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

Phone (412) 261-0710

Fax: (412) 261-1606

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PURE WATER APPLICATIONS USING ELECTRODEIONIZATION

The use of Electrodeionization (EDI) for water purification continues to grow. Environment safety concerns and improvements to the technology have gained an increased acceptance for Industrial applications. The session will review traditional mixed bed ion exchange challenged by EDI technology and power plant water purification.

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

Session Chair: Alan Knapp, Evoqua Water Technology, LLC, Vancouver, WA

Discussion Leader: Larry Gottlieb, ResinTech, Inc., West Berlin, NJ

IWC 14-01

Comparison of Continuous Electrodeionization Technologies ... 22

Jeff Tate, Agape Water Solutions, Inc, Harleysville, PA

Discussion by Greg Osen, AVANTech, Inc., Columbia, SC

IWC 14-02

Qualification of Continuous Electrodeionization for Treatment of Steam Generator Blowdown in a PWR ... 37

Jonathan Wood, Evoqua Water Technologies, Lowell, MA, Jeffrey Levy and Natalie Rodgers Westinghouse Electric Company, Cranberry Township, PA

Discussion by Tom Kosir, GE Water, Gueiph, ON Canada

IWC 14-03

Advancements in CEDI for Power applications ... 55

Nicholas Armstrong, Jonathan Wood and Joseph Gifford, Evoqua Water Technologies LLC, Lowell, MA

Discussion by Venkat Jagannathan, QUA Group, LLC, Canonsburg, PA

WATER REUSE

Reclaim water use in industry is critical in securing a viable environmental future. This session includes industry champions who will use actual experiences and case studies in describing solutions to unforeseen challenges. They will be using actual data, water balance modeling and experiences to implement operational strategies when describing lessons learned.

Reclaim water from POTW's along with other sources of water will be reviewed as alternate sources to fresh water in the Power generation industry. Reclaim use and its concentration in the plant also affects wastewater discharge from both a regulatory aspect and discharge location. Come and give us your hands-on experiences, in our discussion following each paper.

IWC Representative: Robert Applegate, Graver Water Systems, LLC, New Providence, NJ

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

Discussion Leader: Andrew Erickson, Burns and McDonnell, Kansas City, MO

IWC 14-04

Recycled Water: The Growing Trend in Power Plant Water Supply ... 72

Josh Prusakiewicz, HDR, Inc., Ann Arbor, MI

Discussion by Kenneth Chen, Fluor, Aliso Viejo, CA

IWC 14-05

Evaluation of Reclaim Water from a POTW for Process Water Supply at a 49 MW Merchant Power Plant ... 88

Daniel Wilkinson & S. Ehrhardt, Dewberry Engineers Inc., Raleigh, NC

Discussion by Michael Reyes, Veolia, Charlotte, NC

IWC 14-06

An Updated Water Balance: The Key to Identifying Compliance Options ... 100

Karen Burchardt, P.E., Samantha Tewell and Olivia Dawson-Olson, Burns & McDonnell Engineering, Kansas City, MO & Maggie Skelton, PE, Minnesota Power Cohasset, MN

Discussion by Sean Sudol, Richard Brady and Associates, Greenville, SC

PRODUCED WATER TREATMENT

Every oil producing/Hydraulic fracturing for Oil & Gas production facility have an undesirable end product, called produced water. Depending upon the formation and production methods used to extract these products i.e., steam flooding or water flooding, we can expect produced water with different composition consisting of oil & grease, dissolved solids, heavy metals and silica. Depending upon the end use and other Regulatory mandated disposal requirements, produced water treatment can be a technical and capital intensive task. In this session, we have three excellent technical papers in which the authors will share their innovative technical skills and methodology on how best to treat and manage the produced water for optimum usage and disposal.

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

Session Chair: Rafique Janjua, Fluor Enterprises, Inc., Sugarland, TX

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

IWC 14-07

Boron Removal from Produced Water ... 120

H. Robert Goltz, Ph.D., Chris Eicher and Tom McCandless, The Dow Company, Midland, MI

Discussion by William Moore, Westech, Inc., Humble, TX

Authors' Closure by H. Robert Goltz, Ph.D., The Dow Company, Midland, MI

IWC 14-08 ...142

Automated Self-Cleaning Filter for Ultra-High and Variable Suspended Solids Loading

David Levitt, Spiral Water Technologies, San Rafael, CA

Discussion by Vina Arjomandnia, Fluor, Houston, TX

IWC 14-09 ... 152

How to Assess, Select and Develop Your Optimal Water Management System

Howard McCarthy, P.E., Tetra Tech, Denver, CO

Discussion by William Tuck, Anderson Water Systems, Inc., Ancaster, ON Canada

POWER PLANT STEAM CYCLE CHEMISTRY: DETECTION AND MITIGATION OF CONTAMINANTS

Protecting plant equipment in the make-up water and water steam cycle are of critical importance to maintain power plant performance. The session focuses on analytical detection and monitoring of organic and inorganic contaminants to prevent fouling and flow accelerated corrosion (FAC) in these systems and also includes a paper on investigating ways to remove phosphate from this water

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

Session Chair: Lauren Versagli, DOW Chemical, Philadelphia, PA

Discussion Leader: Vickie Olson, Honeywell, Atlanta, GA

IWC 14-10

Further Advances in Monitoring Low Level Iron in the Steam Cycle ... 166

Kenneth Kuruc, Denton Slovacek & Luke Johnson, Hach, Loveland, CO

Discussion by Randy Turner, Swan Analytical USA, Inc., Wheeling, IL

IWC 14-11

Phosphate Removal from Boiler & HRSG Blowdown ... 176

Michael Rosen, Sargent & Lundy, L.L.C., Chicago, IL

Discussion by Chad McKnight, Southern Company Water Chemistry, Birmingham, AL

IWC 14-12

Reliable Organics Detection Helps Protect Power Plant Components ... 192

David Gray, Peggy Banarhall, Kirk Buecher, and Steven Carelli, Mettler Toledo Thornton, Inc., Billerica, MA

Discussion by Vance Lumme, GE Power and Water, Portland, TX

DESIGN AND OPERATION OF ZERO LIQUID DISCHARGE SYSTEMS

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.

ZLD selection and configuration depend on numerous factors including fuel source, water chemistry, climate, environmental requirements, CapEx, and OpEx. The papers in this session will help you navigate through the many ZLD strategies, select the most appropriate ZLD system for your site, and share valuable ZLD operating experience.

IWC Representative: Brad Wolf, P.E., Berkeley Research Group, LLC, Pittsburgh, PA

Session Chair: Raymond Post, P.E., ChemTreat, Inc., Langhorne, PA

Discussion Leader: David Ciszewski, GE Water and Process Technologies, Bellevue, WA

IWC 14-13

Evaluating ZLD Strategies ... 201

William Shaw, P.E., Veolia Water North America, Plainfield, IL

Discussion by Chris Haussmann, P.E., Water Systems Specialists, Inc., Seattle, WA

IWC 14-14

Design Issues for a Zero Liquid Effluent Discharge (ZLED) Wastewater Treatment System for a 6x800 MW WFGD Retrofit Project ... 221

Steve Russell, Black & Veatch, Overland Park, KS, Robert M. Craig Jr., Renisha Lutchminarain, and Abigail Melanie, Eskom, Johannesburg, South Africa

Discussion by Jack Lyons, OUC, Sacramento, CA

IWC 14-15

Water Recovery and Reuse at the Pueblo Chemical Agent-Destruction Plant (PCAPP) ... 240

Yakup Nurdogan, Ph.D., P.E., Bechtel National, Inc., Pueblo, CO, Paul J. Usinowicz, Ph.D., P.E., B.C.E.E., Craig A. Myler, Ph.D., Bechtel National, Inc. Frederick, MD, George D. Lecakes, Battelle, Pueblo, CO, August Benz, P.E., Bechtel National, Inc., San Francisco, CA

Discussion by Mike Preston, P.E., Black & Veatch Corporation, Overland Park, KS

IWC 14-16

Thermal ZLD System Using a Spray Dry Evaporator (SDE) In a Waste to Energy Plant, a Case Study ... 255

Ashwin Patni, Lechler Inc., St Charles, IL

Discussion by Dan Sampson, WorleyParsons, Orlando, FL

UPDATES AND INNOVATION IN MINE WATER TREATMENT

Mine water treatment in the United States is driven by Federal and State water quality protection programs, requiring high efficiency removals of metals prior to discharge of water that has come into contact with ore and wastes or that has been dewatered from mineral-bearing zones in the mine workings. The 2014 IWC mining session will explore the performance of two biological treatment technologies for selenium removal, including fluidized and packed bed treatment, in achieving low effluent concentrations. Attendees will be able to compare and contrast the merits of each technology for future applications. In addition, two innovations in metals treatment processes will be presented that hold promise as viable alternatives to standard lime treatment for heavy metals removal. This session will provide food for thought when planning new mine water treatment plants or existing plant upgrades.

IWC Representative: George Abraham, P.E., Veolia Water Solutions & Technologies, Moon Twp., PA

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

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

IWC 14-17

Optimization of a High Density Sludge Mine Drainage Treatment Facility ... 270

Brent Means, U.S. Office of Surface Mining Reclamation Enforcement, Harrisburg, PA & Rich Beam Pennsylvania Department of Environmental Protection, Harrisburg, PA

Discussion by Rick Szilagyi, WesTech Engineering, Inc., Rockton, IL (*Not available*)

IWC 14-18

New Techniques to Reduce Long-Term Operating Costs of Biological Systems Removing Oxyanions in Water Treatment Operations ... 283

David Enegeess, Andy Bohner, Todd Webster, Envirogen Technologies, Inc., Kingwood, TX, Ola Opara and Jack Adams, Inotec, LLC Kingwood, TX

Discussion by Anthony Vaughn, Monsanto, St. Louis, MO

IWC 14-19

Case Study for Cost Effective Mine Water Treatment to Meet Stringent Selenium Regulatory Limits ... 297

Tom Rutkowski, Chris Beck, Bill Agster, Golder Associates, Lakewood, CO, James Peterson, Frontier Water Systems San Diego, CA

Discussion by Kashi Banerjee, Veolia Water Solutions & Technologies, Moon Twp, PA

IWC 14-20

Meeting Nevada DEP-BMRR Profile II Parameters with Electrocoagulation-Based Treatment Solutions ... 307

B. Denney Eames, Bryan Neilsen, WaterTectonics, Everett, WA, & Charles Landis, Halliburton, Inc. Houston, TX

Discussion by Corne Pretorius, Golder Associates, Ltd., Burnaby, BC, Canada

PRODUCED WATER TREATMENT FROM COAL SEAM GAS AND SAGD OPERATIONS

Produced water is inherently challenging to treat due to the variable fouling potential and water characteristics from site to site. Treatment techniques will vary according to each sites produced water and effluent requirements. This session will cover Coal Seam Gas and SAGD water treatment methods.

IWC Representative: John Lucey, Jr. P.E., McKim and Creed, Raleigh, NC

Session Chair: Chip Westaby, Turner Designs Hydrocarbon Instruments, Fresno, CA

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

IWC 14-21

The Start-Up/Performance Testing of The World's Largest Coal Seam Gas Produced Water Treatment Plant ... 326

Carolina Gonzalez & Jennine Finlayson, GE Water & Process Technologies, Bellevue, WA

Discussion by Allen Daza, Aquatech International Corp., Canonsburg, PA

IWC 14-22

The Lime Softener Misnomer ... 338

René Bélanger, Baker Hughes, Inc., Edmonton, AB Canada and Joe B. Bodeux Baker Hughes Inc., Cold Lake, AB Canada

Discussion by Claude Gauthier, Purolite, Toronto, ON, Canada

IWC 14-23

Controlling Fouling and Scale Formation in SAGD Evaporator Operations ... 349

John Richardson, Ph.D., ChemTreat, Inc., Glen Allen, VA, Jerod Pluth, Rob Bedinger, & Sanyi Wang, Fort Saskatchewan, AB Canada

Discussion by Steve Portelance, WorleyParsons Canada, Calgary, AB Canada

IWC 14-24

Oil vs. Cation Exchange Resins in Produced Water Applications ... 368

Guy Mommaerts, Ion Exchange Services (Canada) Inc., Elora, ON Canada and David Dally LANXESS Sybron, Inc., Birmingham, N.J.

Discussion by Darrell Hartwick, Buckman, Vaudreuil, Canada

ASME HRSG SYSTEM CHEMISTRY FOR UNIT RELIABILITY

The reliability of HRSG's is critical to plant operations and availability. This ASME sponsored session reviews using the recent ASME HRSG chemistry guidelines to develop optimum chemistry programs.

The 2nd paper covers the importance of proper chemistry control when using phosphate based programs to avoid corrosion of boiler tubes. The third paper compares amine and amine-ammonia combination programs vs. ammonia treatment to help select the best treatment program. The fourth paper reviews steam purity in HRSG's and setting of effective upper allowable impurity control limits

IWC Representative: Colleen Layman, P.E., HDR Inc., Harper's Ferry, WV

Session Chair: Irvin Cotton, Arthur Freedman Associates, Newport, RI

Discussion Leader: K. Anthony Selby, Water Technology Consultants, Inc., Evergreen, CO

IWC 14-25

Using Guidelines to Develop Optimum Steam Chemistry Limits for an HRSG ... 385

David Daniels, M&M Engineering Associates, Inc., Leander, TX

Discussion by Luis Carvalho, ChemTreat, Glen Allen, VA

IWC 14-26

Correct for Ammonia/Amine Effect on pH to Avoid Corrosion with Phosphate Treatment ... 398

Robert Bartholomew, P.E., Sheppard T. Powell Associates, LLC, Baltimore, MD

Discussion by Anton Banweg, Nalco, Naperville, IL

IWC 14-27

The Effects of Ammonia and Organic Amines on the Water Chemistry of Gas Turbine Heat Recovery Steam Generators and Associated Equipment ... 416

James Robinson & Gregory J. Robinson, GE Water & Process Technologies, Trevose, PA

Discussion by James Bellows, Siemens, Orlando, FL

Author's Closure by James Robinson, GE Water & Process Technologies, Trevose, PA

IWC 14-28

Steam Purity in Heat Recovery Steam Generators ... 431

Edward Beardwood, Solenis International L.P., Wilmington, DE

Discussion by Stephen Shulder, Electric Power Research Institute (EPRI), Charlotte, VA

Author's Closure by Edward Beardwood, Solenis International L.P., Wilmington, DE

ADVANCES IN ION EXCHANGE OPERATIONS

Pure water is an essential part of nearly all industrial processes ranging from process steam production to nuclear power generation. The need for effective and efficient pure water production is often overlooked due to the immediate needs of just producing enough water to satisfy the daily demand. Water treatment technology that exists today provides the water treatment plant operators and management an opportunity to improve their efficiency and while not having to sacrifice efficacy.

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

Session Chair: James Summerfield, Dow Chemical Company, Edina, MA

Discussion Leader: Peter Meyers, ResinTech, West Berlin, NJ

IWC 14-29

Recent Advances in the Design and Operation of Continuous Ion Exchange Equipment for Water Treatment ... 460

Charles Drewry, R. U. Seneviratne, and T. D. Knowlton, Calgon Carbon Corporation, Pittsburgh, PA

Discussion by Rob Loken, Envirogen Technologies Inc, Rancho Cucamonga, CA

IWC 14-30

An Innovative Treatment Concept: Dynamic Bed Ion Exchange ... 474

Kevin Slough, M. Asc., P. Eng., & Amr Zaky Ph.D, P.Eng., FilterBoxx Water & Environmental Corp., Calgary, AB Canada

Discussion by Rich Dennis, Severn Trent, Tampa, FL (*Not available*)

IWC 14-31

Co-Current vs. Counter-Current Ion Exchange Systems (IXS) ... 489

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

Discussion by Doug Kellogg, Evoqua, Rockford, IL

IWC 14-32

Softening Concepts; Utilizing a Unique Countercurrent Packed Bed Technology for the Produced Water Markets ... 506

David Dally, LANXESS Sybron Chemicals Inc., Birmingham, NJ & Guy Mommaerts Ion Exchange Services, Canada Inc., Elmira, ON, Canada

Discussion by Cliff Gilbert, Dow Water and Process Solutions, Princeton, NJ

INNOVATIVE INDUSTRIAL WASTEWATER SOLUTIONS

Industrial wastewater treatment can take many forms and have many different objectives. This Session is an opportunity to hear about some unique and innovative treatment solutions and be inspired to think “outside the box” for treatment solutions. Our first two papers discuss innovative biologically based treatment processes developed out of necessity to address difficult and unique wastewater treatment requirements. We’ll then have an opportunity to examine the many claims and considerations surrounding design and ownership of zero liquid discharge (ZLD) systems in an attempt to establish realistic expectations for ZLD facilities. Our final paper will look at a unique water circulation solution implemented when more traditional solutions failed at one utility to treat troublesome algae blooms that plagued their cooling water pond.

IWC Representative: John Lucey, Jr. P.E., McKim and Creed, Raleigh, NC

Session Chair: Mike Preston, Black & Veatch, Overland Park, KS

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

IWC 14-33

Immobilized Cell Bioreactor Technology for Hydrocarbon Removal from Industrial Wastewater ... 520

F. Stephen Lupton, UOP - A Honeywell Company, Des Plaines, IL

Discussion by Anna I. Casasús, Ph.D., Kemira, Atlanta, GA

IWC 14-34

Innovative Treatment of Combined Sanitary and Industrial Wastewater ... 533

Janean Elbicki, Ph.D., Gene Kroeschen, Nelson Merrick, Dennis Fulmer, Ray McConville and Jaw Fu, Alcoa Inc., Alcoa Center, PA & Yatin Thaker, Bauer Resources GmbH Houston, TX

Discussion by Abigail Antolovich, PE, UOP, A Honeywell Company, Lakewood, CO

IWC 14-35

Rash Statements and Equivocation – Lessons Learned in ZLD Design, Procurement, Commissioning, and Operation ... 546

Daniel Sampson, WorleyParsons, Folsom, CA

Discussion by Frederick Douglas, Cosmos Technologies Inc., Pittsburgh, PA

IWC 14-36

Eliminating Algal Blooms in a Cooling Water Reservoir Reduced Costs and Improved Ecosystems ... 562

Bert Hibel, Medora Corporation, Little Elm, TX & Gale McGaha Miller Platte River Power Authority, Fort Collins, CO, H
Kenneth Hudnell, Medora Corporation & University of North Carolina at Chapel Hill New Bern, NC

Discussion by Tom Higgins PhD, P E, CH2M HILL, Reston, VA

ADVANCES IN HYDROFRACTURING WATER TREATMENT

The outlook for energy use in the U.S. continues to point toward increased reliance on natural gas from gas shale formations. This still-young technology is advancing rapidly, and the treatment of wastewater from hydrofracturing continues to evolve as more and more shale plays are developed.

The four papers in this session all focus on innovative aspects of hydrofracturing water treatment, all based on technical advances in the field.

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

Session Chair: John Schubert, P.E., HDR Engineering, Inc., Sarasota, FL

Discussion Leader: Michael Soller, P.E. CPC, Bowen, Indianapolis, IN

IWC 14-37

Modeling and Experimental Results of Vapor Compressor-driven Membrane Distillation ... 573

Ajilli Hardy, Andy Shapiro GE Global Research, Niskayuna, NY, Jens Rütten, GE Global Research, Munich Germany, Josh Dewanaga and Grant Williamson, GE Power and Water, Bellevue, WA

Discussion by Russell Huffmyer, HDR Inc, Pittsburgh, PA

IWC 14-38

The Impact of Ionic Strength upon Inhibitor Speciation and Efficacy ... 592

Robert Ferguson, French Creek Software, Inc., Phoenixville, PA

Discussion by Michael Bluemle, Solenis, Wilmington, DE

IWC 14-39

Application of Chlorine Dioxide for Water Treatment in Upstream Oil & Gas including Hydraulic Fracturing ... 612

Warren Robinson, Aegis Chemical Solutions, LLC, Houston, TX & Jennifer Miller, PhD, Evoqua Water Technologies LLC

Discussion by Jason Monnell, GAI Consultants, Homestead, PA

IWC 14-40

Innovative Treatment of Shale Fracturing Water Using Magnetic Ballast Clarification and Advanced Membrane Systems ... 628

Brian Mastin, Ph.D., Southern Research Institute, Birmingham, AL, Behrang (Ben) Pakzadeh, Southern Research Institute, Cartersville, GA, Bill Chatterton, Southern Research Institute, Durham, NC, Jay Renew, Southern Research Institute, Cartersville, GA,, Joon Min, Allen Chan, BKT United, Anaheim, CA

Discussion by Americus Mitchell, IDI, Richmond, VA

ANTICIPATING NEW DISCHARGE REQUIREMENTS FOR FGD-EQUIPPED POWER PLANTS

Power plants equipped with flue gas desulfurization (FGD) systems face challenging wastewater issues. Most notably, the U.S. Environmental Protection Agency (EPA) has proposed new Effluent Limitation Guidelines (ELG) that aim to significantly tighten discharge limits on mercury, selenium, arsenic and nitrates across the U.S. Other contaminants of increasing concern, such as boron, will also be subject to mitigation efforts. Since FGD wastewaters involve complex chemistries, meeting more stringent discharge requirements is rarely simple, and usually requires exploring and advancing state-of-the-art approaches. This session provides some recent learning from real-world efforts to reduce wastewater discharges at FGD-equipped power plants.

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

Session Chair: Richard Stuebi, MAR Systems Inc., Cleveland, OH

Discussion Leader: Jay Wos, Southern Research Institute, Birmingham, AL

IWC 14-41

Minimizing Wastewater Treatment Costs through FGD Upgrades ... 643

Bryan Hansen, Burns & McDonnell, Denver, CO

Discussion by Robert Strange, Southern Research Institute, Birmingham, AL

IWC 14-42

Evaluation of the Origin of Dissolved Organic Carbon (DOC) and the Treatability of Mercury in FGD Wastewater ... 658

Mandi Richardson, Catherine Sylvestri, Nicolas Bloom, URS Corporation, Austin, TX, Paul Chu, and Charles Dene, EPRI, Palo Alto, CA

Discussion by Angela Zagala, Nalco, Cary, NC

IWC 14-43

Start Up of a Full Scale Boron Removal System for FGD Waste Water ... 679

W. Carlin, M. Roth, and L. Versagli, The Dow Chemical Company, Spring House, PA, S. Wojciechowski and D. Reed, NRG, Springhouse, PA

Discussion by Paul Chu, EPRI, Palo Alto, CA

IWC 14-44

Flue Gas Desulfurization: Technological and Operational Impact to Purge Water Treatment Systems Due to Environmental Regulations ... 693

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

Discussion by William Kennedy, Duke Energy, Charlotte, NC

PRACTICAL APPLICATION OF MEMBRANE PRETREATMENT AND TECHNOLOGIES

This year's IWC Membrane Session covers real-world application of the technology. The papers in this session cover a full gamut of subjects ranging from pretreatment alternatives to chlorine for bio control to multi-membrane processes for zero liquid discharge (ZLD). All are important topics as industry becomes more environmentally conscious either to be green or to follow governmental regulations. One paper discusses in detail chlorine and alternatives to chlorine for membrane bio control to minimize formation of disinfectant byproducts. Another paper discusses the replacement of an antiquated demineralizer system with a design, build, own, operate, and maintain system. A third paper discusses a unique crystallization technique that lends itself to pretreatment prior to an ultrafiltration/nanofiltration/ reverse osmosis ZLD system. And, a fourth paper discusses a membrane-based system used for water recycle at a methanol production plant.

IWC Representative: Dennis McBride, Flour, Greenville, SC

Session Chair: Jane Kucera, Nalco, an Ecolab Company, Naperville, IL

Discussion Leader: Brian Powers, P.E., HDR Engineering, Inc., Charlotte, NC

IWC 14-45

Alternative Disinfection for Reverse Osmosis Systems ... 715

Anne Arza, & Jane Kucera Nalco, an Ecolab Company, Naperville, IL

Discussion by Paul Olson, The Dow Chemical Company, Minneapolis, MI

Author's Closure by Anne Arza, Nalco, an Ecolab Company, Naperville, IL

IWC 14-46

Ameren Meramec Energy Center Outsourced Demineralizer System ... 739

Christopher Taylor & Edward Kammerer, Ameren Missouri, St. Louis, MO

Discussion by Steven R. Gagnon, AVANTech Incorporated, Columbia, SC (*Not Available*)

IWC 14-47

Refinery Process Water Deoxygenation – A Case Study on Gas Transfer Membrane (GTM) ... 750

Scott Willis, M. Ulbricht, J. Schneider, & A. Segupta, Membrana, Charlotte, NC

Discussion by Christian Frye, GE Power and Water, Houston, TX

IWC 14-48

Wastewater Reuse at a Methanol Production Plant ... 762

Mike Snodgrass, Ryan Vargas TriSep Corporation, Goleta, CA, & Jeff Li, Eco Environmental Investments Limited Hong Kong, China

Discussion by Tony Fuhrman, Hydranautics - A Nitto Group Company, Pittsburgh, PA

REFINERY WASTEWATER TREATMENT WITH EMPHASIS ON SELENIUM REMOVAL

The refining industry is faced with ever increasing and demanding environmental regulations to protect the environment. Wastewater from the refining process contains free and dissolved oil & grease, hazardous hydrocarbons, phenol, amines, ammonia nitrogen, BTEX compounds, heavy metals, total dissolved solids, selenium and other hazardous compounds. This session presents cutting edge trends such as innovative control technology to optimize performance of dissolved gas flotation or induced gas flotation for effective removal of oil and grease, speciation of selenium in refinery wastewater and review of selenium treatment technologies with emphasis on environmental obligations and cost-effectiveness, and pilot scale study results of an innovative non-biological treatment of selenium and other metals.

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

Session Chair: Ramesh Kalluri, P.E., Kalluri Group, Inc., Houston, TX

Discussion Leader: Randy Harney, Fluor, Aliso Vieja, CA

IWC 14-49

Enhanced Control of Wastewater Treatment: Chemical Optimization and Management of Fluctuating Loading from Heavy Crudes and Tight Oils ...781

David Workman, Nalco, an Ecolab Company, Naperville, IL & Tina Syvret Nalco Champion, an Ecolab Company, Houston, TX

Discussion by Milton Crossen, Evoqua, Chino Hills, CA

IWC 14-50

Characterization of Selenium Species in Refinery Wastewater Streams ... 791

Frank Castaldi, Golder Associates Inc., Houston, TX & Bruce Douglas Golder Associates, Inc., Denver, CO

Discussion by Joseph Guida, P.E., Fluor, Sugarland, TX

Author's Closure by Frank Castaldi, Golder Associates Inc., Houston, TX

IWC 14-51

A Practical Approach for Removing Selenium from Oil Refinery Wastewater ... 812

Timothy Eggert, GE Power & Water – Water and Process Technologies, Seal Beach, CA, Charles Boswell GE Power & Water – Water and Process Technologies, Rancho Palos Verdes, CA, Sarady Ka, GE Power & Water – Water and Process Technologies Norwalk, CA, Robin W. Kluck, GE Power & Water – Water and Process Technologies, Benicia, CA

Discussion by Josh Lawrence, Fluor, Calgary, AB Canada

IWC 14-52

Removal of Selenium and Mercury from Refinery Wastewater: Experimental and Pilot Results ... 827

Michael Wismer & Charles McCloskey, Evoqua Water Technologies LLC, Roseville, MN

Discussion by John Penca, Fluor, Aliso Viejo, CA (*Not available*)

MINIMIZING SCALE AND CORROSION IN OTSG AND EVAPORATOR BOILER AN ASME SPONSORED PANEL SESSION

This ASME sponsored session will consist of 4 papers followed by an open floor discussion. Papers being presented will relay applicable knowledge on erosion corrosion; modeling electrolytes within your water/ boiler system; Lab testing methods for hardness, oxygen, and sulfide; and evaporator/boiler boundary heat transfer for Once through Steam Generator and Evaporator Boiler systems.

IWC Representative: Debbie Bloom, Nalco, an Ecolab Company, Naperville, IL

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

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

IWC 14-53

Erosion-Corrosion in Oil Field Once Through Steam Generators ... 842

Martin Godfrey, Paul Desch and Logan LaRocque, Nalco Champion, an Ecolab Company, Eagan, MN

IWC 14-54

OLI Electrolytes Modelling of Practical Applications in Thermal In-situ Operations ...860

Subodh Peramanu, Elise Lagace and Simon Davies, Canadian Natural Resources Ltd, Calgary, AB Canada

IWC 14-55

On-site Laboratory Methods for Determination of Dissolved Hardness, Dissolved Oxygen, and Sulfide

Residual for Steam Generators for In-Situ Bitumen Recovery ... 879

Ramesh Sharma, ConocoPhillips Company, Houston, TX

IWC 14-56

Evaporator and Boiler Boundary Heat Transfer Phenomena and Water Chemistry ...890

Rafael Gay-de-Montella, M.Sc. P.Eng., Transprocess Inc., Calgary, AB Canada

ASME Panel Transcription''''', - -

FGD WASTEWATER CHARACTERISTICS AND TREATMENT

FGD wastewater continues to be complex stream that require innovative methods of measurement and treatment. Operational changes and inconsistent loading add to the challenge and require flexible yet effective treatment processes to consistently meet stringent water quality limits. The upcoming Effluent Limitation Guidelines will only sharpen the focus on innovative treatment processes. This session touches on all these points, and includes papers on operational challenges, FGD blowdown chemistry, and various treatment options. The papers include bench scale, pilot, and full scale studies and detailed discussions on heavy metals handling in these complicated streams.

IWC Representative: Patricia Scroggin, P.E., Burns & McDonnell, Kansas City, MO

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

Discussion Leader: Jonathan Shimko, Tetra Tech, Inc., Pittsburgh, PA

IWC 14-57

The Impact of Variable and Low Load Operation on Wet Flue Gas Desulfurization Slurry Chemistry and Waste Water, Including Trace Metal Speciation and Effluent Flow Rates, with Suggested Mitigation Strategies ...940

Shannon Brown, Daniel B. Johnson, Purusha Bonnin-Nartker, Richard F. DeVault, Joseph M. Mitchell and Garrett E. Pavlovicz, Babcock & Wilcox Power Generation Group, Inc., Barberton, OH

Discussion by Jason D. Monnell, Ph.D., GAI Consultants, Inc., Pittsburgh, PA

IWC 14-58

Reactive Iron Media – An Enhanced Zero Valent Iron Process for Metals and Metalloid Removal From Water and Wastewater. ... 957

Simon Dukes, Evoqua Water Technologies LLC, Lowell, MA, David Berger, Frank Sassaman Evoqua Water Technologies, Warrendale, PA, Yong Huang, Ph.D., Texas A&M Agrilife Research College Station, TX ,Paul Chu, Electric Power Research Institute, Palo Alto, CA, Xinjun (Jason) Teng, Southern Company Services, Inc., Birmingham, AL

Discussion by Jay Harwood, GE Power & Water, Burlington, ON Canada

Author's Closure by Simon Dukes, Evoqua Water Technologies LLC, Lowell, MA

IWC 14-59

Pilot Studies for the Treatment of a Highly Oxidized Flue Gas Desulphurization Wastewater ...979

Joseph Chwirka, Tetra Tech, Albuquerque, NM, Jean-Claude Younan SCANA, Paul Chu, Electric Power Research Institute

Discussion by James Beninati, PE, HDR Engineering, Inc., Pittsburgh, PA

IWC 14-60

High Rate Softening without Sand ... 1002

Sarah Petrovich, Chuck Blumenschein and Kashi Banerjee, Veolia Water Solutions & Technologies NA, Moon Twp., PA

Discussion by Jonathan Shimko, Tetra Tech, Inc., Pittsburgh, PA

COOLING WATER TREATMENT

IMPROVING MONITORING, PERFORMANCE AND SYSTEM EFFICIENCIES

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 papers in this session cover different areas of a cooling water treatment program. The first paper discusses corrosion monitoring under heat transfer conditions while the second paper targets cooling tower film fill fouling / monitoring. The third paper outlines the impact and control for mussels discovered at Lead Mead. The final paper completes the session with the treatment of high silica cooling water.

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

Session Chair: Ken Dunn, Solenis, Shrewsbury, MA

Discussion Leader: Scott Quinlan, GAI Consultants, Cranberry Township, PA

IWC 14-61

Corrosion Monitoring Study Using Traditional Methods Compared to a New Innovative Approach to “Actual” Corrosion Rates ... 1015

L J Aspinall, & Paul Puckorius, Puckorius & Associates, Inc., Arvada, CO

Discussion by Loraine Huchler, P.E., CMC, MarTech Systems, Inc., Lawrenceville, NJ

IWC 14-62

Utilizing Gamma Scanning Technology to Monitor Blockage or Fouling in Film Fill Counter-Flow Cooling Towers as Preventive Maintenance ... 1030

Maureen Gerty, Nalco Champion Company, An Ecolab Company, Sugar Land, TX, Paul Chila, Quantum Technical Services LLC, Houston, TX

Discussion by Claudia C. Pierce, Ph.D., GE Power & Water, Trevose, PA

IWC 14-63

Macrofouling Control - Tested Control Strategies and Recent Research for Dreissenid Mussels ... 1043

Leonard Willet, Bureau of Reclamation - Hoover Dam, Boulder City, NV, Renata Claudi, RNT Consulting Inc., Picton, ON Canada

Discussion by Chris Baron, Solenis, Newark, DE

IWC 14-64

Cooling Water Chemistry Programs for High Silica Waters ... 1060

Kevin Boudreaux, Nalco, an Ecolab Company, Naperville, IL

Discussion by Prasad Kalakodimi, Ph.D., ChemTreat, Inc., Richmond, VA

WASTEWATER REUSE IN INDUSTRIAL APPLICATIONS

Reuse/recycle water demands are driven by tighter regulations on plant discharge, restriction on inlet water volume and water availability. This session will present challenges using municipal waste, grey waters and ash leachate as feed water for power plants. New chemical treatments for cooling towers specifically targeting contaminants in waste water will also be reviewed. Presented will be a sophisticated program that will calculate overall plant chemistry and flows. Experiences from several plants will confirm that one design will not fit all applications.”

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

Session Chair: William Moore, Westech Engineering, Inc., Humble, TX

Discussion Leader: Greg Osen, AVANTech, Inc., Columbia, SC

IWC 14-65

Water Reuse Applications in Power Industry Cooling Tower Circulating Water System ... 1080

John Van Gehuchten, P.E., HDR Engineering Inc., Pittsburgh, PA

Discussion by Mike Preston, P.E., Black & Veatch Corporation, Overland Park, KS

IWC 14-66

Controlling Deposition & Corrosion when using Recycled Water for Cooling Towers ...1097

Caroline Sui, Jeff Melzer, GE, Water & Process Technologies, Trevose, PA, Timothy W. Eggert, GE Power and Water, Water & Process Technologies, Seal Beach, CA, Warren Dan Harbs, GE Power and Water, Water & Process Technologies, Fountain Valley, CA

Discussion by Diane R. Martini, Sargent & Lundy, LLC, Chicago, IL

IWC 14-67

Advanced Modeling Techniques for Refinery Water Conservation Projects ... 1118

Ronald Tebbetts, Nalco Champion, an Ecolab company, Sugar Land, TX & Kenneth J. Cygan Nalco, an Ecolab Company, Houston, TX

Discussion by Kristen Jenkins, P.E., CH2M HILL, Atlanta, GA

IWC 14-68

Municipal Reclaimed Wastewater in Power Generation ... 1133

Gary Engstrom, U.S. Water, St. Michael, MI & Brian Clarke, P.E. Kiewit Power Engineers, Lenexa, KS

Discussion by Vincent Como, Black & Veatch, Overland Park, KS

IWC 14-BU1

Evaluation of an Industrial Wastewater Treatment Plant to Improve Treatment Efficiency and Reduce Operational Costs (2014)

Katie Jones, PE, Leigh-Ann Dudley, Dan Wilkinson, PE, Dewberry Engineers Inc., Raleigh, NC

OPTIMIZING SAGD PRODUCED WATER TREATMENT OPERATIONS

SAGD oil production is a relatively new industry that has been growing rapidly for the past twenty years. During this period the industry has experienced several lessons learned. The industry is constantly striving to optimize current operations and to adopt new technologies to meet future operational challenges. This technical session describes current efforts to optimize first generation SAGD produced water operations and discusses pilot test programs to evaluate emerging

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

Session Chair: Lanny Weimer, GE Water and Process Technologies, Ellicott City, MD

Discussion Leader: David Pernitsky, Suncor Energy, Calgary, AB Canada

IWC 14-69

Process Optimization Strategies at the Orion SAGD Facility ... 1162

Chandra Adimoolam, P. Eng., OSUM Oil Sands Corporation, Cold Lake, AB Canada & Greg Mandigo
AquaChem ICD, Aquatech International Corp., Hartland, WI

Discussion by Jason Grundler, Conoco Phillips Canada, Calgary, AB Canada

IWC 14-70

New Generation Chemical Cleaning Program for SAGD Produced Water Evaporators ... 1187

Sean Warren, Paul Jacobs, Suncor Energy, Calgary, AB Canada, Carol Batton, John Hoots, and Ahmad Faizi,
Nalco-Champion, an Ecolab Company, Naperville, IL

Discussion by Mark Nicholson, Veolia, Plainfield, IL

IWC 14-71

Piloting New Technologies for SAGD Produced Water Deoiling ... 1207

Michael Salerno, GE Water and Process Technologies, Trevose, PA

Discussion by Rafique Janjua, Fluor, Houston, TX

IWC 14-72

Ultrafiltration using Ceramic Membranes for the Purification of Produced water in the Steam-Assisted Gravity Drainage (SAGD) ... 1221

Adel Guirgis, Sunshine Oilsands Ltd., Calgary, AB Canada & Rafael Gay-de-Montella Transprocess Inc.,
Calgary, AB, Canada

Discussion by Dave Rowley, Conoco Phillips Canada, Calgary, AB Canada

IWC 14-BU2

Recovery of Water Soluble Oil (WSO) from Produced Water using Regenerable Polymeric Adsorbents ... 1241

H. Robert Goltz, Ph.D., and Aaron Johnson Dow Chemical Company, Midland, MI USA

**POWER GENERATION PAST AND PRESENT
REFINING PRETREATMENT AND DEMINERALIZATION DESIGN TECHNOLOGIES
AND INNOVATING WITH RENEWABLES**

Renewable technologies such as solar and geothermal may be adapted at power generation facilities to offset the auxiliary load of the plant or even replace traditional fossil generation. These renewable technologies bring with them new water treatment challenges. While these innovative renewable technologies are making their debut, refinements to existing core water treatment technologies that treat water for steam and cooling applications at power generation facilities, are ongoing. These refinements in traditional technologies are essential to keep up with changing environmental wastewater discharge regulations, more stringent steam purity requirements, and reduce water usage. This session covers a broad range of water treatment applications in the power generation industry from renewables to raw water quality data collection and analysis, demineralization, and wastewater treatment.

IWC Representative: Patricia Scroggin, P.E., Burns & McDonnell, Kansas City, MO

Session Chair: Michele Funk, Bechtel Power, Frederick, MD

Discussion Leader: Richard Roy, Public Services of New Hampshire, Bow, NH

IWC 14-73

Thermal Desalination and Solar Energy: a Case Study ... 1260

Charles Desportes, Aquatech International Corp., Hartland, WI

Discussion by Jeffery Preece, Duke Energy, Raleigh, NC

IWC 14-74

Control of Metal Sulfide Deposits in Geothermal Binary Plants ... 1277

Jasbir Gill, Nalco, an Ecolab Company, Naperville, IL, Logan Muller Nalco, An Ecolab Company, Auckland, New Zealand, David Rodman, Nalco, An Ecolab Company Townsville, Australia, Kevin Brown, Nalco, An Ecolab Company, Christchurch, New Zealand, Ray Robinson, Nalco, An Ecolab Company, Kaikohe, New Zealand

Discussion by Greg Behrens, P.E., URS Corporation, Austin, TX

IWC 14-75

Selecting Water Treatment Equipment and Preparing a Comprehensive Water Balance for New Facilities ... 1295

Brad Buecker, Kiewit Power Engineers, Lenexa, KS

Discussion by Bryan Hansen, P.E., Burns and McDonnell, Centennial, CO

IWC 14-76

Planning to Achieve ELG Compliance in a Period of Uncertainty ... 1313

Kristen Jenkins, P.E., CH2M HILL, Atlanta, GA, Dennis Fink CH2M Hill, Oakland, CA, Dr. Thomas Higgins, CH2M Hill Chantilly, VA & Christina Joiner, CH2M Hill, Atlanta, GA

Discussion by Matthew Kirk Ellison, Southern Company, Birmingham, AL (*Not Available*)