

83rd Annual International Water Conference (IWC 2022)

The World's Premier Conference on
Industrial Water & Wastewater

Orlando, Florida, USA
6 – 10 November 2022

Volume 1 of 2

ISBN: 978-1-7138-6325-0

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© (2022) by the Engineers Society of Western Pennsylvania
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

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

eswp@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: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

DEMONSTRATION SELENIUM REMOVAL FOR EPA SUPERFUND GROUNDWATER REMEDICATION.....	1
<i>J. Maughan, T. Rutkowski, K. Budgell</i>	
DEMONSTRATION SELENIUM REMOVAL FOR EPA SUPERFUND GROUNDWATER REMEDICATION.....	16
<i>A. Togna</i>	
SELENIUM, HEAVY METALS AND ARSENIC REMOVAL WITH ION EXCHANGE RESINS AND IRON OXIDE MEDIA	20
<i>A. Liu, J. McPeak, W. Nova, K. Ljubetic, H. Liang, D. Kratochvil</i>	
FULL-SCALE NON-BIOLOGICAL SELENIUM TREATMENT FOR THE POWER AND MINING SECTORS.....	43
<i>K. Ljubetic, H. Liang, D. Kratochvil, Z. Liu, W. Ruiz</i>	
A CLOSER LOOK AT DEAERATOR PERFORMANCE MONITORING AND INSPECTION.....	67
<i>C. Scholl</i>	
BOILER TREATMENT TESTING USING OTSG PILOT	82
<i>M. Norona, V. Martez, D. Rowley, S. Peramanu</i>	
CHLORIDE STRESS-CORROSION CRACKING (SCC) OF STAINLESS STEEL ALLOYS IN BOILER SYSTEMS.....	101
<i>M. Esmacher, M. Budhathoki, D. Meskers Jr.</i>	
OPERATING A CYCLING FGD WWT SYSTEM	123
<i>D. Henderson, R. Lidke, M. Nevill</i>	
ACHIEVING FGD ZLD BY SOFTENING AND TREATMENT IN A COOLING TOWER EVAPORATOR SYSTEM.....	137
<i>T. Higgins, M. McCloud, T. Gaboian, N. Parker, L. Weimer</i>	
ONLINE MEASUREMENT OF DISSOLVED TRACE SPECIES CONCENTRATIONS IN WET FGD ABSORBER SLURRY	164
<i>C. Hutson, G. Blythe, J. Currie, J. Sanchez</i>	
DRIVING HIGH RECOVERIES IN WATER REUSE APPLICATIONS WITH NOVEL, ZWITTERIONIC MEMBRANES	192
<i>C. Roy, J. Ledlee</i>	
CONTINUOUS NEPHELOMETRIC MEASUREMENT IN REVERSE OSMOSIS AS A SURROGATE FOR THE SILT DENSITY INDEX	218
<i>D. Slovacek, V. Malkov</i>	
ELECTROCHEMICAL TECHNOLOGIES USED IN REVERSE OSMOSIS SYSTEMS	231
<i>J. Tate</i>	

CERAMIC MICROFILTRATION ALLOWS REUSE OF CHALLENGING WASTEWATERS AT TWO U.S. LOCATIONS.....	252
<i>D. Holland</i>	
CONSIDERATIONS FOR THE SUCCESSFUL TREATMENT OF VARIABLE ARSENIC CONCENTRATIONS IN TODAY'S CCR IMPOUNDMENTS.....	270
<i>J. Ma, D. Donkin, J. Woodley</i>	
ANALYTICAL VARIABILITY OF SELENIUM IN FGD WASTEWATER	287
<i>M. Giraldo, B. Kennedy, A. Sutherland</i>	
WHAT CAN WE LEARN FROM THE TREATMENT OF EMERGING CONTAMINANTS TO BUILD A FRAMEWORK FOR MITIGATING MICROPLASTICS	301
<i>S. Binahmed-Menzies, M. Ellis, T. Boom</i>	
REMOVAL OF TRACE METALS IN THE HDS PROCESS	316
<i>J. Schubert</i>	
SUCCESS USING THE PROGRESSIVE DESIGN-BUILD MODEL FOR FOOD AND BEVERAGE INDUSTRIAL WASTEWATER TREATMENT PROJECTS	335
<i>T. Lawlor, J. Gehuchten, M. Maurer, J. Mickler</i>	
AMMONIA NITROGEN CONVERSION IN STRUVITE USING A NOVEL SUSTAINABLE ELECTROCOAGULATION PROCESS	355
<i>E. Bergeron, V. Leveillee</i>	
BOAT HARBOR REMEDIATION, PILOT STUDY	378
<i>H. Seyedy, C. Everest, C. Skirth, S. Dore, S. Kemp</i>	
CASE STUDY: IMPROVING YEAR-ROUND AMMONIA REMOVAL FROM INDUSTRIAL WASTEWATER WITH A SIMPLE, LOW-ENERGY BIOLOGICAL SYSTEM.....	399
<i>K. Bossy</i>	
FUNDAMENTALS OF SUSTAINABILITY: THE RISE OF ESG.....	422
<i>I. Morales, M. Grygar</i>	
HIGH PERFORMANCE AND SUSTAINABILITY NOW GO HAND IN HAND.....	441
<i>E. Peirtsegaele</i>	
WATER FOR GREEN HYDROGEN - CHALLENGES AND OPPORTUNITIES	460
<i>A. Hodgkinson, T. Higgins</i>	
CHALLENGES IN SUSTAINABLE AND ECONOMIC SOLUTIONS FOR ACCESS TO CLEAN WATER IN CENTRAL AMERICA	482
<i>V. Willey</i>	
RECOVERY OF LITHIUM FROM BRINE USING LITHIUM ION SIEVES	504
<i>C. Brown, R. Molnar, A. Robinson</i>	
A RARE OPPORTUNITY: TREATABILITY EVALUATION FOR OXALATE-RICH RARE EARTH PROCESSING WASTEWATER	521
<i>A. Ling, S. Binahmed-Menzies, B. Vermace, J. Kirk, B. Rew</i>	
E3 LITHIUM'S INNOVATIVE JOURNEY TO LITHIUM RECOVERY	535
<i>Cl. Mussbacher</i>	

BARIUM CHEMISTRY TO TREAT SULFATE – BUT WHAT ABOUT SELENIUM?	552
<i>K. Dufresne, A. Holmes, H. Parthasarathy, M. Isciemen, A. Herrin</i>	
DYNAMIC EVAPORATION POND PERFORMANCE MODELING FOR PREDICTION OF CARNALLITE RECOVERY AS A FUNCTION OF POND AREA EXPANSION	572
<i>A. Karimi, S. Panasiuk, A. Hodgkinson</i>	
NEW APPROACHES FOR MEMBRANE-BASED OCEAN MINING OF SODIUM CHLORIDE FOR CHORALKALI FEEDSTOCK	597
<i>C. Bartels, R. Franks, E. Oklejas, R. Weaver</i>	
DESIGN BEST PRACTICES - CONSIDERING THE END AT THE BEGINNING	617
<i>B. Hansen</i>	
WHAT ABOUT OTHER BRINES?	634
<i>O. Lokare, A. Guedes, K. Blohm, R. Stover, R. Swaminathan, R. Pawar</i>	
USE OF A PILOT-SCALE HYBRID ENGINEERED WETLAND TREATMENT SYSTEM FOR REMOVAL OF PER- / POLY- FLUOROALKYL SUBSTANCES (PFAS) AND OTHER CONSTITUENTS OF CONCERN FROM A LANDFILL LEACHATE	650
<i>O. Tedrow, A. McQueen, P. Lee, B. Olson, J. Novak</i>	
DESTRUCTION OF PFAS-CONTAMINATED FIRE TRAINING POND WATER VIA CONTINUOUS HYDROTHERMAL PROCESSING.....	675
<i>B. Pinkard, I. Novosselov</i>	
TECHNOLOGIES FOR EFFECTIVE TREATMENT OF ULTRA-SHORT CHAIN PFAS	694
<i>C. Bryan, J. Berry, S. Smith</i>	

VOLUME 2

PFAS WATER TREATMENT: A PERSPECTIVE ON PRETREATMENT	719
<i>A. McCabe, K. Wolohan, A. Ling</i>	
USING INNOVATIVE SOLUTIONS TO REMOVE LEAD AND IMPROVE EQUITY	739
<i>S. Waldvogel, B. Bhayani, O. McFoy</i>	
CAPACITIVE ELECTRODIALYSIS DESALINATION	757
<i>K. Slough, J. Grose</i>	
CARBON CAPTURE: A WATER OVERVIEW.....	778
<i>A. Erickson</i>	
REPURPOSING COOLING TOWER BLOWDOWN TO ACHIEVE NET ZERO.....	799
<i>J. Camp, D. Murray</i>	
PREPARATION FOR CONVERSION TO ZERO LIQUID DISCHARGE OPERATION	816
<i>D. McBride, R. Onsurez</i>	
INTEGRATION OF ADVANCED TREATMENT TECHNOLOGIES TO A ZERO LIQUID DISCHARGE DESIGN AT SIERRA BIOFUELS FACILITY	834
<i>A. Mittal, S. Callioni, L. Rich</i>	
ZERO LIQUID DISCHARGE (ZLD) SYSTEM - AN ADVANCED WATER REUSE SYSTEM FOR OIL & GAS REFINERY	860
<i>A. Lester, S. Muddasani</i>	

NEW POLYMER A FOR CALCIUM CARBONATE (CACO ₃) DEPOSIT CONTROL FOR COOLING WATER SYSTEMS	882
<i>S. Patel</i>	
IN SITU DETECTION AND ONLINE MONITORING OF TAGGED SCALE INHIBITORS IN COOLING WATER SYSTEMS	900
<i>C. Eaton, S. Margan</i>	
DEVELOPING A NEW MULTIFUNCTIONAL CLOSED-LOOP CORROSION INHIBITOR.....	916
<i>H. Lu, S. Margan, B. Lugo, C. Eaton, K. Curry</i>	
MODELING SUBSTITUTE INHIBITORS AND REPLACEMENT FORMULATIONS IN TIMES OF RAW MATERIAL SHORTAGES	932
<i>R. Ferguson, C. Farmer</i>	
REMEDY SELECTION ALTERNATIVES FOR GROUNDWATER CORRECTIVE ACTION: AN EXAMPLE OF AN INTEGRATED APPROACH USED AT COAL COMBUSTION RESIDUAL (CCR), MINING, AND CONTAMINATED SITES	955
<i>P. Nolan, R. Verburg</i>	
A COMPARISON OF SEVERAL COAL COMBUSTION RESIDUAL (CCR) POND CLOSURE WATER TREATMENT SYSTEMS	976
<i>DI. Torgerson, H. Schreiber</i>	
LESSONS LEARNED EXECUTING COAL-FIRED POWER PLANT OUTAGE WASHWATER TREATMENT USING BOTTOM ASH DEWATERING INFRASTRUCTURE - THREE YEARS AND GOING	994
<i>D. Donkin, J. Ma, J. Woodley, B. Evans</i>	
PROCESS AND TECHNICAL DISCUSSION OF TWO BOTTOM ASH SLUICE WATER TREATMENT SYSTEMS	1016
<i>H. Schreiber, D. Torgersen, T. Hiatt, C. Grabowski</i>	
HOT WATER SANITIZABLE MEMBRANE.....	1035
<i>J. Peichel</i>	
MEMBRANE CLEANING OPTIMIZATION; A DISCUSSION OF THE IMPACT OF TEMPERATURE, PH, TIME, AND CHEMICAL SELECTION ON CLEANING EFFICACY	1061
<i>J. Utter</i>	
INVESTIGATION OF THE NEW GENERATION OF STABILIZED CHLORINE BIOFOULING CONTROL AGENT IN SEAWATER REVERSE OSMOSIS (SWRO): FROM LABORATORY SCALE TO PILOT PLANT	1089
<i>Y. Lu, B. Lee, H. Komori, K. Hayakawa, K. Tan, L. Sim, T. Chong</i>	
CASE STUDY: 96% RECOVERY OF POWER PLANT'S COOLIGN TOWER BLOWDOWN WITH AN ADVANCED REVERSE OSMOSIS DEMONSTRATION PLANT	1107
<i>L. Ophek, M. Alper</i>	
HOLLOW FIBER NANOFILTRATION FOR REUSE OF MUNICIPAL WASTEWATER: A TECHNO-ECONOMIC AND LIFECYCLE-BASED COMPARISON TO CONVENTIONAL MEMBRANE TREATMENT	1131
<i>J. Grooth, D. Reurink, S. Wait</i>	
ZERO LIQUID DISCHARGE OF OILFIELD PRODUCED WATER VIA C-PVDF HOLLOW FIBER (HF) MEMBRANE-BASED DCMD AND CRYSTALLIZATION PROCESS	1146
<i>J. Yu, L. Zou, G. Fernandez, Y. Zhang, S. White, G. Zhang</i>	

A HIGH-LEVEL GUIDE FOR DESIGNING HIGH RECOVERY SWRO AND ULTRA-HIGH PRESSURE RO SYSTEMS.....	1160
<i>E. Oklejas, R. Weaver, J. Ruiz, C. Bartels, R. Franks</i>	
FIELD EXPERIENCES USING A NOVEL NON-PHOSPHORUS COOLING WATER TREATMENT	1180
<i>T. Eggert, P. Difranco, R. Hendel, R. Wright</i>	
USE OF POLYMERS FOR DEPOSIT CONTROL IN ONCE THROUGH UTILITY SYSTEMS	1208
<i>M. Standish</i>	
AN INNOVATIVE, ONLINE, AUTOMATED FIELD QPCR LEGIONELLA TEST DEVICE	1227
<i>L. Huchler, E. Lemieux</i>	
DEVELOPING CORROSION MODELS THAT INCLUDE THE IMPACT OF INHIBITORS	1244
<i>R. Ferguson, K. Young</i>	
ULTRA-LOW LEVEL PFAS REGULATORY REQUIREMENTS AND OPERATIONAL LEARNINGS IN PFAS REMOVAL AT WATER & WASTEWATER PLANTS.....	1270
<i>C. Scott, E. Towe</i>	
DESTRUCTIVE TREATMENT TECHNOLOGIES FOR PER-AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN AQUEOUS MEDIA	1285
<i>J. Claffey, K. Perez, A. Safulko, K. Bceem</i>	
PFAS DESTRUCTION IN WATER USING BDD ELECTRODES ELECTROOXIDATION: COST-EFFECTIVE? IN WHICH CONDITIONS?	1308
<i>V. Leveille, G. Llamosas, E. Bergeron, I. Touahar, J. Liu</i>	
ELECTROCHEMICAL DESTRUCTION OF PFOA AND PFOS IN HIGH SALINITY WATER.....	1330
<i>O. Schneider, J. Alvarez, E. Christ</i>	
15 YEARS OF MEMBRANE BIOREACTOR (MBR) EXPERIENCE FOR INDUSTRIAL WASTEWATER	1353
<i>S. Arabi, K. Messologitis, R. Ruocco</i>	
HIGH RECOVERY ELECTROCHEMICAL DESALINATION FOR TERTIARY WASTEWATER TREATMENT	1372
<i>C. Unrau, S. Mehta, M. Wong</i>	
ULTRAVIOLET ADVANCED OXIDATION PROCESSES WITH ONSITE CHEMICAL GENERATION.....	1387
<i>R. Faria, M. Ghafari, S. Dukes, J. Griffis</i>	
IMPROVED BIOLOGICAL NUTRIENT REMOVAL BY INTEGRATING BIOAUGMENTATION IN THE WASTEWATER COLLECTION SYSTEM.....	1404
<i>D. Chrysochoou</i>	

Author Index