Seawater Reverse Osmosis Systems
by Pure Aqua, Inc.
A Proven Track Record

• 10,000+ Successful System Installations
• 3,000 Satisfied Clients
• 2,500 Custom Systems in Operation
• 300+ Million Gallons of Pure Water Produced Daily World Wide
Interesting Facts

• Many regions in the world do not have easy access to fresh drinking water.
• Reverse Osmosis Desalination process completely removes salts from seawater making it drinkable.
• Seawater RO systems are usable anywhere from yachts to municipalities.
• It’s important to choose the correct materials of construction to handle seawater (which is highly corrosive). Pure Aqua uses materials such as Duplex SS 2205 and Monel to guarantee a longer operating life and less maintenance.
Characteristics of Seawater

- Total Dissolved Solids: 30,000 mg/L to 45,000 mg/L
- Total Suspended Solids: 50 mg/L to 250 mg/L
- pH: 7 – 8
- Microorganisms & Bacteria
- Small amount of heavy metals
Seawater Reverse Osmosis

Pre-Treatment
- Feed / Backwash Pumps
- Pre-Chlorination
- Multimedia Filtration
- De-Chlorination
- Antiscalant

Reverse Osmosis
- 5-micron Filter
- Instrumentation
- Energy Recovery
- High Pressure Pump
- Reverse Osmosis Membrane

Post-Treatment
- Post pH Adjustment
- Calcite Filtration
- Post Chlorination
Pre & Post Treatment Options Available

Media Filtration with Automatic Backwashing
Chemical Dosing Treatments and UV Sanitation
Pre-Chlorination

• Seawater typically contains microorganisms and bacteria that can form a bio-film on the membrane surface
• Killing / deactivating bacteria and microorganisms before the reverse osmosis membrane will prevent biofouling
• A continuous chlorine dose is around 3 mg/L
• Helps oxidize metals
Pre-treatment (De-Chlorination)

- Chlorinated feed must be dechlorinated to prevent oxidation of membranes.
- Chlorine level before membranes is monitored by an ORP (oxygen reduction potential) sensor.
Pre-treatment (Antiscalant)

- Feed must be injected by PA0100 antiscalant to prevent scaling or fouling the membranes.
- RO Antiscalant chemicals are surface-active materials that interfere with precipitation reactions in three primary ways:
  - **Threshold inhibition**: it is the ability of an antiscalant to keep supersaturated solutions of springily soluble salts.
  - **Crystal modification**: it is the property of an antiscalant to distort crystal shapes, resulting in soft non-adherent scale.
  - **Dispersion**: which is the ability of some antiscalant to adsorb on crystals or colloidal particles and impart a high anionic charge, which tends to keep the crystals separated.
Typical Seawater RO System Flow Diagram

RAW SEAWATER

RAW WATER TANK

PRE CHLORINATION

FEED PUMP

MEDIA FILTER

ANTISCALANT & DECHLORINATION DOSING

SEAWATER RO SYSTEM

POST pH & CHLORINATION DOSING

PRODUCT WATER TANK

TO POINT OF USE

DISTRIBUTION PUMP
Pre-treatment (Multimedia)

- Multimedia Filtration
  - Reduces turbidity and suspended solids
  - Removes dirt, silt, and other particles (10-25 microns)
  - Three layers of media consisting of Anthracite, Sand, and Gravel
  - Largest particles are trapped near the top of the filter
  - Smaller particles are trapped deeper in the filtration bed
  - The use of both anthracite and sand allows for longer run times
Pre-treatment (Multimedia)

- Multimedia Filtration
  - Largest particles are trapped near the top of the filter
  - Smaller particles are trapped deeper in the filtration bed
  - The use of both anthracite and sand allows for longer run times
  - Anthracite will distribute the flow to avoid turbulence and turbidity leakage
Pre-Treatment (Multimedia)

- Multimedia Filtration
  - Three main cycles
    - Service
    - Backwash
    - Settle & Rinse
  - Backwash is initiated based on a differential pressure of 10-15 psi
  - Pressure drop across a clean multimedia filter is 3-5 psi
Feed / Backwash Pumps

- Feed Pump
  - Pumps water from tank through the pre-treatment to the reverse osmosis system
- Backwash Pump
  - Reverses the flow of water through the multimedia filter
- TEFC Motors
- Centrifugal Pumps
- **Duplex 2205** Stainless Steel
- Corrosion resistant
- Depending on design pump redundancy is possible
- Pumps sized appropriately to save energy
Post-Treatment

- **pH adjustment**
  - Caustic Dosing
- **Calcite Filter**
  - Raises the pH
  - Self correcting and will raise pH to a non-corrosive equilibrium
Reference Projects
Location: Belize
Application: Resort
Water Source: Seawater
System Features: Advanced PLC, Energy Recovery Turbine
136,000 GPD | SWRO

**Location:** Maldives

**Application:** Exclusive Resort

**Water Source:** Seawater

**System Features:** Floor Mounted PLC, Energy Recovery Turbine
250,000 GPD x 3 | SWRO

**Location:** Pakistan

**Application:** Drinking Water

**Water Source:** Seawater

**System Features:** PLC, Energy Recovery Turbine, Cleaning System
126,000 GPD x 2 | SWRO

Location: Oman
Application: Ministry of Defense
Water Source: Seawater
System Features: Floor Mounted PLC, Energy Recovery PX, Ion Exchange, Boron Removal System
130,000 GPD | SWRO

**Location:** Oman

**Application:** Ministry of Defense

**Water Source:** Seawater

**System Features:** Floor Mounted PLC, Energy Recovery PX, Double Pass RO System
16,000 GPD | SWRO

Location: Yemen
Application: Exclusive Resort
Water Source: Seawater
System Features: Microprocessor Control Panel
Location: Chile
Application: Copper Mine
Water Source: Seawater
System Features: Double Pass RO with Microprocessor Control Panel
**16,000 GPD | SWRO**

**Location:** Thailand  
**Application:** Drinking Water  
**Water Source:** Seawater  
**System Features:** PLC and VFD
12,000 GPD | SWRO

Location: Colombia
Application: Drinking Water
Water Source: Seawater
System Features: Microprocessor Control Panel and VFD
16,000 GPD | SWRO

**Location:** Saudi Arabia

**Application:** Drinking Water

**Water Source:** Seawater

**System Features:** Microprocessor Control Panel and VFD
**12,000 GPD | SWRO**

**Location:** Indonesia  
**Application:** Oil & Gas  
**Water Source:** Seawater  
**Features:** Explosion Proof, PLC Control Panel, Skid Mounted Pre and Post Treatment
100,000 GPD | SWRO

Location: Venezuela
Application: Drinking Water
Water Source: Seawater
System Features: Containerized SWRO, PLC, Energy Recovery Turbine
Location: Abu Dhabi-UAE
Application: Drinking Water
Water Source: Seawater
System Features: Microprocessor SWRO
5,600 GPD | SWRO

Location: Peru
Application: Drinking Water
Water Source: Seawater
System Features: Microprocessor SWRO
96,000 GPD | SWRO

Location: Maldives
Application: Resort
Water Source: Seawater
System Features: PLC Control Panel, Energy Recovery Turbine
48,000 GPD | SWRO

Location: Maldives
Application: Resort
Water Source: Seawater
System Features: PLC Control Panel, Energy Recovery Turbine
THANK YOU

www.pureaqua.com