



Society of Petroleum Engineers

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**Wendell De Landro**  
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**Michael Kersey**  
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**Bill Sorem**  
RasGas Co.

**Stan Tan**  
Weatherford Intl. Inc.

**Mark Van Domelen**  
Halliburton Energy Services

## SPE Applied Technology Workshop

# HIGH RATE GAS WELLS

21-24 March 2010 • Burswood Entertainment Complex, Perth, Australia

## Workshop Description

High rate gas wells are becoming more and more common throughout the world, especially in offshore environments. Australia has wells capable of over 300 MMscf/d for over ten years. Operators in Trinidad are routinely producing over 200 MMscf/d with higher rate wells capable of in excess of 300 MMscf/d. In Brazil 300+ MMscf/d wells are currently in production whilst the North Sea has fields like Ormen Lange. There are also high rate carbonate completions such as those found in Qatar. Other high rate gas well field developments are under way in India, Myanmar, and Australia. With the increasing number of high rate gas wells currently in operation, what have we learned? What are the best practices? What are the pitfalls? This Applied Technology Workshop (ATW) will examine the state of the art in high rate gas wells. For the purpose of this Workshop, a high rate gas well is defined as being capable of producing more than 200 MMscf/d.

## Workshop Focus and Objectives

This Workshop will provide excellent networking opportunities for sharing of the latest applications, best practices and related technologies surrounding the design and operation of high rate gas wells. The Workshop will cover issues from reservoir engineering, completions and production, as well as subsea and surface facilities. Topics that are expected to facilitate discussion include:

- Reservoir Monitoring and Management
- Sand Producing Formations
- Sand Face Completions
- Carbonate Completions
- Upper Completions
- High Rate Low Pressure Completions
- Surface Facilities
- Subsea Installations
- Operating High Rate Gas Wells
- Well Integrity
- Well Interventions

## Who Should Attend

This ATW will be of interest to development engineers, reservoir engineers, completion engineers, production engineers, HSE managers as well as engineers involved in subsea or surface facilities for high rate gas wells.

**EARLY BIRD REGISTRATION DEADLINE : 21 JANUARY 2010**

**REGISTRATION DEADLINE: 21 FEBRUARY 2010**

**REGISTER EARLY TO SAVE USD 100.00!**

## HIGH RATE GAS WELLS

### PRELIMINARY DAILY ACTIVITIES AGENDA

#### Sunday, 21 March 2010

3:00 p.m.	Hotel Check-in
2:00 p.m. - 4:00 p.m.	Programme Committee Meeting
5:00 p.m. - 7:00 p.m.	SPE Registration and Poster Set-Up
6:00 p.m. - 7:00 p.m.	Discussion Leaders and Session Chairpersons/Managers Briefing
7:00 p.m. - 9:00 p.m.	Welcome Reception/Dinner

#### Monday, 22 March 2010

7:30 a.m. - 8:30 a.m.	Breakfast
8:30 a.m. - 9:30 a.m.	<b>Session 1: Introduction/Opening/ Keynote Address</b>
9:30 a.m. - 10:00 a.m.	Group Photo/Coffee Break
10:00 a.m. - 12:00 p.m.	<b>Session 2: Reservoir Drainage</b>
12:00 p.m. - 1:00 p.m.	Lunch
1:00 p.m. - 3:00 p.m.	<b>Session 3: Reservoir Management</b>
3:00 p.m. - 3:15 p.m.	Coffee Break
3:15 p.m. - 5:15 p.m.	<b>Session 4: Completion (Carbonate)</b>
5:15 p.m. - 6:30 p.m.	<b>Session 5: Poster Session</b>
7:00 p.m. - 9:00 p.m.	Group Dinner

#### Tuesday, 23 March 2010

7:30 a.m. - 8:30 a.m.	Breakfast
8:30 a.m. - 11:00 a.m.	<b>Session 6: Completion (Sandface Completion)</b>
11:00 a.m. - 11:15 a.m.	Coffee Break
11:15 a.m. - 1:15 p.m.	<b>Session 7: Completion (Upper Completion)</b>
1:00 p.m. - 1:45 p.m.	Lunch
Afternoon	Rest & Recreation/Networking Opportunities/Dinner on own

#### Wednesday, 24 March 2010

7:30 a.m. - 8:30 a.m.	Breakfast
8:30 a.m. - 10:30 a.m.	<b>Session 8: Facilities and Technology (Subsea Facilities)</b>
10:30 a.m. - 10:45 a.m.	Coffee Break
10:45 a.m. - 12:45 p.m.	<b>Session 9: Facilities and Technology (Surface Facilities)</b>
12:45 p.m. - 1:45 p.m.	Lunch
1:45 p.m. - 3:45 p.m.	<b>Session 10: Operation and Intervention (Well Integrity and Reliability)</b>
3:45 p.m. - 4:00 p.m.	Coffee Break
4:00 p.m. - 5:15 p.m.	<b>Session 11: Operation and Intervention (Intervention Strategies)</b>
5:15 p.m. - 5:45 p.m.	<b>Session 12: Summary and Wrap Up</b>
6:30 p.m. - 8:30 p.m.	Group Dinner

#### Thursday, 25 March 2010

7:30 a.m. - 10:30 a.m.	Breakfast at Leisure
11:00 a.m.	Hotel Check-Out

### POSTER SOLICITATION AND INFORMATION

Poster Session Co-Chairpersons:

**Liang- Biao Ouyang**, *Chevron Australia Pty. Ltd.*

**Indran Pathmanathan**, *Halliburton Energy Services*

As an adjunct to the scheduled presentations, the Programme Committee will incorporate a poster presentation session in this Workshop. The poster session will allow participants an opportunity to present additional new ideas to those interested. The poster session is scheduled from 5:15 p.m. – 6:30 p.m. on **Monday, 22 March 2010.**

All participants are encouraged to prepare and bring a poster presentation to the Workshop. Posters will be on display for the entire Workshop period and provide participants an excellent opportunity for networking. As with the session discussions, the poster session will be conducted off the record to encourage frank discussion and presentation of unconfirmed or partial results. Presentations on both research and field experience are solicited.

#### SPE WORKSHOPS AND COMMERCIALISM

The Workshop Programme Committee has a stated policy against the use of commercial trade names, company logos, or language that is commercial in tone.

**Note that the Workshop Programme Committee will review all posters prior to display, and reserves the right to refuse permission to display any poster considered by the committee to be commercial in nature.**

The poster display should be designed for eye-level viewing and made from simple graphic materials. Size of the poster board will be advised at a later time. The poster display may include printed materials, tables, graphs, photographs, or illustrations. All the materials should be of sufficient size so as to be easily read and should be prepared in a manner that will accomplish the following:

- Identify topic by title, presenter, affiliation, address, and phone number.
- Include a brief abstract that summarises the technology to be addressed.
- Make the display as self-explanatory as possible.
- Place the information sequentially; beginning with the main idea or problem, method used, result, etc. (Draw a plan keeping the size and number of illustrations in mind).
- Keep illustrations simple by using charts, graphs, drawings, and pictures to create interest and visually explain a point.
- Use contrasting colours.
- Use large print for narrative materials. (We suggest a minimum of 24 points or 3" high letters for the title).

Whether or not you elect to participate in the poster session or have been invited by the Programme Committee to present during one of the regular sessions, please come prepared to participate actively in the discussions. Open interaction is encouraged. With the full cooperation and participation of all attendees, we anticipate an outstanding Workshop.

## HIGH RATE GAS WELLS

### PRELIMINARY TECHNICAL AGENDA

**Monday, 22 March 2010 • 10:00 a.m. - 12:00 p.m.**

#### **SESSION 2: RESERVOIR DRAINAGE**

**Session Co-Chairpersons/Moderators:**

*Azhar Al Kindi, Shell Upstream Intl.*

*Carl Stockmeyer, Baker Hughes*

This session addresses key aspects of reservoir drainage for high rate gas wells. Understanding reservoir drainage links directly to well design and the infrastructure required for field development. An important challenge is balancing the drainage scheme, and associated well architecture, with the capacity allowance for individual wells. A longer term challenge is the assessment and mitigation of the impact of high rate well drainage on complementary development projects such as infill drilling and compression.

The session sub-topics will include:

- Drainage area evaluation.
- Optimal and cost efficient drainage pattern development.
- Managed Drainage as a risk mitigation.
- Planning future development for 'High Rate' reservoirs.
- New technology enabling maximum reservoir drainage designs.

**Monday, 22 March 2010 • 1:00 p.m. - 3:00 p.m.**

#### **SESSION 3: RESERVOIR MANAGEMENT**

**Session Co-Chairpersons/Moderators:**

*Azhar Al Kindi, Shell Upstream Intl.*

*Kamel Bennaceur, Schlumberger*

This session explores critical aspects of reservoir management when being drained by high rate gas wells. Reservoir management objective have a direct impact on the basis of design for the entire system as well as post execution planning and life of field operating philosophy. The geological and dynamic factors which enable high rate gas wells call for good surveillance data in order to facilitate robust reservoir management, performance simulation and performance forecasting. If high rates are maintained by allowing excessive drawdown, then diagnostic monitoring measures for near wellbore conditions may be required. For commingled high rate gas wells, additional reservoir management measures may need to be accounted for to monitor likely differential depletion, preferential water encroachment and to ensure proper production allocation.

The session sub-topics will include:

- Proactive and Reactive measures to safeguard costly production where a single well failure can result in major production shortfalls.
- Facilitating a robust performance simulation for high offtake reservoirs.
- Management of high rate commingled producers.
- New technology enabling cost effective reservoir management.
- Best practices in high rate gas well reservoir management.

**Monday, 22 March 2010 • 3:15 p.m. - 5:15 p.m.**

#### **SESSION 4: COMPLETION (CARBONATE)**

**Session Co-Chairpersons/Moderators:**

*Bill Sorem, RasGas Co.*

*Mark Van Domelen, Halliburton Energy Services*

The goal of this session will be to share experiences and challenges associated with current practices used for the design, execution and evaluation of completions in high rate carbonate reservoirs. Of particular interest are new or novel technologies that are allowing for successful completions in this high rate carbonate formations.

The session sub-topics will include:

- High Capacity Completion Types and Methods – Monobore, Tubing and Packer, Cased Hole and Open Hole
- Perforating, Logging and Stimulation Techniques
- High Volume Well Testing and Cleanup Techniques
- Reservoir Monitoring and Assessment
- Reservoir Performance – Zone Coverage, Condensate Banking, Conformance
- Workover Techniques – Isolation Plugs, Non-Damaging Kill Fluids and Materials

**Tuesday, 23 March 2010 • 8:30 a.m. - 11:00 a.m.**

#### **SESSION 6: COMPLETION (SANDFACE COMPLETION)**

**Session Co-Chairpersons/Moderators:**

*Peter Adams, Kebabangan Petroleum Operating Co. Sdn.Bhd.*

*Ian Mickelburgh, Schlumberger*

The goal of this session is to share information and experience on completing high rate gas wells, with a particular focus on the sandface completion design. The session will target sandstone formations and design issues specifically related to sand producing formations. It will look at why specific sand control techniques have been chosen, and how they have performed to date.

The session sub-topics will include:

- Sand Management Strategy
- Sand Control Techniques
- Well Stimulation
- Zonal Isolation
- Completion Performance

**Tuesday, 23 March 2010 • 11:15 a.m. - 1:15 p.m.**

#### **SESSION 7: COMPLETION (UPPER COMPLETION)**

**Session Co-Chairpersons/Moderators:**

*Stuart MacKay, Schlumberger*

*Stan Tan, Weatherford Intl. Inc.*

The upper completion in a high rate gas well is typically kept as simple as possible; large bore safety valve, production packer, permanent monitoring and sometimes chemical injection. These components are expected to provide functionality with a minimum of OPEX over the design life of the well, which may be 20+ years. Because each well is a high production well, reliability is of paramount importance. High rate gas wells may present design

## HIGH RATE GAS WELLS

### PRELIMINARY TECHNICAL AGENDA (CONTD.)

and operation challenges such as those related to high fluid velocities, and specific materials requirements due to geometrical constraints, required performance envelope, well chemistry, or temperature. This session will review developments in upper completion component technology.

The session sub-topics will include :

- Qualification Testing for robust design.
- Permanent Monitoring.
- Installation without intervention.
- Largest technically feasible design

#### Wednesday, 24 March 2010 • 8:30 a.m. - 10:30 a.m. SESSION 8: FACILITIES AND TECHNOLOGY (SUBSEA FACILITIES)

**Session Co-Chairpersons/Moderators:**  
*Wendell De Landro, Shell Intl. E&P Co.*

*Daniel Teng, Woodside Energy Ltd.*

High rate gas flow together with the potential for free water and sand production introduces another level of complexity to remote subsea systems. This session will examine the areas affecting the design and operation of subsea equipment associated with high rate gas wells, which may be located in a remote, deep-sea and low temperature environment.

The session sub-topics will include:

- Subsea Tree Design for high rate gas wells.
- Erosion Modeling.
- Multiphase Flow Metering.
- Water Production and Hydrate Management.
- Sand Detection and Management.

#### Wednesday, 24 March 2010 • 10:45 a.m. - 12:45 p.m. SESSION 9: FACILITIES AND TECHNOLOGY (SURFACE FACILITIES)

**Session Co-Chairpersons/Moderators:**  
*Jeanette Roberts, Aker Solutions*

*Raymond Tibbles, Schlumberger*

Surface facilities play an important part in ensuring reliable production of high rate gas. As gas developments become more challenging, and often located in deepwater and remote from infrastructure, the capital investment and design challenges associated with the surface facilities are critical for ensuring a successful development. Technology enablers include floating production facilities, closed-loop MEG systems, gas FPSOs and floating LNG.

The session sub-topics will include:

- Deepwater Technology
- Gas FPSOs
- Floating LNG
- Flow Assurance
- Hydrate Management
- CO<sub>2</sub> Handling
- Liquids Handling
- Design Considerations
- Reliability

Wednesday, 24 March 2010 • 1:45 p.m. - 3:45 p.m.

#### SESSION 10: OPERATION AND INTERVENTION (WELL INTEGRITY AND RELIABILITY)

**Session Co-Chairpersons/Moderators:**

*William Martch, Shell Intl. E&P Co.*

*Jose Ricardo Solares, Saudi Aramco*

The high cost of high rate gas producers, and the need to maximize financial return by keeping them fully operational, demands a very high level of well completion integrity and reliability because financial loss from production interruption can be catastrophic. As development of gas reserves from hostile reservoir environments continues to challenge long-standing practices, new and optimum practices and methodologies are consistently being developed and implemented throughout the industry. This session will focus on sharing best practices and lessons learned, implementation of new technologies, and review of industry trends to ensure well integrity and reliability in high gas producers.

The session sub-topics will include:

- Well Completion Strategies and Results
- Well Integrity Monitoring Practices and Long-term Assurance
- Equipment Selection Decision-making Methodologies
- Downhole Corrosion Prevention and Monitoring Practices
- Sand Management Strategies
- Downhole Flow Assurance Approaches and Experiences

Wednesday, 24 March 2010 • 4:00 p.m. - 5:15 p.m.

#### SESSION 11: OPERATION AND INTERVENTION (INTERVENTION STRATEGIES)

**Session Co-Chairpersons/Moderators:**

*Michael Kersey, RasGas Co.*

*Indran Pathmanathan, Halliburton Energy Services*

Intervention operations in high rate gas wells can often be complicated by high pressures, high temperatures, H<sub>2</sub>S, deviated well paths, and unique downhole equipment. Considering the cost and value of these assets and the consequences of formation damage or the loss of well control, thorough upfront planning and effective strategies are critical to successful well intervention operations. This session will address workover strategies and experience with regards to:

- Workover Fluid Selection and Well Control Methodology
- Formation Damage Prevention and Remediation
- Stimulation and Surveillance in Highly Deviated Completions
- Well Design to Facilitate Intervention Activities

## HIGH RATE GAS WELLS

### Documentation:

1. Proceedings will not be published; therefore, formal papers and handouts are not expected from speakers.
2. Work in progress, new ideas, and interesting projects are sought.
3. Professionally-prepared visual aids are not required; handwritten viewgraphs are entirely acceptable.
4. Note-taking by participants is encouraged. However, to ensure free and open discussions, no formal records will be kept.

### Workshop Deliverables:

- The committee will prepare a full report containing the highlights of the Workshop discussions. This report will be circulated to all attendees. A one-page summary will be prepared by the Workshop Co-Chairperson, which will be posted on the SPE Web Site, and published in the Journal of Petroleum Technology (JPT), if space permits. The copyright of the summary report will belong to SPE.
- PowerPoint presentation materials will be posted on a specific SPE URL address after the Workshop. Provision of the materials by the discussion leaders will signify their permission for SPE to do so.

### Commercialism:

In keeping with ATW objectives and the SPE mission, excessive commercialism in posters or presentations will not be permitted. Company logos must be limited to the title slide and used only to indicate the affiliation of the presenter and others involved in the work.

### Registration Fees:

#### Early Bird Registration Deadline: 21 January 2010 (Residential)

- **SPE MEMBER : US\$2,600.00 (includes 10% GST)/person on/before 21 January 2010**
- **NONMEMBER : US\$2,700.00 (includes 10% GST)/person on/before 21 January 2010**

#### Registration Deadline: 21 February 2010 (Residential)

- **SPE MEMBER : US\$2,700.00 (includes 10% GST)/person after 21 January 2010**
- **NONMEMBER : US\$2,800.00 (includes 10% GST)/person after 21 January 2010**

### Fee includes the following:

- Three-day registration fee for all Workshop sessions;
- Four nights accommodation based on single occupancy with arrival Sunday, 21 March and departure Thursday, 25 March 2010;
- Welcome reception followed by dinner (Sunday evening);
- Three meals per day except on Tuesday;
- Daily coffee/tea breaks;
- Workshop Workbook and Certificate of Continuing Education Units (CEU).

**Note:** Registration fee does not include hotel accommodation and meal costs for additional family member(s).

#### Early Bird Registration Deadline: 21 January 2010

##### (Non-Residential)

- **SPE MEMBER : US\$1,800.00 (includes 10% GST)/person on/before 21 January 2010**
- **NONMEMBER : US\$1,900.00 (includes 10% GST)/person on/before 21 January 2010**

#### Registration Deadline: 21 February 2010

##### (Non-Residential)

- **SPE MEMBER : US\$1,900.00 (includes 10% GST)/person after 21 January 2010**
- **NONMEMBER : US\$2,000.00 (includes 10% GST)/person after 21 January 2010**

### Fee includes the following:

- Three-day registration fee for all Workshop sessions;
- Welcome reception followed by dinner (Sunday evening);
- Two meals per day except on Tuesday;
- Daily coffee/tea breaks;
- Workshop Workbook and Certificate of Continuing Education Units (CEU).

### Registration Policy:

- Registration fee **MUST** be paid in advance for attending the Applied Technology Workshop.
- Full fixed fee is charged regardless of the length of time that the registrant attends the Workshop.
- Fixed fee cannot be prorated or reduced for anyone (Workshop chairpersons, committee members, speakers, discussion leaders, students and registrants).

### Cancellation & Refund Policy:

- A full refund less **US\$150.00** processing fee will be charged for cancellation received before the registration deadline **21 February 2010**.
- For cancellation received after the registration deadline **21 February 2010**, 25% refund will be made to the registrant.
- No refund on cancellation received seven (7) days prior to the starting of the Workshop date, on or after **14 March 2010**.
- Substitutions will not be accepted without prior Programme Committee approval.
- **No refund** will be issued if a registrant fails to show up at the Workshop on-site.

### Attendance Certificate:

All attendees will receive an attendance certificate attesting to their participation at the Workshop. This certificate will be provided in exchange for a completed Workshop Questionnaire.

### Continuing Education Units:

This Workshop qualifies for SPE Continuing Education Units (CEU) at the rate of 0.1 CEU per hour of the ATW.

### Workshop Venue:

#### **Burswood Entertainment Complex**

Great Eastern Highway  
Burswood WA 6100  
Australia

Tel: 61.8.9362.7777 • Fax: 61.8.9470.1789

Website : [www.burswood.com.au](http://www.burswood.com.au)

### Accommodation:

#### **InterContinental Perth Burswood**

Great Eastern Highway  
Burswood WA 6100  
Australia

Tel: 61.8.9362.7777 • Fax: 61.8.9470.1789

Website : [www.burswood.com.au](http://www.burswood.com.au)

### Attendees' Information:

General and detailed accommodation information will be forwarded to registrants with the attendee package prior to the scheduled Workshop in January 2010.

### Dress Code:

Casual clothing is recommended. The Workshop atmosphere is informal.

### Transportation/Visa:

Delegates are advised to book their international/domestic airline tickets early from their country/city to Perth, Australia. Further detailed transportation information will be available and included in the attendee package, which will be sent to registrants in January 2010.

All travellers to Australia must be in possession of passports valid for at least six (6) months with proof of onward passage, either return, or through tickets. Contact your local travel agent for information on visa requirements to Australia.

**ATTENTION NON-MEMBERS:  
JOIN SPE DURING THIS WORKSHOP AND RECEIVE  
YOUR FIRST YEAR'S MEMBERSHIP FREE!  
SUBMIT YOUR MEMBERSHIP APPLICATION ONSITE!**



**HIGH RATE GAS WELLS****POSTER PARTICIPATION FORM**

You are invited to prepare a poster display for presentation. If you are interested in participating, please complete the form and return it to the SPE Asia Pacific Office (Kuala Lumpur, Malaysia), address indicated below by **21 February 2010**.

(Please print in black ink)

**DATE:** \_\_\_\_\_

**SPE Member:**  Yes Membership No. \_\_\_\_\_  No

**NAME:** \_\_\_\_\_

**POSITION:** \_\_\_\_\_

**COMPANY:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

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\_\_\_\_\_  
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**TELEPHONE:** \_\_\_\_\_ **FAX:** \_\_\_\_\_

**E-MAIL ADDRESS:** \_\_\_\_\_

**Please provide the topic with a short abstract of the proposed poster:**

**Topic:** \_\_\_\_\_

**Abstract:** \_\_\_\_\_

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**PLEASE RETURN THE POSTER PARTICIPATION FORM BY 21 February 2010 TO:**

Jenny Chong, Senior Manager-Operations  
Society of Petroleum Engineers  
Suite 23-02, Level 23, Centrepoint South, Mid Valley City  
Lingkaran Syed Putra, 59200 Kuala Lumpur, Malaysia  
Tel: 60.3.2288.1233 • Fax: 60.3.2284.9220  
E-mail: [jchong@spe.org](mailto:jchong@spe.org) • Web Site: [www.spe.org](http://www.spe.org)