

71st Annual International Water Conference 2010

**San Antonio, Texas, USA
24-28 October 2010**

ISBN: 978-1-61782-506-4

Printed from e-media with permission by:

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



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

Copyright© (2010) by the Engineers Society of Western Pennsylvania
All rights reserved.

Printed by Curran Associates, Inc. (2011)

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

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

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

www.eswp.com

Additional copies of this publication are available from:

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

TABLE OF CONTENTS

CONDENSATE POLISHING SYSTEMS FOR POWER PLANTS WITH PANEL DISCUSSION SPONSORED BY THE ASME RESEARCH & TECHNOLOGY COMMITTEE

Design Considerations for Condensate Polishing Off-Site Regeneration	2
<i>Gerald Alexander</i>	
Amine Form Operation of Deep Bed Condensate Polishing Ion Exchange Resins	16
<i>Lewis Crone</i>	
A Report On Resin Separation and Backwash Efficiency of Mixed Bed Ion Exchange Resins	30
<i>William E Moore, Bharathwaj Gopalakrishnan, Gary L. Foutch</i>	
Panel Discussion Transcript: Condensate Polishing Systems for Power Plants with Panel Discussion sponsored by the ASME Research & Technology Committee	41
<i>N/A</i>	

UNUSUAL TOPICS IN WATER TREATMENT

Patent Law Developments That Affect Water Treatment Technology	51
<i>Clifton E. McCann, Lars H. Genieser</i>	
A System for Integrating Water Pollution Prevention with Water Footprint Reduction	63
<i>David L. Nystuen</i>	

INDUSTRIAL WASTEWATER TREATMENT

Commissioning of Biological Nitrogen Removal from Cheese Plant Wastewater Using an Alternate Carbon Source	74
<i>Eric Blumenstein, Paul Pigeon, Pamela Edrich, Joe Middlebrooks, Sheldon Knapp, Douglas Pettinger</i>	
Physico-Chemical Treatment of Biologically Treated Pharmaceutical Wastewater: Efficiency of Fenton's Reagent and Activated Carbon	105
<i>Anal Chavan, Vrajesh Mehta, Priyanka Keshari</i>	
Generating Power from Onion Waste	113
<i>Juan Josse, Andrew Dale, Lynn Orphan</i>	

TRACE METALS/SELENIUM REMOVAL

Emerging Biological Selenium Removal Processes for Refinery Wastewater	125
<i>Yakup Nurdogan, Patrick Evans, John Christiansen</i>	
Biological Treatment of Nitrate and Selenium: Two Pilot Case Studies of Active and Passive Water Treatment	137
<i>Tom Rutkowski, Rachel E. Hanson</i>	
Removal of Water Pollutants by Immobilized Magnetite Nano-particles	149
<i>Adva Zach-Maor, Raphael Semiat, Hilla Shemer</i>	

NEW METHODS IN BOILER ASSET PROTECTION AND SYSTEM EFFICIENCY

Research Evaluation of Polyamine Chemistry for Boiler Treatment: Phase Distribution and Steam Carry-over	156
<i>Rosa Crovetto, Anthony Rossi, Eunice Murtagh</i>	
Evaluating the Correlation of Low Conductivity Boiler Water Pitting and Generalized Corrosion Analysis Compared to Coupons and On-Line Water Chemistry	163
<i>Vickie G. Olson, Slawomir Kus, Mark Yunovich, Sheree Xiu Zhao</i>	
Study of Deaerator Efficiency Improvement at a Manufacturing Plant and Paper Mill Using At-Temperature ORP	179
<i>Christina Fleming, Richard A. Peterson, Scott Dolezal, Kurt Kraetsch</i>	

FGD WASTEWATER

Selenium Speciation and Partitioning in Wet FGD Systems	189
<i>Gary Blythe, Mandi Richardson, Paul Chu, Charles Dene, Dirk Wallschläger, Katherine Searcy, Kevin Fisher</i>	
Case Study: Cost-minimization Approach to the Design, Procurement, Installation and Commissioning of a FGD Wastewater Treatment System at a Power Station	204
<i>Antonio O. Lau, Richard A. Ubaldi, Michael G. McDonough, Edward V. Bowes, Wayne G. Spitzner</i>	
ABMet: Setting the Standard for Selenium Removal	216
<i>Jill Sonstegard, James Harwood, Tim Pickett, William Kennedy</i>	

PRODUCED WATER 1

Subsurface Wash and Backwash Effectiveness in SAC Vessels at Cenovus' Foster Creek SAGD Facilities	230
<i>C. Wilson Mussbacher, Tamer Antar</i>	
Corrosion Control in Inter-Site Pipeline Carrying Produced or Recycled Water in Oil-Sand	243
<i>Jasbir S. Gill</i>	
Produced Water Recovery at Seneca Resources Using Short Bed Ion Exchange	261
<i>Lewis Krause, Michael Sheedy, Keith Jones</i>	
Horizontal Evaporators: An Option to Vertical Evaporators in SAGD	271
<i>J. Michael Marlett</i>	

COOLING WATER 1

Development of Next Generation Phosphorus-Free Cooling Water Treatment Technology	280
<i>Raymond M. Post, Richard H. Tribble, John R. Richardson</i>	
Calcium Carbonate Scale Prediction Methods for Cooling Tower Water Systems- What is the Most Accurate, Where and Why Some Fail, and How to Utilize to Provide Optimization of a Scale Control Program	291
<i>Paul R. Puckorius</i>	

REFINERY WASTEWATER

State of Options in Petrochemicals Wastewater Treatment Processes	306
<i>Rafique Janjua</i>	
Resource Recovery from Refinery Wastewater Sludges and Waste Conversion from Hazardous to Non-Hazardous - A Case Study at a Major Oil Refinery in Louisiana	316
<i>Jared Meiser, Bob Cook</i>	
Successful Pilot Trial to Recycle Petrochemical Wastewater Using External Membrane Bioreactor in combination with High Efficiency Reverse Osmosis	320
<i>Arun Mittal, Apurva Mulye</i>	
MBBR and DAF Treatment Solutions	336
<i>Chandler H. Johnson</i>	

COOLING WATER 2

Barium and Strontium Scale Chemistry and Prediction in Cooling Water Systems	345
<i>Robert J. Ferguson, Baron R. Ferguson</i>	
State of the Art of Friendly "Green" Scale Control Inhibitors	363
<i>David Hasson, Hilla Shemer, Alexander Sher</i>	
In Situ Monitoring of Biofilm Growth and Disinfection Using a Thermal Analysis Measurement Technique	378
<i>Olivier Horner, Celine Bouteleux</i>	
Cooling Tower Designs for the Water-Constrained Nuclear World	386
<i>Natasha Jones, Christopher Kaplan, Keegan Kinney, Ram Narula</i>	

NUCLEAR

Modeling Studies and Electrochemical Experiments on Amine Systems	400
<i>James Bellows, Matthew Taylor, Daniel Seong, Digby Macdonald</i>	
Effects of Polyacrylic Acid on Ion Exchange Resins	412
<i>Douglas Kellogg</i>	
Implementation of Zinc Injection at the San Onofre Nuclear Generating Station	424
<i>Jonathon A. Muniga</i>	
Ultra-low Sulfate Resins for Condensate Polishing Applications in Nuclear Power Plants	430
<i>Peter A. Yarnell</i>	

ZERO LIQUID DISCHARGE

Design and Construction Considerations for Zero Liquid Discharge Facilities	449
<i>James Beninati, Michael Soller</i>	
Low Temperature Crystallization Process is the Key to ZLD Without Chemical Conditioning	459
<i>William A. Shaw</i>	

MONITORING AND CONTROL OF WATER CHEMISTRY IN BOILER SYSTEMS AND OTHER APPLICATIONS

Corrosion Product Sampling	472
<i>Jeff McKinney</i>	
Benefits of Integrated Conductivity Sensors in Water Treatment Systems	482
<i>Stefan Raabe, David M. Gray</i>	
Degassed Acid Conductivity Used for the Steam Quality Monitoring: Concept, Specifications and Limitations	491
<i>Markus Bernasconi</i>	
New Image Based Water Analyzer for Real Time Monitoring and Research	496
<i>Kent Peterson, Harry Nelson</i>	

PRETREATMENT

New and Unusual Items in Ion Exchange and Water Treatment	506
<i>George J. Crits, Wm. Runyan</i>	
Pilot Testing of Draft Tube-Enhanced Crystallization and Sand-Ballasted Settling Technologies Prove New High-Rate Softening Application for Refineries	515
<i>Holly Johnson, Mark Hess</i>	
Use of Fractal Liquid Distribution for Producing Demineralized Water for Chlor-Alkali Industry	535
<i>Richard Posa, Matthew Burger, Christopher Martin</i>	
Wide Particle Size Spectrum, High Efficiency Pleated Filters	547
<i>F. Tepper, L. Kaledin, O. Vargas, T. Kaledin</i>	

RECYCLE/REUSE

IGCC Grey Water Treatment System for Duke Energy Indiana's Edwardsport Facility	562
<i>Andrew Broerman, M. Adam Edwards</i>	
Urine Recycling in Space	568
<i>Patricia Mendoza Watson</i>	
Water Reuse for New and Existing Cooling Tower Systems- Guidelines and Recent Experiences	574
<i>Paul R. Puckorius</i>	

PRODUCED WATER 2

Characterization of Deposition and Metallurgical Degradation in OTSG Overheating Failures	583
<i>Paul B. Desch</i>	

Scale and Deposit Formation in Steam Assisted Gravity Drainage (SAGD) Facilities	603
<i>W. Hugh Goodman, Martin R. Godfrey, Thomas M. Miller</i>	
Comparison of Produced Water Evaporator Systems at Connacher Great Divide Pod 1 and Algar Facilities	618
<i>Carolina Gonzalez, James Nowak</i>	
High Recovery Reverse Osmosis for Treatment of Produced Water	625
<i>Bob Kimball</i>	

RO/MEMBRANE

Zero Discharge Desalination (ZDD) Technology – Ion Substitution Electrodialysis Maximizes Water Recovery for Inland Desalination	638
<i>Brad Biagini, Bernie Mack, Thomas A. Davis, Malynda Cappelle</i>	
Enhancing RO Permeate Recoveries with Cyclic Ion Exchange	649
<i>Francis Boodoo</i>	
Novel Membrane Fouling Procedure to Compare Fouling-Resistant Membranes	668
<i>Gregg Poppe, Abhishek Roy, Katariina Majamaa, William Mickols</i>	
Recycling Industrial Wastewater with Innovative Membrane Technologies	677
<i>Henia Yacubowicz, Antonia Von Gottberg</i>	

POWER PLANT WATER SYSTEMS DESIGN

Automated Selenium Analyzer for Water Quality Monitoring	685
<i>Vladimir Dozortsev, William T. Dietze, Li Xiao, Derek A. Eggert</i>	
Incorporating Safety into Water Treatment Design	693
<i>Michele Funk, Michael Chuk, Kumar Sinha</i>	
Experiences Using Neutralizing Amines to Control pH and Minimize FAC in a Combined-Cycle Power Plant	724
<i>Robin Kluck, Juan Torres, Adolfo Antompietri, José Rivera</i>	
Carbon Capture Technology Ramifications on Power Plant Water Treatment	741
<i>Sandra Kolvick, Dennis McBride</i>	

NATURAL GAS HYDRO FRACTURING FLOW BACK WATER TREATMENT

Water Management: Treatment of Frac Water at Wellhead	747
<i>Chuck J. Kozora</i>	
Precipitation Reactions in Hydrofracturing Wastewater Treatment	755
<i>John Schubert</i>	
NORM Removal from Frac Water in a Central Treatment Facility	775
<i>James Silva, Hope Matis, Joseph Tinto</i>	
Water Recovery via Thermal Evaporative Processes For High Saline Frac Water Flowback	787
<i>Joseph Tinto, Robert Solomon</i>	

NON-CHEMICAL COOLING WATER WITH PANEL DISCUSSION

A New Mechanical Water Softener Using Plasma Discharge with an Application to the Prevention of Mineral Fouling in Cooling Water	803
<i>Yong Yang, Hyoungsup Kim, Andrei Starikovskiy, Alex Fridman, Young I. Cho</i>	
Hydrodynamic Cavitation for Cooling Water Treatment: A Technology Update	816
<i>Philip Vella</i>	
Field Comparison of a Novel Ultrasonic Microbial Control Program with a Conventional Bromine Microbial Control Program	823
<i>Donald W. Weakley</i>	
Author Index	