventors are a clear passing of a torch from the early days. Explaining one example, Saudi Aramco inventor Bill Connor said, “There are oily chemicals in wastewater that don’t biologically treat very well and make it unfit for reuse.”

While lying in bed one night, Connor came up with a solution. “I couldn’t sleep, and I was thinking about it, and I essentially came up with an entirely different way of approaching the problem,” he said. His idea treats the previously unusable wastewater. “This technology will allow Saudi Aramco to reduce water consumption. It’s exciting to be able to do something that will be very helpful to the Kingdom of Saudi Arabia and its future.”

For Omer Refa Koseoglu, “doing something” means developing cleaner fuels through refining – a subject he’s passionate enough about to have been granted three patents already. “The secret is knowledge. I know the refining process well,” he said. “We do research, and I find a gap there, and I file a patent.”

Flexibility and openness to alternative solutions is why his team has many patents in process. “When it comes to ideas, I tell them, ‘No idea is stupid,’” Koseoglu said. “‘Come with the idea. Let’s discuss it with the team, and then we can build on it.’ That’s how we came up with so many applications.”

Patents follow the company’s business needs, which was the case with Saad Y. Mousa and his colleagues, Hani A. Al-Otaibi and Maan J. Khalife, who developed and patented a program that forecasts how many specialists there will be in a discipline after 10 years. “There was a need; in fact, there still is a need for this program,” said Mousa, who was the team’s computer programmer. “We use formulas for manning prediction, plus we develop Individual Development Plans and track development,” he said. “It’s already in use in four or five departments within Aramco.”

The company’s large support system – in the form of labs, processes and encouragement – also has increased the number of patents. “The experiments were conducted in the lab, with the EXPEC Advanced Research Center. Management would sit with us and really ensure that we protect our ideas,” said Abdullah M. Al-Dhafeeri, who, with Mohammed A. Al-Yami, combined gel with acid-soluble cement to help when drilling muddy reservoirs. “I was thinking of how we can be innovative and create a new solution that doesn’t exist in the market. That’s how we came up with it. It’s unique.”

Employees’ capacity to come up with unique solutions is why Al-Falih felt that a target of 100 patents per year was not too ambitious. “We all need to participate and create our own innovations and inventions,” he said.

“Saudi Aramco is bringing the best talent from all over the world, putting it together and creating true energy… energy of ideas, energy of hope and energy of development,” Al-Falih said. “You are the true champions.”

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2011 Young Professional Technical Symposium

Call For Papers

Abstract submission deadline: January 15, 2011
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The Young Professionals and Students Outreach committee of the Society of Petroleum Engineers – Saudi Arabia section is delighted to invite you to submit your paper abstract for the **2011 Young Professionals Technical Symposium**. The symposium will be held in Dhahran, Saudi Arabia on March 14-16, 2011.

The YP Technical Symposium is an annual event that provides an exceptional venue for regional and international SPE young professionals to share technical experiences and exchange ideas. The symposium programs include technical and poster sessions, and a panel discussion. The technical sessions cover the following technical categories:

- **Drilling, Workover and Well Completion**
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For submission, please send your abstracts to Saud Al-Dawsari at **Saud.Dawsari@aramco.com**

Msalli Al-Otaibi
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The Society of Petroleum Engineers (SPE) Saudi Arabia Section and the Dhahran Geoscience Society (DGS) are pleased to invite you to submit a paper proposal for the 2011 SPE/DGS Annual Technical Symposium and Exhibition (ATS&E) to be held on **May 15-18, 2011**, at Seef Center in al-Khobar, Saudi Arabia. The ATS&E is the largest gathering for petroleum professionals in the Kingdom and is heavily attended by international professionals as well.

The technical program committee accepts abstracts under Exploration and Production (E&P) as well as Geosciences highlighting: new technologies, case histories, fundamental research, field applications and new field development.

The ATS&E covers a wide range of E&P technical categories including:

- **Reservoir Engineering and Management**
- **Drilling Operations**
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- **Unconventional Resources**
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- **Reservoir Simulation**
- **Well Completion**
- **Offshore Fields Exploration and Development**
- **Well Stimulation**
- **Reservoir Characterization**
- **Developments in Geological and Geophysical studies**
- **Non-Seismic Geophysics**

The ATS&E is a great chance to share your knowledge, experience and latest technology advancement. I look forward to receiving your abstracts by December 20, 2010. Submissions can be made online by visiting the event website at **www.atse2011.org**. Authors will be notified of acceptance by January 30, 2011.

Dr. Ghaithan A. Al-Muntasheri, Chairman
2011 SPE/DGS Annual Technical Symposium and Exhibition
E-mail: ghaithan.muntasheri@aramco.com

OGEP 2010

The 2nd Saudi Meeting on Oil and Natural Gas Exploration and Production Technologies

KFUPM Campus, Dhahran, Saudi Arabia
December 18 - 20, 2010

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Welcome Message

Dear OGEP 2010 Participants & Delegates,

On behalf of the Supervisory, Technical and Organizing Committees, I am honored to welcome you to the 2nd Saudi Meeting on Oil and Gas Exploration and Production Technologies (OGEP 2010) to be held at King Fahd University of Petroleum & Minerals during December 18-20, 2010 under the auspices of His Excellency Ali Naimi, the Saudi Arabia Minister of Petroleum and Mineral Resources.

The meeting is designed to provide a forum to discuss a broad range of topics relevant to academia and E&P practices including academia and industry business relationships, human resources, exploration, production, drilling, completion, reservoir, simulation, health, safety & environment, and economics and energy.

The theme of the meeting is "Academia & Petroleum Industry: Synergy for a Better Tomorrow." The theme was selected to focus on enhancing the collaboration between the academia and industry in research and development and preparing a competent workforce of the future.

The OGEP 2010 includes an executive plenary session, technical sessions, poster sessions, invited speakers, panel discussions, workshops, students paper contest, young professionals session, and an exhibition covering the latest advances in oil and gas exploration and production technologies.

I would like to express my great gratitude to the keynote and invited speakers, authors, and panelists for their participation and efforts in preparing their papers, presentations, and posters. Special appreciation goes to members of the supervisory, technical, and organizing committees for their dedicated efforts and unlimited support to develop such program.

Hope you join us and actively participate in this event.

Dr. Abdulrahman Saleh Al-Jarri
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Keynote Speakers

Andrew Gould is Chairman and CEO of Schlumberger Limited, a position he has held since February 2003. Prior to this, Mr. Gould was President and Chief Operating Officer, Schlumberger Limited, Executive Vice President Oilfield Services, President of Schlumberger Wireline and Testing, and President of Sedco Forex. He previously held a series of financial and management in Asia, Europe and the United States. Mr. Gould is a member of the boards of directors of Schlumberger Limited and of Rio Tinto plc. He serves on the commercialization advisory board of Imperial College, London. He is a member of the Advisory Board of the King Fahd University for Petroleum and Minerals, Dhahran, Saudi Arabia and of the Board of Trustees of The King Abdullah University of Science and Technology in Jeddah, Saudi Arabia. Gould joined Schlumberger in 1975 in Paris, after working for Ernst & Young. He received his degree in economic history from the University of Wales. He holds an honorary Doctorate in Engineering from the Colorado School of Mines and is an honorary Fellow of Cardiff University.

Dr. Nigel Middleton is Senior Vice President for Strategic Enterprises at the Colorado School of Mines. Prior to his current appointment, he held successive positions as Provost, Executive Vice-President for Academic Affairs and Dean of Faculty, Vice-President for Academic Affairs and Dean of Faculty, and Associate Vice-President for Academic Affairs, since 2007, 2004, 2001 and 1996 respectively. He came to Colorado School of Mines in 1990 as Assistant Director of the Engineering Division, and has since been engaged in academic administration and instruction and research in electrical engineering, with emphases in telecommunications engineering and special applications of signal processing techniques. He has been fully involved in the development of Colorado School of Mines' new undergraduate curriculum and has led or participated in many nationally funded initiatives in engineering education. He has also been a principal in developing a major collaborative partnership between Colorado School of Mines and The Petroleum Institute in Abu Dhabi, through the sponsorship of theAbu Dhabi National Oil Company and major multinational corporate participants. Prior to joining Mines, he was on the faculty in Electrical and Computer Engineering at West Virginia University, and this followed the period 1977-85 when he was employed in the research and development of integrated systems technologies for mechanization, power distribution, and environmental control in deep South African gold mines. This work was performed for the Chamber of Mines of South Africa Research Organization, where he held divisional Chief Engineer positions in electrical engineering, and then in power and control engineering for applied multidisciplinary engineering systems. Dr. Middleton has received many academic awards, and has a publication record spanning accomplishments in industrial and academic research, and in engineering education. Dr. Middleton is Professor of Engineering at the Colorado School of Mines and holds the Ph.D. and B.Sc.(eng.) cum laude degrees from the University of the Witwatersrand in Johannesburg, and he holds a Professional Engineer's license in South Africa. He is a member of the Governing Board of The Petroleum Institute and is a director of Mines Applied Technology Transfer, Inc.He is a Senior Member of the IEEE, a member of the American Society for Engineering Education, and a member of the South African Institute of Mining and Metallurgy.

Khaled Abdallah Al-Buraik is Vice President of Northern Area Oil Operations for the Saudi Arabian Oil Company (Saudi Aramco). He also serves on Saudi Petroleum International Inc (SPII) and Sino Saudi Gas Limited Board of Directors, and is a member of the Society of Petroleum Engineers, the Saudi Council of Engineers and International Association of Drilling Contractors. His contributions extend to the social activities as he serves as a Board member of al-Birr Charitable Society in the Eastern Province, the National Committee for the Care of Prisoners, Released Prisoners and their Families in the Eastern Province, and Committee for Prince Muhammad bin Fahd Projects for the Charitable Housing in the Eastern Provence. As Vice President of Northern Area Oil Operations, Khaled is responsible for managing the maintenance and operations of the oil facilities located on the northeastern coastline of the Kingdom of Saudi Arabia, as well as the Shaybah field in the south. Northern Area Oil Operations has four main operating departments and two other supporting departments. Before joining Saudi Aramco, from 1984, to 1987, he worked as a faculty member at KFUPM in the Petroleum Engineering Department. Khaled studied petroleum engineering at KFUPM in Saudi Arabia, where he earned both his bachelor's as well as his Master's degrees. He completed several leadership and management development programs, including Oxford Energy Seminar, UK, Leadership at the Peak, Colorado Springs, the IMD Executive Management Training Program, Lausanne, Switzerland, the Leadership Development Seminar, Washington and the Saudi Aramco Global Business program. Khaled began his Saudi Aramco career in 1987 and during the past 23 years he has held several management positions, which include the manager for producing engineering and seawater injection departments, drilling and workover and producing departments. He served as the Saudi Aramco's Chief Petroleum Engineer, from May 2005 until June 2008. This position had the overall general management responsibility for meeting production commitments, and developing additional production capacities, overseeing all petroleum engineering activities in Saudi Aramco which include reserves and reservoir management, reservoir simulation and forecasting, development planning, petrophysics and facilities expansions. From July 2008 to June 2010, Khaled served as the Vice President of Saudi Aramco Affairs, who is responsible for promoting an image of excellence and reliability for the Company, maintaining effective relations with the Saudi Arab Government, worldwide public relations and media activities and providing translation services for Saudi Aramco organizations.

Ford Brett is Managing Director of PetroSkills and CEO of Oil and Gas Consultants International (OGCI) – the world's largest petroleum training organization. Prior to joining OGCI, he was with Amoco Production Co. where he worked on drilling projects in the Bering Sea, North Slope of Alaska, Gulf of Mexico, offshore Trinidad, and Wyoming. He was honored by the 2000 Crosby Medallion for Global Competitiveness from the American Society for Competitiveness for its work in "global competitiveness through quality in knowledge management, best practices transfer, and operations improvement". In 1996, along Tommy M. Warren as co-inventor were honored for their work on improved drilling techniques with a nomination for the National Medal of Technology, the US Government's highest technology award. Mr. Brett has been

granted over 30 U.S. and International patents, authored or co-authored over 30 technical publications, and has consulted in the area of technical and drilling project management in over 35 countries. He holds a B.S. in mechanical engineering and physics from Duke University, an M.S.E. from Stanford University, and an M.B.A. from Oklahoma State University.

Dr. Mark H. Weichold became dean of Texas A&M University at Qatar in January 2007. As dean and CEO, he serves as the chief executive officer of Texas A&M's branch campus to provide it with intellectual and administrative leadership, coordinate priorities and goals with faculty and department heads and support faculty development and quality educational programs. Major responsibilities of the position include academic program management, financial management, external relations with Qatar Foundation and the U.S. Ambassador to Qatar, and promotion of Texas A&M at Qatar in Qatar and in Texas. Prior to his appointment to Texas A&M at Qatar, he served on Texas A&M's main campus as the University's Associate Provost for Undergraduate Programs and Academic Services since 1998 and in 2003, he became the Dean of Undergraduate Programs and Associate Provost for Academic Services. In that capacity he had responsibility for the Office of Admissions and Records and the Office of Student Financial Aid, in addition to the Office of Honors Programs and Academic Scholarships, General Academic Programs, the Career Center, the Student Learning Center, and the University Writing Center. While serving on the main campus, he was involved with the Blinn TEAM Program, the Aggie Access Program, the Task Force on the Undergraduate Experience, Freshman Convocation, the Undergraduate Admissions Advisory Committee, a member of the Qatar Program Development Team, and the Minority Recruiting Leadership Team. Dr. Weichold earned B.S., M.S. and Ph.D. degrees from Texas A&M University in electrical engineering and has worked for General Dynamics Fort Worth Division, Motorola in Austin, Texas, and the US Army Electronic Technology and Devices Laboratory in Fort Monmouth, New Jersey. A registered professional engineer in the State of Texas, he is also a member of the Board of Directors for Ten X Technologies Inc. of Austin, Texas. He joined the electrical engineering faculty at Texas A&M University in 1982 and now holds the rank of Professor where his research interests include topics related to electron devices such as process development, device design, fabrication, and characterization. He has authored more than 80 journal articles, conference papers, and scientific reports, has been awarded three US patents. He is a senior member of IEEE, a member of the American Physical Society and of the American Vacuum Society. In addition, he has served as president of the Texas A&M chapter of Phi Kappa Phi Honor Society, a member of the Blinn College Advisory Board, the College Station Business Development Corporation and the College Station Independent School District Board of Trustees. He has also served the engineering profession as a program evaluator for ABET. Weichold has been recognized with the Association of Former Students Distinguished Achievement Award for Administration (2006), the United Way Trailblazer Award (2001), the Texas A&M International Programs Office's International Excellence Award (1997), the TAMU GSC Kunze Award for Outstanding Graduate Advising (1997), the Eta Kappa Nu Outstanding Professor Award (1996, 1991, 1987), the Halliburton Professor of Electrical Engineering Award (1995), the Tenneco Award for Meritorious Teaching (1993), the University Honors Program Undergraduate Fellows Program Award (1991), and the General Dynamics Excellence in Engineering Teaching Award (1989).

Ganesh C. Thakur (2012 SPE President) is vice president, global advisor and fellow of Chevron Energy Technology Company. Thakur is a world-recognized leader in reservoir engineering & simulation, secondary recovery, reservoir and well productivity improvement, heavy oil, horizontal well technology and EOR. He is also known for the emergence of reservoir management (RM) — in particular waterflooding — as a key interdisciplinary practice. Thakur has an impressive list of publications and teaching engagements conducted around the world.His skills and expertise are called upon widely in the design and operation of RM programs, mentoring technical professionals, and serving as an ambassador of technical capabilities to National Oil Companies and Government Ministries. He is an SPE Distinguished Member and has served as Technical Director – Reservoir for the Board of Directors, and an SPE Distinguished Lecturer. Thakur has authored 50 technical articles, three books, and presented over 150 lectures/short courses around the world. A past chairperson of the SPE Reprint Series, Thakur has served on the SPE Editorial Review and Forum Series committees and as short-course instructor on Integrated Reservoir Management and Waterflood Management. He received SPE's 2005 Reservoir Description and Dynamics award, 2006 Penn State University's outstanding alumni achievement award, and 1994 Orange County, California's outstanding engineer of the year award. Thakur earned a B.S. degree in petroleum engineering from Indian School of Mines and M.S. and Ph.D. degrees in petroleum and natural gas engineering plus an M.A. degree in mathematics, all from Pennsylvania State University. In addition, he earned an executive MBA degree from Houston Baptist University. He has served as an adjunct professor at USC, University of Texas (Permian Basin), University of Houston, and Houston Baptist University.

Mohammed Yahya Al-Qahtani is Executive Director, Petroleum Engineering & Development of the Saudi Arabian Oil Company (Saudi Aramco). He also serves on the Saudi Council of Engineers Board of Directors, the Arabian Geophysical & Surveying Company Ltd (ARGAS) Board of Directors, and as Chairman of the Board of Directors of the Society of Petroleum Engineers, Saudi Arabian Section. Mohammed served as a board member of the American Petroleum Institute (API) and LUKOIL Saudi Arabia Energy Ltd. (LUKSAR) Board of Directors. Mohammed studied petroleum engineering at KFUPM in Saudi Arabia, where he earned his bachelor's degree in 1988. He obtained his master's degree and Ph.D. in Petroleum Engineering at the University of Southern California, Los Angeles in 1992 and 1996 respectively. Mohammed completed several leadership and management development programs, including the IMD Program for Executive Development, Lausanne, Switzerland, the Saudi Aramco Management Development Seminar, Washington, Economics of Oil Seminar, London and the Program for Leadership Development, Bahrain. Mohammed began his Saudi Aramco career in 1988 and during the past 21 years he has held several management positions, which includes the manager for seawater injection, production and facilities development, reservoir management, and reservoir description and simulation departments. In 2007, he held the position of Chairman, President & CEO of Aramco Services Company, Houston Texas, and the position of Chairman, Saudi Refining Inc., Houston Texas. He was then appointed as Saudi Aramco's Chief Petroleum Engineer in 2008. On April 1, 2009 Mohammed was appointed as Executive Director, Petroleum Engineering & Development.

Invited Speakers

Patrick Allman-Ward has been Vice President for Upstream New Business Development in Saudi Arabia since the beginning of 2009. For five years prior to this he was Director and Chief Executive Officer of the South Rub Al-Khali Company Limited, a 50/50 Joint Venture between Shell and Saudi Aramco set up in November 2003 to explore for non-associated gas and condensate in the Rub 'al Khali (Empty Quarter). From 2001 to 2003 Patrick was the Shell Exploration VP for the Asia-Pacific region. Patrick has 29 years of experience in the oil industry with Shell principally as an explorer but he has also held technical and management positions in new business development, economics, business planning, technical services and production geology. He has worked in the Netherlands, Malaysia, Nigeria, Brunei, the United States and Saudi Arabia. Patrick Allman-Ward studied in the U.K. at Durham and Leicester Universities (BSc Geology, MSc Mineral Exploration and Mining Geology) and the Royal School of Mines, Imperial College, London University where we he obtained his PhD (Mining Geology) in 1981.

Dr. Jamal Shamas is a professional environmental engineer with over 25 years of consulting experience in the field of industrial water and wastewater management. He has obtained his Bachelors, Masters, and Doctor of Science degrees from the American University of Beirut, Leeds University in the UK, and Tulane University in New Orleans, Louisiana (USA), respectively.After a 20+-year consulting career in the USA,Dr. Shamas relocated to MENA (UAE) to head CH2M HILL's industrial water and process business as a senior technical manager and business development leader. He has consulted for the O&G, Chemicals, Petrochemical, Power, Metals, and other industries in several countries including Europe, Asia, North America, Middle East, and North Africa. He has also served as visiting lecturer and adjunct professor at Tulane and Louisiana State University civil engineering departments. His specialty areas include studies and design of process water and wastewater treatment systems, residuals management, water reuse/reclamation, and removal of trace contaminants. Particularly, Dr. Shamas has extensive experience in the design and operation of water and wastewater treatment systems for the petroleum refining industry.

Waleed Al-Mulhim is the Manager of Southern Area Reservoir Management Department in Saudi Aramco. His responsibilities include the greater Ghawar field, Abqaiq field and all Non Associated gas reservoirs. Waleed overseen the reservoir aspects of several developments, including the Mega Khurais increment; the largest single increment ever developed in the oil industry which has the most extensive intelligent field application. Waleed has served in a number of Petroleum Engineering chief positions, including the division head of Oil and Gas Planning and the division head of Reserves Assessment. Waleed was also a key member of Saudi Aramco's Gas Negotiation Team, who negotiated the gas agreements in Rub Al Khlai. He was also one of the pioneers in the gas developments of Saudi Aramco as he was a key member of the Hawiyah and Haradh Gas Plants developments that have a combined production target of 4 Billion Standard Cubic Feet.Waleed was born in Al Khobar, Saudi Arabia. He is a graduate of the University of Southern California and received his Masters Degree from Stanford University.His career in Saudi Aramco began in 1984. He completed his executive education in Tuck at Dartmouth, New Hampshire in 2006 and he attended Saudi Aramco's Management Development Seminar in Washington in 2008. Waleed is also an active member of the Society of Petroleum Engineers and has participated in many program and executive committees. Waleed has also received the 2010 SPE Middle East Region Management & Information Award.

John Edwards has worked for Schlumberger in various operational, engineering and management positions since 1978, mostly spent on the acquisition and processing of various measurements deployed on wireline, drillpipe or on permanent completions. He is currently Technical Manager in Oman focusing on reservoir surveillance associated with enhanced oil recovery.

AbdulHameed Al-Rushaid is currently acting General Manager of Drilling in Saudi Aramco. He graduated with a BS degree in Petroleum Engineering from KFUPM in 1988 and joined Saudi Aramco in the same year as a production Engineer. In 1990, He joined Drilling and Workover as Workover Engineer. Then, he worked as a drilling engineer in both oil and gas wells. Also, he worked as reservoir engineer for one year in 1995. AbdulHameed held various positions with D&WO and involved in mega projects like HWYH gas increment, Qatif oil increments, AFK increment, and Manifa increments as division head and manager. Seconded to LukOil Saudi Aramco (LUKSAR) as a drilling manager in year 2004. AbdulHameed was appointed as Northern area Oil Drilling Dept. manager in year 2006, Offshore Drlg Dept manager in 2008 and Exploration Drlg Dept. manager in year 2009 before moving to Tanajib as SFNY offshore Producing Dept in late October 2009.The position am holding. Currently acting GM of Drilling. Completed the University Executive Program in year 2007 from the IMD in Lausanne, Switzerland.Also completed Sauid Aramco Management Development Seminar (SAMDS) in year 2009. AbdulHameed is a Member of the SPE.

Dr. Masanori Kurihara is the Director General Manger of Japan Oil Engineering Co., Ltd. He has participated in numerous reservoir evaluation and simulation studies as well as the development and improvement the numerical simulators. In addition to the above, he was engaged in educational projects, including the installation of the Petroleum Exploration and Production Data Bank System, the design of Arab Petroleum Training Institute, seminar for petroleum engineers of Saudi Arabia and Kuwait, and the JNOC Training Course project. In 1995, he took a Ph.D. degree develop-

ing the 3D streamline model and applying this program to characterizing uncertainties of a reservoir. He was appointed to a member of the Technical Program Committee of SPE Asia Pacific Conference on Integrated Modelling for Asset Management held in Japan in April 2000. He also played a role of a co-chairman of the gas hydrate related sessions in Offshore Technology Conference held in Houston in May 2008, in the Spring Meeting of American Chemical Society held in Salt Lake City in March 2009 and in Offshore Technology Conference held in Houston in May 2010. In 2008, he was selected as a member of the Russian Academy of Natural Science, US Section. In 2010, he won the Science and Technology Award of the Minister of Education, Culture, Sports, Science and Technology. He takes charge of the class of "Special Lecture on Advanced Reservoir Engineering", where he is mainly teaching the reservoir characterization and petrophysics.

Joseph Danko has more than 25 years of experience in consulting, engineering, design, CM, and operations. He is currently the Global Director of Sustainable Solutions for CH2M HILL. In this role, he is leading an enterprise-wide team to develop and implement sustainable solutions across the globe. Prior to this role, Mr. Danko was the Project Director on CH2M HILL's $800 M Fort Hills Infrastructure Utilities EPC Contracts for PCOSI. In this role he oversaw and coordinated major project delivery issues and worked with Senior PCOSI Management and both CH2M HILL Project Managers and their teams to ensure our projects were delivered on-time and on-budget. Over his career Joseph has been lead process on a number of industrial designs, developed and implemented new technologies and managed a number of projects from consulting through operations. In 2003, Mr. Danko managed a byproduct synergy (BPS) project for Dow Chemical in Houston, Texas. Joseph holds a B.S. in Chemical Engineering from the University of New Hampshire and M.S. degree in Chemical Engineering from Oregon State University.

Dr. David Rowan is the product development manager for reservoir engineering and simulation software products at Schlumberger Information Solutions. David has a Bachelors degree in chemistry a Ph.D. in Condensed Matter Physics both from the University of Oxford, and prior to joining industry worked in academic research. David has been with Schlumberger for 9 years, working in and then leading the reservoir simulator development team. He has worked on both the ECLIPSE family of simulators and the next generation INTERSECT simulator, managing the field management team. His primary interests are in the use of simulators to optimize time-consuming reservoir engineering processes, particularly field development planning, integrated asset modeling, and history matching.

Juergen Neumann is Region Product Line Manager for Weatherford Reservoir Completion Systems, covering the Middle East and North Africa from his home base in Dubai. Prior to the current assignment, he has been for two years Business Development Manager for Well Screen Technology in North Africa and for four years country BDM for all Weatherford product lines in Lagos, Nigeria. Juergen has over twenty years of experience in the oil industry and has filled during his career a number of positions in Operations, Technical Management, Sales & Marketing and Line Management with major service companies. Juergen holds a degree in Mining Engineering from the University of Aachen, Germany, and is a member of the Society of Petroleum Engineers.

Mohammed I. Al-Sowayigh is a Manager of the Sea Water Injection Department. He has been with Saudi Aramco for 26 years. Mohammed has worked as a Petroleum Engineer in most of these past years in the disciplines of Production Engineering, Drilling, Workover and Reservoir Engineering. He also has other assignments with Operations and Well Services.He was re-assigned lately in July this year to the current position. Mohammed is a long-standing member of the SPE since 1981. He chaired one of the Middle East SPE Forum Series in Oman in 2001. He also served on two SPE MEOS Program Committees, chaired several technical sessions and co-authored couple of technical publications. Mr. Al-Sowayigh graduated in 1984 with a BS degree in Petroleum Engineering from King Fahd University of Petroleum & Minerals.

Dr. S.M. Farouq Ali was born in India, and is president of H.O.R. Heavy Oil Recovery Technologies in Alberta. He is an honorary professor at the U. of Calgary and professor at the U. of Regina. Prior to this, he served at the U. of Alberta, and at the Pennsylvania State University, for 40 years as professor of petroleum engineering. He has supervised over 200 graduate students, authored over 500 papers, and three books. He serves as consultant to oil companies, and has done over 300 reservoir studies worldwide. Dr. Farouq Ali has been honored for his work on thermal recovery and simulation with awards from the Society of Petroleum Engineers, the Canadian Institute of Mining and Metallurgy, and the Russian Academy of Sciences. He was awarded honorary doctorates by two major universities in Russia, and also received the Academy's Kapitsa Gold Medal. In 2007, he received the Society of Petroleum Engineers' highest award, the Anthony F. Lucas Gold Medal for technical excellence. In Oct 2009, he was elected to the U.S. National Academy of Engineering.

Dr. Aldo Vesnaver got a Master degree in Physics and a PhD in Geophysics from the University of Trieste (Italy). From 1983 to 2001, and from 2006 to 2010, he has been working at the Italian National Institute for Applied Geophysics (OGS) as R&D scientist and Vice-Director of Department. From 2001 to 2006, he worked at Saudi Aramco in seismic R&D.In 2010 he was appointed "Saudi Aramco Chair" at the KFUPM University in Dhahran (Saudi Arabia). Aldo was a co-founder of the Italian EAGE-SEG Section in 2001, and is its current President. He was Chairman of the SEG Global Affairs Committee in 2004-2005 and Chairman of the Membership Committee in 2008-2009. He is an organizer of the Italian, Balkan and Serbian Challenge Bowl. In 2009 he was awarded by the SEG Lifetime membership. He served as the SEG Honorary Lecturer for Europe 2010. From 2002 to 2005, he has been part of the Executive Committee of the Dhahran Geoscience Society. From 2003 to 2006 he was Associate Editor of the journal "Geophysics" and book reviewer for "The Leading Edge". From 2003 he has been Associate Editor of the journal "Geophysical Prospecting", and from 2006 to 2008 its Editor-in-Chief. In 2010, he was elected Chairman of the EAGE Research Committee. He published over 100 papers in international refereed journals or conference proceedings. The main research topics pursued include reservoir monitoring, tomography, passive seismic and near surface.

Hans-Christian Freitag received a BSc in Physics from University of Technology in Berlin, Germany and a MSc in Geophysics from University of Technology in Clausthal, Germany. Hans-Christian began work in the wire line logging industry in 1989. During his career he has worked in Angola, Austria, Bahrain, Denmark, Germany, Italy, Kuwait, Netherlands, Nigeria, Norway, Oman, Qatar, Russia, Syria, Thailand, Trinidad and Tobago, United Arab Emirates, USA, Yemen, and the United Kingdom. Hans-Christian has held positions in sales, business development, marketing, and operations for wire line logging as well as drilling and evaluation systems, including MWD, LWD, coring, real time centers. He is currently the Vice President – Marketing for the Middle East Region for Baker Hughes.

Geoff Pike is an Exploration Geoscientist from the UK and seconded from Shell to the South Rub al' Khali Company (SRAK) since June 2007. He has a first degree in Geology from Imperial College, London and a PhD from Monash University, Australia where he studied Volcanology and Sedimentology of the early (Archaean) Earth. In SRAK, Geoff worked initially on seismic interpretation and geological understanding of the Paleozoic section of the Rub al' Khali as part of the First Exploration Period drilling campaign. With SRAK's successful entry into a Second Exploration Period, Geoff is now interpreting large 3D seismic datasets to better understand the size, distribution and internal complexity of giant, Mesozoic sour gas accumulations in the Kidan area. Away from SRAK, Geoff enjoys most outdoor activities (excluding golf) and is a keen runner.

Dr Sergio Persoglia is the Director for International Collaborations at the OGS, that he joined in 1981. Prior to this assignment, he has been head of the team for R & D in Seismics ('86-'87) Director of the department Geophysics of the Lithosphere ('87-'95) and Advisor to the OGS President ('96-'01).Expert in seismic data collection and processing, he has been scientific and/or operative responsible for OGS of many national programs. Among these programs, worthy to be mentioned are CROP (Deep Crust, with about 1.300 km of seismic profiles across the Alps and Appennines, and 5.900 km in the Italian seas) and PNRA (National Research Program in Antarctica, with more than 45.000 km of seismic profiles in the Ross and Weddell seas and in the Antarctic Peninsula).In the period 1986 -2000, he has been Director Responsible of all the surveys performed by OGS seismic crews, and from 1998 President of CO.GE.PRO., a consortium for the development of deep geophysical investigations. In the last 10 years, his main area of activity has been the development of international collaborations in Europe and, as such, he has been President in 2001 of ENeRG, the European Network for Research in Geo Energy, joining institutes from 31 countries.The large number of scientific contacts has given him the possibility to be more and more directly involved in projects dealing with CO2 geological storage. In the last years, he acted as Network Manager and, then, Secretary of CO2GeoNet, the European Network that involves more than 250 researchers in 13 institutes from7 European countries. Actually he is Secretary General of the Association CO2GeoNet, a legal entity registered in France and Secretary of the Italian CO2 Club. In October 2010, he has started a new duty, as coordinator of the CO2 Geological Storage Joint Program in EERA, the European Energy Research Alliance. Mr Sergio Persoglia holds a degree in Electronic Engineering of the University of Trieste, Italy.

OGEP 2010 Technical Program

Saturday, December 18, 2101
Time: 0800 - 0915
Venue: King Fahd Convention Hall (Bldg. #60)

Opening Ceremony

Saturday, December 18, 2101
Time: 1030 - 1215
Venue: King Fahd Convention Hall (Bldg. #60)

Executive Keynote and Plenary Session

Moderator:
• Dr. Mohammed Y. Al-Qahtani
Executive Director of PE & D, Saudi Aramco

Keynote Speakers:
• Andrew Gould
Chairman & CEO, Schlumberger Limited

• Dr. Nigel Middleton
Senior Vice President for Strategic Enterprises, Colorado School of Mines

• Mr. Khalid A. Al-Buraik
Vice President, Northern Area Oil Operations, Saudi Aramco

• J. Ford Brett
President & CEO, PetroSkills

• Professor Mark H. Weichold
Dean & CEO, Texas A&M University, Qatar

• Ganesh C. Thakur (2012 SPE President)
Vice President, Global Advisor RM and Fellow, Chevron Energy Technology Company

Saturday, December 18, 2010 **Time: 1315 - 1500** **Room: Hall 104 – Bldg. # 60**

Session 1: Academia & Industry Business Relationships

Session Chairpersons: Dr. Omar Almisned, KACST
Mike Kaminski, KFUPM

Invited Speaker **Academia and Industry Partnering to Develop and Implement Advanced Technology**
Joseph Danko, Global Director Sustainable Solutions, CH2M Hill

OGEP 2010-055	The Technologist Development Program: Saudi Aramco's Strategy to Prepare Today's Professionals for Tomorrow's Challenges *Hussein Al-Ali, Saudi Aramco*
OGEP 2010-097	Research & Development Collaboration in Oil & Gas Operations: Who Carries the Ball? *Ali Kamrani, the University of Houston, USA*
OGEP 2010-079	Bridging the Gap between the Oil & Gas Industry and Academia *Abdelaziz Khalifat and Hani Qutob, Weatherford Oil Tool Middle East Ltd., Dubai, UAE*

OGEP 2010-001	Two-way Academia-Industry Collaboration to Enhance KFUPM Student Learning Experience *Abdullatif A. Al-Shuhail, King Fahd University of Petroleum and Minerals, Saudi Arabia*

Alternate

OGEP 2010-047	Training Applications in Upstream Industry *Mustafa Shuala, Saudi Aramco*

Saturday, December 18, 2010 **Time: 1315 - 1500** **Room: Hall 105 – Bldg. # 60**

Session 2: Exploration Technology

Session Chairpersons: Dr. Mohammed Al-Badri, Schlumberger
Paul Thompson, Chevron

Invited Speaker **Meeting Exploration Challenges in the Decade Ahead**
Patrick Allman-Ward, Vice President for Upstream New Business Development in Saudi Arabia, Shell

OGEP 2010-187	Paleozoic Strata in the Rub Al Khali Basin: Main Factors Controlling Hydrocarbon Accumulation and Prediction of Favorable Exploration Fairways *Lei Zheng, Zhijun Jin, Fanjun Kong, Guoping Bai, and Feng Ding, SINOPEC, China*
OGEP 2010-143	Leveraging Asset Development in the Partitioned Zone of Saudi Arabia and Kuwait through Application of Gravity and Magnetic Technologies – the Saudi Arabian Chevron *Robert Pawlowski et al., Chevron Energy Technology Company, USA*
OGEP 2010-071	Using Multi-frequency NMR as a New Wettability Measurement *Benjamin Nicot, P. Ligneul, Schlumberger Dhahran Carbonate Research Center, Saudi Arabia, and J.-P. Korb, Laboratoire de Physique de la Matière Condensée, France*

Alternate

OGEP 2010-108	Permeability Distributions in Sarah Formation from Subsurface Rub Al-Khali, Saudi Arabia *Ali Sahin, M. Abdallah, Center for Petroleum and Minerals, Research Institute of KFUPM, S. Zhang, S. Q. Li, and A. Sakloua, Sino-Saudi Gas Limited, Dhahran, Saudi Arabia*
OGEP 2010-107	Data Reliability Assessment Using Local Incoherent *Saleh Al-Dossary and Abdulaziz AlSharikh, Saudi Aramco*

Saturday, December 18, 2010 **Time: 1315 - 1500** **Room: Hall 106 – Bldg. # 60**

Session 3: Health, Safety and Environment (HSE)

Session Chairpersons: Abdullah A. Al-Ghamdi, KAUST
Yehia Ibrahim, Baker Hughes

Invited Speaker **Integrated Water Management Solutions for Petroleum Refineries- Towards a Sustainable Practice**
Jamal Y. Shamas, CH2M HILL International, UAE

OGEP 2010-078	Behavior Based Safety Process At Saudi Arabian Chevron Co. *Fayez Al-Dhafeeri, Saudi Arabian Chevron, Kuwait*

OGEP 2010-159	Radiation-Based Technologies in Saudi Aramco *Khalid A. Mously, Rafat Nassar, and Michael Cowie, Saudi Aramco*
OGEP 2010-194	Operational Excellence *Zamel Al Doussari, Saudi Arabian Chevron, Saudi Arabia*

Alternate

OGEP 2010-057	Saudi Arabian Chevron Occupational Hygiene Process *Fayez Al-Dhafeeri, Saudi Arabian Chevron, Kuwait*

Saturday, December 18, 2010 **Time: 1515 - 1650** **Room: Hall 104 – Bldg. # 60**

Session 4: Reservoir Engineering & Management -1

Session Chairpersons: Adnan Al-Kanaan, Saudi Aramco
Dr. Omar Almisned, KACST

Invited Speaker **Reservoir Management: Architecting Most-Efficient Hydrocarbon Extraction Strategies**
Waleed A. Al-Mulhim, Manager of Southern Area Reservoir Management Department, Saudi Aramco

OGEP 2010-170	The Continuous 4D Monitor of Oil and Gas Reservoirs, Storage in CCS (Carbon dioxide Capture and Storage) and Aquifers *Junzo Kasahara, NTT-data-CCS, Co. Ltd., Kayoko Tsuruga, University of Marine Science and Technology, and Yoko Hasada, Daiwa Exploration & Consulting Co., Ltd., Japan*
OGEP 2010-102	Exploiting Best Reservoir Management Strategies to Revitalize Idle Well in a Challenging Mature Clastic Reservoir Amer H. Abuhassoun, Saudi Aramco
OGEP 2010-040	Model-Centric 3D Petrophysical Application Technology Roger R. Sung and Khalid S. Al-Wahabi, Saudi Aramco

Alternate

OGEP 2010-034	In-Situ Determination of Remaining Oil Saturation and Sweep in a Carbonate Reservoir with Varying Salinities *Abdi Majdpour, D. Krinis, N. Dawood, Leak Wah Ong, Saudi Aramco*
OGEP 2010-162	Effective Water Management Practices Yield A Substantial Reduction In Water Production In Mature Area Of A Large Carbonate Reservoir: Case Study *Raied A. Al-Khuzayem and Jaime Rodriguez, Saudi Aramco*

Saturday, December 18, 2010 **Time: 1515 - 1650** **Room: Hall 105 – Bldg. # 60**

Session 5: Reservoir Characterization -1

Session Chairpersons: Dr. Michael Kaminski, KFUPM
Aiman Bakhorji, Saudi Aramco

Invited Speaker **Recent advances and current plans in Europe about CO2 geological storage**
Dr. Aldo Vesnaver, Saudi Aramco Chair at KFUPM
Dr. Sergio Persoglia (OGS, Italy)

OGEP 2010-050	Geological Heterogeneity in Carbonates: Wafra First Eocene Reservoir, Partitioned Zone (PZ), Saudi Arabia and Kuwait – Implications for Steamflooding *W. Scott Meddaugh, Saudi Arabian Chevron, W. Terry Osterloh, Niall Toomey, Dennis Dull, Chevron Energy Technology Company, Nicole Champenoy, Shamsul Aziz, Saudi Arabian Chevron, and Dana Rowan, Chevron Energy Technology Company, Houston, Texas*
OGEP 2010-183	The Shajra Formation: A Newly Defined Permo-Carboniferous Unit *Abdulaziz A, Laboun, King Saud University, Saudi Arabia*
OGEP 2010-135	Kidan Sour Gas Part II: The Notional Development Plan *Gijs CJ Holstege and Peter Wood, South Rub Al Khali Co. Ltd./Shell Intl.*

Alternate

OGEP 2010-059	The Land-Streamer Acquisition System to Map the Sand Dune Base *Hashim Almalki, King Abdulaziz City for Science and Technology, Saudi Arabia*
OGEP 2010-121	Smart Depletion in Tight Gas Reservoirs- A Rock Mechanics View *Hazim Abass, Saudi Aramco*

Saturday, December 18, 2010 Time: 1515 - 1650 Room: Hall 106 – Bldg. # 60

Session 6: Economics & Energy

Session Chairpersons: Jamal A. Khonaifer, Saudi Aramco
Adeeb Al-Khunaizi, MOPM

Invited Speaker **Japan's Methane Hydrate R&D Program**
Dr. Masanori Kurihara, Japan Oil Engineering, Japan

OGEP 2010-195	Applying Optimization Methods in E&P Investments *Mohammed H. Husni, Saudi Aramco*
OGEP 2010-030	Transmission Expansion Planning Using Nonlinear Programming *Zakariya Mahmoud Al-Hamouz, and Ali Sadiq Al-Faraj, Saudi Aramco*
OGEP 2010-160	Application of Flare Minimization Plan in Saudi Aramco *Wael Al-Blaies, Saudi Aramco*
OGEP 2010-193	A Methodology to Determine both the Technically Recoverable Resource and the Economically Recoverable Resource in an Unconventional Gas Play *Husameddin Saleh A. AlMadani, Saudi Aramco*

Alternate

OGEP 2010-072	Quick Energy Audit in Southern Area Producing GOSPs *Bandar J. Al-Qahtani, Saudi Aramco*
OGEP 2010-106	Integration of Multifunctional Systems to Reduce Rigless Costly PWIs Wellhead Replacement Job Executions *Hassan I. Al-Tammar, Saudi Aramco*

Saturday, December 18, 2010 Time: 1515 - 1650 Room: King Fahd Convention Hall (Bldg. # 60)

Student Paper Contest

Sunday, December 19, 2010 **Time: 0800 - 0945** **Room: Hall 104 – Bldg. # 60**

Session 7: Drilling Technology -1

Session Chairpersons: Charles P. Kreuz, Weatherford
Dr. Enam Hossain, KFUPM

Invited Speaker **Drilling Technologies and Expertise, Which One is Out Pacing the Other?**
AbdulHameed A. Al-Rushaid, Saudi Aramco

OGEP 2010-101	Deep Tight Gas Zonal Isolation Solution with Novel Flexible and Expandable Cement Technology *Dominic Ong and Maimoon Jaffery, Schlumberger, Saudi Arabia*
OGEP 2010-037	PRSS: A Breakthrough in Drilling Performance in Deep Gas Drilling *Shaji P. Thomas, Khalid Nawaz, Saeed Al Reda and Abdullah A. Kubaisi, Saudi Aramco; Jaywant Verma, Khalid Mehmood, Sukesh Ganda, and Oussama Asskar, Schlumberger*
OGEP 2010-133	Selecting the Right Bit for a Specific Application with a Click of a Button *Ryan Seike, Baker Hughes, Saudi Arabia*

Alternate

OGEP 2010-192	New Filtration Control Polymer for Improved Brine-based Reservoir Drilling Fluids Performance at Temperatures in Excess of 400°F and High Pressure *R.G. Ezell, A.M. Ezzat, J.K. Turner, Halliburton, and J.J. Wu, Champion Technologies*
OGEP 2010-017	The Recycling of Waste Vegetable Oil for Biodegradable and Environment Friendly OBM Formulation *Md. Amanullah, Saudi Aramco*

Sunday, December 19, 2010 **Time: 0800 - 0945** **Room: Hall 105 – Bldg. # 60**

Session 8: Completion Technology -1

Session Chairpersons: Faisal Mutair, Saudi Aramco
Steve Dyer, Schlumberger

Invited Speaker
Juergen Neumann, Weatherford

OGEP 2010-110	Case History: Successful Application of Combined Rotary-Jetting and MLT to Stimulate Dual-Lateral Producer in Ghawar Field *Muhammad H. Al-Buali, Ibrahim H. Al-Arnaout, Ayed M. Al-Shehri, Surajit Haldar, and Saad M. Al-Driweesh; Saudi Aramco*
OGEP 2010-131	Reaction Mechanisms of EDTA Dissolving Calcium Carbonate in Various pH at High Temperature, High Pressure *Xiangdong Willie Qiu, Schlumberger Carbonate Research Center, Saudi Arabia*
OGEP 2010-054	Innovative Approach to Stimulate Horizontal Gas Well Using DTS Technology Combined with Coiled Tubing in Saudi Arabia *Francisco Garzon, J. Ricardo Solares, Jose Ricardo Amorocho, Abdulmohsin AL-Mulhim, Saudi Aramco, Wassim Kharrat, Iyad Hamed-Naji, George Brown, and Vidal Noya, Schlumberger*

Alternate

OGEP 2010-138	Productivity Index Enhancement of Stimulated Gas Wells through Hydraulic Fracturing *Hazim Nayel Dmour, King Saud University, Saudi Arabia*
OGEP 2010-119	Numerical Simulation of Dissolution Patterns During Matrix Acidization of Vugular Carbonate Cores *Anes Yahaya Usman, KFUPM, Frank F. Chang, Schlumberger Carbonate Research Center, Mahmoud El-Awady Doklah, and Abdulaziz Al-Majed, KFUPM, Saudi Arabia*

Sunday, December 19, 2010 **Time: 0800 - 0945** **Room: Hall 106 – Bldg. # 60**

Session 9: Formation Evaluation -1

Session Chairpersons: Rami BinNaser, Saudi Aramco
Dr. Arun Kumar, KFUPM

Invited Speaker **Use of NMR and Di-Electric to Measure the Affect of Chemical EOR**
John Edwards, Schlumberger

OGEP 2010-120	Accurate Oil-Water Contact Delineation in Heterogeneous Carbonate Formations Under Water Drive Using Down Hole Fluid Analysis *M. Zeybek, Schlumberger, Z. Ab Rahim, R. Gunarto, M. Abdul Latif, Saudi Aramco, and H. Ayyad, Schlumberger*
OGEP 2010-181	Use of Innovative Extended Reach Logging and Intervention System *Ron Collins, Weatherford Canada*
OGEP 2010-141	Using Elemental Geochemistry to Improve Sandstone Reservoir Characterization: A Case Study From the Unayzah a Interval of Saudi Arabia *Robin MacDonald, Douglas Hardman, Ronald Sprague, Yacine Meridji,Witjaksono Mudjiono, Saudi Aramco, James Galford, Marvin Rourke, Halliburton, Michael Dix, Chemostrat, and Michael Kelton, Core Laboratories*

Alternate

OGEP 2010-099	Improving Permeability Models in a Deep Saudi Arabian Gas Reservoir Through Better Measurement Accuracy *David Forsyth, Saudi Aramco*
OGEP 2010-096	Permeability Restoration of Saudi Arabia Rocks *Osama Ahmed Lotfy Kamal Al-Mahdy, King Saud University, Saudi Arabia*

Sunday, December 19, 2010 Time: 0800 - 0945 Room: King Fahd Convention Hall (Bldg. # 60)

Young Professionals Session

Session Chairpersons: Abdullatif A. Al-Omair, Saudi Aramco
Abdullah Al-Mulhim, Weatherford

Invited Speaker
Ashraf Tahini, Saudi Aramco

An Experimental and Numerical Investigation of Water-Oil Flow in Vugular Porous Media
Fabrice Pairoys, Schlumberger Carbonate Research Center, Saudi Arabia

The Role of New Technologies in Gas Well Performance Enhancement
Hamza M. Al-Jamaan, Saudi Aramco

Effective Bridging
Hossam S. Ibrahim, Baker Hughes

Sunday, December 19, 2010 Time: 1000 - 1130 Room: King Fahd Convention Hall (Bldg. # 60)

Panel Discussion 1: "Academia and the Petroleum Industry: Working Together to Supply Future Workforce"

Panel Moderator: Dr. Abdul-Aziz M. Al-Shaibani, KFUPM

Panelists: Khalid Mubarak Al-Buhairan, Saudi Arabian Chevron
Dr. Sidqi BuKhamseen, KFUPM
Ken Delve, PetroSkills
Salam P. Salamy, Saudi Aramco

This panel will address the needed collaboration and alignments between academia and industry to retain, attract and prepare a competent E&P workforce for the future. The panel will also discuss best and future needed practices (such as but not limited to knowledge sharing, networking, communication, teaching & learning techniques), and other skills or considerations needed for human resources developments.

Panelists, Panel 1

Dr. Sidqi A. Abu-Khamsin is a Professor at the Department of Petroleum Engineering at King Fahd University of Petroleum& Minerals (KFUPM). He holds B.S. (1975) and M.S. (1977) degrees in Chemical Engineering, both from KFUPM, and a Ph.D. degree (1984) in Petroleum Engineering from Stanford University. He has been a faculty member with KFUPM since 1984, and has served as department head from Jan. 2004 to Sept. 2010. Dr. Abu-Khamsin's main research interest is EOR processes of heavy oils and tars, particularly thermal process. Over the past 10 years, he has conducted research on displacement of Saudi Arabian tars using cold and hot-water flooding, solvent injection and in-situ combustion. He has also collaborated on developing a technique for sand control based on low-temperature oxidation for which the team received a US patent. A recent area of interest is reaction kinetics of oilfield scaling. Dr. Abu-Khamsin serves on the International Advisory Board to Saudi Aramco's EXPEC Advanced Research Center, and is a member of SPE and AICHE.

An international human resources manager, with more than twenty years of experience, Mr. Khalid Al-Buhairan heads up the Human Resource function for Saudi Arabian Chevron, a wholly owned subsidiary of Chevron. His experience covers the entire human resource function, with an emphasis on education, training and development, total remuneration and international human resources. He is an active member of the Society of Human Resource Management, American Society of Training & Development, Worldatwork and Arabian Society for Human Resource Management. Khalid is a graduate of the University of Southern California with a bachelor of science in Public Administration. He enjoys reading, traveling and sports, especially soccer and tennis.

Salam P. Salamy is a Petroleum Engineering Consultant for Saudi Aramco with over 25 years of industry experience. He is currently heading the Exploration & Producing (E&P) Upstream Professional Development Center which is responsible for the training and development of Saudi Aramco E&P professional employees. Salam joined Saudi Aramco in 1996 as an Engineer in the Reservoir Management Department on the Shaybah Field Project. Prior to his current assignment he has held the position of Assistant to Vice President, Petroleum Engineering & Development, and has held several Reservoir Management supervisory positions. Prior to joining Saudi Aramco, he worked with the US Department of Energy; BDM International-Oil and Gas Division, and the US National Institute of Petroleum Energy Research (NIPER). Salam's 25 years of experience is primarily in the area of horizontal well technology and he is the author and co-author of over 25 technical publications. Salam participated in the 2004-2005 Society for Petroleum Engineering (SPE) Distinguished Lecturer program and has been a Keynote Speaker at several SPE Forums and Workshops. He has also received the 2009 SPE Distinguished Member Award and the 2006 Middle East Region Service Award, and served as 2003-2004 SPE Saudi Arabia Section Chairman. Salam holds Bachelor (1982) and Masters (1985) degrees in Petroleum and Natural Gas Engineering from West Virginia University, Morgantown, WV, USA.

Ken Delve is Director, PetroSkills (Middle East). Prior to joining PetroSkills 3 years ago, he fulfilled roles as Principal Consultant and Chief Instructor with an international training Company, a Director of Aviation and Strategic Development with a leading specialist publisher, and as an RAF Officer. He is also an established author (35 books and numerous articles) and lecturer. He has extensive training experience in the development and implementation of the Systems Approach to Training (SAT) from Analysis and determination of competency frameworks, to the design of training courses and validation of training. As Global Manager of PetroSkills Competency Management solutions, he was involved in the implementation of the PetroSkills Alliance Competency Maps and Profiles. He is Course Director (and instructor) for the PetroSkills 'Improving Communications Quality' course.

Sunday, December 19, 2010 **Time: 1300 - 1445** **Room: Hall 104 – Bldg. # 60**

Session 10: Reservoir Characterization -2

Session Chairpersons: Husam Al-Mustafa, Saudi Aramco
SanLinn Kaka, KFUPM

OGEP 2010-137	Static Corrections Using Manual/Double Cooling and Simulated Annealing *Turki Al-Rowaili, Saudi Aramco*
OGEP 2010-062	Delineating Deep Basement Discontinuities of Qarun Lake Area, Egypt *Ahmad S. Helaly, Ain Shams University, Ahmed A. El-Khafeef, and Shokry A.Soliman, Egyptian Petroleum Research Institute (EPRI), Egypt*
OGEP 2010-171	Producing Oil From a Reservoir Seal Interval: Ratawi Shale Sandstones Case Study, South Umm Gudair, Partitioned Zone, Saudi Arabia and Kuwait *Cristina Masarik, Saudi Arabia Chevron, Houston, Saleh Al-Gamdi, and Ken Kelsch, Joint Operations, (JO), Partitioned Zone*
OGEP 2010-018	Integration of Production and Image Logging in Horizontal Wells for Accurate Evaluation and Well Performance *Leak-Wah Ong, A. R. Al-Belowi, Razally M. Ali, Saudi Aramco, Arash Soleimani, Shauket Malik, Adnan Basyouni, and Murat Zaybek, Schlumberger*
OGEP 2010-175	Saturation Determination by 2 and 4 Electrode Methods during Laboratory Resistivity Measurements *Austin O. Ajufo, Umar D. Tayibu, Reynaldo B. Nunez and Bartholomew U. Abu, Gabas Omni Petroleum Services, Saudi Arabia*

Alternate

OGEP 2010-185	Saudi Arabian Chronolithostratigraphic and LithostratigraphicColumns *Abdulaziz A. Laboun, King Saud University, Saudi Arabia*
OGEP 2010-196	Petroleum Potential of the Cretaceous Sequence of the Jezaqamar Basin, Southern Dhofar, Sultanate of Oman *Osman Salad Hersi, Abdulrahman Al-Harthi, Iftikhar A. Abbasi, Abdulrazak Al-Sayigh, and Ali Al-Lazki, Dept. of Earth Sciences, Sultan Qaboos University, Muscat, Oman*

Sunday, December 19, 2010 **Time: 1300 - 1445** **Room: Hall 105 – Bldg. # 60**

Session 11: Production Optimization -1

Session Chairpersons: Saad Al-Driweesh, Saudi Aramco
Stephen Murphy, Weatherford

Invited Speaker **Production Optimization Technologies: Achieving & Sustaining Maximum Performance**
Mohammed I. Al-Sowayigh, Saudi Aramco

OGEP 2010-082	Production Optimization using Smart Completion Technology – A Case Study *Keshabananda Baruah, Hussain A Quwaisim, and Nashi M. Al-Otaibi, Saudi Aramco*
OGEP 2010-080	Developing a Thermodynamic Model for Estimating CO2 Solubility in Crude Oil *Mahmood Moshfeghian, Kindra Snow-McGregor, and Mark E. Bothamley, John M. Campbell & Company, USA*

OGEP 2010-081	Batch Treatments with a New Water-Based Corrosion Inhibitor to Protect Oil and Gas Wells *Sunder Ramachandran, Vladimir Jovancicevic, Carlos Menendez, and Jeff Long, Baker Hughes, USA*

Alternate

OGEP 2010-086	Hydrodynamic Scaling of Cyclonic Separators *Mohamed N. Noui-Mehidi and Ahmed Y. Bukhamseen, Saudi Aramco*
OGEP 2010-016	Successful Water Shut-off in an Open-Hole Horizontal Well in Wafra-Ratawi Field PZ Using Combined Application of Mechanical and Chemical Isolation Technologies with Fiber Optic Coiled Tubing *Bagio Utomo, Mosad Al-Harbi, Saudi Arabian Chevron, Shehabuddin Razzak, Kuwait Gulf Oil Company, Shafik Elbalasy, OSSCo., Saad Hamid, Tarek Shaheen, Adnan Ghani and Pimteera Boonjai, Schlumberger*

Sunday, December 19, 2010 **Time: 1300 - 1445** **Room: Hall 106 – Bldg. # 60**

Session 12: Reservoir Simulation & Modeling -1

Session Chairpersons: Hussain A. Al-Faddagh, Saudi Aramco
Dr. Hasan Al-Yousef, KFUPM

Invited Speaker **Reservoir Simulation: The Next Challenges**
David Rowan, Schlumberger

OGEP 2010-149	Uncertainty Quantification and Pressure Maintenance Optimization of the Carbonate Humma Marrat Reservoir *Nikola Maricic, Yan Chen, and Stephen Johnson, Chevron*
OGEP 2010-070	Simulation and Optimization of Complex Architecture Wells with Smart Completions *Jamil Al-Thuwaini, Shamsuddin H. Shenawi, and Bevan B. Yuen, Saudi Aramco*
OGEP 2010-129	Innovative Simulation History Matching Approach Enabling Better Historical Performance Match and Embracing Uncertainty in Predictive Forecasting *Emad Elrafie, Mohammed Agil, Tariq Abbas, Boy Idroos, Saudi Aramco, and François-Michel Colomar, Beicip-Franlab*

Alternate

OGEP 2010-155	A Study of Coupling Surface Network to Reservoir Simulation Model in a Large Middle East Field *Saad M. Al-Mutairi, Ehtesham M. Hayder, Alberto R. Munoz, Ahmad T. Al-Shammari, and Nayif A. Al-Jama, Saudi Aramco*
OGEP 2010-076	The Real Challenges in Reservoir Simulation *M. Enamul Hossain, King Fahd University of Petroleum & Minerals, Saudi Arabia*

Sunday, December 19, 2010 Time: 1500 - 1700 Room: King Fahd Convention Hall (Bldg. # 60)

Panel Discussion 2: "Partnering Technologies for a Better Tomorrow: Academic and Industrial Prospective"

Panel Moderator: Dr. Panos Kelamis, Saudi Aramco

Panelists: Tareq Al-Khalifah, KACST
Khaled M. Nouh, Middle East President, Baker Hughes
Zara Khatib, Technology Marketing Manager for Shell
Samer S. Al-Ashgar, Saudi Aramco
Medhat Kamal, Chevron Energy Technology Company, California

This panel will explore how academia and the industry can team up in technology partnering to address specific technical challenges. Academia plays a fundamental role in how basic sciences can be exploited to develop new concepts and describe how certain methods/algorithms would work to overcome a technical challenge. Examples of successful technology partnership between different organizations will be discussed. Collaborate to innovate is a key driver and represents critical alignment between the industry and academia. The panel will examine collaboration models for the benefits of involved organizations. Oil and Gas industry Challenges are increasing with greater complexity requiring closer collaboration and creativity to ensure the development of viable solutions. Ideas exploring future collaboration models will be discussed in this panel.

Monday, December 20, 2010 Time: 0800 - 0945 Room: Hall 104 – Bldg. # 60

Session 13: Extended Reach, Horizontal & Multilateral

Session Chairpersons: Dr. Abdullah Al-Sultan, KFUPM
David Maggs, Schlumberger

Invited Speaker Reservoir Access – Advances in Drilling and Evaluation Technology Increase Production Capacity and Recoverable Reserves Potential
Hans-Christian Freitag, Baker Hughes

OGEP 2010-008	Smart Combination of Technology Tools for Rigless Intervention on a Tri-Lateral Well, Case History *Ahmed Al-Zain, Abdulwafi Al-Gamber, and Rifat Said, Saudi Aramco*
OGEP 2010-011	Wireline Well Tractor Technology Experience in Extended Reach Horizontal Well *Alaa S. Shawly, Muhammad H. Buali, Mohammed R. Omran, Alaa A. Dashash , Walid K. Guraini and Ahmad A. Nawawi, Saudi Aramco; Haider Al-Khamees and Nassar Al Awami, Welltec; Juan Torne, Halliburton*
OGEP 2010-163	Successful Acid Treatment in a Thin Formation and Short Radius Well with Severe Dog Leg- A Case Study *Ahmed Mahsoon, AbdulAziz Al-Ruwaily, and Rifat Said, Saudi Aramco*

Alternate

OGEP 2010-109	Maximizing Coiled Tubing Reach during Logging Extended Horizontal Wells Using E-line Agitator *Muhammad H. Al-Buali, Alaa A. Dashash, Alaa S. Shawly, Walid K. Al-Guraini, Saad M. Al-Driweesh, Saudi Aramco, Vsevolod Bugrov, Schlumberger, Scott Nicoll, NOV Andergauge*

Panelists, Panel 2

Tariq A. Alkhalifah is Professor of Geophysics in the division of Physical Sciences and Engineering at KAUST. Prior to joining KAUST, Tariq was Research Professor and Director of the Oil and Gas Research Institute at King Abdulaziz City for Science & Technology (KACST).He has previously held the positions of Associate Research Professor, Assistant Research Professor and Research Assistant at KACST. From 1996 to 1998, Tariq served as a Postdoctoral Researcher for the Stanford Exploration Project at Stanford University, USA. He received the J. Clarence Karcher Award from the Society of Exploration Geophysicists (SEG) in 1998 and the Conrad Schlumberger Award from EAGE in 2003. Tariq received his doctoral degree in Geophysics (1996) and master's degree in Geophysics (1993), both from the Colorado School of Mines, USA. He holds a bachelor's degree in Geophysics from King Fahd University of Petroleum and Minerals (1988), Saudi Arabia.

Dr. Zara Khatib, PhD in Chemical Engineering, has 29 years of broad Oil and Gas experience from 1980 to date, supported by a strong technical & operational knowledge and demonstrated by a successful track record in trouble-shooting and delivering solutions for operations in upstream and downstream businesses of Shell and in technology development, deployment & commercialization in several engineering disciplines including Reservoir, Production, Surface Facilities, Gas Processing and Separation and Environmental. Dr. Khatib joined Shell in 1984 following a two-year assignment as a lecturer at the Chemical Engineering Department, University of Houston and post-doctoral assignment at Imperial College London.In 2005, Dr. Khatib became the manager for Technology Marketing and Deployment for Middle East and North Africa Region. In 2010 Dr. Khatib ia assigned as the Chief Technologist developing the strategy and implantation plans for the New Gas Research Centre at the Petroleum Institute Abu Dhabi. She is recognized as a technical expert in Gas Processing and Treatment, Water Injection, Reservoir Souring and Integrated Water Management in the Oil & Gas Industry. She has over 100 technical papers and presentations. In 1991, she was awarded by SPE the "Best Paper of Year Award for Production Technology" and in 1998 and in 2009 was selected to be a Distinguished Lecturer for Society of Petroleum Engineers. In 2005, she was selected to be the only Oil & Gas industry member of the United Nation Expert Group on Climate Change. Has over 100 Shell and external journal publications and delivered many keynote presentations at global regional forums. Currently she participates on several international committees such as the G8-CCS committee, World Energy Council-Clean Fossil Fuel Systems, and International Sigma XI Committee. She also chaired several Society of Petroleum Engineers' Technical and Educational committees on major regional conferences such as GEO, IPTC, MEOS and ADIPEC in addition to many SPE applied technology workshops. In addition, she participates on the R&D expert panel of the Emirates Foundation Science Committee and reviewed and rated several research project proposals.

Samer AlAshgar is the Manager of Saudi Aramco's upstream oil and gas "EXPEC Advance Research Center" responsible for directing six technology divisions that seek to develop technologies relevant to oil and gas exploration, development and production. Mr. AlAshgar has broad oil and gas experience spanning from facility operations to both production and reservoir engineering. Before joining the EXPEC ARC, he was the head of the Oil and Gas Production Planning Division within Saudi Aramco responsible for managing the long-term development strategy of the company's oil and gas reserves. He joined Saudi Aramco after obtaining his BS in Chemical Engineering from the University of Tulsa. He holds a Masters Degree in Petroleum Engineering from Stanford University and an MBA from MIT.

Medhat (Med) M. Kamal is a Senior Research Consultant and leader of the Dynamic Reservoir Characterization group with Chevron Energy Technology Company in San Ramon, California. Kamal has more than 35 years of industry experience in well testing, reservoir description, and production and reservoir engineering. He is the author of multiple technical articles in SPE journals and has served as a Technical Editor, Review Chairman and Executive Editor of SPE Reservoir Engineering and Evaluation. Kamal is the editor and lead author of SPE Monograph 23 Transient Well Testing. He is a past SPE Distinguished Lecturer and winner of many society awards, including the Cedric K. Ferguson Medal, the SPE Distinguished Service Award, and the Texas Petroleum Engineer of the Year Award. He has served on and chaired multiple SPE committees, including the Text Book and Monograph Committees, the first SPE Board Committee on R&D and the first SPE R&D conference. He has also served on SPE International Board of Directors as the Regional Director of the Western North America Region. Kamal holds a BS degree from Cairo U. and MS and PhD degrees from Stanford U. all in petroleum engineering.

Khalid M. Nouh currently holds the position of President of Baker Hughes Incorporated for the Middle East region based in Dubai U.A.E.A position he assumed in September 1st 2009. In his capacity, Mr. Nouh is in charge of landing the newly formed ONE-BHI geomarkets reorganization in the Middle East region through strong development of fit for purpose sales approach with strong focus on building customer's intimacy. Reporting to Mr. Nouh are four Geomarket VPs located in UAE, Egypt, Saudi and Iraq all managing Baker Hughes business through the 11 countries of the Middle East region (Saudi, Kuwait, Iraq, Bahrain, Qatar, UAE, Yemen, Oman, Pakistan, Syria and Egypt). Prior to his current position and before joining Baker Hughes, Mr. Nouh was the VP Schlumberger-IPM, in charge of developing Production & Drilling risk sharing projects in the Middle East. A role he assumed in May 2008. Prior to his IPM role, Mr. Nouh served as the VP & General Manager of Schlumberger's Oilfield Services covering Saudi, Bahrain, Kuwait and Pakistan,a role he assumed in May 2004 managing quadruple growth figures while maintaining outstanding business profitability. In a series of earlier assignments starting 2003,Mr. Nouh was assigned as VP & General Manager of Schlumberger Oilfield Services in Libya based in Tripoli, prior to that in 2002 Mr. Nouh was Director of Recruiting, Training and Development of Schlumberger worldwide based in Schlumberger HQ in Paris. In 2000 he was assigned as the regional Vice President of Schlumberger Wireline for Middle East and Asia Pacific based in Dubai. In January 1998 he worked in Houston TX in charge of new technology development for Wireline Open-Hole technologies specifically HPHT applications. Mr. Nouh began his international career in 1994 as wireline Field Engineer in Doha, then moved to Syria as the Shell (AFPC) lead engineer followed by another assignment during 1996/97 in Cairo, Egypt as field operations manager. Mr. Nouh started his career in 1989 working in his home country for Saudi Aramco, he spent a period of 5 years in several positions with different business units starting in Berri Gas Plant and moved to Ras Tanura Refinery,NA contracting department, OSPAS… etc. Mr. Nouh was born and raised in Riyadh – Saudi Arabia, he earned a degree in Mechanical Engineering from King Saud University in 1989. He is an active member of the Society of Petroleum Engineering and the affiliate of the American Association of Energy Economists in Dubai - UAE.

Monday, December 20, 2010 **Time: 0800 - 0945** **Room: Hall 105 – Bldg. # 60**

Session 14: IOR/EOR

Session Chairpersons: Dr. Abdulrahman Alquraishi, KACST
Adeeb Al-Khunaizi, MOPM

Invited Speaker **Enhanced Oil Recovery - Promise and Failures**
Dr. S.M. Farouk Ali, President of Heavy Oil Recovery Technologies in Alberta, Canada

OGEP 2010-144	Heavy Oil Development by EOR Steamflood Application *Fahad Al-Otaibi, Ministry of Petroleum & Minerals, Saudi Arabia*
OGEP 2010-077	Steam Solvent Co-Injection for Heavy Oil Recovery *Myeong Noh, Saudi Arabian Chevron, R. Jha, and M. Kumar, Chevron Energy Technology Company, Kuwait*
OGEP 2010-145	Purification Effect on Oil/Water Interface *Ahmed Gmira, Schlumberger/SDCR, Saudi Arabia*

Alternate

OGEP 2010-116	Selection of Efficient EOR Method Based on Eclipse Simulation *M. M. Amro, TU Bergakademie Freiberg, M. S. Benzagouta, King Saud University, Steffen Schmitz, DPI-Gas Technology- Freiberg- Germany, and Malik Chahboun, TU Bergakademie Freiberg, Germany*
OGEP 2010-147	Molecular Dynamics Simulation of Surfactant Flooding *Mikhail Stukan, Schlumberger Dhahran Carbonate Research, and Edo Boek, Schlumberger Cambridge Research*

Monday, December 20, 2010 **Time: 0800 - 0945** **Room: Hall 106 – Bldg. # 60**

Session 15: Reservoir Engineering & Management -2

Session Chairpersons: Dr. Musaed Al-Awad, King Saud University
Dr. Dhafeer Al-Shahri, Saudi Aramco

OGEP 2010-132	Lessons Learned From Production Logging in the Maastrichtian Reservoir, Wafra Field, Partitioned Zone *James Turner, David Reddie, Gamal Remila, Steve Palar, Afzal Iqbal, and Ayed Al-Shammari, Saudi Arabian Chevron, Kuwait*
OGEP 2010-189	Exploitation of Saudi Deep Gas Reservoirs with Horizontal Well Technology *Mahbub Ahmed, Hamoud Al-Anazi, Adnan Al-Kanaan, Dwi Waspada, and Ali Habbtar, Saudi Aramco*
OGEP 2010-046	Tracking Fluid Movement in the Reservoir Using 4-D Borehole Gravity Inversion Method *Khaled Hadj-Sassi, Mohammed Badri, and Jean-Marc Donadille, Schlumberger Dhahran Carbonate Research, Saudi Arabia*

OGEP 2010-103	Reservoir Characterization and Well Evaluation during Pre-Injection in a Clastic Field, Saudi Arabia *Zulkiflie Abdullah, Saudi Aramco*

Alternate

OGEP 2010-179	Recent Applications and Learning's from Advanced Geosteering Techniques in Thin Carbonate Reservoirs *Ali Al-Julaih, Maher Al-Mashadi, Troy Thompson, and Majid Al-Otaibi, Saudi Aramco*
OGEP 2010-039	Assisted Decline Curve Analysis within an Integration Reservoir Management Portal *Ahmed Al-Nuaim, Saudi Aramco*

Monday, December 20 2010 Time: 0800 - 0945 Room: King Fahd Convention Hall (Bldg. # 60)

Session 16: Integrated Technologies & Case Studies

Session Chairpersons: Noel Ginest, Saudi Aramco
Mohammad Makkawi, KFUPM

Invited Speaker **Kidan Sour Gas Part I: The 3D Seismic Story**
Geoff Pike, South Rub Al-Khali Co. Ltd.

OGEP 2010-178	Effective Development of Thin Oil Zones with Complex Carbonate Geology *D.B. Fischbuch, O.A. Taibah and T.M. Al-Zahrani, Saudi Aramco*
OGEP 2010-005	Downhole Wet Connect Tools Enables Integration of Intelligent Completions with ESPs *Ahmed Sunbul, Cosmas Nwachukwu, Khaled Kilany, Khalid Mohanna, Saudi Aramco, Suresh Jacob, and Savio Saldhana, WD Halliburton*
OGEP 2010-154	DownHole Data Transmission & Tools Manipulation via Telemetry System in Exploratory well (Worldwide First Time Implementation): A Successful Case Study *Rashid Hamad Al-Obaid, Abdalhakim Amer Al-Nahdi, Saudi Aramco, and Fuad Mabrooky, Schlumberger*

Alternate

OGEP 2010-067	A Long Term Injectivity Test Aims To Unlock Higher Reservoir Potential in Field Characterized By a Tar Mat Zone *James Arukhe, Mubarak Dhufairi, Saleh Al Ghamdi, and Badr Harbi, Saudi Aramco*
OGEP 2010-033	Towards Green Computing Using Diskless High Performance Clusters *K. Salah, KFUPM, R. AlShaikh, and M. Sindi, Saudi Aramco*

Monday, December 20, 2010 Time: 1000 - 1115 Room: Hall 104 – Bldg. # 60

Session 17: Drilling Technology -2

Session Chairpersons: Ali Al-Hajji, Saudi Aramco
Cliff Kirby, Baker Hughes

OGEP 2010-190	Surfactant Nanotechnology Offers New Method for Removing Oil-Based Mud Residue to Achieve Fast, Effective Wellbore Cleaning and Remediation *Ryan van Zanten and Dodie Ezzat, Halliburton*

OGEP 2010-173	Evaluation of Drilling Designs for Smart MRC Wells Applied in Saudi Aramco *K. M. Al-Amri, Saudi Aramco, A. A. Al-Majed, M. A. Doklah, and M. A. Al-Marhoun, King Fahd University of Petroleum and Minerals, Saudi Arabia*
OGEP 2010-020	Cement Slurry Analysis System *Ali K. Al-Awami, Scott S. Jennings, and Mohammad S. Nefai, Saudi Aramco*

Alternate

OGEP 2010-025	Real Time Diagnostic Tool *Ammar Fakhruddin, Saudi Aramco*
OGEP 2010-191	Improving the Kinetic Stability of Emulsions *Ryan van Zanten and Kingsley Nzeadibe, Halliburton*

Monday, December 20, 2010 **Time: 1000 - 1115** **Room: Hall 105 – Bldg. # 60**

Session 18: Completion Technology -2

Session Chairpersons: Duke Giusti, Halliburton
Tushar Mukherjee, Saudi Aramco

OGEP 2010-148	Design Methodology for Nozzle Based Inflow Control Devices (ICD) *Mahmoud Abd El Fattah, Varma Gottumukkala, and Oloruntoba Ogunsanwo, Schlumberger*
OGEP 2010-104	Successful Flow Profiling and Acid Stimulation Using Distributed Temperature System (DTS) In First Smart Water Injector in Saudi Arabia *Naji K. Al-Salman, Abdulhadi A. AL-Ghafly, Kady, Alaa A, and Yousef A. Al-Rufaie, Saudi Aramco*
OGEP 2010-095	Experimental Evaluation of Matrix Damage and Permeability Alteration associated with the Injection of Simulated Produced Brine through Fractured and Non-fractured Rock *Emad S. Alhomadhi, King Saud University, Omar A. Almisned, King Abdulaziz City for Science and Technology, and James M. Somerville, Heriot-Watt University*

Alternate

OGEP 2010-158	Real-Time Reservoir Monitoring Needs: A Need for Well Completion Longevity and Total Management *Abdullah Al Qahtani, Saudi Aramco*
OGEP 2010-089	Successful Isolation of a Water Contribution Zone Using Fiber Optic Telemetry Enabled Coiled Tubing Conveyed Inflatable Packer Capped with Cement (Case Study) *Alaa Shawly, Saudi Aramco*

Monday, December 20, 2010 **Time: 1000 - 1115** **Room: Hall 106 – Bldg. # 60**

Session 19: Reservoir Characterization -3

Session Chairpersons: Jim Turner, Chevron
Abdulaziz Al-Aslani, Saudi Aramco

OGEP 2010-100	Reservoirs Heterogeneity Characterization of the Shajara Member: Permo-Carboniferous Unayzah Formation *K. E. Al-Khidir, A. A. Al-Laboun, A. A. AlQuraishi, and M. S. Benzagouta, King Saud University, Saudi Arabia*
OGEP 2010-084	A Holistic Approach to Tight Reservoir Fracture Characterization – A Case Study *Ahmed Alhuthali, Danang Widjaja, Stig Lyngra, and Rodolfo Phillips Guerrero, Saudi Aramco*
OGEP 2010-028	Evaluating Amount and Form of Anhydrite Distribution and Compartmentalization in a Complex Carbonate Reservoir *Afzal Iqbal, Saudi Arabian Chevron, Bingjian Li, Schlumberger Vietnam, and Mansoor A. Rampurawala, Schlumberger Kuwait*

Alternate

OGEP 2010-006	Late Carboniferous Through Early Triassic Sediments of India And the Arabian Peninsula: Role of Palynology in Exploration of Coal and Hydrocarbons *Arun Kumar, King Fahd University of Petroleum and Minerals, Saudi Arabia*
OGEP 2010-060	A Comparison Between Porosity Derived From Seismic Reflection Data and That Computed From Well Log Data, Al Amal Field, Gulf of Suez, Egypt *Salah Shebl Azzam, Egyptian Petroleum Research Institute, Egypt*

Monday, December 20, 2010 Time: 1000 - 1115 Room: King Fahd Convention Hall (Bldg. # 60)

Session 20: Information Management & Real Time

Session Chairpersons: Sami A. Al-Neaim, Saudi Aramco
Moamen Hassan, Baker Hughes

OGEP 2010-128	Overview of Saudi Aramco's Intelligent Field Program *Abdulaziz AbdulKarim, Tofig AL-Dhubaib, Emad Elrafie, and Mohammad O. Alamoudi, Saudi Aramco*
OGEP 2010-043	How Small is "Small Data"? *Fatai Anifowose and Abdulazeez Abdulraheem, King Fahd University of Petroleum and Minerals, Saudi Arabia*
OGEP 2010-094	Case Study: Summarization of Real-Time Data to Produce A Valid Representative Well Rate Test *Mohammed Al-Omran, Saudi Aramco*

Alternate

OGEP 2010-142	Real-Time Oracle Inventory Model, KPI & Applications *Farooq A. Khan, Saudi Aramco*
OGEP 2010-041	E&P Data Life Cycle Management *Jawad M. Al-Khalaf, Saudi Aramco*
OGEP 2010-197	Risk Management and Real-Time Monitoring in Offshore Oil and Gas Exploration and Development *Tahir Husain, Faculty of Engineering and Applied Science, Memorial University of Newfoundland St. John's, Canada*

Monday, December 20, 2010 **Time: 1300 - 1445** **Room: Hall 104 – Bldg. # 60**

Session 21: Production Optimization -2

Session Chairpersons: Faisal T. Al-Khelaiwi, Saudi Aramco
Dr. M. Dokla, KFUPM

OGEP 2010-105	First World Wide Cameron's Silencer Choke Valve Manufactured for Saudi Aramco *Abdulhadi A. AL-Ghafly, Naji K. Al-Salman, and Yousef A. Al-Rufaie, Saudi Aramco*
OGEP 2010-112	Laboratory Investigation on the Effect of High Pressure, Temperature and salinity on Surfactant Properties *Wimpy Karnanda, M.S. Benzagouta, KSU, M. Amro, and A. A. AlQuraishi, KACST, Saudi Arabia*
OGEP 2010-140	Near Real-Time Smart Well Control Optimization through Model Predictive Control *Ahmed Bukhamsin, Saudi Aramco*
OGEP 2010-069	Chemical Engineering Application for Wash Water Optimization *Fahad A. Al-Amri, Saudi Aramco*

Alternate

OGEP 2010-073	Demulsifier Optimization Using Advanced Controller (ADC) *Bandar J. Al-Qahtani, Saudi Aramco*
OGEP 2010-048	Automated Superheat Control System for Gas Transmission *Hani H. Al-Khalifa, Saudi Aramco*

Monday, December 20, 2010 **Time: 1300 - 1445** **Room: Hall 105 – Bldg. # 60**

Session 22: Formation Evaluation -2

Session Chairpersons: Dr. Hasan Al-Hashim, KFUPM
Dave Clark, Baker Hughes

OGEP 2010-180	Expanding the Role of Resistivity Image Logs Using Improved Acquisition and Interpretation Techniques *Robert Kuchinski and Paul Kalathingal, Weatherford International*
OGEP 2010-125	Rigorous Estimation of Original In-Situ Fluid Composition from Disturbed Two-Phase Fluid Samples *Masanori Kurihara, Yukihiro Matsumoto, Hisanao Ouchi, Koya Akamine, and Nobuyuki Samizo, Japan Oil Engineering Co., Ltd.*
OGEP 2010-140	Near Real-Time Smart Well Control Optimization through Model Predictive Control *Ahmed Bukhamsin, Saudi Aramco*
OGEP 2010-032	Analyzing Data from Multi-Laterals: An Innovative Approach *Faisal M. Al-Thawad, Saudi Aramco*

Alternate

OGEP 2010-161	Uncertainly Analysis of Archie's Parameters Determination Techniques in Carbonate Reservoirs *G.M. Hamada, The British University in Egypt, A.A. AlMajed, KFUPM, M. Okasha, Saudi Aramco, and A. A. AlGathe, Hadhrmout University-Yemen*

OGEP 2010-053	Determination Some of Reservoir Characteristics of Bahariya Formation in Bed-1 Field, Western Desert, Egypt, By Using the Repeat Formation Tester *Tarek F. Shazly, Egyptian Petroleum Research Institute, and A. Z. Nooh, British University in Egypt*

Monday, December 20, 2010 **Time: 1300 - 1445** **Room: Hall 106 – Bldg. # 60**

Session 23: Reservoir Simulation & Modeling -2

Session Chairpersons: Eduardo Pacheco, Halliburton
Derick Zurcher, Baker Hughes

OGEP 2010-049	Perspectives on Geostatistics, Reservoir Modeling, Heterogeneity, and Uncertainty *W. Scott Meddaugh, Chevron, Houston, USA*
OGEP 2010-130	Natural Fracture Detection, Characterization and Modeling Using the Event Solution Synergy Approach *Abdullatif Al-Omair, Emad Elrafie, François, and Mohammed Agil, Saudi Aramco*
OGEP 2010-002	Application of Artificial Neural Network for Reservoir Characterization, Case Study form Oil Field in South Algeria *M. Sitouah, G. Korvin, A. Al-Shuhail, O. Abdulatif, A. Abulraheem, A. Zerguine, King Fahd University of Petroleum & Minerals, Saudi Arabia*
OGEP 2010-003	Reservoir Simulation in Real Time Domain Shamsuddin Shenawi, Bevan Yuen, Tony Pham and Gonzalo Hernandez, and Hussain Al-Faddagh, Saudi Aramco

Alternate

OGEP 2010-061	Secondary Gascap Blowdown Modeling with A New Three-Phase Oil Relative Permeability Model Tuned By Experimental Data *Saad A. Al-Garni, Bevan Yuen, Nazih F. Najjar, Stig Lyngra, and Methgal A. Al-Shammari / Saudi Aramco*
OGEP 2010-026	An Integrated Asset Modeling Workflow for Oil and Water Disposal Optimization M. Ehtesham Hayder, Alberto Munoz and Omar Obathani, Saudi Aramco

Monday, December 20, 2010 **Time: 1430 - 1600** **Room: King Fahd Convention Hall (Bldg. # 60)**

Panel Discussion 3: "Economic Exploration, Exploitation, and Development of Tight Gas"

Panel Moderator: H.E. Yahya Jamil Shinawi, Director General - MinPet

Panelists: Thomas Mueller, Shell
Johan Daal, Halliburton
Chris Hopkins, Vice President Shale Gas Business line, Schlumberger
Jay Cupples, Piceance Basin Program Manager, Chevron
Ismail M. Buhidma, Saudi Aramco

This panel will explore the opportunities to overcome challenges facing tight and shale gas reservoirs. Some of these include addressing exploration plays, drilling, formation evaluation, fracturing and completion issues and best practices, new technologies to better estimate porosity and permeability of these reservoirs, capillary forces and flow mechanism issues. Technology gap identification and understanding of the productivity potential of these reservoirs will be discussed in this panel.

Panelists, Panel 3

Thomas Mueller has been Hydrocarbon Maturation Manager for unconventional resources in Shell Upstream International Exploration in The Hague/Netherlands since 2009. Before joining Shell Exploration in 2006 as a global HCM consultant he worked in Bapetco (Egypt), a Joint Venture Company between Shell and the Egyptian General Petroleum Corporation, as chief RE and asset development leader. Thomas has more than 20 years oil industry experience with Shell mostly in the development of tight gas reservoirs but he also held positions in new business development, economics, integrated field studies and resource reporting. His main technical expertise is in the maturation and development of tight and unconventional gas reservoirs. Thomas joined Shell in 1990 following several years of research in Enhanced Oil Recovery at the Technical University of Clausthal in Germany and a two-year post-doc period at The University of Texas in Austin. In 1989, he was awarded the 'Georg-Huneaus-Prize' of the German Society of Petroleum Sciences and Coal Chemistry for his contribution to EOR research. He holds a Master degree in Geophysics and a PhD in Petroleum Engineering both from the Technical University of Clausthal in Germany.

Alejandro Salguero is currently working in Dubai as a technical advisor for the Halliburton Global Technical Solutions Team. He started his career as a well test engineer in 1995 as a Well Testing Engineer and transitioned to a wide range of operational roles in well testing. He has extensive experience with the planning and design, execution and coordination of well testing operations, as well as post-job analysis and reservoir evaluation. In his most recent position Alejandro was the Operations Engineer for Completion Tools in Brazil, where he also managed IOC projects in Brazil, Venezuela, Bolivia, Trinidad and Tobago. He has since moved to Carrollton, Texas to take the position of Reservoir Global advisor for the department of Reservoir Information. Alejandro Salguero earned a BS degree in Petroleum Engineering from the Universidad Mayor de San Andres in Bolivia, South America.

Chris Hopkins, recently appointed Vice President of Unconventional Resources for Schlumberger, is responsible for the R&D strategy, operational support, and marketing of Schlumberger services for shale gas, coalbed methane, and tight gas. From 2005 until just prior to his current assignment, Hopkins was president of Schlumberger Data & Consulting Services where he guided this division through a period of significant growth and managed the integration of several key acquisitions. He joined Schlumberger in 1999 following the Schlumberger acquisition of S.A. Holditch & Associates. Hopkins has 25 years of petroleum engineering experience, including drilling and production assignments with Chevron and numerous managerial positions with Schlumberger in Operations and R&D. In addition, while with S.A. Holditch and Associates, Hopkins was a primary investigator for the GRI Devonian Shale's research project. Hopkins earned M.S. and B.S. degrees with honors in petroleum engineering from Texas A&M University and West Virginia University. An Elected Distinguished Member of SPE since 2003, he chaired the SPE Learning Innovation Task Force and served on the Well Completions Committee.

Jay Cupples is currently the Piceance Basin Program Manager in Chevron's Mid-Continent Alaska Business Unit. He received a bachelor's degree in chemical engineering from the University of Missouri in 1982. He joined Chevron later that year as a production engineer, and has held numerous engineering and management positions in the United States working South and East Texas, onshore Louisiana, and the Gulf of Mexico prior to working the Piceance Basin in Western Colorado.

Ismail M. Buhidma, a senior petroleum consultant with Saudi Aramco and the Team Leader for Aramco's Tight Gas Technical Assessment Team, has 30 years of experience in the petroleum industry covering all aspects of petroleum engineering. He has been with Aramco for the last twelve years where he is involved in non-associated gas development. Before that, he worked with Qatar General Petroleum, Atlantic Richfield (ARCO), Flopetrol and Esso Libya. His areas of interest are gas reservoir management, reservoir characterization, pressure transient testing and reservoir simulation. He holds a BS and MS degrees in Petroleum Engineering from Tulsa University. He has served on SPE editorial committee and participated in several SPE forms and Workshops.

OGEP 2010-047	Training Applications in Upstream Industry *Mustafa Shuala, Saudi Aramco*
OGEP 2010-108	Permeability Distributions in Sarah Formation from Subsurface Rub Al-Khali, Saudi Arabia *Ali Sahin, M. Abdallah, Center for Petroleum and Minerals, Research Institute of KFUPM, S. Zhang, S. Q. Li, and A. Sakloua, Sino-Saudi Gas Limited, Dhahran, Saudi Arabia*
OGEP 2010-007	Data Reliability Assessment Using Local Incoherent *Saleh Al-Dossary and Abdulaziz AlSharikh, Saudi Aramco*
OGEP 2010-176	Sandstone Reservoir Porosity-Permeability Prediction from Petrographic Data using Artificial Neural Network, A Case Study from Wajid Sandstone, Saudi Arabia *Osman Abdullatif and Mohamed Sitouah, KFUPM, Saudi Arabia*

OGEP 2010-057	Saudi Arabian Chevron Occupational Hygiene Process *Mohammad Al-Aradi, Saudi Arabian Chevron, Kuwait*
OGEP 2010-034	In-Situ Determination of Remaining Oil Saturation and Sweep in a Carbonate Reservoir with Varying Salinities *Abdi Majdpour, D. Krinis, N. Dawood, Leak Wah Ong, Saudi Aramco*
OGEP 2010-162	Effective Water Management Practices Yield A Substantial Reduction In Water Production In Mature Area Of A Large Carbonate Reservoir: Case Study *Raied A. Al-Khuzayem and Jaime Rodriguez, Saudi Aramco*
OGEP 2010-059	The Land-Streamer Acquisition System to Map the Sand Dune Base *Hashim Almalki, King Abdulaziz City for Science and Technology, Saudi Arabia*
OGEP 2010-121	Smart Depletion in Tight Gas Reservoirs- A Rock Mechanics View *Hazim Abass, Saudi Aramco*
OGEP 2010-013	Fracture Mapping by Diffraction Imaging *Constantine Tsingas, Saudi Aramco*
OGEP 2010-072	Quick Energy Audit in Southern Area Producing GOSPs *Bandar J. Al-Qahtani, Saudi Aramco*
OGEP 2010-106	Integration of Multifunctional Systems to Reduce Rigless Costly PWIs Wellhead Replacement Job Executions *Hassan I. Al-Tammar, Saudi Aramco*
OGEP 2010-192	New Filtration Control Polymer for Improved Brine-based Reservoir Drilling Fluids Performance at Temperatures in Excess of 400°F and High Pressure *R.G. Ezell, A.M. Ezzat, J.K. Turner, Halliburton, and J.J. Wu, Champion Technologies*
OGEP 2010-017	The Recycling of Waste Vegetable Oil for Biodegradable and Environment Friendly OBM Formulation *Md. Amanullah, Saudi Aramco*
OGEP 2010-138	Productivity Index Enhancement of Stimulated Gas Wells through Hydraulic Fracturing *Hazim Nayel Dmour, King Saud University, Saudi Arabia*
OGEP 2010-119	Numerical Simulation of Dissolution Patterns During Matrix Acidization of Vugular Carbonate Cores *Anes Yahaya Usman, KFUPM, Frank F. Chang, Schlumberger Carbonate Research Center, Mahmoud El-Awady Doklah, and Abdulaziz Al-Majed, KFUPM, Saudi Arabia*
OGEP 2010-099	Improving Permeability Models in a Deep Saudi Arabian Gas Reservoir Through Better Measurement Accuracy *David Forsyth, Saudi Aramco*
OGEP 2010-096	Permeability Restoration of Saudi Arabia Rocks *Osama Ahmed Lotfy Kamal Al-Mahdy, King Saud University, Saudi Arabia*
OGEP 2010-175	Saturation Determination by 2 and 4 Electrode Methods during Laboratory Resistivity Measurements *Austin O. Ajufo, Umar D. Tayibu, Reynaldo B. Nunez and Bartholomew U. Abu, Gabas Omni Petroleum Services, Saudi Arabia*
OGEP 2010-185	Saudi Arabian Chronolithostratigraphic and Lithostratigraphic Columns *Abdulaziz A. Laboun, King Saud University, Saudi Arabia*
OGEP 2010-087	An Interactive System For Seismic Data Visualization In 3D *Sajjad Ali, Tariq Alkhalifah, Mohammad Zakariah, and Hashim Almalki, King Abdulaziz City for Science and Technology, Saudi Arabia*
OGEP 2010-196	Petroleum Potential of the Cretaceous Sequence of the Jezaqamar Basin, Southern Dhofar, Sultanate of Oman

	Osman Salad Hersi, Abdulrahman Al-Harthi, Iftikhar A. Abbasi, Abdulrazak Al-Sayigh, and Ali Al-Lazki, Dept. of Earth Sciences, Sultan Qaboos University, Muscat, Oman
OGEP 2010-086	Hydrodynamic Scaling of Cyclonic Separators *Mohamed N. Noui-Mehidi and Ahmed Y. Bukhamseen, Saudi Aramco*
OGEP 2010-016	Successful Water Shut-off in an Open-Hole Horizontal Well in Wafra-Ratawi Field PZ Using Combined Application of Mechanical and Chemical Isolation Technologies with Fiber Optic Coiled Tubing *Bagio Utomo, Mosad Al-Harbi, Saudi Arabian Chevron, Shehabuddin Razzak, Kuwait Gulf Oil Company, Shafik Elbalasy, OSSCo., Saad Hamid, Tarek Shaheen, Adnan Ghani and Pimteera Boonjai, Schlumberger*
OGEP 2010-098	Elemental Sulfur Risks and Facilities Development Approach for Sour, Lean Gas Fields *Mofeed Al-Awwami, Ivan C Cruz, and Reegina Zainal, Saudi Aramco*
OGEP 2010-155	A Study of Coupling Surface Network to Reservoir Simulation Model in a Large Middle East Field *Saad M. Al-Mutairi, Ehtesham M. Hayder, Alberto R. Munoz, Ahmad T. Al-Shammari, and Nayif A. Al-Jama, Saudi Aramco*
OGEP 2010-076	The Real Challenges in Reservoir Simulation *M. Enamul Hossain, King Fahd University of Petroleum & Minerals, Saudi Arabia*
OGEP 2010-044	Single Porosity Simulation of Fractures with Low to Medium Fracture-to-Matrix Permeability Contrast *Rida Abdel-Ghani, Saudi Aramco*
OGEP 2010-109	Maximizing Coiled Tubing Reach during Logging Extended Horizontal Wells Using E-line Agitator *Muhammad H. Al-Buali, Alaa A. Dashash, Alaa S. Shawly, Walid K. Al-Guraini, Saad M. Al-Driweesh, Saudi Aramco, Vsevolod Bugrov, Schlumberger, Scott Nicoll, NOV Andergauge*
OGEP 2010-116	Selection of Efficient EOR Method Based on Eclipse Simulation *M. M. Amro, TU Bergakademie Freiberg, M. S. Benzagouta, King Saud University, Steffen Schmitz, DPI-Gas Technology- Freiberg- Germany, and Malik Chahboun, TU Bergakademie Freiberg, Germany*
OGEP 2010-147	Molecular Dynamics Simulation of Surfactant Flooding *Mikhail Stukan, Schlumberger Dhahran Carbonate Research, and Edo Boek, Schlumberger Cambridge Research*
OGEP 2010-179	Recent Applications and Learning's from Advanced Geosteering Techniques in Thin Carbonate Reservoirs *Ali Al-Julaih, Maher Al-Mashadi, Troy Thompson, and Majid Al-Otaibi, Saudi Aramco*
OGEP 2010-039	Assisted Decline Curve Analysis within an Integration Reservoir Management Portal *Ahmed Al-Nuaim, Saudi Aramco*
OGEP 2010-038	Integrated Reservoir Management Portal *Mutlaq Al-Subaie, Saudi Aramco*
OGEP 2010-067	A Long Term Injectivity Test Aims To Unlock Higher Reservoir Potential in Field Characterized By a Tar Mat Zone *James Arukhe, Mubarak Dhufairi, Saleh Al Ghamdi, and Badr Harbi, Saudi Aramco*
OGEP 2010-033	Towards Green Computing Using Diskless High Performance Clusters *K. Salah, KFUPM, R. AlShaikh, and M. Sindi, Saudi Aramco*
OGEP 2010-025	Real Time Diagnostic Tool *Ammar Fakhruddin, Saudi Aramco*

OGEP 2010-191	Improving the Kinetic Stability of Emulsions *Ryan van Zanten and Kingsley Nzeadibe, Halliburton*
OGEP 2010-158	Real-Time Reservoir Monitoring Needs: A Need for Well Completion Longevity and Total Management *Abdullah Al Qahtani, Saudi Aramco*
OGEP 2010-089	Successful Isolation of a Water Contribution Zone Using Fiber Optic Telemetry Enabled Coiled Tubing Conveyed Inflatable Packer Capped with Cement (Case Study) *Alaa Shawly, Saudi Aramco*
OGEP 2010-006	Late Carboniferous Through Early Triassic Sediments of India And the Arabian Peninsula: Role of Palynology in Exploration of Coal and Hydrocarbons *Arun Kumar, King Fahd University of Petroleum and Minerals, Saudi Arabia*
OGEP 2010-060	A Comparison Between Porosity Derived From Seismic Reflection Data and That Computed From Well Log Data, Al Amal Field, Gulf of Suez, Egypt *Salah Shebl Azzam, Egyptian Petroleum Research Institute, Egypt*
OGEP 2010-029	Gas Detection by Spectral Decomposition Using Matching Pursuit *Ahmed M. Almarzoug, Saudi Aramco*
OGEP 2010-142	Real-Time Oracle Inventory Model, KPI & Applications *Farooq A. Khan, Saudi Aramco*
OGEP 2010-041	E&P Data Life Cycle Management *Jawad M. Al-Khalaf, Saudi Aramco*
OGEP 2010-051	Real Time Data Summarization and Validation *Abdulsatar Ahmed Al-Shaikh, Saudi Aramco*
OGEP 2010-197	Risk Management and Real-Time Monitoring in Offshore Oil and Gas Exploration and Development *Tahir Husain, Faculty of Engineering and Applied Science, Memorial University of Newfoundland St. John's, Canada*
OGEP 2010-073	Demulsifier Optimization Using Advanced Controller (ADC) *Bandar J. Al-Qahtani, Saudi Aramco*
OGEP 2010-048	Automated Superheat Control System for Gas Transmission *Hani H. Al-Khalifa, Saudi Aramco*
OGEP 2010-124	Well W-30: The Use Of SCADA For Production Optimization *Ayed Mohammed Al-Shammari, Abdullah Al-Kandari, Chet Babin and Steve Palar, Saudi Arabian Chevron*
OGEP 2010-161	Uncertainly Analysis of Archie's Parameters Determination Techniques in Carbonate Reservoirs *G.M. Hamada, The British University in Egypt, A.A. AlMajed, KFUPM, M. Okasha, Saudi Aramco, and A. A. AlGathe, Hadhrmout University-Yemen*
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OGEP 2010-026	An Integrated Asset Modeling Workflow for Oil and Water Disposal Optimization *M. Ehtesham Hayder, Alberto Munoz and Omar Obathani, Saudi Aramco*

The Technologist Development Program: Saudi Aramco's Strategy to Prepare Today's Professionals for Tomorrow's Challenges

By Hussein Al-Ali and David G. Kersey, Saudi Aramco.

One of Saudi Aramco's strategic objectives is to prepare the workforce to meet evolving technical challenges in Petroleum Engineering (PE). To address this important objective, the Petroleum Engineering Technologist Development Program (TDP) was established to provide the opportunity for young engineers to become recognized experts in critical technical disciplines. The TDP provides organizational support for the participants to progress in professional and managerial careers to ultimately fulfill Saudi Aramco's business needs.

The program is overseen by management and technical advisory committees. New candidates are selected based on competency, years of experience, outstanding performance and strong personal skills. In addition, they must have demonstrated technical ability, resourcefulness, and dedication to address emerging technical and operational challenges. The technical advisory committee will assist in selecting an area of specialty based on Company requirements, candidates' interests and expertise. Also, they will nominate a mentor (subject matter expert) to guide and manage development of technical and soft skills.

Each participant has a competency development road map based on a plan to develop required technical and soft skills. The participants must complete all required tasks and develop expertise in his area of specialty. In addition, the candidates are trained during rotational development assignments and, in many cases, they enroll in an advanced degree program. They need to meet specific TDP graduation requirements including publication in technical journals and active participation in international technical meetings and forums. In addition, to graduate from the TDP, a candidate is must demonstrate to the technical review committee that he has achieved technical expertise in his chosen specialty.

Saudi Aramco designed the TDP to ensure young engineers have the opportunity to become technical experts in critical specialties. The program has successfully met its goals as evidenced by the number of successful graduates

Almost every major oil and gas company faces a looming loss of well trained, experienced and technically skilled personnel over the next few decades, mostly due to retirement[1]. In many companies, the large number of people nearing retirement is a result of successful hiring campaigns in the early 1980s when oil prices were high. The near-term retirement of this generation of technical experts makes it imperative to develop programs to transfer knowledge from experienced engineers to the new work force. Saudi Aramco has developed a number of programs to ensure knowledge transfer and has taken clear measures to develop training programs focusing on career development.

This paper highlights Saudi Aramco's success story in developing and training qualified Petroleum Engineering (PE) technical specialists. The overall strategy involves technical training in the company's Upstream Professional Development Center (UPDC). The Center provides an outcome based, business driven curriculum for all upstream E&P employees. The curriculum provides immersive, intensive and integrated training from the time of employment to retirement. PE selects high performing engineers from this curriculum for entry into the Petroleum Engineering Technologist Development Program (TDP). The TDP builds on the UPDC program as it is a proactive response to changing business needs in PE. It is a mentoring program that links mature, technical specialists with young professionals. It is a key part of PE's training strategy and is designed to achieve the following:

• Accelerate the development of young professionals. Close the knowledge gap between generations. Utilize the UPDC's "best in class" courses to transfer local knowledge from mature experts to the younger generation.Use focused work assignments to develop technical expertise.Develop the company's future technical and management leaders.

The focus of this paper is on how the TDP is structured to add value to the development of technical expertise in PE and how the TDP is part of the best practices implemented by the PE organization. A highly trained work force is required to address a number of issues including maturing reservoirs, increased reservoir complexity, new operating environments and real-time data. Training the work force to effectively develop and use technology to solve these technical issues is the focus of the TDP. The need to transfer knowledge to the new generation is especially critical as the technical challenges will only increase with time.

Many companies, including Saudi Aramco, have changed their requirements for employee competence to meet these challenges[2]. Companies require high levels of capability in creativity, innovation and networking to address new challenges. These skills are very difficult to find and develop and the TDP was designed to be a platform to develop technical expertise in critical business areas through a structured development specialty program.

The PE TDP was created in late 1998 with the objectives to provide the opportunity for young Saudi qualified engineers and scientists to become recognized technologists within their chosen field. The importance of effectively using technology in PE prompted the need to expedite developing the critical technical skills necessary to provide a sustainable source of expertise. In addition to filling critical engineering requirements, this program also provides a vehicle for Saudi engineers to progress in their careers upwards on the technical or professional ladder.

Technologists are expected to be recognized experts in their field of specialty and are required to solve complex issues. In terms of education and experience, a technologist should have a technical degree in his or her field of expertise (sometimes a post-graduate degree is required) and over five to eight years of practical experience (dependent upon his/her graduation degree). The TDP has no fixed duration, but candidates graduate as soon as they meet the technical objective of their respective programs. They must have demonstrated technical ability, resourcefulness, and dedication to address future technical and operational challenges. In addition, they will be the company source of technical expertise that will help in adapting the worldwide state-of-the-art technology for Saudi Aramco's operations. They are often known in the oil industry through their participation in regional and international professional societies.

Program Committees

The development program is overseen by two committees: The Steering Committee and the Technical Review Committee (TRC).

1. Steering Committee

The Steering Committee consists of all PE department managers and is chaired by the Chief Petroleum Engineer. The committee oversees the direction of the TDP and provides guidance to the TDP TRC. The committee has the following responsibilities:

• Approve TDP areas of specialty.
• Set guidelines for candidate selection and graduation.
• Approve the admittance of the TDP candidates and TDP mentors.
• Review PE TDP candidates' activities and achievements.
• Recognize candidates/mentors for their outstanding achievements.

2. Technical Review Committee

The Technical Review Committee consists of senior PE professional staffs from all the departments in PE. Members are nominated by PE management and the committee is chaired by a senior technical professional. The committee has the following responsibilities:

• Recommend admission to the program.
• Review development programs and ensure company objectives.
• Monitor participant's progress.
• Support mentors with "Best Practices."
• Recommend graduation from program.
• Identify new areas of specialties.
• Enhance program performance.

Program Management and Oversight

1. Candidate Selection

A TDP candidate is first nominated by his Supervisor, Division Head, and Department Manager. The application is reviewed by the TRC and approved by the Steering Committee.

Candidate Qualifications
Applicants should have work experience in the main PE disciplines of Drilling & Workover, Production, Reservoir, Facilities Engineering, and Formation Evaluation. The candidate must have shown high performance work ethics and exhibit leadership, initiative and soft skills. The following work experience is also required from each candidate, depending on the level of higher education:

• B.S. Degree holders: Minimum of 5 years of work experience after B.S. degree.
• M.S. Degree holders: Minimum of 3 years of work experience after M.S. Degree.
• Ph.D. Degree holders: Minimum of 2 years of post Ph.D. experience.

2. Mentors: Selection and Roles and Responsibilities
One of the most important steps in the TDP is the selection of a mentor. Each TDP participant is assigned a mentor who is recognized both as an expert in his/her area of expertise and for his/her ability to facilitate the technical development of the mentee. Mentors are nominated by his division, reviewed by his department, and approved by the PE TDP Steering Committee.

Mentor Qualifications
Mentors should have the following qualifications:

• Senior Saudi Aramco professional staff with more than 20 years of relevant industry experience.
• Demonstrate strong technical knowledge through meetings and publications.
• Have a special interest in training young Saudi engineers and possess strong interpersonal skills.

Roles and Responsibilities
A mentor's role is to guide the professional development of the TDP mentee. Key specific responsibilities include:

• Guides the mentee in the preparation of a 4–6 year development program. Takes genuine interest in his mentee's development.
• Prepares and updates individual development plans (IDPs) and ensures the IDP fully defines the technical objectives envisioned for the TDP, aligns assignments (courses, work programs, etc.) with the objectives and evaluates each completed assignment to be sure the TPD accomplished the technical objectives.
• Reviews monthly reports from the mentee.
• Keeps mentee's division head informed about progress.
• Reviews and revises development plan based on progress and need.
• Makes recommendation to PE TDP Steering Committee regarding changes to the development plan.
• Oversees design of the mentee's graduation project and guides him throughout the project.

3. Candidate Roles and Responsibilities
The candidate must actively consult with his mentor during the entire program. Following are some specific areas of interaction:

• Works with Mentor to select a technical area of specialization and to develop an IDP.
• Prepares objective and expectations for each IDP assignment.
• Liaises with the Mentor to discuss IDP assignments, objectives and expectations with the hosting department and obtain an agreement to ensure the development goals can be achieved.
• Prepares monthly and annual progress reports.
• Participates in professional societies activities.
• Meets all TDP objectives through technical and focused work assignments.
• Makes annual presentations to the PE TDP Steering Committee to document TDP progress.

Graduation Criteria
The mentee must demonstrate that they have fulfilled all the technical objectives outlined in his/her TDP program.

In addition, the mentee is required to:

• Publish in a technical journal a minimum of two papers (as lead author) in the area of his/her specialty.
• Publish a minimum of three company technical reports on best practices.
• Lead a multidisciplinary team.
• Write a report documenting a major study undertaken by the Mentee to summarize achievements and work done in the program.
• Present the TDP accomplishments to the TDP Technical and Steering Committees.

4. Tracking Procedures and Accountability
After the IDP has been accepted, progress in the TDP is monitored through:

• Mentor and TRC analysis of development road maps, which present a timetable to achieve the TDP objectives.
• Annual progress review meetings.
• Semi-annual progress review reports.

Program Performance

The TDP is a task driven development program designed to ensure the program meets both business and technical objectives. Graduates of the program have been assigned to key technical and high management positions and are recognized as "Champion Performers" in potential/performance matrixes.

The TDP has been an excellent mechanism to aid career path planning of high performing PE staff. PE has benefited from the experience gained by the mentees as they address business needs by developing expertise in critical areas. The TDP has also met a corporate goal of knowledge transfer between senior staff and TDP mentees. This transfer has ensured lessons learned and best practices are retained for present and future use in PE.

The TDP is part of Saudi Aramco's strategy of preparing the work force for the future. It offers young professionals the opportunity to work closely with company specialists to develop expertise in technical areas with high business value. The program is structured to offer both managerial and technical oversight. This oversight ensures the areas of specialty are aligned with PE objectives and the make certain the TDP Mentees have the technical resources and guidance necessary to become recognized technical experts.

The program is integrated with other company training programs to accelerate the development of young professionals through mentoring, class instruction, focused work assignments and independent project work. The TDP has and will continue to prepare Saudi Aramco's work force for the future.

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Bridging the Gap between the Oil & Gas Industry and Academia

By Abdelaziz Khalifat and Hani Qutob, Weatherford Oil Tool Middle East Ltd., Dubai, UAE.

Academics and Industrialists have a different mindset; they are living in different worlds and pursuing different goals. The Academic is striving for creating new solutions with a high innovation rate, scientific achievements and recognition from peers with a long range perception. The Industrialist thinks in terms of short range goals, prefers proven solutions with a low risk and is mainly concerned with costs, profits and economic survival. In view of that, the deficiency of properly skilled labor across the oil and gas industry is emerging as a significant and complex challenge to Middle Eastern countries' development and future. Regardless of the large number of universities technical graduates and post-graduates added to the workforce, only small percentage of them are considered employable by the rapidly growing industry. Hence, the growing gap between academia and industry is reflected on slight availability of high-quality college/university graduates demanded by the industry. This problem can be overcome by having industry-academia interactions which will help to impart relevant knowledge and will be sustainable in the changing conditions.

Academic institutions place great importance to closer interaction with industry and research and development organizations. Some interaction has been witnessed, in the developed countries, between large public and private sector enterprises and academic institutes at the level of industry involvement in technology development. Still, industry support to basic research is almost non-existent in developing countries. Academic institutions laboratories utilization by industry for developmental purposes and for product testing has seen some success. With the establishment of in-house research centers by different industries such labs' utilization is on a gradual decrease.

Effective collaboration between the Oil and Gas industry and universities will be critical to the industry economic recovery and sustainable international competitiveness. Business must also make a sustained effort in supporting higher education by providing the support needed to help students build the employability and technical skills that are so important. This paper suggests a number of key issues to achieve successful cooperation between industry and academia. The areas in which interaction is possible include industry support to basic research for knowledge creation, industry participation in technology development involving some exploratory work, academic intervention in solving industry problems, laboratory utilization by industry, faculty members' sabbatical leave and industry involvement in curriculum development. Also, the paper proposes that the Oil and Gas industry should work with universities to:

- Sponsor students studying subjects relevant to business, such as science and technology.
- Offer more opportunities for internships, placements, work experience or projects.
- View working with universities as part of core innovation activity.
- Integrate an academic research group and an industrial development team to generate useful research results and solutions.

The joint research venture can be successful only by proper project preparation and implementation that are the main focus of this manuscript. Some cases of cooperation between academia and industry will be discussed including the cooperation of the Well Engineering Center of Excellence at Weatherford and different academic institutions in the region.

The reduction of universities' revenues and rising costs for campuses are driven by different factors: the soaring expense of need-based scholarships; declining financial support from governments preoccupied with other budget problems; the massive spending needed to bring/keep libraries, classrooms, and laboratories up to date in our information technology age; the pressures of maintenance and repair costs; and the price of star faculty members (in addition to the regular salaries of tenured professors, regardless of their performance). Then there is a competition for students from for-profit universities, providers of on-line education, and corporations' own training programs. To overcome financial problems universities have no other choice but to commit themselves much more seriously than they have done so far to begin a process of redesigning/reinventing themselves.

The universities can reinvent themselves through three different approaches: First, universities have to identify their basic missions and deemphasize activities not essential to those missions so that they can focus on their strengths; Second, universities have to pare down their internal bureaucracies, which will result in the reduction of the number of layers within their institutions. They can hire outside companies to provide services that they don't need to control directly, such as payroll, record keeping, data processing, legal services, maintenance services, transportation and security, among many others. Universities also have to increase financial incentives for excellence by rewarding employees who meet specific goals; Third, universities have to form alliances with each other and have to have an effective cooperation with industry to share expertise, cut costs, reduce risk. Research alliances with industry are particularly productive because they enable involved parties to combine disparate skills and share the ultimate rewards.

In recent years the discussion about whether the universities can encompass a third mission of economic development, in addition to research and teaching, has received more and more attention (Etzkowitz and Leydesdorff, 2000; Leydesdorffand Meyer, 2003; Mansfield and Lee, 1996; Khlaifat et al, 2006). The third mission cannot generate technological spillover without university-industry research cooperation (Martin and Scott, 2000; Siegel and Zervos, 2002).

University researchers choose to interact with industry for a diverse set of reasons (D'Este et al. 2005; Howell et al. 1998; Kurfess and Nagura, 1997; Meyer and Shmock, 1998, Khlaifat et. Al, 2006): industry provides a new source of revenue for university; industrially sponsored research provide faculty members and students with exposure to real world research problems and a chance to work on intellectually challenging research programs; industrial funding provides less "red tape" than government money; and, some government funds are available for applied research, based upon a joint effort between university and industry. On the other hand, several other reasons that motivate the industry to cooperate with universities have been identified by (Hill and Brash, 2004; Kurfess and Nagura, 1997) as: access to manpower, including well-trained graduate and knowledgeable faculty members; access to basic and applied research results from which new products and processes may evolve; solutions to specific problems by professional expertise not available elsewhere; access to university facilities; conducting continuing education and training; and, obtaining prestige or enhancing the company's image and reputation.

The paper is addressing different issues related to narrowing the gap between academia and industry and its impact on economic development worldwide. Part of the manuscript is devoted to the case of Jordan, where authors elaborate on the status of academia-industry relations and cooperation. Bridging the gap between oil and gas industry and academia in developing world is discussed. Some cases of cooperation between academia and industry will be presented including the cooperation of the Well Engineering Center of Excellence at Weatherford and different academic institutions in the region.

While it can be argued that cooperation between industry and academia would benefit both parties, such ventures have not always gone well, and are burdened by differences of pace, regulations and work environment. There must be a third party that gets involved into the cooperation business where the ventures objective is enhancing the country's economic development. Thus, the government-industry-university relations can be represented the best by a triangle that serves as the basis for any country's economic development strategy. The country's economic development must strategically position itself at the center of the triangle and the triangle metaphor implies that there are close linkages between the three sectors and that these connections are instrumental for the country's economic development.

Development of Academia-Business collaboration is normally faced with the cultural differences between academic institutions and business firms. These differences are mainly due to their different missions. Before going into any venture, the two parties have to discuss and make clear issues related to funding, conflict of interest, talking the same language and creators or users of technology. If addressed properly, these cultural differences results in narrowing the gap between academia and industry noticeably.

Extensive efforts have been made during the last two decades to boost universities-industry collaboration in Jordan. Many consider the major responsibility lies on the academic side, while few others think it is in the industry side. The authors believe that it is a combination of several factors within the two sides. One of the authors has faced this situation for the last two decades. Tackling the issues related to: industrial in-house research and development program, used imported technology, industrial employees interests, academic research versus teaching, whether collaboration is still a public relation issue, helps defining and characterizing the problems

that enlarges the gap between academic institutions and industry in Jordan.

It must be admitted that oil and gas industry cannot survive in the prevailing competitive environment without appreciating the need for research and development. This need may not be completely met by the in-house R&D. Universities and research institution, by definition of their missions, have the proper resources, expertise and attitude for carrying out such activities. Such a demand-availability relationship should encourage business-academia collaborations to narrow the gap.

Although academia-industry collaboration in applied R&D is growing slowly, industry support to basic research is still far from being satisfactory. Industrial financial support can be boosted by continuing education programs and the development of active cooperative research programs. These two programs can succeed only if their terms of reference are SMART (Simple terms and conditions understandable to both parties; Measurable outcomes; Applicable outcomes; Reliable research results; Time bond project duration) and carried out by a proper joint research project preparation and implementation.

Before initiating a joint research project between a university and an industrial entity, each party must believe that its partner is willing to work jointly on a ground of mutual trust. This may be achieved by emphasizing the need to discuss openly two critical issues: 1) recognition of industry and academia needs and 2) project duration. In order to accomplish the objectives stated earlier, the development of a partnership between academia and industry will enable them to participate through one or more of the following modes: working together; exchange of research staff; conduction workshops and conferences; supervising undergraduate/graduate students; and becoming tenants in technology incubator/science parks.

There is no way to narrow the gap and have a long-term relationship between industry and academia if they do not learn from their past experiences and share different behaviors such as decision making, open communication, appreciation of conflicts/differences and focus.

Different examples of Weatherford Tool cooperation with different universities will be presented:

- Teaching "Natural Gas Hydrates" graduate course at Norwegian Institute of Technology (NIT) from 1989 to 1998.

- Research and Development project carried by the best students studying petroleum engineering at Norwegian University of Science and Technology (NUST) as part of their thesis and conducted at ResLab during the last two semesters of their study. The advantage for the students was that they got an office in WFT premises, a top laptop with industry standard software components installed, and many senior WFT experts in the selected thesis topic to guide them in their work. Students worked with real field data and a real problem that gained interest both from the industry (WFT), oil company (Statoil) and academia (NUST). The most important benefit to WFT was that the students could work with software simulations and stay focused an entire year. This resulted in having professional engineers who can run advanced simulations and were acknowledged as simulation experts on a higher level than many seniors in operation companies. Operation companies became very interested to hire these students once they were graduated and entered into a full time position with WFT. That generated a good revenue for WFT and operators hired young experts who could simulate any IOR measure with Eclipse/Petrel/RMS++. This type of cooperation helped student's professor (advisor) to know more about industrial challenges and cope with the way of thinking of petroleum industry personnel. This model of cooperation was so successful for WFT that was implemented with two more universities in Bergen and Stavanger. During the last three years WFT had recruited the best students in each class. Nowadays WFT is well known to petroleum engineering students in Norway and it is considered a highly attractive model of academia-oil industry cooperation. Number of student applications to be approved for such internship this year was very high (about 80% of the class studying petroleum engineering at NUST).

- Bridging the gap from laboratory scale to reservoir scale: Weatherford Petroleum Consultant offers a university course in Norway about up-scaling the laboratory results to reservoir scale using SENDRA software. The first course was very popular among university students, so the course will be given on a regular basis.

- Adding Geomechanics Capability to Petrolog: Adding the "strength modeling" (estimation of rock mechanical properties) capability to Petrolog was defined as a research and development project for a long time, however, involvement of related expert to more commercial projects in addition to lack of enough budget and time caused continuous delays in starting the project. This project was carried out by through cooperation with academia. Several MSc students in Petroleum Engi-

neering major from Heriot-Watt University were interviewed and one of them whose competency matched the project requirements were selected. The student was able to finish the project in two month with very satisfactory results. He developed 62 algorithms which enabled Petrolog to calculate various rock mechanical properties (Dynamic and Static Modulus, Rock Strength, Friction Angle, and Cohesion). There was an extensive quality checks to ensure that the algorithms were consistent with those developed by the various authors. Special care was taken to make sure that the units were consistent with papers reviewed to ensure reliable results. Most of the equations have a set of conditions and geographical regions over which they are most valid which were specified in the algorithms. It is worth mentioning that the student was hired by Weatherford after completing his master degree.

- The collaboration between Weatherford Well engineering Center of Excellence and Heriot-Watt University was extended to other areas of research like tight gas sand, underbalanced drilling and gas condensate reservoirs.

From this paper we conclude that the best answer to the question, "What is the most effective method of cooperation between academia and industry?" is that it depends on the research project goal, graduate student and his/her advisor, industry, and the university. But the next best answer is, "Mutual teaching between academia and industry". Industry and academia are two significantly different environments and must be integrated in a careful manner with sensitivities to the realities of both parties. Once the joint industry-university collaborative research projects ball starts rolling, the mutual interaction will provide too many benefits for both parties that will be reflected on the countrys' industrial development. Success stories of closes cooperation between Oil and Gas Industry and academia resulted in narrowing the gap between the two parties and preparing the students better for the job market.

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Permeability Distributions in Sarah Formation from Subsurface, Rub' Al-Khali Basin, Saudi Arabia

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This paper was prepared for presentation at the 2nd Saudi Meeting on Oil and Natural Gas Exploration and Production Technologies (OGEP 2010) held at the King Fahd University of Petroleum & Minerals (KFUPM) Campus in Dhahran, Kingdom of Saudi Arabia, December 18-20, 2010.

Abstract

Late Ordovician Sarah Formation consists mainly of fine to coarse-grained sandstone sequences of glacial and glacio-fluvial origin. It is considered to be an important reservoir target in the subsurface of Arabia, especially in Rub' Al-Khali Basin. Sarah Formation has been intersected and cored by several vertical wells during the recent gas exploration activities undertaken by the Sino-Saudi Gas Limited in Block-B Area (northern Rub' Al-Khali). Each core has been measured by a profile permeameter to provide continuous permeability measurements. In addition, permeability and porosity measurements have been determined using regular laboratory equipment on plug samples taken every foot. Both profile permeability and plug measurements were available for extensive study of patterns of distributions of permeability values.

This paper presents the statistical distributions of permeability and porosity values representing Sarah cores from two representative vertical wells. The results indicate that both porosity and permeability are characterized with relatively lower values typically observed in tight reservoir rocks. The results further indicate that permeability distributions are highly skewed similar to permeability distributions reported elsewhere. Moreover, the coefficient of variation values for permeability distributions based on both profile permeameter and laboratory measurements are relatively high indicating heterogeneous nature of these distributions. The plots of profile permeability values with depth along wells indicate that it is possible to recognize some relatively high permeability layers which are characterized with considerable fluctuations. These layers appear to be correlated with highly fractured intervals.

Introduction

Sarah Formation consists mainly of fine to coarse-grained sandstone sequences of glacial and glacio-fluvial origin. It is widely distributed in central and northwestern Saudi Arabia (Vaslet, 1989, Mcgillivray and Hussein, 1992; and Clark-Lowes, 2005). Numerous evidences in these areas indicate a precise link between Sarah Formation and the icecap that existed in the Gondwana paleocontinent in Late Ordovician time (McClure, 1978; Vaslet 1990; and Senalp and Al-Laboun, 2000). Sarah Formation has, also, been recorded in the subsurface within the Rub' Al-Khali Basin during the recent drilling operations by the Sino-Saudi Gas Limited (Zhang, et al., 2009) and other joint venture gas exploration companies (Hulver et al., 2009). On the basis of both its lithology and the overlying organic rich shales, Sarah Formation has been considered to have a significant economic potential. Therefore, it has been the main target for tight gas exploration activities undertaken in Rub' Al-Khali Basin during the recent years.

The purpose of this study is to investigate the patterns of permeability distributions within Sarah cores from subsurface in Rub' Al-Khali. It is based on the permeability measurements conducted on two cores (Core-X and Core-Y) from two wells (Well-A and Well-B) drilled by the SSG Limited in the Block-B area in the northern Rub' Al-Khali Basin. Core-X consists mainly of fine to medium-grained, creamy sandstones with relatively uniform lithology, whereas the Core-Y consists mainly of fine to medium-grained sandstones of variable color and lithology

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Both profile permeability and plug permeability measurements from each core were made available for this study. Because of the confidentiality of data, the actual well numbers, core numbers and actual depth values were not reported here. After slabbing cores, the profile permeability measurements were conducted at points along each core using the Pressure-Decay Profile Permeameter (PDPK-400) equipment supplied by the Core Lab. The resulting data included a total of 177 point measurements along the Core-X and 228 measurements along the Core-Y.

After completing profile permeability measurements, the plugs with 1.5 inches by 2.0 inches dimensions were taken along each core at an interval of approximately one foot. Highly fractured and soft intervals were avoided during plugging. The plugging operation resulted in 29 plugs along the Core-X and 25 plugs along the Core-Y. The plug permeability and porosity measurements on each of these plugs were conducted at 500 psi pressure using the standard laboratory equipment supplied by Coretest Systems Inc. (OPP-610), resulting in plug data used in this study.

Discussion

The depth versus profile permeability measurements along Core-X and Core-Y indicated that the majority of points lie within 1.0 and 10.0 mD interval for Core-X and within 0.1 to 1.0 mD interval for Core-Y. Considerable amount of fluctuations is observed in both plots. Several very high measurements with extensive fluctuations represent highly permeable fractured intervals. The plot for Core-Y appears more complex, reflecting relatively variable nature of lithology in this core. It is possible to match the plots with the observed lithologic intervals within cores.

Despite some differences in magnitudes of permeability values representing Core-X and Core-Y, the general statistical patterns revealed by histograms is very similar indicating positively skewed nature of distributions as observed in permeability distributions from other formations (Saner and Sahin, 1999; Sahin and Saner, 2001; Sahin et al., 2007; and Abdulkadir et al., 2010). Most values are clustered near zero and only few values located in the tail. Very similar patterns of distributions are observed for the plug permeability measurements from both cores.

Statistical parameters, including mean, median, standard deviation, coefficient of variation, skewness and kurtosis have been calculated for both profile permeability and plug permeability measurements. Comparison of the parameters indicates that profile permeability means are considerably higher than the corresponding means for plug measurements. This may be explained by the fact that profile permeability measurements cover the entire core possibly including some fractured and poorly consolidated intervals, whereas the plugs have been selected in more consolidated tight intervals.

Although the general patterns of distributions for profile permeability and plug permeability measurements are very similar, the corresponding coefficient of variation value for each core is significantly different, reflecting the lithological differences between cores. As pointed out earlier highly variable character of lithology in Core-Y has resulted in greater standard deviation, and hence greater coefficient of variation for this core. Core-X, on the other hand, is more homogeneous as reflected by the smaller coefficient of variation. These results point to a clear link between lithology and statistical analysis.

Comparing the variability of two types of measurements used in this study, the results show that the profile permeability measurements have much greater variability than the corresponding plug measurements. This is expected as the profile permeability measurements are based on points and plug measurements represent a volume with 1.5 inches by 2.0 inches dimensions. According to the volume-variance relationship, the greater the volume of sample, the smaller the variance, and hence the standard deviation (Journel and Huijbregts, 1978). Therefore, the plug samples with larger volume provide smaller coefficients of variation as observed from both cores in our study. Consequently, it can be stated that it is better to depict various heterogeneities using the profile measurements as the plug measurements tend to smooth out the heterogeneities to a certain degree (Hurst and Rosvoll, 1991).

Statistical parameters for plug porosity measurements revealed considerable differences between mean porosity values of two cores. The mean porosity for Core-X is approximately three times of that of Core-Y. Very similar values of mean and median in both cases indicate the normal nature of porosity distributions. With regard the coefficients of variation for porosity, Core-X revealed relatively smaller value indicating homogeneous nature of porosity distribution in this core. On the other hand, Core-Y shows considerably higher value of coefficient of variation. Such result is consistent with the coefficient of variation value for permeability as reported earlier, and can be considered another statistical indicator of highly variable nature of lithology in this core.

Summary/Conclusion

The main conclusions drawn from this study are summarized as follows:

1. The profile permeability values have consistently higher mean values. This may be explained by the fact that profile permeability measurements cover the entire core possibly including some fractured and poorly consolidated intervals, whereas the plugs represent more consolidated tight intervals.
2. The patterns of statistical distributions for both profile permeability and the corresponding plug permeability values are quite similar. All histograms representing these distributions display dominant positive skew.
3. The coefficient of variation values for both profile permeability and plug permeability values are relatively high indicating very heterogeneous nature of permeability values within the studied cores.
4. The coefficients of variation values for plug permeability measurements are smaller than the corresponding values representing profile permeability measurements. This is explained by the fact that the profile measurements represent only points, whereas the plug measurements are based on relatively greater volume, resulting in some smoothing of heterogeneities.
5. Although the distribution patterns of plug porosity and permeability data are totally different, the conclusions drawn on the basis of coefficient of variation values for porosity are consistent with the corresponding conclusions based on permeability measurements.

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Behavior Based Safety Process at Saudi Arabian Chevron Co.

By Fayez Al-Dhafeeri, Saudi Arabian Chevron, Kuwait..

The main purpose of this paper is to share Saudi Arabian Chevron experience in Recognizing that there is a behavioral component in over 80 percent of accidents, and how Saudi Arabian Chevron Company Behavior-Based Safety (BBS) process aimed at preventing injury to employees and contractors through reinforcement of safe behaviors and reduction of at-risk behaviors in the workplace.

BBS is a process which involves observing yourself and/or others for safe behaviors. This is usually done with a BBS form or checklist which has been prepared with identified critical safe behaviors specific to the operation or location for the personnel doing the observations.

The BBS process provides for both immediate feedback to the person who was observed (both safe behaviors and at risk behaviors are discussed), and the analysis of observations (with no name identified as to who was being observed) as they are collected and aggregated across the group. BBS observations are analyzed and opportunities for reducing risk behaviors are identified and BBS action plans are developed and implemented. Continual improvement in reducing the number of observable at risk behaviors is a goal in BBS, therefore reducing the number of incidents.

The scope of Behavioral based safety process of Saudi Arabian Chevron requires all Chevron employees as well as all contract employees to participate in a BBS process.

This process is designed to encourage cross-observation between Chevron and contractor employees as well as between employees of different contractors while keeping the implementation practical for contractors who work on a site by themselves.

1.0 Overview

Saudi Arabian Chevron Company has established an effective BBS process which is built as organizational framework on consistent plan and implementation.

1.1 Establish Organizational Framework

Saudi Arabian Chevron has established a consistent organizational framework. Developed a procedures details the components of this framework and how they shall be established. This procedure consists of three sections:

- Gain Management Support
- Establish BBS Process Advisor
- Establish Steering Committee

1.2 Plan and Implement the BBS Process

After the organizational framework became in place, the organization began the planning and implementation of the BBS process. A procedure developed details the planning and implementation of the process. This procedure consists of seven sections:

- Identify Critical Behaviors and Develop the Observation Plan
- Conduct the Initial Communication and Train the Workforce
- Conduct Observations and Feedback
- Collect and Analyze Data
- Develop Action Plans
- Communicate Progress and Findings
- Recognize Efforts and Celebrate Results

1.3 Evaluate BBS Process

Saudi Arabian Chevron Company review the existing BBS process by using the Initial Assessment tool. The results of this assessment indicate whether the BBS process meets the process requirements, requires improvements.

1.3.1 Process Performance Index
Utilizing BST as BBS services leading company, process performance also measured using process performance index.

2) Discussion

2.0 Measurement
Saudi Arabian Chevron tracked the following metrics to determine if the BBS process is effective in fulfilling its intended purpose. There are a number of indicators that can be tracked for this process, however for efficiency of reporting, the metrics required to be reported to Chevron are limited to two leading and two lagging measures.

2.1 Leading Measures
The primary objective of the BBS implementation is elimination of employees' at-risk behaviors which requires employees' understanding of what safe behaviors are and continuous reinforcement of the safe behaviors. BBS process experts believe that employees who participate as observers improve their safety behaviors as much as or more than those they observe. Therefore it is important to maximize employee participation in observations and work to make the practice accepted by local cultures.

To measure the extent of both employees' and contractors' participation across Saudi Arabian Chevron Company, the following metric is tracked every month:

• Percentage of workforce participation
(Number of company and contractor employees conducting observations in the month) / (Total number of company and contractor employees in the process implementation scope).

2.1.1 Lagging Measures
To measure an organization's progress toward reinforcement of safe behaviors and elimination of at-risk behaviors leading to prevention of incidents, this process requires monthly reporting of the following lagging metrics:

• Percentage of safe behaviors
• Total recordable incident rate (TRIR)

3) Summary/Conclusion

3.0 Audit of Performance
An audit of process design and implementation effectiveness shall be done using the Chevron Behavior-Based Safety Assessment Tool.

3.1 Continual Improvement
Process gaps, non-conformance, and improvement opportunities identified from the Audit of Performance procedure shall be summarized and used to assist in building Continual Improvement Plans.

4) References

Saudi Arabian Chevron behavior Based Safety Process.

Operational Excellence

By Zamel Al Doussari, Saudi Arabian Chevron, Saudi Arabia.

Abstract

The objective of this abstract is to share with others one of our strategic intents that leads to high performance in the areas of Safety, Health, Environment, Reliability and Efficiency of our business. This strategic intent "Operational Excellence" not only does it support our commitment to protecting our people and the environment, it also makes good business sense. The safe, reliable, efficient and environmentally sound operation is a key factor to the financial success.

Introduction

Operational Excellence (OE) can be defined as "the systematic management of safety, health, environment, reliability and efficiency to achieve world-class performance." OE is how we conduct our business and is an intimate part of our day-to-day activities. All employees and business partners are committed to achieving world-class OE performance.

Implementing the OE Management System will enable us to accomplish strategic business objectives, achieve world-class performance, and deliver sustained value. To better describe "world-class performance", the following OE Objectives have been established. We have to systematically manage OE in order to:

• Achieve an injury-free workplace
• Eliminate spills and environmental incidents. Identify and mitigate key environmental risks
• Promote a healthy workplace and mitigate significant health risks
• Operate incident free with industry-leading asset reliability
• Maximize the efficient use of resources and assets

To achieve and sustain our objectives, we must develop a culture where everyone believes all accidents are preventable and that "zero incidents" is possible. The Tenets of Operation provide a foundation for an Operational Excellence culture. The tenets of operation are based on two key principles:

- Do it safely or not at all

- There is always time to do it right Leadership accountability

Leadership accountability is the largest single factor for success in OE. Leaders establish the vision and set objectives that challenge the organization to achieve world-class results. They direct the Management System Process (MSP), setting priorities and monitoring progress on plans that focus on the highest impact items. Leaders visibly demonstrate their commitment through personal engagement with the work force and showing genuine concern for the health and safety of every individual.

Leaders at every level are also expected to foster a culture grounded in operational excellence. By their actions, leaders must send the message that operational excellence is a priority throughout their organizations. Through personal example, they must demonstrate that zero incidents of any kind - whether related to safety, health, environmental, reliability or efficiency - is attainable.

OE Leadership Team (OELT)

OE Leadership Team Charter is instituted to provide the necessary oversight and communication to assure HSE, Reliability and Efficiency activities and plans are developed, implemented, maintained, and reviewed for continuous improvement.

Management System Process (MSP)

Management System Process (MSP) is a systematic approach used to drive progress toward world class performance. The Management System Process is linked to our business planning process and begins with the defining a vision of success and setting objectives. Gaps

between current performance and these objectives are uncovered during the assessment phase, then plans are developed to close the gaps, the plan is implemented and a review of the plan implementation and performance is completed.

The five steps of the Management System Process:

•Vision and Objectives - including Tenets of Operation
• Assessment - Conduct risk-based gap analysis
• Planning - Develop risk-based action plans and provide resources to close gaps. Serves as linkage between OE and business planning process.
• Implementation - Planned actions are implemented and tracked against established targets.
• Review - Review all OE Management System activities to evaluate performance and make adjustments. Self Assessment

A key step of the MSP is the assessment step, during which a comprehensive evaluation of the OEMS is completed to identify gaps in OE processes and performance against established objectives.

OE Expectations:

OE Expectations are organized under 13 elements and spell out specific requirements for the management of safety, health, environment, reliability and efficiency. The expectations are met through processes and programs put in place by local management. In many cases, a single process may fulfill the intent of one or more expectations. In some cases, one expectation may require several processes to be put in place.

Element 1: Security of Personnel and Assets
Provide a secure environment in which business operations may be successfully conducted.

Element 2: Facilities Design and Construction
Design and construct facilities to prevent injury, illness and incidents and to operate reliably, efficiently and in an environmentally sound manner.

Element 3: Safe Operations
Operate and maintain facilities to prevent injuries, illness and incidents.

Element 4: Management of Change
Manage both permanent and temporary changes to prevent incidents.

Element 5: Reliability and Efficiency
Reliability: Operate and maintain wells and facilities to sustain mechanical integrity and prevent incidents.

Efficiency: Maximize efficiency of operations and conserve natural resources.

Element 6: Third-Party Services
Systematically improve Third-Party Service performance through conformance to Operational Excellence.

Element 7: Environmental Stewardship
Strive to continually improve environmental performance and reduce impacts from our Operations.

Element 8: Product Stewardship
Manage potential health, environmental, safety (HES) and integrity risks of our products throughout a product's life cycle.

Element 9: Incident investigation
Investigate and identify root causes of incidents to reduce or eliminate systemic causes and to prevent future incidents.

Element 10: Community Awareness and Outreach:
Reach out to the community and engage in open dialogue to build trust.

Element 11: Emergency Management
Prevention is the first priority, but be prepared to respond immediately and effectively to all emergencies involving Chevron wholly-owned or operated assets. For company products or interests such as common carriers, chartered vessels and facilities operated by others, be prepared to monitor the response and, if warranted, take appropriate actions.

Element 12: Compliance Assurance
Verify conformance with company policy and government regulations. Ensure that employees and contractors understand their OE-related responsibilities.

Element 13: Legislative and Regulatory Advocacy
Work ethically and constructively to influence proposed laws and regulations, and debate on emerging issues.

Summary/Conclusion

As a business and as a member of the world community, Chevron is committed to creating superior value for our stockholders, customers, partners, employees and the countries in which we operate. To succeed; Safe, reliable, efficient and environmentally sound operations just make good business sense, and we strive to complete every task the right way, every time.

Geological Heterogeneity in Carbonates: Wafra First Eocene Reservoir, Partitioned Zone (PZ), Saudi Arabia and Kuwait – Implications for Steamflooding

By W. Scott Meddaugh, Saudi Arabian Chevron, W. Terry Osterloh, Niall Toomey, Dennis Dull, Chevron Energy Technology Company, Nicole Champenoy, Shamsul Aziz, Saudi Arabian Chevron, and Dana Rowan, Chevron Energy Technology Company, Houston, Texas.

The Paleocene/Eocene age First Eocene dolomite reservoir at Wafra Field in the PNZ (Saudi Arabia and Kuwait) is estimated to hold more than 10 billion barrels of 18-22 °API, high sulfur oil. Current estimates suggest that only 5-10% of the OOIP may be produced during primary development. Consequently, steam flooding is being investigated as an appropriate secondary development option. Critical uncertainties relative to steamflooding include reservoir heterogeneity. The detailed data (log, core plug, and core micropermeameter, and seismic) collected for steamflood pilot projects provides a unique opportunity to assess areal and vertical reservoir heterogeneity in the First Eocene reservoir. Thermal simulation using very fine scaled models (cell sizes as fine as 1.25x1.25 m) has been used to model the impact of reservoir heterogeneity on steam flooding and provide guidance to building coarser scale sector and full field models.

The Paleocene/Eocene age First Eocene dolomite reservoir at Wafra Field in the PNZ (Saudi Arabia and Kuwait) is estimated to hold more than 10 billion barrels of 18-22 °API, high sulfur oil. Current estimates suggest that only 5-10% of the OOIP may be produced during primary development. Consequently, steam flooding is being investigated as an appropriate secondary development option. An initial 1.25-acre, single pattern pilot (SST) and a later, large scale, 40-acre, 16 pattern pilot (LSP; see Al-Yami et al., 2009 for a description of the LSP project and Meddaugh et al., 2007 for a summary of the geological setting) have been developed to examine steamflooding. The detailed data (log, core plug, and core micropermeameter, and seismic) collected for both projects provides a unique opportunity to assess areal and vertical reservoir heterogeneity in the First Eocene reservoir.

Analysis of temperature and petrophysical logs obtained in a temperature observation well located 35 feet from the SST injector have showed that a vertical barrier to steam migration exists approximately 80 feet above the base of the completions in the injector. Two, relatively thick (5-10 feet), very low porosity and very low permeability evaporite-rich zones (mainly coalesced nodular to possibly bedded anhydrite with some gypsum) that were regarded as the most likely barriers prior to the start of steam injection did not act as barriers. Instead, an interval characterized by numerous thin, variously cemented (including celestite and native sulfur cements), exposure surfaces or hardgrounds has provided the vertical barrier. This zone is also characterized by generally low porosity and low permeability as well as very light oil stain. Detailed studies, including micro-permeameter measurements, thin section analysis, quantitative mineralogical studies, micro- and ultra-CT scans of representative samples were used to further characterize the reservoir and the steam barrier interval.

The geological and stratigraphic assessments of heterogeneity are supplemented by a history-matched thermal simulation model that suggests that the evaporite-rich zones may have acted as short term baffles but that the "ultimate" vertical barrier to steam migration is coincident with the interval characterized by the abundant exposure surfaces or hardgrounds. Recent data from the LSP have been incorporated particularly in regard to the "size" and distribution of high permeability "connections" between LSP injectors and producers, particularly those producers that have had a temperature response in a matter of days after start of steam injection.

To maintain the same level of model resolution in the 16-pattern, 40-acre LSP steamflood pilot model, record-sized grids and parallel computation were successfully used. To date, probabilistic LSP forecasts have been developed, but history matching efforts await greater pilot maturity. A suitably complex, high resolution model has been built to investigate some recent and long-

standing questions regarding the influence of several key modeling inputs on steamflood forecasts. The results of these investigations have important influence on the development of full-field Eocene steamflood models, our approach to history matching the LSP, and a possible explanation for the unusually rapid heat migration seen in parts of the LSP.

Investigations focused on the impact of the following input factors on oil and steam production, at both pilot and well levels, using three 5-spot pattern sizes (2.5, 5.0, and 10 acre):

- Semivariogram length (150 and 1500 m)
- Number of control wells (4 or 60)
- Permeability constrained or un-constrained at control wells
- Very-high resolution grid block size (5x5 m or 1.25x1.25 m areal dimension)

To eliminate possible complications due to up-scaling, earth models were used directly for the flow simulations. Specifically, a model (1.8 MM cells) of the EOC_210-400 zones was used because of interest in these zones as possible LSP recompletion and/or full-field targets. To obtain statistically valid response means, 25 geostatistical realizations were run for each investigation scenario, for a total of 350 runs.

Judged at the pilot level (mean of all producers and all 25 runs), neither variation in semivariogram length, pattern size, nor number of control wells caused any statistical difference in mean oil production. At the individual producer level, statistically significant variations in mean oil response were observed for different semivariogram lengths, but the variations were distributed such that when summed, the result of no variation at the pilot level was obtained. With 2.5-acre patterns, the response variation was larger for the shorter semivariogram length cases, but there was no difference in well response variation for 5- or 10-acre pattern cases as a function of semivariogram length.

Analysis of the results described above revealed that there was substantial variation in oil, water, and steam responses at individual producers in runs comprising a set of 25 geostatistical realizations. The variation was so extensive that our ability to match historical production at individual wells from a single model realization will be severely hindered, if not impossible. To determine whether this wide variability was caused by the fact that permeability was distributed in the earth models using a cloud transform, without constraint at wells, an experimental method was used to constrain permeability at wells. Comparison of well responses, from 25-realization sets with and without well permeability constraint, indicated that constraining permeability at the wells substantially reduced response variability. However, because considerable variation still remained, our ability to match individual wells remains uncertain.

The unexpectedly rapid heating of one of the LSP wells to 170°F within 2 weeks observed in the field was not forecast using the LSP model (within 6 weeks), despite using smaller than normal cell sizes. We wondered if the cell size was substantially reduced would the forecast be closer to the observed data. Two sets of 25-realization models were built for a single stratigraphic zone using 5x5 m or 1.25x1.25 m cells. Mean steam breakthrough time was 2.2 times faster with the 1.25 m models. Assuming this speed-up factor applies to the LSP model, forecast steam breakthrough would be around 3 weeks, which is close to the observed 2 weeks. These results indicate that the local, rapid heat migration observed in the field can possibly be explained by the presence of connected high permeability rock, thus not necessarily requiring the presence of fractures or faults.

The results of this study will strongly influence the full field and sector models that will be generated to derive full field forecasts. The results of this study, when viewed at the individual injector-producer scale (large local heterogeneity characteristic of many carbonate reservoirs) rather than the full pilot scale suggests that there may be limited quantitative value to history matching individual wells. At the pilot level, variation in semivariogram length, pattern size, or number of control wells had no significant statistical impact on mean oil production.

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The Shajra Formation: A New Permo-Carboniferous Unit in Saudi Arabia

By Abdulaziz Abdullah Laboun, Geology Department, College of Sciences, King Saud University, Riyadh, Saudi Arabia.

This paper was prepared for presentation at the 2nd Saudi Meeting on Oil and Natural Gas Exploration and Production Technologies (OGEP 2010) held at the King Fahd University of Petroleum & Minerals (KFUPM) Campus in Dhahran, Kingdom of Saudi Arabia, December 18-20, 2010.

Abstract

Spectacular succession of red and white eolian and fluvial sandstones and green, maroon, and gray mudstones are well exposed at the Wadi Ash Shajra at the Qusayba depression in central Arabia. This succession was assigned as a reference section of the Unayzah Formation of Laboun (1986). Detailed surface and subsurface investigation have revealed a transgressive flooding surface representing a sequence boundary within the Unayzah Formation and this succession is below this sequence boundary. The Unayzah Formation was redefined by the author and the term Unayzah was restricted to the shallow marine siliciclastics and minor carbonates and anhydrites section bracketed between sequence boundary and the base of the first well defined limestone bed of the Khuff Formation. The continental sandstone and mudstone facies below the sequence boundary which are best exposed at the Wadi Ash Shajra were excluded from the redefined Unayzah Formation.

It is herein proposed that the term Shajra Formation to be introduced for these continental facies. This formation is named after the Wadi Ash Shajra. It is exposed below the Unayzah Formation in central Arabia and equivalent section were encountered in the subsurface. The Shajra Formation rests unconformably on various older units ranging in age from Devonian to Precambrian. This regional angular unconformity probably time-equivalent to the Hercynian Orogeny.

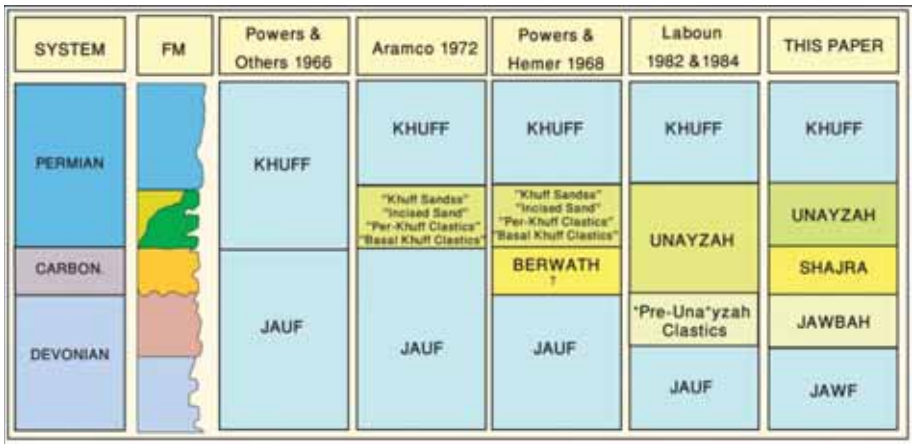

Figure 1: Old and current nomenclature of the Upper Paleozoic succession.

The heterogeneous fluvial, and eolian porous sandstones of the formation host great quantities of oil, condensate, and natural gas in several oil and gas fields in Saudi Arabia. These sandstones with overlying porous sandstones of the Unayzah Formation form the Unayzah Reservoir.

Introduction

This paper is based on field work carried out by the author in central Arabia. However, related published work from other parts of the Arabian Peninsula and subsurface were reviewed. Carboniferous siliciclastics were encountered in the Well ST-8 and ? Permo-Carboniferous rocks are exposed in central Arabia. They are mainly composed of siliciclastics. These rocks host great quantities of oil, condensate and natural gas in the Greater Arabian Basin. These rocks are becoming a primary exploration target and their stratigraphy has therefore attracted considerable attention.

At the present time, almost every geologically related organization in Saudi Arabia has its own terminology and definitions of the lithostratigraphic units of the stratigraphy of the geologic column in general, and for the Permo-Carboniferous succession in particular. This practice has resulted in great confusion to the stratigraphy of Arabia and has created communication obstacles among geologists. Old and current nomenclature of the Upper Paleozoic succession of Saudi Arabia is shown in Figure 1.

Shajra Formation

It is herein proposed that the term Shajra Formation to be used for the section below the unconformity at the base of the re-defined Unayzah Formation. This formation is exposed in central Arabia (Figure 2).

The basal contact of the Shajra Formation is marked by a regional angular unconformity with various older units. The Shajra formation is a widespread in the Greater Arabian basin. The porous sandstones of the Shajra Formation form the lower part of the Unayzah Reservoir which contains hydrocarbons in several oil and gas fields.

Lithology, Type Locality, Occurrence and Thickness

The type locality of the Shajra Formation is within the Wadi Ash Shajra (lat. 26°55'N, long. 43°34'E) in the eastern escarpment of the Qusayba depression, Al-Qassim region, central Arabia (Figure 3). The Shajra Formation is best exposed at its type locality where it is 34 meters in thickness. The most complete section of the Shajra Formation is exposed at its type locality (Figure 3). The formation is composed of non-marine red, pink, yellow, and gray cross-bedded, fine- to coarse-grained quartz sandstones, siltstones, and varicolored mudstones. Petrified logs are abundant in fluvial channel lag.

Excellent outcrops of the Shajra Formation are exposed in wadi southeast of the type locality. At this wadi a spectacular sections of olive-green, limonitic-yellow,

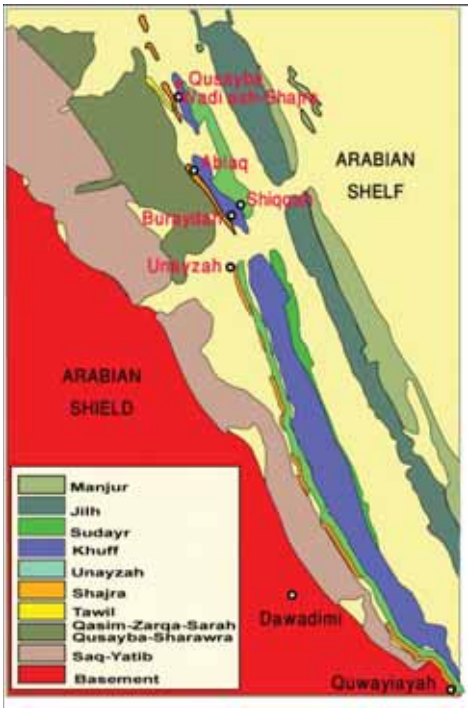

Figure 2: Outcrops of the Shajra Formation in central Arabia.

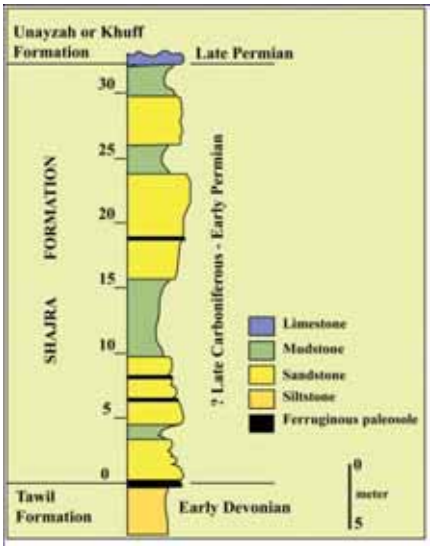

Figure 3: Generalized lithologic description of the Shajra Formation at the type locality, Wadi Ash Shajra, Qusayba Depression, Al-Qassim Region.

dark-pink and grey shales and mudstones, siltstones and sandstones are exposed. Point bar sandstones and mud-filled abandoned channels are recognized.

The upper part of the Shajra Formation is exposed in low farm areas west of the As Safra escarpment (Khuff carbonates escarpment) from north Buraydah town in the north to Quwyai'yah in the south.

The Shajra Formation is not present in the Tabuk basin, west of the Ha'il-Rutbah arch. The formation is encountered in all of the wells that penetrated the sub-Shajra unconformity (Hercynian unconformity). Similar section of sandstones, siltstones, and varicolored shales have been reported from different parts of the Greater Arabian basin. The Shajra Formation is the lithostratigraphic and chronostratigraphic equivalent of the lower part of the Faraghan Formation of the Zagros basin (Szabo and Kheradpir, 1978) and the al-Khlata Formation of the Haushi Group of Oman (Aley and Nash, 1984).

The Shajra Formation shows major thickness variations. It increases northward in the Widyan basin. Thickest section is encountered in the Badanah well. The Shajra Formation progressively thins toward the southern margin of the Widyan basin over the Central Arabian Arch and on the Summan platform. In al-Qasim region, the formation fills a north-trending narrow trough bounded on the east by the Summan Platform and on the west by the Arabian Shield. This thickness variation of the Shajra is well represented in the Shaqra and at-Tarafiyah wells. On the western flank of this trough, the formation thins to approximately 1.8 m on the Arabian Shield in the town of Al-Quwyai'yah.

The depositional phase of the Shajra siliciclastics marked a major change in the sedimentation and evolution of the Arabian Shelf. These deposits primarily represent land derived sediments that preceded the deposition of the Unayzah and Khuff marine deposits

Sub-Shajra Unconformity

The Arabian Platform was subjected to several tectonic events during the Paleozoic. The well-documented regional effects of these tectonic movements are represented by the sub-Saq (Assyntic), the sub-Zarqa (Taconic), the sub-Tawil (Acadian), and the sub-Shajra (Hercynian) unconformities.

The sub-Shajra regional and well pronounced hiatus is attributed to a period of uplift synchronous with the maximum phase of the Hercynian and earlier tectonic movements. The sub-Shajra unconformity is marked by angular relationships with underlying strata ranging in age from Devonian to Precambrian (Figure 4).

Clastics derived from fluvial erosion of westward and local areas blanketed the region, filling lows and covering paleohighs prior to the major transgression of the sea over the entire region where thick shallow marine deposits of the Unayzah and Khuff Formations.

Hydrocarbon Potential

The fluvial and eolian sandstones of the Shajra are important as a potential reservoir for hydrocarbons because they unconformably overlie various rock types of different facies. The Shajra sandstones form the lower part of the Unayzah Reservoir.

Summary/Conclusion

Surface and subsurface studies of the Permo-Carboniferous succession have revealed the followings:

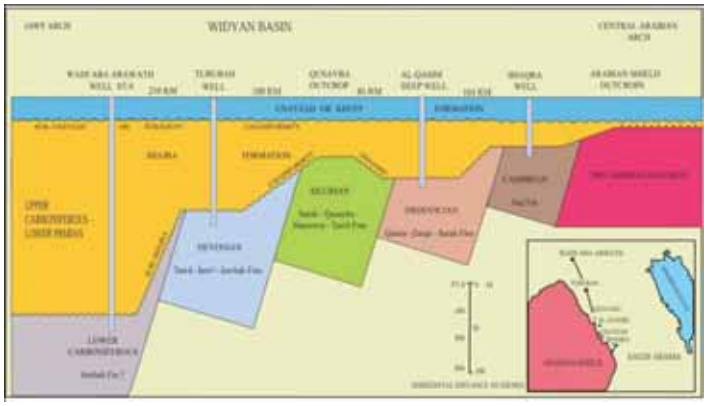

Figure 4: Generalized cross-section showing stratigraphic relationships of the Shajra Formation with underlying units.

1. Recognition of a regional sequence boundary within the original Unayzah Formation (Laboun 1982, 1984, 1984, 1986, 1987) resulted in dividing the succession to two different units; a lower continental siliciclastics and an upper shallow marine siliciclastics and minor carbonates and anhydrites.The term Unayzah Formation was restricted to the upper unit.The term Shajra Formation is herein introduced for the lower unit.

2. The sub-Shajra regional unconformity is a time equivalent of the Hercynian unconformity.

3. The surface section of the Shajra Formation resembles the equivalent section in the subsurface.

4. Local unconformities have been recognized within the Shajra Formation represent minor stratigraphic break in sedimentation.

Depositional history, erosion, facies change, and thickness of the Shajra Formation were influenced by the Hercynian Orogeny.

5. Surface sandstones collected from the Shajra Formation exhibit good to excellent porosity and permeability. The porous eolian and fluvial sandstone facies form the upper part of the Unayzah Reservoir.

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On a Nonlinear Programming-Based Transmission Expansion Planning

By Zakariya Mahmoud Al-Hamouz Ali Sadiq Al-Faraj.

This paper was prepared for presentation at the 2nd Saudi Meeting on Oil and Natural Gas Exploration and Production Technologies (OGEP 2010) held at the King Fahd University of Petroleum & Minerals (KFUPM) Campus in Dhahran, Kingdom of Saudi Arabia, December 18-20, 2010.

A modified formulation of the transmission expansion planning (TEP) problem is proposed by including the corona term. Consequently, the objective function includes the costs of investment, ohmic loss and corona, which reveals a highly nonlinear function. Hence, nonlinear programming optimization techniques are used to solve such a problem.

The new formulation has been applied to the well-known Garver's 6-bus system. It has been found that for a range of tariffs of kWh, the total cost of the expanded network (when including the corona power loss) is less than that when excluding this new term. Comparison with previously reported work is also included.

The general form of the TEP can be stated as follows, given

(1) the load-generation pattern at a target year,
(2) the existing network configuration,
(3) all possible routes (length and right of way), and
(4) line types

The planner has to estimate the most economic network which feeds the loads with the required degree of quality and realizes a pre-specified reliability level.

The optimization techniques, such as linear programming, quadratic programming and nonlinear programming, in addition to heuristic techniques have been adopted by many investigators in solving the problem.

New optimization techniques, like simulated annealing, genetic algorithm and Tabu search, received great attention of researchers for handling large TEP problems.

In the present work, a new term (corona) has been added to the TEP problem. This results in a nonlinear objective function which is solved by a nonlinear programming subroutine. The effect of corona on the TEP process and its cost has been investigated.

I. Mathematical Formulation

The new formulation proposed in this paper can be written mathematically as:

Minimize:

$\sum$ cost of investment + $\sum$ cost of ohmic loss + $\sum$ cost of corona

Subiect to:

1) Power balance at each bus.
2) Kirchoff's voltage law on each closed basic loop.
3) Line flow, conductor radius, & spacing constraints.

II. Method of Solution

The ohmic loss on all lines and the corona loss on the new lines are considered in addition to the capital investment of the new lines. The optimization technique used here is the nonlinear programming MATLAB subroutine. The steps of solution are as follows:

Step (1)
Formulate the system, where the objective function includes the costs of investment and corona loss of new lines and the cost of ohmic loss of all lines.

Step (2)
Use the nonlinear programming MATLAB-based subroutine to obtain the power flows on the existing lines and overloaded routes.

Table 1: Transmission Line and Possible Route Data

Line #	Bus-Bus Path	X (p.u.)	R (p.u.)	Capacity (MW)	Length (Mile)	Path Use Cost (p.u.)
1	1 – 2	0.4	0.1	100	40	-------
2	1 – 4	0.6	0.15	80	60	-------
3	1 – 5	0.2	0.05	100	20	-------
4	2 – 3	0.2	0.05	100	20	-------
5	2 – 4	0.4	0.1	100	40	-------
6	3 – 5	0.2	0.05	100	20	100
7	6 – 2	0.3	0.075	-------	30	150
8	6 – 4	0.3	0.075	-------	30	150
9	6 – 3	0.48	0.12	-------	48	150

Table 2: Generation and Load Data

Bus #	Existing		Future	
	Dispatch MW	Load MW	Dispatch MW	Load MW
1	20	40	50	80
2	0	60	0	240
3	150	10	165	40
4	0	40	0	160
5	0	60	0	240
6	-------	-------	545	0

Table 3: Power Flows in the 1st Iteration

Line #	Flow (MW)	Direction	
		From Bus	To Bus
1	31.99	2	1
2	21.33	4	1
3	23.32	1	5
4	12.68	3	2
5	0	4	2
6	100	3	5
*7	259.31	6	2
*8	181.33	6	4
*9	104.35	6	3
*10	116.67	3	5

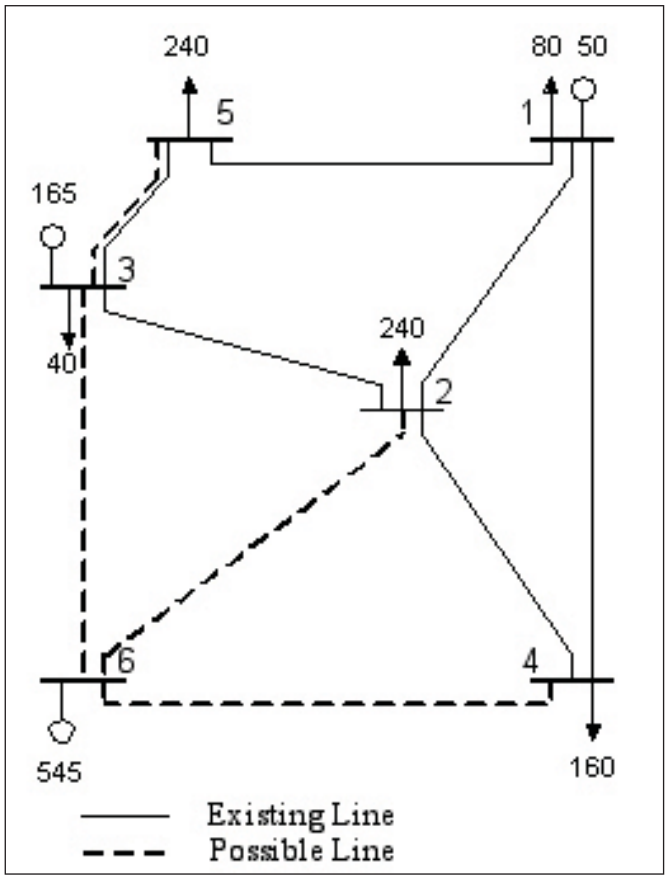

Fig 1. Initial networks with possible routes.

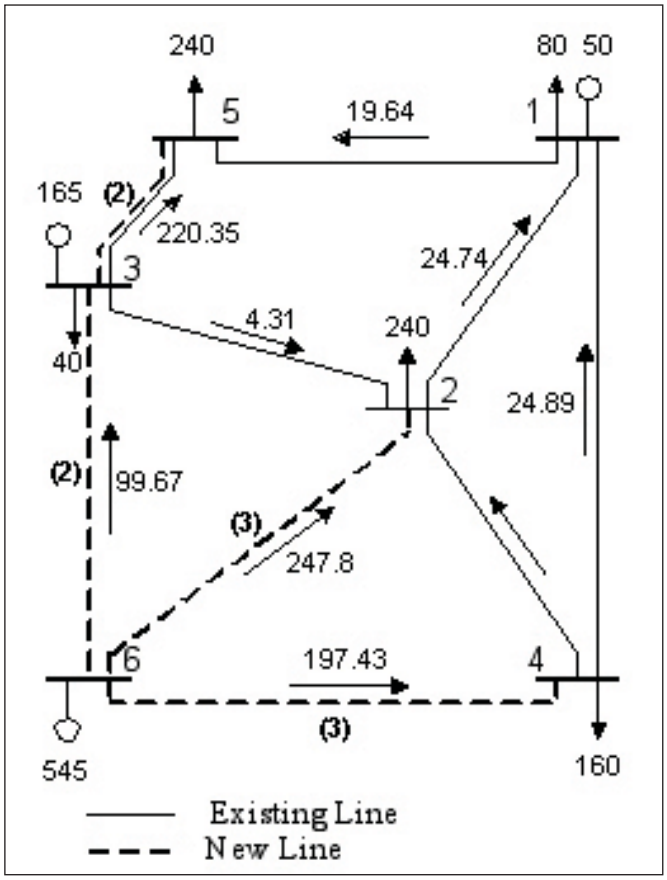

Fig 2. Final expanded network [(x): number of added lines]..

Step (3)
Search for the maximum-overload route and add a line there, and if the maximum overload is still on that route, another line will be added. If the maximum overload becomes on another route, a line will be added there and the process continues until the maximum overload becomes again on one of those routes previously having a maximum overload in this iteration. At this time, step four takes place.

Step (4)
Reformulate the problem taking into consideration the new line additions made in the third step. The process continues until no overload exists and finally a DC load flow is made [7].

III. Application of the Proposed Transmission Expansion Planning Method

The proposed method is applied to the Garver's system shown in Fig. 1.

IV. Results and Discussion

In the following subsection, the detailed process of expansion is presented when corona power loss is included. The same process applies for the case when corona is excluded.

A minimization of the objective function subject to the specified constraints has been done using the nonlinear programming. The power flows obtained in the first iteration are given in table 3. It is clear that the 6-2 route has the maximum overload. Therefore, a line is added (with a 100-MW capacity) to this route. After this addition, the maximum overload is now shifted to the 6-4 path. Hence, a line is added to this path. As a result, the overload is back on the 6-2 path, which has been encountered before in this iteration. Therefore, the line addition is stopped and the objective function and constraints are reformulated taking into account that the two added lines are now existing ones.

The power flows of the second iteration are shown in table 4. It can be seen that the maximum overload is carried by the route 6-2. A line is added to this route. Consequently, a line in each path is added to paths 6-4, 3-5 and 6-3 respectively. After these additions, the maximum overload is back on the route 6-2. Therefore, line addition in this iteration is terminated and reformulation of the objective function and constraints is prepared to obtain a new set of power flows.

This process of adding new lines and minimizing the objective function subject to the specified constraints is

Table 4: Power Flows in the 2nd Iteration

Line #	Flow (MW)	Direction	
		From Bus	To Bus
1	32.18	2	1
2	33.41	4	1
3	35.60	1	5
4	0.001	3	2
5	17.94	4	2
6	99.97	3	5
7	100.0	6	2
8	76.07	6	4
*9	154.2	6	2
*10	135.2	6	4
*11	79.39	6	3
*12	104.4	3	5

* Overloaded route

Note: Each added line has a capacity of 100 MW

Table 5: Total Cost in Million $

Tariff Cent/ kWh	Previous (No Corona)	Present	
		No Corona	With Corona
1	197.17	204.6	211.94
2	284.35	284.2	283.88
4	458.71	443.4	427.76
6	633.07	602.6	571.65
8	807.43	761.8	715.53
10	981.79	921.0	859.42

repeated until no overload exists. Fig. 2 shows the power flows and the number of added lines on the final expanded network.

Table 5 shows the total expansion cost. The second and third columns represent the total expansion cost for different tariffs in cent/kWh when corona is not included, while column four represents the total expansion cost when corona is included.

As it can be seen from this table, the total cost is larger in the corona case when the tariff is 1 cent/kWh. On the other hand, the total cost will be smaller when including corona at a tariff of 2 cent/kWh or higher. For example, when the tariff is 4 cent/kWh, a saving of 15.64 million dollars can be achieved in the life time of the network when compared to the present expansion when corona loss is not included. Therefore, it is worth including the corona power loss term in the expansion process.

A modified formulation of the objective function for TEP is proposed. A new term has been included which is the corona loss. The effect of this new formulation on the expansion process has been investigated. Comparison with previously reported expansion of the Garver's system is presented. It has been shown that including the corona power loss term leads to more economical expanded network, i.e., the total cost of investment, ohmic power loss and corona power loss is less for a certain range of tariffs of cent/kWh.

The authors thank King Fahd University of Petroleum

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Case History: Successful Application of Combined Rotary-Jetting and MLT to Stimulate Dual-Lateral Producer in Ghawar Field

By Muhammad H. Al-Buali, Ibrahim H. Al-Arnaout, Ayed M. Al-Shehri, Surajit Haldar, and Saad M. Al-Driweesh; Saudi Aramco.

The petroleum industry has developed a great understanding about subsurface reservoir behavior and hence, was able to combine the rich knowledge, gained over the past fifty years, with today's available technology to develop what is known today as multilateral wells. As a leader in oil and gas industry, Saudi Aramco's implementation of multilateral wells, especially in southern part of the Ghawar field, has shifted significantly to ensure optimum recovery of the resources by maximizing reservoir contact.

However, many problems were encountered when it comes to accessing and stimulating individual laterals of a multilateral well. As a result, this paper will be centered on describing a unique fully developed technique that utilizes high energy rotary-jetting tool along with multilateral tool (MLT) with both tools combined together in order to meet with objective of acid washing dual Arab-D laterals at one single run with nitrified hydrochloric acid using coiled tubing (CT). This technique of combining both tools was proven to be successful especially that it maximizes the performance of treatment while minimizing the need for large volume of acid.

Oil drilling strategy in the world as a whole, and Saudi Arabia in particular, has shifted drastically from drilling vertical wells to drilling horizontal and multilateral wells. This movement toward deviated wells was justified as these have proven to be successful and economical for oil field development. Yet, although drilling practices have progressed in developing these multilateral wells, there are still limitations on the accessibility of the laterals when logging and/or treatment is required. However, the well intervention work can now be performed on each individual as a result of utilizing the MLT re-entry tool with CT pipe[1, 2 &3].

Developed well models do not represent the actual complexity found in wells scattered around the globe. Therefore, accessing as well as stimulation of these complex oil wells is becoming more challenging and trickier due to advances in well geometry. Although, mud chemistry has improved, mud cake will still form and most of the times causes formation damage especially in overbalance drilling. Typical cleanup solutions for filter cake formed by water based mud include acids, oxidizers, enzyme treatment, or a combination of these materials[4 & 5]. In addition to these chemical solutions, mechanical means like downhole rotary-jetting tool have been used to remove the filter cake in single lateral horizontal wells.

The major advantage of rotary-jetting is to eliminate the domination of the high permeable zone on the treatment distribution, by enhancing pinpoint jetting efficiency. In addition, the system also replaces traditional jetting and wash-tools that lack rotating capacity[6]. For the first time in the Middle East, Saudi Aramco has successfully pilot tested a combined tool of rotary-jetting and MLT. The job was conducted on a dual-lateral horizontal oil producer in the southern part of the Ghawar field of Saudi Arabia.

In this case study, an acid wash treatment was required for well-A, drilled and completed initially in southern area of the Ghawar Field as a vertical producer.The well produced dry oil and started cutting water after several years of production. This was followed by a decline in production and the well eventually ceased flowing few years later. Then, well-A was converted to a dual lateral-horizontal producer to maximize reservoir flowing drainage area.After that, the well started cutting a small amount of water causing the flow to be restricted because of near wellbore formation damage.

This acid job was set to eliminate near wellbore damage as well as enhance well productivity by increasing

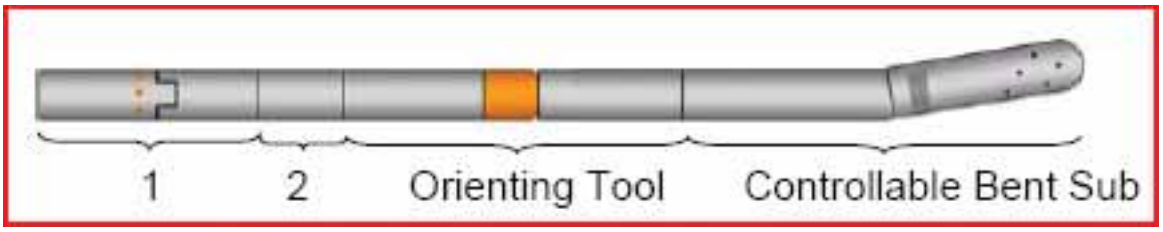

Fig. 1

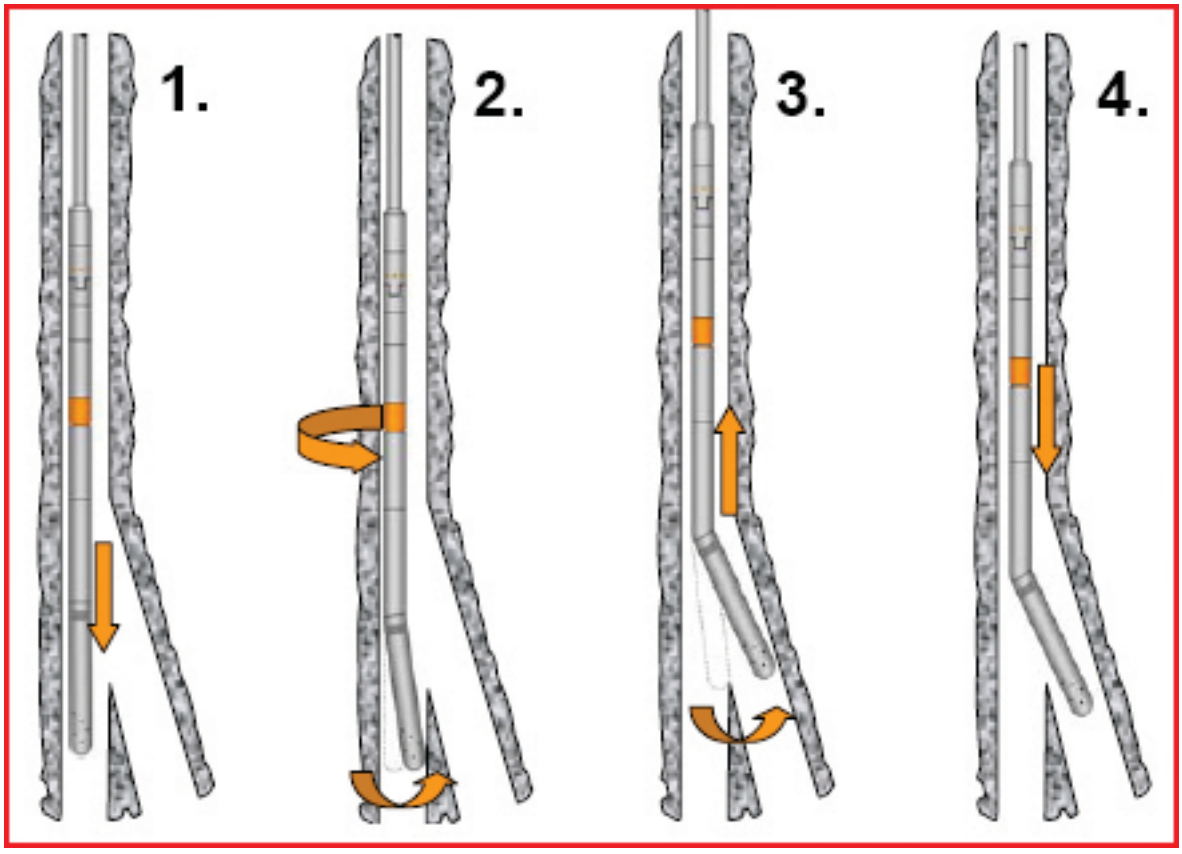

Fig. 2

Flowing Bottom-Hole Pressure (FBHP) and restore the true productive capacity of the well. The project objective was to determine an effective treatment design to enable well accessibility and ensure treatment effectiveness with an optimized cost. To accomplish this goal, a multi-disciplinary team involving production, reservoir and service company engineers was formed to determine the most effective design to enable well accessibility and maximize matrix-acid interaction for both laterals.

With increase in multilateral well complexity, the use of Multilateral Tool (MLT) (Fig-1) was necessary. Accordingly, a multilateral re-entry system was utilized to provide controlled, selective entry, on coiled tubing, to each lateral in one single trip.(See Fig-2). The success of this implementation mainly relied on MLT's Orienting Tool being able to deliver enough torque to index the lower part of the tool's bottom-hole assembly; thus, can be rotated to cover 360° [2&3]. Also, to ensure meeting the target which is treatment effectiveness, it was decided to deploy a high energy rotary-jetting tool, as it had previously very successful performance in CT deployed matrix stimulation of horizontal and vertical oil producers, and power water injectors in this field. The success of this implementation mainly relied on MLT's Orienting Tool being able to deliver enough torque to index the lower part of the tool's bottom-hole assembly; thus, can be rotated to cover 360°. Moreover, this combination will ensure deep penetration due to the high pressure drop seen across the nozzles of the rotary-jetting tool [6&7]. Combining the MLT and rotary-jetting tool was a major challenge itself in terms of each tool's activation time[8&9]. However, this problem was resolved via a cus-

tom-designed shuttle valve installed between both tools.

The final bottom-hole assembly design used to achieve the project's goals consisted of the connector, circulation sub and motor head assembly, downhole filter, MLT, shuttle valve, extension sub and rotary-jetting tool (Fig-3)

The procedure for running both tools to access and wash both laterals was set by all team members and successfully implemented. The following is concluded from this study:

• Intervention in multilateral wells is a challenging and extensive operation that can be optimized and improved.
• To realize the benefits of the MLT and rotary-jetting tools, a special design was successfully implemented by combining and running both tools in a single run to ensure well accessibility and treatment effectiveness. It contributed effectively to restore the well production with a rate of 11,000 BOPD.
• Combining MLT and rotary-jetting tool was the major challenge as two different systems need to be hydraulically activated and monitored from the surface. Thus, a shuttle valve was custom-designed to regulate the operating rates.
• Compared to the chemical consumption for similar horizontal length, chemical consumption was reduced by about 70% because of the use of the rotary-jetting tool in this multilateral well.
• This MLT rotary-jetting combined tool has a good impact in terms of optimizing both operations and acid treatment chemicals.
• Based on the success of this stimulation job, the concept of designing and treating other Maximum Reservoir Contact (MRC) producers and injectors using this technique, chemically and mechanically, has become a recommended process in the Ghawar field.

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Reaction Mechanisms of EDTA Dissolving Calcium Carbonate in Various pH at High Temperature, High Pressure

By Xiangdong Willie Qiu, Schlumberger Carbonate Research Center, Saudi Arabia.

Abstract

HCl is typically used in carbonate stimulation. However in high temperature wells, its high reaction rate with the rock and severe corrosion to well tubular limit its applicability. Chelating agents were introduced to overcome these problems. Though the chelating agents have been shown to create wormholes in carbonate formations like HCl, the chemistry of them reacting with carbonate rock is much more complicated and not well understood. In order for chelating agents to be effectively used in oil and gas well production stimulation, the reaction mechanisms between the chelating and the rock should be quantified. It is the objective of this presentation to discuss the fundamentals of chelating agent-carbonate reaction chemistry.

Lab experiments showed that an EDTA based chelating agent dissolve much more carbonate rock at low pH (around 4) than at high pH (around 11). This is believed to be due to hydrogen attack. However, the amount of the hydrogen at pH 4 is insufficient to explain the additional mass of carbonate dissolved by the chelating agent at this pH. Thermodynamic modeling and experiments have been conducted to further understand the reaction equilibrium in a chemical system containing EDTA based chelating agents and calcium carbonate. It was found that the multiple carboxylic acid groups in the EDTA structure releasing hydrogen at various pH ranges can be used to quantitatively explain the overall carbonate dissolving power of chelating agents.

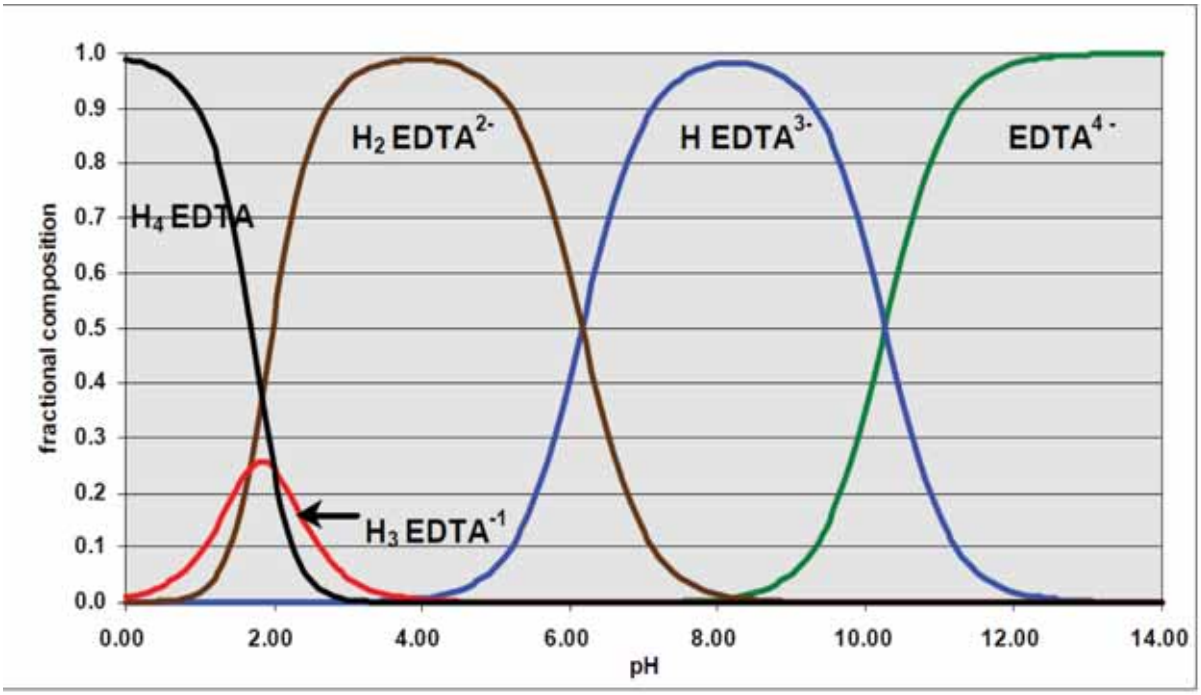

Fig.1. Fractional Composition Diagram at Room Temperature, 1 atm.

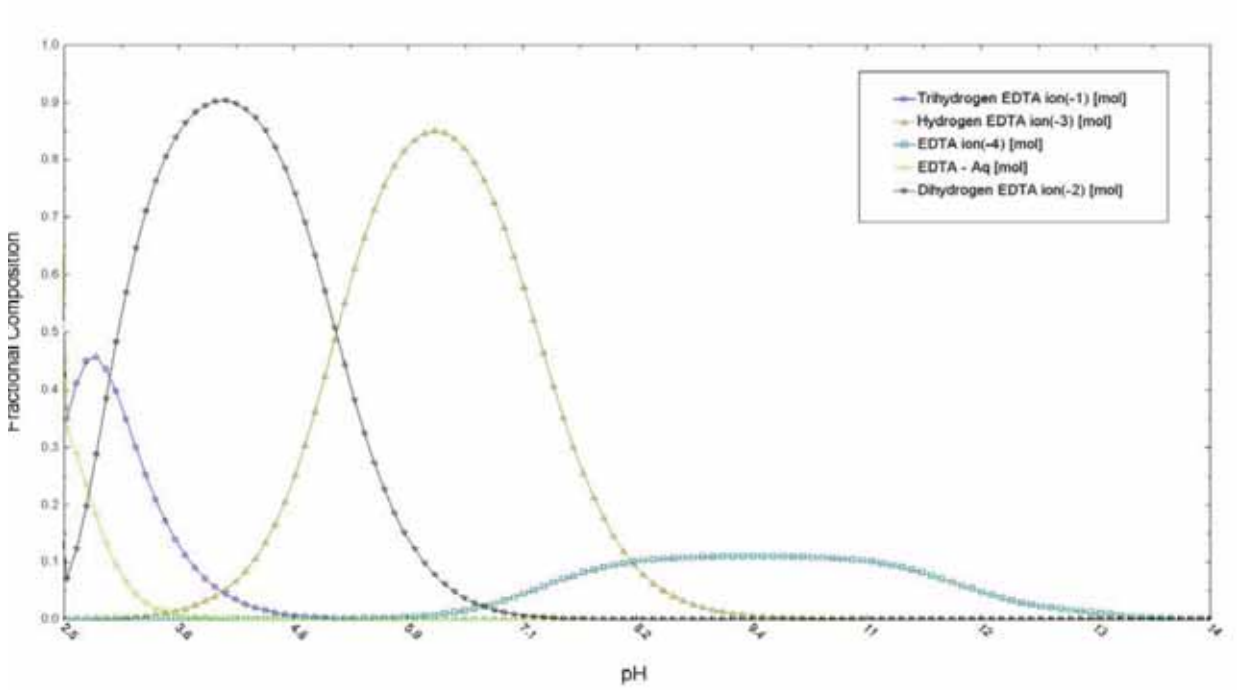

Fig.2. Fractional Composition Diagram at 150°C, 100 atm

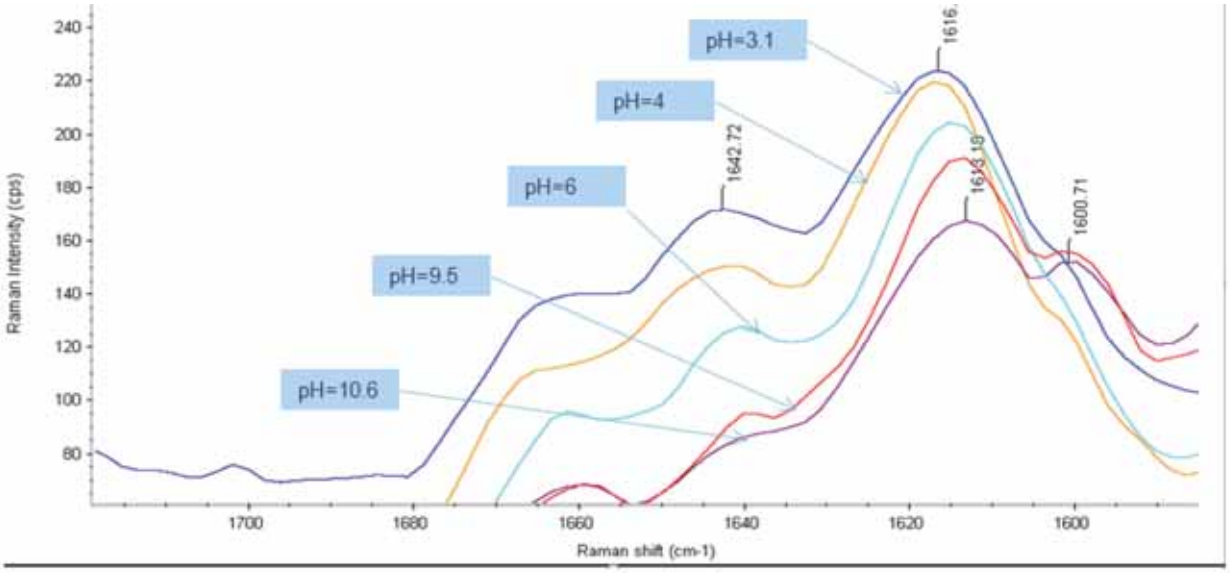

Fig.3. Products of Na4EDTA Reacts with Limestone at Different pH

This presentation demonstrates how an instrument such as Raman spectrometer can be used to link the data from batch experiments to chemical analysis software such as OLI Stream Analyzer to investigate the complex reaction between chelating agents and carbonate rock.

According to fractional composition diagram (Fig.1), from pH 4 to pH 5.9, the major components are H2EDTA- and a partial of HEDTA- . They have the ability to release H+ and attack carbonate rock. In the meantime, deprotonated EDTA has a strong affinity for Ca2+, and EDTA has a good stability constant for calcium chelation. So, at low pH, EDTA can dissolve more carbonate rock is based on the combination of hydrogen attack and sequestration to calcium ions.

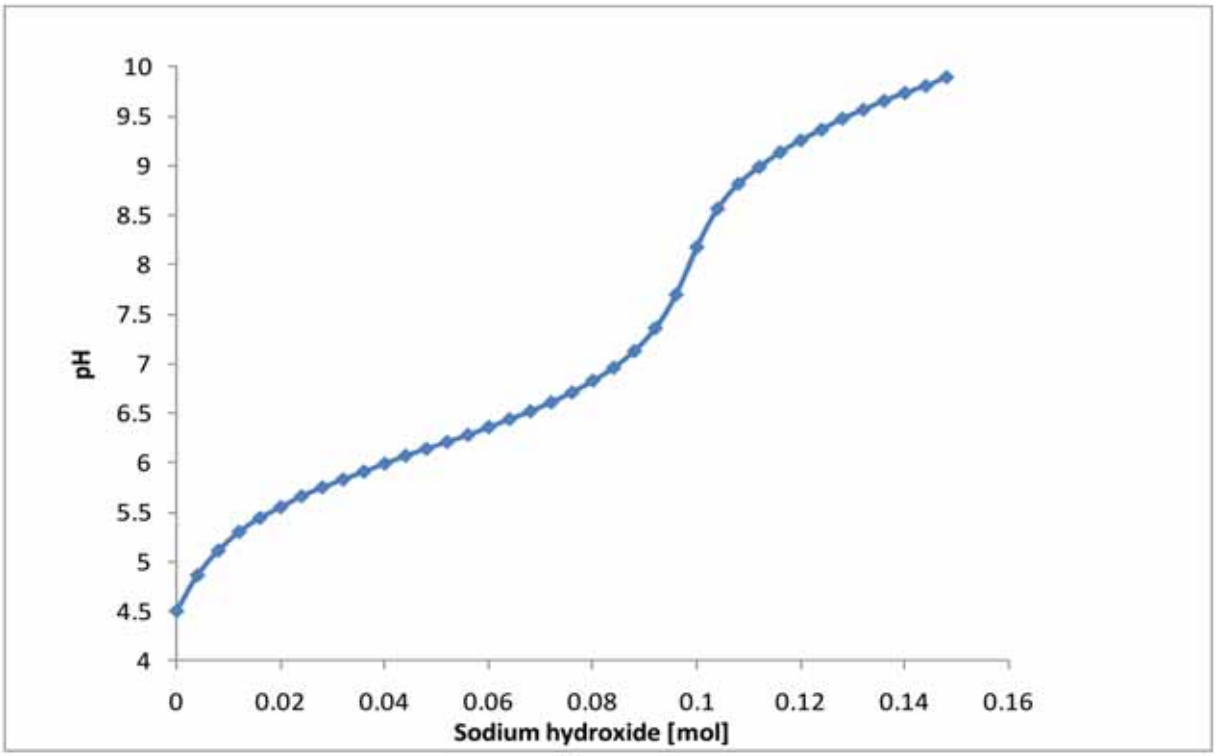

Fig.4. Experiment: Na2H2EDTA (0.1M) pH increasing from 4.5 to 6.5 requires 0.068 mol of NaOH (0.1M)

From another point of view, a titration experiment (Fig.4), which gives a further explanation why EDTA can release such amount of H+ to attack carbonate rocks in this pH range (4 to 5.9). The science behind is a good buffer action at the range.

At high temperature and high pressure, the fractional composition diagram (Fig.2) is showing that one more species--H3EDTA- will take part in carbonate rock dissolving action. In another word, at the same pH range (4 to 5.9), EDTA carbonate rock dissolving power is even higher than at room temperature.

As an identification tool, Raman spectrometer was used to give more detail information (Fig.3):

Wavenumber at 1640cm-1 indicates –COOH, Wavenumber at 1615cm-1 indicates –COO-,Wavenumber at 1600cm-1 indicates [–COO-Ca+] complex. From Raman intensity, more limestone is dissolved when pH is decreasing, but EDTA-Ca complex is less when pH is decreasing.

Innovative Approach to Stimulate Horizontal Gas Well Using DTS Technology Combined with Coiled Tubingin Saudi Arabia

By Francisco Garzon, J. Ricardo Solares, Jose Ricardo Amorocho, Abdulmohsin AL-Mulhim, SPE, Saudi Aramco, Wassim Kharrat, Iyad Hamed-Naji, George Brown, Vidal Noya, SPE, Schlumberger.

Abstract

The objective of most acid stimulation treatments in Saudi Arabia's Khuff carbonate formations is to remove drilling induced damage and achieve maximum well productivity. Open-hole and multi-lateral completed wells, present several challenges that prevent an optimum intervention and placement of fluids with CT. Traditional stimulation practices of these types of producers usually involve spotting fluid systems comprising multiple stages of pre-flushes, acid, and chemical diverting agents along the horizontal section of a well without adequate control over treating fluids placement and displacement.

An innovative approach, combining FOECT and DTS recorded data with reservoir data to selectively place stimulation fluids in targeted formation sections, was successfully field tested in a dual-lateral horizontal gas well completed open-hole in Saudi Arabia.

This paper describes the job design, the operations performed to access the desired lateral, and the stimulation treatment performed combining the two technologies. Details on how the DTS technology was used to identify thief zones during the actual stimulation treatment, and how the placement of treatment fluids was optimized along the horizontal section, are also provided. The successful implementation of the first field trial has provided a strong incentive to utilize a similar approach in other gas producers currently scheduled.

Introduction

As the domestic demand for gas in the Kingdom of Saudi Arabia continues to increase, more gas development projects have been undertaken over the past few years aimed at achieving challenging production targets. Hence, the number of rigs drilling for gas, and the need to maximize well productivity while maintaining low operating cost, have significantly increased.

As Saudi Aramco has shifted from vertical stimulated to horizontal gas producers to optimally develop gas reservoirs, most of these wells are drilled as highly deviated, single or dual-lateral open-hole horizontal completions. Open-hole completions have distinct advantages over cased-hole completions, including lower cost and, in principle, better productivity due to a lower risk of drilling induced damage. However, some of these wells produce at below expectations when brought online either due to lower than expected reservoir quality, or severe drilling induced damage resulting from complications during the drilling operation. Consequently, such wells require complex intervention procedures to perform stimulation treatments.

The preferred method to stimulate open-hole horizontal wells is to access the targeted zone in the desired lateral,and displace acid with CT. Nevertheless, this operation presents many challenges which require an effective way to first identify the correct lateral, access it, and finally stimulate it. Confirmation that the correct lateral has been accessed is usually done by tagging the end of the lateral and matching TD, which is both time consuming and an inefficient way of doing it, or in some instances not possible due to maximum CT reach limitations. The junction in the open-hole where geometries may not be necessarily uniform makes the task more difficult. The potential presence of washouts around the junction may also affect the performance of

the tool used to gain access to the targeted lateral. Under this scenario, a trial and error lateral identification process is usually required. Moreover, after the acid treatment fluids have been pumped, the diameter of the junction may get enlarged due to the acid reacting with the formation, thus making the operation even more difficult.

The traditional stimulation procedure involves spotting multiple stages of pre-flushes, acid, and diversion systems along the horizontal section of a well without adequate control over treating fluids placement and displacement. When used in several dual-laterals in recent applications, this approach has not achieved the objective of increasing well productivity, even after displacing acid in both laterals, which suggests that an effective acid diversion was not achieved. Some of the uncertainties with the highest impact in the outcome of a stimulation treatment performed using the traditional procedure include the following:

- Is the injection profile known?
- Are thief zones present? If so, is their location known?
- If present, are the thief zones hydrocarbon-bearing?
- Are the stimulation treatment fluids entry points known?
- If acid has to be bullheaded, will it reach the same depth as the CT BHA nozzle depth even if a thief zone is present at the heel of the well?
- What is the actual down-hole temperature during treatment? Are the fluid systems designed properly to work at the actual temperature?
- Is effective fluid diversion being achieved?
- What is the best diverting agent to use for either non-hydrocarbon bearing or hydrocarbon bearing zones?
- Are the treatment design and volume adequate?

To answer most of these questions and maximize the chance of performing effective stimulation treatments in open-hole horizontal producers, Saudi Aramco tested a new approach using CT conveyed fiber optic technology.

Technology Description

The FOECT, shown in Fig. 1, is a system that allows real-time monitoring of downhole pressure and temperature without the limitations of conventional wireline-enabled CT units, and provides depth correlation using a CCL. The system comprises a non-intrusive FOC inside the CT string with a 0.071" OD, a BHA, a surface data acquisition device, a DTS system, a CT head where the fiber optical connections are terminated, the electronic package that houses the down-hole communication system, and a CCL. The BHA schematic and pertinent data are shown in Fig. 2.

During a typical operation of the system, the down-hole data are transmitted from the CT working reel, via wireless communication, to the CT control cabin, where the DTS monitoring system and specialized software are used to acquire, display, monitor and record real-time job parameters. The surface acquisition system can also communicate with the tool down-hole and send commands. The fiber does not require calibration prior to running it in the wellbore.

A specialist with reservoir production background and measurements expertise interprets the down-hole events throughout the operation, and makes adjustments as needed. An MSRT, which consists of a surface-controlled orienting tool and a controllable bent sub, can also be added to the BHA when the need to identify and access a targeted lateral in a multi-lateral well arises. This corrosion-resistant MSRT is operated solely at flowing conditions and is conveyed with standard coiled tubing equipment.

Field Trial Experience

The first field application involving FOECT was performed in Well-A, a dual-lateral gas producer completed in a carbonate reservoir. A cartoon depicting the well's

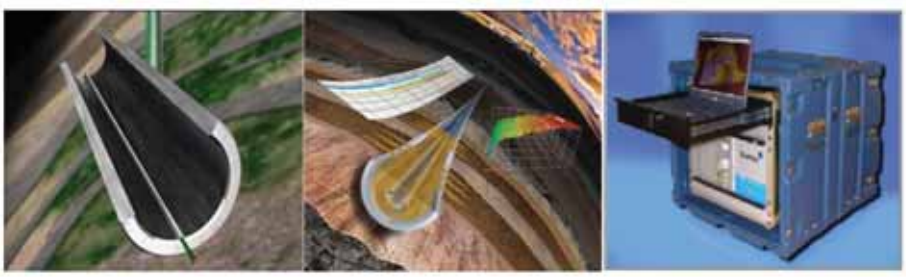

Fig.1 Fiber optic enabled coiled tubing system with distributed temperature survey recorder

BHA: PTC+ MHA + MLT + shuttle valve + extension + Blaster

Item	Tool Description	Tool Connections	Tool OD (inch)	Tool ID (inch)	T-Length (inch)
1	PTC tool	iCoil thread	2 1/8	0.688	76.58
2	X-over		1 11/16	0.8	6
3	MHA + Circ sub	DS Standard 1.8125 in 10 SA	2 1/8	0.8	60
4	Down Hole Filter	DS Standard 1.8125 in 10 SA	2 1/8	-	28
5	Orienting Tool (OT)	DS Standard 1.8125 in 10 SA	2 1/8	-	88
6	Controllable Bent Sub (CBS)	DS Standard 1.8125 in 10 SA	2 1/8	-	90
7	Shuttle valve + X-over + extension sub	DS Standard 1.8125 in 10 SA	2 1/16	1.5	30
8	Blaster Swivel	1.5 SA Box-Pin	2 7/8	-	25
9	Drift Ring Nozzle Head	Special LHT	2 7/8	-	4
Note: All BHA dimensions inputted in this sheet must be physically measured on location.		Max Tool-String OD:	2 7/8		
		Min Tool-String ID:		0.688	
		Total Length of BHA			33.8 ft

Item

1
2
3
4
5
6
7
8
9

Tool Schematic

Fig.2 BHA schematic

completion diagram is shown in Fig. 3, and its directional survey schematic is shown in Fig. 4. After drilling, the well was flowed back for cleanup and it performed at below expected target rate. It was then decided to perform an acid stimulation treatment, targeting the 12,500-13,100 ft section in the upper lateral (L-1), because this zone showed the best reservoir quality in open-hole logs.

Details of the stimulation operation performed in Well-A using FOECT are described next:

Running in-hole operation (RIH)
• Loaded the well with KCl brine
• RIH CT and broke circulation maintained with treated water
• Confirmed L1 access exceeding L0 MD.

Pre-flush stage in lateral L1
• A pre-flush volume of 125 bbl was pumped while reciprocating the CT across the target zone in L1
• FOECT data analysis showed significant fluid leakoff occurring in lateral L0 at the lateral junction
• Pumped initial acid stage to remove potential skin damage without using diversion

First acid stage in lateral L1
• POOH to12,600 ft while pumping acid, then RIH to 13,000 ft.
• Pumped 200 bbls of 26% HCl acid
• FOECT data analysis showed continuous leakoff into lateral L0 with little or no acid going to target in L1
• Re-designed job to include diverting fluids
• Pumped foam and viscoelastic self-diverting acid to divert from lateral L0 while maintaining CT inside

lateral L1
• Pulled CT to 12,000ft to pump foamed and viscoelastic self-diverting acid to lateral L0 (CT still 300 ft inside lateral L1).
• Pumped 20 bbl of foam and 10 bbl of nitrified viscoelastic self-diverting acid into lateral L0.

Second acid stage in lateral L1
• Reciprocated CT from 13,000 to 12,600 ft while pumping acid, then RIH to 13,100 ft to analyze data
• Pumped 150 bbl of 26% HCl acid
• FEOCT data analysis showed decreasing fluid leakoff into lateral L0, and increased acid action in lateral L1, but 200 ft above the targeted zone. Data also showed

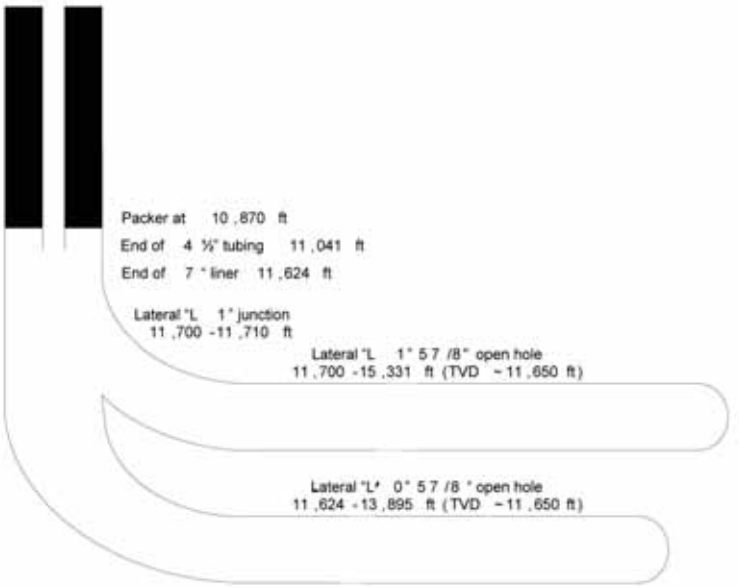

Fig.3 Well-A completion diagram

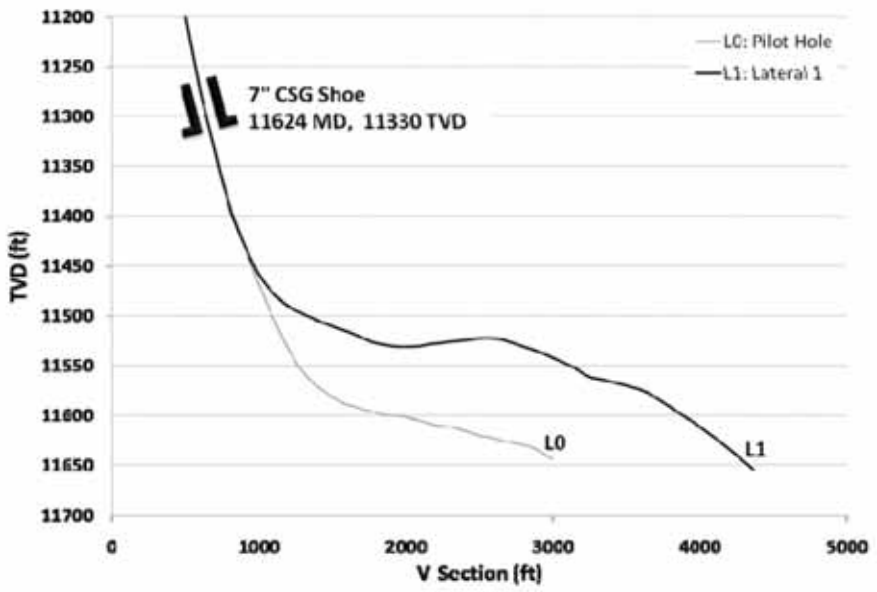

Fig.4 Well-A directional survey schematic

limited acid action across the 300 ft target zone

• Pump 200 bbl of nitrified viscoelastic self-diverting acid into lateral L1, prior to pumping the final acid stage

• POOH CT from 13,000 to 12,400 ft while pumping the acid, then RIH to 13,000 ft

Final acid stage in lateral L1

• POOH CT from 13,000 to 12,600ft while jetting acid. Stopped at 12,900 ft, 12,800 ft and 12,750 ft L

• Pump 250 bbls of 26% HCl acid

• FEOCT data analysis showed clear further increased acid action in lateral L1 across the 12,400-13,000 ft target interval and upwards of 200 ft above it

• Pumped post-flush stage while POOH

Stimulation of lateral L0

• Access to lateral L0 was attempted but not achieved even after multiple attempts, suggesting washout of the open-hole junction beyond what was expected during the job design. Consistently observed fluid leakoff into L0 throughout the acid stimulation treatment in lateral

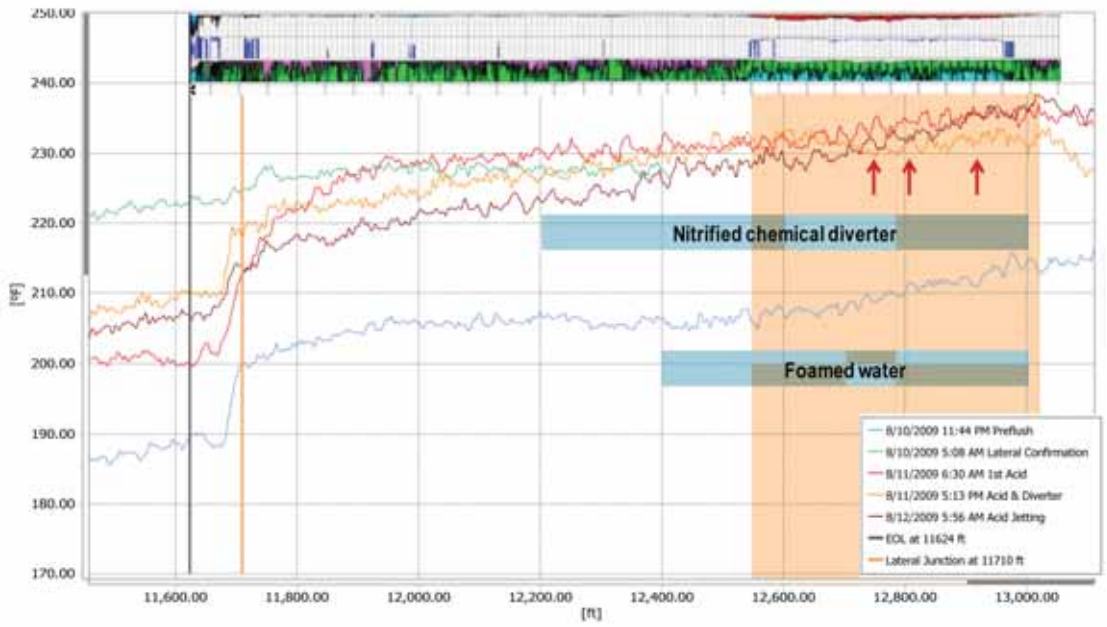

Fig.5 Temperature data recorded during acid stimulation treatment in Well-A

L1 may have contributed to deterioration of the open-hole junction

• Pumped 250 bbls of nitrified 15% HCl viscoelastic self-diverting acid in 5 stages of 50 bbls each with the CT stationary at 11,600 ft. The L1 lateral was filled up with foam to avoid re-stimulating it

An example of one of the temperature data charts generated during the stimulation treatment is shown in Fig. 5

Post-Stimulation Results

The post-stimulation performance of Well-A exceeded expectations. Well-A produced at a pre-stimulation treatment rate of 12 MMSCFD, and it achieved a post-stimulation rate of 23 MMSCFD. The use of FOECT helped achieve uniform acid coverage across the target zones by monitoring fluids placement, and by effectively using optimum volumes of nitrified viscoelastic self-diverting acid and foam across the identified thief zones. Moreover, the fluid injection profile showed a significant improvement after the treatment.

Excessive treatment fluids leakoff into the the non-targeted L0 lateral was avoided by identifying the leakoff early, and using foam and nitrified viscoelastic self-diverting acid to mitigate it. Confirmation of gradually reduced losses to the thief zone in lateral L0 was clearly observed.

Conclusions

1. The first successful application of a combination of FOECT and DTS technologies to stimulate a Saudi Aramco gas producer increased its productivity by almost 100% over the pre-stimulation rate.

2. The ability to monitor real-time data helped optimize and properly place the stimulation treatment fluids by avoiding the identified non-pay thief zones. Excessive fluid leakoff into the non-targeted lateral was observed early, and real-time data were used to make necessary adjustments to the fluid volume, pumping schedule and rheology.

3. Temperature profiles obtained after pumping each of the modified acid treatment stages clearly indicated significant incremental improvement towards uniform fluid placement, in direct contrast with the profiles recorded during the pre-stimulation pre-flush injection stage. Post-flush evaluation in each lateral further confirmed the efficiency of the chemical diverter.

4. One of the lessons learned from this implementation is that fluid conveyed at the BHA does not necessarily interface with the formation at a given depth, as expected, even when high pressure jetting tools are used. In presence of thief zones, fluids can be spent unnecessarily or unproductively. Therefore, the practice of pumping pre-determined stages of acid and chemical diverter

from toe to heel is probably not the most effective one, at least for the kind of formation and well completion discussed in this paper. It is worth mentioning that the pressure, temperature and CCL tool was not run in this occasion due to technical problems observed in the previous job.

5. The new CT stimulation approach tested in Well-A achieved most of the treatment objectives, thus providing an incentive to further expand the application of the technology.

Acknowledgements

The authors express their appreciation to Saudi Aramco and Schlumberger management for their permission to publish and present this work. Special recognition goes to Tashfeen Sarfraz and Danilo Cesar da Silva, who actively participated in the implementation of this job. The close cooperation and support provided by other Saudi Aramco organizations, including Gas Reservoir Management and Gas Well Services and Completions, which made the field trial possible are also gratefully acknowledged

Nomenclature

BHA = Bottom-hole assembly
BHP = Bottom-hole pressure
BHT = Bottom-hole temperature
bpm = Barrels per minute
CCL = Casing collar locator
CT = Coiled tubing
DTS = Distributed temperature survey
ESP = Electric submersible pump
FOECT= Fiber optic enabled coiled tubing
FOC = Fiber Optics Carrier
ID = Inside diameter, in.
MD = Measured depth, ft
MLT = Multilateral tool
MRC = Maximum reservoir contact
MSRT = Multi-lateral selection reentry tool
OD = Outside diameter, in.
POOH = Pull out of hole
psi = Pounds per square inch
RIH = Run in hole
TD = Total depth, ft

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New Filtration Control Polymer for Improved Brine-based Reservoir Drilling Fluids Performance at Temperatures in Excess of 400°F and High Pressure

By R.G. Ezell, A.M. Ezzat, J.K. Turner SPE Halliburton; J.J. Wu Champion Technologies.

Brine-based reservoir drilling fluids are a special class of fluids designed to minimize formation damage, provide the necessary hole cleaning, and help reduce well-bore cleanup time and cost, and allow producing potential reservoirs to the maximum of their potential.. These fluids should address the wide range of difficulties frequently encountered in horizontal drilling, completion, and workover operations. Filtrate control chemicals for currently available drill-in fluids systems exposed to extreme high bottom hole temperatures and pressures conditions are not effective or stable for drilling long horizontal sections of the reservoir. Failure to secure low filtration rate and thin wallcake causes stuck pipe and losses of expensive downhole tools.

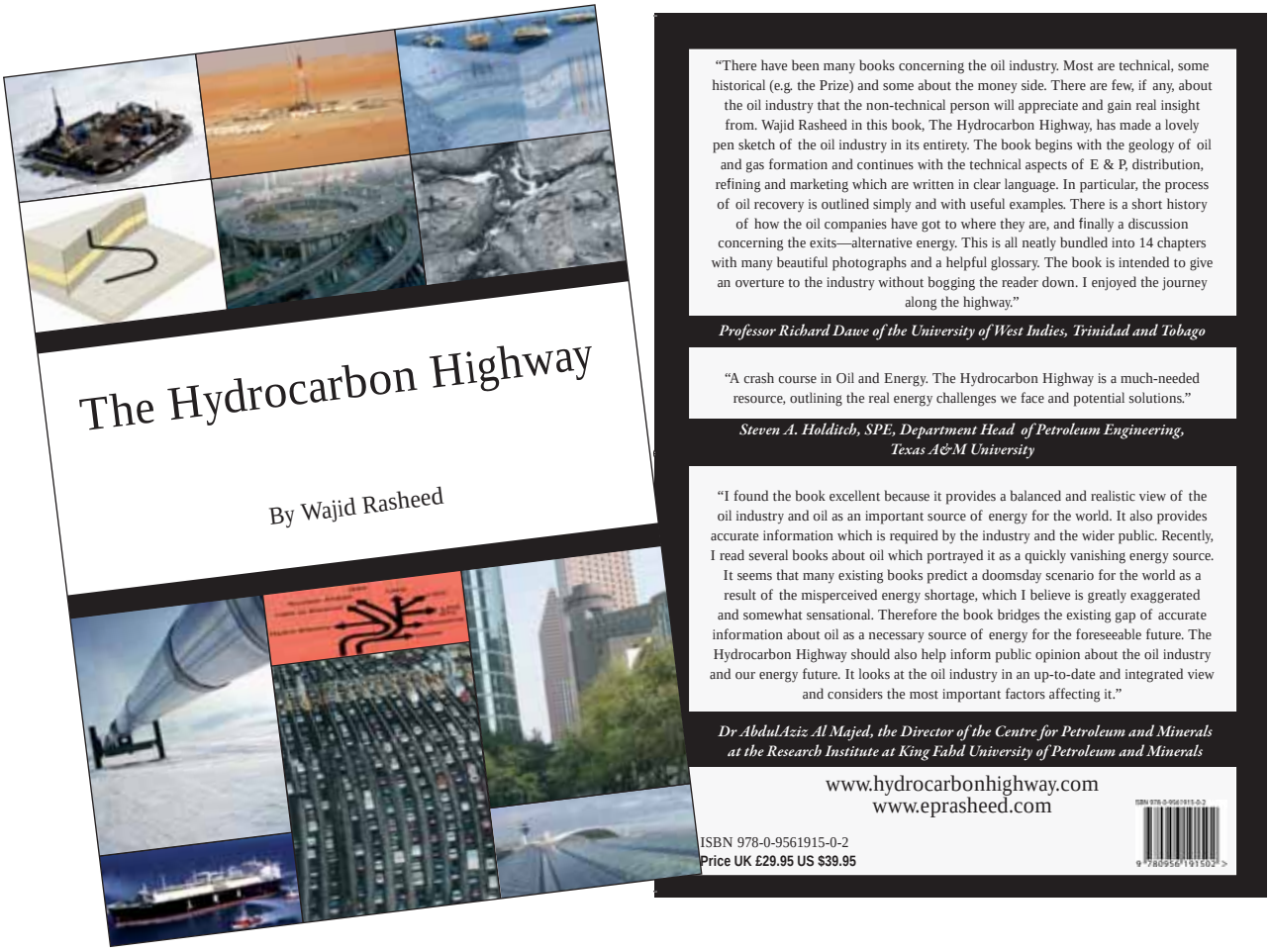
Conventional fluid loss control additives for high performance brine-based drill-in fluids include nonionic water soluble polymers, such as starches, derivatized starches, gums, derivatized gums, and cellulosics.

Cross-linked starches are often considered the benchmark of performance for utilization in reservoir fluids but, they do not have thermal stability that is required for successful employment at temperatures exceeding 300°F for extended contact periods.

Conventional linear synthetic polymers are also utilized, but oftentimes, they require another additive, such as phyllosilicate particles, to be able to effectively function as fluid loss control additives. However, the use of clay can be problematic in drill-in fluids, as removing the clay from the subterranean formation can be difficult because it infiltrates into pores of the subterranean formation. Furthermore, the addition of the linear synthetic polymers to a treatment fluid dramatically increases the viscosity of the fluid, which can result in increased ECDs and decreased drilling rates.

Through advanced polymer synthetic techniques, the novel polymeric fluid loss control additive has been developed for brine-based reservoir drill-in and completion fluids. The new polymer provides enhanced thermal stability to temperature in excess of 400oF in monovalent and divalent halide brines. This paper will present detailed fluid formulations and discusses the polymer evaluation data under simulated downhole HPHT conditions.

Pipelines and Tankers



Transportation of oil and gas is a key factor affecting the industry. Only rarely are oil or gas fields conveniently located next to consumers. This chapter looks at how oil, gas and products reach consumers.

Gas, which requires a huge distribution infrastructure, is particularly affected. Only recently have such solutions as Liquefied Natural Gas (LNG) and Compressed Natural Gas (CNG) tankers allowed many countries to export their natural gas. Qatar, Nigeria and Trinidad, for example, produce far more natural gas than their domestic market requires. The best solution for these countries is to convert their gas to LNG which can be transported to a variety of markets in the world by ship.

Pipelines are the most common forms of transporting crude oil, natural gas, refined products, derivatives and ethanol. They are highly efficient and this is a major reason that oil and gas is such a popular energy source. In fact, pipelines are so efficient that coal companies have tested their use for transporting coal. The coal is ground up into small particles that are pumped within a liquid slurry from the mines to their principle destination, power generating stations or large industrial complexes.

Pipelines extend from oil and gas producing fields, which in turn receive oil and gas from many wellheads. The delivery point can be refineries, liquefaction facilities, petrochemical plants or ports for tanker shipping. Before transportation can occur, however, a complex network of pipelines and associated infrastructures must be in place. Pipelines range from small-diameter field flow lines and gathering lines to huge transcontinental lines.

Oil companies use complex software to visualise, plan, route and monitor pipelines.

While this allows routes to be visualised, any relevant geological and geotechnical features of the route will be subject to local inspections and using a 3D visualisation model developed from aerial photographs and topography data processing. Nowadays, where the use of technological innovation allows capturing, storing and processing a large amount of information, the features visualised on flat paper can be brought to life in 3D forms. Principal considerations range from socio-environmental factors to pipeline design and sizing, data transmission, control systems and leak detection[1].

Socio-Environmental Factors

Achieving a balance between transporting crude oil, natural gas and its derivatives and acting in a socially responsible manner is not easy. Although pipelines are rec-ognised as one of the safest forms of hydrocarbon transportation and distribution, they require a high degree of monitoring and management. Such care is not only restricted to the oil company, but also encompasses the community that may be affected by the construction of a pipeline. In cases where this occurs, participation of communities that live near the pipeline is vital. If communities participate fully at the planning stages, recommendations can be made regarding the use of land that surrounds the pipeline. This contributes to maintaining harmonious relationships between operators and host communities and reduces the risk of conflicts developing years later. The aim is to maintain a positive co-existence between the populace, host communities and the pipeline network[2].

Pipeline Design and Construction

This involves new-build pipeline projects where designs aim to reduce costs, minimise environmental impact and ensure the safe operation of the pipeline. Often this involves the mapping and registration of any existing buried or submerged pipelines as well as the analysis of any likely structural problems. Pipelines installed in unstable geological areas must undergo geotechnical surveys to determine the risk of soil movement or formation collapse. The interaction between the soil and the pipeline is constantly assessed in order to guarantee the structural integrity of the line. For buried pipeline applications, new technologies are being developed and applied to improve safety and these include 3D visualisation and monitoring systems as well as the evaluation of the soil-pipeline interaction[3].

In order to guarantee the structural integrity of the pipelines installed in these areas, it becomes necessary to survey and map all the unstable areas and study soil mass movements. Creep movements usually involve extensive areas and present slow speed. In general, they are difficult to detect through visual inspection. Natural subsidence, or compaction of shallow sediments, can cause extreme stress on buried lines that can result in damage or rupture.

Types of Pipelines

Oil and gas pipelines are often welded together in the case of steel pipes or specially connected in the case of composite materials. Inner diameters can reach 48 inches (121 cm) and pipelines may stretch for many miles onshore and offshore. Onshore pipelines may be placed within trenches a few feet below ground or they may be suspended off the ground using steel supports. Offshore, pipe laying vessels such as barges are required to trench and lay pipelines. Pipelines maybe created on site with pipe joints welded together on the vessel. Alternatively, pipe joints are often welded together on land into a continuous pipeline unit which is then floated out to the site for layout saving time and money.

The oil and gas is kept mobile within the pipeline by pumping and compressor stations which are carefully spaced along the pipeline according to mobility requirements.

Multi-product pipelines are used to transport two or more different products in sequence in the same pipeline. Usually in multi-product pipelines, there is no physical separation between the different products. Some mixing of products occurs, creating an interface which is removed from the pipeline at receiving facilities and segregated to prevent contamination. If fluids are to be completely segregated from one another, a device called a ‘pig’ is inserted in the line between the two liquids. Pigs are pliable plugs that can be pumped through the line for long distances. They can negotiate bends in the line and are retrieved by a ‘pig trap’ that operates like an air-lock at the destination end.

Remote Operations and Control Compressor Stations

Compressor stations along natural oil and gas pipelines are often remotely operated. System and equipment status as well as any alarm data are exchanged with a Control and Supervision Centre (CSC) through a Supervisory Control and Data Acquisition (SCADA) system.

Supported by the SCADA software, operators receive immediate detailed information about what is happening in the pipelines. By monitoring the levels of flow, pressure and temperature of the oil and gas and, at the sign of any abnormality, the system allows for pumps to be switched on or off and valves to be opened or closed within any segment of the entire pipeline. This helps operators avert leakages, blockages and maintains the safe and productive operation of the pipeline.

Such systems can perform a range of control actions such as starting and stopping compressor units and stations as well as remotely setting pressure and flow control points[4]. In addition, most compressors and line pumps are instrumented with sensors and associated telemetry that monitors their 'health' status around the clock.

This can provide an early warning of dangerous operating conditions or impending failures and enable operators to take timely action.

Storage

Demand cycles particularly affect the gas industry. Gas, used primarily for home heating, sees widely fluctuating demand between summer and winter. Building a pipeline large enough to handle wintertime demand would be a waste of money because it would only be used efficiently for a few months each year. A system is needed that could accept a steady stream of natural gas all year long, storing it at the terminal end during the summer months against peak demand during the subsequent winter. Storing the huge volumes of gas in surface tanks was impractical and uneconomic so companies created gas storage fields. These consist of storage wells that access depleted oil or gas reservoirs, or large aquifers. Gas is pumped down into these wells in the summer and then produced into the distribution network in winter. Alternatively, large caverns can be leached into salt domes to form huge subterranean storage chambers.

Pipeline Systems

Pipeline rated operating pressures will be dictated by several factors including hydrocarbon type, pipeline length, pipeline integrity and others. Often stations are located along the pipeline and will typically use reciprocating compressors driven by gas engines. To provide efficient outflow of large volumes, pipelines with greater diameters and higher pressure ratings are required. Increasing steel burst strength by specifying different alloys means thinner pipe can be used. The benefits include saving steel by weight reduction, thereby reducing the costs of pipe purchasing, pipe construction and assembly[5].

Remote Data Transmission

This involves the monitoring of all operating parameters and events of station equipment and systems. Typically this includes:

- Operating data such as pressure, temperature, power consumption and flow rates, and
- Fire and leak detection with remote signalling.

All the data mentioned above has to be available as continuous, real-time information to CSC operators[6].

SCADA

This system is made up of two basic sub-systems: the control and supervision centre and the local operation station. The components of the control and supervision centre are described below:

- Real-time database server: All the current data is stored on redundant servers which continuously communicate with the local database on the compressor stations to receive process data and send operator commands
- Historical database server: These servers receive data from real-time servers, storing process data on hard disk and tape cartridges
- Human-machine interface: This is used by operators to supervise and control the pipeline. From these stations, data can be accessed via real-time servers, historical servers and an advanced functions station
- Engineering station: This station is used for developing and testing purposes
- Advanced functions station: This workstation runs the pipeline simulator. Additionally, there are three software modules for pig tracking, inventory calculation (line-pack) and leak detection
- Very Small Aperture Terminal (VSAT) communication system: This system comprises a personal earth station at the CSC, a hub station at the provider's installations, and a personal earth station at each compressor station

• INMARSAT communication system: This is used for communication with the city gates where natural gas from a pipeline enters the smaller diameter distribution network. This system does not communicate continuously. The operation is periodic (every four hours) and by exception (from the city gates to the CSC)
• Leased lines: These lines are used as backup for the VSAT system at the compressor stations, and
• Global Positioning System (GPS): These systems are used to maintain each compressor station synchronised with the CSC.

The components of the local operation station, which is provided at each compressor station, are described below:

• Local database and operation station: This redundant server has the function of continuously gathering data from the programmable controllers, and sending data for the real-time database server at CSC. These stations can be used to operate the compressor station in case of communication problems with the CSC
• Programmable Logic Controller (PLC): The PLC is used for process control and interlocking. There is a PLC for each turbo compressor and one redundant Central Processing Unit (CPU) for utilities such as generator sets, switchgear, fuel gas systems, compressed air systems, etc.
• VSAT communication system: As described above for CSC
• Leased line: As described above for CSC, and
• GPS: This is used for time synchronisation between the compressor station and the CSC.

Operational stations continuously communicate with the CSC servers. From these stations, it is possible to access all the operational and maintenance data from the area of responsibility of each operational division[7].

Corrosion Management

By preventing corrosion-related failures, corrosion management technology increases operational reliability standards, reduces environmental damage and extends the lifespan of the pipeline network[8].

Systems Capable of Detecting Leaks

Oil companies can detect leaks more efficiently by pinpointing oil, gas or other derivative leaks in pipelines. Overall, this improves profitability by reducing the loss of hydrocarbon products and any environmental impacts. Leak detection technology is used in oil and gas to minimise product losses with a consequent reduction in the environmental impact as well as the costs. A flow and leak detection simulation system for multipurpose pipelines can be employed by the oil company for this purpose[9].

Rehabilitation of Pipelines

The reason for rehabilitating pipelines is to make the best use of existing resources and to minimise the need for new builds. This, however, requires integrity criteria to be met which will extend the lifespan of the pipeline network. Hydrostatic test methodologies, certification criteria and commonly available repair techniques are all employed. Oil companies are benefitting through higher pipeline utilisation factors, more flexible and economic pipeline repairs, reduced maintenance costs and enhanced safety. To repair in-service pipelines, welding of in-service pipelines and the use of composite materials are commonly used[10].

Figure 1 - Modern Pipeline, Shipping and Product Remote Operations Centre (Saudi Aramco)

Pigging Technology

'Pigs' play a vital role in keeping the pipelines operational. Pigs are instrumented battery-powered devices that can be pumped through the pipeline to inspect for corrosion, cracking or buckling both internally and externally. Their usage helps ensure the integrity of the pipeline and keeps the flow of products going. Pigs also help reduce the risks of environmental damage and avoid emergency shut-downs.

Both onshore and offshore pipelines can be inspected using pigs.

Pipeline Material Technology

By using advanced materials, operators can reduce costs, increase reliability and extend the life of a pipeline. High-strength steel has been developed for use in large pipelines in order to increase operational safety and reduce the costs of building new pipelines. Models for the simulation of pipeline structural behaviour are also used extensively in order to identify defects and their repair needs.

Figure 2 - The Baku-Tbilisi-Ceyhan Pipeline is 1,099 miles (1,768 km) Long (Courtesy of BP)

Coiled tubing can also be used as an effective tool for pipeline applications. This includes the transportation of pigs, removing organic deposits and hydrate plugs or sand and placing a patch or liner to repair minor leaks.

Transfer Systems

These solutions help ensure optimal production flow and supply to the oil and product markets. Studies and tests for the application of friction reducers are carried out for oil product pipelines and this has shown to be viable in various types of pipelines, especially those with utilisation factors close to capacity. The next challenge is the development of proprietary additives to further enhance transfer; for example, to facilitate the transport of heavy crude from the oilfields of Venezuela to the port terminal on the Caribbean Sea, a solvent is added to the crude to reduce its viscosity. This solvent is subsequently separated and retrieved at the terminal end and pumped back to the source to be re-used.

Tankers

Crude oil tankers make up many of the world's largest ships, hence the common term 'supertanker'. Vessels are classed as Ultra Large Crude Carriers or ULCCs (a handful of which are able to carry more than three million barrels [MMbbl] of oil) and Very Large Crude Carriers or VLCCs (which may carry approximately two MMbbl of oil).

Another fleet class exists at the one MMbbl mark and refers to ships that serve smaller ports where larger counterparts cannot berth[11]. Refined oil products are carried by far smaller vessels carrying half a MMbbl of oil to storage depots or other facilities. These vessels begin the distribution process of moving oil from the refineries to the tanks in consuming countries, from where the oil cargoes are fed by road, rail, pipeline and coastal tankers and inland tank barges to power stations and depots close to where the products are consumed.

Tankers are advantageous over pipelines as they are can respond to market fluctuations much more quickly. Cargo can be distributed to any destination in the world that has berthing facilities. However, they are limited to carrying capacity and potential delays in delivery.

Modern tankers are usually built with a lattice construction and double hull to enhance safety. Tankers are often filled using onshore pumps, but are discharged using the tankers' own pumps.

LNG Tankers

LNG tankers must be specially designed to meet the needs of LNG transportation*. Special needs are generated by the very low temperatures that must be maintained to keep gas at a pre-determined liquefied state. LNG companies mostly build LNG ships for a specific project, then own and operate them thereafter. Construction costs have dropped from US $280 million in 1995 (for a 138,000 m^3 capacity ship) to US $150 to $160 million in 2004. This is still more than double the cost of a crude oil tanker. Most added costs relate to the construction of insulated tanks[12].

LNG shipping costs vary based on the ship's operating and amortisation costs, the size of the cargo, and the distance transported. The costs of building and operating receiving terminals, unloading, storage, and re-gasification facilities vary by site. In the US, new onshore terminals built on existing designs are expected to cost US $400 million or more[13]. The cost of constructing offshore LNG facilities is substantially higher. LNG is transferred from the production facility to the tanker's storage tanks using specially constructed booms and pumps. Specially configured loading pipes are designed to withstand the very low temperatures necessary for liquefaction.

The two main designs are the membrane and spherical tanker type. The former has multiple tanks with linings made from thin nickel steel alloys capable of withstanding extreme temperatures. These tanks are integrated into the hull of the ship.

The spherical design tanker has characteristic circular containment tanks that are structurally supported by beams in the hull of the ship[14].

We have seen that the main ways to transport oil and gas are pipelines and tankers. But what happens to crude oil once it has been transported? What needs to be done to prepare the oil and gas for the end customer? How do we take crude oil and turn it into useable products? This is where refining fits in and turns crude into products and feedstock. Refining is core to delivering all the products that oil and gas has to offer; in other words, releasing its commercial value.

Figure 3 - The Trans Alaska Pipeline (BP)

Figure 4 - Ultra-Large Crude Carrier (Saudi Aramco)

Figure 5 - The Nilza Tanker (Petrobras)

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Saudi Downstream
الصناعات التحويلية السعودية
المنتدى الأول

Dear Colleague,

It is our pleasure to inform you of CWC's upcoming meeting, Saudi Downstream, taking place on 8-9 March 2011 at The Mövenpick, Yanbu. The Strategic Forum & Exhibition will be under the patronage of the Custodian of the Two Holy Mosques King Abdullah and is hosted by the Royal Commission for Jubail and Yanbu.

This meeting will look at the investment opportunities in the downstream petrochemical and minerals sectors of Jubail, Yanbu and Ras Azzour and will welcome senior stakeholders, international Minister's for trade, thought leaders and major investors.

This strategic investment meeting has the full support of Sabic, and Saudi Aramco as well as much of the private sector in Kingdom, and will provide you an opportunity to discuss how your business can capitalise from the huge investments being made in these sectors, and to take advantage of one-to-one meetings with stakeholders and potential partners.

This is a rare opportunity for you to position your organisation alongside the Ministry of Petroleum & Mineral Resources, the Ministry of Commerce & Industry, the Ministry of Finance, the Royal Commission, Sabic and Saudi Aramco and to also discuss how you can work together to achieve your common goals at the most senior level.

Other organisations sending senior delegations include: Islamic Development Bank, NICDP, SIDF, Saudi Ports Authority and KACST.

On behalf of HH Prince Saud Bin Thunayan Al Saud and the Royal Commission, we look forward to welcoming you to Saudi Arabia.

Yours truly,

Simon Gosling
Vice President - Middle East, The CWC Group

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Saudi Downstream | Strategic Forum & Exhibition

About the Event

Saudi Downstream will host the first forum and exhibition in Saudi Arabia to focus on the downstream petrochemicals and mineral industries. Organised on behalf of the Royal Commission of Jubail and Yanbu, the forum will explore the opportunities within the Kingdom's downstream petrochemical sector which will play a central role in the diversification of the economy.

"Our vision at Saudi Downstream is to make ourselves available to those companies hoping to capitalise on the unrivalled low cost of land, utilities and feedstocks that we benefit from here in Kingdom. We are here to support your investment!"

H.E. DR ALAA NASSIF, ROYAL COMMISSION FOR JUBAIL AND YANBU

OFFICIAL OPENING & KEYNOTE ADDRESSES FROM:

- Custodian of the Two Holy Mosques
  King Abdullah Bin Abdulaziz Al Saud
- **HH Prince Saud Bin Abdullah Bin Thunayyan Al Saud**
  Chairman of *Royal Commission for Jubail and Yanbu* and Chairman of *SABIC*
- **H.E. Abdullah Zainel Alireza**
  Minister for Commerce & Industry
- **H.E. Ibrahim Al Asaaf**
  Minister for Finance

HOSTED BY
ROYAL COMMISSION FOR JUBAIL AND YANBU

ORGANISED BY
CWC

SPONSORED BY
ALTURKI

Strategic Forum

Key topics for discussion include:

- Feedstocks and pricing
- Industrial expansion
- Integrated projects and joint ventures
- Specialty chemicals
- Downstream minerals – zinc, aluminum, copper and the mineral map
- Project financing and enablers

Sponsorship

To receive further information on how **Saudi Downstream** can benefit you through:

- SPONSORSHIP
- NETWORKING
- BRANDING
- EXHIBITING

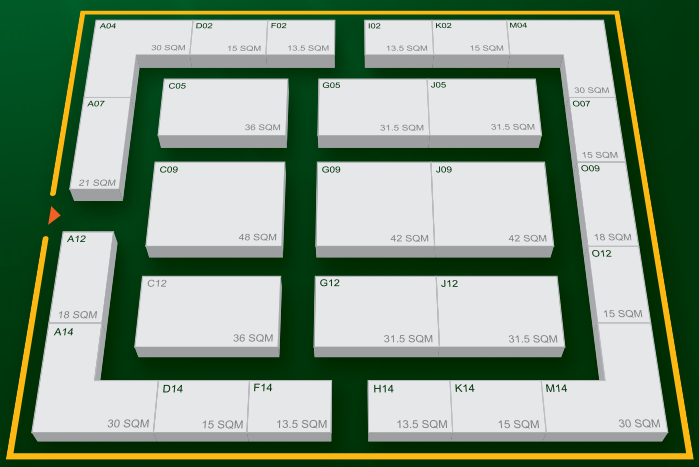
Contact Chris Hugall on +44 20 7978 0084 or email chugall@thecwcgroup.com

Exhibition

Participating at the **Saudi Downstream** exhibition will enable you to showcase your products which will help transform the Kingdom in to a manufacturing powerhouse and leading exporter of petrochemicals across the region.

Exhibition stands are in high demand for this prestigious event. Contact us today to discuss stand availability and prices.

Contact Shunker Goel on +44 20 7978 0080 or email sgoel@thecwcgroup.com



www.saudidownstream.com

Saudi Downstream
الصناعات التحويلية السعودية
المنتدى الأول

HOSTED BY

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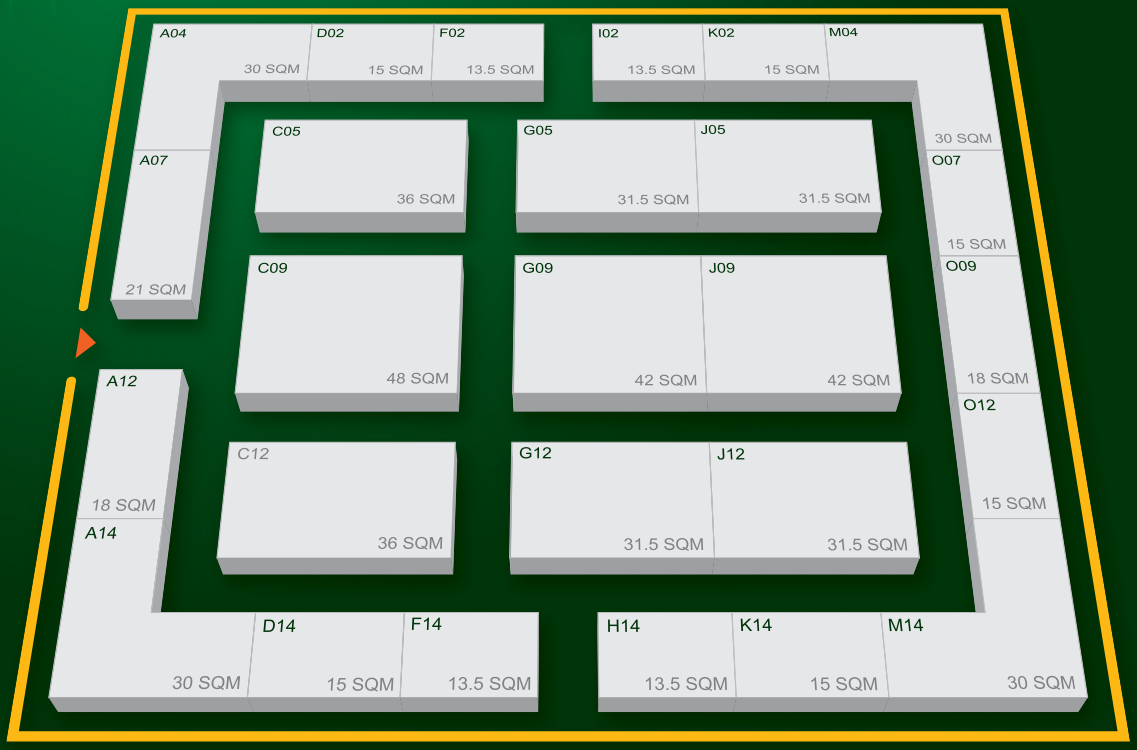

Strategic Forum & Exhibition | 8-9 March 2011 | Yanbu Al-Sinaiyah

The first event to be held under the patronage of the Custodian of the Two Holy Mosques, **King Abdullah Bin Abdulaziz Al Saud**, focusing on the downstream petrochemical and mineral industries.

The exhibition unites all companies involved in the downstream petrochemical industries, focusing on the investment opportunities available in the Kingdom.

Benefits of Exhibiting

- *Introduce and showcase new products*
- *Strengthen your presence within the petrochemical market*
- *Meet face-to-face with buyers and investors*
- *Keep up-to-date with other industry product development and innovations*
- *Network with key industry figures and find out more about investment specifications*

Visitor Tickets

FREE TO ATTEND

The **Saudi Downstream Exhibition** is free to attend for all industry trade professionals. Register online for your free visitor ticket at **www.saudidownstream.com**

BOOK YOUR STAND NOW!

Exhibition stands are in high demand for this prestigious event.

Contact Shunker Goel today on **+44 20 7978 0080** or email **sgoel@thecwcgroup.com** to discuss stand availability and prices.

WITH THE PARTICIPATION OF

Kingdom of Saudi Arabia
Ministry of Commerce & Industry

Kingdom of Saudi Arabia
Ministry of Petroleum and Mineral Resources

Ministry of Finance

لتجمعات الصناعية
Industrial Clusters

سابك
sabic

ارامكو السعودية
Saudi Aramco

www.saudidownstream.com

SAUDI DOWNSTREAM STRATEGIC FORUM & EXHIBITION

Jubail, Yanbu and Ras Azzour: Open for Business



From the 8-9 March 2011 the Royal Commission for Jubail and Yanbu are hosting the region's most high-profile downstream petrochemical event, Saudi Downstream.

Under the leadership of the Royal Commission, the transformation of Jubail and Yanbu in to world-class industrial cities for the petrochemical and energy-intensive industries has been accomplished with an investment of over $20 billion and has witnessed the creation of over 200 industries that have invested an additional $42 billion, providing employment for over 85,000 workers.

The 157,000 residents of the two cities enjoy world class amenities and security, with low cost utilities and land and exceptional transport and infrastructure links all provided at highly competitive rates by the Royal Commission.

Saudi Downstream is the platform where Saudi Arabia's senior stakeholder's will showcase this extraordinary success and explain in detail how they plan to maintain this growth and their commitment to the future development of the region and the energy intensive industries.

Being the first event focusing on the downstream petrochemical and mineral industries to be held under the patronage of the Custodian of the Two Holy Mosques, King Abdullah Bin Abdulaziz Al Saud this event will cement relationships for companies looking at establishing their role in the Kingdom's stable, yet booming economy.

Saudi Downstream is fully supported by Sabic and Saudi Aramco, as well as the Ministry of Petroleum and Mineral Resources, the Ministry of Finance, the Ministry of Commerce and Industry.

If your company is considering the opportunities in Kingdom and being a part of the increasingly integrated upstream and downstream industry which reaches deep in to Asia, Africa and Europe and the Americas then your senior management must attend. One-to-one meetings are available for peer-to-peer senior management.

For chemical companies looking to showcase their technologies, the exhibition is the central part of the event where investors will network with key industry figures and find out more about investment specifications including:

- *Feedstocks and pricing*
- *Capital finance, including government loans via the Saudi Industrial Development Fund*
- *Ownership rights and partnership liabilities*
- *Available infrastructure*
- *Logistics including transportation in and out of the region*
- *The costs of setting up in the region*

Needless to say, for any company already investing in Kingdom and for those companies considering the potential of setting up a manufacturing base within Jubail, Yanbu and Ras Azzour, the benefits are numerous.

Saudi Downstream is the opportunity for your company to develop long term relationships and partnerships with key stakeholders and decision makers in Saudi Arabia; within two days you will qualify how lucrative the market can be for you.

For more information on Saudi Downstream contact Chris Hugall on **+44 20 7978 0084** or visit **www.saudidownstream.com**

For more information on The Royal Commission, visit **www.rcjy.gov.sa/en-us**

Royal Commission For Jubail and yanbu

Saudi Arabia – the world's most important hub for downstream petrochemical and mineral production

ROYAL COMMISSION FOR
JUBAIL AND YANBU

THE ROYAL COMMISSION

Responsible for your investment needs in Saudi Arabia

Massive feedstock cost advantage and supportive governmental policies coupled with world-class facilities in all aspects of scale, performance, safety and in every aspect of competitiveness, along with favourable logistics conditions to supply both Europe and the Asia Pacific region make Saudi Arabia one of the most important investment destinations for the energy intensive industries.

With future investments in excess of US$100bn in the increasingly integrated upstream and downstream sectors Jubail, Yanbu and Ras Azzour provide your business a hub for stability and growth.

Principle feedstocks include: Methane, Ethane, Propane, Butane, LPG, NGL, Kerosene, Diesel, Lube Oil, MTBE, Aromatics/Alphatic, HD Polyethylene, Linear LD Polyethylene, Propylene, Polypropylene, Xylenes, Benzene, Purified Terephthalic Acid, Nitrogen, Oxygen, Sulphur Chlorine and Caustic Soda.

www.rcjy.gov.sa/en-US | www.saudidownstream.com

REGISTRATION FORM

Saudi Downstream
الصناعات التحويلية السعودية
المنتدى الأول

Strategic Forum & Exhibition: 8-9 March 2011

Please complete in block capitals or attach a business card

Company Name:

Address 1:

Address 2:

Town/City:

County/State: Postal/Zip code:

Country:

Business Type:

Contact for payment:

Telephone: Fax:

Email:

VAT Reg Number

Signature

DELEGATE DETAILS:

Delegate 1:

Surname: (Dr/Mr/Mrs/Ms/Miss)

First Name(s):

Position:

Department:

Email:

Telephone: Mobile:

Delegate 2:

Surname: (Dr/Mr/Mrs/Ms/Miss)

First Name(s):

Position:

Department:

Email:

Telephone: Mobile:

Delegate 3:

Surname: (Dr/Mr/Mrs/Ms/Miss)

First Name(s):

Position:

Department:

Email:

Telephone: Mobile:

DATA PROTECTION

The personal information provided by you will be held on a database and may be shared with companies in the CWC Group Limited. Sometimes your details may be made available to external companies for marketing purposes. If you do not wish your details to be used for this purpose please write to: Database Administrator, CWC Group Limited, Regent House, Oyster Wharf, 16-18 Lombard Road, London SW11 3RB, UK or email database@thecwcgroup.com

REGISTERED OFFICES

CWC Group Limited, Regent House, Oyster Wharf, 16-18 Lombard Road, London SW11 3RB, UK

3 EASY WAYS TO REGISTER

1. **ONLINE** - at www.saudidownstream.com
   The quickest & easiest way to book
2. **FAX** - Your completed form to
   +44 20 7978 0099
3. **POST** - Your completed form along with payment to **CWC Group Limited, Regent House, 16-18 Lombard Road, London, SW11 3RB UK**

PRICING

Package A - Conference Only
(8-9 March 2011) US $1,950

PAYMENT DETAILS

☐ Cheque: I enclose a cheque made payable to CWC Group Limited. Please send to CWC Group Limited, Regent House, Oyster Wharf, 16-18 Lombard Road, London SW11 3RB, UK

☐ Bank Transfer Account No: 67060422
Sort Code: 20-78-58 Swift code: BARCGB22
Barclays Bank (Slough)
UK IBAN: GB02 BARC 2078 67060422
All bank transfers must be marked clearly with the delegate name/ invoice number

☐ Debit/credit card Please debit my card
☐ MasterCard ☐ VISA (tick and complete details)
An additional 1.5% finance charge will be applicable on all card transactions

Card No ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ Security code ☐☐☐

Today's Date: Expiry Date:

Name on Card:

Billing Address:

Postcode: Country:

Signature:

BOOKING CONDITIONS

Payment should be made within fourteen (14) days from the date of booking. Full payment must be received for entrance to be guaranteed.

A confirmation letter and invoice will be sent to you on receipt of your booking. Should you be unable to attend, a substitute delegate is welcome at no extra charge. Cancellations must be received in writing not less than fourteen (14) days prior to the event, you will then receive a credit note for 100% of the contract fee paid to be used at another CWC Group event which must occur within one year from the date of issuance of the credit note. In the event that CWC cancels or postpones an event for any reason and the delegate is unable or unwilling to attend the rescheduled date, you will receive a credit for 100% of the contract fee paid. You may use this credit for another CWC event, which must occur within one year from the date of cancellation or postponement. Except as specified above, no credits will be issued for cancellations. There are no refunds given under any circumstances. Non-payment or non-attendance does not constitute cancellation. The booking fee does not include accommodation or travel costs; these are the responsibility of the Delegate. It may be necessary for reasons beyond the control of the organisers to alter the content, timings or venue. The Company will not accept liability for any transport disruption or individual transport delays and in such circumstances the normal cancellation restrictions apply.

VENUE INFORMATION

Mövenpick Hotel & Resort Yanbu
Al Mahaar Island,
Royal Commission
Yanbu
Saudi Arabia
Phone:+966 4 393 33 33

ACCOMMODATION

The conference fee does not include accommodation. A limited number of reduced room rates have been reserved for delegates at the Mövenpick Hotel & Resort Yanbu, Saudi Arabia. Accommodation information will be sent to you with your confirmation letter by our Client Services Team when you register.

For discounted reservation rates please email: hotel.yanbu@mövenpick.com

Under the patronage of His Royal Highness Prince Khalifa bin Salman Al Khalifa
Prime Minister of the Kingdom of Bahrain

Society of Petroleum Engineers

ufi Approved Event

MEOS 2011

17th Middle East Oil & Gas Show and Conference

Conference: 20-23 March 2011
Exhibition: 21-23 March 2011

Bahrain International Exhibition and Convention Centre

www.MEOS2011.com

Organisers

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Arabian Exhibition Management

fawzi@aeminfo.com.bh

Worldwide Co-ordinator

oes

meos@oesallworld.com

Conference Organisers

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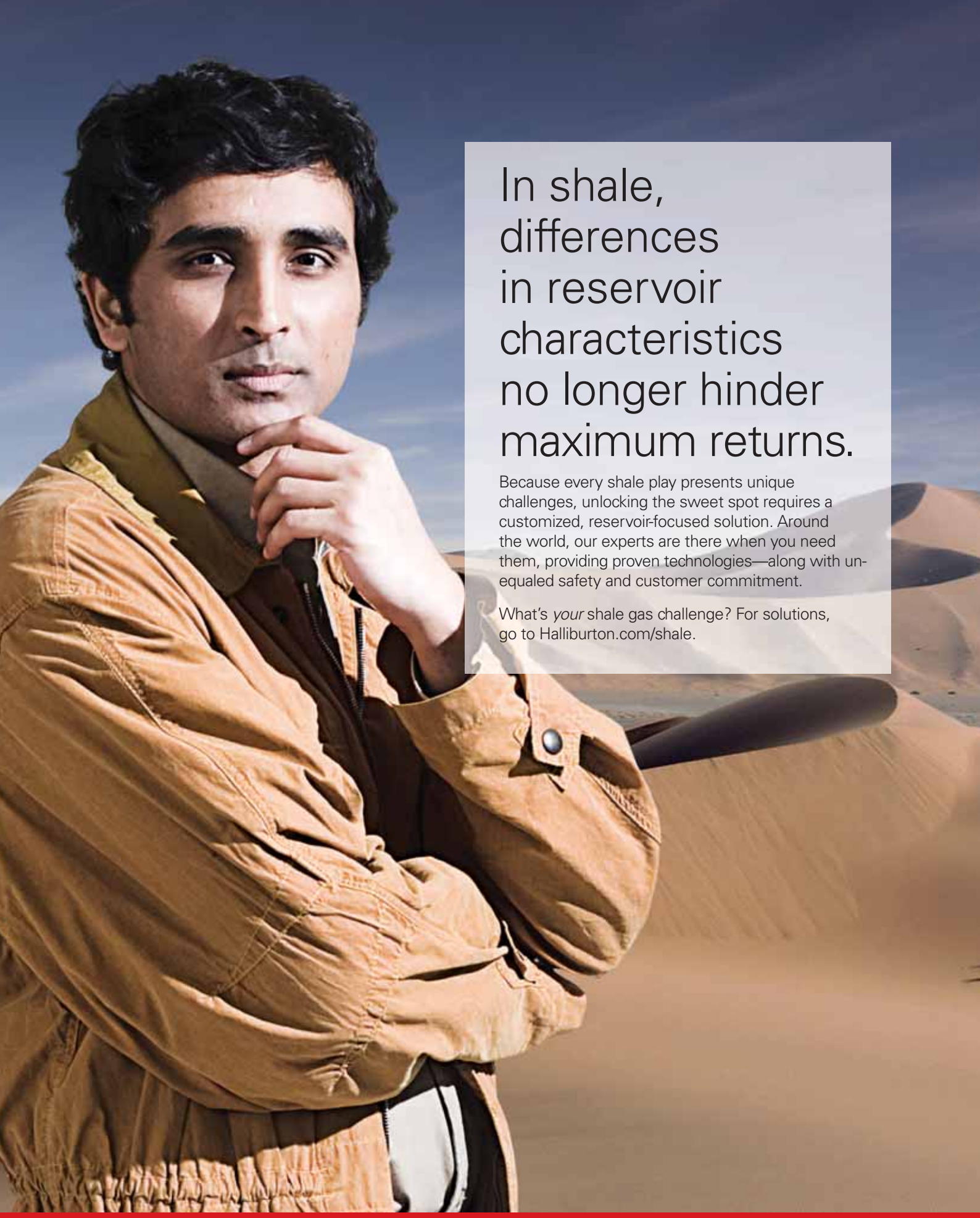
Contribute to Saudi Arabia Oil & Gas during 2011

EPRasheed is looking for editorial submissions on the topics outlined in the editorial calendar. This can provide your company with the opportunity to communicate EP technology to the wider oil and gas community. Please send abstracts or ideas for editorial to **wajid.rasheed@eprasheed.com**

Preference is given to articles that are Oil Company co-authored, peer reviewed or those based on Academic research.

Editorial 2011 Calendar

Jan/Feb	Mar/Apr	May/Jun	Jul/Aug	Sep/Oct	Nov/Dec
• Saudi Aramco RTOC • Digitalization • While Drilling Technology • Telemetry • Production • Extended Seismic Feature (4D, OBC, Wide Azimuth)	• Khurais • Near Surface Modelling • Rotary Steerable & Motor Systems • Drill Bits and Underreamers • Complex Wells • Geophysical • Drill-Pipe Integrity	• Manifa • Remote Operation Centres • Drill-Bit Technology • Advances in Drill-Pipe • Zonal Isolation (incl. Packers, Multi-Zone Completions) • Carbonate Reservoir Heterogenity • Exploration Rub Al Khali	• Shaybah • Drilling Optimization • Formation Evaluation • Wellbore Intervention • Casing While Drilling • Multi-Laterals • Tubulars	• Khursaniyah • Passive Seismic • Expandable Completions • Tubulars • Logging and Measurement WD • Environmental Stewardship • Refining	• Hawiyah • Smart Completions • I field • Geosteering • GOSP • OGEP
BONUS CIRCULATION					
	10th Middle East Geoscience Conference & Exhibition 4-7 March 2011 Manama Kingdom of Bahrain **17th Middle East Oil & Gas Show and Conference** 20-23 March 2011 Manama Kingdom of Bahrain Saudi Downstream **Strategic Forum & Exhibition** 8-9 March 2011 Yanbu Al-Sinaiyah	**SPE/DGS Annual Technical Symposium & Exhibition** 15-18 May 2011 Seef Center Khobar, Saudi Arabia **73rd EAGE Conference & Exhibition/SPE EUROPEC 2011** 23-26 May 2011 Vienna Austria		**SPE Annual Technical Conference and Exhibition** 30 Oct - 2 Nov 2011 Denver Colorado	
SPECIAL PUBLICATIONS					
	• Official Magazine	• Official Magazine		Saudi Aramco Supplement	• Official Magazine



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Because every shale play presents unique challenges, unlocking the sweet spot requires a customized, reservoir-focused solution. Around the world, our experts are there when you need them, providing proven technologies—along with unequaled safety and customer commitment.

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