

# **74th Annual International Water Conference 2013**

**Orlando, Florida, USA  
17-21 November 2013**

**Volume 1 of 2**

ISBN: 978-1-63266-683-3

**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© (2013) by the Engineers Society of Western Pennsylvania  
All rights reserved.

Printed by Curran Associates, Inc. (2014)

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

Engineers Society of Western Pennsylvania  
Pittsburgh Engineers Building  
337 Fourth Avenue  
Pittsburgh, Pennsylvania 15222

Phone (412) 261-0710  
Fax: (412) 261-1606

[www.eswp.com](http://www.eswp.com)

**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)

## **REUSE AND RECOVERY TREATMENT TECHNOLOGIES**

*IWC Representative:* Dan Rice, DBR Consulting, Sault Ste. Marie, MI

*Session Chair:* Scott Quinlan, GAI Consultants, Cranberry Township, PA

*Discussion Leader:* Jonathan Shimko, Tetra Tech, Pittsburgh, PA

### **IWC-13-01**

*Oil Fields (Produced) Water Treatment Recovery – Reuse Challenges and Opportunities ..... 21*

Rafique Janjua, P.E., Fluor Enterprise Inc, Sugar Land, TX

Prepared discussion by: William Moore, Westech Engineering, Salt Lake, UT *Not Available*

### **IWC-13-02**

*A Water Toolbox to Optimize SAGD Water Recycling Operations ..... 32*

Leo Kobylka, Amir Ehsan Hosseini; Basil Perdicakis, Statoil Canada Ltd., Calgary, AB  
Canada

Prepared discussion by: Jason Monnell, GAI Consultants, Homestead, PA

### **IWC-13-03**

*Advanced Membrane Process for Water and Wastewater Recovery ..... 55*

Riad Al-Samadi, Ph.D., P.Eng, Advanced Water Solution, Burlington, ON Canada

Prepared discussion by: Gianna Cooley, CDM Smith, Houston, TX *Not Available*

## **WATER CONSERVATION AND MANAGEMENT**

*IWC Representative:* Steve Gagnon, AVANTech, Inc., Columbia, SC

*Session Chair:* William Willersdorf, Veolia Water Solutions & Technologies, Moon Twp., PA

*Discussion Leader:* Robert Applegate, Graver Water Systems, LLC, New Providence, NJ

### **IWC-13-04**

*Municipal Recycled Water Use in Industry: A Roadmap ..... 71*

Daniel Sampson, WorleyParsons, Vallejo, CA

Prepared discussion by: Joel M. Davie, M.S., P.E., Bechtel Power Corporation, Frederick, MD

### **IWC-13-05**

*Municipal Reclaimed Water Use and Treatment in Industry ..... 85*

Timothy Eggert, GE Water and Process Technologies, Seal Beach, CA , W. Dan Harbs, GE Power & Water Water and Process Technologies, Fountain Valley, CA, , Robin W. Kluck, GE Power & Water - Water and Process Technologies, Walnut Creek, CA

Prepared discussion by: Bruce Alderman, Desalitech, Eastampton, NJ

### **IWC-13- 06**

*Water Management and Underground Injection Well Permitting at Great River Energy's Coal Creek Station ..... 101*

Scott Allen, P.E., Ron Jorgenson, Golder Associates Inc., Lakewood, CO , Jennifer Charles, Great River Energy, Underwood, ND

Prepared discussion by: Diane Martini, Sargent & Lundy, LLC, Chicago, IL

## **PRODUCED WATER PRETREATMENT FOR ENHANCED OIL RECOVERY SYSTEMS**

*IWC Representative:* Michael Sheedy, Eco-Tec, Inc., Pickering, ON Canada

*Session Chair:* Ivan Morales, Devon, Calgary, AB Canada

*Discussion Leader:* Chip Westaby, Turner Designs Hydrocarbon Instruments, Fresno, CA

### **IWC-13-07**

*The Case for Elimination of Lime Softeners for Treatment of Produced Water Feeding OTSGs ..... 118*

Michael Dejak, Eco-Tec Inc., Pickering, ON Canada, Steve Portelance, RET,  
WorleyParsons, Pickering, ON Canada

Prepared discussion by: Donald Downey, Purolite Corporation, Paris, ON  
Canada

### **IWC-13-08**

*Chemistry of Produced Water Evaporator Distillate ..... 137*

Martin Godfrey, Ph.D., Ecolab, Eagan, MN, Logan LaRocque, Corbin Ralph, Tim Miller,  
Nalco Champion an Ecolab Company, Eagan, MN

Prepared discussion by: Kevin Brown, Chemtreat, Vancouver, Canada

### **IWC-13-09**

*Boiler Feed Water Treatment at a Canadian Oil Sands Facility ..... 154*

Khalid Farooq, Pall Corporation, Port Washington, NY

Prepared discussion by: Kevin Drake, P. Eng., Drake Water Treatment  
Consulting Ltd., Calgary, Canada

## **ONGOING RESEARCH AND RESULTS TO HELP MEET THE PROPOSED EFFLUENT LIMITATION GUIDELINES**

*IWC Representative:* Brad Wolf, Berkeley Research Group, LLC, Pittsburgh, PA

*Session Chair:* Dave Malkmus, ResinTech, West Berlin, NJ

*Discussion Leader:* Bryan Hansen, Burns and McDonnell, Centennial, CO

### **IWC-13-10**

*Navigating the New Steam Electric Power Effluent Limitation Guidelines ..... 174*

Colleen Layman, HDR Engineering, Harpers Ferry, WV

Prepared discussion by: Kristin Glikbarg, Burns and McDonnell, Kansas City, MO

### **IWC-13-11**

*WRC Overview ..... 195*

Jeff Wilson, Southern Company, Birmingham, AL

Prepared discussion by: Peter Meyers, ResinTech, West Berlin, NJ

### **IWC-13-12**

*Immobilization of Heavy Metals by Solidification/Stabilization in Co-Disposed Coal Fly Ash and Concentrated FGD Wastewater Brines ..... 202*

Jay Renew, Southern Research Institute, Kennesaw, GA, Ching-Hua Huang, Ph.D., Susan Burns, Ph.D., Maya Carrasquillo, Georgia Institute of Technology, Atlanta, GA, Kirk Ellison, Southern Company, Birmingham, AB

Prepared discussion by: Michele Funk, Betchel, Frederick, MD

## **ION EXCHANGE AND SPECIALTY ADSORBENTS FOR SELECTIVE CONTAMINANT REMOVAL IN PRODUCED, GROUND AND MUNICIPAL WATERS**

*IWC Representative:* Jim Sabzali, Aldex Chemical Company Ltd., Granby, QC Canada

*Session Chair:* Larry Gottlieb, ResinTech, West Berlin, NJ

*Discussion Leader:* Don Downey, Purolite Corporation, Paris, ON Canada

### **IWC-13- 13**

*Oxyanion Removal and Recovery using Silica Polyamine Composites ..... 211*

Edward Rosenberg, Ph.D., University of Montana and Purity Systems Inc., Missoula, MT

Prepared discussion by: Terry Heller, Purolite Corporation, Bala Cynwyd, PA

### **IWC-13-14**

*Chromate Removal at the Hanford Site (Part 2) ..... 229*

Peter Meyers, ResinTech, Inc, West Berlin, NJ ,James P. Hanson; Naomi Bland, U.S. DOE, Richland Operations Office, Richland, WA, Chuck Miller; Dean Neshem, CHPRC, Richland, WA

Prepared discussion by: Cindy Gresham, Thermax, Northville, MI

### **IWC-13-15**

*Selective Removal of Sulfate from Produced Water ..... 243*

Kevin Slough, Filterboxx Water, Calgary, AB Canada, Yuemin Zhu, Environmental Corp., Calgary, AB Canada

Prepared discussion by: Claude Gauthier, Purolite, Bala Cynwyd, PA

### **IWC-13-16**

*Ion Exchange System Selection Criteria: Design and Operational Considerations ..... 254*

William Schwartz, P.E., Robert Loken, Envirogen Technologies, Rancho Cucamonga, CA

Prepared discussion by: Sreekumar Janardhnan, Degremont –Anderson, Ancaster, ON Canada

## **METALS CHEMISTRY AND PROCESS ENGINEERING MARRY (AND SOMETIMES LIVE HAPPILY EVER AFTER) IN MINE WATER TREATMENT**

*IWC Representative:* George Abraham, Veolia Water Solutions & Technologies, Moon Township, PA

*Session Chair:* Paul Pigeon, Golder Associates, Inc., Lakewood, CO

*Discussion Leader:* Jim Woods, WesTech Engineering, Inc., Salt Lake City, UT

### **IWC-13-17**

*A Promising Path Forward for Oil Sands Operations - Basal Water Management Using Desalination Technologies to Eliminate Fresh Water Intake ..... 271*

Kavithaa Loganathan, Ph.D., Chandresh Acharya, Canadian Natural Resources Limited, Fort McMurray, AB Canada

Prepared discussion by: Michael Dejak, Eco-Tec, Pickering, ON, Canada

### **IWC-13-18**

*Case Study on a Selenium Treatment System to Treat Combined Flow of Surface and Underground Mine Wastewater ..... 287*

Michael Soller, Bowen Engineering Corporation, Indianapolis, IN , James Harwood, GE Water & Process Technologies, Oakville, ON Canada

Prepared discussion by: Tom Rutkowski, Golder Associates, Lakewood, CO

### **IWC-13-19**

*Selenium Stability in Tailings Ponds ..... 311*

Donald Kirk & John Graydon, University of Toronto, Toronto, Ontario Canada

Prepared discussion by: Kashi Banerjee, Veolia Water Solutions & Technologies, Moon Township, PA *Not Available*



## **SHALE GAS AND EOR WATER MANAGEMENT AND REUSE**

*IWC Representative:* John Lucey, Jr. P.E., Nuverra Environmental Solutions, Coraopolis, PA

*Session Chair:* Patrick Ryan, Water Street Solutions, Minneapolis, MN

*Discussion Leader:* Frank Johns, Tetra Tech, Inc., Denver, CO

### **IWC-13-21**

*Peracetic Acid Use for Microbial Control and Water Treatment in Unconventional Oil ..... 321*

Robert Ryther, Ph.D., Nalco-Champion, Sugar Land, TX, Victor Keasler, Renato DePaula, Brian Epps, Nalco-Champion, Sugarland, TX, Junzhong Li, David McSherry, Richard Staub, Ecolab, Eagan, MN

Prepared discussion by: George A. Ganzer, BWA Water Additives US, LLC, Buckingham, PA

### **IWC-13-22**

*Thermal Recovery of Extra Heavy Oil deposits-Reduced Water use and Energy Intensity using Secondary Vaporizers ..... 333*

Karina Heitnes Hofstad, Statoil, Trondheim, Norway, Leo Kobylka, Basil Perdicakis, Statoil, Calgary, AB Canada

Prepared discussion by: William A. Shaw, P.E., Veolia Water Solutions & Technologies, Pewaukee, WI

### **IWC-13-23**

*Nanoflotation – Water Treatment Technology To Separate Colloidal Solids in Recycle Water for an Oil Sands Operation ..... 358*

David Bromley, M.Eng, P.E., David Bromley Engineering Ltd., Vancouver, BC Canada, Kavithaa Loganathan, Ph.D., Canadian Natural Resources, Ltd., Ft. McMurray, AB Canada

Prepared discussion by: Howard McCarthy, P.E., Tetra Tech Inc., Denver, CO

### **IWC-13-24**

*Diluent Aided Cleaning (DAC) Applied to De-oiling of SAGD Process Waters 4:30 PM ..... 375*

Jason Grundler, Statoil, Calgary, AB Canada, Svein Viggo Aanesen, Statoil, Porsgrunn, Norway, Cecile Fjeld Nygaard, Statoil, Houston, TX

Prepared discussion by: Melonie Myszczyzyn, CNRL, Calgary, AB Canada

## **IDENTIFYING AND PREVENTING CORROSION AND FAILURES IN STEAM GENERATORS SPONSORED BY ASME**

*IWC Representative:* Colleen Layman, P.E., HDR, Inc., Harpers Ferry, WV

*Session Chair:* David Daniels, M&M Engineering, Leander, TX

*Discussion Leader:* Irv Cotton, Arthur Freedman Associates, Newport, RI

### **IWC-13-25**

*Pressure Part Damage in Steam Generators due to Steam/Water Stratification ..... 394*

Anton Banweg, Nalco, an Ecolab Company, Naperville, IL

Prepared discussion by: Kevin Shields, Structural Integrity Associates, Inc., Annapolis, MD

### **IWC-13-26**

*Hydrogen Damage Mitigation by Boiler Chemical Cleaning ..... 406*

Andrew Howell, Ph.D., Xcel Energy, Henderson, CO

Prepared discussion by: Robert D. Bartholomew, Sheppard T. Powell Associates, LLC, Baltimore, MD

### **IWC-13-27**

*Distinguishing Between Under Deposit Corrosion Mechanisms in Boilers ..... 420*

Kevin Shields, Amanda Robinson, Structural Integrity Associates, Inc., Austin, TX, R. Barry Dooley, Structural Integrity Associates, Inc., Charlotte, NC

Prepared discussion by: Mel J. Esmacher, P.E., GE Power Water & Process Technologies, The Woodlands, TX

### **IWC-13-28**

*The Importance of Preventing Condenser Tube Leaks and Other Impurity Ingress into Steam Generators ..... 435*

Brad Buecker, Kiewit Power Engineers, Lenexa, KS

Prepared discussion by: Ted Beardwood, Ashland Chemical Company, Ajax, ON Canada

## **DIVERSITY IN MEMBRANE APPLICATIONS**

*IWC Representative:* Dennis McBride, Fluor Enterprises, Inc., Greenville, SC

*Session Chair:* Jane Kucera, Nalco Company, an EcoLab Company, Naperville, IL

*Discussion Leader:* Brian Powers, HDR Inc., Charlotte, NC

### **IWC-13-29**

*Optimization of an All Membrane Zero Liquid Discharge System at Los Alamos National Laboratories ..... 449*

Stanley Karrs, Siemens Industry Inc. Water Technologies, Warrendale, PA, Paul Parker, P.E., Los Alamos National Security, LLC, Los Alamos, NM

Prepared discussion by: H.G. Sanjay, Ph.D., IONZ BlueWater Solutions, Inc., Royal Palm Beach, FL

### **IWC-13-30**

*Novel PTFE Membranes for Hydrocarbon De-oiling from Produced Water in Cyclic Steam Stimulation and Refinery Applications ..... 465*

Vita Martez, L. Zhao Southern Alberta Institute of Technology, Calgary, AB Canada, R. Gay de Montella, Transprocess Inc., Calgary, AB Canada, H. Fukuyama, H. Ikebe, Toyo Engineering Corporation, Tokyo, Japan, T. Morita, Sumitomo Electric Industries Ltd., Osaka, Japan

Prepared discussion by: Michael Snodgrass, SpiraSep, Goleta, CA

### **IWC-13-31**

*Performance data & Operational Experience of FEDI system at Brazos Electric ..... 484*

Venkat Jagannathan, Qua Group LLC, Canonsburg, PA, Vincent P. Hawkes, Sr., Brazos Electric Johnson County Generation Facility, Cleburne, TX

Prepared discussion by: Steven R. Gagnon, AVANTech Inc., Columbia, SC

### **IWC-13-32**

*Designing RO Systems for Maximum Water Recovery ..... 494*

Robert Kimball, P.E. & Ken Klinko, P.E., CDM Smith, Helena, MT

Prepared discussion by: Brad Biagini, Veolia Water Solutions & Technologies, Moon Township, PA

## **INDUSTRIAL WASTEWATER TREATMENT FOR FGD, MICROELECTRONICS, REFINING AND OTHER INDUSTRIES**

*IWC Representative:* John Lucey, Jr. P.E., Nuverra Environmental Solutions, Coraopolis, PA

*Session Chair:* Michael Preston, Black & Veatch, Overland Park, KS

*Discussion Leader:* Michael Bluemle, Ph.D., Ashland Water Technologies, Wilmington, DE

### **IWC-13-33**

*Removal of Hardness and Sulfate from FGD Effluent using Ion Exchange ..... 515*

David Kratochvil, Ph.D., Patrick Littlejohn, Brent Baker, BioteQ Environmental Technologies, Vancouver, BC Canada, Phil Fatula, LANXESS Sybron Chemicals, Inc., Pittsburgh, PA

Prepared discussion by: Greg Behrens, P.E., URS Corp., Austin, TX

### **IWC-13-34**

*Novel Process for the Treatment of Wastewaters from the Microelectronics Industry ..... 532*

Antonio Lau, Temple Ballard, Rich Ubaldi, Infilco Degremont, Inc., Richmond, VA Nabin Chowdhury, Denise Horner, Sunhil Mehta, John Williamson, Degremont North America R&D Laboratory, Ashland, VA

Prepared discussion by: Frank Reightler, 4G Environmental Corp., Jim Thorpe, PA

### **IWC-13-35**

*Ballasted Clarification with Inert Material Surpasses 1,000 Units in Multiple Industries and Applications ..... 544*

William Willersdorf, Veolia Water Solutions & Technologies, Moon Township, PA

Prepared discussion by: Hollie Scott, Degremont, Salt Lake, UT

### **IWC-13-36**

*Removal of Selenium in Refinery Effluent with Adsorption Media ..... 561*

Missy Hayes & Nancy Sherwood, MAR Systems, Inc., Solon, OH

Prepared discussion by: Ivan Cooper, Civil & Environmental Consultants, Inc., Charlotte, NC

## **ADVANCES IN FRAC WATER TREATMENT AND RESIDUALS RECOVERY**

*IWC Representative:* Michael Ryder, P.E., Chester Engineers, Moon Township, PA

*Session Chair:* Michael Soller, P.E. CPC, Bowen Engineering, Indianapolis, IN

*Discussion Leader:* John Schubert, HDR, Inc., Sarasota, FL

### **IWC-13-37**

*Recovering Valuable Byproducts from Oil and Gas Wastes ..... 579*

Russell Huffmyer, Nuverra Environmental Solutions, Coraopolis, PA, John Van Gehuchten, HDR Engineering, Inc., Pittsburgh, PA

Prepared discussion by: John Schubert, HDR, Inc., Sarasota, FL

### **IWC-13-38**

*Pretreatment Targets for Salt Recovery from Marcellus Shale Gas Produced Water ..... 592*

James Silva, Ph.D., Rachel Gettings, William Kostedt, Vicki Watkins GE Global Research Center, Niskayuna, NY

Prepared discussion by: Jerry Penland, Chester Engineers, Moon Twp., PA

### **IWC-13-39**

*Plasma Treatment of Produced Water from Hydraulic Fracturing for Shale Gas ..... 607*

Y.I. Cho, Ph.D., Drexel University, Philadelphia, PA, K.C. Wright, H.S. Kim, D. Cho, A. Rabinovich, A. Fridman, Drexel University, Philadelphia, PA

Prepared discussion by: Josh Prusakiewicz, HDR Inc., Pittsburgh, PA

### **IWC-13-40**

*Frac Water Treatment and Disinfection ..... 633*

John Williams, Xchem-Terra Services, Irving, TX

Prepared discussion by: Doug McIlwaine, ChemTreat, Richmond, VA

## **FGD OPERATIONAL IMPACTS AND TREATMENT TECHNOLOGIES FOR THAT TROUBLESOME FGD WASTEWATER DISCHARGE STREAM**

*IWC Representative:* Manoj Sharma, Aquatech International Corp., Canonsburg, PA

*Session Chair:* Patricia Scroggin, Burns and McDonnell, Kansas City, MO

*Discussion Leader:* Jason Monnell, GAI Consultants, Homestead, PA

### **IWC-13-41**

*How Operation of a Wet Flue Gas Desulfurization System Can Impact the Wastewater Quality Generated ..... 655*

Bryan Hansen, P.E., Burns & McDonnell, Denver, CO

Prepared discussion by: Joseph Potts, Duke Energy, Belmont, NC

### **IWC-13- 42**

*Purification of Flue Gas Desulfurization Wastewater with Super Capacitor Radial Deionization ..... 670*

Behrang Pakzadeh, Ph.D., Southern Research Institute, Cartersville, GA , Jay Wos; Ken Cushing, Southern Research Institute, Birmingham, AL, Jay Renew, Southern Research Institute, Cartersville, GA, Patrick Curran, Atlantis Technologies, Monarch Beach, CA, Richard Breckenridge, Electric Power Research Institute, Charlotte, NC, Jason (Xinjun) Teng, Southern Company Services, Birmingham, AL, Cassie Willingham, Georgia Power, Cartersville, GA, Dongxu Yan, Layne, Phoenix, AZ ,John Hall, Layne, Lakeland, FL, Russell Mack, Layne, Boston, MA

Prepared discussion by: William Kennedy, P.E., Duke Energy, Belmont, NC *Not Available*

### **IWC-13-43**

*Meeting Part-per-Trillion Mercury Limits for Power Plant Wastewater ..... 681*

Thomas Higgins, Ph.D., P.E., CH2M HILL, Chantilly, VA, Cynthia Yeager, P.E., CH2M Hill, Bellevue, WA, Dennis Fink, P.E., CH2M Hill, Oakland, CA, Kristen Jenkins, P.E., CH2M Hill, Atlanta, GA

Prepared discussion by: Paul Chu, Electric Power Research Institute, Palo Alto, CA *Not Available*

### **IWC-13-44**

*FGD Scrubber Wastewater ZLD Solid Waste Characterization and Disposal Options ..... 698*

Kirk Ellison, Southern Company Services, Inc., Birmingham, AL

Prepared discussion by: Katie Bland, P.E., Burns & McDonnell, Kansas City, MO

## DESIGNING, OPERATING, AND TROUBLESHOOTING ZERO LIQUID DISCHARGE SYSTEMS

*IWC Representative:* Kumar Sinha, P.E., Consultant, Frederick, MD

*Session Chair:* Raymond Post, P.E., ChemTreat Langehorne, PA

*Discussion Leader:* Lanny Weimer, GE Water, Elliot City, MD

### **IWC-13-45**

*ZLD Systems: Variations in Design Due to Raw Water Chemistries, Space, and Cost Considerations for Recent Combined Cycle Power Plants ..... 712*

Sara Titus, P.E., Colleen Chapman, Joel Davie, Lisa Kouchinsky, Bechtel Power Corporation, Frederick, MD

Prepared discussion by: Craig Van Dyke, GE Water and Process Technologies, Brookfield, IL

### **IWC-13-46**

*Operating a ZLD, What Does it Take? ..... 729*

Vincent Como, Black & Veatch, Overland Park, KS

Troy Cannon, Brazos Electric Power Cooperative, Bridgeport, TX, Mitch Mueller, P.E. Black & Veatch Corporation, Overland, KS

Prepared discussion by: Christian Haussmann, Water Systems Specialists, Inc., Seattle, WA

### **IWC-13-47**

*The Thermal ZLD Experience for FGD Wastewater at PSNH's Merrimack Station ..... 744*

Patricia Scroggin, P.E., Burns & McDonnell, Kansas City, MO Richard Roy, Public Service Company of New Hampshire Bow, NH

Prepared discussion by: James Beninati, HDR Inc., Pittsburgh, PA

### **IWC-13-48**

*Troubleshooting and Antifoam Application Minimizes ZLDS Plant Operating Costs and Downtime ..... 760*

Kevin Boudreaux, Nalco Company, Grapevine, TX Steve Biggar, Quantum Auburndale Power, LP, Auburndale, FL, Ellie Palomo, Nalco Company, Naperville, IL

Prepared discussion by: Daniel Sampson, Worley Parsons, Sacramento, CA

## **POTABLE WATER, SLAKING THE WORLD'S THIRST**

*IWC Representative:* Steven Gagnon, AVANTech, Inc., Columbia, SC

*Session Chair:* Peter Meyers, ResinTech, West Berlin, NJ

*Discussion Leader:* James Sabzali, Aldex Chemical Company Ltd., Granby, QC Canada

### **IWC-13-49**

*Technical Evaluation of Ion Exchange and Biological Treatment of Oxyanions for Potable Water Production: System Selection Considerations ..... 780*

William Schwartz, Envirogen Technologies, Rancho Cucamonga, CA

Prepared discussion by: Ajit Dighe, Thermax Inc, Northville, MI

### **IWC-13-50**

*Operation of the Chino Desalters II ..... 793*

Francis DeSilva, ResinTech Inc, Berlin, NJ, Steven Ibach, Chino Desalter II Jurupa, CA

Prepared discussion by: Donald Thompson, CDM Smith, Jacksonville, FL

### **IWC-13-51**

*Drinking Water Nitrate Removal via Ion Exchange and Electrochemical Nitrate Destruction for Brine Reuse ..... 806*

Rich Dennis, Christopher E. Clark, Severn Trent Services, Inc., Tampa, FL , H. Robert Goltz, Dow Water & Process Solutions, Midland, MI

Prepared discussion by: H.G. Sanjay, Ph.D, IONZ BlueWater Solutions, Inc., Royal Palm Beach, FL

### **IWC-13-52**

*Treatment and Recycling of Brine from Ion Exchange Process for Nitrate Removal in Drinking Water ..... 817*

Brian Atland, P.E. Calgon Carbon Corporation Pittsburgh, PA

Prepared discussion by: William Carlin, Dow, Spring House, PA *Not Available*



## **OTSG – DESIGN, TREATMENT, AND MONITORING OPPORTUNITIES, AN ASME PANEL SESSION**

*IWC Representative:* Debbie Bloom, Nalco, an EcoLab Company, Naperville, IL

*Session Chair:* Melonie Myszczyzyn, CNRL, Calgary, AB Canada

*Discussion Leader:* Ivan Morales, Devon, Calgary, AB Canada

### **IWC-13-53**

*Increasing OTSG Steam Quality to 90% While Operating on WLS Treated BFW ..... 825*

Annie (Qian) Sun, Gary Giesbrecht Suncor Energy Inc., Calgary, Alberta Canada, Alex Berruti, Innovative Steam Technologies Inc. (IST), Cambridge, ON, Canada

### **IWC-13-54**

*On-line Silica Analyzer in SAGD Produced Water ..... 841*

Ramesh Sharma, Travis O. Dinsdale, V. Houston, K. Bansalm, ConocoPhillips, Houston, TX

### **IWC-13-55**

*Electrochemical Corrosion Studies of EDTA and Polymers in Simulated Once-Through Steam Generator (OTSG) Water for Steam-Assisted Gravity Drainage (SAGD) Process ..... 849*

Tzu-Yu (Liberty) Chen, Jasbir Gill, John E. Hoots, Carol B. Batton, Corbin K. Ralph, Nalco Champion, an Ecolab company, Naperville, IL

### **IWC-13-56**

*Forensic Analysis and Interpretation of Once through Steam Generator (OTSG) Deposits can Assist in System Operational Improvements ..... 861*

Glenn Weagle, Ph.D., Nalco Champion, Sherwood Park, AB Canada

### **ASME Panel Discussion ..... 870**

## **INNOVATIVE SOLUTIONS TO TRACE CONTAMINANTS ISSUES**

*IWC Representative:* Michael Gottlieb, ResinTech, West Berlin, NJ

*Session Chair:* Thomas Lawry, HDR Inc., Pittsburgh, PA

*Discussion Leader:* Mark Owens, Inflico Degremont, Richmond, VA

### **IWC-13-57**

*New Heavy Metals Removal Technology Offers an Innovative and Sustainable Solution ..... 918*

Melanie Solmos, Paul J. Zinn, Daniel E. Schwarz, Nalco, an Ecolab Company,  
Naperville, IL

Prepared discussion by: Michael Pudvay, GEA Process Engineering, Detroit, MI  
*Not Available*

### **IWC-13-58**

*Upcoming Effluent Guidelines Challenges: Using Constructed Wetland Treatment Systems to your Advantage ..... 926*

Katie A. Bland, Christopher J. Snider, Burns & McDonnell, Kansas City, MO, Jared Morrison, Paul Von Hertsensberg, Westar Energy, Inc., Topeka, KS

Prepared discussion by: Diane Martini, Sargent & Lundy, LLC, Chicago, IL

### **IWC-13-59**

*Meeting the Newest FGD Wastewater Trace Contaminant Guidelines with Functionalized Activated Alumina ..... 946*

Nancy Sherwood, Darrell Zielinski, MAR Systems Inc, Solon, Ohio

Prepared discussion by: Rudy Labban, PE, Inflico Degremont, Ashland, VA

### **IWC-13-60**

*Helping Industries Meet Stringent Mercury and Heavy Metal Discharge Limits through Cost-Effective Technology ..... 963*

E. H. Kelle Zeiher, Al Foster, Maurice Smith, AkzoNobel, Chattanooga, TN

Prepared discussion by: James Beninati, HDR Engineering, Pittsburgh, PA

## **COOLING WATER TREATMENT - IMPROVING PERFORMANCE, MONITORING AND SYSTEM EFFICIENCIES**

*IWC Representative:* Paul Puckorius, Puckorius & Associates, Inc., Arvada, CO

*Session Chair:* Kenneth Dunn, Ashland Water Technologies, Shrewsbury, MA

*Discussion Leader:* Ed Sylvester, Chemtreat, Glen Allen, VA

### **IWC-13-61**

*Novel Dual Active Targeted Delivery Technology for Improved Biofilm Control in Industrial Cooling Systems ..... 984*

Linna Wang, Juan Jiang, Yan Yang, Yongtao Shi, Qiaoni Liu, GE Power & Water, Water & Process Technologies, Shanghai, China, Javier Tomas San Celestino, GE Power & Water, Water & Process Technologies, Barcelona, ES, Dorothy Reynolds, Gloria Tafel, Jeffrey Melzer, GE Power & Water, Water & Process Technologies, Trevose, PA

Prepared discussion by: Sam Renfrow, Chemtreat, Columbus, MI

### **IWC-13-62**

*The Impact of pH and Protonation State on Scale Inhibitor Activity ..... 999*

Robert J. Ferguson, French Creek Software, Inc., Valley Forge, PA

Prepared discussion by: Prasad Kalakodimi, Chemtreat, Glen Allen, VA

### **IWC-13-63**

*A Monitor for Measuring Scale Deposition in Cooling Towers ..... 1007*

Charles J. Reedy, Ph.D., Nalco, An Ecolab Company, Naperville, IL

Prepared discussion by: Lee Hollimon, Ashland Water Technologies, Pensacola, FL

### **IWC-13-64**

*Real-time Performance Diagnostics Identifies Fouling Root Cause-Increasing Plant Efficiency by 5% ..... 1017*

Darcy Dauterive, Jeffy Kristy, Ashland Water Technologies, Wilmington, DE

Prepared discussion by: Craig Myers, Nalco, An Ecolab Co., Naperville, IL

## PURE WATER

*IWC Representative:* Steven Gagnon, AVANTech, Inc., Columbia, SC

*Session Chair:* Steven Siverns, Pureflow, Inc., Graham, NC

*Discussion Leader:* Alan Knapp, Siemens Industry Inc., Water Technologies, Lake Oswego, ON  
Canada

### IWC-13-65

*Ultrapure Water (UPW) – Quality and Technology to Support Advanced Industries' Needs ..... 1034*

Vyacheslav Libman, Ph.D., Air Liquide - Balazs NanoAnalysis, Fremont, CA

Prepared discussion by: John Brittan, Siemens Water Technologies, LLC,  
Colorado Springs, CO

### IWC-13-66

*Advanced Oxidation Process Technology for Ultrapure Water in the Semiconductor Industry ..... 1051*

Glen Sundstrom, Bruce Coulter, Siemens Industry Inc. Water Technologies, Rockford,  
IL , Christopher Hall, Siemens Water Technologies LLC, Colorado Springs, CO, Alan  
Knapp, Siemens Water Technologies LLC, Portland, OR

Prepared discussion by: Randy Cooper, Ph.D., Neotech Aqua Solutions, San  
Diego, CA

### IWC-13-67

*Pretreatment System Selections & Typical Design Parameters ..... 1064*

Gregory Osen, Steven Gagnon AVANTech, Inc., Columbia, SC

Prepared discussion by: Brian Powers, HDR Engineering, Inc., Charlotte, NC

### IWC-13-68

*Case Study of a Filtration System that Virtually Eliminated Biofouling of the RO system ..... 1087*

Reinhold Brenner, Von Roll BHU Environmental Technologies, Stuttgart, Germany

Prepared discussion by: Katariina Majamaa, Dow Chemical China, Shanghai,  
China

## **SAGD PRODUCED WATER TREATMENT ZERO LIQUID DISCHARGE**

*IWC Representative:* Michael Sheedy, Eco-Tec, Inc., Pickering, ON Canada

*Session Chair:* Rafique Janjua, Fluor Enterprises, Inc., Sugar Land, TX

*Discussion Leader:* Manish Backliwal, AquaChem ICD, Hartland, WI

### **IWC-13-69**

*Key Parameters, Design Criteria and Tips for Selection of Produced Water Evaporators - A Different Approach ..... 1101*

Andreas Ronnfors, M.Sc. M.E. Energy Sciences, Alfa Laval Corporate AB, Lund, Sweden, Rafael Gay-de-Montella, M.Sc. P.Eng., Transprocess Inc. Calgary, AB, Canada, Crisel Rivas, Stanley Foster, Alfa Laval, Calgary, AB, Canada

Prepared discussion by: Ramesh Sharma, ConocoPhillips, Houston, TX

### **IWC-13-70**

*Bench-Scale Evaluation of Solidification Technology for SAGD Waste Brines ..... 1111*

David Pernitsky, Anita Selinger, Suncor, Calgary, AB Canada, Chris Haussmann, Water Systems Specialists, Inc., Seattle, WA, Jean-Marc Jossinet, Nexen Energy ULC, Calgary, AB Canada, Paul Lear, DeNovo Group, Chicago, IL, James Nowak, GE, Bellevue, WA, Sudhir Parab, Conoco Philips Canada, Calgary AB, Canada, Adele Zenide, Canadian Natural Resources Limited, Calgary, AB Canada

Prepared discussion by: Martin R. Godfrey Ph.D., Nalco, Calgary, AB Canada

### **IWC-13-71**

*Enhancements in Evaporative Efficiency for Oil Sands Water Treatment ..... 1124*

Greg Mandigo, AquaChem ICD Aquatech International Corporation Hartland, WI

Prepared discussion by: Kevin Drake, P. Eng., Drake Consulting, Calgary, AB Canada

### **IWC-13-72**

*Factors to Consider when Evaluating Conventional Treatment (HLS or WLS/LSF/lx) vs. Evaporator for Produced Water Treatment (PWT) ..... 1144*

John Fair, Fair Canada Engineering Ltd., Calgary, AB Canada

Prepared discussion by: Mike D'Ippolito, Devon Canada, Calgary, AB, Canada

## **STEAM CYCLE CHEMISTRY: MONITORING, CONTROL, AND PERFORMANCE ISSUES**

*IWC Representative:* Wayne Bernahl, W. Bernahl Enterprises Ltd., Elmhurst, IL

*Session Chair:* William Moore, WesTech Engineering, Inc., Salt Lake City, UT

*Discussion Leader:* William Tuck, Anderson Water Systems, Inc., Ancaster, ON Canada

### **IWC-13-73**

*The Impact of Steam Cycle Chemistry on Power Plant Performance and Operational Costs ..... 1167*

Kenneth Chen, Fluor Enterprises, Inc., Aliso Viejo, CA, Dennis McBride, Fluor Enterprises, Inc. Greenville, SC

Prepared discussion by: Josh Prusakiewicz, HDR Inc., Pittsburgh, PA

### **IWC-13-74**

*Monitoring Flow Accelerated Corrosion in the Steam Cycle Using Alternative Methods ..... 1182*

Kenneth Kuruc, Denton Slovacek, Mike Sadar, Luke Johnson, Hach Company, Loveland, CO

Prepared discussion by: Daniel Sampson, Worley Parsons, Vallejo, CA

### **IWC-13-75**

*The Influence of System Parameters on TOC Degradation ..... 1194*

David Moed, S.G.J. Heijman, L.C. Rietveld, Delft University of Technology, Delft, Netherlands, A.R.D. Verliefde, Ghent University, Ghent, Netherlands, Delft

Prepared discussion by: Debbie Bloom, Nalco Company, Naperville, IL

### **IWC-13-76**

*Outsourced Water Treatment Provides Higher Purity and Low TOC for Nuclear Power Plant ..... 1210*

Michael Reyes, Veolia Water Solutions & Technologies, Vandalia, OH USA

Prepared discussion by: Randy Harney, Fluor, Aliso Viejo, CA *Not Available*

### **IWC-13-BU2**

*Modularized Design and Construction Approach to Achieve the Lowest Total Cost for a SAG Produced Water Evaporation Facility ..... 1219*

Yatin Pandit, Jeff Burn, Gary Rasmussen, Nishith Vora,  
William Heins, GE Water & Process Technologies