

Overview of Residential Reverse Osmosis  
and Adsorption Technologies  
Included in PFC Study  
and  
Current Findings  
(March 2008)

Minnesota Department of Health  
Water Science & Marketing, LLC  
Water Quality Association

# Point-Of-Use Water Treatment

- Installed on individual faucet or tap.
- Treats water used for cooking and drinking.
- Includes pitcher filters, faucet-mounted units, and on- or under-the counter units.
- May involve one or more treatment methods, such as carbon adsorption.

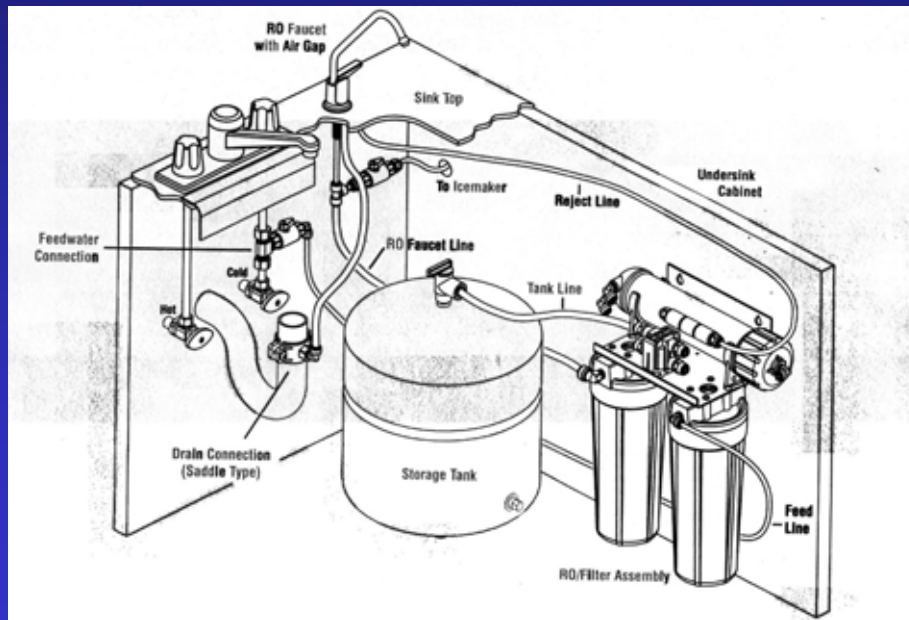
# Outline

- Reverse Osmosis
- Carbon Adsorption
- Current Findings and Future Plans

# Technologies Included

Reverse Osmosis

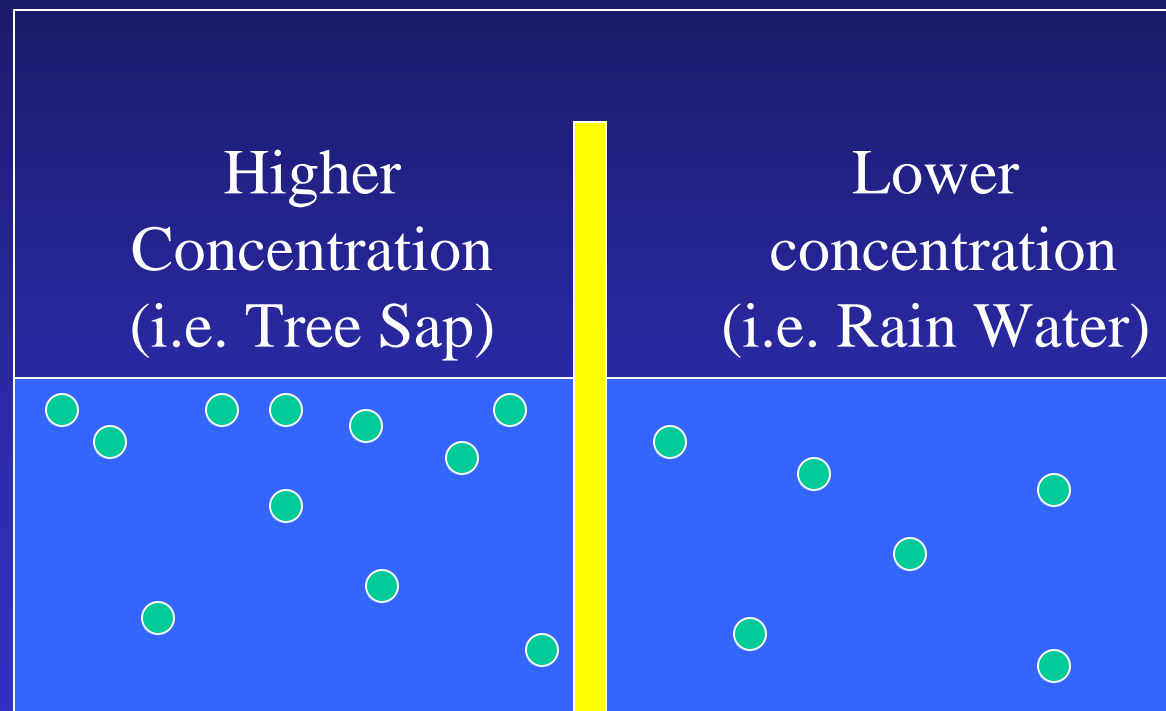
Adsorption



# Reverse Osmosis

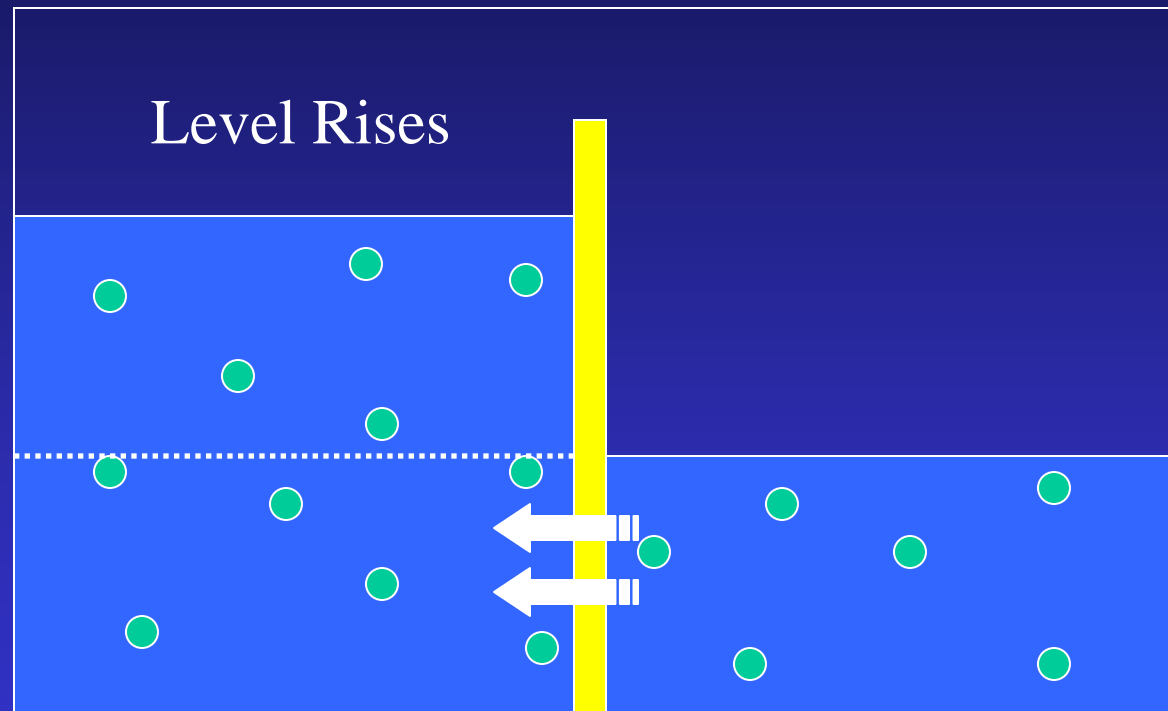
- Semi-permeable membranes
  - Examples (eggs, cell walls, roots)

# Osmosis



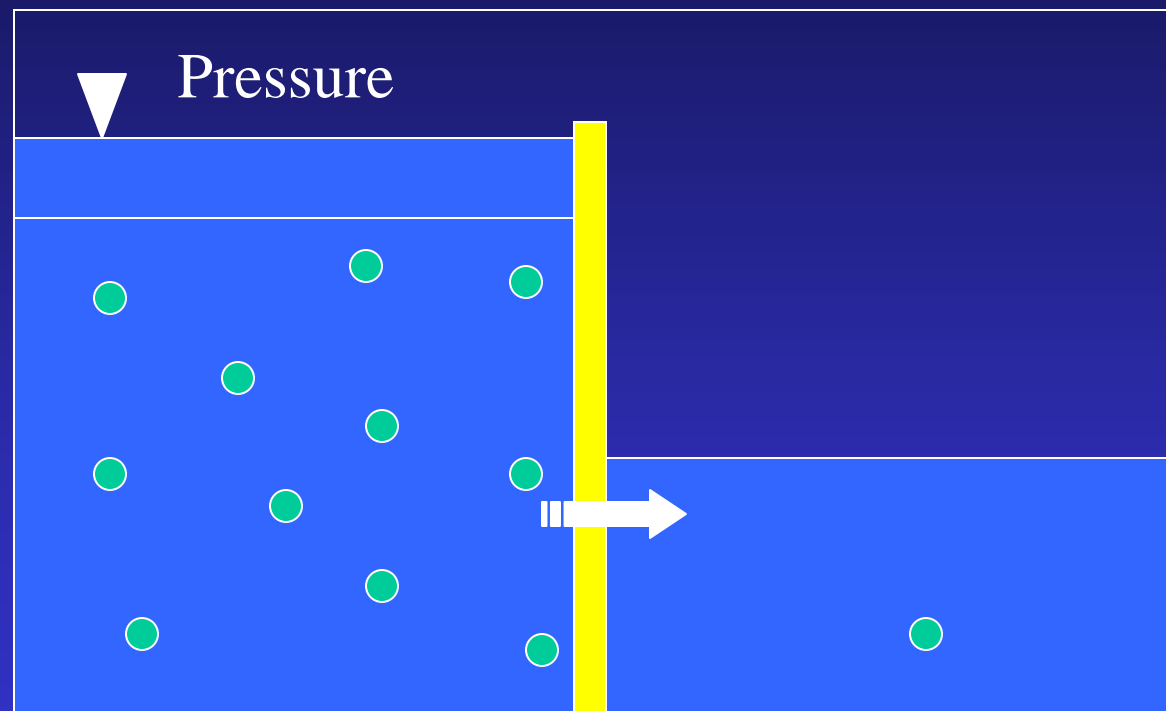
Semi-permeable  
Membrane

# Osmosis



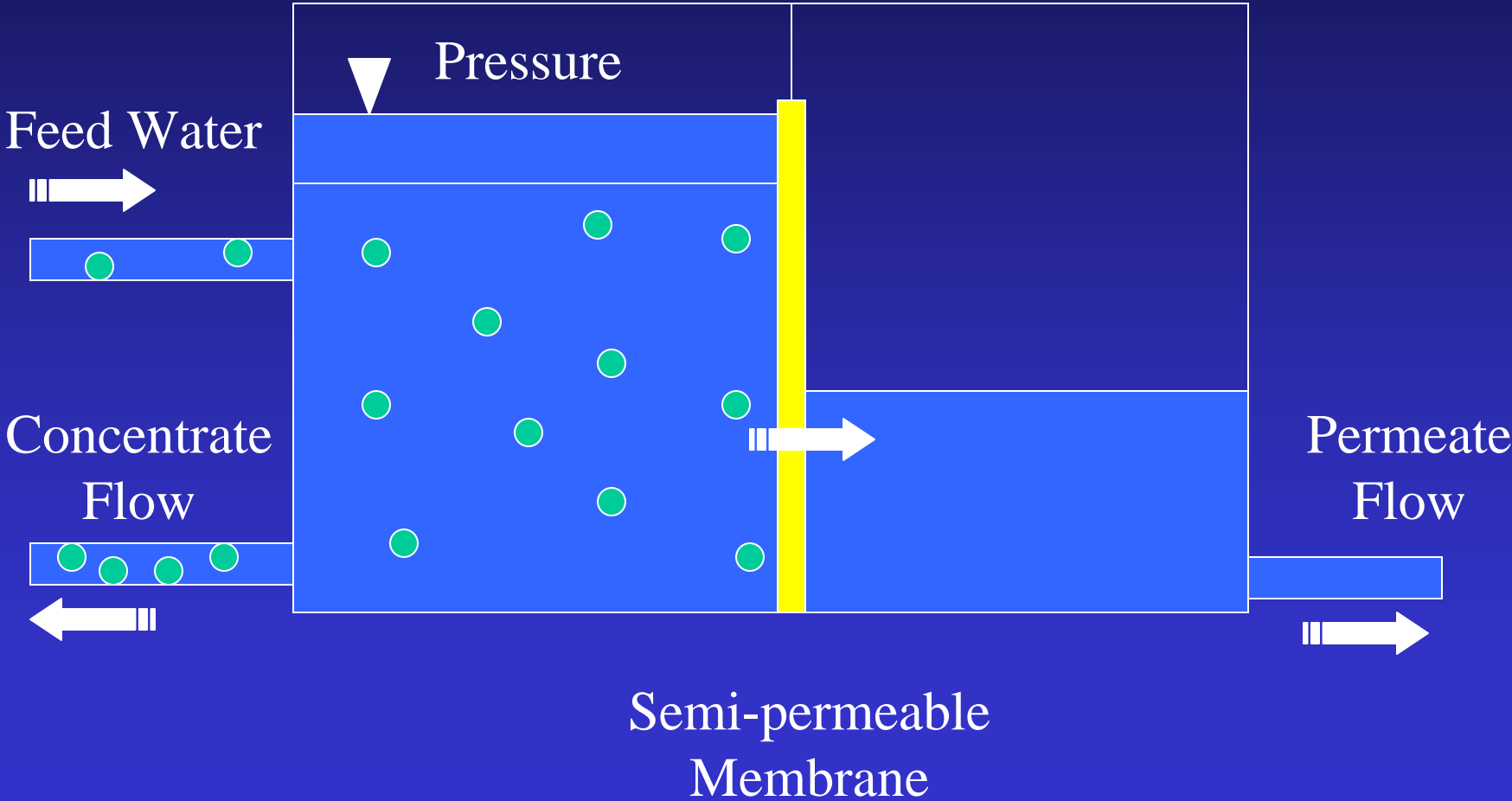
Water Flow

# Reverse Osmosis

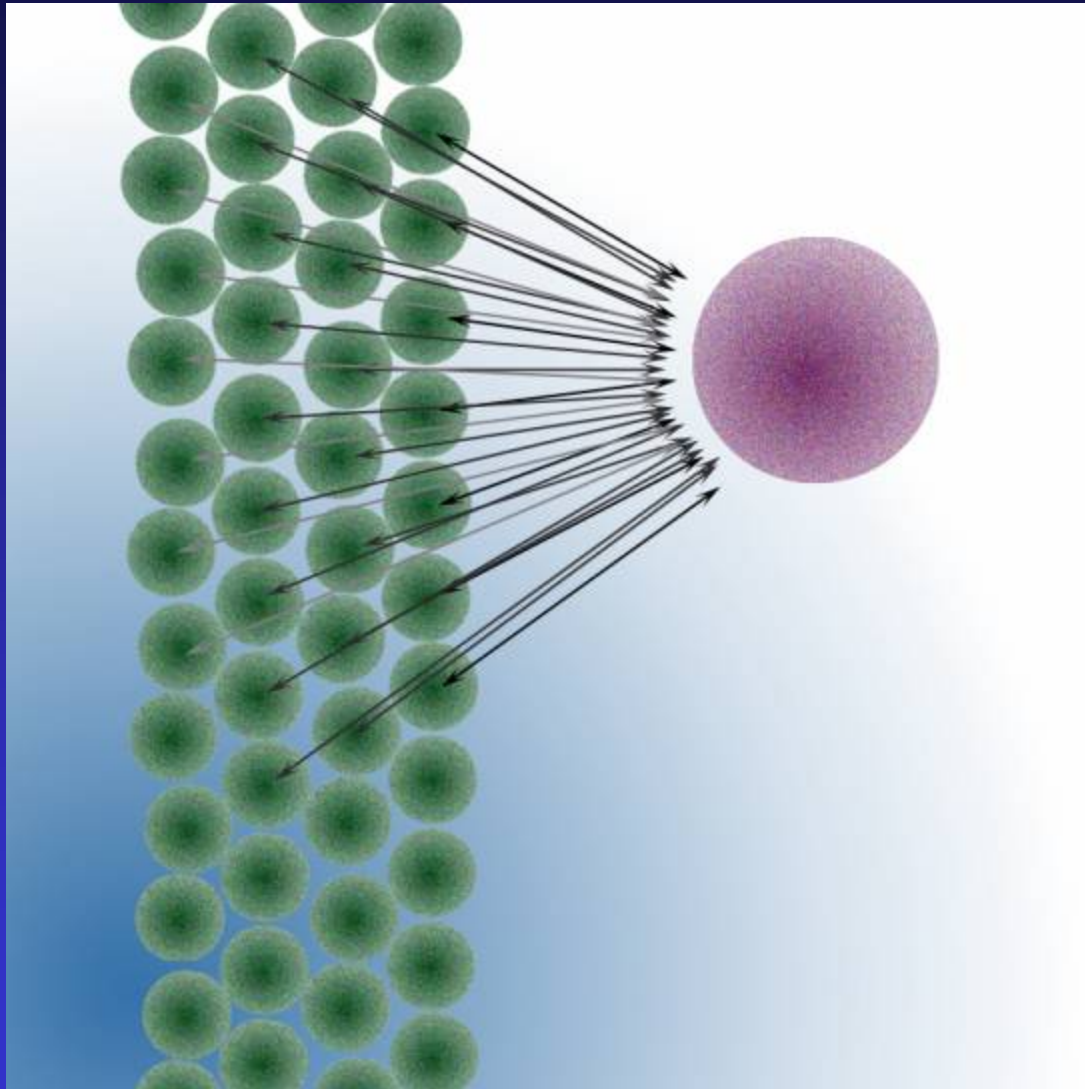


Semi-permeable  
Membrane

# Reverse Osmosis Applied



# Adsorption



The adsorption force on a passing molecule is the sum of all van der Waals forces exerted by the carbon atoms of the media

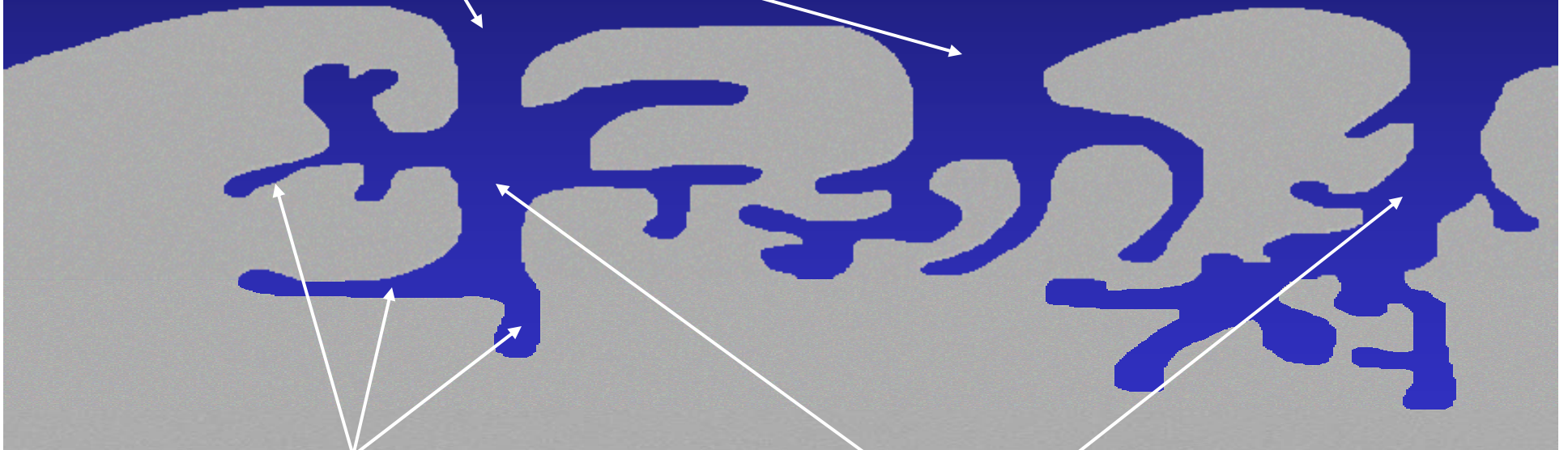
# Activated Carbon Structure

Macropore

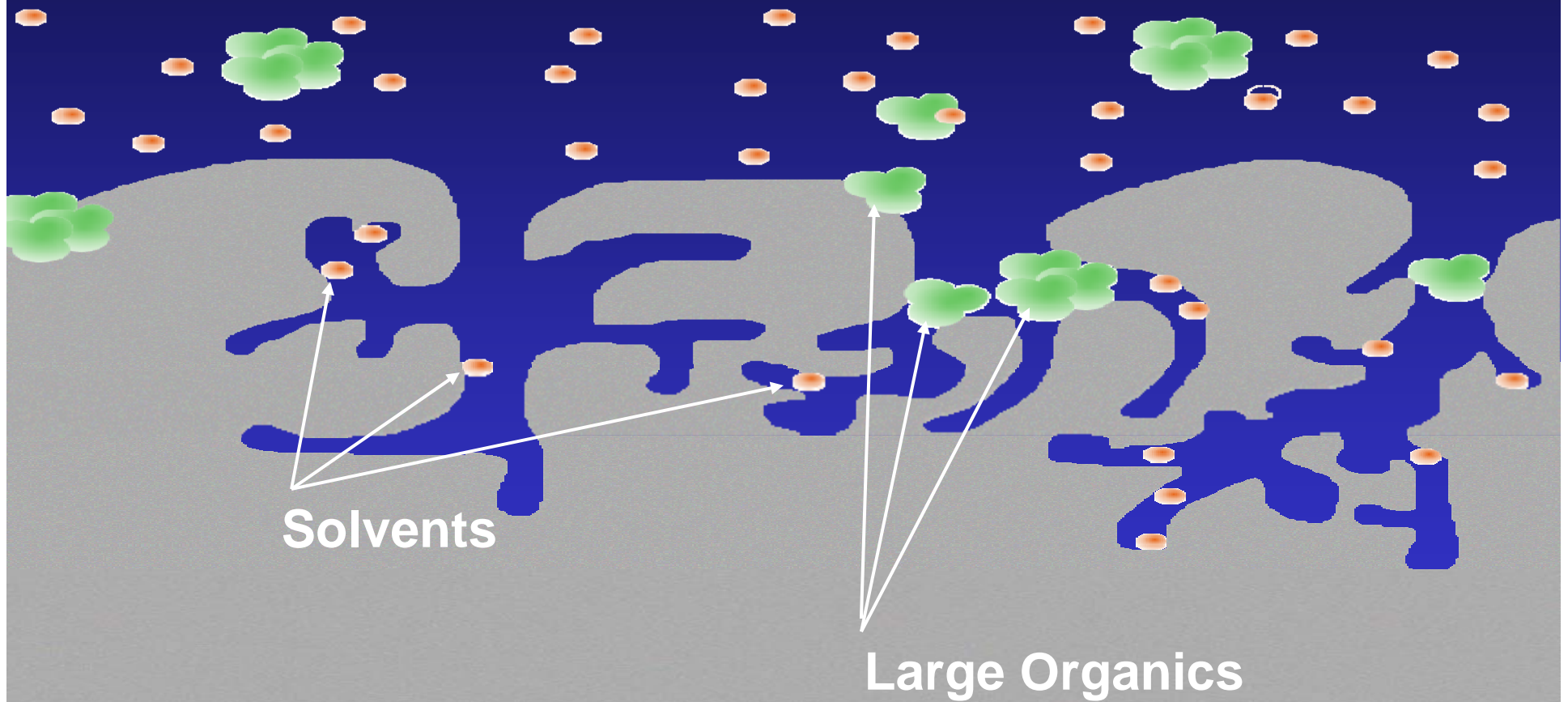
Micropore

Channels

Surface of Activated Carbon



# Activated Carbon Structure

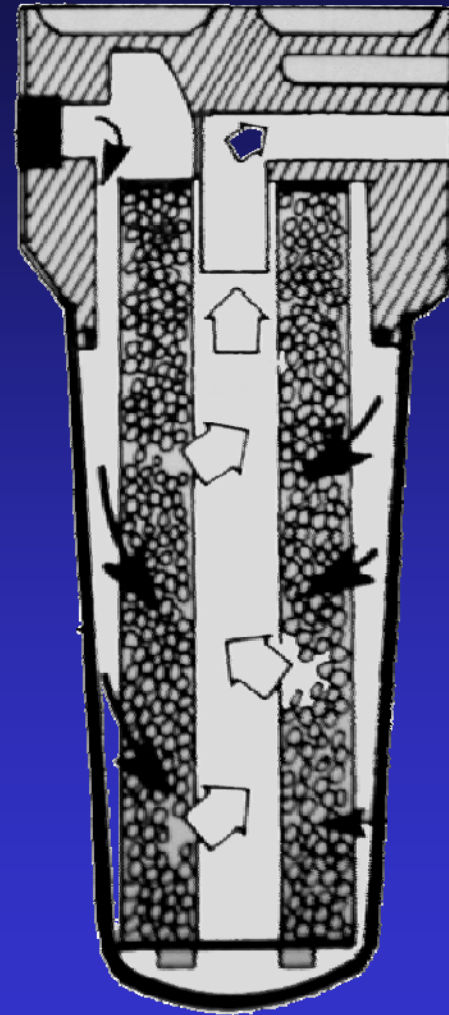


# Cartridge Filter (Adsorption)

- Flow rate
- Volume of water available not limited by water pressure tank
- No waste water
- Simplicity of operation
- Minimal space requirement
- Low capital cost

# Cartridge Filter System

- Performance =
  - Housing
  - Housing Seal
  - Element



# MDH PFC Study

Pre-Phase I – Mfg. Survey

Phase I – Bench Scale Testing

Phase 2 – Field Testing

# Pre-Phase I

- Invitation to participate ~ 500 manufacturers
- Device selection process (from 30 manufacturer nominations)
- 14 devices selected for Phase I (bench scale testing)

# Phase I

- Performance evaluation (bench-scale).
- Strong challenge water to devices.
- NSF/ANSI standards.
- Of 14 devices included in Phase I, 6 performed effectively and 5 selected for additional bench-scale testing.
- All 11 devices were selected for Phase II (field testing).

# Target Requirements for POU Device Performance in Phase I

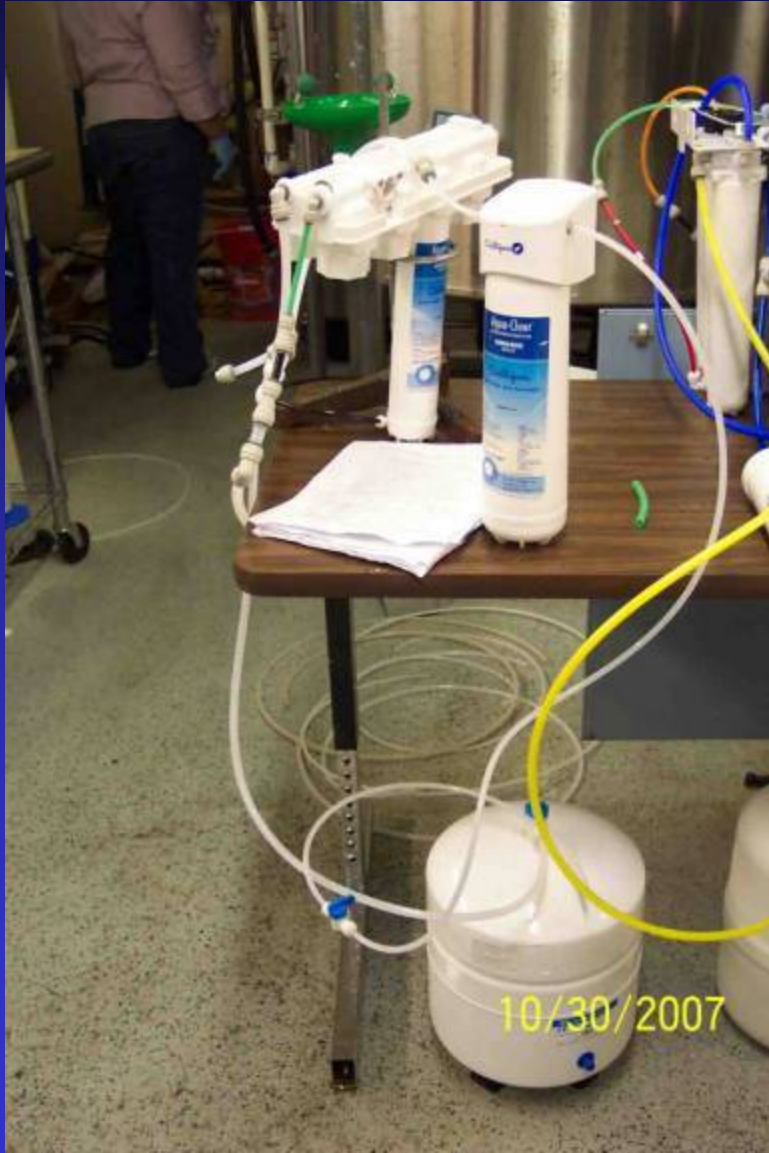
For Challenge Concentrations of:

- 10 parts per billion (ppb) of PFBA:
  - Reduce to less than 0.2 ppb
- 3 ppb each of PFOA and PFOS:
  - Reduce to less than 0.2 ppb
- Mixture of all three PFCs (10 ppb PFBA, 3 ppb PFOA, 3 ppb PFOS):
  - Reduce to less than 0.2 ppb each and less than 0.5 ppb in total.

# Phase I Testing (WQA)



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# Phase I - Effective POU Devices

- CUNO SQC-3
- Culligan Aqua Clear
- EcoWater ERO-375E-CP
- Kinetico Plus Deluxe VX
- Pentair RO 3500-EX w/GS
  
- Culligan RC-EZ-4 (carbon cartridge)

# Phase II Objectives

## 4 – AC and 7 – RO systems

Real world application  
St. Paul Park Well #3 (PFBA only)  
Oakdale Well #5 (PFBA, PFOA, PFOS)

PFC removal performance  
Operational performance

Final Report due May 2008

# Phase II Test Station



# Phase II Test Station



# Installation Performed by

- Licensed Plumber.
- Licensed Water Conditioning Contractor.

# Other MDH Recommendations

- Test your well water annually for total coliform bacteria.
- Test your well water for nitrate-nitrogen. If detected, test annually and monitor levels.
- Test your well water once for arsenic and for fluoride.

# Other Recommendations

- If you have a water treatment device, it is important to maintain that device following manufacturer recommendations. Filters, membranes, resins, and other media must be replaced or regenerated. Otherwise, they will eventually be worthless.