

Engineers Society of Western Pennsylvania

# 67<sup>th</sup> Annual International Water Conference 2006

October 22-26, 2006  
Pittsburgh, Pennsylvania, USA

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

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571  
[www.proceedings.com](http://www.proceedings.com)

**ISBN: 978-1-60423-335-3**

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



## Legionella

**Session Chair:** Irv Cotton, Arthur Freedman Associates, Newport, RI

**Discussion Leader:** Helen Cerra, ChemTreat, Inc., Glen Allen, VA

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

### **The Legionella Shift: How the Risk from Legionnaires Disease has Changed the Perception of Water Treatment ..... 1**

MALCOLM TURVEY, Ashland Netherlands, B.V., Drew Industrial, Barendrecht, The Netherlands; JOANNE

KUCHINSKI, Ashland Water Technologies, Drew Industrial, Boonton, NJ

IWC-06-01

**Prepared Discussion By:** WILLIAM F. MCCOY, PH.D., Phigenics, Inc., Naperville, IL

### **Legionella and Biofilm Control with Hydrogen Peroxide ..... 18**

MARTIN NOSOWITZ, ARKEMA Inc., King of Prussia, PA, PAUL PUCKORIUS, Puckorius & Associates, Inc.,

Evergreen, CO

IWC-06-02

**Prepared Discussion By:** CHARLES ASCOLESE, GE Water & Process Technologies, Trevose, PA

**Author's Closure By:** MARTIN NOSOWITZ, ARKEMA Inc., King of Prussia, PA, PAUL PUCKORIUS, Puckorius & Associates, Inc., Evergreen, CO

### **Sampling and Analyzing Environmental Samples for Legionella Bacteria ..... 32**

DOUGLAS TOAL, Aerotech P&K, Cherry Hill, NJ

IWC-06-03

### **Rapid Legionella and Biofilm Identification by DNA ..... 36**

GEORGE ASPREY, Microbiological Labs, Streetsboro, OH; PA, PAUL PUCKORIUS, Puckorius & Associates, Inc.,

Evergreen, CO

IWC-06-04

## Potable Water-Advanced Treatment Applications

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

**Discussion Leader:** Colleen M. Layman, P.E., Bechtel Power Corporation, Frederick, MD

**IWC Representative:** Andrew Calderwood, Consultant, Pittsburgh, PA

### **Multi-Parameter Analytical "Fingerprinting" For The Identification of Water Contamination Events in Potable and Process Water ..... 42**

SCOTT CROSIER, Hach Company, Fairport, NY

IWC-06-05

**Prepared Discussion By:** COLLEEN LAYMAN, P.E., Bechtel Power Corporation, Frederick, MD

### **Calcium Removal from Water ..... 50**

PETER MEYERS, ResinTech, Inc., Inc., West Berlin, NJ

IWC-06-06

**Prepared Discussion By:** AL FARBER, Bechtel National, Frederick, MD

### **Effect of pH and Silica on Arsenic Selective Medias ..... 60**

MICHAEL GOTTLIEB, PETER MEYERS, ResinTech, Inc., West Berlin, NJ

IWC-06-07

## Predictive Techniques for the Assessment of Cooling Water Performance

**Session Chair:** Michael Dalton, Ashland Specialty Chemical Company, Katy, TX,

**Discussion Leader:** Robert Ferguson, French Creek Software, Kimberton, PA

**IWC Representative:** Alan Smith, Consultant, Pittsburgh, PA

### **On-Line Analysis of Water Treatment Programs ..... 67**

JOHN RICHARDSON, RICHARD E. GEISLER, DALE P. STUART, RICHARD H. TRIBBLE, ChemTreat, Inc., Ashland, VA, and MICHAEL G. TRULEAR, ChemTreat, Inc., Glen Allen, VA  
IWC-06-08

**Prepared Discussion By:** SAL ESPOSITO, GE Water And Process Technologies, Trevose, PA

### **Prediction and Monitoring of Fouling in Recirculating Cooling Water System Heat Exchangers ..... 84**

DOUGLAS DEWITT-DICK, Ashland Specialty Chemical Company, Portland, TX; EDWARD S. BEARDWOOD, Ashland Water Technologies, Toronto, ON., Canada  
IWC-06-09

**Prepared Discussion By:** DAVID SCHLOTTENMIER, Bridger Scientific, Sagamore Beach, MA  
(NOT AVAILABLE FOR PUBLICATION)

**Author's Closure By:** DOUGLAS DEWITT-DICK, Ashland Specialty Chemical Company, Portland, TX; EDWARD S. BEARDWOOD, Ashland Water Technologies, Toronto, ON., Canada

### **Evaluation of Scale Inhibitors for Cooling Waters Using Electrochemical Impedance Spectroscopy ..... 93**

JESUS MARIN-CRUZ, Instituto Mexicano del Petróleo, C.P., Mexico  
IWC-06-10

## Zero Liquid Discharge: Panel Discussion

*Session Chair:* Cheryl Sawyer, Cogentrix, Inc., Suffolk, VA,  
*IWC Representative:* Kumar Sinha, Bechtel Power, Frederick, MD

### **FGD Waste Water Blowdown Treatment and ZeroLiquid Discharge ..... 100**

DEVESH MITTAL, JACK HOSKIN, Aquatech International Corporation, Canonsburg, PA  
IWC-06-11

### **Start-up, Commissioning, and Operational Data From the World's First SAGD Facilities Using Evaporators to Treat Produced Water for Boiler Feedwater ..... 113**

LANNY WEIMER, WILLIAM HEINS, GE Water & Process Technologies, Bellevue, WA  
IWC-06-12

**NOT AVAILABLE FOR PUBLICATION**

### **ZLD Systems for Power Plants ..... 114**

MICHAEL PRESTON, Black & Veatch Corporation, Overland Park, KS  
IWC-06-13

### **ZLD: General Topics of Interest ..... 120**

DANIEL BJORKLUND, AquaChem ICD,  
IWC-06-58

**NOT AVAILABLE FOR PUBLICATION**

## Produced Water

**Session Chair:** Manoj Sharma, Aquatech International Corp., Canonsburg, PA,

**Discussion Leader:** Allan L. Farber, Bechtel National Inc., Frederick, MD

**IWC Representative:** James R. Datesh, Dacar Industries, Inc., Pittsburgh, PA

### **Desalination of Produced Water using OPUS Technology ..... 121**

LNSP NAGGHAPPAN, N.A. Water Systems, a Veolia Water Solutions & Technology Company, Pittsburgh, PA

IWC-06-14

**Prepared Discussion By:** CAROLINE WILSON MUSSBACHER, Encana Oil & Gas Partnership, Calgary, AB,  
Canada

### **High Efficiency De-oiling for Improved Produced Water Quality ..... 137**

MICHAEL BRIDLE, WorleyParsons MEG Ltd., Calgary, Alberta, Canada

IWC-06-15

### **Fresh, Produced, and Newest Brackish Water Ion Exchange Treating at the CNRL Wolf Lake Thermal Operations ..... 147**

MELONIE MYSZCZYSZYN, Canadian Natural Resources Limited, Bonnyville, AB, Canada

IWC-06-16

### **Water Reuse in Alberta Heavy Oil Extraction ..... 157**

RAFAEL GAY-DE-MONTELLA, SHULAMIT KULTNER, Colt Engineering Corporation, Calgary, AB, Canada

IWC-06-17

**Prepared Discussion By:** GORDON PAGE, Encana, Calgary, AB, Canada; CAROLINE WILSON MUSSBACHER,  
EnCana Oil and Gas Partnership, Calgary, AB, Canada

## Raw Water Pretreatment

**Session Chair:** George Abraham, Veolia Water Solutions & Technologies, Moon Township, PA,

**Discussion Leader:** John Kane, N.A. Water Systems, Moon Township, PA

**IWC Representative:** Bradley Wolf, Veolia Water North America, Moon Township, PA

### **Two Stage Clarification Process Ensures Consistent Performance ..... 176**

RICHARD ROSS, PE, Siemens Water Technologies, Chalfont, PA, ERIC LAWRENCE, Siemens Water Technologies, Ames, IA., & GLEN SUNDSTROM, Siemens Water Technologies, Rockford, IL.  
IWC-06-18

**Prepared Discussion By:** ROBERT APPLEGATE, Graver Water Systems, LLC, Cranford, NJ

### **Effective Monitoring of Ion Exchange Pretreatment System Performance ..... 185**

ROBERT HOLLOWAY, Holloway Associates, Etobicoke, ON, Canada  
IWC-06-19

### **Sand Ballasted High Rate Clarification Process for Treatment of Process Water ..... 194**

CHARLES BLUMENSCHNEIN, P.E., DEE, ERICA LATKER, KASHI BANERJEE, N.A. Water Systems, a Veolia Water Solutions & Technologies Company, Moon Township, PA  
IWC-06-20

**Prepared Discussion By:** CHRIS HOWELL, Crown Solution, Inc., Vandalia, OH

### **A New High Performance Dead-end Ultrafiltration ..... 204**

EMMANUEL DOUSSIERE, Aquasource, Toulouse, France  
IWC-06-21



## Water Reclamation/ Conservation/Recycle/ Reuse

*Session Chair:* Dennis McBride, Fluor Power, Greenville, SC,  
*Discussion Leader:* Daniel C. Sampson, Nalco Company, Vallejo, CA  
*IWC Representative:* Joseph Loftis, Consultant, Pittsburgh, PA

### **Innovative Membrane Waste Disposal for the Taunton River Desalination Plant ..... 213**

ERIK NOTTLESON, Inima USA, Brockton, MA  
IWC-06-22

### **Water Recovery from the Atmosphere in Humid Climates such as in United Arab Emirates (UAE) ..... 219**

ESAM ELSARRAG, Technical Studies Institute, Abu Dhabi, UAE  
IWC-06-23

### **Water (Resource) Conservation Using Closed-Loop, Evaporative Cooling Systems For Process and Power Applications ..... 226**

PETER DEMAOKOS, Niagara Blower Co., Buffalo, NY  
IWC-06-24

### **Department of Energy/Office of Fossil Energy's Innovations for Existing Plants (IEP) R&D Program ..... 234**

SARA PLETCHER, BARBARA CARNEY, SARAH FORBES, U.S. Department of Energy - National Energy Technology Laboratory, Morgantown, WV; ANDREA MCNEMAR, Science Applications International Corporation, Morgantown, WV  
IWC-06-25

## Advances In Biological/Chemical Wastewater Treatment Applications

*Session Chair:* Stanley Karrs, Siemens, Warrendale, PA,

*Discussion Leader:* Shashi Gorur, PE, Siemens Water Technologies, Warrendale, PA

*IWC Representative:* John T. Lucey, Jr. PE, HDR Engineering, Inc., Pittsburgh, PA

### **Submerged Membrane Bioreactors for Water Reclamation ..... 249**

BALAVISWANATH, TAO GUIHE, KIRAN KEKRE, Centre for Advanced Water Technology, Singapore Util. Int'l. PTE LTD., Singapore; HARRY SEAH, Public Utilities Board, Singapore  
IWC-06-26

### **Innovated Bio-ecological Process for Municipal Sewage and Sludge Stabilization. .... 261**

GODEFROID BUKURU, YANG JIAN, Tongji University, Shanghai, China  
IWC-06-27

### **Volatilization of Trihalomethanes from Big Wapwallopen Creek, Pennsylvania ..... 274**

LAWRENCE OWOPUTI, PH.D., P.E., JERRY PENLAND AND JOHN BALEWSKI, P.E., ATS-Chester Engineers, Pittsburgh, PA  
IWC-06-28

## ASME Sponsored Session: Controlling Water Chemistry in High Pressure Boiler Systems

**Session Chair:** Deborah Bloom, Nalco Company, Naperville, IL,

**IWC Representative:** David Simon, Cyrus Rice Water Consultants, Pittsburgh, PA

### **A Comprehensive Look at Conductivity Measurement in Steam and Power Generation Waters ..... 282**

DAVID M. GRAY, Mettler-Toledo Thornton, Inc., Bedford, MA

IWC-06-29

### **Is Cation Conductivity Monitoring Relevant For Today's Combined Cycle Power Plant? – Yet Another Case Study Says It Is Not ..... 293**

LUIS CARVALHO, PE., GE Water & Process Technologies, Mississauga, ON, Canada; THOMAS JAMES, GE Water & Process Technologies, Oklahoma, OK; WILLIAM HUNTER, PowerSmith Cogeneration, Oklahoma City, OK

IWC-06-30

PA

### **Online Ion Chromatography to Monitor Boiler Water Chemistry ..... 300**

BEVERLY NEWTON, Dionex Corporation, Sunnyvale, CA

IWC-06-31

### **Experience and Use of Oxidation Reduction Potential (ORP) Measurements in Power Plant Applications ..... 307**

STEPHEN SHULDER, Constellation Energy, MD

IWC-06-32

### **Panel Discussion Transcript ..... 319**

*This transcript has been prepared by the International Water Conference (IWC) from a panel discussion. It is as accurate as we can reasonably make it, but errors may exist. The authors have not had the opportunity to review the transcript or correct it. Neither, the IWC, the authors, nor the companies which they represent assume any liability for the use of the information in this transcript. The opinions expressed were presented to facilitate discussion and are not necessarily those of the presenters, their employers, or the IWC.*

## Heavy Metal Removal

**Session Chair:** Michael Sheedy, Eco-Tec Inc., Pickering, Ontario, Canada

**Discussion Leader:** H. Robert Goltz, Ph.D., Dow Special Separations, Midland, MI

**IWC Representative:** Craig Brown, P.Eng., Chemionex, Pickering, Ontario, Canada

### **Towards a Resin-in-Pulp Process for Recovery of Nickel and Cobalt from Laterite Leach Tailings: an Iminodiacetic Acid Ion Exchange Resin as a Prospective Resin ..... 327**

BEREND WASSINK, MARVIN NEUFELD & DAVID DREISINGER University of British Columbia - Dept. of Materials Engr., Vancouver, BC, Canada; GAVIN K.W. FREEMAN, Sherritt International Corporation, Calgary, AB, Canada  
IWC-06-33

**Prepared Discussion By:** CRAIG BROWN, P.Eng., Chemionex, Pickering, ON, Canada

**Author's Closure By:** BEREND WASSINK, MARVIN NEUFELD & DAVID DREISINGER University of British Columbia - Dept. of Materials Engr., Vancouver, BC, Canada; GAVIN K.W. FREEMAN, Sherritt International Corporation, Calgary, AB, Canada

### **Performance Improvements through Structural Design and Comparisons with Polystyrene Resins of Silica Polyamine Composites ..... 345**

EDWARD ROSENBERG, PH.D., CAROLYN HART, MARK HUGHES, VARADHARAJAN KAILASAM, JESSE ALLEN, JESSICA WOOD, BRIANNE CROSS, University of Montana/ Purity Systems, Inc., Missoula, MT  
IWC-06-34

**Prepared Discussion By:** MICHAEL PALEOLOGOU, NACEUR JEMAA, Pulp And Paper Research Institute Of Canada, Pointe Clair, QE, Canada

### **Metal Removal and Recovery from Process Solutions using Short Bed Ion Exchange ..... 361**

PAUL PAJUNEN, P.ENG., AND MICHAEL SHEEDY, P.ENG., Eco-Tec Inc., Pickering, ON, Canada  
IWC-06-35

**Prepared Discussion By:** PHILIP FATULA, Sybron Chemicals Inc., a Lanxess Company, Pittsburgh, PA

## ASME Sponsored Session: Start-ups and Cycling of HRSGs in Combined Cycle Plants

**Session Chair:** Edward Beardwood, Ashland Chemical Drew Division, Ajax, Ontario,

**IWC Representative:** David Simon, Cyrus Rice Water Consultants, Pittsburgh, PA

### **Designing HRSG's for Cycling ..... 370**

JOSEPH SCHROEDER, LEWIS DOUGLAS, PE, Nooter Eriksen, Fenton, MO

IWC-06-36

### **Chemistry Challenges for Cycling Heat Recovery Steam Generators ..... 381**

DAVID DANIELS, Mechanical & Materials Engineering, LLP, Austin, TX

IWC-06-37

### **Failure Analysis Case Histories Associated with Start-ups and Cycling of Heat Recovery Steam Generators ..... 390**

DAVID KOTWICA, GE Water & Process Technologies, The Woodlands, TX

IWC-06-38

### **Measurement of Iron Oxide Throw Associated with Start-ups and Cycling of Heat Recovery Steam Generators in Combined Cycle Power Plants ..... 407**

CHARLES KUHfeldt, Ashland Water Technologies, Drew Industrial, Boonton, NJ

IWC-06-39

### **Panel Discussion Transcript ..... 415**

*This transcript has been prepared by the International Water Conference (IWC) from a panel discussion. It is as accurate as we can reasonably make it, but errors may exist. The authors have not had the opportunity to review the transcript or correct it. Neither, the IWC, the authors, nor the companies which they represent assume any liability for the use of the information in this transcript. The opinions expressed were presented to facilitate discussion and are not necessarily those of the presenters, their employers, or the IWC.*

## Innovative Membrane System Applications /Troubleshooting Of Membrane Systems

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

*Discussion Leader:* Jonathan Wood, Siemens Water Technologiess, Lowell, MA

### **Reverse Osmosis Troubleshooting: Improving RO Performance ..... 422**

JANE KUCERA, Nalco Company, Naperville, IL

IWC-06-40

**Prepared Discussion By:** MICHAEL PRESTON, Black & Veatch Corporation, Overland Park, KS

**Author's Closure By:** JANE KUCERA, Nalco Company, Naperville, IL

### **Design, Construction and Operation of a 6,730 gpm RO/CEDI System for ConEdison's East River Repowering Project ..... 441**

CHRISTINA HO, Consolidated Edison, New York, NY; JONATHAN WOOD, Siemens Water Technologies, Ionpure  
Products, Lowell, MA

IWC-06-41

### **Maximizing Membrane Performance through Pretreatment Optimization ..... 450**

JOHN CLARK, Chemtrac Systems, Inc., Norcross, GA

IWC-06-42

## Special Applications of Ion-Exchange Technologies

*Session Chair:* Peter Midgley, Anderson Water Systems, Dundas, Ontario,

*Discussion Leader:* Jim Sabzali, Thermax Inc., Novi, MI

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

### **Condensate Polishing: An Overview of Available Technologies, Advantages, Disadvantages and Economics ..... 462**

ROBERT APPLEGATE, MICHAEL O'BRIEN, Graver Water Systems, LLC, Cranford, NJ

IWC-06-43

**Prepared Discussion By:** KENNETH FREDERICK, Ion Exchange Associates, LLC, Smithville, WV

### **New Procedure for Removing Organic Fouling from Anion Resins ..... 477**

WILLIAM BORNAK, Recirculation Technologies Inc., Warminster, PA

IWC-06-44

### **Unusual Items and Procedures in Ion Exchange and Water, II ..... 487**

GEORGE CRITS, Idreco, USA, West Chester, PA

IWC-06-45

**Prepared Discussion By:** CLAUDE GAUTHIER, P.ENG., The Purolite Company, Kitchener, ON, Canada

### **Mixed Bed Resin Storage ..... 494**

PETER MEYERS, FRANK DESILVA ResinTech, Inc., West Berlin, NJ

IWC-06-46

## FGD Methods Influencing Water Use and Treatment of Wastewater

*Session Chair:* Colleen Layman, P.E., Bechtel Power Corporation, Frederick, MD,

*Discussion Leader:* Clayton Finney, GE Infrastructure, Houston, TX

*IWC Representative:* Mark Cheresnowsky, GE Water & Process Technologies, Gloucester, VA

### **Mercury Separation from Flue Gas Scrub Water with TMT 15 ..... 501**

JOE LALLY, BOB GEC, Degussa Corporation, Parsippany, NJ; RUEDIGER PELDSZUS, Degussa AG

IWC-06-47

### **New European Regulatory Requirements Drive Stringent**

### **FGD Purge Water Implementation ..... 519**

LAWRENCE GURNARI, N.A. Water Systems, a Veolia Water Solutions & Technologies company, Moon Township, PA;

WILLIAM SHAW, HPD, Plainfield, IL; MICHAEL VENDRUP & TERKEL CHRISTENSEN, Kruger A/S, Denmark

IWC-06-48

### **Analytical and Preparatory Issues Associated with Total and**

### **Speciation Analysis of Selenium ..... 533**

HAKAN GURLEYUK, PH.D., RUSS GERARDS Applied Speciation and Consulting, LLC, Tukwila, WA

IWC-06-49



## Fouling Control in Water Systems; Updated Information

**Session Chair:** Wayne Micheletti, Wayne C. Micheletti, Inc., Charlottesville, VA,

**Discussion Leader:** James Dromgoole, Fort Bend Services, Inc., Stafford, TX

**IWC Representative:** Alan Smith, Consultant, Pittsburgh, PA

### **Enhanced Tube Fouling Under Cooling Water Conditions ..... 542**

EDWARD BEARDWOOD, Ashland Water Technologies, Ajax, ON, Canada; GEORGE HAYS, STEVEN COLBY, Ashland Water Technologies, Boonton, NJ  
IWC-06-50

**Prepared Discussion By:** JAY FARMERIE, Cyrus Rice Water Consultants, Inc., Pittsburgh, PA

**Author's Closure By:** EDWARD BEARDWOOD, Ashland Water Technologies, Ajax, ON, Canada

### **Simultaneous Cleaning and Disinfection of Cooling Water Systems ..... 564**

JASBIR GILL, PH.D., AMIT GUPTA, Nalco Company, Naperville, IL  
IWC-06-51

**Prepared Discussion By:** ARTHUR FREEDMAN, PH.D., Arthur Freedman Associates, Inc., East Stroudsburg, PA

### **Opportunities and Pitfalls: The Successful Design and Implementation of Sodium Hypochlorite Systems ..... 577**

ANTON CALLERY, ITT Advanced Water Treatment/Portacel, Inc., The Woodlands, TX  
IWC-06-52

**Prepared Discussion By:** RAYMOND POST, P.E., GE Water & Process Technologies, Trevose, PA

### **Environmental Effects of Electrolytically Generated Halogens for Biofouling Control ..... 590**

RUDOLF MATOUSEK, Severn Trent Services, Sugar Land, TX; DAVID HILL, Severn Trent De Nora LLC, Sugar Land, TX; R.P. HERWIG, Ph.D., School of Aquatic & Fisher Sciences, University of Washington, Seattle, WA  
IWC-06-53

**Prepared Discussion By:** CHRISTOPHER NALEPA, PH.D., Albemarle Corp., Baton Rouge, LA

## Strategic Marketing & Business Planning

*Session Chair:* Bradley Wolf, Veolia Water North America, , ,

*IWC Representative:* James R. Datesh, Dacar Industries, Inc., Pittsburgh, PA

### **Water, Water Everywhere.....? ..... 603**

ERIC BECKMAN, PH.D., University of Pittsburgh, Pittsburgh, PA

IWC-06-54

### **BOMA Perspective ..... 667**

JOHN GREENWALD, Mechanical Operations Co., Inc. & BOMA, Pittsburgh, PA

IWC-06-55

### **Business Continuity Planning ..... 682**

MICHAEL SMITH, ReadySmith, Inc., Oakville, ON, Canada

IWC-06-56

### **Intellectual Property Protection – Avoiding Loss of Trade Secrets ..... 694**

KEITH HADDAWAY, PH.D., Esq., CLIFTON MCCANN, Esq., Venable LLP, Washington, DC

IWC-06-57