

# Reverse Osmosis Water Treatment

## Hands-On



### DAILY SCHEDULE

8:00 a.m. -11:30 a.m.

12:30 p.m. -5:00 p.m.

### WHO SHOULD ATTEND

Anyone needing to know the latest, **UNBIASED** information on reverse osmosis water treatment **AND** get hands-on experience!  
(DHP is a training company, **NOT** an equipment vendor)

### WHY YOU SHOULD ATTEND

There are a lot of intricacies to operating reverse osmosis (RO) and nanofiltration (NF) units that you don't get from salespeople, installers and even an Operations & Maintenance Manual. For example, were you trained on how to "shim" the elements within each pressure vessel? Were you trained that using a detergent, glycerin or silicone as a lubricant when loading elements has potential biofouling implications? Were you trained on what to do to protect yourself from potential biological hazards when loading and unloading elements and cartridge filters? Did you get hands-on training on "probing", "profiling", performing an SDI (Silt Density Index) and how to trend RO/NF unit performance?

You learn all of the above and **MUCH, MUCH MORE** in this training course!

## WHAT YOU'LL RECEIVE

- 24 hrs of interesting, easy-to-understand classroom and hands-on RO/NF training
- 24 hrs of the latest in multimedia training including 3-D animations
- A highly illustrated workbook
- Break refreshments

## INSTRUCTORS



Jason Turner



Robert Decker



Scotty Gann



Bill Dees

Every instructor for the Reverse Osmosis Water Treatment Hands-On course is an instructor at one of DHP's four on-campus Associate Degree in Advanced Water Treatment programs. The hands-on courses are held at a college-program location using the same equipment, labs, instruments and training aids as our college students. Each DHP college instructor is a graduate of the four-semester Advanced Water Treatment Program. You won't find anyone more dedicated to students and more excited about water treatment than DHP instructors. DHP instructors have trained over 13,000 water treatment professionals worldwide since 1988.

## OVERVIEW OF HANDS-ON TRAINING

- Silt Density Index
- Chlorine analysis
- Biocounts
- Start up, monitor and shut down pretreatment equipment
- Start up, monitor and shut down RO units
- Load and unload elements
- Calibrate and use monitoring instruments
- Performance trends and analysis
- Profiling
- Probing
- Troubleshooting RO unit problems



## WHAT YOU'LL LEARN

- 6 new ways to save your facility time and money
- Why the first 5 minutes of start-up are critical
- The ability to interpret 3 trends that determine when to chemically clean your RO unit
- Be able to predict and prevent fouling, scaling and chemical attack problems
- The 8 hotspots to visually inspect elements and vessels in order to identify problem areas
- Special techniques to properly load and unload elements that will minimize downtime

# DETAILED AGENDUM

## DAY 1

### Morning: Classroom

7:45 Refreshments (Provided)

8:00 Introductions

Overview of advanced water treatment: where RO/NF fits

9:00 Break (Refreshments Provided)

9:15 Contaminants

- Dissolved & Suspended
- Charged & Uncharged
- Non-Living & Living Particles
- Rejection of Contaminants by RO/NF membranes



10:15 Break (Refreshments Provided)

10:30 Osmosis & Reverse Osmosis

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

Membranes

Membrane Elements

- Envelopes
- Feed water spacer
- Permeate carrier



11:30 Lunch (Provided)

### Afternoon: Hands-On In Water Plant & Labs

12:30 Safety in the Hands-On Areas

Tour/Understand the Water Treatment Equipment & Areas

Start Up the Pretreatment System

- Fill tank
- Perform Silt Density Index on the feed water
- Verify dechlorination (free and total chlorine analysis)
- Perform biocount analysis on the feed water



Start Up the RO Units

- Calibrate a conductivity meter
- Record performance data every 15 minutes
- Analyze the affect of temperature on RO unit performance

Start Up the RO Units with Different Feed Water

- Record performance data every 15 minutes

Analyze and Explain the Differences between RO Unit Operations on Different Feed Waters

4:30 Questions & Answers

5:00 End

## DAY 2

### Morning: Classroom

7:45 Refreshments (Provided)

8:00 Workshop-Build a Simulated Membrane Element  
RO/NF Unit Design and Operation: Pressure vessels (PVs)

9:00 Break (Refreshments Provided)

9:15 Critical RO/NF unit design features: Recovery, Water flux (gfd), Crossflow

- Design software
  - How to use it to verify your units' performance
  - Determine why the first element fouls the most
- Workshop

10:15 Break (Refreshments Provided)

10:30 RO/NF Unit Operation: What Happens Every  
Inch/Centimeter of the Way

- TDS, Pressure, Permeate flow, Permeate conductivity/TDS, Feed-concentrate flow, Net Driving Pressure

Workshop

Monitoring

- Instrumentation required for proper monitoring
- Silt Density Index, Normalized Permeate Flow, Salt Passage/Salt Rejection, Pressure Drops, Recovery
- Profiling (determine the pressure vessel having a problem)
- Probing (determine where in a PV a problem is located)

11:30 Lunch (Provided)

### Afternoon: Hands-On In Water Plant & Labs

12:30 Start Up the Pretreatment Skids and RO Units

- SDI, dechlorination, calibrate a conductivity meter, etc.
- Take data readings (the RO units have problems today!)

Perform a Profiling on each RO unit

Perform a Probing of each affected pressure vessel

- Determine where the problem(s) is(are) located within the PVs

Shutdown the RO units, open up the PVs,  
remove the elements and fix the problem(s)

Restart the RO units

- Take all designated performance readings
- Ensure that the problem(s) has(have) been fixed

Shut Down the RO Units and Pretreatment Skids

Discuss the performance differences with different problems

4:30 Questions & Answers

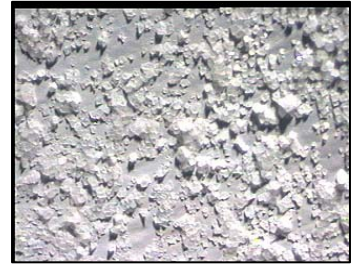
5:00 End



## DAY 3

### Morning: Classroom

- 7:45 Refreshments (Provided)
- 8:00 Workshop: Given Different Gauge Readings for Different RO/NF Units,  
Determine the Problem(s)  
How to Use Free Performance-Monitoring Software  
Workshop: Using Monitoring Software
- 9:00 Break (Refreshments Provided)
- 9:15 Problems
- Mechanisms of scaling
  - Mechanisms of fouling
  - Mechanisms of chemical attack
- 10:15 Break (Refreshments Provided)
- 10:30 Troubleshooting
- Symptoms of fouling
  - Symptoms of scaling
  - Symptoms of chemical attack
  - Trend analysis
- Workshop: Troubleshooting Different Problems
- 11:30 Lunch (Provided)



Scaling

### Afternoon: Hands-On In Water Plant & Labs

- 12:30 Start Up the Pretreatment Skids and RO Units
- SDI, dechlorination, calibrate a conductivity meter, etc.
  - Take data readings (the RO units have DIFFERENT problems today!)
- Perform a Profiling on each RO unit  
Perform a Probing of each affected pressure vessel
- Determine where the problem(s) is(are) located within the PVs
- Shutdown the RO units, open up the PVs, remove the elements and fix the problem(s)
- Restart the RO units
- Take all designated performance readings
  - Ensure that the problem(s) has(have) been fixed
- Shut Down the RO Units and Pretreatment Skids  
Discuss the Performance Differences with the Different Problems  
Perform Trend Analysis
- 4:00 Summary & Conclusions
- Final Questions & Answers
  - Seminar evaluation
- 5:00 End



## **CERTIFICATE OF COMPLETION**

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

### **WHAT OTHERS 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 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:

**“LOVED IT!!!”**

**Alan Martin-Raytheon**

**“After 3 years of operating RO units, I finally have a thorough understanding of them!”**

**Don DeLauter-Amgen**

**“Great course, great teachers, great equipment. I liked the use of multimedia...videos, illustrations, computers, etc.” Evan Francis-Monterey Bay Aquarium**