

Reverse Osmosis Operation & Maintenance

1-Day Seminar

Information Packet

Seminar Cost - \$699 USD (Early Bird Discounts May Apply)

Seminar Length – 1 day (8 hours per day)

Seminar Description

The purpose of the “Reverse Osmosis Operation & Maintenance” seminar is to provide the water treatment professional, from the inexperienced to highly experienced, with a thorough understanding of the reverse osmosis technology. This information is usually missing in “Operations and Maintenance (O & M) Manuals” and in on-the-job training. Being equipped with this knowledge allows operators, engineers, maintenance personnel, and managers to use their own intellect, experience, and creative abilities to identify, evaluate, and to troubleshoot many situations that arise.

The fundamentals that are covered include the following:

1. Water Contaminants Overview
2. Semipermeable RO/NF Membranes
3. Osmosis & Reverse Osmosis
4. Membranes
5. Membrane Elements
6. Pressure Vessels
7. RO/NF Units RO Unit Operation
8. Seawater RO Unit Operation
9. Potential Problems
10. Brackish water pretreatment to minimize scaling, fouling, chemical attack
11. Seawater pretreatment
12. Chemical Cleaning

The information presented during this seminar is not designed to specifically instruct participants on how to run their equipment but rather is designed to educate participants in the general design, process, and operations of a pharmaceutical water treatment system. This is extremely valuable information. This information is offered in good faith but without actual or implied guarantee as conditions and methods of implementing this information are beyond our control.

All materials used during this seminar are COPYRIGHT PROTECTED. No reproduction of any part may be made without the written consent of David H. Paul, Inc. The workbook material may not be used as part of in-house or out-of-house training programs without the written consent of David H. Paul, Inc. Tape recording and videotaping of the seminar are not permitted without the written consent of David H. Paul, Inc.

Who Should Attend

Anyone desiring to know the latest, UNBIASED information on reverse osmosis (RO) and nanofiltration (NF) water treatment monitoring and troubleshooting.

Why You Should Attend

Much of the information presented in this course is typically not found in O & M manuals and other vendor material. While this is a Knowledgeable-level course, unless you've attended another DHP RO course or have gone through a DHP on-line RO training program, most attendees find that this material is essential to the complete understanding of DHP's Advanced-level and Expert-level courses. This course covers the fundamental information you need to know for the smallest POU/POE systems to the largest brackish water and seawater RO/NF units.

What You'll Receive

- 8 hours of practical, interesting, easy-to-understand reverse osmosis water treatment training
- 8 hours of the latest in multimedia training including video & 3-D animations
- A highly illustrated workbook
- Break refreshments (lunch not included)

Instructor Biography

Your instructor will be one or more of the following



David Paul
David H. Paul, Inc.
Owner/Founder/Instructor

David Paul is the President of David H. Paul, Inc. (DHP), an advanced water treatment training and consulting firm. David has 36 years of operating, managing, training and consulting experience in membrane water treatment. He has published over 160 technical articles and papers, of which many have been for Water Technology, Water & Wastes Digest and Water Conditioning and Purification. He has trained many times at the WQA Annual Conference and has held seminars at the WQA Headquarters. He has created and administers many on-line, on-site, and on-campus training programs in advanced water treatment. He holds a B.S. degree in biology and an M.S. degree in microbiology



Bill Dees
David H. Paul, Inc.
Director of Training
Services/Instructor

Bill Dees is Director of Training Services for David H. Paul, Inc. (DHP). He has 10 years of experience as a Service Technician/Installer/Service Manager and was part owner and General Manager of his own Residential/Commercial water conditioning business. In addition he has 15 years of design, operation, maintenance, troubleshooting, training and consulting experience of water treatment systems including membrane, ion exchange, pretreatment and post-treatment equipment. Bill holds an Associate of Applied Science Degree in Industrial Water Treatment from San Juan College, DHP's first on-campus, college degree program. Bill also performs system technical assessments, consulting, element autopsies and chemical cleaning evaluations.



Dick Youmans
David H. Paul, Inc.
Director of Certification/
Instructor

Richard (Dick) Youmans has over 30 years of experience in the industrial water treatment industry with 16 of those specializing in reverse osmosis chemical applications, training and troubleshooting. Dick received an Associate of Applied Science Degree in Industrial Water Treatment from San Juan College and David H. Paul, Inc. in 2002. As a corporate trainer, he has trained over 1,400 students in reverse osmosis technology and chemistry.

Certificate of Completion

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

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).

Testimonials

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

DETAILED AGENDA

7:45 Refreshments (Provided)

8:00 Introductions

Water Contaminants Overview

- Ions
- Gases
- Organics
- Silica

Semipermeable RO/NF Membranes

- Structure
- Water Flux
- Salt Flux
- Rejection of contaminants

9:00 Break (Refreshments Provided)

9:15 Osmosis & Reverse Osmosis

- Osmotic pressure
- Applied pressure
- Net Driving Pressure
- Water flux
- Salt flux

Membranes

- Flat sheet, hollow fiber
- Brackish, seawater
- Low pressure, low fouling, high rejection

Membrane Elements

- 2" (5 cm), 2.5" (6 cm), 4" (10 cm), 8" (20 cm), 8.5" (22 cm) elements
- 12.75" (32 cm), New 16" (41 cm) and new 18.25" (46 cm) elements
- Envelopes
- Feed water spacer
- Permeate spacer
- Flow path
- Low pressure, low fouling, high area & high rejection

Workshop 1: Build a simulated element

10:15 Break (Refreshments Provided)

10:30 Pressure Vessels

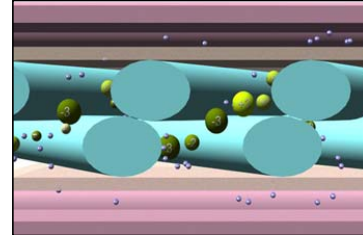
- 2", 2.5", 4", 8", 16", 18.25"
- End port, side port, multi-port
- Stainless steel, fiberglass
- Shimming elements

RO/NF Units

- POU, POE, industrial, municipal
- Single stage, multi-stage
- Single pass, double pass
- Brackish water RO, seawater RO

Workshop 2: RO membrane performance

11:30 Lunch (Not Provided)



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Courtesy: Dow FilmTec



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12:30 RO Unit Operation

- POU
- Single pass
- Double pass
- Recovery rate
- Concentration
- Water flux per element
- Net driving pressure (NDP) per element
- Salt passage per element
- NDP and SP versus temperature



Courtesy: U.S. Bureau of Reclamation

Seawater RO Unit Operation

- Single stage, double stage
- Single pass, double pass

1:45 Break (Refreshments Provided)

2:00 Potential Problems

- Scaling
- Fouling
- Chemical Attack



Courtesy: Tampa Bay Water

Brackish water pretreatment to minimize scaling, fouling, chemical attack

- Minimize scaling
 - Softening
 - Acid injection
 - Scale inhibitor injection
- Minimize fouling
 - Clarification
 - Media filtration
 - Cartridge filtration
 - Microfiltration/ultrafiltration
- Minimize chemical attack
 - Activated carbon
 - Sulfite injection
 - Ultraviolet irradiation



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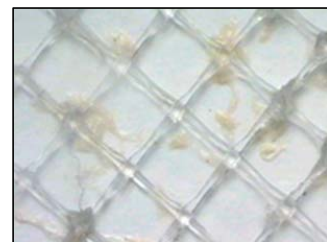
Seawater pretreatment

- Conventional
- Advanced

3:15 Break (Refreshments Provided)

3:30 Chemical Cleaning

- Removing scalants
- Removing foulants
- A good cleaning procedure
- How to determine when to stop cleaning
- How to determine the effectiveness of a cleaning



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Workshop 3: RO Unit Operation & Maintenance

4:45 Summary & Conclusions

- Final Questions & Answers
- Seminar evaluation

5:00 End