



2018 AWT Annual Convention & Expo
September 26-29, 2018
Omni Orlando Resort at ChampionsGate • Orlando, FL

#AWTconf2018 awt.org/annualconvention2018



**CLOSED CIRCUIT
REVERSE OSMOSIS**

The New Standard for Industrial Desalination

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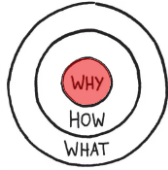


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The Agenda

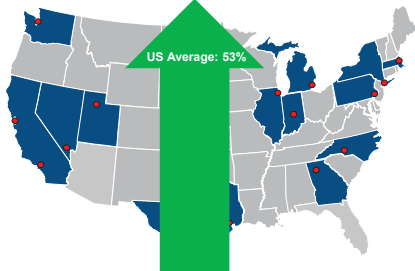
- 1 **Why**
Why are we here today to talk about CCR0 and why should you care to listen?
- 2 **How**
How is CCR0 different and how could that be valuable to you?
- 3 **What**
What are the actual products and results that can you can expect with CCR0?



By 2050, OECD forecasts an increase of 55% in global water demand and 400% manufacturing water demand, leading to competition for water resources, shortages and rising costs

Water Cost Increase (2010-2017)

- Atlanta, GA – 26%
- Austin, TX – 112%
- Boston, MA – 26%
- Charlotte, NC – 70%
- Chicago, IL – 90%
- Dallas, TX – 44%
- Detroit, MI – 56%
- Houston, TX – 62%
- Indianapolis, IN – 71%
- Las Vegas, NV – 39%
- Los Angeles, CA – 63%
- New York, NY – 46%
- Philadelphia, PA – 50%
- Salt Lake City, UT – 29%
- San Francisco, CA – 127%
- Seattle, WA – 35%



Growing Industrial Water Concerns

Water & Disposal Access Security

Water & Disposal Costs

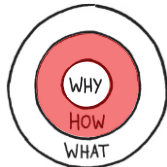
Public / Investor Awareness

"If you aren't responsibly managing water in your business, you won't be in business 20 years from now."

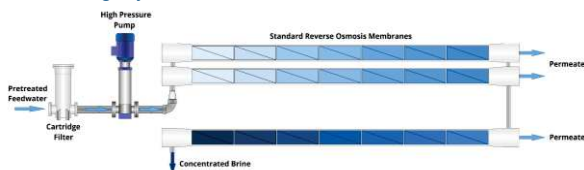
- Muhtar Kent, Chairman and Former CEO of the Coca-Cola Company

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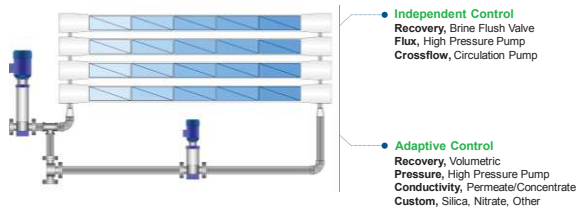
How Legacy RO Works



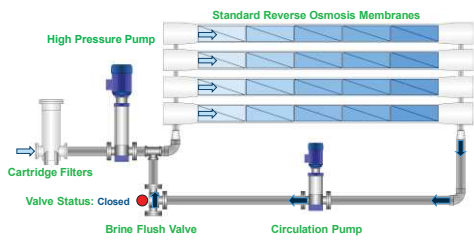
Pain Points

1. **Recovery:** The more stages, the more complex and less flexible due to hydraulic limitations.
2. **Fouling:** Lead elements foul due to high individual membrane element flux and steady-state conditions.
3. **Scaling:** Tail elements scale due to continuous exposure to high salinity at low crossflow velocities.
4. **Flexibility:** Recovery, flux and crossflow are dependent of the others.
5. **Energy:** High-pressure pump operates at peak pressure 100% of the time.
6. **Consumables:** Membrane life is a function of CIP frequency. Antiscalant dosing based on recovery, beta-values, kinetics.

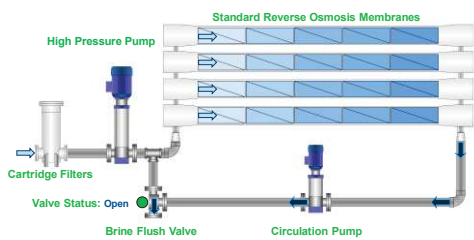
How **CCRO** Works: Standard Components



How **CCRO** Works: Step 1 – Closed Circuit (6-60 mins)



How **CCRO** Works: Step 2 – Plug Flow (1.5 mins)



Location:
USA

Industry:
Pulp & Paper

Application:
Industrial Process & Boiler Makeup

Pain Point:
Recovery, Energy Costs, CIP Frequency, Chemical Demand

Solution:
Two (2) R10's w/Common CIP

Results:
Increased Performance from All Aspects of the System & Membranes

Case Study 2: Producing Paper Products in the Sonoran Desert

Parameter	Unit	Multi-Stage		Closed Circuit	CROD Value
		1 x 100%	2 x 100%	2 x 100%	
# of Trains		2	1	1	
# of Stages		2	1	1	
Area (per Train)		3.1 (3 Membranes)	3.1 (3 Membranes)	3.1 (3 Membranes)	
Process		Steady State	Dynamic		
Recovery		73%	88%		
Initiation Rate		26%	63%		
Permeate Flux (gfd)		15.4	15.5		
Daily Process Water (gallons)		335,520	311,040	336,000	Increase in Permeate Production
Daily Wastewater (gallons)		57,213	42,024	57,213	Reduction in Wastewater Generated
Specific Power Consumption (kWh/gpd)		1.75	1.67	1.75	Reduction in Energy Required
Antioxidant Consumption (gpm)		8	3	8	Reduction in Antioxidant Consumption
Blowdown Frequency		247 / Year	14 / Year	247 / Year	Elimination in Blowdown Frequency
CIP Frequency		248 / Year	42 / Year	248 / Year	Reduction in CIP Frequency
Lead Element Flux (light, avg)		20.3	13.9	20.3	Reduction in Lead Element Flux
Flux Distribution (light, avg)		16.2 - 20.10	13.9 - 16.20	16.2 - 20.10	
Min Beta Value		1.34	1.09	1.34	Reduction in Min Beta Value
Beta Range		1.03 - 1.34	1.00 - 1.09	1.03 - 1.34	

Location:
USA

Industry:
Food & Beverage

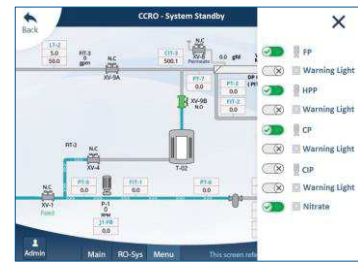
Application:
Ingredient Water

Pain Point:
Variable Feed Water Conditions

Solution:
Two (2) R24's w/Common CIP

Results:
90% Recovery, No Required CIP's, Automatic Adjustment to Variations in Feed Water Conditions

Case Study 3: Ensuring the Safety of Consumers' Children



Location:
USA

Industry:
Power Generation

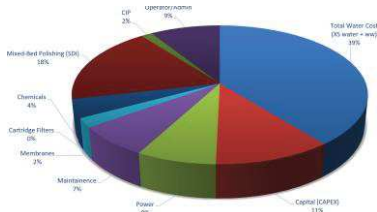
Application:
Turbine Makeup

Pain Point:
High Operational Expense (OPEX) w/ High Purity Water System

Solution:
Five (5) Containerized R3's w/CIP

Results:
Annual OPEX Reduced by 85% (\$6.4MM), Power Magazine Award

Case Study 4: Powering Los Angeles at a Fraction of the Cost



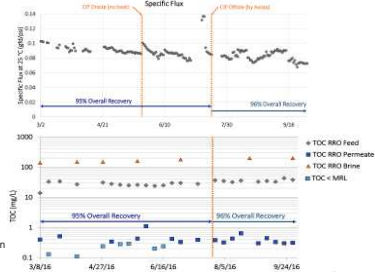
- Location:** USA
- Industry:** Pharmaceutical
- Application:** Wastewater Reuse
- Pain Point:** Variable Feed Water Conditions
- Solution:** Three (3) RB's w/Common CIP
- Results:** Automatic Adjustment to Variations in Feed Water Conditions

Case Study 5: Reusing Pharmaceutical Wastewater in California



- Location:** USA
- Industry:** Municipal
- Application:** Wastewater Reuse
- Pain Point:** High Recovery Required on WW w/High Organics and Silica (SiO₂)
- Solution:** One (1) R1 w/CIP
- Results:** Automatic Adjustment to Variations in Feed Water Conditions

Case Study 6: Municipal Wastewater for Industrial Reuse





THANK YOU!

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USA
