

**Course:**  
**Reverse Osmosis Operation & Maintenance - OLC**

**What you will learn:**

You will learn all of the practical information necessary to thoroughly understand Reverse Osmosis (RO) and Nanofiltration (NF) water treatment technologies and apply your knowledge while operating an industrial reverse osmosis water treatment facility.

**Length:**

Eleven (11) hours of online training

**What you will earn:**

David H. Paul, Inc. Certificate upon successfully passing an exam based on the proficiencies learned in this course.

**OVERVIEW OF TOPICS**

- Water Contaminants Overview
- Semipermeable RO/NF Membranes
- Osmosis & Reverse Osmosis
- Membranes
- Membrane Elements
- Pressure Vessels
- RO/NF Units
- RO Unit Operation
- Seawater RO Unit Operation
- Potential Problems
- Brackish water pretreatment to minimize problems
- Seawater pretreatment to minimize problems
- Chemical Cleaning of RO/NF units

**11 one hour training units for this course:**

**Water Contaminants**

- Ions
- Gases
- Organics
- Silica

**Semipermeable Membranes RO/NF**

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

## **Osmosis & Reverse Osmosis**

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

## **Membranes & Membrane Elements**

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

## **Pressure Vessels**

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

## **Reverse Osmosis Units**

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

## **Brackish Water 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

## **Seawater RO Unit Operation**

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

## **Potential Problems**

- Scaling
- Fouling
- Chemical Attack

## **Pretreatment**

- 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
- Seawater pretreatment
  - Conventional
  - Advanced

## **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