

EXPERT BIOFOULING CONTROL OF SEAWATER RO SYSTEMS



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Courtesy Photos: Perth Desalination Plant, RAWEC, Tampa Bay Water, Siemens

Who Should Attend

Anyone requiring, or desiring, expert knowledge on biofouling control of water treatment systems, but specifically of seawater reverse osmosis (SWRO) systems. The information learned, however, applies to all surface water RO plants, whether fresh, brackish or seawater.

Why You Should Attend

Biofouling continues to be the single biggest challenge with operating RO systems on many surface waters (fresh, brackish and seawater) and some ground waters. It's typical that these systems experience a higher requirement for chemical cleaning, which frequently results in shortened membrane life plus associated higher operating and maintenance costs. There have been several important discoveries during the past few years of which you should be aware.

This course will give valuable, practical information unknown to most water treatment personnel. Most of DHP's consulting over the past 20 years has been in the area of managing biofouling. The instructor will discuss actual case studies during this seminar.

What You'll Receive

- 8 hours of interesting, easy-to-understand expert biofouling control training
- 8 hours of the latest in multimedia training including 3-D animations
- A highly illustrated workbook
- Break refreshments

Instructors



David Paul is the author of over 150 published articles on membrane water treatment, has developed and administers a 4,000 page correspondence training program on advanced water treatment, and has created and administers on-campus Associate Degree in Advanced Water Treatment programs at four different locations in the United States. David is the President of David H. Paul, Inc. (DHP), an advanced water treatment training and consulting firm located in the USA. DHP has trained over 16,000 water treatment professionals worldwide since 1988.



Bill Dees provides water treatment training and consulting services for David H. Paul, Inc. (DHP). He has over 18 years of design, installation, operation, maintenance, troubleshooting, training and consulting experience of water treatment systems including membrane, ion exchange, pretreatment and post-treatment equipment. Bill is also the Technical Services Manager for DHP, responsible for membrane module autopsies and consulting. Bill holds an Associate of Applied Science Degree in Industrial Water Treatment from San Juan College, DHP's first on-campus, college degree program.

EXPERT BIOFOULING CONTROL OF SEAWATER RO SYSTEMS

Overview of Topics

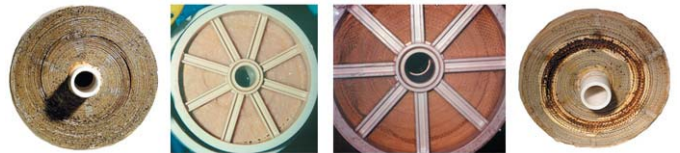
- Overview of bacteria
- Surface water characteristics that promote biofouling
- Where & How Membrane Biofouling Occurs
- Design & Operational Schemes That Promote Biofouling
- Options for Controlling Biofouling
- Biofouling Case Studies
- Attendees' Process Flows and Biofouling

What You'll Learn

- Expert understanding of bacteria
- What aspects of your feed water and pretreatment promote biofouling
- The latest in pretreatment to minimize biofouling
- Design considerations that minimize biofouling
- What aspects of your operation and maintenance promote biofouling
- Operation and maintenance to minimize biofouling
- The latest techniques in monitoring biofouling
- The latest options to control biofouling

Certificate of Completion

Each attendee will receive a DHP certificate of completion following the seminar.



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What Others Say About DHP Training Seminars

DHP has trained over 16,000 water treatment professionals worldwide since 1988. Trainees include industrial, governmental and drinking water clients. The average rating given by attendees for all DHP seminars, including this one, is over 9 (on a scale of 1-10, with 1 being a terrible rating and 10 being an outstanding rating).

The following are typical comments from attendees of DHP Seminars:

“Your lectures help a lot in the operation of the RO system. We can apply all the knowledge we learned from you!”

Luisito Agua - Plant Shift Leader
RAWEC - Saudi Arabia

“The workshop’s are excellent, they actually make you think. You also cover things very thoroughly.”

Cory Wirth - Technical Service
Osmoflo - Australia

“After 15 years in the industry, this class filled many holes gained from being self taught.”

Scott Risser - Senior Chemical Engineer
Tucson Electric Power - Springerville, AZ

“Excellent Training!”

Daniel Barge - Municipal Water Treatment
Brazos River Authority - Granbury, TX

“Great Class!”

Martin Rocks - Maintenance Technician
Tropicana Products

EXPERT BIOFOULING CONTROL OF SEAWATER RO SYSTEMS

Detailed Agendum

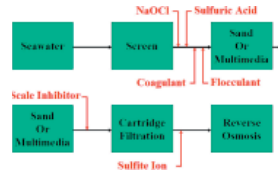
7:45 Refreshments (Provided)

8:00 **Introductions**

Workshop 1: Process flow and current biofouling at each attendee's plant

Overview of bacteria

- Structure,
- Food
- Aerobic
- Anaerobic

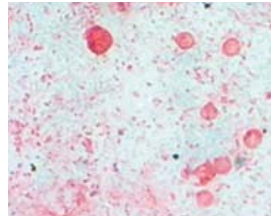


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9:00 **Break (Refreshments Provided)**

9:15 **Overview of bacteria**

- Reproduction
- Ideal Conditions
 - pH, temperature
 - AOC, trace nutrients, oxygen
 - Turbulence
- Heterotrophic Plate Counts
- Zeta Potential
- Gram Stain



Surface water characteristics that promote biofouling

- TOC (Total Organic Carbon)
- DOC (Dissolved Organic Carbon)
- AOC (Assimilable Organic Carbon)
- Humic Acid Compounds
- Inorganic nutrients
- Temperature



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10:15 **Break (Refreshments Provided)**

10:30 **Where & How Membrane Biofouling Occurs**

- Initiating requirements
- Seeding
- Growth
- Steady state
- Non-steady state

Design & Operational Schemes That Promote Biofouling

- Equipment
- Process
- Operations
- Maintenance

Workshop 2: Evaluating the biofouling potential of different feed waters and process schemes

11:30 **Lunch (Not Provided)**

12:30 **Options for Controlling Biofouling**

- Design
- Process
- Operational
- Pretreatment
- Chemical cleaning
- Biocides



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1:45 **Break (Refreshments Provided)**

2:00 **Biofouling Case Studies**

- Each case study
 - Problem(s) encountered
 - Process Flows
 - Autopsy Results
 - How biofouling was controlled

3:15 **Break (Refreshments Provided)**

3:30 **Workshop 3: Attendees' Process Flows and Biofouling**

- Ensure that everyone leaves with tools to monitor and manage biofouling

4:45 **Summary & Conclusions, Final Q & A**

5:00 **End**



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