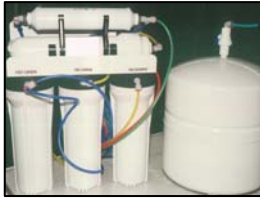


Expert Biofouling Control



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Courtesy: Orange County



Tampa Bay Water

WHERE & WHEN

For a list of where and when this seminar is being presented, click [here](#).

This seminar can also be presented at your facility.

DAILY SCHEDULE

8:00 a.m.-11:30 a.m. -- Lunch Break -- 12:30 p.m.-5:00 p.m.

WHO SHOULD ATTEND

Anyone requiring, or desiring, expert knowledge on biofouling of water treatment systems, but specifically of reverse osmosis (RO) system or nanofiltration (NF) system operating on surface water or groundwater under the influence of surface water. This applies to both brackish surface water and surface seawater.

WHY YOU SHOULD ATTEND

Biofouling continues to be the single biggest challenge with operating RO and NF systems on many surface waters (both brackish and seawater), and some ground waters. It's typical that these systems experience a higher requirement for chemical cleaning, which frequently results in less than 3-5 years of membrane life plus associated higher operating costs. There have been several important discoveries during the past 2-3 years of which you should be aware.

This course will give valuable, practical information unknown to most water treatment personnel. Most of David Paul's consulting over the past 18 years has been in the area of managing biofouling. David will discuss actual case studies (from his consulting work) during this course, including one or more case studies in each of the following industries:

- Pharmaceutical/biotech
- Power Generation
- Semiconductor
- Municipal drinking water (both brackish and seawater)

WHAT YOU'LL RECEIVE

8 hours of interesting, easy-to-understand expert troubleshooting training

8 hours of the latest in multimedia training including 3-D animations

A highly illustrated workbook

Break refreshments

INSTRUCTOR



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Barring unforeseen circumstances, David Paul will instruct this training program. David was an operator for 2.5 years, first-level supervisor for 1 year and manager for 8 years of one of the most advanced water treatment systems in the world. He then began David H. Paul, Inc. (DHP) and has trained and consulted since 1988. David is the author of over 130 published articles on advanced 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 three different colleges in the United States. David is the President of DHP, an advanced water treatment training and consulting firm located in Farmington, New Mexico, USA. DHP has trained over 13,000 water treatment professionals worldwide since 1988.

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



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DETAILED AGENDA

- 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

- 9:00 Break (Refreshments Provided)

9:15 Overview of bacteria

- Reproduction
- Ideal Conditions
 - pH, temperature
 - AOC, trace nutrients, oxygen
 - Turbulence
- Heterotrophic Plate Counts
- Dip slides
- 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

- 10:15 Break (Refreshments Provided)

10:30 Where & How Membrane Biofouling Occurs

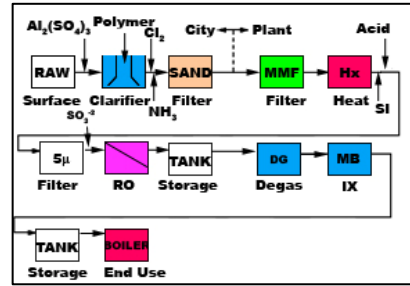
- Initiating requirements
- Seeding
- Growth
- Steady state
- Non-steady state

Design & Operational Schemes That Promote Biofouling

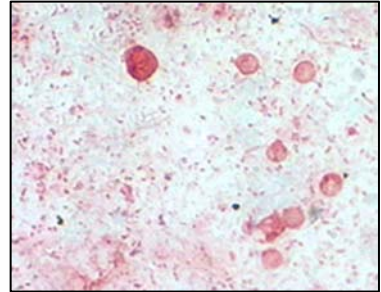
- Equipment
- Process
- Operations
- Maintenance

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

- 11:30 Lunch (Not Provided)



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12:30 Options for Controlling Biofouling

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

1:45 Break (Refreshments Provided)

2:00 Biofouling Case Studies

- Examples
 - Pharmaceutical/Biotech
 - Power Generation
 - Semiconductor
 - Municipal Drinking Water
 - Brackish water
 - Seawater
- Each case study
 - Problem(s) encountered
 - Process Flows
 - Autopsy Results
 - How biofouling was controlled

3:15 Break (Refreshments Provided)

3:30 Workshop 3: Expert Biofouling Control

Workshop 4: Attendees' Process Flows and Biofouling

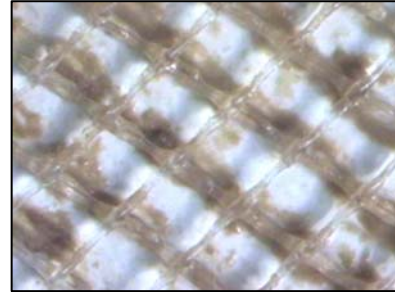
- Ensure that everyone leaves with tools to monitor and manage biofouling

4:45 Summary & Conclusions, Final Q & A

5:00 End



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CERTIFICATE OF COMPLETION

Each attendee will receive a DHP *Certificate of Completion* following the seminar.

WHAT ATTENDEES SAY ABOUT DHP TRAINING SEMINARS

DHP has trained over 13,000 water treatment professionals worldwide since 1988. Trainees include industrial, governmental and drinking water clients. The average rating given by attendees for all DHP seminars 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:

“Learned so much my brain hurt.”

Harold (Budji) McDill, System Operator, Monterey Bay Aquarium

“Excellent course material/presentation-lays a solid foundation to build upon. Very high emphasis on students understanding the volume of information given.”

Robert Markle, Boiler Area Leader, Proctor& Gamble

“Course should be required prior to installing & operating RO systems.”

Kim Price, Sr. Plant Engineer, Lucent Technologies

“Excellent info and presentation.”

W.R. Schulz, Manager of Product Development, Isco Industries

“Very good course, even if you have some background in RO.”

Kevin Simmons, Mechanical Project Engineer, US Filter (Siemens)

“Excellent! Very helpful.”

Stan Brooks, President, MoBetta Water Inc.

“Great! Workshops really helped on my troubleshooting skills.”

Gerald Lands, Operator, Duke Energy

“Great seminar! Came in knowing very little about reverse osmosis, left with a good understanding of RO and RO units.”

Chris Greer, Technical Sales Rep., Ashland Specialty Chemical

“This class was extremely enlightening even for someone with RO experience.”

Lionel Fontes, Chemist, SRP

“Great course- I would recommend this course to everyone in this field of work.”

Mike Wilkey, UPW/IWS Tech., Intel-Colorado Springs

“The flow and concentration of information was excellent.”

Joe Turner, Plant Utility Operator, Amgen-Longmont

“Very informative, very in depth, and very helpful.”

Martin Wix, Instrument Tech., BOC Gases