

First Afternoon Session

2:00pm - 2:55pm

Dave Fister:

- Water use reduction & recovery methods
- Energy savings in paint & powder coat curing

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Available Water for Reuse

- Rinse water
 - Primary rinse water (high in TDS, variable pH)
 - Secondary rinse water (low in TDS, variable pH)
- Treated waste water
 - Very low in dissolved metals
 - Very high in TDS from neutralization and treatment
 - Consistent pH, typically slightly alkaline from metal precipitation process
 - Typically room temperature
 - May have some other residuals such as oils, soaps, or emulsifiers



Rinse Water Requirements

- For reuse as rinse water, water needs to be:
 - low in TDS
 - near neutral in pH to avoid possible contamination of the chemical tanks by rinse dragout into those tanks
 - Free of oils, soaps, etc.

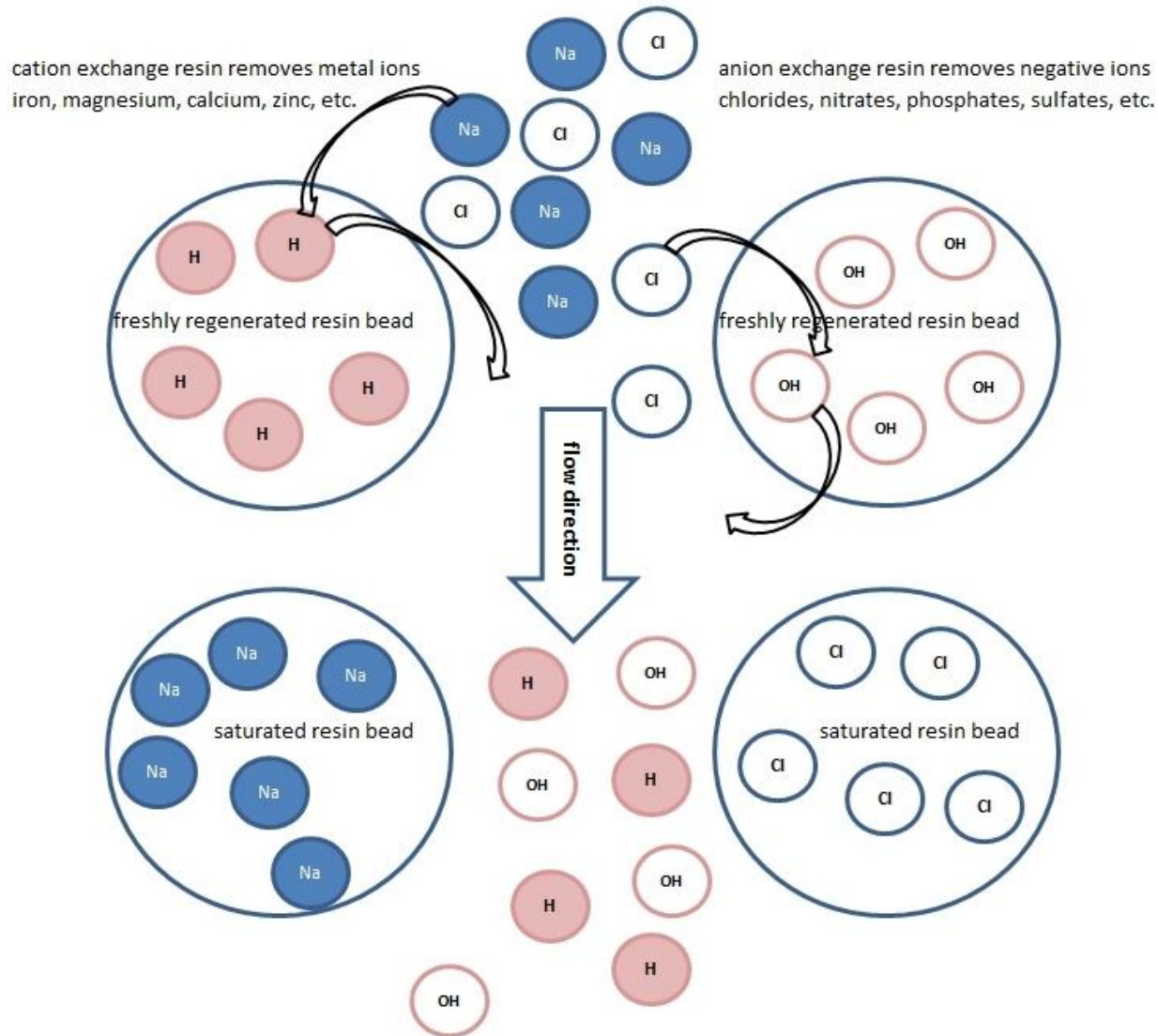


Methods of Removing TDS

- Mixed bed resin columns (ion exchange) to remove both cations and anions (will not remove dissolved organics such as sacharin)
- Reverse Osmosis to remove all solids and solubles except for small amounts of NaCl (0.5 to 3% of the initial concentration)



Resin Columns (ion exchange)



Advantages/disadvantages of Ion Exchange

Advantages

- Excellent ion removal
- Flow rate can be increased with a larger diameter column

Disadvantages

- Requires a carbon filter to remove organics
- Requires additional filtration to remove particulate and any resin bead particles
- Requires regular cylinder exchange or regular regeneration to maintain ion removal rate



Reverse Osmosis

Figure 1.

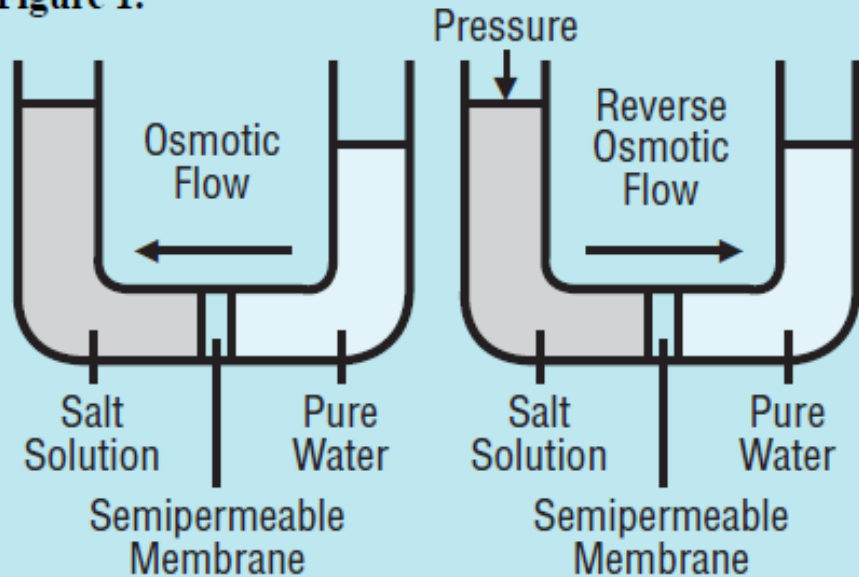
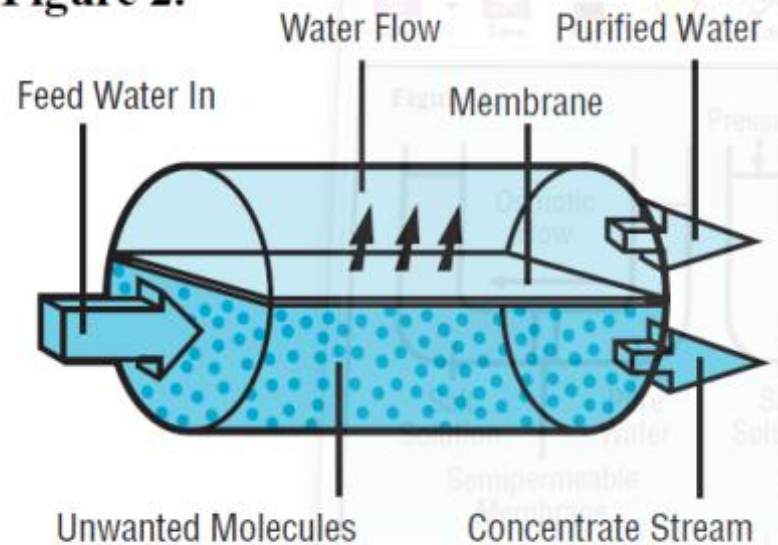


Figure 2.



Advantages/disadvantages of RO

Advantages:

- Removes everything: ions*, bacteria, viruses, solids
- Relatively simple, low maintenance system

Disadvantages:

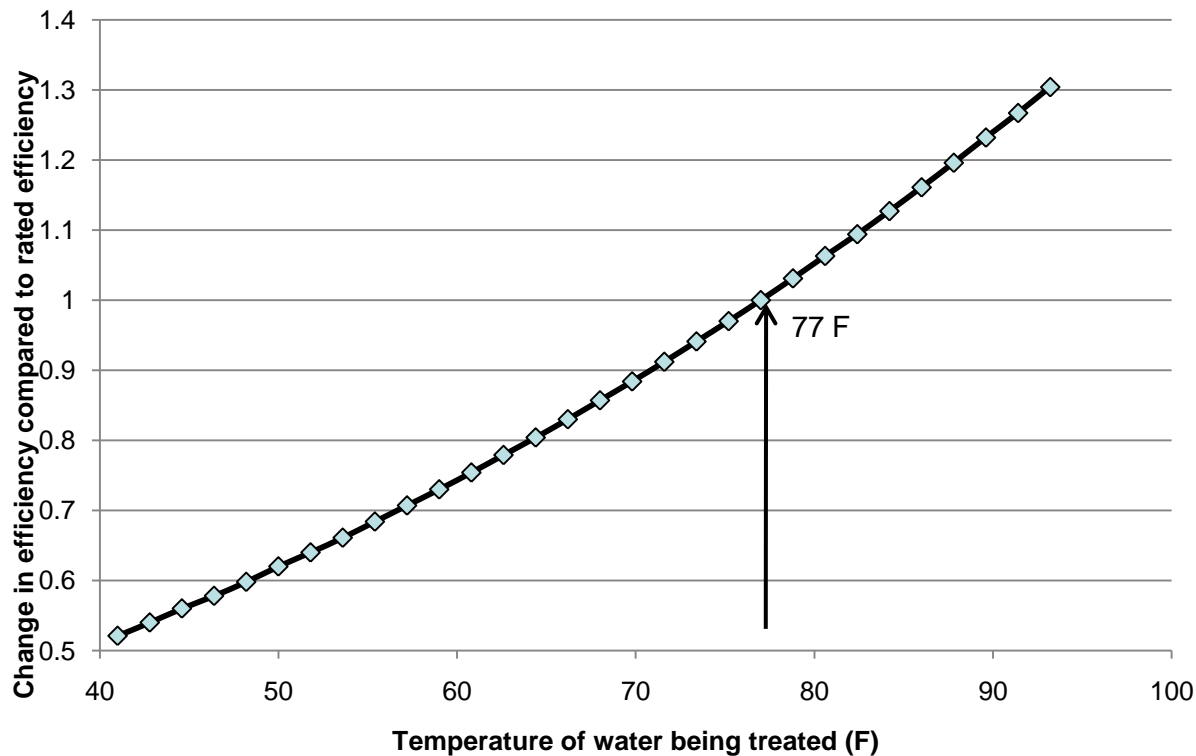
- Low temperature water produces lower pure water yields
- Higher TDS water produces lower pure water yields
- *Tend to leak small amounts of single charge ions (Na^+ , K^+)
- Membrane can foul rapidly if suspended solids are high (may require pre-filtration with ultrafilter)
- Current technologies allow up to about 75% fresh water yields (typical yields ~50%)



RO-Temperature Relationship

- Higher water temperatures, over 77° F but no higher than 100F, will have water recovery yields greater than the rated yields.

RO Efficiency vs. Water Temperature
(data provided by SpectraPure)



Different RO Membrane Types

Cellulose Acetate	Low cost	Medium water flow	pH range 4-8	Max. temp. 95 F	Oxidation resistant
Composite (thin film composite, TFC)	High cost	High water flow	pH range 2-11,	Max. temp. 113 F	Vulnerable to oxidizers (chlorine)
Aromatic Polyamide	Medium cost	Low water flow	pH range 4-11	Max. temp, 95 F	Oxidation resistant

In short, no perfect membrane material

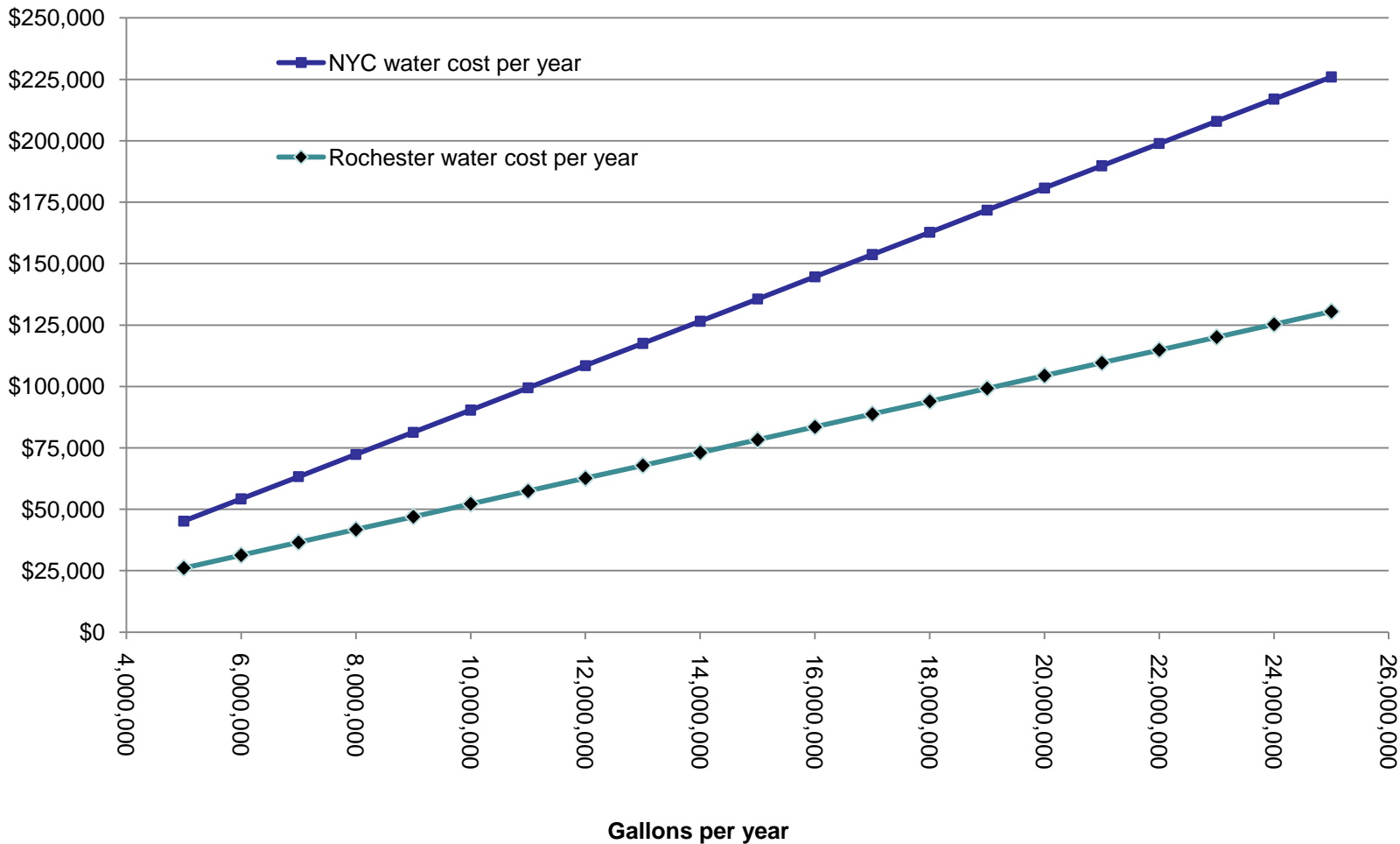


Water Cost vs. RO Equipment Cost

- Some cost comparisons from on-line prices (Watertiger, PureWaterExpress, Siemens)
- Rochester city water charges \$5.22/1000 gallons (\$2.67 water bill, \$2.55 water treatment tax)
- New York City, \$9.04/1000 gallons with sewer charges included



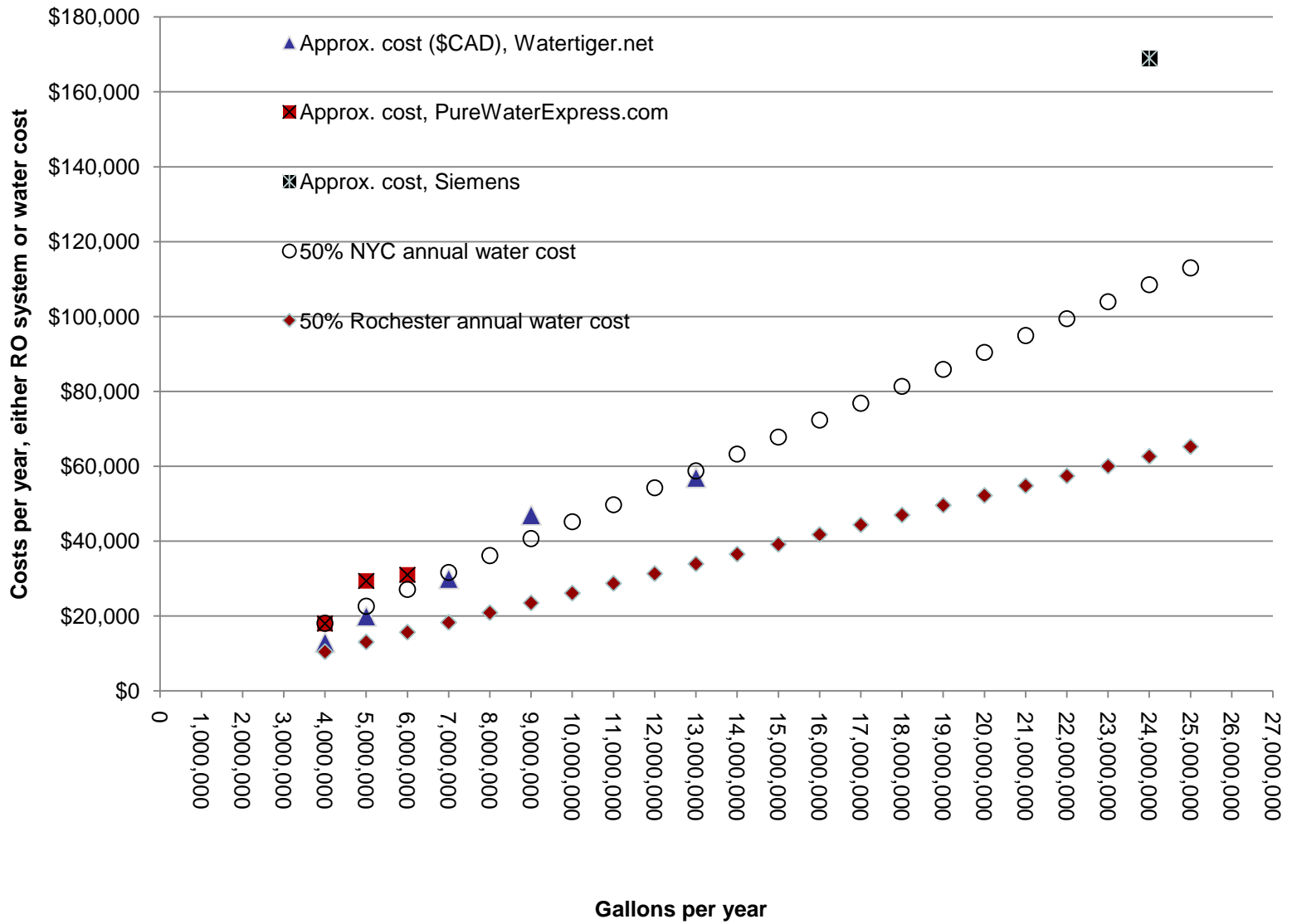
Water Cost Curves



Water Recovery Cost

- For an 8 hour operation, pure water storage and waste water storage is needed to obtain the best use of RO equipment (16 hours of off-shift filtration available).
- An RO system should be sized for less than the lows of daily water use.
- Be sure that the concentrate from the RO is still below the metals concentration limit for disposal.





Payback Considerations

- At the right place, both DI and RO systems can help recover water for either rinsing or makeup water.
- As water prices continue to rise, the payback for these systems gets better.
- In the previous RO example, NYC costs make an RO system pay for itself in approximately one year.



Questions?

