

# **SPE International Conference and Exhibition on Oilfield Scale 2014**

**Aberdeen, United Kingdom  
14-15 May 2014**

**ISBN: 978-1-63266-591-1**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2014) by the Society of Petroleum Engineers  
All rights reserved.

Printed by Curran Associates, Inc. (2014)

For permission requests, please contact the Society of Petroleum Engineers  
at the address below.

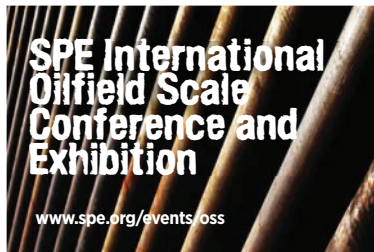
Society of Petroleum Engineers  
P. O. Box 833836  
Richardson, Texas 75083-3836

Phone: (800) 456-6863  
Fax: (972) 952-9435

[books@spe.org](mailto:books@spe.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)



Conference Proceedings

14-15 MAY 2014  
ABERDEEN EXHIBITION AND CONFERENCE CENTRE  
ABERDEEN, UK

## Table of Contents

OTC-24090-RPT

**Downhole Scale Management on the Alba Field: A Case History F**

*R. Farrell, A. Leontieff, A. Strachan, Baker Hughes; J. Muir, Chevron ETC; R.E. Stanley, H. Dahle Smith, Chevron Upstream Europe*

SPE-169748-MS

**Kinetics and Inhibition of Ferrous Sulfide Nucleation and Precipitation F I**

*Q. Wang, Z. Zhang, A.T. Kan, M.B. Tomson, Rice University*

SPE-169750-MS

**Evaluation of Anti-fouling Surfaces for Prevention of Mineral Scaling in Sub-Surface Safety Valves F F**

*T.V. Charpentier, A. Neville, University of Leeds; S. Baraka-Lokmane, C. Hurtevent, J. Ordonez-Varela, Total; F. Moeller Nielsen, V. Eroini, J.H. Olsen, Statoil; J. Ellingsen, O. Bache, ConocoPhillips*

SPE-169751-MS

**Structure, Stoichiometry, and Modelling of Mixed Calcium Magnesium Phosphonate Scale Inhibitor F I**  
**Complexes for Application in Precipitation Squeeze Processes**

*S.S. Shaw, K.S. Sorbie, Heriot-Watt University*

SPE-169752-MS

**Synergistic Properties of Phosphonate and Polymeric Scale Inhibitor Blends for Barium Sulphate F I**  
**Scale Inhibition**

*S.S. Shaw, K.S. Sorbie, Heriot-Watt University*

SPE-169753-MS

**Experimental and Modeling Study on Enhancement of Squeeze Treatment in Sandstone by the Addition F J**  
**of Zinc Ion**

*F. Yan, A.T. Kan, M.B. Tomson, Rice University*

SPE-169755-MS

**Improving Scale Inhibitor Squeeze Design for Naturally Fractured Reservoirs F H**

*V.E. Spooner, R. Stalker, R.J. Wright, G.M. Graham, Scaled Solutions Limited*

SPE-169756-MS

**Calcium Naphthenates in Complex Production Systems - Evaluation and Chemical Inhibition Challenges F H**

*D.A. Nichols, Scaled Solutions Ltd; F.F. Rosario, M.C. Bezerra, Petrobras; S.E. Gorringer, H. Williams, G.M. Graham, Scaled Solutions Ltd*

SPE-169757-MS

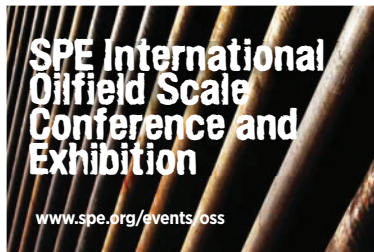
**Experience on the Development and Implementation of a Scale Management Strategy in Central F G**  
**Graben Fields**

*S. Baraka-Lokmane, C. Hurtevent, H. Zhou, P. Saha, N. Tots, F. Rieu, R. Lastennet, T. Sugiarto, Total*

SPE-169758-MS

**Field Method for Determination of Bicarbonate Alkalinity F H**

*L. Wang, A.T. Kan, Z. Zhang, F. Yan, Y. Liu, Z. Dai, M.B. Tomson, Rice University*



Conference Proceedings

14-15 MAY 2014  
ABERDEEN EXHIBITION AND CONFERENCE CENTRE  
ABERDEEN, UK

## Table of Contents

SPE-169759-MS

**Extreme Challenges in FeS Scale Cleanout Operation Overcome using Temporary Isolation, High Pressure Coiled Tubing, and Tailored Fluid Systems**

*M. Buali, N.H. Ginest, J.A. Leal Jauregui, O.F. Sambo, Saudi Aramco; A. Chacon, J.R. Vielma, Halliburton—Boots & Coots*

SPE-169760-MS

**The Influence of Turbulence (or Hydrodynamic Effects) on Strontium Sulphate Scale Formation and Inhibitor Performance**

*C.J. Johnston, L. Sutherland, Nalco Champion an Ecolab Company; T. Herrmann, University of Aberdeen*

SPE-169761-MS

**Correlation of Shear and Turbulence on Scale Formation and Inhibition**

*G.M. Graham, H. Thomson, D. Bowering, R. Stalker, Scaled Solutions Ltd*

SPE-169762-MS

**An Assay Method for the Detection of all Scale Inhibitors at Extremely low Concentration**

*Y. Liu, A.T. Kan, Rice University; C. Yan, Brine Chemistry Solutions; F. Wang, L. Wang, M.B. Tomson, Rice University*

SPE-169763-MS

**Carbon Nanotubes: A New Methodology for Enhanced Squeeze Lifetime Using CNTs**

*N. Ghorbani, Statoil; M.C. Wilson, N. Kapur, University of Leeds; N. Fleming, Statoil; A. Neville, University of Leeds*

SPE-169764-MS

**Concept, Design and Implementation of a Halite Scale Mitigation Completion in a Gas Well**

*D.J. Maxwell, K. Young, Axis Well Technology*

SPE-169765-MS

**Predicted and Observed Evolution of Produced Brine Compositions, and Implications for Scale Management**

*Y. Hu, E.J. Mackay, O. Ishkov, Heriot-Watt University; A. Strachan, Baker Hughes*

SPE-169766-MS

**Modelling of CO<sub>2</sub> and Seawater Injection in Carbonate Reservoirs to Evaluate Inorganic Scaling Risk**

*E.J. Mackay, A. Martins de Souza, Heriot-Watt University*

SPE-169769-MS

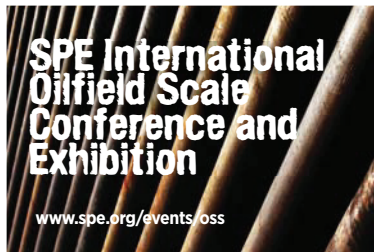
**Influence of Calcium and Bicarbonate Ions on the Kinetics of CaCO<sub>3</sub> Formation at HTHP in the Absence and Presence of Scale Inhibitors**

*B. Xu, SouthWest Petroleum University; T. Chen, P. Chen, H.T. Montgomerie, T.H. Hagen, Nalco Champion, an Ecolab Company; Q. Guo, X. Yang, Southwest Petroleum University*

SPE-169770-MS

**Scale Removal with Ultrasonic Waves**

*H. Kunanz, S. Wölfel, Montanuniversitaet Leoben*



Conference Proceedings

14-15 MAY 2014  
ABERDEEN EXHIBITION AND CONFERENCE CENTRE  
ABERDEEN, UK

## Table of Contents

SPE-169771-MS

**Prediction of Barite Scaling Risk and Inhibition for Oil and Gas Production at High Temperature** H F I  
*F. Zhang, Rice University Executive Education; C. Yan, Brine Chemistry Solutions; N. Bhandari, A.T. Kan, M.B. Tomson, Rice University*

SPE-169772-MS

**Attachment/Release of Phosphonate to/from a CaCO<sub>3</sub> Surface in Supersaturated Brines** H F  
*N. Zhang, A.T. Kan, M.B. Tomson, Rice University*

SPE-169773-MS

**Scale Inhibitor Residual Analysis: Twenty-first Century Approach** H I  
*Y. Zhang, J.K. Daniels, J. Hardy-Fidoe, C. Durnell, M.E. Broussard, E. Hammond, X. Huang, Nalco Champion*

SPE-169774-MS

**Laboratory Methods for Scale Inhibitor Selection for HP/HT Fields** H I  
*J.K. Daniels, I.J. Littlehales, L. Lau, S. Linares-Samaniego, Nalco Champion, An Ecolab Company*

SPE-169776-MS

**Sulfide Scale Control in Produced Water Handling and Injection Systems: Best Practices and Global Experience Overview** H I  
*J.J. Wylde, Clariant Oil Services*

SPE-169777-MS

**Sulfide Scale Control: A High Efficacy Breakthrough Using an Innovative Class of Polymeric Inhibitors** H F  
*A.J. Savin, B. Adamson, J.J. Wylde, J.R. Kerr, Clariant Oil Services; C.W. Kayser, T. Trallenkamp, D. Fischer, Clariant Production (D) GmbH; C. Okocha, Heriot Watt University*

SPE-169778-MS

**The Challenges Associated with Reaction Products Left in Scale Inhibitor Species after Radical Polymerization** H I  
*J.J. Wylde, Clariant Oil Services*

SPE-169779-MS

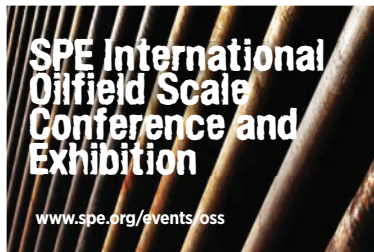
**Coupled Adsorption/Precipitation Tests with a Phosphonate Inhibitor and Carbonate Substrate** I €  
*W. Thomas, K.S. Sorbie, M.A. Singleton, Heriot-Watt University*

SPE-169780-MS

**Do We Need Higher Dose Scale Inhibitors to Inhibit Scale under Turbulent Conditions? Insight into Mechanisms and New Test Methodology** I €  
*T. Chen, Nalco Champion, An Ecolab Company; Q. Guo, SouthWest Petroleum University; U. Anyanwu, Robert Gordon University; P. Chen, H.T. Montgomerie, T. Hagen, Nalco Champion, An Ecolab Company; B. Xu, X. Yang, Southwest Petroleum University; R. Benvie, Nalco Champion, An Ecolab Company*

SPE-169781-MS

**Minimizing Scale Deposition Through Surface Enhancement in Downhole Tools** I H  
*G.M. Graham, N. Goodwin, Scaled Solutions Ltd; E.H. Albino, H. Guan, Schlumberger; H.L. Pinto, M.M. Bezerra, Petrobras*



Conference Proceedings

14-15 MAY 2014  
ABERDEEN EXHIBITION AND CONFERENCE CENTRE  
ABERDEEN, UK

## Table of Contents

**SPE-169782-MS**

**Qualification of Chemicals / Chemical Injection Systems for Downhole Continuous Chemical Injection**

*C. Stewart-Liddon, N. Goodwin, G.M. Graham, Scaled Solutions Ltd; T. Tjomslund, B.M. Hustad, O.G. Svela, J.H. Olsen, S. Østgaard, Statoil ASA*

**SPE-169783-MS**

**Qualification of Downhole Valves Used in Continuous Injection Systems**

*C. Stewart-Liddon, N. Goodwin, G.M. Graham, Scaled Solutions Ltd; T. Tjomslund, B.M. Hustad, O.G. Svela, J.H. Olsen, S. Østgaard, Statoil ASA*

**SPE-169784-MS**

**Pre-Production Deployed Scale Inhibition Treatments in Deep-Water, West Africa**

*D.E. Patterson, W.H. Williams, Chevron; M.M. Jordan, R. Douglas, Nalco Champion*

**SPE-169785-MS**

**New Insights on the Impact of High Temperature Conditions (176°C) on Carbonate and Sulphate Scale Dissolver Performance**

*M.M. Jordan, Nalco Champion; H. Williams, Scaled Solutions; S. Linares-Samaniego, Nalco Champion; D.M. Frigo, Shell International*

**SPE-169786-MS**

**Improvement Of Thermodynamic Modeling Of Calcium Carbonate And Calcium Sulfates At High Temperature And High Pressure In Mixed Electrolytes**

*Z. Dai, Rice University; W. Shi, Chevron Energy Technology Company; A.T. Kan, Rice University; N. Zhang, Statoil; M.B. Tomson, Rice University*

**SPE-169787-MS**

**Systematic Study of Barite Nucleation and Inhibition with Various Polymeric Scale Inhibitors by Novel Laser Apparatus**

*C. Yan, Brine Chemistry Solutions, Rice University; A.T. Kan, F. Zhang, Y. Liu, Rice University; R. Tomson, Brine Chemistry Solutions; M.B. Tomson, Rice University*

**SPE-169788-MS**

**Selection of Scale Control Strategy on a Sub Sea Developed Field in the North Sea and How 6 Different Companies Contributed**

*E. Sorhaug, Talisman Energy Norge A/S; M.M. Jordan, Nalco Champion, An Ecolab Company; R.A. McCartney, Oilfield Water Services Ltd; R. Stalker, Scaled Solutions Ltd; E.J. Mackay, Heriot-Watt University; J.J. Green, Corex (UK) Ltd.*

**SPE-169791-MS**

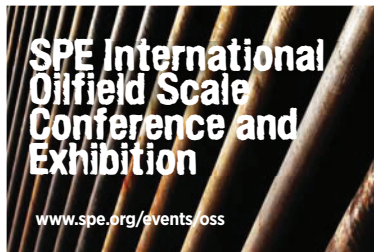
**Studies of Sandlike Scale in the Bottom Hole**

*S. Xie, CNOOC-Zhanjiang Ltd.; W. Xu, CNOOC; L. Song, M. Yan, H. Zheng, Y. Li, CNOOC-Zhanjiang Ltd.; P. Chen, H.T. Montgomerie, T. Chen, Nalco Champion; X. Yang, Southwest Petroleum University*

**SPE-169792-MS**

**Oilfield Scale Inhibitors for Application in Precipitation Squeeze Treatments: Solubility of the Ca<sub>2</sub>PPCA Complex**

*N.M. Farooqui, K.S. Sorbie, Heriot Watt University*



Conference Proceedings

14-15 MAY 2014  
ABERDEEN EXHIBITION AND CONFERENCE CENTRE  
ABERDEEN, UK

## Table of Contents

**SPE-169793-MS**

**Squeezing Sub-Sea Wells Co-Mingled in the Same Flowline on the Norne Field**

*S.M. Heath, Nalco Champion; O. Selle, E. Storas, Statoil ASA; B. Juliussen, A. Thompson, C.J. Johnston, K. Vikshaland, L. Lid, Nalco Champion; T.E. Gundersen, T. Bjellaas, Vitas AS*

**SPE-169796-MS**

**Prediction and Evaluation of Calcium Carbonate Deposition at Surfaces**

*E. Mavredaki, Oil Plus Ltd.; A. Neville, University of Leeds*

**SPE-169797-MS**

**Novel Method For Real-Time Monitoring of Scale Control Products at the Site of Use**

*J.R. Johnstone, Kemira Chemicals (UK) Ltd; S. Toivonen, Kemira Oy; R. Griffin, A. O'Brien, Kemira Chemicals (US); P. Mundill, J. Siivonen, P. Väisänen, S. Tittanen, M. Lehmusto, H. Härmä, P. Hänninen, T. Teimonen, Aqsens Oy*

**SPE-169798-MS**

**Sulphide Scale (PbS/ZnS) Formation And Inhibition Tests For A Gas Condensate Field with Severe Scaling Conditions**

*C. Okocha, K.S. Sorbie, Heriot-Watt University; C. Hurtevent, S. Baraka-Lokmane, Total France; M. Rossiter, Total E&P UK*

**SPE-169799-MS**

**Post-frac Flowback Water Chemistry Matching in a Shale Development**

*O. Vazquez, R. Mehta, E.J. Mackay, Heriot-Watt University; S. Linares-Samaniego, M.M. Jordan, J. Fidoe, Nalco Champion*

**SPE-169800-MS**

**The Impact of Pre-flush Additives on Scale Squeeze Treatments - Application of Modelling and New Test Methodologies to Understand Mechanisms of Retention and Optimise Field Treatment Designs**

*O. Vazquez, Heriot-Watt University; T. Chen, Nalco Champion; Q. Guo, South West Petroleum University; L. Crombie, P. Chen, S.M. Heath, Nalco Champion*

**SPE-169802-MS**

**Maintaining Production of Frac-Packed Wells by Inhibiting Scale Buildup and Fines Migration**

*F. Liang, formerly Halliburton; L.K. Vo, P.D. Nguyen, T.W. Green, Halliburton*

**SPE-169803-MS**

**Development of Novel Test Methodology to Understand the Mechanisms of Halite Inhibition and Environmentally Acceptable Halite Scale Inhibitors for High Temperature Application**

*K. Ho, T. Chen, P. Chen, T. Hagen, H.T. Montgomerie, R. Benvie, Nalco Champion, An Ecolab Company*

**SPE-169804-MS**

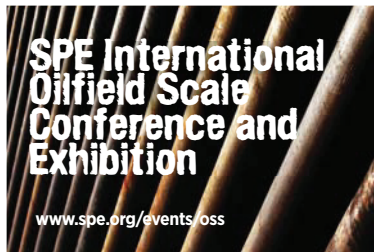
**Constraining the Conditions of Scale Deposition in a Gas Condensate Well: A Case Study**

*R.A. McCartney, Oilfield Water Services Limited; S. Duppenbecker, R. Cone, BP Exploration Co*

**SPE-169805-MS**

**Test Method Development And Scale Inhibitor Evaluations For High-salinity Brines in the Williston Basin**

*H. Lu, C. Haugen, T. Garza, J. Russek, Baker Hughes; C. Harbaugh, Hess Corporation*



Conference Proceedings

14-15 MAY 2014  
ABERDEEN EXHIBITION AND CONFERENCE CENTRE  
ABERDEEN, UK

## Table of Contents

**SPE-169806-MS**

**Liquid Scale Inhibitors for Metallic-Crosslinked Gel Fracturing Systems**

*Z.D. Yue, Q. Fu, Multi-Chem, a Halliburton Service; N.K. Lang, Halliburton; C. Fan, Multi-Chem, a Halliburton Service*

**SPE-169807-MS**

**A Comparative Study between Mechanical and Chemical Scale Removal Techniques Offshore Malaysia: Planning, Execution & Result**

*W. Wan Mohd Fablillah, A. Azman, M. Yaakub, PETRONAS Carigali Sdn Bhd*

**SPE-169808-MS**

**An Advanced Method for Preparing Ferrous Sulfide and Testing Potential Inhibitors**

*R.G. Fowles, S.J. Levey, C.S. Smith, Weatherford Edmonton Research and Development Center*

**SPE-169810-MS**

**Mechanisms, New Test Methodology and Environmentally Acceptable Inhibitors for Co-deposition of Zinc Sulfide and Calcium Carbonate Scales for High Temperature Application**

*C. Tortolano, T. Chen, Nalco Champion, An Ecolab Company; L. Zou, Imperial College; P. Chen, H.T. Montgomerie, T. Hagen, R. Benvie, Nalco Champion, An Ecolab Company*