Multi-State Salinity Coalition

U.S. Department of the Interior
Bureau of Reclamation

Sandia National Laboratories

MSSC 2009
ANNUAL SALINITY SUMMIT

Water and Energy: Our Future in the Balance

January 15-16, 2009

Monte Carlo Resort and Casino

Las Vegas, Nevada

MSSC 2009 Salinity Summit
Water and Energy - Our Future in the Balance
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National Salinity Summit Planning Commitee

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Established in 1902, the Bureau of Reclamation is best known for the dams, powerplants, and canals it constructed in the 17 western states. These water projects led to homesteading and promoted the economic development of the West. Reclamation has constructed more than 600 dams and reservoirs including Hoover Dam on the Colorado River and Grand Coulee on the Columbia River.

Today, we are the largest wholesaler of water in the country. We bring water to more than 31 million people, and provide one out of five Western farmers (140,000) with irrigation water for 10 million acres of farmland that produce 60% of the nation's vegetables and 25% of its fruits and nuts.

Reclamation is also the second largest producer of hydroelectric power in the western United States. Our 58 powerplants annually provide more than 40 billion kilowatt hours generating nearly a billion dollars in power revenues and produce enough electricity to serve 6 million homes.

Today, Reclamation is a contemporary water management agency with a Strategic Plan outlining numerous programs, initiatives and activities that will help the Western States, Native American Tribes and others meet new water needs and balance the multitude of competing uses of water in the West. Our mission is to assist in meeting the increasing water demands of the West while protecting the environment and the public's investment in these structures. We place great emphasis on fulfilling our water delivery obligations, water conservation, water recycling and reuse, and developing partnerships with our customers, states, and Native American Tribes, and in finding ways to bring together the variety of interests to address the competing needs for our limited water resources.

Since 1949, Sandia National Laboratories has developed science-based technologies that support our national security. Today, the 300+ million Americans depend on Sandia's technology solutions to solve national and global threats to peace and freedom.

Through science and technology, people, infrastructure, and partnerships, Sandia's mission is to meet national needs in five key areas:

- Nuclear Weapons
  ensuring the stockpile is safe, secure, reliable, and can support the United States' deterrence policy
- Energy and Infrastructure Assurance
  enhancing the surety of energy and other critical infrastructures
- Nonproliferation
  reducing the proliferation of weapons of mass destruction, the threat of nuclear accidents, and the potential for damage to the environment
- Defense Systems and Assessments
  addressing new threats to national security
- Homeland Security
  helping to protect our nation against terrorism

Sandia is a government-owned/contractor operated (GOCO) facility. Sandia Corporation, a Lockheed Martin company, manages Sandia for the U.S. Department of Energy's National Nuclear Security Administration. We seek collaborative partnerships on emerging technologies that support our mission

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Camp Dresser & McKee Inc. - CDM is a consulting, engineering, construction, and operations firm delivering exceptional service to public and private clients worldwide.

HDR Engineering - HDR (hdrinc.com) is an employee-owned architectural, engineering and consulting firm that excels at managing complex projects and solving challenges for clients. More than 5,700 professionals, including architects, engineers, consultants, scientists, planners and construction managers, in more than 140 locations worldwide, pool their strengths to provide solutions beyond the scope of traditional A/E/C firms. HDR is No. 17 in the *Engineering News-Record* Top 500 Design Firms rankings for 2006.

Awwa Research Foundation
Advancing the Science of Water®

Water Research Foundation - The Awwa Research Foundation is a member-supported, international, nonprofit organization that sponsors research to enable water utilities, public health agencies, and other professionals to provide safe and affordable drinking water to consumers. With close to 1,000 subscriber members in the U.S. and abroad, the Foundation has funded and managed more than 900 projects valued at more than $370 million. More information on the Awwa Research Foundation is available at www.awwarf.org.

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Albuquerque Bernalillo County Water Utility Authority

The Albuquerque Bernalillo County Water Utility Authority was created in 2003 by an act of the state Legislature, which transformed the City of Albuquerque's water department into a regional entity with its own governing board. Responsible for providing water and wastewater services and water resource management for the Albuquerque metro area, the Water Authority serves approximately 520,000 users and is the largest water utility in the state of New Mexico. For more information visit www.abcwua.org

carollo Engineers...Working Wonders With Water™

Carollo Engineers - For 75 years, Carollo has been a leader in water-focused engineering. With over $380-million worth of desalting projects currently under design or construction across the United States, Carollo is at the forefront of salinity management, providing engineering services on projects ranging from brackish and seawater desalination to concentrate management and zero discharge solutions.

San Antonio Water System

San Antonio Water System - SAWS is a public utility owned by the City of San Antonio. It was created in May 1992 through the consolidation of three predecessor agencies:

- City Water Board (the previous city-owned water supply utility)
- City Wastewater Department (the city government department responsible for sewage collection and treatment)
- Alamo Water Conservation and Reuse District (an independent city agency created to develop a system for reuse of treated wastewater)

SRP

Salt River Project - SRP is two entities: the Salt River Project Agricultural Improvement and Power District, a political subdivision of the state of Arizona; and the Salt River Valley Water Users' Association, a private corporation. The District provides electricity to about 920,000 retail customers in the greater Phoenix metropolitan area. It operates or participates in 11 major power plants and numerous other generating stations, including thermal, nuclear, natural gas and hydroelectric sources.

TUCSON WATER

Tucson Water is a department of the City of Tucson, Arizona, serving approximately 775,000 people in a 350-square-mile service area.

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

EPWU is the regional planner and provider of water, wastewater, reclaimed water, and stormwater services to nearly 700,000 people in the greater metropolitan area. It is a component part of the City of El Paso and is governed by a five-member Public Service Board. Its mission is to furnish at a fair and reasonable cost to customers, high-quality potable water in sufficient quantities to satisfy domestic, industrial, and fire protection requirements, along with collection of liquid waste for treatment and disposal without risk to public health and the environment.

City of Phoenix

The City of Phoenix Water Services Department provides reliable water and wastewater services to 1.5 million residents in its 500 square mile service area. Over the past 20 years, the City has dramatically reduced dependency on groundwater supplies, increased deliveries of renewable surface water and reclaimed water sources, and reduced per-capita consumption by over 20 percent. Phoenix has been the lead municipality in the Central Arizona Salinity Study, and is striving to identify cost-effective solutions for managing TDS in the City's surface water, reclaimed water and groundwater sources.

CITY OF SCOTTSDALE ARIZONA

The City of Scottsdale Water Resources Department mission is to plan, manage and operate a safe, reliable water supply and wastewater reclamation system and provide efficient, sustainable, high quality service to our customers. The potable water system includes two surface water treatment plants (100 mgd), 23 wells, four groundwater treatment facilities, ~2,000 miles of water lines, 44 reservoirs, 86 booster pump stations, and close to one hundred separate pressure zones. The wastewater collection/reclamation system includes two water reclamation facilities, 48 lift stations, over 1,300 miles of sewer lines, and an advanced water treatment facility. Reclaimed wastewater is delivered to 23 golf courses and The City of Scottsdale Sports Complex for turf irrigation or recharged to replenish groundwater supplies following advanced treatment.

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Greetings MSSC Summit Attendees

Welcome to the 2009 Annual MSSC National Salinity Summit. The theme of this year's summit is “Water and Energy, Our Future in the Balance”. The MSSC is partnering with the Bureau of Reclamation and Sandia National Laboratories in an effort to work collaboratively in our approach to address key issues pertaining to the water/energy nexus and how desalination is an integral part of bringing these issues together. Collaboration is imperative to developing key policies that will ultimately drive sound solutions to addressing the many issues we, as water professionals, must face when looking at finding sustainable water supplies.

MSSC has received a record sponsorship this year despite the current economy. This alone states the importance of the issue. Please take a moment to thank our sponsors who have made the Summit a tremendous success.

Our organization has grown through the years and continues to grow. We now have member agencies in California, Arizona, Nevada, Texas, and New Mexico. If you are not already a member of the MSSC, I encourage you to join. With the increased demand that our nation is facing for sustainable water supplies, I am confident that MSSC will continue to grow and prosper.

Sincerely,

Ed Archuleta, P.E.
MSSC Chairman

Greetings, and welcome to the National Salinity Summit! The 2009 National Salinity Summit Planning Committee did an excellent job of bringing together a strong program. This year's Summit will include sessions that focus on salinity management and the water and energy nexus. Session discussion will include future and pending federal legislation associated with desalination and salinity management, source control, environmental concerns, the energy/water nexus, water softeners, applied research, innovative technologies, brackish water and ocean water desalination, recycled water desalination, and project implementation.

I would like to extend my thanks to all of the 2009 Annual Summit's generous sponsors. The success of the Summit would not be possible without their support and dedication to the MSSC. All of the sponsors are listed in this brochure. We also have them listed on the MSSC website and will provide a link to their sites as advertisement to them. Please take a moment to thank them during the event. In addition to the success of the event, their support allows the MSSC to hold the event at a reasonable cost to Summit attendees.

It has been a pleasure to serve as the MSSC National Salinity Summit Planning Committee Chair. I have enjoyed working with such an intelligent and talented planning committee. Please take the time to fill out the evaluation forms that are provided for you in the registration packets. Your comments will help us provide the best quality events in the future.
I look forward to seeing you here at the Summit!

Best Regards,

Ernesto A. Avila, P.E.
2009 MSSC Summit Chair

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Conference Schedule

Thursday, January 15, 2009

8:00 a.m. Welcome/Opening Remarks/Presentation by Keynote Speaker

Introduction of MSSC Chairman

Ernesto A. Avila, P.E., *Northern California Salinity Coalition and MSSC 2009 Annual Summit Chair*

Welcome and Introduction

Edmund Archuleta, *President and CEO, El Paso Water Utilities, MSSC Chairman*

Introduction of Keynote Speaker:

William Steele, *Project Manager, U.S. Bureau of Reclamation*

Keynote:

Karl Wirkus, *Deputy Commissioner, U.S. Bureau of Reclamation*

8:45 a.m. - 9:45 a.m. Legislative, Federal and Policy Update

What kind of policies do we need to find the balance between water and energy now and in the future? How will they be funded in an era of scarce resources at all levels of government? Without answers to these kinds of questions, the ability to produce alternative water supplies, protect groundwater basins and maintain arable lands will be constrained, leading to profound effects upon our abilities to compete in the global economy, feed our citizens and provide a high quality of life.

Moderator: Eric Sapirstein, *President, ENS Resources*

Karen Wayland, *Natural Resources Defense Council - Environmental Issues*
Marcus Faust, *Lobbyist - Climate Change*
Dave Reynolds, *Association of California Water Agencies - Western Issues*
Guy Martin, *Western Urban Coalition - Regional*

9:45 a.m. - 10:05 a.m. Break - Poster and Reception Area

10:05 a.m. - 11:05 a.m. Cultural and Socio-Economic Impacts of Salinity Management

Societal Impacts of Saline Water Management. What if we did not manage salts in water? The impacts would be staggering growth limitations, increased costs of producing safe and reliable water supply, reduced agricultural productivity, and environmental degradation. The ability to live in many areas would be limited and of course the unknown consequences of climate change are likely to impose new adaptive management challenges directly tied to salinity. How do we address salinity management and ensure that these challenges are successfully met in an era of fiscal constraints, unknown environmental hurdles and technological developmental needs?

Moderator- Mike Gabaldon, *Director of Technical Services, Bureau of Reclamation*

Salinity Management in the Bureau of Reclamation - What are the sources of salinity (agricultural drainage, effluent, produced waters, industrial reject) in waters of the Western U.S., and what are the programs that address them? What are the program goals, and how do we know we are achieving them?

Josh Dickinson, *Deputy Director, WateReuse Association*

Opportunities for Private Industry in Saline Water Management - How can commercial organizations position themselves to take advantage of the need to manage salinity (i.e., desal plant construction, wetlands engineering), and deal with the impacts of managing salinity (concentrate disposal, land fallowing programs)?

Jon Freedman, *Legal Counsel, GE-Water*

Taking the Plunge Into Water Treatment
What strategic factors drove GE's move into advanced water treatment technology and services? What kinds of lessons can the public and utilities learn from GE's strategic identification process? What goals did GE establish for this line of business, and how have they done meeting them?

Sharon Green, *Legislative & Regulatory Liaison, Sanitation Districts of Los Angeles County*

Residential Salinity: Going After The Source in the Garage - A Case Study from Northern Los Angeles County - What can a community do when 75% of the chloride in its wastewater comes from the potable water supply and residential self-regenerating water softeners, and water quality regulators are requiring that chloride levels be reduced by 50%? Do rebate programs work? Can salinity be controlled via the ballot box? Will communities accept "water softener police" or will there be a customer rebellion? The Santa Clarita Valley Sanitation District in northern Los Angeles County has pursued a variety of innovative chloride reductions methods and will present a case study from which others can learn.

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11:05 a.m. - 12:20 p.m. **Challenges and Progress in Developing Brackish Groundwater as a Sustainable Water Supply**

As development of new supplies becomes more challenging, brackish groundwater resources are being identified and developed to provide sustainable municipal supplies in meeting future demands. In some instances these supplies are seen as critical resources which are becoming cost competitive with alternative supplies; while in other cases it is a resource manage-ment issue. Development of brackish groundwater for potable use poses site-specific challenges such as effective brine disposal techniques, infrastructure and resource management issues including energy consumption. The energy cost component must be considered and integrated with other resource policy issues. This panel will provide an overview of technical and policy challenges and the project successes being made in development of brackish groundwater.

Moderator - Floyd Marsh, *Manager, Water Resources, Lockwood Andrews and Newnam - Phoenix Office*

Jerry Postema, *Deputy Utility Director, City of Goodyear, AZ*

Development of Brackish Groundwater as a Sustainable Municipal Water Supply in Central Arizona

How is the City of Goodyear treating and developing local brackish groundwater as a sustainable supply for long term municipal supply? What are the key issues that are being addressed including effective treatment technologies, relative energy requirements and costs and management issues such as brine disposal?

Phyllis Stanin, *Principal Hydrogeologist and Vice President, Todd Engineers*

Hydrogeological and Technical Considerations of Deep Well Injection Project Design to Manage Brine Streams

What hydrogeological and other technical considerations influence site specific injection well design for deep brine disposal? What issues will entail data needs and interpretation, regulatory compliance with the U.S. Environmental Protection Agency's Underground Injection Control (UIC) program, installation costs, and well operation including energy requirements?

Paul Gorder, *Senior Vice President & Southwest Area Manager, CDM Engineering*

Development of Brackish Groundwater as a Sustainable Supply to Support Growth and Military Base Expansion in El Paso, Texas

What challenges were faced and addressed that allowed local saline groundwater supplies to support growth associated with expansion of a military base and the surrounding community. How were the following challenges addressed: local impacts, management of the supply and long term costs of supply options including comparative energy costs to treat and deliver alternative supplies?

12:20 p.m. - 1:45 p.m. **Luncheon Keynote Speaker**

Rolf Schmidt-Petersen, *Chief, Rio Grande Bureau, New Mexico Interstate Stream Commission - Rio Grande Salinity Coalition*

1:45 p.m. - 3:00 p.m. **Cost and Energy Consideration for Brine Handling and Disposal**

Brine management, including cost and loss of resource, is one of the most challenging issues for the implementation of desalination plants. What are the available brine disposal options and their associated costs and energy requirements? Furthermore, how do these options compare in terms of the energy requirements for localized water treatment versus imported water? An overview of emerging technologies and treatment approaches to minimize the volume of brine produced from existing water treatment plants will be presented in terms of costs, energy consumption, carbon footprint, and the impact on disposal costs.

Moderator - Andrew Sienkiewich, *Manager, Metropolitan Water District of Southern California*

Mike Mickley, Ph.D., *President, Mickley & Associates*

Economics and Energy Requirements for Various Water Treatment/Brine Management Options

What are the relative costs and energy requirements for various forms of brackish water treatment including that of brine management options? How do they compare with those of imported water supplies? With the rapid advances in membrane technology over the past few decades, the use and treatment of poorer quality water has been growing. Overall costs, however, have been increasingly dependent on brine management costs. A broad overview of options and

Conference Schedule

costs will be given. The two following presentations discuss in detail two of the options: locally available disposal lines, such as SARI (Santa Ana Regional Receptor), and ZLD technologies.

Jack Safely, *Western Municipal Water District*

Financial Aspects of Brine Line Construction and Operations

What are the specific economic data of the SARI **(Santa Ana Regional Receptor)** line in California and the financial and energy considerations of brine transport and treatment? The line has been experiencing several issues, including severe scaling precipitation of solids, biogrowth, and solids formation. What are the impacts of these issues and the potential application of brine minimization technologies on disposal economics? What are the required energy demands of disposal via the SARI line, in terms of pumping and treatment?

Tom Seacord, P.E., *Associate and Project Manager, Carollo Engineers*

Energy and Cost Implications of Brine Concentration and ZLD Treatment

What is the state-of-the-art for brine reduction treatment at both inland plants and plants along a regional brine line? Technologies include brine concentration using secondary chemical and membrane treatment, which increases overall water recoveries and reduces brine volumes, thus resulting in lower disposal costs to available brine lines. The presentation will also discuss current and emerging technologies for the ZLD treatment of water at inland utilities. Specifically, what are the costs and energy demands for all treatment approaches?

3:00 p.m. - 3:20 p.m. **Break - Poster and Reception Area**

3:20 p.m. - 5:00 p.m. **Water and Energy - Carbon Footprint and Desalination**

Critics point out that desalting plants use a lot of energy, increasing greenhouse gases and speeding global warming. But are all desalination technologies energy hogs? This session will explore water purification treatments with a smaller carbon footprint, including some that are on the cutting edge of use.

Moderator - Val Frenkel, *Director, Membrane Technologies, Kennedy/Jenks Consultants*

Alan Zelenka, *Energy Services Leader, Kennedy/Jenks Consultants*

The Water-Energy Carbon Nexus and Climate Action Plans for Desalination Plants - Using the Carlsbad Desalination Plant as a case study, a systematic framework for creating a Climate Action Plan is described.

John Larson, P.E., *Vice President, Renewable Power Program Manager, HDR Engineering*

Renewable Energy Matched to Water Treatment - Desalination in a Carbon Constrained World

Traditional Energy production uses large quantities of water while desalination uses large quantities of energy. Considering Global Warming - Producing clean water without increasing carbon emissions and producing energy without increasing water are the clear challenge of the climate/energy age. The presentation will provide an understanding of both energy production and desalination with the objective of moving forward with the idea while dealing with the reality of the limitations. Much like investments, a portfolio of solutions and investments over time can provide the desired outcome.

Gary Darling, *General Manager, Delta Diablo Sanitary District*

Sustainable Resource Development and Delta Protection - Several San Francisco Bay Area public utility agencies are developing sustainable water and energy resource projects from what used to be "waste" streams. Learn how to make and to preserve energy from the "waste".

5:15 p.m. - 7:30 p.m. **Networking Reception and Poster Session**

Friday, January 16, 2009

8:30 a.m. - 10:15 a.m. **The Future of Desalination- A Town Hall Meeting**

An overview of the recent National Academy of Science report *Desalination: A National Perspective* will be presented. We will discuss the recommendations of the Acadamies with the following questions in mind: (1) What should the role of government and the national laboratories be in enabling the future of desalination? (2) What should the role of industry be in enabling the future of desalination? (3) How do we best coordinate activities of both to achieve the biggest payoff for the future?

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Moderator - Travis Huxman, Ph.D, *Director, Biosphere 1 and Biosphere 2, University of Arizona*

Eric Sapirstein, *President, ENS Resources*
What to Expect with the New Administration

John O'Donnell, *Murray, Scheer, Montgomery, O'Donnell*
What to Expect with the New Administration

Mark Beuhler, *Former Assistant Director, Coachella Valley Water District, Section Manager/West Region Desalination Lead, HDR Engineering*
Agency Perspective

Mike Gabaldon, *National Technical Director, Bureau of Reclamation*
Bureau of Reclamation Perspective

Mark Rigali, *Manager, Geochemistry Department, Sandia National Laboratories*
Sandia Perspective

Stephanie Johnson, *National Committee of Sciences Desalination Report*
NAS Report - Overview of Report

10:15 a.m. - 10:30 a.m. **Break - Poster and Reception Area**

10:30 a.m. - 11:45 a.m. **Energy & Water - Finding the Balance**

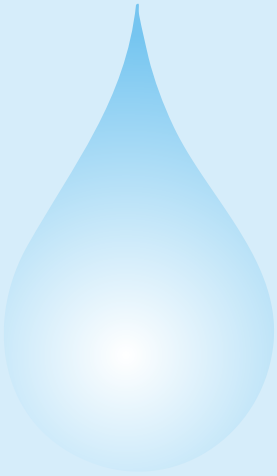
Energy and water are inextricably entwined - even the earliest "water treatment" in the 4th Century BC depended on the energy from fire to boil water for distillation. Today, we use energy-intensive technologies to produce large volumes of water, and large volumes of water to produce gigawatts of energy. How can we balance our consumption of energy and water in their mutual production? Do we let the market prioritize the generation/consumption of these resources? Or do we assign a national priority to water/energy generating needs, and align production to meet those needs? How does sustainability fit in? This session will provide some thought-provoking ideas on the topic.

Moderator - Mark Rigali, *Manager, Geochemistry Department, Sandia National Laboratories*

Ron Pate, *Principal Member of Technical Staff, Sandia National Laboratories*
Impacts of Bio-Fuels Generation Have on Salinity Management
Do domestically-produced biofuels have the potential to reduce U.S. reliance on imported petroleum, contribute to rural economic development, and provide environmental benefits through reduced greenhouse gas emission? What are the overall benefits and impacts of biofuels? What are the promises and challenges for biofuels from the perspective of water use and salt management?

Andrea McNemar, *Project Manager, Existing Plants Division, National Energy Technology Laboratory*
Department of Energy/National Energy Technology Laboratory's Power Plant Water R&D Program
Will water availability issues become more acute in many regions of the country due to the large amount of cooling water currently required for current and future power generation, and increased water demand expected with the addition of carbon capture systems? How is the Department of Energy's National Energy Technology Laboratory addressing these issues? What four concepts or technologies may reduce freshwater withdrawal and consumption by conventional and advanced fossil-based power systems?

11:45 a.m. - Noon **Closing Comments and Adjourn**



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Poster Presentations

Seawater Desalination in the San Francisco Bay
Bob Castle, Val Frenkel, Ph.D., Tom Pankratz, and Todd Reynolds

Panoche Drainage District Pilot Testing Zero Discharge Solutions For Agricultural Drainage Water
Dennis Falaschi, Panoche Drainage District, Joe McGahan, Summers Engineering
and Richard Chmielewski, Separation Processes Inc.

Why Gamble With Your Future? Go Membranes
Val S. Frenkel, Ph.D., Kennedy/Jenks Consultants, Fred Goldman, Ph.D.,PE, Kennedy/Jenks Consultants,
Shawn Bradford, City of Goodyear, Paul Hendricks, EUSI

The Comprehensive Energy Services Master Enabling Agreement (CESMEA)
Michael Gauthier, AECOM Energy Services

Feasibility Study of a Regional Concentrate Conveyance Facility in San Diego
F. Cesar Lopez, Jr., San Diego County Water Authority

Verifying the Use of Specific Conductance as a Surrogate for Chloride in Saltwater Matrices
Bill Mann, In-Situ Inc.

Opportunities for Desalination of Brackish Groundwater in Arizona
Edwin McGavock, Errol L. Montgomery & Associates

Underground Injection Wells for the Disposal of Drinking Water Treatment Residuals
Chi Ho Sham, Ph.D., The Cadmus Group, Inc.

Seawater Desalination Current trends, Energy Optimization and Emerging Technologies
Srinivas (Vasu) Veerapaneni, Sunny Wang & Rick Bond Black & Veatch

Water Recovery Limitations during RO Desalination of CAP Water
Dongxu Yan, Umur Yenal, James Lykins, Ornella Nkurunziza, Robert Arnold, Wendell Ela,
Chemical and Environmental Engineering, University of Arizona, Tucson, AZ

Vibratory Shear Enhanced Processing (VSEP®) for Minimizing Water Brine from Reverse Osmosis (RO) Treatment of CAP Water
Umur Yenal, Ph.D., Department of Chemical and Environmental Engineering, University of Arizona

Pilot Testing of Zero -Liquid Discharge Technologies Using Brackish Groundwater for Inland Desert Communities -
Andrew Wiesner, Carollo Engineers, Adam Zacheis, Ph.D., Carolla Engineers, Graham Juby, Carollo Engineers,
Tom Mulvihil, Indian Wells Water District, Renee Morquecho, Indian Wells Water District

Poster Presentations

Seawater Desalination in the San Francisco Bay

Authors:
Bob Castle, Val Frenkel, Ph.D., Tom Pankratz, and Todd Reynolds

The use of seawater desalination to supplant traditional fresh surface and groundwater sources is increasing around the world. Although the Marin Municipal Water District (MMWD) in Marin County, California is currently meeting its water needs with reservoirs and water imported via pipeline from the Russian River, the District recognizes that it would experience significant problems during periods of less than average rainfall. Preliminary studies have concluded that seawater desalination could be a secure, long-term source of fresh water and that reverse osmosis (RO) is the most cost-competitive method of desalting the estuarine waters of San Francisco Bay.

As a result of their investigation, the District has undertaken a 9-month pilot test program to establish technical, engineering, environmental, and budgetary information required to reach an informed decision on how best to implement seawater RO (WRO) desalination in the San Francisco Bay. The scope of the study comprises conducting pilot trials to evaluate the relative performance of various pre- and post-treatment systems and to define RO design requirements. Tests will also be conducted to compare multiple RO membranes from three different suppliers. All of the data collected will be used to develop capital and operating costs of one or more full-scale facilities.

The northern San Francisco Bay is a complex estuarine water body that is influenced by the ocean, rivers, and bay discharge, all affecting water quality on a diurnal and seasonal basis. Flood tides increase Bay salinity and ocean-borne phytoplankton and zooplankton populations, while ebb tides in combination with fresh water inflow can introduce organic sediment and increase turbidity values. Mixing induced by tidally influenced flows and wind can disrupt stratified water and re-suspend solids, complicating pretreatment. Because of these varying water quality conditions, pretreatment optimization will be the focus of the study. The relative performance of two submerged microfiltration/ultrafiltration (MF/UF) pretreatment systems will be compared to the results obtained with a conventional treatment using clarification and granular media filtration.

The pilot test program will also include a comprehensive public outreach campaign to inform the citizens of the progress and results of this pilot study project. The population of Marin County is well-educated, affluent, and unusually well-informed. San Francisco Bay is known to contain trace levels of anthropogenic compounds, including endocrine disruptors, pharmaceutically active compounds, personal care products, and industrial contaminants that have caused considerable concern among local residents. In addition to the "classic" environmental concerns regarding concentrate disposal and disruption of local marine life, the public is particularly interested in the effectiveness of treatment processes in removing these emerging compounds from their new potential source of drinking water. It is expected that the success of the pilot study may hinge on the forging of an effective partnership between the citizens of the County and the MMWD.

This paper will present the design issues considered throughout the selection and testing of the system, including a review of the pilot test protocol, specific test objectives, and the results and operating data obtained from the MF/UF and RO systems. An overview of the public outreach program will also be presented.

Poster Presentations

Panoche Drainage District Pilot Testing Zero Discharge Solutions For Agricultural Drainage Water

Authors:
Dennis Falaschi, Panoche Drainage District, Joe McGahan, Summers Engineering
and Richard Chmielewski, Separation Processes Inc.

The Panoche Drainage District (PDD) is the sponsoring agency responsible for implementation of part of the Westside Regional Drainage Plan developed to address water quality issues related to the discharge of agricultural drainage water from the Grassland Drainage Area. The Grassland Drainage Area comprises approximately 100,000 acres of productive farmland on the west side of the San Joaquin Valley in Fresno and Merced Counties of California. Drainage water from this area is known to contain high total dissolved solids (TDS) concentrations greater than 15,000 mg/l as well as elevated levels of selenium, boron, alkalinity, nitrate, chlorides, sulfate and other salts as well as organic contaminants.

The concentration of selenium limits the possible discharge options for disposal of agricultural drainage water from the area. Current discharges containing selenium, which ultimately reach the San Joaquin River, will be limited in the future. Concentrations of boron also limit reuse options, due to boron sensitivity of many crops. The high salinity, selenium and boron as well as other constituents in the drainage water pose a significant challenge for treatment technology considerations.

The State of California has provided funding for the PDD Pilot Testing Project under its Proposition 50 program. The Project is being implemented to pilot test technologies which will allow for beneficial reuse of the drainage water and incorporate zero or near zero liquid discharge.

This poster presentation will outline the technology selection process and the extensive evaluation of the many proposed technologies for treating the agricultural drainage waste. The presentation will discuss the Request for Qualifications which was developed for this project to solicit proposals for this pilot testing program. The drainage water quality will be discussed along with desired treated water quality. An engineering evaluation matrix which was used to rate the proposals will be provided and several of the innovative technology solutions will be presented. Proposed solutions involved biologically based treatment options, thermal evaporative techniques and membrane based technologies.

Selection of pilot test contractor has been made and pilot test protocol is being developed in anticipation of a one year pilot test program to start in 2009. Project schedule and testing objectives will be provided.

Poster Presentations

Why Gamble With Your Future? Go Membranes

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Salinity Management for Inland States: Goodyear Project

Membrane technologies are becoming the standard in water, wastewater, and water recycling programs and projects. Reverse Osmosis (RO) is one of the basic membrane technologies used to remove salts and other contaminants from source water while preparing high quality potable water. Based on the salinity level in the feed water, there are two major types of RO technologies:

- Sea Water RO (SWRO) - when the salinity level or Total Dissolved Solids (TDS) in the feed water are > 10,000 mg/l
- Brackish Water RO (BWRO) - when the salinity level or Total Dissolved Solids (TDS) in the feed water are < 10,000 mg/l

While producing high quality effluent, RO technologies concentrate salts and other contaminants in the reject stream, commonly called concentrate and/or brine. Success or failure of the RO project very much depends on how this concentrate/brine can be managed. RO concentrate contains an increased concentration of salts, which makes it difficult to discharge and/or handle. For ocean/sea shore projects, most of the solutions employ a number of different brine management approaches using ocean/sea sanctuary water with relatively high TDS levels. For example, the average salinity of the Pacific Ocean along the shores of California contains TDS ~ 33,500 mg/l.

What would be the solution for inland States, where no large pools of high TDS water are available for discharging the concentrate/brine? The Goodyear City project is an example of such a solution.

The City of Goodyear is using RO to reduce the TDS level in the well source water to achieve potable water with TDS < 750 mg/L. As RO operates at 85% recovery, 15% of the feed flow ends up in the concentrate with TDS in the range 10,000 mg/l. The concentrate is currently being discharged into the wastewater treatment plant. As the City grows there is concern that the brine will adversely impact the wastewater treatment plant.

This paper summarizes the technical approach used to review water chemistry using specific ion concentrations and ratios to achieve the best results. The work includes establishing a water balance to estimate the amount of brine, calculating evaporation to consider evaporation pond alternatives, studying secondary RO to decrease the volume of the brine, and reviewing crystallizers to obtain a dry residue for disposal in landfills.

This paper will help engineers, consultants, end users and others better understand how to approach the management of brine from RO treatment of brackish water. This concept can be very useful for the inland "dry" States such as Arizona, Nevada and others.

Poster Presentations

The Comprehensive Energy Services Master Enabling Agreement (CESMEA)

Author:
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Many states, like California, have mandates for improved energy usage. In our state it is the Governor's Executive Order S-20-04 which calls for the state to commit to aggressive action to reduce state building energy usage by building and retrofitting facilities to achieve the most energy and resource efficient buildings by taking all cost-effective measures described in the Green Building Action Plan for facilities owned, funded or leased by the state and to encourage cities, counties, and schools to do the same. And that state agencies, departments, and other entities under the direct executive authority of the Governor cooperate in taking measures to reduce grid-based energy purchases for state-owned buildings by **20% by 2015**, through cost-effective efficiency measures and distributed generation technologies; these measures should include but not be
limited to:

- Designing, constructing and operating all new and renovated state-owned facilities paid for with state funds as "LEED Silver" or higher certified buildings; and
- Identifying the most appropriate financing and project delivery mechanisms to achieve these goals.

California State University (CSU) in support of state mandates made a commitment to improve campus-building performance and achieve the lowest environmental impact feasible, by continuing to practice responsible stewardship using available resources. The Chancellor's Office Plant, Energy and Utilities group, working with the Contract Services and Procurement, General Counsel and the Finance and Treasury departments, developed a program to enable CSU campuses to aggressively seek and implement utility conservation opportunities. The Comprehensive Energy Services Master Enabling Agreement (CESMEA) program provides campuses with a cost effective, efficient delivery system to promote the development of utility and infrastructure improvement projects to lower operating costs, reduce deferred maintenance backlog and compliment CSU's sustainability initiatives. The CESMEA is designed to streamline project assessment, development, construction and implementation of utility and infrastructure improvements, while enabling timely responses to executive initiatives, grant and incentive programs by having a prequalified group of Energy Service Companies (ESCO's) available to each campus under a Master Enabling Agreement (MEA). The MEA Agreements were signed in 2005 with each of the ESCO's and already 21 campuses are participating in this program.

San Bernardino was the first major campus to upgrade their utility infrastructure and utility efficiency under this innovative CESMEA Program for energy services. AECOM Energy Services assisted CSUSB in reducing its carbon footprint of the campus in many ways. Under this project, AECOM expanded the existing central chiller plant to include two new 1200-ton efficient electric centrifugal chillers, added a 1-million gallon thermal energy storage tank, new cooling towers, the required ancillary equipment, and variable frequency drives in the both the central plant and other campus buildings. An additional campus improvement was reducing the use of potable water through water efficiency retrofits resulting in over a 50% reduction in potable water usage. Additionally, AECOM Energy also implemented water substitution through the drilling of an on-campus well capable of producing more than 1,600 gallons per minute. A new irrigation and well water distribution system that uses the campus well water to irrigate athletic fields and other landscaping vegetation was designed and implemented as well. The substitution and efficiency improvements combined greatly reduced purchased potable water from the City of San Bernardino. The combination of electric and natural gas usage reduction at this facility as a result of this project equates to a reduction of approximately 2,500 metric tons of CO_2 emissions per yearthe equivalent to removing 600 cars from the road or planting 120,000 trees.

In summary, for the first projected year of the energy project, savings goals for electrical energy consumption were exceeded by 22%, and electrical energy cost savings were exceeded by 21%. The combined the overall energy cost savings were $653,900 per year.

AECOM Energy Services proved its expertise on campus. Our CSUSB client is proud of the results achieved and is a champion of AECOM Energy both within the CSU System as well as for the entire State of California. We have become known for our professionalism, client responsiveness, and speed of execution. The success on this project demonstrated the firm's capabilities and led to more than $100 million in new business and securing 10 CSU locations out of a possible 24 CSU location - despite six competitors for each project.

Poster Presentations

Feasibility Study of a Regional Concentrate Conveyance Facility in San Diego

Author:
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The San Diego County Water Authority (Water Authority) is a public agency serving the San Diego region as a wholesale supplier of water. Continued development of local, reliable and high quality water supplies is essential to lessen the region's dependence on imported water. The Water Authority, in collaboration with its south County member agencies, the City of San Diego, Otay Water District, and the Sweetwater Authority, is investigating the feasibility of implementing a regional concentrate conveyance project in southern San Diego County to transport brines from a variety of sources throughout southern San Diego County to the South Bay Ocean Outfall (SBOO) for environmentally sound ocean discharge. Construction of a regional concentrate conveyance facility (brine line system) could facilitate the development of additional brackish groundwater and recycled water supplies in San Diego County and could potentially reduce or eliminate impacts and discharges from current concentrate management practices. This Feasibility Study has identified various potential municipal, industrial, and institutional system users and determined their expected contribution to the proposed concentrate conveyance system to be between 12.9 mgd and 13.3 mgd. The SBOO has sufficient design capacity (333 mgd under pumped conditions) to accommodate flow from the proposed concentrate conveyance system since the current combined flow through the SBOO is at 10 percent of design capacity. The City of San Diego and the International Boundary and Water Commission (IBWC), the owners of the SBOO, understand the purpose and need for the proposed concentrate conveyance system and support the concept of utilizing the SBOO for concentrate management. Preliminary conveyance system alternatives were identified, including pipeline sizes, alignments, and system configuration. Coarse screening of these alternatives was conducted and three alternatives were evaluated in more detail, including the development of hydraulic models and preliminary cost estimates. For this Feasibility Study, eight decision criteria were identified by the agencies: right of way/easements, permitting, utilities, constructability, capital cost, operation and maintenance cost, traffic/public impacts, and environmental impacts. In order to determine the relative weights of the eight decision criteria, the client agencies participated in a weighting exercise known as "forced pair comparison" that simplifies the comparison of numerous planning criteria by allowing a decision maker to assign the relative importance to two criteria at a time. This relative comparison is performed for all the possible pairs of criteria, and the results can be aggregated using simple algorithms to determine the overall relative importance of every criterion. Analysis of institutional issues also occurred which included discussions with stakeholders regarding ownership, payment terms, permitting, rate setting, and enforcement of operation of a regional concentrate conveyance pipeline.

Poster Presentations

Verifying the Use of Specific Conductance as a Surrogate for Chloride in Saltwater Matrices

Author:
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Salinity management of surface water and groundwater is critical for domestic, industrial, and agricultural water supplies. Desalination plants monitor chloride concentration of reverse osmosis (RO) product water and brine discharges. Coastal groundwater supplies, when overused, are particularly vulnerable to chloride contamination due to their close proximity to saltwater. Rather well-defined relationships of specific conductance (SC) to chloride exist (Hem 1992; Christensen et al. 1999).

Due to the inherent measurement challenges of chloride ion-selective electrodes (ISEs) and the high cost of laboratory chloride analysis by ion chromatography (IC), a viable field method for estimating chloride values in continuous monitoring applications is needed. To validate the relationship between SC and chloride, SC measurements by electrochemical conductivity cells and chloride concentration measurements by ISE were determined for 35 PSU OSIL Atlantic Seawater Standard and 10 dilutions at six different temperatures (66 unique samples). Chloride is a reliable reference or a chemically conservative constituent and is used to characterize salinity in water samples. When monitoring water supplies, chloride values are preserved even when collecting data some distance away from the source and are least affected by travel from the source to points further downgradient.

A strong linear relationship was established, thus demonstrating the validity of using SC as a reliable surrogate for chloride estimation. This study also compared measurement drift of a chloride ISE and a conductivity sensor under controlled laboratory conditions. Minimal drift of the conductivity sensor coupled with a large drift of the chloride ISE demonstrates a significant advantage of using conductivity sensors for water quality checks, long-term monitoring, and field deployments.

Poster Presentations

OPPORTUNITIES FOR DESALINATION OF BRACKISH GROUNDWATER IN ARIZONA

Author:
Edwin McGavock, Errol L. Montgomery & Associates

Desalination of brackish groundwater is integral to Arizona's future water supply. Recognizing that fact, the Central Arizona Water Conservation District, who administers the Central Arizona Project (CAP) to acquire and convey renewable supplies to existing and emerging Arizona population centers, has embarked on a program to identify and prioritize groundwater basins where desalination is most feasible.

Brackish groundwater is defined here as containing 1,000 to 10,000 milligrams per liter (mg/L) total dissolved solids (TDS). More than 600,000,000 acre-feet of brackish groundwater are estimated to be stored in Arizona aquifers, generally at depths of less than 1,200 feet. More than 1 billion acre-feet of brackish groundwater are estimated to be stored in New Mexico's aquifers (New Mexico State Engineer, 2004).

Brackish groundwater is found throughout Arizona, as indicated by maps prepared by Daniel (1981). Evaporite deposits are responsible for most salinity in northern Arizona groundwater, particularly in the Coconino Sandstone aquifer, which furnishes most of the water for public supply and electrical power generation in northern Arizona. Evaporative concentration of water through multiple agriculture irrigation cycles is primarily responsible for brackish groundwater in southern Arizona, although evaporites are also a factor in southern Arizona basins such as Safford, Picacho, and the West Salt River.

Dozens of brackish groundwater areas exist in Arizona; however, only a limited number have sufficient brackish water in storage to be of current interest for desalination. The area extending from the Picacho basin near Eloy, along the Gila River into the Yuma area, is of interest because desalination could replace current or future CAP uses, augment CAP deliveries to the Tucson area, and possibly mitigate waterlogging in the Buckeye and Yuma areas. In addition, the Safford basin is promising for desalination, if an end use for fresh water supplies can be identified. The Wilcox basin is also believed to have desalination potential, and could serve to augment supplies near Sierra Vista.

Perhaps the most extensive brackish and saline groundwater resource in the state exists in the Coconino Sandstone aquifer of the Little Colorado River (LCR) basin, both on and off of the Navajo and Hopi Reservations. Desalinated Coconino aquifer water could be used to augment supplies for the City of Flagstaff, provide drinking water for many Native American communities, and serve the needs of several existing electrical generating plants in the LCR basin. Not only is there a potential for future co-location of power and desalination plants in this area, but the deep saline aquifers of the LCR basin are also amenable to sequestration of carbon dioxide generated from new and existing coal-fired power plants. Montgomery & Associates is currently providing technical support to a team of stakeholders as they implement pilot sequestration investigations at a site near Holbrook, Arizona. The saline aquifers also offer injection targets for desalination brine waste.

Electrical power demands in Arizona are forecast to increase by about 1,000 megawatts per year in the future. Meeting this demand using coal-fired, gas-fired, nuclear, or solar-trough technology will require an additional 18,000 to 20,000 acre-feet of water per year. Desalination of brackish groundwater would provide Arizona with an opportunity to expand its' role as a traditional power generating state and become a key player in the renewable energy market without impacting the state's finite fresh-water supplies.

A major impediment to desalination in Arizona is the current classification of even the most saline groundwater supplies in the state as "Drinking Water Aquifers". Because injection into deep, saline aquifers is often the best, or only, feasible method of brine disposal, utilization of the significant brackish groundwater resources in the state will require restructuring of the regulatory framework.

Poster Presentations

Underground Injection Wells for the Disposal of Drinking Water Treatment Residuals

Author:
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Drinking water systems use a variety of treatment processes to remove contaminants from the water they produce for consumers. Many of these treatment processes produce liquid wastes (residuals). Treatment facilities may also produce liquid residuals indirectly when dewatering slurry or sludge, which are semi-solid wastes. These liquid drinking water treatment residuals (DWTRs) may be candidates for disposal by underground injection. In a number of states, water systems already employed underground injection to dispose of liquid DWTRs in an economically viable and environmentally safe manner. In the coming years, it is expected that there will be an increase in interest in DWTR disposal via underground injection. This is due to the increasing popularity of advanced technologies that produce relatively large volumes of liquid waste, along with the increasing use of marginal source waters, and the limitations imposed by various environmental programs on other disposal options.

Five drinking water treatment processes that concentrate contaminants in liquid residuals are discussed in this paper and they are: granular bed filtration (e.g., conventional and direct filtration), membrane separation, ion exchange, activated alumina adsorption, and granular activated carbon adsorption. Water systems have several options for disposing of liquid residuals, including direct discharge to surface water, discharge to sanitary sewers, spray irrigation, or underground injection. There are regulatory requirements associated with each of these options, including recycling. The volumes of liquid residuals generated and their chemical compositions are important considerations for DWTR disposal. These characteristics depend on the chemical make-up of the source water, the volume of water treated, the treatment technologies employed and treatment goals, and operational factors such as the frequency of backwashing. The types of chemical constituents and contaminants potentially found in liquid DWTRs are numerous and include metals, salts, dissolved organics, disinfection by-products, and microbial contaminants.

Some of these constituents might pose a threat to underground sources of drinking water (USDWs) if they are present in injected DWTRs. For example, arsenic, barium, cadmium, chlorine, chromium, fluoride, mercury, nitrate, selenium, and combined radium 226/228 have been detected in DWTRs in concentrations that exceed federal Maximum Contaminant Levels (MCLs). Microbial contaminants, lead, and copper, which have treatment technique requirements in lieu of numeric MCLs, were also detected. This purpose of this paper is to evaluate technical and regulatory issues regarding the use of underground injection wells for the disposal DWTRs.

Poster Presentations

Seawater Desalination Current trends, Energy Optimization and Emerging Technologies

Authors:
Srinivas (Vasu) Veerapaneni, Sunny Wang & Rick Bond Black & Veatch

With the available fresh water sources already over-allocated, many regions facing the need to meet the ever-increasing demand are considering use of previously untreatable (economically) supplies to diversify their portfolio. Invariably, treatment of many such sources requires advanced technologies such as desalination. One of the major obstacles of implementing desalination processes is their cost both capital and operating cost. The operating cost is typically dominated by energy consumption. For instance the energy consumption of a seawater RO plant is in the range of 12 to 15 kWhr/kgal depending on the salinity and temperature. Even for brackish water desalination and wastewater reclamation applications, the energy cost accounts for a significant part of the operations budget and is highly dependent on salinity, system design and membranes used. With the implementation of these energy intensive treatment processes, many utilities are also considering their impact on the environment. As these advanced processes consume more energy, the carbon footprint of these processes also increases. Given this water-energy nexus, utilities are taking pragmatic approach in addressing environmental impact of new technologies that are treating increasingly saline water sources. This presentation will be of two parts, focusing both on energy consumption and supply for these advanced processes.

Energy efficient desalination facility design and optimized operation: Although currently there are numerous desalination facilities treating various source waters, there is no consolidated information on the typical use of energy, and factors affecting it (both design and operating parameters). In addition, due to significant developments in desalination technology in recent years, high degree of energy consumption optimization is possible, using existing and commercially available technologies. In particular, there are several utilities that were built decades ago and have recently been upgraded using newer membranes and other equipment, resulting in significant energy savings. To investigate such opportunities and to investigate potential means of improving energy efficiency in new facilities, AwwaRF and California Energy Commission (CEC) have recently funded a study titled "Desalination Facility Design and Operation For Maximum Energy Efficiency" Preliminary results from project will be presented. In particular, results from the following tasks of the project will be presented - literature review and survey results that focus on energy aspect of desalination.

Current state of renewable energy sources for water treatment, with emphasis on desalination: Despite optimized design and operation, desalination processes are energy intensive, compared to conventional treatment of traditional water sources such as surface water. To reduce the carbon footprint of these desalination facilities, several utilities are considering use of renewable energy sources. In recent years, the use of renewable energy is expanding rapidly due to a combination of market and political forces. In this part of the presentation, a brief overview of current state of availability of renewable energy sources is presented. This includes energy from wind, solar, solar thermal, geothermal and ocean (both wave and currents). Evaluation of these various energy sources with respect to current technical feasibility at a scale needed for desalination process, and costs will be presented. Finally, current use of these energy sources in desalination, albeit limited, will be presented. As an example, the seawater desalination facility in Perth uses wind energy to negate the carbon footprint of the desalination facility, that consumes as much as 190 Gwh per year.

Poster Presentations

Water Recovery Limitations during RO Desalination of CAP Water

Authors:
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By year 2010, 60% of the water demand in Tucson, Arizona will be satisfied by Colorado River water delivered via the Central Arizona Project (CAP) canal. Because of its salinity, CAP water will require reverse osmosis (RO) desalination followed by residuals salt management. Without salt management steps, CAP water deliveries will add 200,000 300,000 tons of salts to Tucson soils and ground water each year. Among the significant costs of RO treatment is the value of water lost as brine. Current RO recovery is limited to 75-80% for CAP water due primarily to precipitates formed from hardness ionsbarium and calcium. If all CAP water were RO treated under these conditions, the value of water lost would be on the order of $15M/year. A pilot-scale RO plant and parallel bench-scale investigations have been conducted for the past three years to investigate the factors limiting water recovery during RO treatment of CAP water. Laboratory plate and frame membrane reactor studies were conducted to determine membrane scaling by the suspected limiting salts in CAP water (e.g. barium sulfate, calcium sulfate, calcium carbonate). The efficacy of commercial antiscalants to delay the onset of scaling was then studied. Finally, autopsies were conducted on membranes from the field site after their water permeation had degraded to the point where they required replacement. Neither barium nor calcium was observed to be in abundance on the spent membranes, while clay was observed as the dominant fouling agent. The results suggest that clay may play a crucial role in early membrane failure and that antiscalants may not provide the benefits expected. These observations match results in laboratory trials where little scaling was observed at concentrations up to 120 times the salt's solubility ($14400 x K_{sp}$) limits. The presentation will report on additional membrane autopsies performed on spent membranes when the RO is operated at 85% recovery, as well as when membranes are fouled/scaled in parametric bench-scale studies.

Poster Presentations

Vibratory Shear Enhanced Processing (VSEP®) for Minimizing Water Brine from Reverse Osmosis (RO) Treatment ofCAP Water

Author:
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The value of water in southwestern cities is such that applications of unit operations for water recovery that were previously not cost effective are now widely considered. Based on willingness to pay, the marginal value of water in southern Arizona may be as high as $4000/AF. Consequently, extraordinary efforts to minimize brine wastes derived from RO treatment of CAP water are justified. Among the promising methods for recovering additional water from RO brines is the Vibratory Shear Enhanced Processing (VSEP®, New Logic Inc.), which induces intense shear waves at the VSEP membrane surfaces to avoid fouling and scaling during post-RO treatment of brine. The efficiency / limitations of this technology for the wholesale treatment of CAP brines have not been previously established.

Here we investigate the effect of operational parameters of VSEP (cycle time and pressure) on water recovery (from RO brine), permeate flow rate and overall process economics. Results will be used to assess the economic viability of VSEP as a post-RO water recovery process in southern Arizona and to comment on the feasibility of the technology for minimization of brine volume/water loss for salt management in the region. A pilot-scale VSEP unit is located at the Tangerine Road Field Site for this study. The project should yield findings that are generally applicable to all communities facing salt management difficulties.

Poster Presentations

Pilot Testing of Zero -Liquid Discharge Technologies Using Brackish Groundwater for Inland Desert Communities

Authors:
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In response to greater demands for potable water in the Indian Wells Valley Water District (IWVWD) service area, the IWVWD identified desalination of brackish groundwater as a potential new source of water. However, given the District's geographical location on the edge of the Mojave Desert, membrane desalting would ultimately require a zero liquid discharge (ZLD) treatment system since brine disposal options do not exist. To determine if desalination is a viable option, a piloting project was performed including the evaluation of ZLD technologies. Pilot testing included brackish water treatment with reverse osmosis (RO) and electrodialysis-reversal (EDR) treatment of RO concentrate. The objectives of this study were to demonstrate the feasibility of RO primary desalting and EDR secondary desalting, show the primary RO process can operate on the groundwater with minimal membrane fouling, and evaluate the effectiveness of a reversible RO configuration for reducing membrane fouling tendencies and the ability to operate at higher recovery levels. This presentation will include an overview of the pilot test results and a discussion of their effects on the cost of ZLD technologies.

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