# VSEP Vibrating Membrane Separation System for Desalination

Dr. J. Brad Culkin, CTO, New Logic Research, Inc.

# Presentation Outline

- History of Salinity Problem
- Why Spiral-Wound Membranes Can't Recover More Water
- Alternative Approach by NLR with VSEP
- Brine Disposal Options
- The Bottom Line

# History of the Salinity Problem

- Currently about ½ human contribution, and ½ natural processes, e.g. San Joaquin River, etc.

- Currently not deemed economically feasible to remove salt from municipal outfalls and industrial effluent.
  - Traditional membrane systems cannot recover more than 60-70% of the total flow
  - Deep Well injection of remaining fraction
  - Huge injected volumes represent unacceptable loss of water
  - Deep Wells potentially problematic
    - Geology must cooperate
    - High flows especially difficult

# Why can't spiral-would membranes recover more water?

- Limit of spiral-wound membrane technology is the limiting solubility of TDS
- Precipitation must not occur inside modules
- Extend recovery up to 70% by manipulating precipitation kinetics (antiscalants work this way)
- Few ways to alter thermodynamic equilibrium
  - Adjust pH for calcium salts
  - Eventual limit due to silica
  - Also Fe, Mn, Mg

NEW LOGIC RESEARCH, INC.
INDUSTRIAL STRENGTH MEMBRANE FILTRATION™

# Alternative Approach by NLR with VSEP

- VSEP (Vibratory Shear Enhanced Process)
- Open channel flow
- Very high shear rates
- Solids appear by precipitation during reverse osmosis
- Suspended solids slurry causes no problems

VSEP

# Alternative Approach by NLR with VSEP

- New recovery limit is 95–99%; corresponds to brine concentrations up to 20-30% TDS
- Limit set by osmotic pressure
- Volume reduction of 50:1 or 98% recovery typical
- Cost typically less than $2.00/1000 gallons
- Disposal of ~20% brine remains a problem

# Disposal Options for Brine

- Deep Well Injection
  - Low flow rates of brine reject
  - Basically pure NaCl
  - Typical cost of $4.00/1,000 gallons where feasible

# Disposal Options for Brine

- Evaporation
  - High cost / 1,000 gallons: ~$20-$50/1,000 gallons
  - Low flows make this potentially feasible
  - NaCl product could be recycled into economy
  - Recovery of phosphate also attractive option

# Disposal Options for Brine

- Land Fill Option
  - Polymer encapsulation emerging technology
  - Work with regulators for extractable limits for NaCl
  - Not currently attractive or ready for prime time

# Disposal Options for Brine

- Haul Brine to a More Logical Outfall Location
  - EBMUD will accept brines for $0.03/gallon
  - EBMUD outfall is more tolerant of salinity due to tidal action and flushing of the Bay with ocean water

# The Bottom Line

- Through VSEP, it is now possible to deal with the salinity problem by a <u>process solution</u>

- Total cost of treatment as low as $1.50-$2.00/1,000 gallons

- Technology is mature, proven, and cost-effective

# The Bottom Line

- Permeate meets all environmental criteria including conductivity and TDS

- Blending near zero TDS permeate with can actually beneficiate a saline river

V✧SEP®
NDUSTRIAL STRENGTH
MEMBRANE FILTRATION

NEW LOGIC
RESEARCH, INC

For more information, please contact:

Dr. J. Brad Culkin
CTO, New Logic Research, Inc.
510-655-7305 ext. 230
bculkin@vsep.com

Visit the VSEP Web site at http://www.vsep.com