



# Purified Water Systems

## Comparison of Mixed Bed Service Exchange and Electro-deionization

Pure H2O Technologies 211 Warren Street Newark, NJ 07103

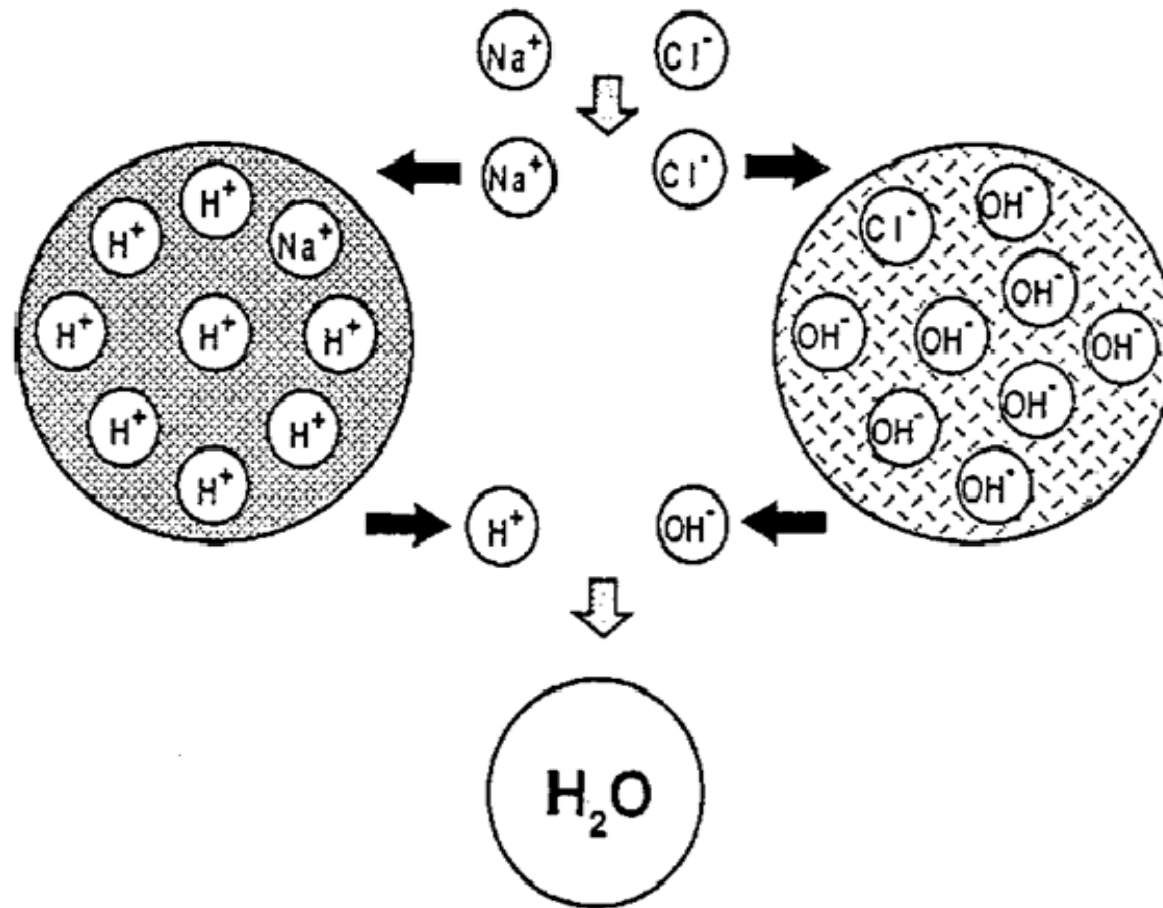
[www.ipureh2o.com](http://www.ipureh2o.com)

Instructor: Robert Marsiglia

# De-Ionization Application

- \*Used to achieve higher resistivity than Reverse Osmosis alone
- \*Various Water Specifications require minimum Resistivity levels
  - ASTM Type I, II, III
  - Electronics grades E-I, II and III
  - USP and WFI Water
  - Various CAP and NCCLS Specifications
- \*Used in Universities, Hospitals, Pharmaceutical and Research Facilities

# Ion Exchange Principle



# General Commercial Methods of De-ionization

- \* In-place Regenerable Separate and Mixed Bed DI
- \* Service Exchange (Off-site) Separate and Mixed Bed DI
- \* Electro-Deionization
- \* Combination of EDI and Resin DI

# In-Place Regenerable DI



# In-place Regeneration Considerations

- \* Assures better quality control over off-site “regen” facilities
- \* Viewed as “older” technology
- \* Must have acid and caustic supplies in-house
- \* Requires Trained Personnel for Proper Operation
- \* Can require frequent PM due to acid/caustic environment
- \* Waste can be hazardous and incur surcharges
- \* Quality production limited by quality of “regen” process
- \* Useful in “Remote” Plant locations requiring Pure Water

# In-Place Regeneration Considerations

## (Example: 70 GPM Duplex unit)

- \* Initial capital cost ~ \$160,000
- \* Most in-place units used for high flow rates
- \* Uses ~ 6,000 gallons per regeneration
- \* Uses ~ 30 gallons HCL and ~ 20 gallons NaOH per “regen” cycle
- \* Regeneration cycle takes ~ 3.5 – 4 hours
- \* Capacity here is 300,000 grains (240,000 “usable”)
- \* Ensure capacity exceeds regeneration time

# Mixed Bed Service De-ionization





# Mixed Bed DI Considerations

- \* Portable Units of Various Sizes are available
- \* Size and quantity of Vessel(s) depends upon flow rate
- \* Can achieve highest water quality
- \* Does not require RO for pure water production
- \* No waste stream during operation
- \* Can be installed Post RO and/or in Distribution Loop
- \* Water Quality does decline over time
- \* Handling considerations
- \* Off-site quality control

# Mixed Bed Service Exchange Costs

Cubic foot of DI Resin has ~ 8,000 grain “usable” capacity for USP Water (10,000 Grain Total)

RO water ~ 1.25 Grains/Gallon

1 Cubic Foot of Resin handles ~ 6,400 Gallons of Water

1,200 Gallons per day Usage (5 days per week)

24,000 Gallons per month

~ 3.75 ft<sup>3</sup> Resin per month usage (“14-47” vessel holds ~ 3.6 ft<sup>3</sup>)

Price for Cubic Foot of Resin: ~ \$100.00 delivered

Monthly Cost: ~ \$360.00 (“14-47”)

Yearly cost: ~ \$4,320.00

Linear Usage Cost: 3,600 Gallons per day equates to \$12,960.00/year

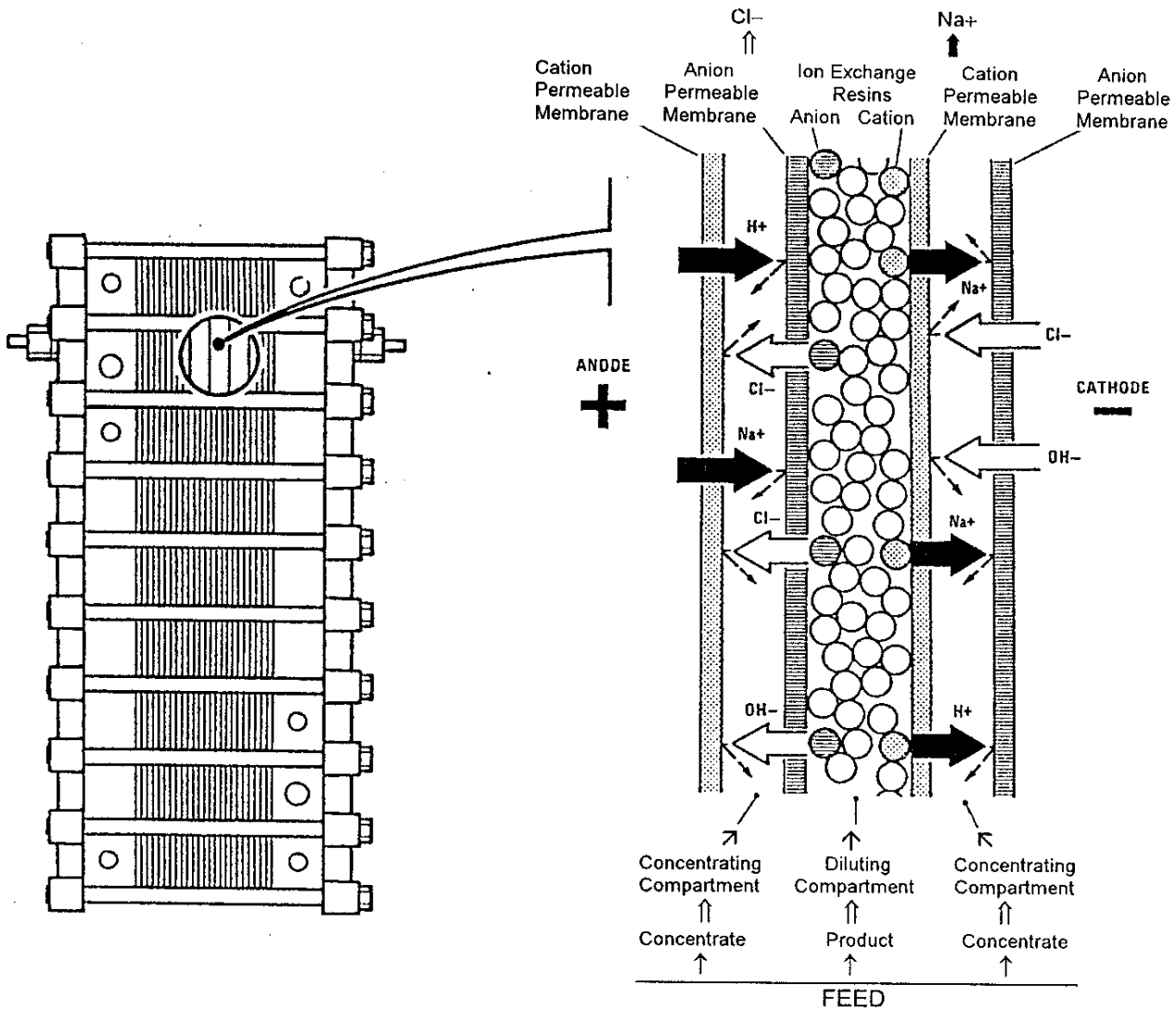
# Electro-deionization Units



# Electro-deionization Principle

- \* Utilizes Ion exchange, membrane and electrical principles
- \* Ion exchange resin “capture” ions from RO feed stream
- \* DC current is applied across the cell, attracting cations and anions to the appropriate positive or negative terminal
- \* Ions pass through selective membranes to waste streams
- \* This process provides “continuous” resin regeneration
- \* Electrical current minimizes bacteria growth in dynamic cell areas
- \* ~ 97% Efficient

# EDI Technology



# Electro-Deionization Considerations

- \* Requires single-pass RO Feed water supply
- \* Can be free standing or integrated into RO unit
- \* Sized to match RO permeate flow rate
- \* Can not be installed in distribution loop
- \* Minimal power consumption: \$0.06/1,000 gallons processed
- \* Minimal maintenance: 6 – month bolt torque
- \* Consistent quality: 12 – 15 Meg-ohm-cm
- \* Long life: 10 + years under normal operation
- \* Designs can be hot water sanitized

# Electro-Deionization Costs

- \* RO-Integrated Units: ~ \$8,000 for 1, 2, and 3 GPM flows  
(~ \$11,000 for 10 GPM)
- \* Operating cost of ~ \$0.06/1000 gallons processed  
(this can be considered regeneration cost)
- \* Cost effectiveness beginning at ~ 1,200 GPD usage
- \* Low usage rates more applicable to service exchange
- \* Cost remains fixed for full range of RO operation  
(Client can increase usage without significant additional costs)

# DI/EDI Design Considerations

- \* Determine Water Quality Requirements
- \* Determine Water Usage (Maximum and Average)
- \* Equipment: is RO unit part of Design?
- \* Calculate Generation and Distribution Flow Rates
- \* Equipment location (facility and geographically)
- \* Equipment space allotment and access
- \* Client Maintenance Personnel experience and capability



# Questions

How can we help in the  
Design of your Pure Water  
System