



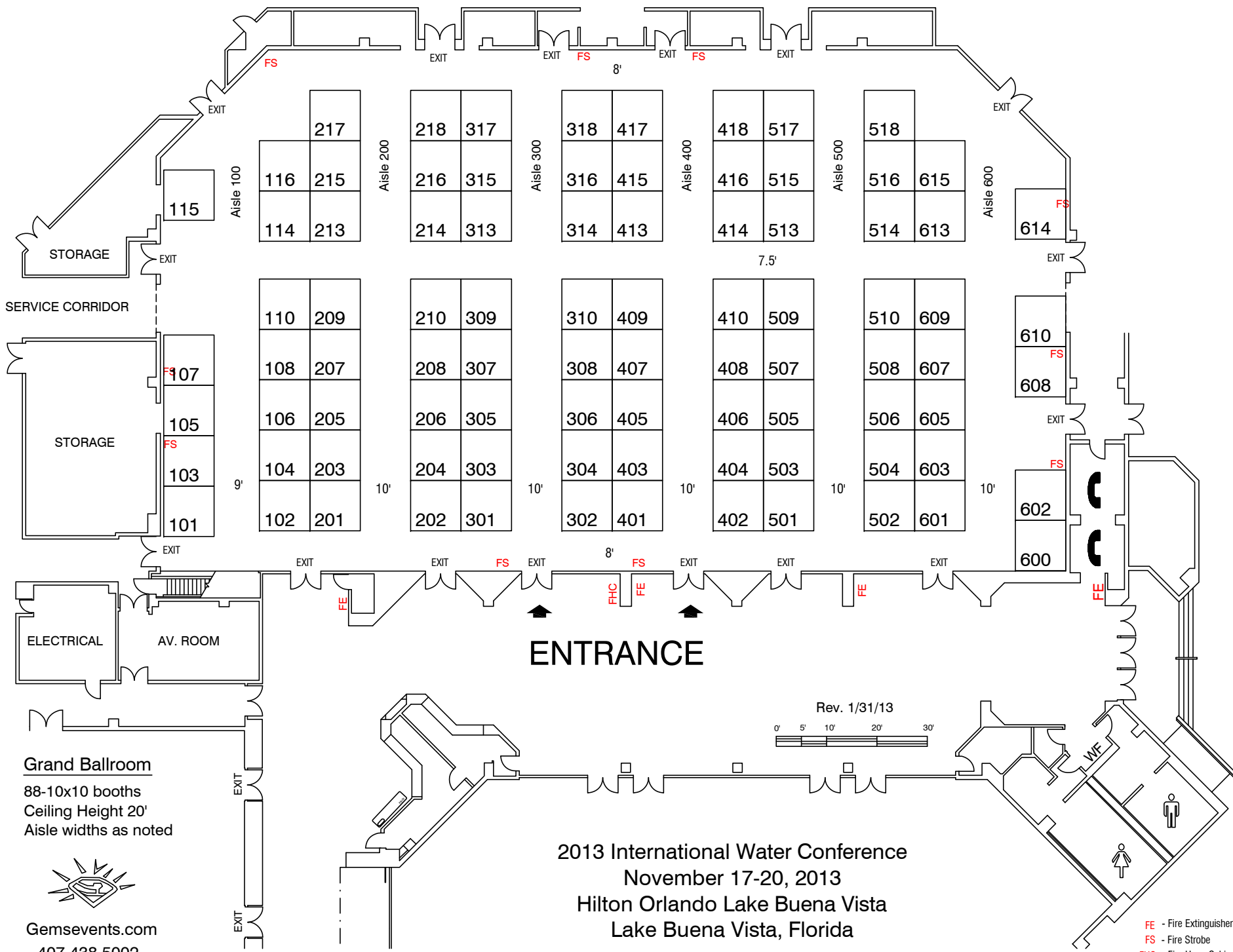
The 74th Annual

**INTERNATIONAL  
WATER CONFERENCE®**



**CONFERENCE PROGRAM GUIDE**

**Hilton in Walt Disney World Resort®  
Orlando Florida, USA | November 17-21, 2013**

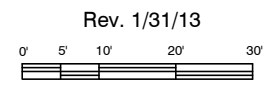


**Grand Ballroom**  
 88-10x10 booths  
 Ceiling Height 20'  
 Aisle widths as noted



Gemsevents.com  
 407.438.5002

**ENTRANCE**



2013 International Water Conference  
 November 17-20, 2013  
 Hilton Orlando Lake Buena Vista  
 Lake Buena Vista, Florida

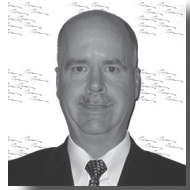
FE - Fire Extinguisher  
 FS - Fire Strobe  
 FHC - Fire Hose Cabinet

## TABLE OF CONTENTS

Schedule at a Glance .....	Centerspread
Chairman's Welcome .....	Pages 2-3
Continuing Education Workshops .....	Pages 52-56
General Information .....	Pages 8-10
Exhibitor Information .....	Pages 59-83
Hotel Maps .....	Inside Cover
Info-Share Suite Listing .....	Page 57-58
IWC Advisory Council .....	Page 5
IWC Executive Committee .....	Page 4
IWC Sponsors .....	Pages 6-7
Keynote / Awards Session .....	Page 18
Spouse's Breakfast .....	Page 9
<b>Technical Sessions, by day:</b>	
<b>Monday AM Technical Sessions .....</b>	<b>Pages 12-18</b>
Reuse and Recovery Treatment Technologies.....	12
Water Conservation and Management.....	13
Produced Water Pretreatment for Enhanced Oil Recovery Systems .....	15
Ongoing Research and Results to Help Meet the Proposed Effluent Limitation Guidelines.....	16
Keynote Session.....	18
<b>Monday PM Technical Sessions .....</b>	<b>Pages 19-25</b>
Ion Exchange and Specialty Adsorbents.....	19
Metals Chemistry and Process Engineering Marry in Mine Water Treatment .....	21
Shale Gas and EOR Water Management and Reuse.....	22
ASME Session: Identifying and Preventing Corrosion and Failures in Steam Generators.....	24
<b>Tuesday AM Technical Sessions .....</b>	<b>Pages 26-33</b>
Diversity in Membrane Applications .....	26
Industrial Wastewater Treatment for FGD, Microelectronics, Refining and Other Industries.....	28
Advances in Frac Water Treatment and Residuals Recovery .....	30
FGD Operational Impacts and Treatment Technologies.....	32
<b>Tuesday PM Technical Sessions .....</b>	<b>Pages 34-41</b>
Designing, Operating, and Troubleshooting Zero Liquid Discharge Systems.....	34
Potable Water.....	36
ASME Session: OTSG – Design, Treatment, and Monitoring Opportunities .....	38
Innovative Solutions to Trace Contaminants Issues .....	40
<b>Wednesday AM Technical Sessions .....</b>	<b>Pages 44-50</b>
Cooling Water Treatment .....	44
Pure Water.....	46
SAGD Produced Water Treatment Zero Liquid Discharge .....	48
Steam Cycle Chemistry: Monitoring, Control, and Performance Issues.....	50

## Chairman's Welcome

Welcome to the 74th annual International Water Conference® (IWC). The Engineers' Society of Western Pennsylvania (ESWP), the IWC Advisory Council, and the IWC Executive Committee are very proud to present the IWC as a very important source of up to date technical information and training on the most relevant topics in the industrial water and wastewater industry. Our conference will span multiple industries including power (both fossil and nuclear), oil and gas production and refining, mining operations, as well as many others. You will find our technical program filled with relevant topics such as wastewater treatment for the shale gas industry; produced water treatment for the oil and gas industry; pure water, fluidized gas desulfurization, reuse and recovery technologies, and zero liquid discharge systems. We continue to provide excellent technical papers on topics such as ion exchange, cooling water treatment, recycle/reuse, membrane treatment, as well as trace contaminant removal. The tremendous resurgence that our conference has experienced over the last number of years is strong validation that it is the best water specific technical conference in the United States and we are particularly proud of our format including peer review and prepared discussions for virtually every paper presented. We hope that you each learn something that helps you advance your career and our profession. Please tell a friend or colleague about us and make sure you invite them to join us in San Antonio next year as we celebrate a monumental milestone — The 75<sup>th</sup> Annual International Water Conference®. Next year's conference promises to be a "can't miss" event that will be full of extra surprises and exciting events to mark the historic anniversary.



*Michael B. Ryder, P.E.*

Scheduling of our technical program always considers avoidance of presenting similar topics in parallel sessions. However, with a large program and the varied interests of the attendees, it is impossible to eliminate conflicts for everybody. Therefore, all papers that are received by the due dates will be available for sale electronically on flash memory at the registration desk.

Our conference also offers the opportunity to attend many workshops, which provide Continuing Education Credits. These workshops are designed to span the needs of those looking for entry level, generalized training to highly specialized training for participants who may be more advanced in their water treatment knowledge. The workshops are held on Wednesday afternoon and Thursday. Registration for the workshops is open at the registration desk during the conference if you did not pre-register.

We have again sold out our Exhibit hall which has been expanded this year to accommodate the growing list of valued exhibitors. The exhibit hall will be full of displays containing the latest technological developments in water and wastewater treatment. Take advantage of this opportunity to meet directly with industry experts. Lunches and refreshments will be supplied in the exhibit hall and all conference registrants are welcome. We also encourage our participants to take advantage of the hospitality suites and vendor provided presentations that may be offered outside of the normal conference hours.

We are excited to have Mr. Peter Oostveer, Group President, Energy & Chemicals of Fluor Corporation, as our keynote speaker. We always strive to have our keynote address complement our technical program by being an educational and informative presentation on a highly relevant topic. We hope that you will find Mr. Oostveer's presentation to be both inspiring and informative.

Of course, a conference of this size does not get put together without the hard work

---

## Chairman's Welcome

---

of a lot of people. I want to especially thank the ESWP staff, Stephanie Mueller, Dave Teorsky, Michael Gaetano, and Cori Stellfox, for their hours of hard work. One of them will be at the registration desk during operating hours to answer any questions and provide any help that you might need.

Every Executive Committee member is a volunteer and has spent countless hours coordinating sessions, exhibits, workshops, and marketing to make sure the conference runs smoothly. Colleen Layman had the challenging task of being our 2013 IWC Technical Program Chairperson. This is one of the most time consuming positions on the IWC Executive Committee. Steve Gagnon was responsible for coordinating the workshops this year. I want to thank Colleen and Steve for the fine job they did in putting together the 2013 IWC Technical Program and Workshops. Many other Executive Committee members also participated in planning and coordinating other aspects of this year's IWC. Please let them know your appreciation by thanking the Executive Committee members, noted by the Committee label on their name badge, for the efforts they put in to making this another successful IWC.

I would also like to thank the representatives of the Advisory Council companies that offer their expertise and advice to keep the conference current and interesting for all. The companies of the Advisory Council also sponsor various events like the coffee breaks, fellowship evenings, and other items that help make the conference better for all of us. Please thank the members of the Advisory Council for their efforts in helping to make the 2012 IWC a success. If you have any interest in becoming a member of the Advisory Council, please see a staff member at the registration desk.

And of course there are the many people involved in the conference as Session Chairs, Discussion Leaders, Authors, Discussers, and Workshop Presenters. They put in a lot of time and effort to make the IWC one of the best technical conferences for those in the business of water and wastewater treatment. This is our goal and what we strive to achieve every year. Thank you to all.

Finally, it is with a heavy heart that we said goodbye to three people in 2013 that have meant a lot and contributed greatly to the success of the IWC over the years. Longtime Executive Committee members Dave Simon and Andrew Calderwood, along with Advisory Council member Peter Midgley all passed away in the last six months and will be missed greatly. Their contributions to the IWC over the years have been immeasurable and were integral to making it what it is today.

I hope that you enjoy this year's conference. I look forward to meeting and talking with many of you during our time in Orlando. We also welcome your feedback as we use this information to make improvements in future conferences. The end of the 2013 IWC marks the beginning of the 2014 – 75<sup>th</sup> Anniversary conference where we look forward to seeing you again in San Antonio.

Sincerely,



Michael B. Ryder, P.E.

Chester Engineers, Inc.

2013 IWC General Chairman

**IWC EXECUTIVE COMMITTEE**

The International Water Conference® (IWC) is sponsored by the Engineers' Society of Western Pennsylvania (ESWP), a membership based, not-for-profit organization, located in Pittsburgh, PA. Learn more at [www.eswp.com](http://www.eswp.com). The IWC is planned mainly through the volunteer efforts of these top industry professionals who make up the IWC Executive Committee and IWC Advisory Council Company representatives. ESWP extends a sincere thank you to the entire Executive Committee for their efforts in planning this year's conference. Very special thanks go to the General Chair, Michael Ryder and Technical Chair, Colleen Layman.

General Chair

Michael B. Ryder, P.E.

Chester Engineers

Technical Program Chair

Colleen M. Layman, P.E.

HDR, Inc.

Workshop Chair

Steven R. Gagnon

AVANTech, Inc.

Immediate Past Chair

Dennis McBride

Fluor Enterprises, Inc.

Committee

George Abraham, P.E.

Veolia Water Solutions & Technologies

Wayne Bernahl

W. Bernahl Enterprises Ltd.

Debbie Bloom

Nalco Company

Michael Gottlieb

ResinTech

John Lucey, Jr., P.E.

Nuverra Environmental Solutions

Paul Puckorius

Puckorius & Associates, Inc./Water  
Training Services

Dan Rice

DBR Consulting

James Sabzali

Aldex Chemical Company Ltd.

Michael Sheedy

Eco-Tec

Manoj Sharma

Aquatech International Corp.

Kumar Sinha, P.E.

Consultant

Bradley D. Wolf, P.E.

Berkeley Research Group, LLC

David Simon\*

Consultant

Andrew Calderwood\*

Consultant

\*deceased in 2013

## IWC ADVISORY COUNCIL

The IWC Advisory Council is a group of companies that provide ongoing support for planning of a successful conference. Membership is open to companies that have an interest in industrial water & wastewater treatment, and are willing to make a commitment to participate in two meetings through the year. In addition to promotional benefits for their firm, AC reps are entitled to one complimentary conference registration. For more information about the IWC, see any members of the IWC Advisory Council, IWC Executive Committee, or contact the ESWP office.

AMBI-Design, Inc.

Shan Sundaram, P.E.

Aquatech International Corp.

Devesh Mittal

Ashland Water Technologies

Ken Dunn

AVANTech, Inc.

Jim Braun

Avista Technologies

Mike Graver

Bechtel Power

Michele Funk

Black & Veatch

Mike Preston

Burns and McDonnell

Patricia Scroggin

ChemTreat, Inc.

Raymond M. Post, P.E.

Chester Engineers

Jerry Penland

Crane Environmental

Robert Glod

Degremont North America

William Tuck

Dow Chemical Company

Jim Summerfield

Eco-Tec Inc.

Michael Dejak

Epicor Incorporated

Fred Keough

Fluor Enterprises, Inc.

Rafique Janjua

Fort Bend Services, Inc.

James Dromgoole

French Creek Software

Robert Ferguson

GAI Consultants, Inc.

Scott Quinlan

GE Water and Process Technologies

Lanny Weimer

Golder Associates Inc.

Paul Pigeon, PE

Graver Water Systems, LLC

Robert Applegate

HDR Inc.

Thomas Lawry

Kalluri Group, Inc.

Ramesh Kalluri

LANXESS Sybron Chemicals, Inc.

Ed Nace

MAR Systems, Inc.

Richard Stuebi

MPW Industrial Services

Justin Pierce

Nalco Company, an EcoLab Company

Jane Kucera

ResinTech

Peter Meyers

Purolite Corporation

Donald Downey

Samco Technologies Inc.

Richard Posa

Severn Trent Services

Charles J. Guzelli

Siemens Water Technologies

Jerry Alexander

Southern Research Institute

Jay Wos

Tetra Tech, Inc.

Jonathan Shimko

Thermax

Cindy Gresham

Turner Designs

Chip Westaby

Veolia Water Solutions & Technologies

George Abraham, P.E.

WesTech Engineering, Inc

Jim Woods

## FINANCIAL SPONSORS

A special "Thank You" to all of our financial sponsors of the 2013 International Water Conference®, it is through the generous support of the following companies that we are able to present the following amenities and events during this year's IWC.

### Registration Banner

American Water Chemicals, Inc.



### Hotel Key Card

Aquatech International Corp.



### Tote Bag

Bowen Engineering Corporation



### Speaker's Breakfast

BWA Water Additives



### Banner at Entrance

GAI Consultants, Inc.



### Coffee Break

HDR, Inc.



### Reception

Mitsubishi Electric Automation



### Lanyards

Nuverra



### Coffee Break

ResinTech, Inc.



UOP, A Honeywell Company



WaterColor Management



Flyer in Tote Bag

WaterColor Management



Web Spot

WesTech Engineering, Inc.





## MEDIA PARTNER AND CO-SPONSORS

A special "Thank You" to the media partners and co-sponsoring organizations of the 2013 International Water Conference®, through their support and marketing efforts, we are able to introduce the IWC to greater audiences. Thank you!

Chemical Engineering

Chemical Processing

GWJ

Pollution Equipment News/ Rimbach Publishing Inc.

UltraPure Water Journal

Water Conditioning & Purification Mag

Water Utility Infrastructure Management Online (UIM)

Process Cooling

Power Plant Chemistry

WaterOnline

Pollution Engineering

World of Chemicals

Sustainable Plant/ Putman Media

Sea Technology Media

International Private Water (IPWA)

H2Bid.com

energy

transportation

real estate

**water**

municipal

government

industry

airport

institutions

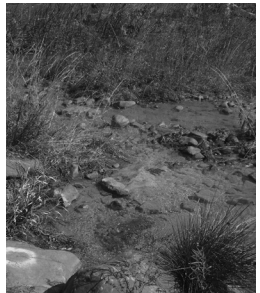


gai consultants



There's always a  
**solution**

Comprehensive strategies succeed when you reach out to GAI's engineering and environmental leaders. Get the answers you need, *before* you need them.



[gaiconsultants.com/IWC](http://gaiconsultants.com/IWC)

### About the IWC

---

The IWC is the world's premier Conference for understanding and dealing with the technical and business challenges of industrial water treatment. IWC presents the latest in scientific advances and practical applications in this field, cutting across a wide range of industries and functional areas.

As the preeminent international technical forum in the field, the IWC will bring together more than 800 end users, researchers, practicing engineers, managers, educators, suppliers and contractors. It is dedicated to advancing new developments in the treatment, use and reuse of water for industrial and engineering purposes.

The IWC has always been a strong educational conference. Attendees come to learn about the latest applications available in the industrial water treatment industry, educate themselves in current technology and applications through attendance in IWC workshops, and network with their peers' active in water treatment.

### What makes the IWC Different?

---

All papers presented at the IWC are carefully peer reviewed for quality and to ensure no commercial aspect is evident. In addition to the broad educational and networking opportunities being offered, the IWC invites you to participate through our unique Prepared Discussion program. Each paper presentation at the conference is followed by a Prepared Discussion – a thoroughly considered, different perspective on the topic. This is followed by an open floor discussion when all audience members and presenters can fully interact - ask questions, seek clarification, and raise alternative viewpoints, in essence – learn more!

### ASME Co-Meetings

---

- The ASME Executive Subcommittee will meet on Sunday, November 17 from 7:00 PM - 9:00 PM.
- The Produced Water Task Group will meet on Tuesday, November 19 from 6:30 PM - 9:30 PM.
- The ASME Main Committee will meet Wednesday, November 20 from 2:00 PM - 5:00 PM and again on Thursday, November 21 from 8:00 AM - 12:00 NOON.

All meetings will occur in the Lily room located on the Mezzanine Level. All are welcome!

### Conference Proceedings

---

All registered attendees (except Exhibit Only) will receive a CD containing the Official Conference Proceedings of the 74th Annual International Water Conference®. The CD will be direct mailed to you approximately 2 months following the conference.

### Call for Papers

---

To participate in the 2014 International Water Conference® as a presenter, please watch for the opening of the IWC Call for Papers. The Call for Papers is done exclusively on-line through the IWC home page at [www.eswp.com/water](http://www.eswp.com/water). For more information on how to become active in the IWC as an Exhibitor, Advisory Council Company, Executive Committee member, please contact Conference Manager, Stephanie Mueller, at 412-261-0170 ext. 13 or by e-mail at [s.mueller@eswp.com](mailto:s.mueller@eswp.com).

### Americans with Disabilities Act

---

The International Water Conference® and the Engineers' Society of Western Pennsylvania support the Americans with Disabilities Act (ADA), which prohibits discrimination against, and promotes public accessibility for, those with disabilities. We ask those requiring specific equipment or services as an attendee to contact the ESWP Conference Department and advise us of any such requirements in advance.

### Professional Development Hours

---

Attendees are eligible to earn up to 20 Professional Development Hours (PDH) to satisfy Continuing Education requirements. Official confirmation of your attendance will be provided upon request. The Engineers' Society of Western Pennsylvania, sponsor of the IWC, is recognized as an Approved Provider by the Florida Board of Professional Engineers Bureau of Licensing and the New York State Board of Professional Licenses\*. ESWP may grant Professional Development Hours to other states as well. Please go to the registration desk in order to receive a form or at [www.eswp.com/water](http://www.eswp.com/water). Return it to the Registration desk at the end of the conference. The ESWP staff will produce letters within the next month after the conference.

\*Special sign-in procedures are required for NY State PDH's

### Attendee Receptions

---

To help you enjoy your stay in Orlando during the 2013 IWC, we have many special events and activities planned for you. Join your fellow conference attendees at the annual Get Acquainted Reception, held on Sunday in the Exhibit Hall to welcome you to the Conference. Also, all registered attendees are welcome to attend the Receptions on Monday and Tuesday night in the Exhibit Hall. Luncheon buffets are also provided Monday and Tuesday afternoons in the Exhibit Hall. Schedule time to visit the exhibits and enjoy lunch on us!

If your spouse is accompanying you to the IWC, please properly register him or her at the Registration Desk to gain admittance into these events.

### Literature Table

---

Our media partners are the ones who make sure the word is spread about the conference! There is a table filled with literature from these partners as well as information about the area. Please take a moment to stop by and check it out!

### Spouses' Welcome Breakfast

---

For spouses who are traveling with conference registrants, the IWC will host a Welcome Breakfast on Monday, November 18 at the Hilton Hotel. You will be able to meet and network with other spouses to plan your own agenda of activities. Please complete registration form at the IWC Registration Desk. Advance registration is required.

### IWC Fun Run

---

Come join us for the 27<sup>th</sup> Annual IWC Fun Run in Orlando! This event, sponsored by ResinTech, is open to all runners and walkers attending the conference and T-shirts will be awarded to all participants (limited quantity). Start time & place: Tuesday Morning, November 19 at 7:00 AM Sharp; meet in the Hilton Hotel lobby at 6:45 AM. Distance: 3 miles — flat and easy course.

### Merchandise

---

IWC shirts and hats are available for sale! Pre-prints for (most) technical presentations are available at the Registration Desk. Pre-prints can be purchased for \$5.00 per copy, or \$25 per 1GB flash drive with all the available papers. Also, you can find copies of previous years' IWC Proceedings for \$55 per volume.

### Name Badge Identification

---

All registered conference attendees are asked to please wear your official IWC name badge at all times. Your official IWC name badge is your passport to the Technical Session, the Exhibit Hall, and International Water Conference® social functions. In addition, important local phone numbers have been printed on the back of your badge for your use. To avoid any confusion with access to the events, please refrain from personalizing your official IWC name badge with any stickers, ribbons, etc., not provided by the Registration Desk.

Please note that exhibit hall only registrations are only entitled to attend functions in the exhibit hall. They are not permitted to attend technical session or plenary sessions. This will be strictly enforced on site.

If you wish to upgrade your registration to a full-conference or one-day registration, please do so at the registration desk.

### Registration Lists

---

There will be a registration list of all those attending the conference available to view at the Registration Desk. A PDF version will also be available on the computer in the WebSpot to view and jump onto a USB.

An electronic version of the Registration List will be available at the Registration Desk the morning of Wednesday, November 16. It provides the names of all registered attendees in both Excel and comma-delimited text formats. There is a \$25 fee, please provide a USB drive.

### In Memory

---

Over the past year of 2013, we lost three important members of the International Water Conference®. Our hearts are saddened by the passing of David Simon and Andrew Calderwood, who were long time members of the Executive Committee, as well as Peter Midgley, who was a member of the Advisory Council. We will keep them in our memories during this and future International Water Conferences®

### Social Media

---

Keep up on the latest details of the conference by using #IWC13 and follow @EngSocWestPA on Twitter, or like us on Facebook: International Water Conference

### Future Conference Dates

---

See you next year on November 16-20, 2014 - Marriott Rivercenter, San Antonio, TX for the 75th Anniversary!



RESINTECH INC.  
**MIST-X**  
Multiple Ion Exchange Simulation Technology

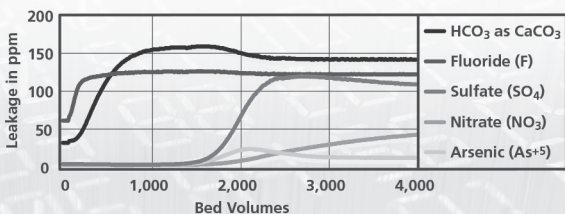
## ACCURATE CAPACITY PROJECTIONS

Until now, ion exchange predictions acquired from engineering manuals and simple computer simulations could only tackle applications such as softening, dealkalization, and deionization.

With the ResinTech MIST-X Simulation Technology we have extended the scope of performance ratings. Now complete breakthrough curves can be provided for any and all ions passing through the resin bed including nitrate, arsenic, uranium, sulfate, and others.

Performance ratings can be made for:

- ANY ION OR COMBINATION OF IONS
- ANY REGENERATION SCHEME
- MULTIPLE CYCLES



### PUT MIST-X TO WORK FOR YOU!

Send in your water analysis and ResinTech will generate a customized graph showing the predicted water quality throughout the run.



856-768-9600 • [resintech.com](http://resintech.com)

## REUSE AND RECOVERY TREATMENT TECHNOLOGIES

Date: ..... Monday November 18  
Time: ..... 8:00 - 11:00 AM  
Room: ..... International Ballroom North

Water reuse in oil recovery applications can save time and money, reducing the need for discharge permits with increasingly stringent limits or costly hauling and disposal fees. This session focuses on various methods that promote maximum reuse of process water, including both traditional and innovative methods for treating produced water; a simulation model for steam-assisted gravity drainage (SAGD) produced water treatment facilities; and patented processes that reduce deposits on reverse osmosis membrane surfaces thereby increasing the recovery of produced water from these

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

**Session Introduction:** **8:00 AM**

Scott Quinlan, GAI Consultants, Cranberry Township, PA

**IWC-13-01** **8:10 AM**

### OIL FIELDS (PRODUCED) WATER TREATMENT RECOVERY – REUSE CHALLENGES AND OPPORTUNITIES

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

Oil fields produced water recovery; its treatment can be challenging and expensive depending on its intended reuse. Produced water treatment required for overboard outfall from offshore platforms, verses water flooding for enhanced oil recovery, verses steam flooding requires different technologies and is progressively more capital intensive. This paper discuss how the prevailing technologies used in steam assisted gravity drain (SAGD) produced water treatment can be improved, either by combining or outright replacing some operating units with innovative yet valid chemical processes which can deliver an optimum water treatment system resulting in lower capital cost, lower operating cost, lower greenhouse gases (GHG) and lower waste production.

Discusser: William Moore, Westech Engineering, Salt Lake, UT ..... 8:35 AM  
Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-02** **9:00 AM**

### A WATER TOOLBOX TO OPTIMIZE SAGD WATER RECYCLING OPERATIONS

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

A “Water Toolbox” consisting of a Process Fluid Database (PFDB) combined with an electrolyte simulation of produced water treatment facilities enables optimization of SAGD water recycling operations. This paper discusses the processes that Statoil (the Company) developed in the creation of the Water Toolbox and some of the early successes as well as challenges and limitations of the simulation tool that have been realized as a result.

Discusser: Jason Monnell, GAI Consultants, Homestead, PA ..... 9:25 AM  
Floor Discussion and Closure: ..... 9:35 AM  
Break: ..... 9:50 AM

**IWC-13-03** **10:10 AM**

### ADVANCED MEMBRANE PROCESS FOR WATER AND WASTEWATER RECOVERY

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

Improving the recovery of permeate from existing and new reverse osmosis membrane systems offers several benefits to people and industry since it increases water availability and minimizes waste. Unfortunately RO Systems are limited by formation of scale,

## Monday's Sessions

calcium and magnesium carbonate, sulphate, phosphate and silica that deposit on the membrane surface thus limiting the membrane permeate recovery. The ARROW® and ZERO® processes alleviate these limitations and allow for substantially increased recovery of product water from RO and NF membranes, thereby achieving recoveries in the range 95% - 98%, using simple and efficient process configurations involving RO and Ion Exchange resins. This patented process is configured in a manner that allows economy and latitude in design, construction, retrofitting and operation, resulting in a rapid economic payback of less than 2 years based on savings in raw water and effluent disposal costs. By achieving 95% - 98% recoveries, this technology also enables installations in remote or water-stressed areas where disposal of membrane system effluents by evaporation can be costly. Case history applications of this technology will be presented in this paper. The process can be used for desalination of brackish water, purification of water for plant use, cooling towers, boilers, power stations and in the recovery and reclamation of water from municipal and industrial facilities.

Discusser: Gianna Cooley, CDM Smith, Houston, TX ..... 10:35 AM  
Floor Discussion and Closure: ..... 10:45 AM  
Conclusion: ..... 11:00 AM

### WATER CONSERVATION AND MANAGEMENT

Date: ..... Monday November 18  
Time: ..... 8:00 - 11:00 AM  
Room: ..... International Ballroom Center

Less than 1% of the world's water is fresh and useable. Managing and conserving water in an economic way is of the utmost importance. The Session includes industry champions who will present challenges and solutions using actual data, water balance modeling and experiences to implement operational strategies. Reclaim water from POTW's along with other sources of water will be reviewed, in both the Power and Refining industries.

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

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

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

**Session Introduction:** ..... 8:00 AM

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

**IWC-13-04** ..... 8:10 AM

#### MUNICIPAL RECYCLED WATER USE IN INDUSTRY: A ROADMAP

Daniel Sampson, WorleyParsons, Vallejo, CA

Industrial users are increasingly encouraged, sometimes required, to replace fresh water with municipal recycled water. Recycled water use usually focuses on cooling systems, but purveyors encourage other uses (demineralized water production, for example). Many users transitioned to recycled water without careful preplanning and suffered as a consequence. Recycled water can successfully replace other sources, but risks must be clearly understood and mitigated where possible. This paper discusses challenges associated with recycled water use and describes key components of a recycled water project.

Discusser: Joel M. Davie, M.S., P.E., Bechtel Power Corporation, Frederick, MD 8:35 AM  
Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-05****9:00 AM**

---

**MUNICIPAL RECLAIMED WATER USE AND TREATMENT IN INDUSTRY**

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

The use of reclaimed water is no longer the exception, but is fast becoming the only source of makeup water for industrial facilities. Reclaimed water presents unique challenges to both water treatment equipment and chemical treatment consultants. This paper reviews the current status of reclaimed water use in the Southwestern U.S. Case studies are presented that compare various chemical treatment options, showing that it is possible to successfully treat cooling systems using reclaimed water as makeup.

Discusser: Bruce Alderman, Desalitech, Eastampton, NJ ..... 9:25 AM

Floor Discussion and Closure: ..... 9:35 AM

Break: ..... 9:50 AM

**IWC-13-06****10:10 AM**

---

**WATER MANAGEMENT AND UNDERGROUND INJECTION WELL PERMITTING AT GREAT RIVER ENERGY'S COAL CREEK STATION**

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

At Great River Energy's (GRE) Coal Creek Station (CCS) generation leaders worked with Golder Associates Inc. (Golder) on a comprehensive site-wide water balance to evaluate and improve water management at the zero liquid discharge (ZLD) facility. Using the water balance as a guide, GRE submitted an aquifer exemption and a permit application for the installation of a Class I underground injection well to manage excess water at CCS.

Discusser: Diane Martini, Sargent & Lundy, LLC, Chicago, IL ..... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

Conclusion: ..... 11:00 AM



## PRODUCED WATER PRETREATMENT FOR ENHANCED OIL RECOVERY SYSTEMS

Date: ..... Monday November 18

Time: ..... 8:00 - 11:00 AM

Room: ..... International Ballroom South

Treatment and Management of Produced Water is essential to maintain production targets, and environmental regulations. The session will cover the elimination of Lime Softener, the use of MVC evaporator distillate, and Microfiltration system as pretreatment to the boiler feedwater in the Steam Assisted Gravity Drainage (SAGD) process.

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

**Session Introduction:** **8:00 AM**

Ivan Morales, Devon, Calgary, Alberta, Canada

**IWC-13-07** **8:10 AM**

### THE CASE FOR ELIMINATION OF LIME SOFTENERS FOR TREATMENT OF PRODUCED WATER FEEDING OTSGS

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

The operating guidelines for Once Through Steam Generators (OTSGs) used in SAGD operations in Alberta indicate that water used to feed such steam generators should contain no more than 50 mg/l of silica. Many SAGD projects in Alberta use produced water and source water with higher silica concentrations (150-350 mg/l) and so the standard water treatment flow sheet when such water will feed an OTSG is to incorporate lime softening with magnesium in order to reduce silica to less than 50 mg/l. By contrast most OTSGs operating on heavy oil production in California have produced water silica concentrations higher than 50 mg/l while virtually no lime softening for silica control is practiced. This paper compares the features of the treatment processes in these two areas and identifies the key design considerations that would result in a significant simplification of the standard treatment process used in Alberta, or elsewhere with high silica, without the expected risks of boiler scaling. Information that will be presented in the paper includes related operating experiences, solubility simulations, proposed flow sheets and economics.

Discusser: Donald Downey, Purolite Corporation, Paris, Onatrio, Canada ..... 8:35 AM

Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-08** **9:00 AM**

### CHEMISTRY OF PRODUCED WATER EVAPORATOR DISTILLATE

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

Steam Assisted Gravity Drainage (SAGD) oil production facilities that utilize evaporators to create feedwater for high pressure drum boilers are becoming more prevalent. Traditionally, demineralized quality feedwater is specified for high pressure boilers. Produced water evaporator distillate rivals demineralized water purity in some respects but differs greatly in others. This paper discusses the chemistry of produced water evaporator distillate and highlights important impurities such as hardness, silica, ammonia, sulfur and organics. The impact of these impurities on boiler cycle chemistry is detailed.

Discusser: Kevin Brown, ChemTreat, Vancouver, British Columbia, Canada ..... 9:25 AM

Floor Discussion and Closure: ..... 9:35 AM

Break: ..... 9:50 AM

**IWC-13-09**

**10:10 AM**

**BOILER FEED WATER TREATMENT AT A CANADIAN OIL SANDS FACILITY**

**Khalid Farooq, Pall Corporation, Port Washington, NY**

The Steam Assisted Gravity Drainage (SAGD) process used in heavy oil (bitumen) recovery from Canadian oil sands and the 'Upgraders' used to further refine the heavy oil into light sweet crude oil, both utilizes Once Through Steam Generators (OTSGs), Heat Recovery Steam Generators (HRSGs) and Conventional Drum Boilers for producing the large quantities of steam required. These steam generation technologies require high quality feed water, and since most operating facilities use water from sources that do not meet the water quality requirements, significant water treatment is necessary prior to its use to produce the steam. Conventional water pretreatment methods such as clarifier, multimedia and sand filtration are typically used upstream of Reverse Osmosis (RO) systems to produce the high quality water required for this application. These conventional pretreatment technologies are not well suited to handle the wide variations in the incoming water quality common in this application. Poor effluent water quality from the conventional pretreatment systems causes RO membrane fouling and the resulting costly production losses. The paper describes the operational experience gained at a Canadian oil sands facility that replaced its conventional multimedia pretreatment system with pressurized, hollow-fiber membrane based Micro Filtration (MF) system.

Discusser: Kevin Drake, P. Eng., Drake Water Treatment Consulting Ltd. .... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

Conclusion: ..... 11:00 AM

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

Date: ..... Monday November 18

Time: ..... 8:00 – 11:00 AM

Room: ..... Crystal Room

On April 20th, the EPA released the unofficial Proposed Effluent Limitation Guidelines (ELG) and Standards for the Steam Electric Power Generating Industry. This session will provide the audience with an overview of the EPA's proposed ELG rule, an overview of the research planned at the Water Research Center, and some results pertaining to the immobilization of heavy metals with fly ash and concentrated FGD wastewater brines

**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

**Session Introduction:**

**8:00 AM**

Dave Malkmus, ResinTech, West Berlin, NJ

**IWC-13-10**

**8:10 AM**

**NAVIGATING THE NEW STEAM ELECTRIC POWER EFFLUENT LIMITATION GUIDELINES**

**Colleen Layman, HDR Engineering, Harpers Ferry, WV**

In 1974 the U.S. Environmental Protection Agency (EPA) first issued the steam electric power effluent limitation guidelines (ELGs) 40 CFR Part 423 designed to regulate the wastewaters discharged from coal, gas, oil, and nuclear power plants. Today this regulation, which was last updated in 1982 and which now regulates wastewater discharges from approximately 1,200 electricity generators across the U.S., is undergoing update by the EPA to take into consideration the best available treatment technologies and current research on the impact of various contaminants on the environment. This paper will provide a brief background on the steam electric power ELGs and the findings of the

## Monday's Sessions

2009 EPA wastewater study that determined the need for the guideline update. It will detail the types of facilities and wastewater streams that will be impacted by the rule update and the timing for final rule issuance and implementation. Finally, it will explore the options available to impacted facilities to comply with the new ELG requirements.  
Discusser: Kristin Glikbarg, Burns and McDonnell, Kansas City, MO ..... 8:35 AM  
Floor Discussion and Closure: ..... 8:45 AM

### IWC-13-11

9:00 AM

#### WRC OVERVIEW

Jeff Wilson, Southern Company, Birmingham, AL

In partnership with the Electric Power Research Institute (EPRI) and the Southern Research Institute (SRI) Georgia Power announced the 12 million dollar WRC in 2011. The WRC was designed to focus on current and anticipated future regulations to the power industry such as the new EPA Effluent Guidelines. In addition, the facility focuses on 7 key areas of the Water Energy Nexus: overall power plant water management, wastewater treatment, Zero Liquid Discharge (ZLD) systems, solid landfill management Issues created by water technologies, advanced and hybrid cooling systems, moisture recovery, and water issues associated with Carbon Capture and Storage (CCS.) The WRC began testing in 2012 and this presentation outlines how the facility was designed and provides details on what technologies are currently being tested or that will soon be tested at the facility.

Discusser: Peter Meyers, ResinTech, West Berlin, NJ ..... 9:25 AM

Floor Discussion and Closure: ..... 9:35 AM

Break: ..... 9:50 AM

### IWC-13-12

10:10 AM

#### IMMOBILIZATION OF HEAVY METALS BY SOLIDIFICATION/STABILIZATION IN CO-DISPOSED COAL FLY ASH AND CONCENTRATED FGD WASTEWATER BRINES

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

Increasingly stringent regulations to control heavy metals in flue gas desulfurization (FGD) wastewater could result in the implementation of zero liquid discharge (ZLD) treatment systems at coal-fired power plants. One option for FGD wastewater ZLD treatment is the coupling of a brine concentrator with a solidification / stabilization (S/S) process. This S/S process could include the mixing of the concentrated brine with coal fly ash / lime, coal fly ash / cement, or a novel binder. A research project is currently being conducted at the Georgia Institute of Technology on the development of S/S technology for the co-disposal of concentrated FGD wastewater brines with coal fly ash. The primary research objectives of the project are to evaluate (i) the immobilization of heavy metals in co-disposed fly ash and concentrated FGD brines, (ii) the impact of coal fly ash properties and brine chemistry on the S/S, and (iii) the predominant minerals formed during the S/S. The first phase of the project will focus on the optimization of S/S recipes. The second phase of the project will evaluate the impact of coal fly ash properties (by varying the source of the ash) and brine chemistry (by varying brine composition) on the S/S process and heavy metal immobilization. The immobilization of heavy metals will be correlated to fly ash properties, brine chemistry, and characteristics of the S/S solids to identify critical factors in the effectiveness of this process.

Discusser: Michele Funk, Betchel, Frederick, MD ..... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

Conclusion: ..... 11:00 AM

## KEYNOTE SESSION

Date: ..... Monday November 18  
Time: ..... 11:00 - 12:00 Noon  
Room: ..... International Ballroom North

### Session Introduction:

11:00 AM

Michael Ryder, P.E., Chester Engineers, Coraopolis, PA

### Peter Oosterveer

#### Group President, Energy & Chemicals, Fluor Corporation

Mr. Oosterveer began his Fluor career in 1989 as a control systems engineer, gaining experience on various global upstream, downstream, and refinery and chemicals projects. In his current role, he is responsible for global business development and operations in the upstream and downstream oil & gas markets and all power, chemicals and petrochemicals industries.



Oosterveer has deep international client and project expertise in the energy and chemicals industries with previous executive roles running Fluor's chemicals operations for Europe, Africa and the Middle East. Before being named to his current role, he served as senior vice president of Fluor's global chemicals and petrochemicals business, where under his guidance the firm became the world's leading engineering, procurement and construction firm for polysilicon capital projects.

For more than 100 years, Fluor has partnered with its clients to design, build and maintain many of the world's most challenging and complex capital projects. Through its global network of offices on six continents, more than 40,000 employees provide comprehensive capabilities and world-class expertise in the fields of engineering, procurement, construction, commissioning, fabrication, operations, maintenance and project management. Today, Fluor serves a global client base in the energy, chemicals, government, industrial, infrastructure, operations & maintenance, manufacturing & life sciences, mining, power and transportation sectors.

### 2013 Awards of Distinction

The Annual Awards are presented at the opening Keynote Session on Monday, November 18 at 11:15 AM in International Ballroom North. Please join us to celebrate the following achievements in the water treatment industry.

**ANNUAL MERIT AWARD:** Each year, the International Water Conference® presents the Annual Merit Award to honor outstanding individuals in the field of industrial water technology. This year's Merit Award Winner is Bradley Wolf, Berkeley Research Group, Pittsburgh, PA.

**PAUL COHEN AWARD:** As a memorial to Paul Cohen and his contributions to the power generation industry, the IWC is proud to recognize the authors of the most precise and innovative presentation in the field of power systems water technology that was presented at the 72<sup>nd</sup> Annual International Water Conference®. This year, we honor Brad Buecker, Kiewit Power Engineers, Lenexa, KS for the presentation IWC 12-19, The Continuing Crusade Against Oxygen Scavenger Use in All-Ferrous Steam Generators.

**JOSEPH A. LEVENDUSKY SCHOLARSHIP:** This year, Epicor Inc. donated \$3,000 to one scholarship recipient, who is striving to continue his education in water engineering. This year's recipient is Charles Russell, West Bend, WI; he will be using this scholarship for his undergraduate career at University of Wisconsin.

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

Date: ..... Monday November 18

Time: ..... 1:30 - 5:30 PM

Room: ..... International Ballroom North

This session contains four papers that discuss the selective removal of eclectic contaminants. The University of Montana will discuss their novel Zr based sorbent and present data on removal of oxyanions: W, Mo, V and Ni. The next paper offers an update on chromate removal at Hanford including operating data and system modifications to switch from strong to weak base resins. A case study on removing sulfates from produced water for the rejuvenation of oil recovery via upstream well injection will then be examined. The final paper will present data from industrial and municipal installations highlighting operating costs and chemical efficiencies of IX systems used for perchlorate, nitrate and arsenic remediation.

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

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

Discussion Leader: ... Don Downey, Purolite Corporation, Paris, Ontario, Canada

**Session Introduction:** **1:30 PM**

Larry Gottlieb, ResinTech, West Berlin, NJ

**IWC-13-13** **1:40 PM**

### OXYANION REMOVAL AND RECOVERY USING SILICA POLYAMINE COMPOSITES

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

Modified silica polyamine composites (SPC), made from silanized amorphous nanoporous silica gel, and polyamines and conventional polystyrene anion exchange resins have been used for the selective removal and recovery of oxyanions of heavy metals such as As(V), Se(VI), Mo(VI), and V(V). The SPCs were functionalized with phosphorus acid using the Mannich reaction, resulting in a phosphonic acid modified composite (BPAP) and then loaded with Zr(IV), giving ZrBPAP. Alkylation of the starting SPC results in the formation of some quaternary amines along with mono- and di-alkylated amine sites providing quasi-analogues to polystyrene strong base resins.

In this report we examined the use of other immobilized metals such as Al(III), Fe(III), Th(IV) and Ce(III and IV) in conjunction with BPAP and the results support the very special role of Zr(IV) in this technology. We also looked at two other chelator groups, amino acetate and EDTA as alternatives to the amino-phosphonic acid in BPAP. The alkylated SPC were compared with related polystyrene strong base resins with regard to recovery of the subject anions and the separation of molybdate from vanadate.

Discussor: Terry Heller, Purolite Corporation, Bala Cynwyd, PA ..... 2:05 PM

Floor Discussion and Closure: ..... 2:15 PM

**IWC-13-14** **2:30 PM**

### CHROMATE REMOVAL AT THE HANFORD SITE (PART 2) 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

It's been more than two years since the first weak base units were installed at the Hanford Site. These units are now approaching 200,000 bed volumes throughput on the lead vessels. All the remaining systems have been successfully converted from strong base to weak base resin. Not a single resin replacement has been necessary to date. This paper chronicles the modifications needed for the switch from strong base to weak base resin and provides operating data for the various systems. Additional data regarding

---

## Monday's Sessions

---

the pH sensitivity and relationship between pH, flow rate and chromate leakage is also presented.

Discusser: Cindy Gresham, Thermax, St. Petersburg, FL..... 2:55 PM  
Floor Discussion and Closure: ..... 3:05 PM  
Break: ..... 3:20 PM

**IWC-13-15** **3:40 PM**

---

### SELECTIVE REMOVAL OF SULFATE FROM PRODUCED WATER

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

Many jurisdictions are imposing tighter regulations around the consumptive use of fresh water for EOR applications thus driving operators toward the use of water from saline or otherwise impacted aquifers. The presence of sulfates in the produced water and the presence of barium or other compounds in the make-up water may result in development of scale which may degrade the permeability or result in plugging of the formation around the injection well and a reduction in the effectiveness of the injection operations. This paper examines the removal of sulfate from produced water through the use of a specialized anion exchange resin and provides case study of its application.

Discusser: Claude Gauthier, Purolite, Bala Cynwyd, PA ..... 4:05 PM  
Floor Discussion and Closure: ..... 4:15 PM

**IWC-13-16** **4:30 PM**

---

### ION EXCHANGE SYSTEM SELECTION CRITERIA: DESIGN AND OPERATIONAL CONSIDERATIONS

William Schwartz, P.E., Robert Loken, Envirogen Technologies, Rancho Cucamonga, CA  
Ion exchange (IX) technology is considered Best Available Treatment Technology (BATT) for removal of many regulated inorganic compounds in municipal and industrial water streams. Developments in resin technology offer new treatment options, but the treatment system design can significantly impact operational costs, and ultimately, the system lifecycle costs. Ion exchange systems can be classified into two broad categories; lead-lag or staggered bed. Each system design has its strengths from an operational perspective. Selection criteria should include influent water quality variability, primary and secondary treatment goals, as well as costs associated with regeneration chemicals and waste stream handling requirements. Waste stream disposal options also need to be further classified into onsite "pre-treatment" and final offsite disposition. Requirements for system operation and maintenance are also critical and needs to be accounted for in the overall lifecycle cost.

Discusser: Sreekumar Janardhnan, Degremont —Anderson, Ancaster, Ontario, Canada .  
4:55 PM

Floor Discussion and Closure: ..... 5:05 PM  
Conclusion: ..... 5:20 PM

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

Date: ..... Monday November 18

Time: ..... 1:30 - 4:30 PM

Room: ..... International Ballroom Center

With lots of metals requiring treatment in the 21st Century regulatory world, water treatment practitioners handling mine water treatment programs need to be ever more mindful of the chemical behavior of the metal ions they are trying to treat. We also need to keep our eyes open to technologies that may provide higher efficiency removals and better sustainability for mine water treatment programs. In this session, we will explore aspects of selenium chemistry, mine water treatment project delivery and some not-so-new but cleverly re-purposed technologies. We will learn about tried-and-true mine water treatment processes ("marriages") and also some innovative "match-making" for "new suitor" processes 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

**Session Introduction:** **1:30 PM**

Paul Pigeon, Golder Associates, Inc., Lakewood, CO

**IWC-13-17** **1:40 PM**

**A PROMISING PATH FORWARD FOR OIL SANDS OPERATIONS - BASAL WATER MANAGEMENT USING DESALINATION TECHNOLOGIES TO ELIMINATE FRESH WATER INTAKE**

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

Environmentally responsible disposal of basal water is a challenge for the Canadian oil sands operations. Saline basal waters are characterized by high total dissolved solids, hardness and alkalinity. Tests were conducted to investigate effectiveness of the desalination technologies for 95% TDS removal employing reverse osmosis and evaporation processes. Zero liquid discharge technologies were tested to completely eliminate concentrates from the evaporator. Water reuse after the targeted treatment is expected to reduce fresh water intake needs.

Discusser: Michael Dejak, Eco-Tec, Pickering, Ontario, Canada ..... 2:05 PM

Floor Discussion and Closure: ..... 2:15 PM

**IWC-13-18** **2:30 PM**

**CASE STUDY ON A SELENIUM TREATMENT SYSTEM TO TREAT COMBINED FLOW OF SURFACE AND UNDERGROUND MINE WASTEWATER**

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

Regulatory agencies are targeting selenium as a trace constituent subject to effluent limitations at the point of outfall into public waterways. Mine owners are impacted as effluent limits for selenium become effective in their discharge permits and thus require the installation of treatment systems to reduce the concentration of selenium to compliant levels. Owners are responsible to assure the systems are extremely reliable and provide consistent capability to meet the effluent limits. Responding to these demands, Owners need to quickly deploy straightforward solutions which guarantee performance, can handle flow variation, and minimize treatment costs. This paper describes the alternatives evaluated by the Owner, key performance requirements, and final treatment process selected to treat two combined outfall flows, one above ground, and one underground,

## Monday's Sessions

to levels below the permitted effluent limits while addressing significant flow variations. In addition this paper describes the design development, and construction method of delivery used for the project to address tight site constraints and legal oversight in the face of compliance deadlines.

Discusser: Tom Rutkowski, Golder Associates, Lakewood, CO ..... 2:55 PM  
Floor Discussion and Closure: ..... 3:05 PM  
Break: ..... 3:20 PM

### IWC-13-19

3:40 PM

#### SELENIUM STABILITY IN TAILINGS PONDS

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

A study was conducted to investigate the effect of environmentally induced changes in pH and Eh on the release rate and change in oxidation state of selenium and selenium compounds from tailings and sediments. Selenium has a similar chemistry to sulphur so there is concern that conditions similar to acid mine drainage might mobilize selenium causing secondary waste water pollution. With climate change and more variable rainfall, the use of tailings ponds as stable long term solutions to contaminants may be questioned. Humidity cells, used to assess acid mine drainage, were filled with selenium containing sediments retrieved from a tailings pond. The solids were leached weekly for 22 weeks and analyzed for a variety of parameters and elemental concentrations. Selenium was solubilized at high levels only from cells that contained added selenium disulphide. Analysis revealed average levels of selenium concentrations from the oxic cells to be 0.004 mg/L and from the anoxic cells to be <0.001 mg/L. It appears that no plausible change in conditions will result in large releases of selenium that could be injurious to wildlife.

Discusser: Kashi Banerjee, Veolia Water Solutions & Technologies, Moon Township, PA ..... 4:05 PM  
Floor Discussion and Closure: ..... 4:15 PM  
Conclusion: ..... 4:30 PM

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

Date: ..... Monday November 18  
Time: ..... 1:30 - 5:30 PM  
Room: ..... International Ballroom South

Both shale gas extraction and Enhanced Oil Recovery technologies produce large amounts of water with undesirable constituents. This session looks at specific ways to prepare these waters for reuse and recycle. The four papers of the session look at boron removal, microbial control, colloid removal and de-oiling of the water.

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

#### Session Introduction:

1:30 PM

Patrick Ryan, Water Street Solutions, Minneapolis, MN

### IWC-13-21

1:40 PM

#### PERACETIC ACID USE FOR MICROBIAL CONTROL AND WATER TREATMENT IN UNCONVENTIONAL OIL

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

Peracetic acid is studied for its biocidal and oxidizing properties in oil and natural gas production systems. Examples of treatment of wastewater for recycle or disposal by



peracetic acid are described. Results from water treatments from hydraulic fracture systems, oil or natural gas production show peracetic acid activity against microbial contamination (planktonic and sessile). Additionally, oxidizing reactions of peracetic acid with hydrogen sulfide in water at non-stoichiometric concentrations and oil-wet iron sulfide emulsions resulting in emulsion breaking effects and reaction with iron sulfide scale in production equipment are discussed.

Discusser: George A. Ganzer, BWA Water Additives US, LLC, Buckingham, PA ..2:05 PM  
Floor Discussion and Closure: ..... 2:15 PM

---

### IWC-13-22 2:30 PM

---

#### THERMAL RECOVERY OF EXTRA HEAVY OIL DEPOSITS-REDUCED WATER USE AND ENERGY INTENSITY USING SECONDARY VAPOURIZERS

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

Thermal recovery methods for producing extra heavy oil or bitumen are energy intensive processes. Minimizing energy use, water consumption and waste production are important. SAGD (Steam Assisted Gravity Drainage) is one of the technologies available for mobilizing bitumen in the Canadian oil sands. The principle of utilizing separated water (blowdown) from a partially vaporized stream in a secondary vapourizer has been evaluated against other SAGD configurations in a technical economic evaluation.

Discusser: William A. Shaw, P.E., Veolia Water Solutions & Technologies, Pewaukee, WI ..... 2:55 PM  
Floor Discussion and Closure: ..... 3:05 PM  
Break: ..... 3:20 PM

---

### IWC-13-23 3:40 PM

---

#### NANOFLOTATION – WATER TREATMENT TECHNOLOGY TO SEPARATE COLLOIDAL SOLIDS IN RECYCLE WATER FOR AN OIL SANDS OPERATION

David Bromley, M.Eng, P.E., David Bromley Engineering Ltd., Vancouver, British Columbia, Canada; Kavithaa Loganathan, Ph.D., Canadian Natural Resources, Ltd., Ft. McMurray, Alberta, Canada

With most industrial water and wastewater treatment requirements, the objectives for treatment are relatively consistent; typically they are separation and removal of colloidal particles, removal of free oil and grease and reduction in the parameters that cause scaling on downstream equipment. The paper addresses a new patented technology, called Nanoflotation that applies two stages of treatment: flotation followed by powder precoated submerged membranes. The technology provides a capability to treat industrial waters and satisfy the three noted objectives. The design basis for both the flotation and membrane stage of the technology is to enhance surface to surface attachment. In the case of the membranes, a reverse engineering approach has been used where the effort is to accelerate fouling of the precoat material which acts like a skin layer on typical membranes. In the case of Nanoflotation, the precoat, once fouled, is replaced with a new precoat. This concept allows for much larger pore size in the membrane thereby increasing flux rate significantly and reducing energy requirements.

Discusser: Howard McCarthy, P.E., Tetra Tech Inc., Denver, CO ..... 4:05 PM  
Floor Discussion and Closure: ..... 4:15 PM

---

### IWC-13-24 4:30 PM

---

#### DILUENT AIDED CLEANING (DAC) APPLIED TO DE-OILING OF SAGD PROCESS WATERS

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

Diluent aided cleaning (DAC) is a technology based on the same principal as a process

## Monday's Sessions

used by Statoil on the Norwegian Continental Shelf in offshore production to improve produced water de-oiling. In DAC, diluent is added to the produced water to aid in the extraction of dissolved hydrocarbon components and in the coalescence of oil droplets. Statoil investigated the application of DAC to SAGD de-oiling and this presentation summarizes the results, highlighting potential benefits and challenges of the technology.

Discusser: Melonie Myszczyzyn, CNRL, Calgary, Alberta, Canada ..... 4:55 PM

Floor Discussion and Closure: ..... 5:05 PM

Conclusion: ..... 5:20 PM

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

Date: ..... Monday November 18

Time: ..... 1:30 - 5:30 PM

Room: ..... Crystal Room

Corrosion and tube failures in steam generators cause expensive and unpredictable downtime. Yet many operators of steam generators suffer from water-side boiler tube failures. Four papers discuss various aspects of identifying and preventing tube failures in steam generators. Common and uncommon failure mechanisms will be discussed along with ways to prevent future corrosion and failures.

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

**Session Introduction:** ..... 1:30 PM

David Daniels, M&M Engineering, Leander, TX

**IWC-13-25** ..... 1:40 PM

#### PRESSURE PART DAMAGE IN STEAM GENERATORS DUE TO STEAM/WATER STRATIFICATION

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

Corrosion can occur in steam generators when there is a concentrating mechanism applied to the bulk boiler water chemistry. One of the most common of these concentrating mechanisms is boiling within a porous, typically metal oxide, deposit on the water side heat transfer surfaces and is known as Wick Boiling. This mechanism can result in the usual under deposit corrosion mechanisms (UDC) such as caustic gouging or acid attack and hydrogen damage. Another potential concentrating mechanism is the physical situation of a steam/water interface under heat transfer. This steam/water interface situation can be created by circulation issues in the steam generator such as steam blanketing and carry under. This paper will discuss situations where the steam/water interface can form and the resultant potential for pressure part damage.

Discusser: Kevin Shields, Structural Integrity Associates, Inc., Annapolis, MD ... 2:05 PM

Floor Discussion and Closure: ..... 2:15 PM

**IWC-13-26** ..... 2:30 PM

#### HYDROGEN DAMAGE MITIGATION BY BOILER CHEMICAL CLEANING

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

Boiler tube failures resulting from hydrogen damage are characterized by corrosion beneath locally heavy internal deposits. The mechanism requires that hydrogen atoms generated by corrosion enter boiler tube metal and react with carbon in the steel. The heavy local deposits provide an environment where corrodents can concentrate at the tube metal surface, and hydrogen atoms resulting from corrosion can be generated at high concentrations. Concern is often expressed that incomplete removal of heavy local

## Monday's Sessions

deposits may result in a high-risk situation, as corrodents such as chloride (from hydrochloric acid cleaning) could initiate hydrogen damage upon return of the unit to service. Experience at Xcel Energy suggests that incomplete removal of heavy local deposits is not necessarily a high-risk situation, as post-chemical clean operation has provided dramatic reduction in the frequency of hydrogen damage failures in nearly all such cases to date. While not advocating chemical cleaning strategies that permit incomplete removal of heavy local deposits, Xcel Energy experience suggests that in the aftermath of incomplete deposit removal, fear of an immediate increase in hydrogen damage may be unwarranted or avoidable. Returning the unit to service slowly with a high blowdown rate should help rinse corrodents from existing hydrogen damage cracks and under-deposit crevices.

Discusser: Robert D. Bartholomew, Sheppard T. Powell Associates, LLC, Baltimore, MD .

..... 2:55 PM

Floor Discussion and Closure: ..... 3:05 PM

Break: ..... 3:20 PM

### IWC-13-27

3:40 PM

#### DISTINGUISHING BETWEEN UNDER DEPOSIT CORROSION MECHANISMS IN BOILERS

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

There are three main under deposit corrosion mechanisms commonly found in fossil plant boilers: hydrogen damage, caustic gouging, and acid phosphate corrosion. These mechanisms often look similar macroscopically and a metallurgical evaluation is necessary to determine which mechanism is occurring. This paper describes the three different mechanisms and highlights their similarities and differences. Topics covered include typical locations of failures, characteristic features of failures, chemistry contributions, and inspection methods.

Discusser: Mel J. Esmacher, P.E., GE Power Water & Process Technologies,

The Woodlands, TX ..... 4:05 PM

Floor Discussion and Closure: ..... 4:15 PM

### IWC-13-28

4:30 PM

#### THE IMPORTANCE OF PREVENTING CONDENSER TUBE LEAKS AND OTHER IMPURITY INGRESS INTO STEAM GENERATORS

Brad Buecker, Kiewit Power Engineers, Lenexa, KS

During the heyday of large coal plant construction, managers, operators, engineers, and chemists became aware of the severe problems that even minor impurity in-leakage can cause. Sometimes it took management a long time to learn that "water is not water" before listening to the chemists. Now, we are seeing significant retirements of these experienced personnel combined with replacement of much coal-fired power generation by gas turbine combined-cycle (GTCC) power. Heat recovery steam generators (HRSGs) associated with these plants also suffers many of the same corrosion mechanisms as coal plants. This paper will examine the impurities that can enter a condensate system, the problems they cause in steam generators, and methods to detect and prevent corrosion and fouling. We will also briefly examine fundamental issues related to steam generator protection during shutdown, layup, and startup.

Discusser: Ted Beardwood, Ashland Chemical Company, Ajax, ON Canada ..... 4:55 PM

Floor Discussion and Closure: ..... 5:05 PM

Conclusion: ..... 5:20 PM

### DIVERSITY IN MEMBRANE APPLICATIONS

Date: ..... Tuesday, November 19

Time: ..... 8:00 AM - 12:00 Noon

Room: ..... International Ballroom North

Applications of membranes are becoming more diverse and more challenging. Today's session deals with the variety we see today in membrane-based processes. Our first paper covers optimization of an all-membrane zero liquid discharge application using reverse osmosis (RO) and microfiltration-softening. Our second paper describes characteristics of a novel polytetrafluoroethylene, hollow fibermembrane for de-oiling hydrocarbons from produced water. In keeping with the variety of membrane applications, the third paper describes fractional electrodeionization for an electric cooperative/power generation, and the final paper covers how to maximize recovery of RO systems in general.

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

#### **Session Introduction:**

**8:00 AM**

Jane Kucera, Nalco Company, an EcoLab Company, Naperville, IL

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

**8:10 AM**

#### **OPTIMIZATION OF AN ALL MEMBRANE ZERO LIQUID DISCHARGE SYSTEM AT LOS ALAMOS NATIONAL LABORATORIES**

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

Design of an all membrane Zero Liquid Discharge (ZLD) System is a complex undertaking that must take into account variations in the feed water constituents, seasonal changes in feed water and system operation, as well as fluctuations in the water temperature. Close monitoring of system performance after startup is necessary to maintain the designed RO concentrate flows/volumes being directed to the evaporation ponds, as well as continued production of a suitable water quality for recycle and reuse. This paper examines the optimization process during the first year of operation of a Zero Liquid Discharge System at the Los Alamos National Laboratories in Los Alamos, New Mexico. The system consists of flow equalization followed by microfiltration softening of high silica containing feed waters and medium pressure seawater Reverse Osmosis (RO). The recovered RO permeate is then blended with feed water and reused while the RO brine is sent to evaporation ponds at the site.

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

..... 8:35 AM

Floor Discussion and Closure: ..... 8:45 AM

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

**9:00 AM**

#### **NOVEL PTFE MEMBRANES FOR HYDROCARBON DE-OILING FROM PRODUCED WATER IN CYCLIC STEAM STIMULATION AND REFINERY APPLICATIONS**

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

The novel Polytetrafluoroethylene (PTFE) Poreflon™ membranes are hollow fibre membranes that demonstrate a low coefficient of friction, and display high chemical compatibility and thermal stability in harsh process conditions. Most petroleum operating facilities in Western Canada require produced water de-oiling and subsequent process water treatment to meet high quality feed water for steam generation or reuse.

In this preliminary study, the PTFE tubular membranes were tested using produced water from refinery and Cyclic Steam Stimulation operations. The influence of process parameters such as trans-membrane pressure (TMP), flux and removal of oil and grease and other constituents from produced water was examined. The results were found to demonstrate de-oiling efficiencies better than conventional polymeric oil removing filters because of their superior physical integrity, low operating pressure, stable flux rate, regenerative ability and long service life.

Discusser: Michael Snodgrass, SpiraSep, Goleta, CA ..... 9:25 AM  
 Floor Discussion and Closure ..... 9:35 AM  
 Break: ..... 9:50 AM

**IWC-13-31** **10:10 AM**

**PERFORMANCE DATA & OPERATIONAL EXPERIENCE OF FEDI SYSTEM AT BRAZOS ELECTRIC**

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

Brazos Electric of Johnson County generation facility Cleburne, TX installed 2 new trains of Fractional Electro Deionization (FEDI) Units to polish RO permeate and make it suitable for boiler feed. Each train was rated for up to 165 gpm and was installed in the year 2010. This paper reports the satisfactory performance of the EDI unit running for the last 3 years with operational data. The FEDI stacks are operating in a patented dual voltage mode and have demonstrated consistent performance and durability. The inlet pH to the FEDI units is maintained at 7.0-8.0. The inlet silica is about 30 to 70 ppb and inlet conductivity is up to 5  $\mu$ S/cm. The outlet conductivity is consistently less than 0.08  $\mu$ S/cm and silica < 10 ppb. The FEDI units have been never been chemically cleaned yet.

Discusser: Steven R. Gagnon, AVANTech Inc., Columbia, SC ..... 10:35 AM  
 Floor Discussion and Closure: ..... 10:45 AM

**IWC-13-32** **11:00 AM**

**DESIGNING RO SYSTEMS FOR MAXIMUM WATER RECOVERY**

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

Achieving maximum water recovery is typically limited by the precipitation of sparingly soluble salts prior to reaching the maximum osmotic pressure limit of the membrane, resulting in a lower desired recovery. This paper discusses a proven methodology for maximizing the water recovery in a RO system design by better understanding feed water chemistry limitations, applying appropriate pretreatment technologies and configuring the RO system for maximum operating efficiency. Examples of actual high recovery RO system designs are presented.

Discusser: Brad Biagini, Veolia Water Solutions & Technologies, Moon Township, PA .....  
 ..... 11:25 AM  
 Floor Discussion and Closure: ..... 11:35 AM  
 Conclusion: ..... 11:50 AM

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

Date: ..... Tuesday November 19  
 Time: ..... 8:00 AM - 12:00 Noon  
 Room: ..... International Ballroom Center

Industries face a number of different challenges in dealing with their wastewater. In this Session we will hear papers dealing with a variety of industrial wastewater issues ranging from organic contamination to sulfates and TDS to heavy metals and radioactive constituents. Come and hear how some tested and tried technologies are finding new applications and also hear about some new technologies that have been developed to address emerging issues.

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

**Session Introduction:** **8:00 AM**

Michael Preston, Black & Veatch, Overland Park, KS

**IWC-13-33** **8:10 AM**

#### REMOVAL OF HARDNESS AND SULFATE FROM FGD EFFLUENT USING ION EXCHANGE

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

Treatment of effluent from flue gas desulphurization (FGD) systems in the metallurgical and power industries represents a significant water treatment challenge. FGD effluents typically contain high levels of Total Dissolved Solids (TDS), including calcium and sulfate. Wet FGD scrubbers typically use lime or limestone slurries to capture sulfur oxides (SO<sub>x</sub>) present in the flue gas. As a result the scrubber blow-down is saturated with respect to gypsum. Depending on the make-up water quality and the amount of HCl present in the flue gas, this translates into sulfate levels ranging from 1,400 to 5,000 ppm and calcium hardness of 1,000 to 3,000 ppm. As regulations for the discharge of sulfate and TDS into receiving waters become tighter, downstream processing of FGD effluent is required prior to final discharge. Removal of calcium hardness and sulfate is also required for the re-use of FGD effluent. Options for hardness and sulfate removal include softening followed by membranes, barium precipitation and ion exchange. A case study of a recent pilot test of an ion exchange process treating lime treated FGD effluent at an US metallurgical plant will be presented. Operating data from the pilot shows that the ion exchange process achieved the target hardness and sulfate levels to meet regulatory limits when treating lime plant effluent containing up to 1,700 mg/L SO<sub>4</sub>. Operating and capital costs for a commercial scale implementation of an ion exchange process for hardness and sulfate removal will also be presented based on the results of the pilot testing.

Discusser: Greg Behrens, P.E., URS Corp., Austin, TX ..... 8:35 AM

Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-34** **9:00 AM**

#### NOVEL PROCESS FOR THE TREATMENT OF WASTEWATERS FROM THE MICROELECTRONICS INDUSTRY

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

Infilco Degremont, Inc. has developed an innovative process to treat wastewaters generated by the microelectronics industry. These high-strength wastewaters contain

## Tuesday's Sessions

many organic and inorganic compounds, such as tetramethylammonium hydroxide ((CH<sub>3</sub>)<sub>4</sub>NOH, TMAH), monoethylamine (C<sub>2</sub>H<sub>5</sub>ONH<sub>2</sub>, MEA), dimethyl sulfoxide ((CH<sub>3</sub>)<sub>2</sub>SO, DMSO), hydrofluoric acid (HF) and others. Based on fundamental biological and physical/chemical treatment principles, this novel process consists of three stages: (1) aerobic biodegradation (i.e., activated sludge) of the organics and organic nitrogen compounds into ammonia-nitrogen and carbon dioxide, (2) chemical oxidation of ammonia into nitrates via ozonation, and (3) post-anoxic biological denitrification of the nitrates into nitrogen gas. This process generates an effluent with >98% removal of the Total Organic Carbon (TOC), >99% degradation of TMAH into ammonia-nitrogen and carbon dioxide and >95% removal of the Total Nitrogen.

Discusser: Frank Reightler, 4G Environmental Corp., Allentown, PA ..... 9:25 AM  
Floor Discussion and Closure: ..... 9:35 AM  
Break: ..... 9:50 AM

### IWC-13-35

10:10 AM

#### BALLASTED CLARIFICATION WITH INERT MATERIAL SURPASSES 1,000 UNITS IN MULTIPLE INDUSTRIES AND APPLICATIONS

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

Clarification technology using inert material as ballast for floc formation has been used in the water treatment industry for the past 25 years. With more than 1,000 installations worldwide, new uses for the technology continue to develop as industries look for better ways to meet their water and wastewater treatment needs. This paper will review the geographical and market sector installations of the technology, and introduce some innovative new ways that it is being applied.

Discusser: Hollie Scott, Degremont, Salt Lake, UT ..... 10:35 AM  
Floor Discussion and Closure: ..... 10:45 AM

### IWC-13-36

11:00 AM

#### REMOVAL OF SELENIUM IN REFINERY EFFLUENT WITH ADSORPTION MEDIA

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

Contaminants in refinery wastewaters were successfully removed with functionalized activated alumina adsorbent media. Adsorption of heavy metals and fluoride was rapid and the contaminant remained tightly bonded to the adsorbent in TCLP testing. The media performed in six case histories at different refineries to meet stringent discharge guidelines for selenium, fluoride and other contaminants.

Discusser: Ivan Cooper, Civil & Environmental Consultants, Inc., Charlotte, NC 11:25 AM  
Floor Discussion and Closure: ..... 11:35 AM  
Conclusion: ..... 11:50 AM

### ADVANCES IN FRAC WATER TREATMENT AND RESIDUALS RECOVERY

Date: ..... Tuesday November 19  
 Time: ..... 8:00 AM - 12:00 Noon  
 Room: ..... International Ballroom South

Treatment of Frac flowback and produced waters is important to the recycle and reuse approach used by E&P companies. This session highlights certain process applications and results using different treatment approaches which target disinfection, purification, and the recovery of liquid and solid residuals.

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

**Session Introduction:** **8:00 AM**

Michael Soller, P.E. CPC, Bowen Engineering, Indianapolis, IN

**IWC-13-37** **8:10 AM**

#### RECOVERING VALUABLE BYPRODUCTS FROM OIL AND GAS WASTES

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

An oft-neglected component of wastes generated during drilling and completion of oil and gas wells in shale plays are the drilling fluids, drilling wastes, and assorted liquids that are captured and require disposition. These streams contain substantial amounts of suspended solids and contamination from the formation being accessed, as well as potential valuable recoverable components such as crude oil and other valuable hydrocarbons. Treatment is required for these streams prior to either reuse or deep well disposal.

In addition, significant revenue can be generated by recovering the valuable byproducts.

Discusser: John Schubert, HDR, Inc., Sarasota, FL ..... 8:35 AM

Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-38** **9:00 AM**

#### PRETREATMENT TARGETS FOR SALT RECOVERY FROM MARCELLUS SHALE GAS PRODUCED WATER

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

Much of the Marcellus shale gas produced water contains significant levels of both barium and naturally occurring radioactive materials (NORM). As the Marcellus continues to be developed there will be a growing need to recover both water and salt from this high total-dissolved-solids (TDS) produced water. Whether the salt product is disposed of as nonhazardous solid waste or beneficially used for deicing, the salt must be pure enough to pass specific regulations with respect to both radium and barium. Based on pretreatment and crystallization experiments with field produced water as well as Aspen Plus™ /OLI simulations, we have developed a methodology for defining pretreatment targets for both barium and radium. The results of this study show that water and salt recovery from Marcellus produced water is an economically attractive option, particularly for produced water from north-central and northeast Pennsylvania.

Discusser: Jerry Penland, Chester Engineers, Moon Twp., PA ..... 9:25 AM

Floor Discussion and Closure: ..... 9:35 AM

Break: ..... 9:50 AM



**IWC-13-39**

**10:10 AM**

**PLASMA TREATMENT OF PRODUCED WATER FROM HYDRAULIC FRACTURING FOR SHALE GAS**

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

The objective of the present study was to investigate a new fouling prevention method in the treatment of produced water. The hypothesis is that as a gliding-arc discharge can remove bicarbonate ions in produced water, calcium carbonate fouling cannot be formed even in an extremely high concentration of calcium ions as in produced waters.

The plasma treatment of produced water reduced the concentration of the bicarbonate ion to zero. Subsequently, heat transfer fouling tests were conducted with water samples, where the concentration of bicarbonate ion varied from 0 to 500 ppm with a fixed concentration of calcium ion of 5,000 ppm. The amount of scale accumulated on a heating element over time was experimentally determined. The present test results showed that no fouling was formed over 30 h on the heating element in the water without bicarbonate ions. This study demonstrated that plasma treatment could reduce the concentrations of bicarbonate ions in produced water to a level where CaCO<sub>3</sub> fouling can be prevented. A new non-chemical fouling prevention method using a plasma gliding arc is introduced for the treatment of produced water.

Discusser: Josh Prusakiewicz, HDR Inc., Pittsburgh, PA ..... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

**IWC-13-40**

**11:00 AM**

**FRAC WATER TREATMENT AND DISINFECTION**

John Williams, Xchem-Terra Services, Irving, TX

The Disinfection and Treatment for removal of Bacteria in Water that is used in Hydraulic Fracturing ("Fracing") is needed and has been validated uniformly over the Oil & Gas Industry for many years. This understanding and acknowledgment has come not from a standard and or an established guideline for best practices that the Oil & Gas follows, but rather from trial and error which has been extremely costly as a whole for this Oil & Gas Industry. The "Trial and Error" methods of Water Treatment by experimenting with and without Biocides and or disinfectants have led to what were once considered Sweet Gas Formations (Not having H<sub>2</sub>S Hydrogen Sulfide) that are now Sour Gas Formations (Now having H<sub>2</sub>S Hydrogen Sulfide) by the introduction of Bacteria (SRB's Sulfate Reducing Bacteria) into a formation that was essentially a Dry Rock Formation. This has added to the long term cost and needs of the Well, Pipeline and Production. This is a problem that is created and or enhanced through the process of using Water that has Bacteria to fracture a Shale Formation. After all, water is and has been universal in the development of life since the beginning of time. This paper will address the developments of Technology and methods that can eradicate the Bacteria to a 8 log reduction 99.999999% Kill (The Bacteria are really Dead not just asleep) and stop the introduction of living Bacteria into the Oil & Gas Shale Formations, where there is an abundant food source for the Bacteria to live off of and once seeded there is no real way to remove them completely.

Discusser: Doug McIlwaine, ChemTreat, Richmond, VA ..... 11:25 AM

Floor Discussion and Closure: ..... 11:35 AM

Conclusion: ..... 11:50 AM

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

Date: ..... Tuesday November 19

Time: ..... 8:00 AM - 12:00 Noon

Room ..... Crystal Room

Flue Gas Desulfurization (FGD) wastewater generated from power plant facilities can be difficult to both predict and to treat. This session will focus on both plant operations impacts on FGD wastewater chemistry and highlight innovative treatment technologies.

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

**Session Introduction:** **8:00 AM**

Patricia Scroggin, Burns and McDonnell, Kansas City, MO

**IWC-13-41** **8:10 AM**

#### HOW OPERATION OF A WET FLUE GAS DESULFURIZATION SYSTEM CAN IMPACT THE WASTEWATER QUALITY GENERATED

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

The treatment of wet flue gas desulfurization (FGD) wastewater streams for removal of trace metals and contaminants is a topic that is gathering a lot of attention in the industry. Understanding the operating complexities of wet FGD systems can further our understanding of the wastewater quality generated. The intent is to provide the audience with a better understanding of wet FGD operating parameters that may have an adverse impact on the quality of wastewater being generated.

Discusser: Joseph Potts, Duke Energy, Belmont, NC..... 8:35 AM

Floor Discussion and Closure: .....8:45 AM

**IWC-13 -42** **9:00 AM**

#### PURIFICATION OF FLUE GAS DESULFURIZATION WASTEWATER WITH SUPER CAPACITOR RADIAL DEIONIZATION

Behrang Pakzadeh, Ph.D., Jay Renew, Southern Research Institute, Cartersville, GA; Jay Wos; Ken Cushing, Southern Research Institute, Birmingham, AL; 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

The US Environmental Protection Agency's effluent guidelines for steam electric power generating units will address stringent discharge limitations for mercury, selenium, arsenic, and nitrate/nitrite in flue gas desulfurization (FGD) wastewater. The Radial Deionization system (RDITM) from Atlantis Technologies may be applicable for FGD wastewater treatment. A 0.5 gpm pilot test was conducted at the Water Research Center at Plant Bowen in Georgia. The main objective was to evaluate the efficacy of the pilot RDI system in treating FGD wastewater.

Discusser: William Kennedy, P.E., Duke Energy, Belmont, NC ..... 9:25 AM

Floor Discussion and Closure: ..... 9:35 AM

Break: .....9:50 AM

**IWC-13-43**

**10:10 AM**

**MEETING PART-PER-TRILLION MERCURY LIMITS FOR POWER PLANT WASTEWATER**

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

This paper reviews options available to power plants to comply with low part per trillion mercury limits on wastewater discharge. Such limits are being driven by both water quality-based effluent limits (especially in the Great Lakes region), as well as technology-based limits (proposed Effluent Limitation Guidelines for the industry). These limits pose a challenge to most commercially available treatment technologies. This paper documents results of full-scale testing of treatment technologies to remove mercury to low part per trillion levels from flue gas desulfurization (FGD) wastewater. This paper also describes lessons learned from case studies of plants that have reported improved mercury removal over time through treatment plant optimization. This includes a discussion of the mercury-removal levels achieved, factors that affect mercury removal, and design and operations issues and lessons learned in optimizing treatment for mercury removal. Technologies evaluated include physical/chemical treatment including organosulfide addition and anaerobic biological treatment. The effect of mercury particle size on removal is evaluated. This provides insights on whether removal performance is due to mercury solubility or the ability to remove particulate mercury (either mercury in particulate matter that is formed in the FGD absorber or precipitated in treatment).

Discusser: Paul Chu, Electric Power Research Institute, Palo Alto, CA ..... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

**IWC-13-44**

**11:00 AM**

**FGD SCRUBBER WASTEWATER ZLD SOLID WASTE CHARACTERIZATION AND DISPOSAL OPTIONS**

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

In the electric utility industry, new steam effluent guidelines are driving development of new water treatment technologies. Zero liquid discharge technologies are being considered as an economically feasible technology for disposing of FGD scrubber wastewater. However, little consideration has been given to the back end costs and risks of disposing of the solids produced by ZLD systems. FGD wastewater contains significant amounts of salts that once evaporated pose unique issues when it comes to disposal. Consideration needs to be given to how and if utilities want to dispose of such materials and how the associated costs affect the economics of the use of a ZLD system.

Discusser: Katie Bland, P.E., Burns & McDonnell, Kansas City, MO ..... 11:25 AM

Floor Discussion and Closure: ..... 11:35 AM

Conclusion: ..... 11:50 AM

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

Date: ..... Tuesday November 19  
 Time: ..... 1:30- 5:30 PM  
 Room: ..... International Ballroom North

Zero Liquid Discharge (ZLD) represents the ultimate in water utilization efficiency and responsiveness to environmental discharge concerns. In some configurations, this powerful technology is capable of recovering nearly every drop of water entering the site while freeing the owner from variable and increasingly stringent discharge requirements. There are myriad ZLD configurations, depending on the fuel source, nature of the wastewater, climate, environmental requirements, and other factors. The papers in this session provide guidance on selecting an appropriate ZLD system for your site, critical success factors for smooth operation, lessons learned during commissioning, and operational troubleshooting.

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

**Session Introduction:** **1:30 PM**

Raymond Post, P.E., ChemTreat, Langehorne, PA

**IWC-13-45** **1:40 PM**

**ZLD SYSTEMS: VARIATIONS IN DESIGN DUE TO RAW WATER CHEMISTRIES, SPACE, AND COST CONSIDERATIONS FOR RECENT COMBINED CYCLE POWER PLANTS**

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

Bechtel is the EPC contractor for multiple, combined cycle power projects which utilize Zero Liquid Discharge (ZLD) technology to treat the blowdown from plant cooling towers. Each ZLD system poses unique design challenges and is configured with site-specific constraints due to varying raw water chemistries, space, and cost considerations. This paper discusses how the ZLD systems fit into the overall plant water management schemes, the evolution of the ZLD system design from the time of scoping of the systems until the start of construction. Additionally, the paper discusses criteria established for evaluating ZLD systems, as well as design considerations including, brine handling and waste minimization challenges associated with the limited footprints of the evaporation ponds.

Discusser: Craig Van Dyke, GE Water and Process Technologies, Brookfield, IL .2:05 PM

Floor Discussion and Closure: ..... 2:15 PM

**IWC-13-46** **2:30 PM**

**OPERATING A ZLD, WHAT DOES IT TAKE?**

Vincent Como, Mitch Mueller, P.E., Black & Veatch, Overland Park, KS; Troy Cannon, Brazos Electric Power Cooperative, Bridgeport, TX

Zero Liquid Discharge (ZLD) systems are in use across the United States in the power industry and will continue to be built in plants as discharge permits continue to tighten. The ability to keep a ZLD system operating is critical to keeping plants online and the operational commitments of these systems can be underestimated. This paper describes what is required to successfully maintain operation of different types of ZLD systems. A variety of subjects will be discussed including: system basics, importance of reliability, bare essentials (power, chemicals, and solids removal), and an analysis of manpower requirements.

Discusser: Christian Haussmann, Water Systems Specialists, Inc., Seattle, WA. 2:55 PM

Floor Discussion and Closure: ..... 3:05 PM

Break: ..... 3:20 PM

**IWC-13-47****3:40 PM****THE THERMAL ZLD EXPERIENCE FOR FGD WASTEWATER AT PSNH'S MERRIMACK STATION****Patricia Scroggin, P.E., Burns & McDonnell, Kansas City, MO; Richard Roy, Public Service Company of New Hampshire Bow, NH**

Public Services of New Hampshire's Merrimack Station (PSNH) installed a Wet Flue Gas Desulfurization system designed to remove mercury to meet state law requirements. PSNH received notice from EPA that they would not receive an NPDES permit modification in time to support their scrubber installation and startup schedule and that the new final NPDES permit would also not be issued promptly. PSNH had anticipated this risk and proceeded with engineering, procurement, construction and commissioning of a thermal Zero Liquid Discharge System (ZLD) consisting of an evaporator and crystallizers to treat their wet scrubber blowdown stream. The system was unique in that it allowed for both partial and full ZLD operation. This paper will discuss the timeline of events from project identification through commissioning. Lessons learned during commissioning will be presented and discussed.

Discusser: James Beninati, HDR Inc., Pittsburgh, PA ..... 4:05 PM

Floor Discussion and Closure: ..... 4:15 PM

**IWC-13-48****4:30 PM****TROUBLESHOOTING AND ANTIFOAM APPLICATION MINIMIZES ZLDS PLANT OPERATING COSTS AND DOWNTIME****Kevin Boudreaux, Nalco Company, Grapevine, TX; Steve Biggar, Quantum Auburndale Power, LP, Auburndale, FL; Ellie Palomo, Nalco Company, Naperville, IL**

To process waste streams via thermal evaporation, Zero Liquid Discharge plants (ZLD's) typically employ brine concentrators (BC) and crystallizers. Excessive foaming is a very common problem among these systems, with the root causes ranging from mechanical, to operational, to chemical. This paper discusses how a ZLD plant experiencing an unexplained foaming event, answered the following questions: "What has changed?" "What is creating the foam?" and "How is the problem going to be addressed long term?" It will also discuss how the foaming was managed during the troubleshooting period without a loss of plant availability.

Discusser: Daniel Sampson, Worley Parsons, Sacramento, CA ..... 4:55 PM

Floor Discussion and Closure: ..... 5:05 PM

Conclusion: ..... 5:20 PM

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

Date: ..... Tuesday November 19  
 Time: ..... 1:30 - 5:30 PM  
 Room: ..... International Ballroom Center

Potable water treatment is of increasing concern in this age of uncertain resources and increasing regulatory requirements. Demand for drinking water is increasing while supplies are increasingly limited by pollution and contamination. The Potable Water Session features papers from industry leaders covering both biological and chemical processes for the treatment of contaminated waters to potable water standards, as well as re-use strategies.

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, Quebec, Canada

**Session Introduction:** **1:30 PM**

Peter Meyers, ResinTech, West Berlin, NJ

**IWC-13-49** **1:40 PM**

**TECHNICAL EVALUATION OF ION EXCHANGE AND BIOLOGICAL TREATMENT OF OXYANIONS FOR POTABLE WATER PRODUCTION: SYSTEM SELECTION CONSIDERATIONS**

**William Schwartz, Envirogen Technologies, Rancho Cucamonga, CA**

Potable water sources containing inorganic, oxyanion compounds such as nitrate, perchlorate, selenium, and chromium have typically been treated using traditional physical-chemical processes such as ion exchange (IX). Recent advances in biological treatment systems have increased interest in their use for treating these compounds. The ability to biologically oxidize or reduce these compounds into other forms can provide significant treatment and cost advantages over the conventional IX treatment options. Several case studies demonstrating the effects of system selection on various feed streams will be detailed in the presentation. These include: IX nitrate removal in CA Municipal Plant #1, IX nitrate and perchlorate removal in CA Municipal Plant # 2, Biological perchlorate removal in CA Municipal Plant #3. For these case studies, background information and performance results will be highlighted to demonstrate the advantages and disadvantages of each treatment system option. Operational cost information will be used to support conclusions.

Discusser: Ajit Dighe, Thermax Inc., Houston, TX ..... 2:05 PM

Floor Discussion and Closure: ..... 2:15 PM

**IWC-13-50** **2:30 PM**

**OPERATION OF THE CHINO DESALTERS II**

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

The Chino Basin Desalter Authority (CDA) purifies groundwater extracted from the lower Chino Basin and distributes the drinking water to member agencies. Since 2006, the CDA has operated the Chino Desalter II, a 10.6 MGD desalting and nitrate removal system, which includes both reverse osmosis and ion exchange nitrate removal systems. A number of interesting changes have been made to the original design to improve operation and optimize performance. This paper discusses lessons learned and chronicles the various changes that have been made to the system since startup.

Discusser: Donald Thomas, CDM Smith, Jacksonville, FL ..... 2:55 PM

Floor Discussion and Closure: ..... 3:05 PM

Break: ..... 3:20 PM

**IWC-13-51**

**3:40 PM**

**DRINKING WATER NITRATE REMOVAL VIA ION EXCHANGE AND ELECTROCHEMICAL NITRATE DESTRUCTION FOR BRINE REUSE**

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

Nitrate is the most widespread inorganic contaminant found in drinking water wells. One of the best available technologies used for its removal, ion exchange, generates a sodium chloride brine waste from resin regeneration. Brine disposal into municipal wastewater systems in many regions of the country is prohibited due to the adverse effects of its salinity on the environment.

Discusser: H.G. Sanjay, Ph.D, IONZ BlueWater Solutions, Inc., Royal Palm Beach, FL 4:05 PM  
 Floor Discussion and Closure: ..... 4:15 PM

**IWC-13-52**

**4:30 PM**

**TREATMENT AND RECYCLING OF BRINE FROM ION EXCHANGE PROCESS FOR NITRATE REMOVAL IN DRINKING WATER**

Brian Altland, P.E., Charles Drewry, Rohan U. Seneviratne, Calgon Carbon Corporation, Pittsburgh, PA; Charles J. Werth, Timothy Strathmann, Allison Bergquist, Jong Kwon Choe, Center of Advanced Materials for the Purification of Water with Systems, University of Illinois at Urbana- Champaign, Urbana, IL

Ion Exchange (IX) is the preferred treatment method for nitrate removal in drinking water. The main challenges of this process are the cost of brine used for regeneration and disposal of the spent brine which contains high concentrations of nitrate and other contaminants in addition to the sodium chloride salt. The focus of this work is the patented Calgon Carbon process for the treatment of the spent brine via a novel catalytic process to destroy the nitrate and recycle the brine, thereby significantly reducing the overall waste and operating costs. We evaluated the sensitivities of the catalytic process to different parameters (e.g., active metal loading, temperature, brine composition, hydrogen loading) with both synthetic and plant spent brine in batch and long term column studies. We compared the performance of the recycled spent brine vs. the virgin brine to regenerate the ion exchange resin. Specific objectives were to (i) understand the effectiveness of the nitrate removal process with spent brine recycle, (ii) determine the key sizing criteria for a full scale spent brine treatment system, and (iii) evaluate the overall economics of the ion exchange treatment process with recycling of the spent brine.

Discusser: William Carlin, Dow, Spring House, PA ..... 4:55 PM  
 Floor Discussion and Closure: ..... 5:05 PM  
 Conclusion: ..... 5:20 PM

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

Date: ..... Tuesday November 19

Time: ..... 1:30 - 5:30 PM

Room: ..... International Ballroom South

This ASME sponsored open floor panel discussion includes papers on improved OTSG design resulting in higher steam quality, an on line silica analyzer used to minimize process upsets, the comparison of two commonly used boiler water treatments, and the use of forensic analysis to identify problem areas upstream of the boiler based on boiler deposition.

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

Session Chair: ..... Melonie Myszczyzyn, CNRL, Calgary, Alberta, Canada

Discussion Leader: ... Ivan Morales, Devon, Calgary, Alberta, Canada

#### Session Introduction:

1:30 PM

Melonie Myszczyzyn, CNRL, Calgary, Alberta, Canada

#### IWC-13-53

1:35 PM

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

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

Once Through Steam Generators (OTSGs) are widely used to provide injection steam for In Situ heavy oil production. OTSGs typically operate between 75 and 80% wet steam quality dependent on operating pressure, boiler feed water (BFW) quality and heat flux as per boiler manufacturer specification. Operation above these limits can lead to inadequate pipe wetting with the risk of overheating due to reduced heat transfer. For BFW quality typical of produced water reuse there is also an increased risk of water impurity deposition at elevated steam quality. However, a new development in OTSG design now allows for operation at 90% steam quality. Operation at higher quality offers improved overall plant thermal efficiency, significant reduction in blowdown volume, reduced BFW flow rate and associated treatment costs, as well as an increase in the quantity of dry steam available for injection. One 64.5 MW OTSG at the company's facility has been retrofitted with modified pipes and operated at 90% steam quality for a 8 month trial period. This paper will review the results from the field testing of the retrofitted unit.

#### IWC-13-54

2:00 PM

ON-LINE SILICA ANALYZER IN SAGD PRODUCED WATER

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

This report summarizes the development work on an online silica analyzer for application in SAGD operations. A pilot test with the analyzer was successfully completed in April of 2013. Based on the pilot test results, operations decided to integrate the analyzer for routine Warm Lime Softener (WLS) performance monitoring. This development work is 1st in SAGD industry and has application in existing and future SAGD operations (retrofit or new project). During the pilot test, the analyzer was able to detect silica excursions in the WLS effluent 6-8 hours ahead of manual grab samples, allowing WLS operators to take corrective steps almost in real time, which is a significant advantage over the grab sample measurement.



**IWC-13-55****2:25 PM****ELECTROCHEMICAL CORROSION STUDIES OF EDTA AND POLYMERS IN SIMULATED ONCE-THROUGH STEAM GENERATOR (OTSG) WATER FOR STEAM-ASSISTED GRAVITY DRAINAGE (SAGD) PROCESS****Tzu-Yu (Liberty) Chen, Jasbir Gill, John E. Hoots, Carol B. Batton, Corbin K. Ralph, Nalco Champion, an Ecolab company, Naperville, IL**

Corrosion of mild steel in the presence of ethylenediaminetetraacetic acid (EDTA) and two polymer programs was investigated using electrochemical potentiodynamic polarization and linear polarization resistance (LPR) measurements. The experiments were carried out in simulated once-through steam generator (OTSG) water for steam-assisted gravity drainage (SAGD) process. Effects of EDTA and polymer concentration, rotating speed (velocity) and pH were studied under de-aerated conditions using a rotating cylinder electrode. The results indicate the critical importance of dosage control and frequent, accurate hardness concentration measurements when using EDTA and other chelant type chemistries for hardness/scale control. Underfeeding EDTA can result in formation of scale and deposits. Overfeeding EDTA can cause severe corrosion problems.

**IWC-13-56****3:00 PM****FORENSIC ANALYSIS AND INTERPRETATION OF ONCE THROUGH STEAM GENERATOR (OTSG) DEPOSITS CAN ASSIST IN SYSTEM OPERATIONAL IMPROVEMENTS****Glenn Weagle, Ph.D., Nalco Champion, Sherwood Park, Alberta, Canada**

OTSG steam generators are widely used in thermal oil extraction operations. These boilers are very tolerant and can operate using less than optimal boiler feed water sources. However they still do form deposits. Deposits formed in thermal operations are quite unique to that industry. Forensic analysis and interpretation of those deposits can be useful in determining persistent operational issues in the facility. Many locations collect deposits and have analysis completed but do little with those results. This presentation will outline with examples many deposits analyses and discuss the likely source of the deposit. Do you have a lime softener issue? Is it carry over or a chemistry issue? Perhaps there is hardness bleed through the water plant. What about dissolved oxygen excursions? Were new wells recently brought into production and shortly thereafter deposit issues identified in the OTSG? Do transport chemistries change the nature of deposits? All of these symptoms can be detected, determined and explained by the nature of the deposits formed in the boiler tubes. In this presentation numerous case histories from numerous sites will be used to outline many of these occurrences. Through careful forensic analysis and determination the operational issues can be determined. Then the operational team has data to support system optimization and performance enhancement.

Break: ..... 3:25 PM

Panel Discussion: ..... 3:45 PM

Conclusion: ..... 5:20 PM

### INNOVATIVE SOLUTIONS TO TRACE CONTAMINANTS ISSUES

Date: ..... Tuesday November 19

Time: ..... 1:30 - 5:30 PM

Room: ..... Crystal Room

Trace contaminants continue to be an issue that drives the industry to find new and innovative forms of treatment. Water quality requirements become steadily (and sometimes not steadily) more stringent, leading to new or retrofitted treatment systems. This session looks at treatment alternatives to deal with these challenges, including activated alumina and activated iron. In addition, papers on sustainable and cost effective solutions provide insight on the direction the industry is

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

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

Discussion Leader: .... Mark Owens, Infilco Degremont, Richmond, VA

#### Session Introduction:

1:30 PM

Thomas Lawry, HDR Inc., Pittsburgh, PA

#### IWC-13-57

1:40 PM

#### NEW HEAVY METALS REMOVAL TECHNOLOGY OFFERS AN INNOVATIVE AND SUSTAINABLE SOLUTION

Melanie Solmos, Paul J. Zinn, Daniel E. Schwarz, *Nalco, an Ecolab Company, Naperville, IL*  
Global market expectations and demand for the removal of heavy metals from wastewater are changing dramatically. Concern regarding the environmental impact of heavy metals in effluent from coal-fired flue gas desulfurization units, refineries, mines, and metal finishing/plating operations continue to fuel legislative action toward increasingly stringent discharge limits. Trends toward sustainability and zero liquid discharge goals are creating demand for solutions that are low in toxicity and which minimize waste. Furthermore, POTWs seeking to limit liability and costs are enforcing expanded heavy metals, turbidity and pH pretreatment restrictions on smaller industrial operations that discharge to them.

Discussor: Michael Pudvay, GEA Process Engineering, Royal Oak, MI ..... 2:05 PM

Floor Discussion and Closure: ..... 2:15 PM

#### IWC-13-58

2:30 PM

#### UPCOMING EFFLUENT GUIDELINES CHALLENGES: USING CONSTRUCTED WETLAND TREATMENT SYSTEMS TO YOUR ADVANTAGE

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

The EPA has developed an amendment to the existing effluent guidelines for steam electric generating units. The draft amendment was published in the Federal Register on June 7, 2013. The intent of the amendment is to update current regulations, which have not been updated since 1982. As coal-fired power plants look to implement new technologies for various effluent streams that may be regulated under the new rule, Constructed Wetland Treatment Systems are one technology that can be utilized to successfully remove metals from effluent streams, but constructed wetlands have not been widely utilized thus far in the power industry. Streams that now require additional monitoring or treatment have qualities making them ideal for treatment through a constructed wetland. Wetlands are appealing for their passive operation, and are often lower in capital and O&M costs than other available water treatment technologies. Constructed Wetland Treatment Systems have proven highly successful for removal of key metals, such as mercury and selenium. Wetlands have also successfully removed certain other constituents of interest in the utility sector. This presentation will include a brief review of recent pilot

## Tuesday's Sessions

project results with FGD wastewater polishing at Westar Energy's Jeffrey Energy Center, and focus primarily on what these results mean for incorporation of Constructed Wetland Treatment Systems as a proven technology for meeting the future effluent guidelines in the steam electric generating sector.

Discusser: Diane Martini, Sargent & Lundy, LLC, Chicago, IL ..... 2:55 PM  
Floor Discussion and Closure: ..... 3:05 PM  
Break: ..... 3:20 PM

### **IWC-13-59** **3:40 PM**

#### MEETING THE NEWEST FGD WASTEWATER TRACE CONTAMINANT GUIDELINES WITH FUNCTIONALIZED ACTIVATED ALUMINIA

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

In 2013, the USA EPA issued lower guideline targets for wastewater discharge from coal fired power plants that further limit the discharge of selenium, mercury, arsenic and other contaminants. In preparation for these new guidelines, a functionalized alumina adsorbent media was used to treat flue gas desulfurization and leachate wastewaters at twelve power plants. Selenium, mercury, and arsenic were removed to low levels across a broad range of water qualities. The media successfully removed the selenate species of selenium.

Discusser: Rudy Labban, PE, Inflico Degremont, Ashland, VA ..... 4:05 PM  
Floor Discussion and Closure: ..... 4:15 PM

### **IWC-13-60** **4:30 PM**

#### HELPING INDUSTRIES MEET STRINGENT MERCURY AND HEAVY METAL DISCHARGE LIMITS THROUGH COST-EFFECTIVE TECHNOLOGY

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

Federal discharge limits for Mercury are 12 parts per trillion. Many states impose even lower limits. Few—if any—affordable treatments can meet the limits.

A proprietary solid chelant was developed to cost effectively meet the target discharge limits for Hg (and other regulated species). The spent product is chemically stable and can be disposed in a public landfill. Laboratory and field studies demonstrating the product's capabilities will be discussed.

Discusser: James Beninati, HDR Engineering, Pittsburgh, PA ..... 4:55 PM  
Floor Discussion and Closure: ..... 5:05 PM  
Conclusion: ..... 5:20 PM

INT'L BALLROOM NORTH      INT'L BALLROOM CENTER      INT'L BALLROOM SOUTH      CRYSTAL ROOM

**SUNDAY, NOVEMBER 17**

**5:00 - 7:00 PM      GET ACQUAINTED RECEPTION IN THE EXHIBIT HALL - GRAND BALLROOM**

**MONDAY, NOVEMBER 18**

**8:00 - 11:00 AM      REUSE AND RECOVERY TECHNOLOGIES      WATER CONSERVATION & MGMT      PRODUCED WATER FOR OIL RECOVERY      RESEARCH & RESULTS TO MEET EFFLUENT GUIDELINES**

**11:00 AM - 12:00 NOON      KEYNOTE SESSION IN INTERNATIONAL BALLROOM NORTH**

**12:00 NOON - 1:30 PM      EXHIBIT HALL LUNCHEON IN THE EXHIBIT HALL - GRAND BALLROOM**

**1:30 PM - 5:30 PM      ION EXCHANGE & SPECIALTY ADSORBENTS      METALS CHEMISTRY IN MINE WATER TREATMENT      SHALE GAS AND EOR WATER      ASME SESSION: PREVENTING CORROSION IN STEAM GENERATORS**

**4:30 - 7:00 PM      RECEPTION IN THE EXHIBIT HALL - GRAND BALLROOM**

**TUESDAY, NOVEMBER 19**

**8:00 AM - 12:00 NOON      DIVERSITY IN MEMBRANE APPLICATIONS      INDUSTRIAL WASTEWATER FOR FGD, REFINING, ETC      ADVANCES IN FRAC WATER TREATMENT      FGD OPERATIONAL IMPACTS**

INT'L. BALLROOM NORTH      INT'L. BALLROOM CENTER      INT'L. BALLROOM SOUTH      CRYSTAL ROOM

**TUESDAY, NOVEMBER 19**

**12:00 NOON - 1:30 PM**      EXHIBIT HALL LUNCHEON IN THE EXHIBIT HALL - GRAND BALLROOM

**1:30 PM - 5:20 PM**      DESIGNING ZLD SYSTEMS      POTABLE WATER      ASME SESSION: OTSD      INNOVATIVE SOLUTIONS TO TRACE CONTAINMENTS

**4:30 - 6:00 PM**      RECEPTION IN THE EXHIBIT HALL - GRAND BALLROOM

**WEDNESDAY, NOVEMBER 20**

**8:00 AM - 12:00 NOON**

COOLING WATER TREATMENT      PURE WATER      SAGD PRODUCED WATER/ZLD      STEAM CYCLE CHEMISTRY

**1:00 - 5:00 PM**      CONTINUING EDUCATION WORKSHOPS - SEE PAGES 52-56

**THURSDAY, NOVEMBER 21**

**8:00 AM - 5:00 PM**      CONTINUING EDUCATION WORKSHOPS - SEE PAGES 52-56

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

Date: ..... Wednesday November 20  
 Time: ..... 8:00 AM – 12:00 Noon  
 Room: ..... International Ballroom North

Corrosion, deposition and microbial growth are closely interrelated and must be properly controlled to maintain overall cooling water system efficiencies. If any of these three aspects are left unchecked, the cooling water treatment program will suffer poor performance. The four excellent papers in this session cover different areas of a cooling water treatment program. The first paper discusses unique technology for microbial control. The next two papers cover scale control from an inhibitor effectiveness and actual monitoring in cooling water. The last paper identifies real improvements in plant 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

---

**Session Introduction:** **8:00 AM**

Kenneth Dunn, Ashland Water Technologies, Shrewsbury, MA

---

**IWC-13-61** **8:10 AM**

**NOVEL DUAL ACTIVE TARGETED DELIVERY TECHNOLOGY FOR IMPROVED BIOFILM CONTROL IN INDUSTRIAL COOLING SYSTEMS**

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, Spain; Dorothy Reynolds, Gloria Tafel, Jeffrey Melzer, GE Power & Water, Water & Process Technologies, Trevose, PA

A novel Targeted Delivery of non-oxidizing biocide was introduced for biofouling control in cooling applications. Liposome enhanced Iso/Bronopol dual actives showed superior removal of biofilm compared to an equal dose of the biocide actives alone, in lab studies under both static and dynamic flow conditions. Confocal examination of the resulting biofilm also confirmed the higher degree of killing by liposome biocides. Improved biofilm control was demonstrated in a field trial at significantly reduced biocide feed.

Discusser: Sam Renfrow, ChemTreat, Columbus, MI..... 8:35 AM  
 Floor Discussion and Closure: ..... 8:45 AM

---

**IWC-13-62** **9:00 AM**

**THE IMPACT OF PH AND PROTONATION STATE ON SCALE INHIBITOR ACTIVITY**

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

Water treatment chemists have long observed that some scale inhibitors work better at high pH rather than low pH, and that some inhibitors have little, if any activity at very low pH. Examples would be the effectiveness of polyacrylic acid at high pH as a calcium carbonate inhibitor, as in ash sluice and some mining applications, mediocre performance near a neutral pH, as in cooling water applications, and very low activity in an acid pH range, as in gypsum control in the pH range from 2 to 4. This paper provides a framework for evaluating relative inhibitor activity using dissociation profiles for common inhibitors and calculating the distribution of inhibitor species versus pH. Minimum effective dosages and inhibitor species concentrations are used to calculate the relative efficacy of different dissociation states for common technical grade scale inhibitors.

Discusser: Prasad Kalakodimi, ChemTreat, Glen Allen, VA ..... 9:25 AM  
 Floor Discussion and Closure: ..... 9:35 AM  
 Break: ..... 9:50 AM

**IWC-13-63****10:10 AM****A MONITOR FOR MEASURING SCALE DEPOSITION IN COOLING TOWERS****Charles J. Reedy, Ph.D., Nalco, An Ecolab Company, Naperville, IL**

Nalco has developed an on-line sensor to detect mineral scale formation in a water stream. The sensor uses a heated quartz crystal microbalance to induce the deposition of thermally unstable minerals such as calcium carbonate or calcium phosphate to emulate the scaling process on the surface of a heat exchanger. The crystal resonates at a base frequency. When scale is formed on the crystal, the sensor registers a change in frequency that it translates to a scale weight. The sensor also includes an automatic self-cleaning function. A potential is placed across the water-side surface of the crystal and a juxtaposed counter electrode to induce water electrolysis.

The electrolysis generates a low pH environment near the crystal surface, dissolving the scale and cleaning the probe. This paper discusses the interpretation of this data in the broader terms of cooling system performance.

Discusser: Lee Hollimon, Ashland Water Technologies, Pensacola, FL ..... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

**IWC-13-64****11:00 AM****REAL-TIME PERFORMANCE DIAGNOSTICS IDENTIFIES FOULING ROOT CAUSE-INCREASING PLANT EFFICIENCY BY 5%****Darcy Dauterive, Jeffy Kristy, Ashland Water Technologies, Wilmington, DE**

Since plant start-up, this zero liquid discharge (ZLD) power plant was challenged with maintaining condenser cleanliness and maximum power production as an apparent result of high iron and manganese in the cooling tower make-up water. As a result of ZLD operations, the cooling tower operated at 40 cycles of concentration, exceeding saturation indices. The plant had been shutting down two to three times per year to clean the condenser. Past treatment focused on inorganic oversaturation of silica, iron, and calcium.

Discusser: Craig Myers, Nalco, An Ecolab Co., Naperville, IL ..... 11:25 AM

Floor Discussion and Closure: ..... 11:35 AM

Conclusion: ..... 11:50 AM

### PURE WATER

Date: ..... Wednesday November 20  
 Time: ..... 8:00 AM - 12:00 Noon  
 Room: ..... International Ballroom Center

In these tough economic times, the development of Pure Water Systems is even more challenging than past decades. This session will discuss many systems and alternative designs that address the needs that are commonly applied to industrial, power, municipal and semiconductor treatment application. This session will review the removal of total organic carbon (TOC), particulate and metal ions by way of clarification, filtration, bio-treatment, oxidation, etc. The papers presented will review equipment operation, ongoing-monitoring and operating changes due to seasonal changes from the feed water source. Case studies of systems performance will be illustrated.

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

**Session Introduction:** **8:00 AM**

Steven Siverns, Pureflow, Inc., Graham, NC

**IWC-13-65** **8:10 AM**

#### ULTRAPURE WATER (UPW) – QUALITY AND TECHNOLOGY TO SUPPORT ADVANCED INDUSTRIES' NEEDS

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

UPW quality requirements within the semiconductor industry have increased with advancing technology nodes. The challenges of semiconductor industry include construction of multimillion gallon per day highest grade UPW systems while also meeting new requirements as contamination requirements become tighter. This paper discusses state-of-the-art UPW systems and challenges of water quality of advanced UPW systems and specific issues that the industry is dealing with at present and into the future.

Discusser: John Brittan, Siemens Water Technologies, LLC, Colorado Springs, CO 8:35 AM  
 Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-66** **9:00 AM**

#### ADVANCED OXIDATION PROCESS TECHNOLOGY FOR ULTRAPURE WATER IN THE SEMICONDUCTOR INDUSTRY

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

This paper will discuss typical organic removal methods commonly applied in semiconductor ultrapure water system and new methods for improving the removal of organic contaminants from the critical process water.

Siemens Water Technologies has developed an advanced oxidation processes that specifically addresses Total Organic Carbon (TOC) levels, to reduce them to sub part-per-billion (ppb) levels. This has been shown to have significant benefits in the integrated chip (IC) manufacturing process.

Discusser: Randy Cooper, Ph.D., Neotech Aqua Solutions, San Diego, CA ..... 9:25 AM  
 Floor Discussion and Closure: ..... 9:35 AM  
 Break: ..... 9:50 AM



**IWC-13-67****10:10 AM**

---

**PRETREATMENT SYSTEM SELECTIONS & TYPICAL DESIGN PARAMETERS****Gregory Osen, Steven Gagnon AVANTech, Inc., Columbia, SC**

The paper will present an understanding of what the raw water source is. Some waters are very clean and require almost no pretreatment, but most water sources require extensive pretreatment and even pilot studies to select and optimize the correct equipment. The paper will review equipment operating concerns and seasonal changes that will be required to keep the equipment performing properly. The paper will also discuss why an accurate water analysis must be obtained, what parameters are required, and how often. Many times the ion exchange or membrane equipment is not the problem; it is that the design was based upon faulty analyses.

Discusser: Brian Powers, HDR Engineering, Inc., Charlotte, NC ..... 10:35 AM

Floor Discussion and Closure: ..... 10:45 AM

**IWC-13-68****11:00 AM**

---

**CASE STUDY OF A FILTRATION SYSTEM THAT VIRTUALLY ELIMINATED BIOFOULING OF THE RO SYSTEM****Reinhold Brenner, Von Roll BHU Environmental Technologies, Stuttgart, Germany**

The so-called "bio-fouling" of Reverse Osmosis Membranes, meaning the clogging of the membranes caused by biological activity of micro-organisms settling on the membrane and producing an adhesive slime, is a major limitation to an economic and reliable application of Reverse Osmosis for desalination of brackish water and seawater. The effects of bio-fouling (clogging of the membranes) in day to day operation of RO-plants result in frequent "CIP-Cleaning" using chemicals to remove the biological slime and to reduce the increased pressure drop caused by the clogging.

Discusser: Katariina Majamaa, Dow Chemical China, Shanghai, China ..... 11:25 AM

Floor Discussion and Closure: ..... 11:35 AM

Conclusion: ..... 11:50 AM

### SAGD PRODUCED WATER TREATMENT ZERO LIQUID DISCHARGE

Date: ..... Wednesday November 20  
 Time: ..... 8:00 AM - 12:00 Noon  
 Room: ..... International Ballroom South

In Steam Assisted Gravity Drain (SAGD) process, high pressure, high temperature steam is injected into the reservoirs, to melt and drain out the mixture in upstream separation facility. It's mandated by local environmental regulations to purify and reuse up to 90% of this produced water for steam generation. This session discusses the latest and innovative technologies how best to maximize the recovery of high quality reusable water with minimum disposable waste from the SAGD produced

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

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

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

**Session Introduction:** **8:00 AM**

Rafique Janjua, Fluor Enterprises, Inc., Sugar Land, TX

**IWC-13-69** **8:10 AM**

**KEY PARAMETERS, DESIGN CRITERIA AND TIPS FOR SELECTION OF PRODUCED WATER EVAPORATORS - A DIFFERENT APPROACH**

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, Alberta, Canada; Crisel Rivas, Stanley Foster, Alfa Laval, Calgary, Alberta, Canada

This paper reviews the basic principles of evaporation, evaporation technologies and explores industry cases related to shale gas flowback and SAGD Produced Water. The purpose of the exercise is to clarify and establish practical engineering specification requirements to enable comparison of the technologies commercially available. Specific areas of discussion deal with water chemistry key parameters such as precipitation, scaling and materials selection. Evaporation systems can be designed in several ways i.e. single body, modular and MEE evaporators depending on energy efficiency and flexibility, specific water chemistry etc. to reach an optimum OPEX and CAPEX. Designing system in a modular way is potentially attractive to offer the possibility to relocate the plant and change evaporation capacity.

Discussor: Ramesh Sharma, ConocoPhillips, Houston, TX ..... 8:35 AM

Floor Discussion and Closure: ..... 8:45 AM

**IWC-13-70** **9:00 AM**

**BENCH-SCALE EVALUATION OF SOLIDIFICATION TECHNOLOGY FOR SAGD WASTE BRINES**

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

In the Steam Assisted Gravity Drainage (SAGD) recovery of bitumen in the Alberta oil sands industry, waste brines are generated from evaporator and boiler blowdown streams. For sites where deep brine-disposal wells are not practical, brines are typically concentrated using evaporation and crystallization processes prior to truck-out to third-party waste managers or processing by zero liquid discharge (ZLD) treatment facilities, which can employ thermal drying. Less energy intensive and less expensive ZLD alternatives are of interest to the industry. Solidification/stabilization techniques have been used extensively as a means of making waste sludges and brines suitable for landfill disposal in other industries, and this approach was examined for SAGD applications. This paper

## Wednesday's Sessions

presents the results of bench-scale investigations into the solidification of several SAGD waste brines from both produced-water evaporator-based processes and from conventional warm lime softening processes. In addition, the results of an in-situ solidification approach, used to improve the operation of an existing SAGD salt-waste landfill, will be presented. A wide spectrum of solidification agents were examined, including cement and cement by-products, fly ashes, clays and lime. Tests for confined and unconfined compressive strength (UCS), leachability and permeability were performed. The results indicated that a strong, stable solid waste could be produced for all of the brines examined. UCS values of greater than 10 psi were achieved. However, there were significant differences between the types of reagents, as well as the quantities needed for the individual brines, indicating that site-specific testing may be beneficial.

Discusser: Martin R. Godfrey Ph.D., Nalco, Calgary, Alberta, Canada ..... 9:25 AM  
Floor Discussion and Closure: ..... 9:35 AM  
Break: ..... 9:50 AM

### IWC-13-71

10:10 AM

#### ENHANCEMENTS IN EVAPORATIVE EFFICIENCY FOR OIL SANDS WATER TREATMENT

Greg Mandigo, AquaChem ICD Aquatech International Corporation Hartland, WI

Evaporation systems have been employed to a large extent in the Alberta Oil Sands to maximize water recovery and minimize the consumption of make-up water sources. As these methods become more mature, there is an increased focus on the efficiency and reliability of the Evaporation systems. This paper will focus on enhancements that can be applied to the evaporative water treatment process to increase cost efficiencies. A new development in energy economy will be explored that delivers power savings of more than 20%. And a new breakthrough that offers superior availability in produced water evaporation will also be discussed.

Discusser: Kevin Drake, P. Eng., Drake Consulting, Calgary, Alberta, Canada .. 10:35 AM  
Floor Discussion and Closure: ..... 10:45 AM

### IWC-13-72

11:00 AM

#### FACTORS TO CONSIDER WHEN EVALUATING CONVENTIONAL TREATMENT (HLS OR WLS/LSF/IX) VS. EVAPORATOR FOR PRODUCED WATER TREATMENT (PWT)

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

This paper will discuss the differences between conventional produced water treatment and the evaporator approach. Listed and reviewed will be criteria which must be evaluated in doing proper due diligence for the selection process. Comparisons will be made on a relative basis and the reader left with enough information to make their own proper evaluation on their specific project once familiar with the major criteria. Advantages and disadvantages of each approach will be identified and summarized objectively.

Discusser: Mike D'Ippolito, Devon Canada, Calgary, AB, Canada ..... 11:25 AM  
Floor Discussion and Closure: ..... 11:35 AM  
Conclusion: ..... 11:50 AM

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

Date: ..... Wednesday November 20

Time: ..... 8:00 AM - 12:00 Noon

Room: ..... Crystal Room

Cycle chemistry is critical to performance, and operating costs of any steam plant. Many factors both within the steam plant and outside of it can affect cycle chemistry. This session discusses several specific subjects concerning the steam cycle.

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, Ontario, Canada

### Session Introduction:

8:00 AM

William Moore, WesTech Engineering, Inc., Salt Lake City, UT

### IWC-13-73

8:10 AM

#### THE IMPACT OF STEAM CYCLE CHEMISTRY ON POWER PLANT PERFORMANCE AND OPERATIONAL COSTS

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

In today's global economy, the increased competition has made it imperative for power plants to design more reliable and efficient operating plants that minimize downtime and unplanned maintenance while maintaining high performance and the desired power output. In order to achieve these goals, it is important to understand how water quality and treatments may affect these inefficiencies and/or failures and to provide preemptive measures to address these potential issues before they become an impact to production. In a typical power plant, water and steam are the motive forces that produce the power and it is the chemistry of the water, with its interaction with its environment, e.g. material, temperature and pressure, which results in these undesirable and costly damages. These damages include pitting, corrosion, and scaling, all of which ultimately leads to poor performance and failures if left undetected and untreated. This paper will focus on the steam cycle water chemistry in a typical combined cycle power plant and review the causes, consequences, and potential solutions for major tubing, piping, and boiler failures. With this knowledge, it is possible to increase the life span of a plant while increasing revenue and reducing maintenance costs.

Discusser: Josh Prusakiewicz, HDR Inc., Pittsburgh, PA ..... 8:35 AM

Floor Discussion and Closure: ..... 8:45 AM

### IWC-13-74

9:00 AM

#### MONITORING FLOW ACCELERATED CORROSION IN THE STEAM CYCLE USING ALTERNATIVE METHODS

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

To date, a particle counter or monitor has traditionally been used to detect the transfer of corrosion products in a HRSG power plant. While this method has been generally well accepted and documented, particle counters do not have a standardized method of calibration and usually need to be calibrated at each facility. Where multiple measurement

## Wednesday's Sessions

points are desired, it can become rather costly. The technology is also limited to detecting particles with a size of 2 microns or greater. Quantifying the amount of iron in the water on site has also been challenging in the ultra low range. Colorimetric methods that could be readily used at the plant were limited to 9 ppb or greater. This has further added to the challenge of ascertaining whether significant corrosion product transfer was occurring at a particular point in the process.

Discusser: Daniel Sampson, Worley Parsons, Vallejo, CA ..... 9:25 AM  
Floor Discussion and Closure: ..... 9:35 AM  
Break: ..... 9:50 AM

### IWC-13-75

10:10 AM

#### THE INFLUENCE OF SYSTEM PARAMETERS ON TOC DEGRADATION

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

Research on the detrimental effect of degradation of organics in steam-water cycles is on-going. In order to come to a well-founded TOC guideline quantification and speciation of the organic acids formed from X ppb TOC under a range of system conditions and multiple TOC sources/fractions is necessary. This paper attempts to find relations between TOC concentrations in boiler make-up water, temperature, retention time and the amount of organic acid species formed. Two test methods have been implemented: a batch autoclave and a flow reactor. Also, samples were taken from a full-scale 331oC/130 bar steam-water cycle.

Discusser: Debbie Bloom, Nalco Company, Naperville, IL ..... 10:35 AM  
Floor Discussion and Closure: ..... 10:45 AM

### IWC-13-76

11:00 AM

#### OUTSOURCED WATER TREATMENT PROVIDES HIGHER PURITY AND LOW TOC FOR NUCLEAR POWER PLANT

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

Veolia Water Solutions & Technologies was contacted by a southeast nuclear utility to develop a competitive solution to design, build, install, operate, and maintain two new 400-gallon-per-minute (GPM) ultra-high purity demineralized water plants to replace their internally operated, 25+ year old, demineralized water plant at two separate stations. As part of the upgrade and replacement, the client required higher quality demineralized water, specifically parts-per-trillion (ppt) concentration levels of metals, low Total Organic Carbon (TOC), and low dissolved oxygen levels. The client also required specialized contingency for mobile water to backup the redundant installed system. This paper will examine the design selection criteria, startup performance data, and special considerations necessary for the successful implementation of the process.

Discusser: Randy Harney, Fluor, Aliso Viejo, CA ..... 11:25 AM  
Floor Discussion and Closure: ..... 11:35 AM  
Conclusion: ..... 11:50 AM

### CONTINUING EDUCATION WORKSHOPS

This year's workshops will cover relevant topics such as EDI, ZLD, Reverse Osmosis, Ion-Exchange Technology and a special package of 3 basic water treatment courses. The workshop program is designed to provide practical information that includes a basic understanding of the topic as well as detailed case studies. They are presented by experts in the field and are loaded with technical content, not for sales information. Each workshop will provide an opportunity for a technical exchange between the students, the instructor and other workshop participants. The workshop will provide attendees 4 professional development hours (PDHs) and a certificate of completion. Advance registration and a separate fee of \$250 is required. All workshops are scheduled based on minimum reservations; please inquire at the conference registration desk about the current status of any of the workshops. Discounts are given for multiple registrations.

### WEDNESDAY NOVEMBER 20, 2013 1:00 - 5:00 PM

#### W1 Water Treatment 101

This workshop is a great introductory course covering the basic concepts of water treatment for industry. It will address unit operations (clarification, filtration, lime/soda ash softening, iron and manganese removal, membrane filters, and roughing demineralizers) used in water preparation for industry with emphasis on power, chemical industry, and refineries. It will include treatment of makeup water for cooling water systems as well as boiler water makeup. Wastewater generated by these unit operations and their treatment and disposal will be discussed. Basic water chemistry requirements for low, medium, and high pressure boilers will be considered with chemical conditioning as required.

Presented by: Dennis McBride, Fluor Enterprises, Greenville, SC

#### W2 Industrial Boiler Water (up to 1800 PSIG/ 120 Bar)

The course is intended for those interested in industrial steam systems operating at pressures up to 1800 psig. While some basic theory is covered, the main focus of the course is to provide practical information that can be used to avoid common system problems. The course covers deaerators, boilers, steam turbines and condensate systems from both mechanical operation and chemical treatment aspects. The causes of deposition and corrosion as well as water quality and monitoring guidelines and chemical treatment options are discussed in an informal atmosphere.

Presented by: James Robinson, GE Betz, Trevose, PA

#### W3 Introduction to Cooling Tower Water Systems and How to Develop a Cooling Tower Water Treatment Program

This workshop discusses the problems commonly found in Cooling Tower Water systems and the various water treatments that can be used to control or prevent those problems. Specific water treatment chemicals are discussed and their advantages and disadvantages are presented. These specific chemicals are for corrosion, scale, fouling, and microbiological control. They are identified generically and include the most recent developments. The preparation of the complete water treatment program is provided in easy to apply steps. This workshop is excellent for operators, utility managers, and water treatment suppliers both new on the job and great as a refresher for others.

Presented by: Paul Puckorius, Puckorius & Associates, Inc., Arvada, CO

### **W4 Treatment of Water for Steam Generation in SAGD Enhanced Oil Recovery Plants**

“Once you know the fundamentals, acquiring experience is just a matter of time.” This course explores the theories and fundamental practices for treating de-oiled produced and brackish waters to generate high pressure steam for use in SAGD enhanced oil recovery operations. We will explore hot and warm lime softening, filtration and ion exchange options such as strong acid versus weak acid cation softening including in-situ versus external regeneration.

Presented by: Steve Gagnon, AVANTech, Inc., Columbia, SC

### **W5 Thermal Zero Liquid Discharge**

This course is designed to give a basic understanding of the information required for the selection and design of an evaporation system in a wastewater application.

It will include the impacts of chemistry, equipment selection and energy source selection as well as provide case studies based on real world applications in a variety of industries.

Presented by: J. Michael Marlett, P.E., P.Eng, Aquatech International Corp., Hartland, WI

### **W6 Treating Produce Water with Ion Exchange Technologies**

General introduction on Softening with Ion Exchange. Description of the nature of SAC resin and of WAC resin. Influence of TDS on selection of which resin to select. Advantages to consider SAC-SAC systems. Why single WAC are able to produce soft water (<0.1ppm) on water with up to 25000ppm TDS. Why WAC Primary followed by WAC Polisher should be considered. Potential foulants of ion exchange resins in the process of softening Produced Water, and how to deal with them. All data presented is based on actual plant experience!

Presented by: Guy Mommaerts, Ion Exchange Services (Canada) Inc., Elimira, Ontario, Canada

**THURSDAY NOVEMBER 21, 2013 8:00 AM - 12:00 NOON**

### **W7 Water Treatment 201**

This course reviews the topics covered in Water Treatment 101 and build on those to provide design and technical details on designing water treatment systems using supplier's equipment information. Unit processes covered in this course are pretreatment softening using lime and soda ash, sodium cycle ion-exchange for softening, demineralization of pretreated raw water using cation/ anion/ mixed-bed ion-exchange systems, reverse osmosis, and EDI. Boiler water chemistry guidelines and chemicals feeds for boiler chemistry control for high pressure power plant boilers, combined cycle plants, and industrial boilers (up to 1500 psi) will be discussed. Advanced wastewater treatment concepts for power plants, industrial plants, and refineries will be included with recycle and reuse when feasible.

Presented by: Kumar Sinha, Consultant, Frederick, MD

### **W8 HRSG and High Pressure (> 900 PSIG/ 60 Bar) Boiler Water Treatment Operation**

This workshop will cover the water quality required for high pressure (> 900 psig/60 bar) steam boilers including the various treatments being used and new developments relative to protection from scale and corrosion. The course will also cover treatment issues related to pre-boiler systems and the condensate systems and a discussion of controls and troubleshooting techniques. Operators, utility plant supervisors, managers, and engineers can all benefit greatly from the practical information provided in this course.

Presented by: David Daniels, Mechanical & Materials Engineering, Austin, TX

### **W9 Cooling Water Treatment Programs and Guidelines When Switching from Fresh to Reuse Water Makeup**

---

This workshop will cover guidelines to be used in developing a cooling water treatment technology going from fresh to recycle waters as makeup. These guidelines will identify possible concerns and potential benefits with recycle water. A step by step approach is provided not only for existing cooling tower water systems but also new systems that can handle almost any recycled waters. A number of case histories are provided. Attendees are encouraged to bring not only any questions but also details on their cooling tower water systems and the recycle water quality being considered. A must workshop for operators, utility managers, and for water treatment suppliers.

**Presented by:** Paul Puckorius, Puckorius & Associates, LLC, Arvada, CO

### **W10 Water and Wastewater Treatment for Natural Gas Development**

---

The ongoing development of the unconventional natural gas market was made possible by developments in the fields of directional drilling and hydrofracturing. Hydrofracturing requires large volumes of water, processing of that water to use in hydrofracturing, and handling of the return water from the well after completion of hydrofracturing. As hydrofracturing water comes in contact with shale, some of the soluble shale constituents dissolve into the hydrofracturing water. Current options for handling of hydrofracturing water include treatment for reuse, treatment for discharge, and deep well disposal. The focus of this course is to provide a foundational understanding of the use of water in hydrofracturing, and the disposition of return water (flowback and produced water) from hydrofractured wells. Areas of emphasis include hydrofracturing water preparation, treatment of flowback water for reuse, evaporation-crystallization of hydrofracturing water, and overall economics of water management. The course serves as a sound introduction to the area for those wishing to learn about shale gas development, and provides detailed information for professionals who may be working with shale gas water.

**Presented by:** John Schubert, P.E., HDR Engineering, Sarasota, FL

### **W11 Fundamentals of Evaporative Water Treatment for Steam Generating EOR Processes**

---

Evaporative water treatment may seem complex at surface-level, but once the underlying principles are understood, evaporation system design and operation become very straightforward. This course is designed to explore everything from the fundamentals of evaporator technology to its integration into various EOR processes: steam injection processes such as SAGD and CSS. Course matter will cover the basics of producing water suitable for steam generation (either drum boilers or OTSG's) and maximizing water recycle by employing concentration and crystallization systems. A particular emphasis will be placed on water chemistry design implications and unit operations such as falling film evaporation and crystallization will be covered in-depth. Several real-world case studies will be examined to reinforce theoretical principles.

**Presented by:** Greg Mandigo, Aquatech International Corp., Hartland, WI

### **W12 Reverse Osmosis - Back to the Basics, Design and Operation**

---

The application of reverse osmosis (RO) has grown rapidly over the last 15 year. However, some of the basics have been lost in shuffle. Furthermore, many times professionals and operators familiar with ion exchange are now faced with operating RO systems with little or no training. This Workshop covers the basics of RO, from sound design to proper operating techniques. Fouling and concentration polarization, data collection and normalization, cleaning and storage are just some of the topics included in this Workshop. This Workshop is intended for all who need to understand the basics of RO.

**Presented by:** Jane Kucera, Nalco Company, Naperville, IL



### **W13 Advanced Ion Exchange**

---

This workshop is designed to build on basic ion exchange principals and will provide the opportunity to acquire an in depth knowledge of how ion exchange resins can be used in applications other than traditional softening and deionizing applications. The workshop is divided into four sections. Section one covers ion exchange fundamental theories and a review of the four basic types of ion exchangers, how their properties differ, and how they are used. Section 2 covers capacity calculations for any virtually any ion and solution and how to make preliminary calculations to determine if ion exchange is feasible and/or practical. Section 3 covers trace ion removal, principal of concentration difference, an over view of selective resins, and brief discussion of how some of the more common trace contaminants can be treated. Section 4 covers identification of problems causes, troubleshooting approaches, cleaning strategies, and how to set up spreadsheet models of operating ion exchange systems that normalize operating data.

Presented by: Peter Meyers, ResinTech, Inc., West Berlin, NJ

**THURSDAY NOVEMBER 21, 2013 1:00 - 5:00 PM**

### **W14 Ion Exchange Technology and Practical Operating Practices**

---

This workshop provides a detailed review of the various ion exchange processes for softening and demineralizing water as well as preparation for boilers, cooling, and process applications. A section on how to evaluate systems, their resin, operation, and water quality of ion exchange units is an excellent troubleshooting and informative portion of this workshop. A review of the different ion exchange resins available along with the newest developments and how those can be applied to provide specific water quality is a must for water treatment system operations. This is a great opportunity to ask questions and solve problems.

Presented by: Wayne Bernahl, W. Bernahl Enterprises, Ltd., Elmhurst, IL

### **W15 Electrodionization (EDI) Presents**

---

Electro-deionization (EDI) is a time proven process which combines semi-permeable membrane technology with ion-exchange media to provide a highly efficient self-regenerated unit that provides demineralized water without chemicals. This workshop will be broken down into two-(2) session. The 1st session will explore the design and operation of EDI modules from different manufacturers of EDI membranes. A typical feed water source shall be reviewed and EDI projections will be presented from different EDI membranes manufacturer(s). The 2nd session will cover their system design approaches and effluent water quality; provide a simplified

EDI - P&ID print of the system designed, present recommended membrane data collection parameters, cleaning protocol, review a typical autopsy report and the system operating cost. This workshop provides one stop shopping for all your EDI needs.

Presented by: Steve Gagnon, AVANTech, Inc., Columbia, SC

### **W16 Advanced Ion Exchange in SAGD**

---

Ion exchange in SAGD waters, both brackish and produced, is usually limited to softening for OTSG make-up. Both are usually lime softened, and often contain high TDS levels, low hardness to TDS ratios and foulants such as oil. This course will explain the two different processes, WAC or SAC ion exchange, reasons for picking one or the other, cleaning and regeneration methods, as well as compare capital and operating costs. It will be useful to both design engineers and operators.

Presented by: Don Downey, The Purolite Company, Paris, Ontario, Canada

### **W17 Cleaning and Troubleshooting of Reverse Osmosis Systems**

---

Effective cleaning of reverse osmosis systems is dependent on several key parameters. These key parameters include RO system design, membrane selection, cleaning skid design, operation, and membrane chemicals and cleaning procedures. Information on these key parameters and their impact on effective cleaning will be discussed in detail. Troubleshooting is necessary when cleaning does not restore the RO performance or when performance problems occur during the start-up/commissioning of new RO membrane elements.

Different methods are discussed that can be used to identify and locate the performance problem in the RO system. Guidelines on the interpretation of results generated by these tools will be provided. Case studies of 2 plants will be presented. This workshop is designed for RO system operators and designers to gather information ask questions and solve problems in a workshop environment.

Presented by: Jantje Johnson, OrangeBoat, Eden Prairie, MN

### **W19 Ultrafiltration**

---

As Ultrafiltration (UF) advances both technically and commercially it offers advantages to address a number of water treatment problems not easily solved by other membrane technologies. The goal of this UF workshop is to provide the participants with a working understanding on the basics of pressurized UF, the terminology and technology of scaled UF as applied against Municipal and Industrial water applications. The course would look at how UF “fits” with other water treatment unit operations and how it can be implemented as part of an overall water treatment plan given varied water conditions and targeted treatment requirements. In addition a brief review of some specific regulatory aspects and requirements of applying pUF into the Municipal space will be discussed. The targeted goal for participants is to provide a basic understanding pUF technology and how it may be applied as key unit operation to address a variety of water treatment needs.

Presented by: Kelly Lange-Haider, Andrea Lima, Ben Orton, Dow Chemical Company, Minneapolis, MN

### 2013 INFO SHARE SUITES:

Join companies this IWC for the long standing tradition of hospitality suites. These suites offer fun, networking, and education. Make sure you stop by them all! The suites will be on the mezzanine level of the Hilton.

#### Veolia Water Solutions & Technologies

---

Room: Camelia  
Day: Monday, November 18, 2013  
Time: 7:00 - 8:00 AM

Veolia's Water Impact Index (WIIX) expands on existing volume-based water measurement tools by factoring in three essential elements: quantity of water used, level of stress upon local water resources and overall water quality. Attend Veolia's breakfast seminar in Camelia to learn how this new tool can help your company attain its sustainability goals. Please RSVP to Kati Ardaugh ([katherine.ardaugh@veoliawater.com](mailto:katherine.ardaugh@veoliawater.com)) by Friday November 15<sup>th</sup>. Space will be first come first serve and is limited. The session will begin at 7:00 AM and will conclude by 8:00 AM in time for the morning sessions.

#### Fluor Corporation

---

Room: Azalea  
Day: Monday, November 18, 2013  
Time: 6:00 - 10:00 PM

Join Fluor in the Azalea suite from 6:00-10:00 PM Monday. Unwind and meet fellow attendees after the conference's first day, enjoy an open bar and appetizers, and meet Fluor leaders to discover what the Company is doing to promote water treatment and to address other topics highlighted in Peter Oosterveer's keynote address.

#### ChemTreat

---

Room: Begonia  
Day: Monday, November 18, 2013  
Time: 7:30 PM - Midnight

ChemTreat operates as a subsidiary of Danaher Corporation, one of the best performing Fortune 500 companies. Our proprietary solutions allow our customers to reduce water, chemical, and energy costs, extend asset life, improve process operations, and reduce downtime. We have expertise in a variety of industries, including automotive, beverage, chemical, food, fuel processing, metals, mining, power, pulp and paper, textile, and commercial-institutional. Our company has developed a robust product portfolio for the prevention of corrosion; scale and biofouling in critical heat transfer systems and advanced polymers for industrial wastewater. Stop by ChemTreat's booth for more information about the info share suite!

#### Aquatech International Corp.

---

Room: Poinsetta/ Quince  
Day: Monday, November 18, 2013  
Time: 9:00 PM - Midnight

Aquatech is hosting a "Customer Appreciation Night" in the Poinsettia/Quince rooms on Monday, November 18 beginning at 9:00 PM until midnight. Join them for an evening that includes poker, blackjack and roulette Casino games along with prizes. You can also enjoy cocktails, appetizers & desserts throughout the evening.

**2013 INFO SHARE SUITES (CONTINUED):****Golder Associates**

---

Room: Gardenia

Day: Tuesday, November 18, 2013

Time: 10:30 AM & 3:00 PM

Please Join Golder Associates on Tuesday for Water Treatment Scientist Corné Pretorius' presentation of recent research conducted on the management of brine and ash at coal fired power plants and petrochemical facilities in South Africa. The research includes comparisons of wet and dries ash deposition as well as innovative ash and brine management solutions that have applicability across industries such as power, oil sands and oil and gas production. Attend a presentation at 10:30 am or 3:00 PM.

### 2013 IWC Exhibits by Booth Number

101 & 103 & 105	Nalco/Ecolab	407	Genesys International, Ltd.
102	LANXESS Sybron Chemicals, Inc.	408	U.S. Water Services
104	MPW Industrial Services	409	Eco-Tec Inc.
106	Cortec Corporation	410	AVANTech, Inc.
107	Graver Water Systems/Ecodyne	413	Turner Designs Hydrocarbon
108	MAR Systems, Inc.	414	QUA Group, LLC
110	Severn Trent	415	Curran International
114	Hach Company	416	ProMinent Fluid Controls, Inc.
115	French Creek Software, Inc.	417	FlaktWoods
116	Global Chem-Feed Solutions	418	DOW Water and Process Solutions
201	Sentry Equipment Corp.	501	Veolia Water
202	Aquatech International Corp.	502	Golder Associates, Inc.
203	H2O Innovation/PWT	503	OrangeBoat
204	Solar Bee/ GridBee (Medora, Co.)	504	GEA Process Engineering
205	U.S. Peroxide	505 & 507	Swan Analytical USA
206	BKT	506	Pall Corporation
207	Diamond V	508	Avista Technologies, Inc.
208	Fluidra USA, Inc.	509	Waters Equipment Co.
209	Schreiber, LLC	510	Environmental Operating Solutions,
210	Thermax, Inc.	513	Ashland Water Technologies
213	Industrial Analytics Corp.	514	Mitsubishi Electric Automation, Inc.
214	Southern Research Institute	515	American Water Chemicals, Inc.
215	TriSep Corporation	516	Honeywell
216 & 218	Siemens Water Technology	517	FilterBoxx
217	AMSA, Inc.	517	UOP LLC, A Honeywell Company
301	ResinTech, Inc.	518	Alfa Laval
302 & 401	GE Power & Water	600	Johnson March Systems, Inc.
303	Parkson Corporation	601	ChemTreat, Inc.
304	Neptune Chemical Pump Co.	602	Ovivo USA, LLC
305	Baker Hughes Process	603	CHEMetrics, Inc.
306	Bowen Engineering Corp.	605	KASELCO, LLC
307 & 309	Degremont Industry	607	Federal Screen Products Inc
308	PSI/ Microclor	608	Duraflow LLC
310	WesTech Engineering, Inc.	609	Zequanox by MBI
313	Chemtrac, Inc.	610	MIOX Corporation
314	BWA Water Additives	613	Milton Roy
315	Justeq LLC	614	Taylor Technologies, Inc.
316	LGA Chemical Solutions, Inc.	615	Advanced Sensors Limited
317	OLI Systems, Inc.	FOYER 1	Brenntag North America
318	Burns and McDonnell	FOYER 2	Ahlstrom Filtration LLC
402	Purolite Company	FOYER 3	Advanced Inspection Tech.
403	WaterTectonics	FOYER 4	Knew Value
404	SAMCO Technologies, Inc	FOYER 5	Aeration Industries Int'l.
405	Illinois Water Technologies	FOYER 6	GRUNDFOS Pump Corp.
406	Mettler Toledo Thornton	FOYER 7	Aqua Treatment Service
		FOYER 8	ITOCHU Chemicals America

**IWC EXHIBIT HALL**

The IWC Exhibit Hall features countless different opportunities to learn about practical and innovative solutions for the industrial water treatment industry from industry leaders. The Exhibit Hall is located inside and outside the Grand Ballroom. The Exhibit Hall hours of operation are:

- Sunday, November 17 from 5:00 - 7:00 PM
- Monday November 18 from 11:30 AM - 1:30 PM and 4:00 - 7:00 PM
- Tuesday November 19 from 11:30 AM - 1:30 PM and 4:00 - 6:00 PM

Be sure to join us for lunch on Monday and Tuesday, as well as the evening receptions Sunday, Monday, and Tuesday. Luncheons and receptions are open to all registered attendees. A listing by booth number of all 2013 IWC Exhibitors is provided below. On the following pages, you will find a detailed description of these Exhibitors, including contact information and company description.

---

**2013 IWC Exhibits by Name -by alphabetical order**

---

**ADVANCED INSPECTION TECHNOLOGIES**

---

Booth: FOYER 3  
Contact: Paul Fitzgerald  
Phone: 321-610-8977  
Email: paul@aitproducts.com  
Website: www.aitproducts.com

AIT is a leading supplier of remote visual inspection equipment to industrial customers. Inspections include; heat exchangers, boiler tubes, steam feed lines, and other areas to check the effects of water on industrial systems. AIT offers high quality inspection cameras to check industrial systems for scale, erosion, pitting, corrosion, deposits and other problems. AIT also rents video borescopes and pipe cameras throughout North America.

**ADVANCED SENSORS LIMITED**

---

Booth: 615  
Contact: Duane Germenis  
Phone: 44 28 9332 8922  
Email: duane.germenis@advancedsensors.co.uk  
Website: www.advancedsensors.co.uk/

Advanced Sensors Ltd is the leading global supplier of Oil in Water analyzers to the Oil and Gas Industries, providing innovative solutions that guarantee analyzers are self-cleaning, reliable and durable. Accurate measurement ensures process and environmental control and offers early warning indicators of leaks and discharges.

**AERATION INDUSTRIES INTERNATIONAL**

---

Booth: FOYER 5  
Contact: Todd Martin  
Phone: 720-469-8828  
Email: aii@aireo2.com  
Website: www.aireo2.com

Aeration Industries International, the world's largest manufacturer of surface aeration equipment, supplies high quality treatment systems and advanced AIRE-O2® Triton aerators and mixers to provide solutions for the challenging industrial wastewater industry, including the petroleum segment. Since 1974, over 65,000 aerators have been delivered throughout the U.S. and in more than 92 countries.

---

**AHLSTROM FILTRATION LLC**

---

Booth: FOYER 2  
Contact: Rodney Komlenic  
Phone: 717-486-6401  
Email: rod.komlenic@ahlstrom.com  
Website: www.ahlstrom.com/

Ahlstrom is a high performance fiber-based materials company, partnering with leading businesses around the world to help them stay ahead. Our products are used in a large variety of everyday applications, such as filters, medical gowns and drapes, diagnostics, wallcoverings, flooring and food packaging. We have a leading market position in the businesses in which we operate.

---

**ALFA LAVAL**

---

Booth: 518  
Contact: Andreas Ronnfors  
Phone: 45-39-53-60 00  
Email: info.dk@alfalaval.com  
Website: www.alfalaval.com

Alfa Laval offers solutions for industrial water treatment that require less floor area, substantially reduce investment costs and minimize maintenance - without sacrificing reliability or safety. As a leading global provider of specialized products and engineered solutions, we offer our De-watering and De-Oiling Technologies together with our Evaporation Systems for the treatment of Produced, Flowback and Blowdown waters for Oil & Gas customers. Our main goal to optimize the performance of their processes, time and time again.

---

**AMERICAN WATER CHEMICALS, INC.**

---

Booth: 515  
Contact: Tarek El-Shafie  
Phone: 813-246-5448  
Email: info@membranechemicals.com  
Website: www.membranechemicals.com

American Water Chemicals, Inc. (AWC) is an international ISO 9001:2008 certified company specializing in advanced chemical solutions and analytical services for membrane separation processes. AWC manufactures membrane antiscalants, antifoulants, and cleaning chemicals for reverse osmosis (RO), nanofiltration (NF), ultrafiltration (UF), and microfiltration (MF) membrane purification systems. AWC is an industry pioneer of advanced membrane autopsy techniques and investigative services and supports both public and private business sectors. Our services are designed to help identify operational problems by improving membrane system performance and reducing cost through scientifically engineered solutions.

---

**AMSA, INC.**

---

Booth: 217  
Contact: Attila G. Relenyi, Ph.D.  
Phone: 888-739-0377  
Email: sales@amsainc.com  
Website: www.amsainc.com

AMSA Inc. manufactures DTEA II organic deposits cleaner, penetrant and dispersant used in industrial cooling water systems. DTEA II is used in geothermal utilities to inhibit and remove sulfur deposits. Outside the USA DTEA II is sold as a biocide.

---

**AQUA TREATMENT SERVICE**

---

Booth: FOYER 7  
Contact: Jesse Rodriguez  
Phone: 717-443-1023  
Email: [jesse@aquat.com](mailto:jesse@aquat.com)  
Website: [www.aquat.com](http://www.aquat.com)

O.E.M., stainless steel fabrication and custom manufacturing. ATS manufactures UV system designs for Make Up Water, Process Water, Product Water, Drinking Water, Rain Water Collection Systems and Reclamation Systems for Disinfection, TOC Reduction and Advanced Oxidation.

See the New ATS Multi-Barrier Filtration and 186K UV System which has been EPA Tested at > 4-log Reduction (99.99%) of Bacteria, Cryptosporidium and Virus to meet EPA and State regulations.

---

**AQUATECH INTERNATIONAL CORP.**

---

Booth: 202  
Contact: Patrick Randall  
Phone: 724-746-5300  
Email: [aic@aquatech.com](mailto:aic@aquatech.com)  
Website: [www.aquatech.com](http://www.aquatech.com)

Aquatech is a global leader in water purification technology for industrial and infrastructure markets with a focus on recycle and reuse, zero liquid discharge, produced water treatment and desalination. Aquatech strives to provide technology leadership and performance excellence to the water industry, and aims to support its clients with cutting edge sustainable solutions, minimizing their life cycle cost, as well as their carbon and water footprint.

---

**ASHLAND WATER TECHNOLOGIES**

---

Booth: 513  
Contact: Kenneth Dunn  
Phone: 508-341-0841  
Email: [kmdunn@ashland.com](mailto:kmdunn@ashland.com)  
Website: [www.ashland.com](http://www.ashland.com)

For nearly 100 years, Ashland Water Technologies has been a leading provider of a wide array of innovative process and water treatment specialty chemicals. Our extensive global expertise, on-site management approach and seasoned team of application experts enable us to partner with you to deliver high-value solutions. Combined with our commitment to environmentally sustainable initiatives, we work with you to protect our world for future generations.

---

**AVANTECH, INC.**

---

Booth: 410  
Contact: Steven Gagnon  
Phone: 803-622-5426  
Email: [sgagnon@avantechinc.com](mailto:sgagnon@avantechinc.com)  
Website: [www.avantechinc.com](http://www.avantechinc.com)

AVANTech, Inc. is a comprehensive industrial water treatment solutions provider. Our extensive experience in engineering process systems enables us to create integrated solutions that can dramatically improve operations in industrial, commercial, power, and nuclear power applications.



**AVISTA TECHNOLOGIES, INC.**

---

Booth: 508  
Contact: Michael Graver  
Phone: 215-859-0752  
Email: [mgraver@avistatech.com](mailto:mgraver@avistatech.com)  
Website: [www.avistatech.com](http://www.avistatech.com)

Avista Technologies is a trusted expert in membrane system chemistry and global process support for Reverse Osmosis and Micro/Ultra Filtration membrane systems and Multimedia Filtration. Reverse Osmosis products include: Vitec® antiscalants, RoClean, AvistaClean® membrane cleaners and RoCide® biocides. AvistaClean® MF cleaners restore MF/UF membrane performance when generics are no longer effective.

**BAKER HUGHES PROCESS & PIPELINE SERVICE**

---

Booth: 305  
Contact: Stewart Emmerson  
Phone: 832-519-2060  
Email: [stewart.emmerson@bjsservices.com](mailto:stewart.emmerson@bjsservices.com)  
Website: [www.bjsservices.com](http://www.bjsservices.com)

Pre-commissioning and turnaround services. Chemical cleaning, boiler and pipe systems. Flowmac flushing of lube and hydraulic systems. Air and nitrogen drying. Accelerated cooldown processes with N2 and Co2. Laboratory and development facilities.

**BKT**

---

Booth: 206  
Contact: Joon Min  
Phone: 714-578-0676  
Email: [info@bkt21.com](mailto:info@bkt21.com)  
Website: [www.BKT21.com](http://www.BKT21.com)

BKT provides biological wastewater treatment, membrane filtration, and energy saving solutions. We have more than 100 wastewater treatment references for biological nutrient removal (BNR) processes, retrofitting, combined sewer overflows (CSOs), and total maximum daily load (TMDL) compliance using both our biological filtration (BBF) and customizable SBR (BCS) technologies. These references include 130 and 190 MGD facilities, which are currently under construction.

**BOWEN ENGINEERING CORP.**

---

Booth: 306  
Contact: Michael Soller  
Phone: 317-576-8730  
Email: [msoller@bowenengineering.com](mailto:msoller@bowenengineering.com)  
Website: [www.bowenengineering.com](http://www.bowenengineering.com)

Bowen is your nationwide water and wastewater industrial construction expert. If you need to reach compliance on water quality for supply or discharge related to Power Plant ELG's, Combined Cycle Power, Mine discharges, Oil & Gas, or drinking water stop by and talk with us about your challenge - we will share our experience with you. Get insights from a partner who has constructed over 1,000 treatment facilities, and has strong phys-chem, biological, evaporator experience with multiple technology partners.

**BRENNTAG NORTH AMERICA**

---

Booth : FOYER 1  
Contact: Brian Liotta  
Phone: 510-816-4903  
Email: BLiotta@brenntag.com  
Website: www.brenntag.com

Brenntag is a global logistics expert, grounded in principles of safety. We have an internal network of technical specialists, and world class supplier relationships. This network enables Brenntag to provide solutions to our customers in the area of water treatment – municipal, commercial, industrial. Product mix includes: Phosphonates, Biocides, Dispersants, Corrosion Inhibitors, Flocculants, Coagulants, Defoamers, Polyphosphates, Amines, Acids & Alkalis.

**BURNS AND MCDONNELL ENGINEERING COMPANY, INC.**

---

Booth: 318  
Contact: Patricia Scroggin  
Phone: 816-822-3097  
Email: pscroggin@burnsmcd.com  
Website: www.burnsmcd.com/

At Burns & McDonnell, our multidiscipline staff of more than 4,300 employee-owners is focused on our clients' success in every facet of the projects in which we are engaged. As a 100 percent employee-owned firm, each of us has a vested interest in the success of every project and client. More than 80 percent of our projects come from repeat clients. They know our mission is to serve them well, and they know that they are dealing with concerned owners in every aspect of our relationship.

**BW WATER ADDITIVES**

---

Booth: 314  
Contact: Melissa Goeren  
Phone: 678-802-3026  
Email: Americas@wateradditives.com  
Website: www.wateradditives.com

BWA Water Additives is a leading global provider of sustainable specialty chemical solutions for industrial water treatment, desalination, and oilfield industries. Our brands: Belclene®, Belcor®, Belgard®, BromiCide®, Bellasol®, Belsperse®, Bellacide® and Flocon® are recognized worldwide for the highest quality and superior technical performance.

**CHEMETRICS, INC.**

---

Booth: 603  
Contact: Mari Lockhart  
Phone: 800-356-3072  
Email: info@chemetrics.com  
Website: www.chemetrics.com

CHEMetrics manufactures water analysis test kits and instruments for over 50 essential parameters. Available tests include dissolved oxygen, nitrite, iron, phosphate, etc. The kits and instruments utilize self-filling reagent ampoules that simplify and speed water quality testing and are ideal for field and lab use. CHEMetrics offers personalized customer support that is a phone call or an email away.

**CHEMTRAC, INC.**

---

Booth: 313  
Contact: Joseph Zimmerman  
Phone: 770-449-6233  
Email: [www.chemtrac.com](http://www.chemtrac.com)  
Website: [jjzimmerman@chemtrac.com](mailto:jjzimmerman@chemtrac.com)

Chemtrac, Inc. designs and manufactures instrumentation for coagulation/clarification/filtration/disinfection optimization, as well as for steam/condensate monitoring. Chemtrac is a global leader in providing streaming current technology, and offers particle counters and monitors for continuous filter performance evaluation. Chemtrac also provides analyzers for chlorine, ozone, pH, ORP, biofilm, and organics monitoring.

**CHEMTREAT**

---

Booth: 601  
Contact: Ray Post, P.E.  
Phone: 804-627-2369  
Email: [rayp@chemtreat.com](mailto:rayp@chemtreat.com)  
Website: [www.chemtreat.com](http://www.chemtreat.com)

ChemTreat is one of the largest and fastest growing industrial water treatment companies in North and South America. Since 1968 our entrepreneurial spirit and emphasis on hiring the very best field engineers have driven our success as we continue to find new ways to demonstrate value for our customers. Our industrial water management programs include boiler, cooling tower, influent, and wastewater treatment.

**CORTEC CORPORATION**

---

Booth: 106  
Contact: Tucker Combs  
Phone: 651-429-1100  
Email: [productinfo@cortecvci.com](mailto:productinfo@cortecvci.com)  
Website: [www.cortecvci.com](http://www.cortecvci.com)

Cortec® Corporation (St. Paul, Minnesota) is trusted globally to provide environmentally friendly, corrosion protection with its VpCl® and MCl® Technologies for Metalworking, Electronics, Water Treatment, Oil & Gas, Packaging, Construction, and other industries. Certified ISO 9001:2008/14001:2004/17025:2005

**CURRAN INTERNATIONAL**

---

Booth: 415  
Contact: Ed Deeley  
Phone: 281-339-9993  
Email: [edeely@curranintl.com](mailto:edeely@curranintl.com)  
Website: [www.curranintl.com](http://www.curranintl.com)

Curran's patented coating methodology places it at the forefront of maintenance excellence. Curran International is the company-of-choice and a valued partner for turnaround projects of any size. Curran crews work around the clock and the world to meet your needs.

**DEGREMONT INDUSTRY**

---

Booth: 307 & 309  
Contact: William Tuck  
Phone: 289-244-7600  
Email: [william.tuck@infilcodegremont.com](mailto:william.tuck@infilcodegremont.com)  
Website: [www.degremont-technologies.com](http://www.degremont-technologies.com)  
Degremont NA - The world's most respected leader in:

- Zero Liquid Discharge
- Boiler Feed Water Treatment
- Clarification
- Wastewater Treatment
- Heavy Metals Removal
- Biological Treatment

Your single source supplier for custom designed, engineered, manufactured and commissioned industrial water treatment systems. Degremont - The most trusted name in the Water & Wastewater Treatment industry.

**DIAMOND V**

---

Booth: 207  
Contact: Michael M. Spacil, M.S.  
Phone: 800-373-7234  
Email: [mspacil@diamondv.com](mailto:mspacil@diamondv.com)  
Website: [www.diamondv.com](http://www.diamondv.com)

Diamond V® is a bioscience company specializing in fermentation technology. The Company manufactures all-natural nutritional products that optimize microbial efficiency. Since 1943, Diamond V® has been committed to advancing nutrition and health in the animal industry and has expanded to human nutrition and, more recently, water and soil remediation. Our commitment to innovation, technology and quality has earned Diamond V® a global reputation of trust and reliability. We help our customers succeed by sharing knowledge, innovation and capability.

**DOW WATER AND PROCESS SOLUTIONS**

---

Booth: 418  
Contact: John C. Patrin  
Phone: 800-447-4369  
Email: [jcpatrin@dow.com](mailto:jcpatrin@dow.com)  
Website: [www.cleanfiltration.com](http://www.cleanfiltration.com)

Clean Filtration Technologies ("CFT") is a wholly owned subsidiary of The Dow Chemical Company and markets the TEQUATIC™ fine particle filter through the Dow Water & Process Solutions business. We specialize in providing innovative, cost-effective solutions for difficult-to-treat water in a variety of applications, leveraging the world-class expertise of Dow to accelerate innovation and speed to market. We are headquartered in Menlo Park, CA, and are committed to customer success.

**DURAFLOW LLC**

---

Booth: 608  
Contact: Bill Matheson  
Phone: 978-851-0447  
Email: [billmatheson@duraflow.biz](mailto:billmatheson@duraflow.biz)  
Website: [www.duraflow.biz/](http://www.duraflow.biz/)

Duraflow manufactures Tubular, Crossflow, Microfiltration Membrane filters in their in Tewksbury, MA facility. These membrane modules are the key components of water and wastewater treatment systems built by Duraflow's trained and authorized OEM manufacturers. These systems are mostly for either recycling industrial wastewater or for prefiltration processes in front of Reverse Osmosis systems. Duraflow membrane modules are recognized as the perfect pretreatment to RO.

**ECO-TEC INC.**

---

Booth: 409  
Contact: Michael Sheedy  
Phone: 905-427-0077  
Email: [msheedy@eco-tec.com](mailto:msheedy@eco-tec.com)  
Website: [www.eco-tec.com](http://www.eco-tec.com)

Eco-Tec will feature its advanced filtration and ion exchange softening systems for use in the treatment of heavy oil produced waters of which more than 10 systems have been supplied to-date.

**ENVIRONMENTAL OPERATING SOLUTIONS, INC.**

---

Booth: 510  
Contact: Maurice Gutierrez  
Phone: 508-743-8440  
Email: [info@eosenvironmental.com](mailto:info@eosenvironmental.com)  
Website: [www.eosenvironmental.com](http://www.eosenvironmental.com)

Environmental Operating Solutions, Inc. (EOSi) has been providing renewable chemicals and technical services for biological contaminant removal applications in water and wastewater treatment systems since 2003. Our agriculturally-derived and eco-friendly MicroC™ line of products (MicroC 1000™ - MicroC 4000™) address contaminants including nitrogen, phosphorus, selenium and perchlorate - providing a non-hazardous and environmentally sustainable alternative to chemicals such as methanol.

**FEDERAL SCREEN PRODUCTS INC**

---

Booth: 607  
Contact: Greg Colman  
Phone: 905-677-4171  
Email: [greg@federalscreen.com](mailto:greg@federalscreen.com)  
Website: [www.federalscreen.com](http://www.federalscreen.com)

FEDERAL SCREEN PRODUCTS manufactures Wedge Wire screen and fabricated Wedge Wire products for straining, screening, and filtering and media retention in water purification, conditioning and waste water equipment. We manufacture to our customers' drawings and specifications in materials such as 316L SS, 304L SS, Alloy 20, Hastalloy C-276, Monel, Super Duplex, Zeron 100 and Titanium. Federal Screens takes pride in their high quality products, reliable customer service, prompt deliveries and competitive pricing.

**FILTERBOXX PACKAGED WATER SOLUTION INC.**

---

Booth: 517  
Contact: Steve Kroll  
Phone: 403-444-8590  
Email: [steve.kroll@filterboxx.com](mailto:steve.kroll@filterboxx.com)  
Website: [www.filterboxx.com](http://www.filterboxx.com)

FilterBoxx Water and Environmental Corp. is a leading provider of process and industrial water and wastewater treatment solutions. FilterBoxx has leveraged its expertise in applications and technologies with significant market understanding to bring forward containerized, mobile, and skid based membrane and non-membrane solutions. FilterBoxx develops robust technical and economical solutions from the ground up, reviewing client and application demands to evolve a flow sheet and suitable technologies to meet the rigors of the project, schedule, and budget whether it be capital purchase or lease.

**FLAKTWOODS**

---

Booth: 417  
Contact: Jason Stoklosa  
Phone: 716-845-0900  
Email: [jason.r.stoklosa@flaktwoods.com](mailto:jason.r.stoklosa@flaktwoods.com)  
Website: [www.flaktwoods.com](http://www.flaktwoods.com)

FlaktWoods ExVel™ turbo-fans are the proven, highly reliable, and best economic solution for Mechanical Vapor Compression (MVC) applications for evaporators and crystallizers. ExVel™ turbo-fans are unique in all of fan and vapor compressor industry, and are single-stage, low speed, high strength centrifugal designs, which are well suited to the demands of typical vapor compression applications and environments.

**FLUIDRA USA, INC.**

---

Booth: 208  
Contact: Keith Laguate  
Phone: 904-378-0999  
Email: [klaguate@fluidra.us](mailto:klaguate@fluidra.us)  
Website: [www.fluidra.us](http://www.fluidra.us)

Astral Industrial, a Fluidra company, manufactures FRP pressure filters from 36" to 118" diameter and 100 PSI operating pressure in our Jacksonville, FL plant. Polyester and vinyl ester resins provide superior corrosion resistance. Filters are provided with internals that are hydraulically balanced to provide superb flow & low pressure drop during filtration and backwashing. Fluidra also manufactures UV systems, valves, actuation, controllers and heaters for a complete approach to water treatment.

**FRENCH CREEK SOFTWARE, INC.**

---

Booth: 115  
Contact: Rob Ferguson  
Phone: 610-935-8337  
Email: [info@frenchcreeksoftware.com](mailto:info@frenchcreeksoftware.com)  
Website: [www.frenchcreeksoftware.com](http://www.frenchcreeksoftware.com)

French Creek develops and markets water treatment modeling software for unique water reuse applications, including flowback systems.

**GE POWER & WATER**

---

Booth: 302 & 401  
Contact: Kyle Wendel  
Phone: 425-828-2400  
Email: [Kyle.Wendel@ge.com](mailto:Kyle.Wendel@ge.com)  
Website: [www.gewater.com](http://www.gewater.com)

With operations in 130 countries and employing nearly 8000 worldwide, GE Power & Water, Water & Process Technologies brings together experienced professionals and advanced technologies to solve the world's most complex challenges related to water availability and quality, increased productivity and cost reduction, and environmental regulations.

**GEA PROCESS ENGINEERING**

---

Booth: 504  
Contact: Cara Gardner  
Phone: 410-997-8700  
Email: [gea-pe.us@gea.com](mailto:gea-pe.us@gea.com)  
Website: [www.niroinc.com](http://www.niroinc.com)

GEA Process Engineering is a full-service engineering company dedicated to supplying evaporation, crystallization, membrane filtration, and drying process technology and systems, from smaller skid mounted options to large industrial scale, for a wide variety of industrial and environmental wastewater applications. All of our wastewater treatment solutions are specifically tailored to each customer's requirement. Our ZLD Systems remove the dissolved solids from the wastewater and returns distilled

**GENESYS INTERNATIONAL, LTD.**

---

Booth: 407  
Contact: Ursula Annunziata  
Phone: 952-949-6535  
Email: [uannunziata@genesysro.com](mailto:uannunziata@genesysro.com)  
Website: [www.genesysamericas.com](http://www.genesysamericas.com)

Genesys North America specializes in high performance membrane chemicals and services for reverse osmosis and nanofiltration systems. The membrane chemicals include anti-scalants and cleaning chemicals. The products and expertise of Genesys North America allow customers to reduce the total cost of their RO/NF operation.

**GLOBAL CHEM-FEED SOLUTIONS**

---

Booth: 116  
Contact: Don Crawford  
Phone: 215-675-2777 X113  
Email: [donc@globalchem-feed.com](mailto:donc@globalchem-feed.com)  
Website: [www.globalchem-feed.com](http://www.globalchem-feed.com)

Global Chem-feed Solutions (GCS) is a supplier of custom skid mounted chemical feed systems as well as wet dust suppression systems for Electric Generating Plants, Hydrocarbon Petrochemical Plants and other Heavy Industrial Manufacturing Facilities. Custom skid mounted chemical dosing systems are engineered for the injection of chemicals into boiler water, cooling water, and waste water systems, as well as a wide variety of process applications. Fugitive dust suppression systems are designed and fabricated for material handling and storage pile applications.

**GOLDER ASSOCIATES, INC.**

---

Booth: 502  
Contact: Paul Pigeon  
Phone: 303-980-0540  
Email: Paul\_piegon@golder.com  
Website: www.golder.com

Golder Associates is an employee-owned, global group of companies specializing in ground engineering and environmental services. From offices worldwide, our employees work with clients who want to manage their environmental and engineering activities in a technically sound, economically viable and socially responsible manner.

**GRAVER WATER SYSTEMS/ ECODYNE WATER**

---

Booth: 107  
Contact: Robert Applegate  
Phone: 908-516-1404  
Email: rapple@graver.com  
Website: www.graver.com

Graver Water Systems, LLC designs and manufactures water and wastewater treatment equipment and systems. Graver's engineers are knowledgeable in pretreatment, degasification, hot lime softening, boiler make-up, condensate polishing, wastewater treatment, cooling water treatment, and oil/water separation for industrial plants and electric.

**GRUNDFOS PUMP CORPORATION**

---

Booth: FOYER 6  
Contact: Shawn Chong  
Phone: 913-961-0813  
Email: schong@grundfos.com  
Website: www.grundfos.us

With an annual production of more than 16 million pump units, Grundfos is one of the world's leading pump manufacturers. Decades of experience allow us to cover every pumping requirement in new systems and in replacements; in process, machining and general industries to handle even the most difficult of challenges including hot liquids, flammable or aggressive medias or high pressure. As a truly global company, Grundfos is present in 45 countries, making expert know-how and support easily accessible in every part of the world.

**H2O INNOVATION/PWT**

---

Booth: 203  
Contact: David Faber  
Phone: 760-598-2206 EXT. 110  
Email: David.Faber@h2oinnovation.com  
Website: www.h2oinnovation.com

As a complete solutions provider, H2O Innovation® provides integrated water treatment systems based on membrane technology and focuses on three main targets: the municipal sector, the energy sector, and the mining industry. H2O Innovation® designs and builds custom treatment systems for the production of drinking water and industrial process water, the reclamation and reuse of water, and the treatment of wastewater. We offer maintenance solutions for our systems, including a complete line of proprietary phosphate-free and low-phosphate antiscalants and cleaning



**HACH COMPANY**

---

Booth: 114  
Contact: Pam Carlson  
Phone: 970-663-1377  
Email: pcarlson@hach.com  
Website: www.hach.com

Hach Company manufactures and distributes analytical instruments and reagents used to test the quality of water and other liquids. Hach systems are designed to simplify analysis, and offer:

- Complete, easy-to-follow methods
- High-quality prepared reagents
- Accurate portable, laboratory and online instrumentation
- Life-time technical support.

**HONEYWELL**

---

Booth: 516  
Contact: Vickie Olson  
Phone: 678-372-0242  
Email: Vickie.Olson@honeywell.com  
Website: www.honeywellprocess.com

Honeywell is a leading supplier of process control instrumentation, including a broad range of analytical instrumentation. Conductivity, pH, ORP and dissolved oxygen analysis systems are available for high purity water and other industrial and municipal liquid applications.

**ILLINOIS WATER TECHNOLOGIES**

---

Booth: 405  
Contact: Paul Byrd  
Phone: 815-636-8884  
Email: paulb@illinoiswater.com  
Website: www.illinoiswatertech.com

Illinois Water Technologies is an independent service and retrofit provider of water treatment equipment. We also stock ion exchange-resin, filter media and provide custom replacement parts as well as common vendor supplied components. Our customers enjoy 24-hour availability, commitment to service, and cost savings that IWTEch brings to the marketplace.

**INDUSTRIAL ANALYTICS CORP.**

---

Booth: 213  
Contact: Nick Afragola  
Phone: 203-245-0380  
Email: nafragola-iac@sbcglobal.net  
Website: www.industrialanalyticscorp.us

Industrial Analytics Corporation, a US company, has been an integral participant in power plant water chemistry since 1990. Unique and user friendly water quality instrumentation are produced at our facility. Current parameters include sodium (manual and auto-cal versions), dissolved oxygen (response from air saturation to less than 10 ppb in under 5 minutes), silica (single and multi-stream, two reagent and three reagent packages), and pH via differential conductivity.

---

**ITOCHU CHEMICALS AMERICA INC.**

---

Booth: FOYER 8  
Contact: Fred Ghanem  
Phone: 856-207-4370  
Email: Fred-Ghanem@itochu-ca.com  
Website: www.itochu-purification.com

ITOCHU Chemicals and Mitsubishi Chemicals teamed up for more than 10 years to offer premium ion exchange resins under the name brands of Diaion™ and Relite™ to the water treatment industry. With best lot-to-lot reproducibility, Mitsubishi Chemical is a chemistry pioneer offering the largest scope of Uniform and Gaussian distributed resins. ITOCHU Chemicals has also expanded its offering to include high grade filtration sand media for iron and manganese removal (Quantum) and MBR membranes (Mitsubishi Rayon) for all your water treatment needs.

---

**JOHNSON MARCH SYSTEMS, INC.**

---

Booth: 600  
Contact: John Sands  
Phone: 215-364-2500  
Email: john.sands@johnsonmarch.com  
Website: www.johnsonmarch.com

Johnson March Systems is a custom designer and manufacturer of Chemical Dosing Systems, Steam and Water Sampling Panels, Chlorination Systems (Electrolytic, Gaseous, Purchased Hypochlorite), Ammonia Feed Systems, ASME Pressure Vessels, Specialty Skid Mounted Packages, and Dust Suppression Systems. JMSI is ISO9001-2008 certified by Underwriters Laboratories. JMSI has a full staff of Mechanical, Chemical, Electrical, Instrumentation and Civil Engineers.

---

**JUSTEQ LLC**

---

Booth: 315  
Contact: Justin Shim  
Phone: 847-656-8626  
Email: justeq@gmail.com  
Website: www.justeq.com

Justeq produces and markets the newest industrial water treatment biocide, Justeq07. Justeq07 is effective, economical and convenient. The production growth of this biocide is the fastest among the industrial water treatment biocides.

---

**KASELCO, LLC**

---

Booth: 605  
Contact: Douglas Herber  
Phone: 361-594-2596  
Email: kasesosales@kaselco.com  
Website: www.kaselco.com

KASELCO has been a leader in the water solutions industry since 1996. We specialize in our own patented electrocoagulation systems, manufactured in the USA. EC has many benefits over other treatment systems including the reduction of operating costs and the ability to create stable waste without the addition of chemicals.

**KNEW VALUE**

---

Booth: FOYER 4  
Contact: LJ Aspinall  
Phone: 281-324-5258  
Email: lj@knewvalue.com  
Website: www.KnewValue.com

Knew Value, LLC would like to introduce you to some unique and innovative ways of addressing various needs within the industrial water treatment market. We have created some "common sense" approaches to some very much needed areas of performance monitoring. We hope you will find our products and services helpful in maintaining the highest level of reliability and profitability for your plant operations. We look forward to serving you.

**LANXESS SYBRON CHEMICALS, INC.**

---

Booth: 102  
Contact: Edward Nace  
Phone: 800-678-0020  
Email: edward.nace@lanxess.com  
Website: www.Lanxess.com

LANXESS Sybron Chemicals Inc offers the most technically advanced ion exchange resins today. We have over 60 years of experience in ion exchange, developing essential products, processes and application technology. We offer a full range of products that cover water treatment, the food industry, catalysis/ chemical processes and many other specialty markets. The products are sold world-wide under the brand name Lewatit

**LGA CHEMICAL SOLUTIONS, INC.**

---

Booth: 316  
Contact: Bernardo Vega  
Phone: 210- 888-0497  
Email: info@lgachemsol.com  
Website: www.lgachemsol.com

LGA Chemical Solutions Inc. based in San Antonio, Texas since 2010, is the brand new division of Omega Chemicals S.A. de C.V., a reputable and trusted chemicals manufacturer that over 40 years has served the Mexican and International markets. LGA Chemical Solutions Inc. brings to your attention a dedicated line of products specifically designated for the water treatment industry. We focused on them to show you our commitment to consistently deliver quality chemical products.

**MAR SYSTEMS, INC.**

---

Booth: 108  
Contact: Richard Steubi  
Phone: 440-505-0962 x106  
Email: rstuebi@marsystemsinc.com  
Website: www.marsystemsinc.com

MAR Systems is an Ohio-based company that was established in 2005. Our firm has developed a FASTER, CHEAPER, GREENER solution for the removal of heavy metal contaminants from water. As a result of the increasing presence of hazardous metal contaminants found in water, MAR Systems has developed patented, proprietary processes that remove mercury, selenium, arsenic and other metals from water through its Sorbster media.

**METTLER TOLEDO THORNTON**

---

Booth: 406  
Contact: Peggy Banarhall  
Phone: 781-301-8822  
Email: [peggy.banarhall@mt.com](mailto:peggy.banarhall@mt.com)  
Website: [www.mt.com](http://www.mt.com)

Mettler-Toledo Thornton, a global leader in high purity water measurement, provides in line industrial monitoring instrumentation for the key parameters measured in cycle chemistry, stator cooling, cooling towers, scrubbers, wastewater & makeup water treatments. Thornton's innovative, reliable sensors and transmitter monitor Conductivity (and Cation conductivity), pH, ORP, TOC, Sodium, Silica, Dissolved Oxygen and Dissolved

**MILTON ROY**

---

Booth: 613  
Contact: Kurt Gaebel  
Phone: 215-441-0800  
Email: [Kurt.gaebel@miltonroy.com](mailto:Kurt.gaebel@miltonroy.com)  
Website: [www.lmipumps.com](http://www.lmipumps.com)

Milton Roy is a global leader in fluid control and metering pump technologies, offering a broad range of pneumatic, hydraulic actuated, solenoid driven metering and centrifugal pumps and accessories that provide cost-effective reliable pumping solutions for chemical dosing and water removal to meet a wide range of industry needs.

**MIOX CORPORATION**

---

Booth: 610  
Contact: Brett Julian  
Phone: 505-343-0090  
Email: [Sales@miox.com](mailto:Sales@miox.com)  
Website: [www.miox.com](http://www.miox.com)

MIOX Corporation is the innovator and industry leader in on-site chemical generators for water disinfection. MIOX systems are used in multiple applications through a wide range of products, cost-effectively producing disinfection chemistry from 1.0 to 3,000 pounds per day FAC (free available chlorine). With this flexibility, the applications range from large industrial cooling towers, water and wastewater treatment, and frac fluid disinfection to clean-in-place and dairy farm applications.

**MITSUBISHI ELECTRIC AUTOMATION, INC.**

---

Booth: 514  
Contact: Ed Ladd  
Phone: 512-693-1451  
Email: [ed.ladd@meau.com](mailto:ed.ladd@meau.com)  
Website: [www.meau.com](http://www.meau.com)

As one of many Mitsubishi automation affiliates around the world, Mitsubishi Electric Automation, Inc., is part of a \$40 billion global company serving a wide variety of industrial markets with a family of automation products including programmable logic controllers, variable frequency drives, operator interfaces, motion control systems, computer numerical controls, industrial robots, servo amplifiers and motors, and industrial sewing machines.

---

**MPW INDUSTRIAL SERVICES**

---

Booth: 104  
Contact: Angela Rolfe  
Phone: 740-345-2431  
Email: [arolfe@mpwservices.com](mailto:arolfe@mpwservices.com)  
Website: [www.mpwservices.com](http://www.mpwservices.com)

MPW is the leading service provider of integrated technology-based Industrial Cleaning, Facility Management, Water Purification and Container Management in North America. MPW partners with customers to enhance operational efficiencies improve reliability and minimize costs. Qualified, highly trained personnel respond to your needs, delivering services with the highest ethical standards and commitment to safety.

---

**NALCO, AN ECOLAB COMPANY**

---

Booth: 101 & 103 & 105  
Contact: Debbie Bloom  
Phone: 630-305-2264  
Email: [dbloom@nalco.com](mailto:dbloom@nalco.com)  
Website: [www.nalco.com](http://www.nalco.com)

With 2011 pro forma sales of \$11 billion and more than 40,000 employees, Ecolab Inc. (NYSE: ECL) is the global leader in water, hygiene and energy technologies and services that provide and protect clean water, safe food, abundant energy and healthy environments. Nalco, an Ecolab company, specializes in industrial water, energy and air applications, helping customers reduce natural resource consumption, enhance air quality, minimize environmental releases and improve productivity. We deliver comprehensive programs and services to the food, energy, healthcare, industrial and hospitality markets in more than 160 countries.

---

**NEPTUNE CHEMICAL PUMP CO.**

---

Booth: 304  
Contact: Thomas R. O'Donnell  
Phone: 215-699-8700  
Email: [tom.odonnell@neptune1.com](mailto:tom.odonnell@neptune1.com)  
Website: [www.neptune1.com](http://www.neptune1.com)

Neptune Chemical Pump Co. is a manufacturer of metering pumps, portable mixers, chemical feed systems, liquid polymer blending systems and glycol feed systems plus water treatment accessories including bypass feeders, bromine feeders, sample coolers, injection quills and corporation stops. In addition, Neptune manufactures relief valves, back pressure valves and calibration columns.

---

**OLI SYSTEMS, INC.**

---

Booth: 317  
Contact: Pat McKenzie  
Phone: 973-998-0240  
Email: [pat.mckenzie@olisystems.com](mailto:pat.mckenzie@olisystems.com)  
Website: [www.olisystems.com](http://www.olisystems.com)

OLI simulation technology is the standard for the simulation of electrolyte systems. OLI provides software tools to model chemical processes, the electrochemistry of aqueous corrosion, water treatment, and environmental behavior. Established in 1971, OLI has an extensive chemical-process-industry client base, and a reputation for accurate simulation of industrial applications.

---

**ORANGEBOAT**

---

Booth: 503  
Contact: Jantje Johnson  
Phone: 952 232 0829  
Email: [info@orangeboatsupport.com](mailto:info@orangeboatsupport.com)  
Website: [www.orangeboatsupport.com](http://www.orangeboatsupport.com)

OrangeBoat provides peace of mind to engineering companies, equipment suppliers, membrane manufacturers, chemical suppliers and operators through unbiased, expert technical service on demand for membrane-based water treatment systems. OrangeBoat works with clients of all sizes to ensure the reliable, efficient operation of water treatment systems.

---

**OVIVO USA, LLC**

---

Booth: 602  
Contact: Claire Madson  
Phone: 281-480-7955 x 3838  
Email: [claire.madson@ovivowater.com](mailto:claire.madson@ovivowater.com)  
Website: [www.ovivowater.com](http://www.ovivowater.com)

Ovivo, a GLV Company, is a solutions provider for plants having water problems. This organization brings together over 200 years of water expertise into a single, highly accessible business focused purely upon creating value for our customers. Ovivo is made up of some two dozen companies worldwide, each specializing in a specific piece of equipment dealing with water. Many of the best known most respected and most reliable brand names are part of our heritage.

---

**PALL CORPORATION**

---

Booth: 506  
Contact: Dave Glovinsky  
Phone: 516-484-3600  
Email: [dave\\_glovinsky@pall.com](mailto:dave_glovinsky@pall.com)  
Website: [www.pall.com](http://www.pall.com)

Pall Corporation is a world leader in filtration, separation, and purification solutions designed to meet the specific needs of our customers and make their operations more cost-efficient. Pall proprietary materials are at the heart of these capabilities. Pall technologies are supported by ISO 14001 certification of our facilities.

---

**PARKSON CORPORATION**

---

Booth: 303  
Contact: Al Loncar  
Phone: 888-PARKSON  
Email: [technology@parkson.com](mailto:technology@parkson.com)  
Website: [www.parkson.com](http://www.parkson.com)

Parkson Corporation is a supplier of innovative, cost effective solutions for potable water, process water, and industrial and municipal wastewater treatment. Since 1971, Parkson has provided its Customers with Superior, Cost-Effective Components and Systems for Water and Wastewater

---

**PROMINENT FLUID CONTROLS, INC.**

---

Booth: 416  
Contact: Laura L. Michael  
Phone: 412-787-2484  
Email: Sales@prominent.us  
Website: www.prominent.us

ProMinent Fluid Controls, Inc. is a global manufacturer of chemical metering pumps, water quality instrumentation, specialized disinfection equipment, and pre-engineered or custom skidded systems serving the Water and Wastewater industries. We have proudly served the Municipal, Industrial and OEM markets in the United States for over 30 years.

---

**PSI/ MICROCLOR**

---

Booth: 308  
Contact: Thomas Mooney  
Phone: 215-530-9200  
Email: tomooney@4psi.net  
Website: www.4psi.net

MicrOclor established in 2003 is dedicated in providing cost effective disinfection solutions to municipal water and wastewater facilities and industrial process water and wastewater facilities. The MicrOclor team has over 130 years of combined electro-chlorination experience that has driven the development of a more robust yet simpler technology for generating bleach on site.

---

**PUROLITE COMPANY**

---

Booth: 402  
Contact: Don Downey  
Phone: 800-343-1500  
Email: don.downey@purolite.com  
Website: www.purolite.com

Purolite is more than a resin company. It's a solutions company. Purolite has evolved over the past 31 years from a small domestic importer of ion exchange resins to the premier manufacturer and innovation leader in the world. As time and technology have changed, so has Purolite. Our dedication to research and innovation is paving the way for new opportunities and endless applications.

---

**QUA GROUP, LLC**

---

Booth: 414  
Contact: VJ Nathan  
Phone: 877-782-7558  
Email: sales@quagroup.com  
Website: www.quagroup.com

QUA® develops, manufactures and markets advanced membrane products for water, wastewater and water reuse applications to leading OEMs throughout the world. QUA's product offerings includes NSF Certified Q-SEP® Ultrafiltration (UF) membranes with a patented cloud point precipitation process. QUA also offers their innovative FED1® Fractional Electrodeionization stack with their patented dual voltage fractional electrodeionization process that displays its superior hardness tolerance compared to the other electrodeionization offerings on the market.

---

**RESINTECH, INC.**

---

Booth: 301  
Contact: Michael Gottlieb  
Phone: 856-768-9600  
Email: mgottlieb@resintech.com  
Website: www.resintech.com

ResinTech is a manufacturer and supplier of ion exchange resins and activated carbon. This year ResinTech is showcasing their line of products for the power generation industry, including demineralization, condensate polishing, and nuclear radwaste treatment. Specialty medias include selective resins for the removal of antimony, silica, and chromate

---

**SAMCO TECHNOLOGIES, INC**

---

Booth: 404  
Contact: Robert Bellitto  
Phone: 716-743-9000 ext. 232  
Email: sales@samcotech.com  
Website: www.samcotech.com

Skid mounted integrated turn-key solutions for pure/ultra pure/waste water and process filtration-separation. Innovative minimum waste/high yield water management and recovery solutions for produced water, boiler feed, condensate polishing, brine concentration/crystallization and Zero Liquid Discharge (ZLD). Exclusive licensee of Rohm & Haas Advanced Amberpack Deionization (ADI) technology.

---

**SCHREIBER, LLC**

---

Booth: 209  
Contact: Bill Kunzman  
Phone: 205-655-7466  
Email: billk@schreiberwater.com  
Website: www.schreiberwater.com

Serving Industrial & Municipal markets since 1979, Schreiber LLC solves wastewater treatment problems through the application of energy-efficient, innovative, and proprietary equipment/process technology. Schreiber offers a complete system from head works to tertiary filtration. Our patented treatment processes such as the Continuous Sequencing Reactor® and compressible media filter "Fuzzy Filter®" combine effectiveness and efficiency to produce the industry's highest quality products.

---

**SENTRY EQUIPMENT CORP.**

---

Booth: 201  
Contact: Jeffery McKinney  
Phone: 414-213-8766  
Email: jeffm@sentry-equip.com  
Website: www.sentry-equip.com

Sentry Equipment Corp designs, manufactures and services systems and equipment used to sample gases, liquids, slurries and bulk solids; enabling safe, simple and repeatable samples for power generation and process industries worldwide. Our combined steam and water products and brands - Sentry®, AquatiPro™, Waters Equipment™, - make Sentry Equipment Corp a worldwide leader in power sampling technology and products.



**SEVERN TRENT WATER PURIFICATION, INC.**

---

Booth: 110  
Contact: Charles Guzzelli  
Phone: 215-872-2157  
Email: [info@severntrentservices.com](mailto:info@severntrentservices.com)  
Website: [www.severntrentservices.com](http://www.severntrentservices.com)

Severn Trent Services is a supplier of disinfection systems; chloride, sodium hypochlorite, chlorine dioxide, ammonia, sulfur dioxide, carbon dioxide, UV and filtration systems; inorganic removal and filters for water and wastewater systems. Severn Trent also designs complete systems and provides service support of equipment for municipal and industrial

**SIEMENS WATER TECHNOLOGY**

---

Booth: 216 & 218  
Contact: Gerald Alexander  
Phone: 818-542-3150  
Email: [gerald.alexander@siemens.com](mailto:gerald.alexander@siemens.com)  
Website: [www.siemens.com/water](http://www.siemens.com/water)

Siemens Water Technologies LLC is a global, integrated leader in water and wastewater treatment products, systems and services for industrial, municipal and aquatics customers. We deliver comprehensive, cost-effective and reliable treatment systems and services that reduce fresh water demand, ensure uninterrupted quantity and quality of water, and enable regulatory and environmental compliance.

**SOLAR BEE/ GRIDBEE (MEDORA, CO.)**

---

Booth: 204  
Contact: Robert Nobile  
Phone: 701-371-4444  
Email: [bob.n@medoraco.com](mailto:bob.n@medoraco.com)  
Website: <http://medoraco.com/contact>

Provides solar and electric powered mixers/circulators for controlling blue-green algae in reservoirs, energy savings and process improvement in wastewater treatment, eliminate temperature stratification and THMs in potable water clear wells and storage tanks.

**SOUTHERN RESEARCH INSTITUTE**

---

Booth: 214  
Contact: Jay Renew  
Phone: 205-223-2923  
Email: [renew@southernresearch.org](mailto:renew@southernresearch.org)  
Website: [www.southernresearch.org](http://www.southernresearch.org)

Southern Research provides on-site testing, analytical services, and contract R&D to help industries address environmental issues. On-site testing includes sampling and analysis of effluents for metals, organics, and other parameters affecting water quality. Contract R&D includes conducting pilot-scale tests to demonstrate technologies for water conservation, hybrid cooling technologies, moisture recovery, and advanced

**SWAN ANALYTICAL USA**

---

Booth: 505 & 507  
Contact: Jeff Parke  
Phone: 847-229-1290  
Email: jeff.parke@swan-analytical-usa.com  
Website: www.swan.ch

Swan Analytical Instruments is a Swiss company which develops and markets globally instrumentation for on-line analysis in potable and waste water drinking plants and other industries, in particular power plants. Swan offers solutions to complex measurement issues.

**TAYLOR TECHNOLOGIES, INC.**

---

Booth: 614  
Contact: Chris Golden  
Phone: 410-472-4340  
Email: chris@taylortechnologies.com  
Website: www.taylortechnologies.com

An ISO 9001:2008-certified manufacturer, Taylor Technologies has produced reliable, reasonably priced water-testing supplies for industrial water treaters since 1930. Offerings include test kits, reagents, standard solutions, storage options, labware, electronic meters, and most recently—the new TTi® 3000 Colorimeter. Preprogrammed to test 30+ water quality parameters most encountered in commercial/industrial settings, the TTi 3000 comes with lifetime free upgrades and a 5-year warranty. Its portability and data-logging capabilities make this device suitable for field or laboratory use. Discounts are available for industrial water treaters.

**THERMAX, INC.**

---

Booth: 210  
Contact: Cindy Gresham  
Phone: 248-468-0541 Ext 403  
Email: cgresham@thermax-usa.com  
Website: www.thermax-usa.com

Thermax is one of the leading manufacturers of Ion Exchange Resins and has been selling their TULSOIN brand of ion exchange resins for more than 35 years. These products are sold globally in the field of water treatment and process application technologies and include Adsorbent resins, Catalyst resins and Chelating resins.

**TRISEP CORPORATION**

---

Booth: 215  
Contact: Mike Snodgrass  
Phone: 805-964-8003 ext. 113  
Email: snodgrass@trisep.com  
Website: www.trisep.com

TriSep Corporation is a specialty membrane company focused on delivering customized products to solve unmet customer needs. A leader in membrane technology and innovation, TriSep manufactures a complete line of RO, NF, UF, and MF membranes and specialty elements. With an emphasis on customized and specialty spiral wound membrane elements, TriSep focuses on challenging water, wastewater, and process applications.

**TURNER DESIGNS HYDROCARBON INSTRUMENTS, INC.**

---

Booth: 413  
Contact: Monisha Edwards  
Phone: 559-253-1414 Ext. 355  
Email: [medwards@oilinwatermonitors.com](mailto:medwards@oilinwatermonitors.com)  
Website: [www.oilinwatermonitors.com](http://www.oilinwatermonitors.com)

Turner Designs Hydrocarbon Instruments, Inc. is the worldwide leader in the application of field portable, laboratory and on-line continuous process monitors for measuring and monitoring hydrocarbons in water. We are in the exclusive business of making laboratory, field portable and on-line instruments based in UV fluorescence technology. Our staff of experts understands customer needs, problems and applications for monitoring petroleum hydrocarbons in water. Customer satisfaction is our first priority.

**U.S. PEROXIDE**

---

Booth: 205  
Contact: Lovella Hebert  
Phone: 404-352-6070  
Email: [lhebert@h2o2.com](mailto:lhebert@h2o2.com)  
Website: [www.h2o2.com](http://www.h2o2.com)

US Peroxide provides wastewater treatment solutions and rapid response to many large U.S. companies and refineries. Our turn-key programs include H<sub>2</sub>S removal, supplemental DO, cooling tower cleaning, BOD/COD removal, high strength wastewater, NO<sub>x</sub>, and more. Our full-service, "hands-off" solutions include chemical treatment application, storage and dosing systems, and technical expertise.

**U.S. WATER SERVICES**

---

Booth: 408  
Contact: Jeff Carlson  
Phone: 866-663-7633  
Email: [jcarlson@uswaterservices.com](mailto:jcarlson@uswaterservices.com)  
Website: [www.uswaterservices.com](http://www.uswaterservices.com)

U.S. Water Services provides integrated water management solutions combining engineering, equipment, chemicals and services. We help industries find cost-effective and environmentally friendly solutions for their most challenging water, energy and compliance problems. Our customer focused approach enables our staff to work as an extension of your team so you can focus on what's important — running your facility.

**UOP LLC, A HONEYWELL COMPANY**

---

Booth: 517  
Contact: Alan Greenberg  
Phone: 847-391-2000  
Email: [Alan.Greenberg@honeywell.com](mailto:Alan.Greenberg@honeywell.com)  
Website: [www.uop.com](http://www.uop.com)

With nearly a century of experience in contaminant removal, Honeywell's UOP is entering the wastewater industry to treat complex waste streams with high effluent quality and minimum sludge generation. UOP has been the leading international supplier and licensor for the petroleum refining, gas processing, petrochemical production and major manufacturing industries. UOP's robust portfolio of catalysts and adsorbents solutions is designed to meet the increasingly complex set of challenges for these industries.

**VEOLIA WATER SOLUTIONS & TECHNOLOGIES**

---

Booth: 501  
Contact: Kati Ardaugh  
Phone: 815-609-2052  
Email: [katherine.ardaugh@veoliawater.com](mailto:katherine.ardaugh@veoliawater.com)  
Website: [www.veoliawaterst.com](http://www.veoliawaterst.com)

Veolia Water handles every step in the water cycle for public authorities, including withdrawing water from nature, producing and piping drinking water. It collects, conveys and treats wastewater, in order to recycle it (irrigation, watering, groundwater recharge, etc.) or release the treated water into the environment. Veolia Water conserves water resources upstream and protects release environments and ecosystems downstream.

**WATERS EQUIPMENT CO.**

---

Booth: 509  
Contact: Mark Gerschke  
Phone: 262-443-6565  
Email: [markg@watersequipment.com](mailto:markg@watersequipment.com)  
Website: [www.watersequipment.com](http://www.watersequipment.com)

Waters Equipment has been engaged in the design and construction of steam and water sampling systems since 1963 and is the pioneer in the field. Waters Equipment also manufactures many of the major sampling conditioning components including sample coolers, high pressure reducers, refillable resin columns, high temperature shutoff valve, multi-stream sequencers, FTA secondary temperature control systems and degassing spargers. We also manufacture systems that complement the sampling process such as cooling water isolation skids (CWIS), condenser leakage monitoring systems and portable samplers.

**WATERTECTONICS**

---

Booth: 403  
Contact: TJ Mothersbaugh  
Phone: 425-312-6274  
Email: [tj.mothersbaugh@watertectonics.com](mailto:tj.mothersbaugh@watertectonics.com)  
Website: [watertectonics.com](http://watertectonics.com)

Established in 1999, WaterTectonics designs, manufactures, deploys, and services integrated water treatment solutions for clients in oil & gas, mining, industrial, and construction applications. The company offers innovative electrocoagulation and electrochemical technologies in addition to a comprehensive suite of services including treatability research, industrial design, and project delivery field services.

**WESTECH ENGINEERING, INC.**

---

Booth: 310  
Contact: Jimmy Woods  
Phone: 801-290-1232  
Email: [jwoods@westech-inc.com](mailto:jwoods@westech-inc.com)  
Website: [www.westech-inc.com](http://www.westech-inc.com)

For raw water pretreatment, cooling water, water reuse, wastewater and potable water treatment, WestTech is your independent source for a full range of reliable industrial and municipal process treatment equipment designed, engineered and built for long lasting efficiency. For new plants, design build projects, retrofits, or entire plant flowsheets, WestTech offers the process, manufacturing and project experience required.

**ZEQUANOX BY MBI**

---

Booth: 609

Contact: Heath Phillips

Phone: 530-750-2800

Email: [Zequanox@marronebio.com](mailto:Zequanox@marronebio.com)

Website: [www.marronebio.com](http://www.marronebio.com)

Approved by the EPA and Canada's PMRA, Zequanox provides highly effective, selective control of invasive zebra and quagga mussels. Zequanox offers a level of efficacy comparable to chemical treatments, but unlike chemicals is noncorrosive, nonvolatile and is safe for workers and the environment. Zequanox has minimal permitting requirements and use restrictions. It is applied directly into the water system using standard injection equipment and personnel need only minimal personal protective equipment (PPE).

