

Reverse Osmosis 101

1-Day Seminar

Information Packet

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

Seminar Length - 1 Day (8 hours per day)

Seminar Description

If you want the basics of the RO technology and only have the time and/or money for one day of classroom training, this is the seminar for you. For this seminar, DHP has condensed the information from two of its best-selling, comprehensive one-day seminars (Reverse Osmosis Operation & Maintenance and Reverse Osmosis Monitoring & Troubleshooting). RO 101 is specifically designed for people who are going to attend DHP's RO hands-on training but who have not previously attended one of DHP's classroom RO seminars.

Who Should Attend

RO 101 will give you the knowledge you need to thoroughly understand how the RO technology works. If you aren't taking any hands-on training but want a quick one-day overview of the RO technology, this is the seminar for you.

Why You Should Attend

Even people with 10+ years of experience marvel at how much they learn in a DHP seminar. The reason for this is that DHP continually improves its step-by-step training methodology and seminar materials so that anyone with a typical high school education can thoroughly understand the information presented. DHP's outstanding, proven training methodology is based upon:

- Practical information. We know what's important and know what's not. You WON'T be taught water flux and salt flux equations (typical in other RO training programs). Only researchers use these equations. You'll be taught what you need to excel in RO water treatment.
- Practical RO water treatment experience. DHP instructors have dozens of years of real-world experience.
- Extensive training experience. DHP has trained tens of thousands of RO water treatment professionals since 1988.
- Effective multimedia presentations. DHP has invested millions of dollars over the years in electronic teaching aids, including extensive photographs, video clips and animations. If a picture is worth a thousand words, DHP has a "bazillion" words worth of training aids.

What You'll Receive

- 8 hrs of enjoyable, interesting, easy-to-understand training
- A highly illustrated workbook
- Break refreshment
- Personal attention: Questions & comments are encouraged

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 located in the USA. He has been involved in many aspects of RO water treatment since 1977. He was an operator 2.5 years, a shift supervisor for 1 year and the manager of a \$500 million USD (today's value) huge water treatment plant that included reverse osmosis. He founded DHP in 1988. Since then he has provided training and consulting services at BWRO and SWRO plants around the world. He is the author of over 160 published articles and several books on membrane water treatment.



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

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.



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:

“Great Course! Well worth the time.”

Bob Castle - Water Quality Manager, Marin Municipal Water District

“Excellent training materials and presentation.”

Gary Trent - Abbott Laboratories

“Excellent... got what I was interested in and more, especially in the inner workings of UF.”

Eric Lozano - Austin Energy

“Well presented and well worth the investment.”

John Countz - Operations Manager, Consolidated Water Co.

“Excellent! More than I expected.”

Mark Hall - Texas Water Development Board

“It was great!”

Trent Hughes - Civil Engineer, Black & Veatch

“Great Course.”

Joe Gonzales - Xcel Energy

“Most Excellent!”

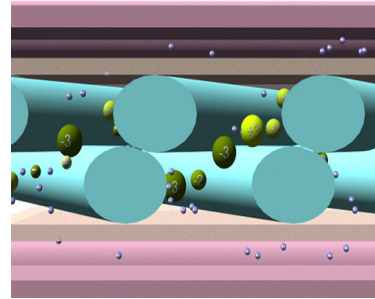
Mike Milner - Alternative H2O Solution

Detailed Agendum

7:45 Refreshments (Provided)

8:00 **Introductions**

- Water Contaminants Overview
 - Ions
 - Gases
 - Organics
- Osmosis & Reverse Osmosis
 - Osmotic Pressure
 - Applied Pressure
 - Net Driving Pressure
 - Water Flux
 - Salt Flux
 - Organics



9:00 Break (Refreshments Provided)

9:15 **Membranes**

Membrane Elements

- 2" (5 cm), 2.5" (6 cm), 4" (10 cm), 8" (20 cm), 8.5" (22 cm) elements
- 16" (41 cm) and 18.25" (46 cm) elements
- Envelopes
- Feed water spacer
- Permeate spacer
- Flow path
- 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 Units

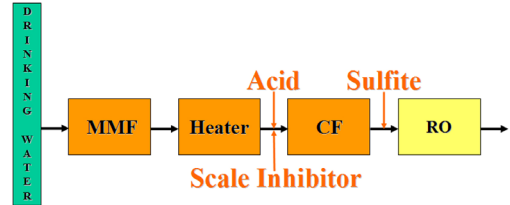
- Single stage, multi-stage
- Single pass, double pass

11:30 Lunch



12:30 RO Unit Operation

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



1:45 Break (Refreshments Provided)

2:00 Potential Problems

- Scaling
- Fouling
- Chemical Attack

Pretreatment to minimize scaling, fouling and chemical attack

- Minimizing scaling
 - Acid injection
 - Scale inhibitor injection
- Minimizing chemical attack
 - Sulfite Injection

Seawater pretreatment summary

- Conventional
- Advanced

Minimizing Fouling

- Chlorination
- Filter aid injection
- Media filtration
- Cartridge filtration
- Microfiltration & Ultrafiltration



3:00 Break (Refreshments Provided)

3:15 Daily Monitoring

- Pressures
- Pressure drops
- Flows
- Conductivities
- Chlorine
- Recovery Rate

Weekly Trending

- Normalized Permeate Flow (NPF)
- Normalized Salt Passage (NSP)
- Normalized Pressure Drop
- Normalized Differential Pressure

4:30 Tour of host facility

5:00 End