

# Membranes

For

POU and POE Applications

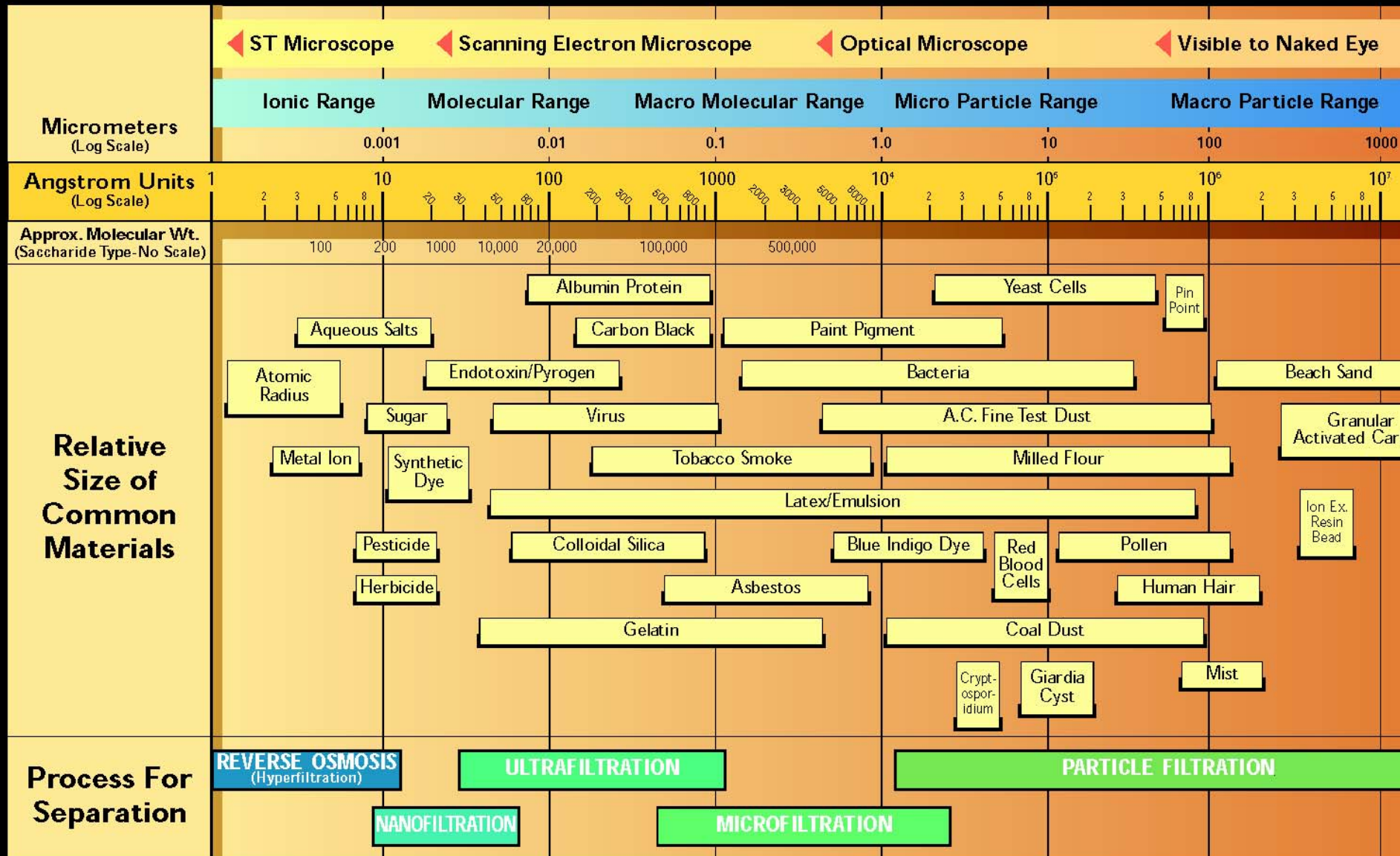
# Types of Membranes

MF Microfiltration

UF Ultrafiltration

NF Nanofiltration

RO Reverse Osmosis

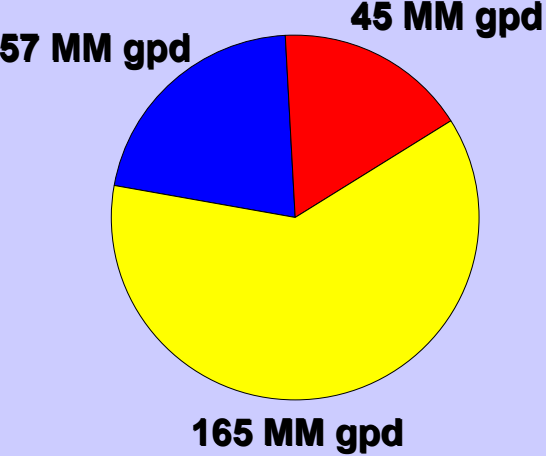


Note: 1 Micron (1x10<sup>6</sup> Meters) ≈ 4x10<sup>5</sup> Inches (0.00004 Inches)  
 1 Angstrom Unit = 10<sup>10</sup> Meters = 10<sup>4</sup> Micrometers (Microns)

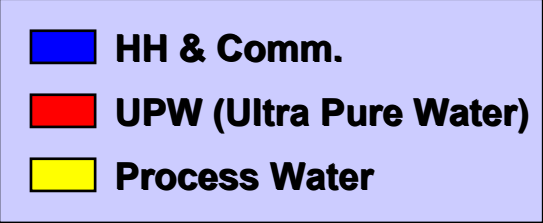
© Copyright 1998, 1996, 1993, 1990, 1984 Osmonics, Inc., Minnetonka, Minnesota

# Global demand for all membrane types in water treatment is growing dramatically

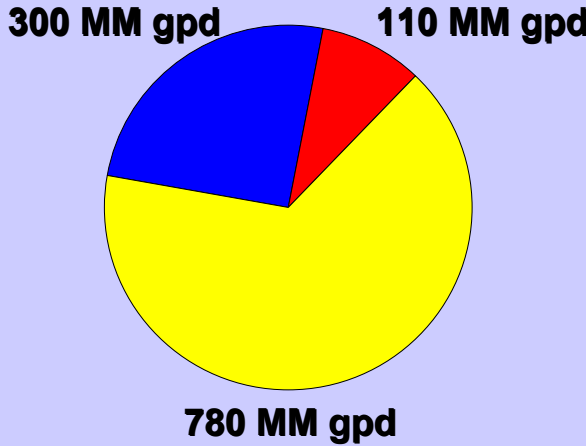
**1985**



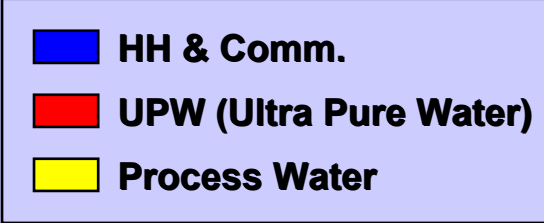
**267 MM gpd**



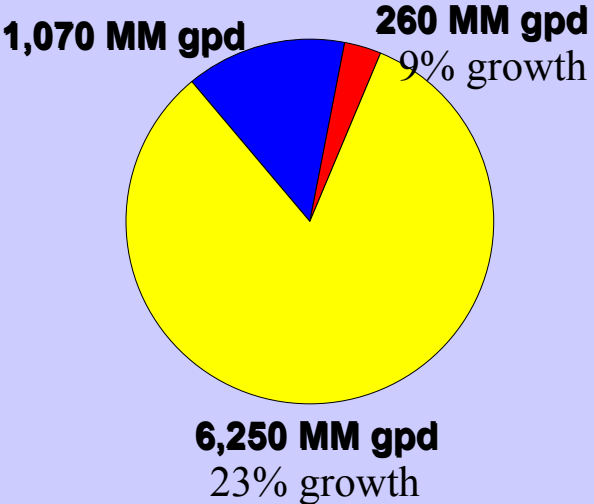
**1995**



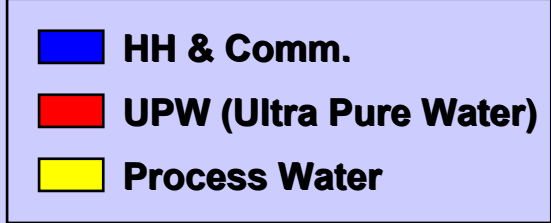
**1,190 MM gpd**



**2005**

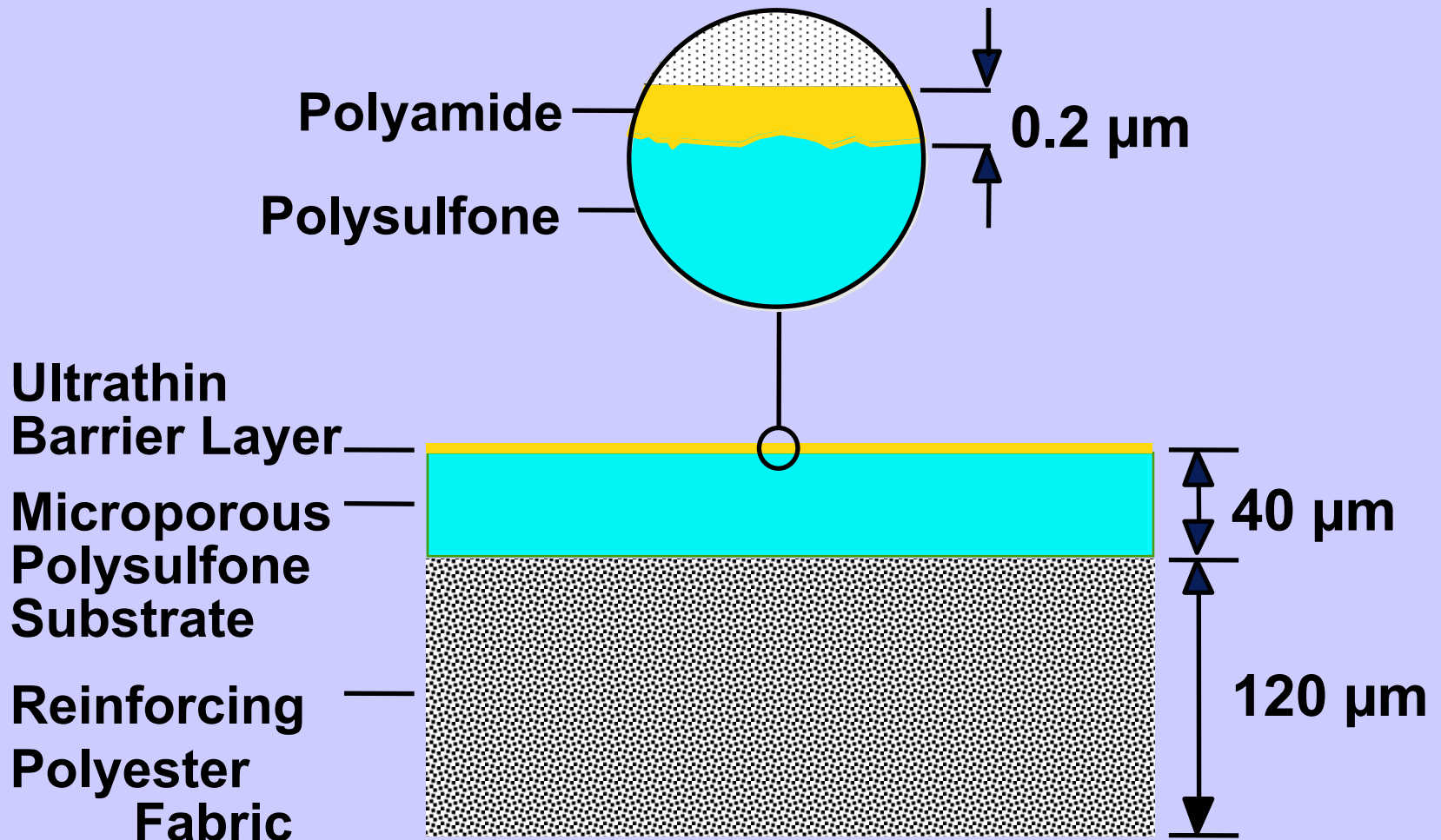


**7,580 MM gpd**  
20% growth

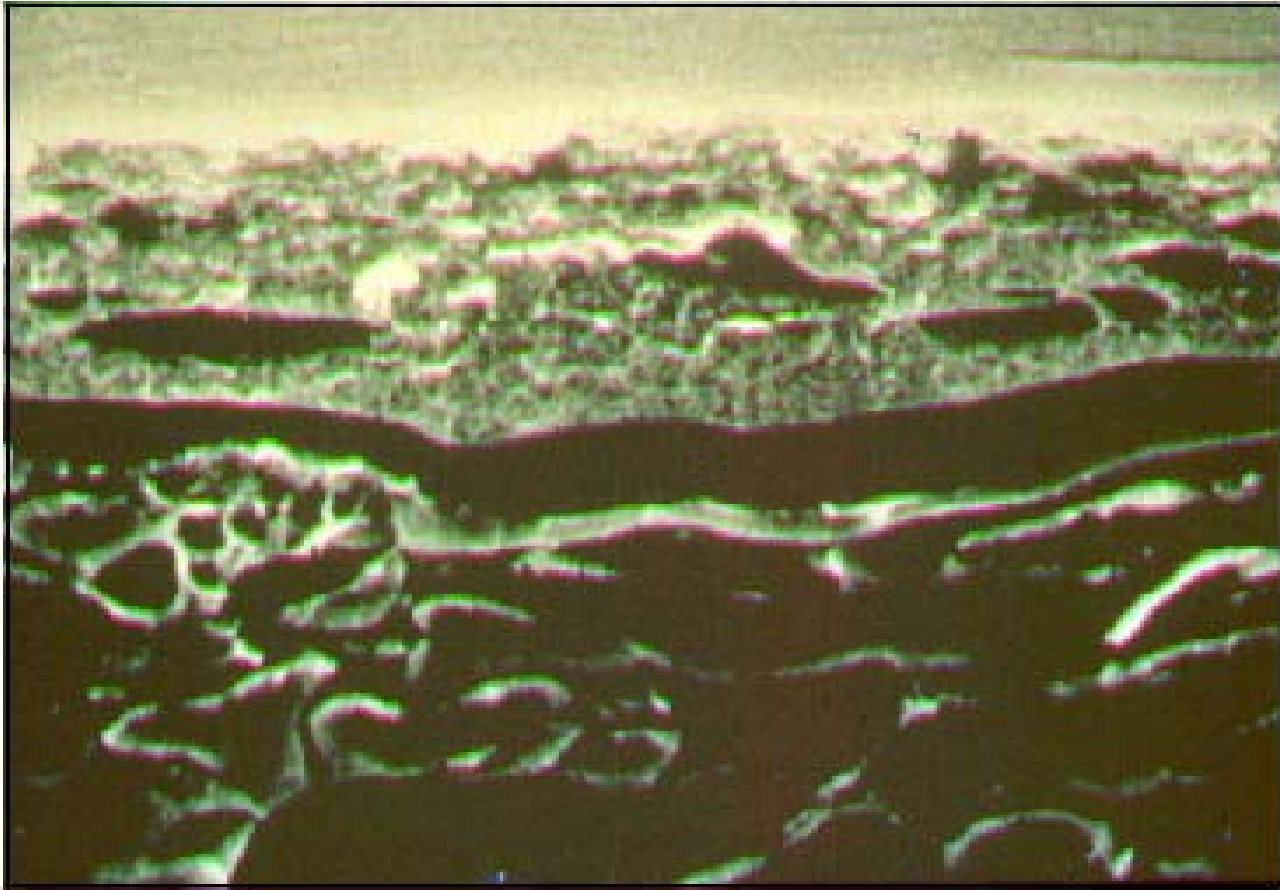


**Note:** gpd = gallons per day

# Cross-section TFC



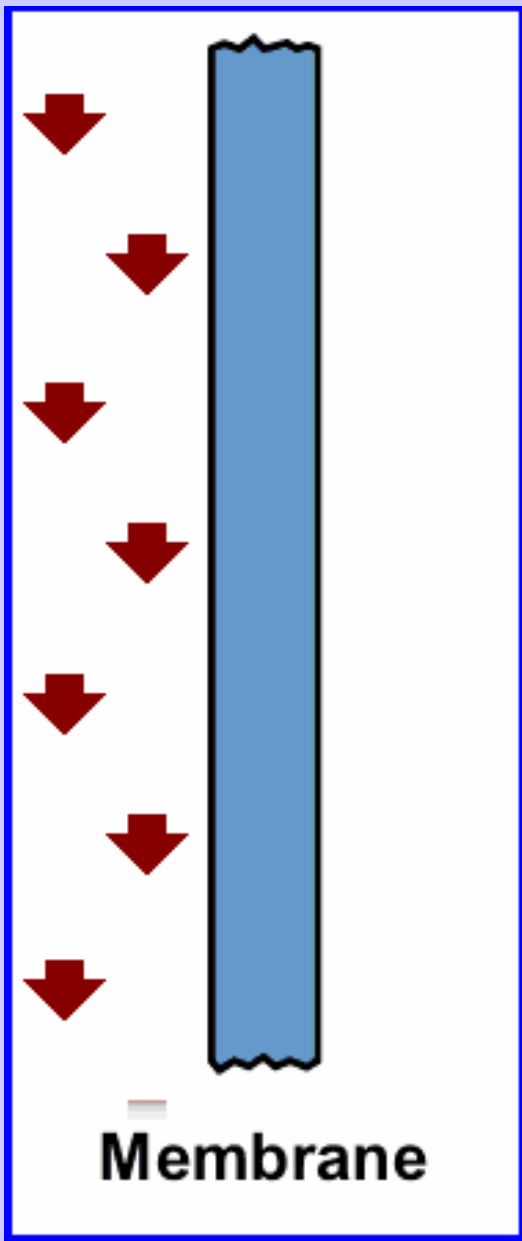
# Flat sheet membrane Cross-section



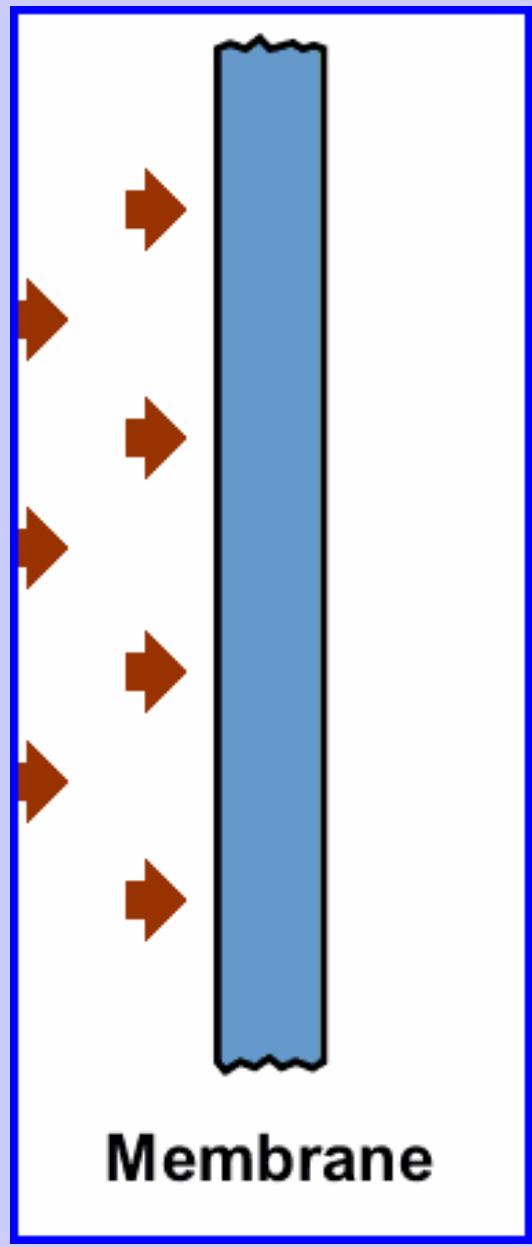
**Figure 6.1-15: Thin Film Composite Membrane**

# Membrane Operating Modes

- Dead Head
- Cross Flow
- Periodic Back Pulse/Back Flush



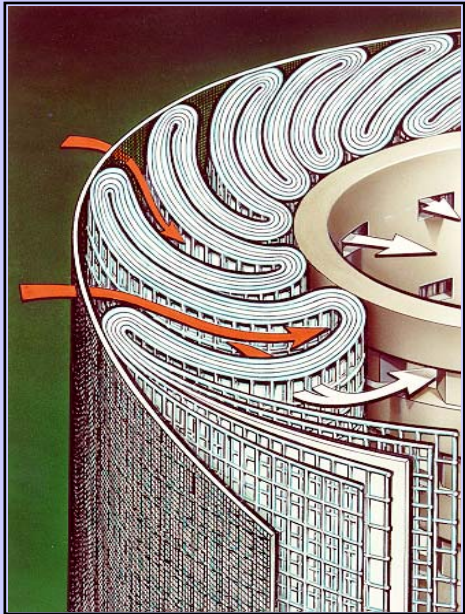
Cross Flow



Dead End

# Membrane Configurations

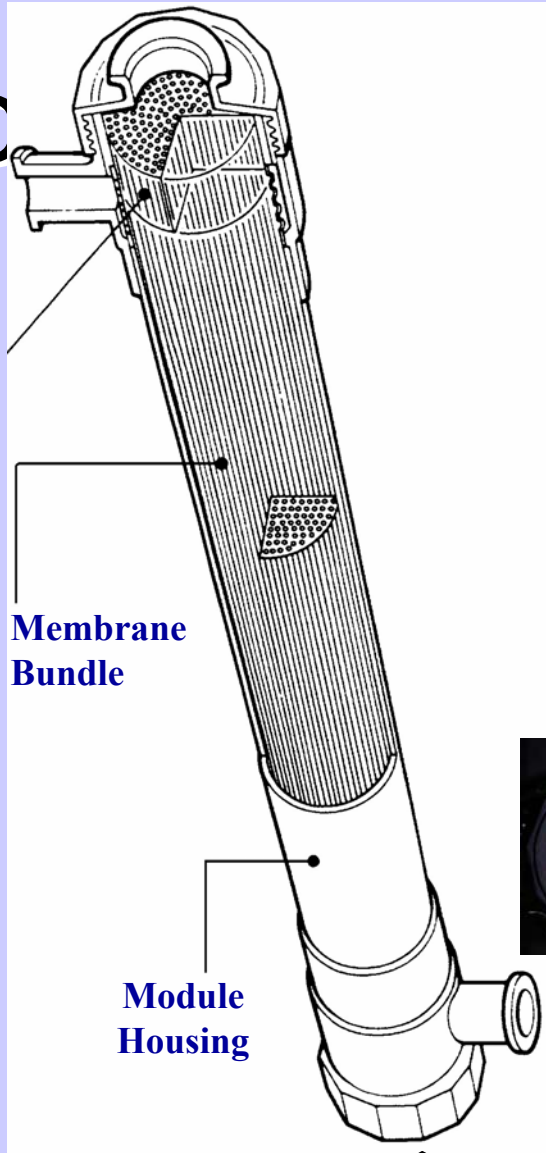
- Flat Plate
- Pleated
- Hollow Fiber
- Tubular
- Spirol Wound





Housing

Upper Bonded Section

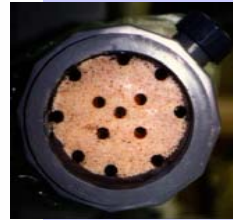


Membrane Bundle

Module Housing

# and Module

Module Feed

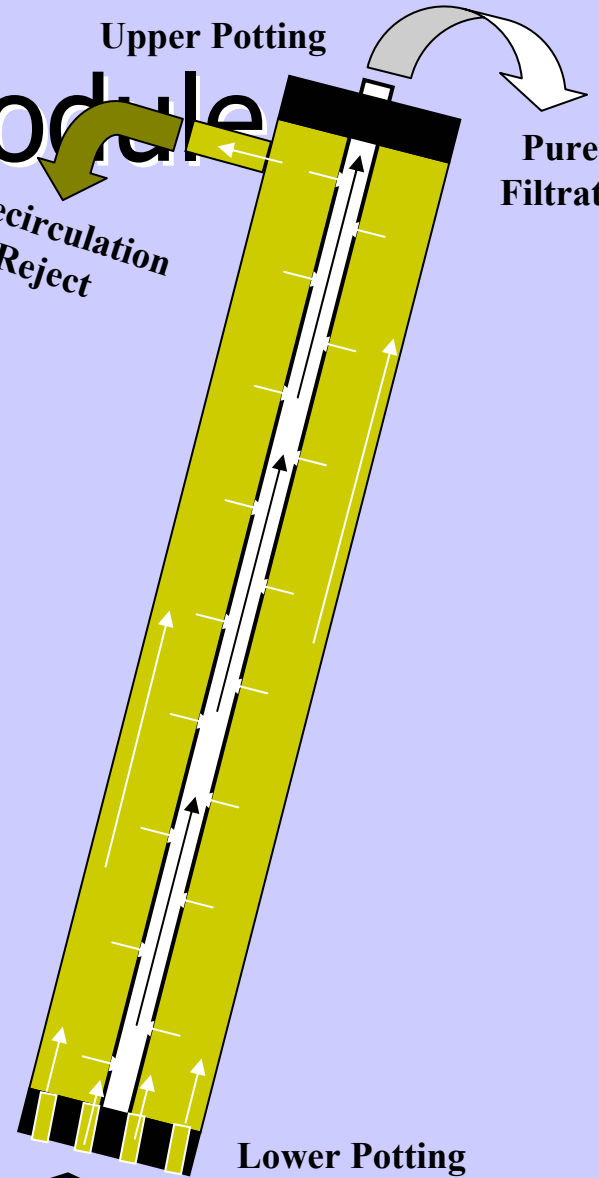


Raw Feed

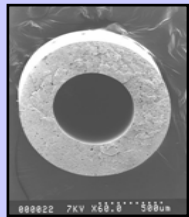
Upper Potting

Recirculation or Reject

Pure Filtrate



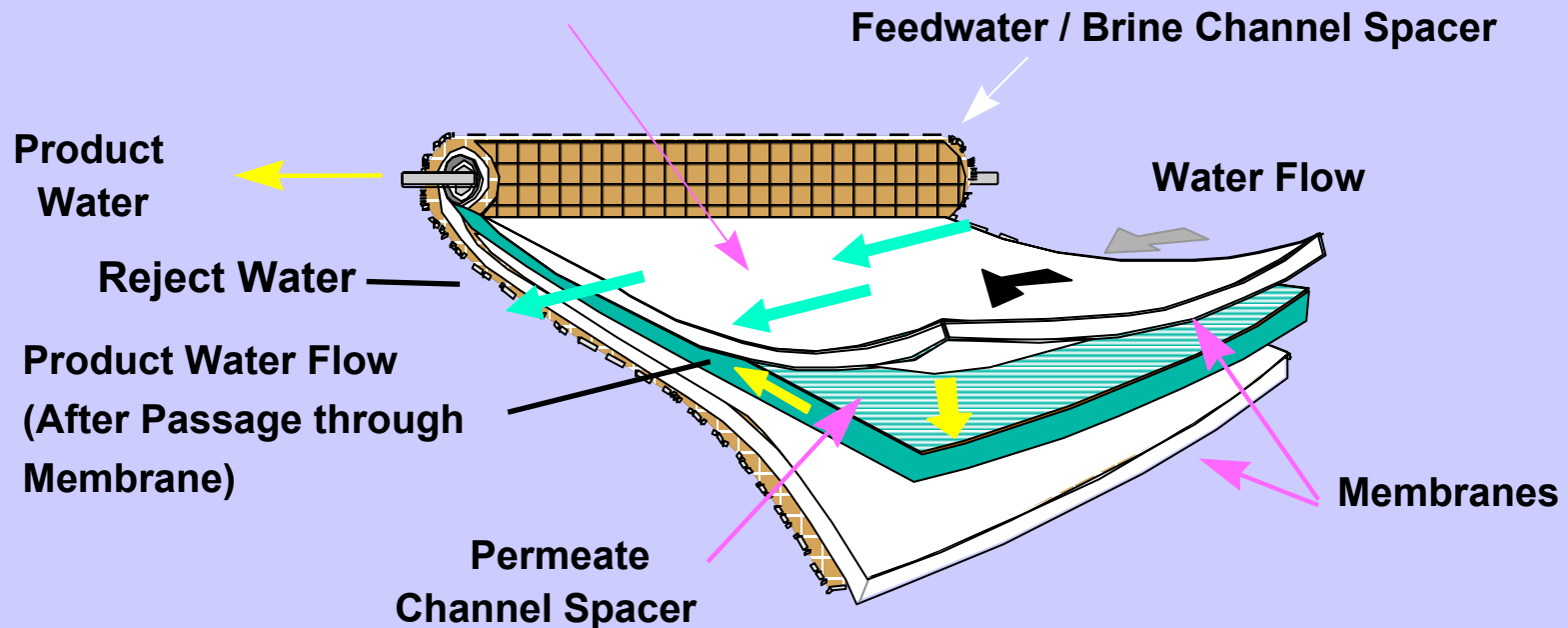
Lower Potting



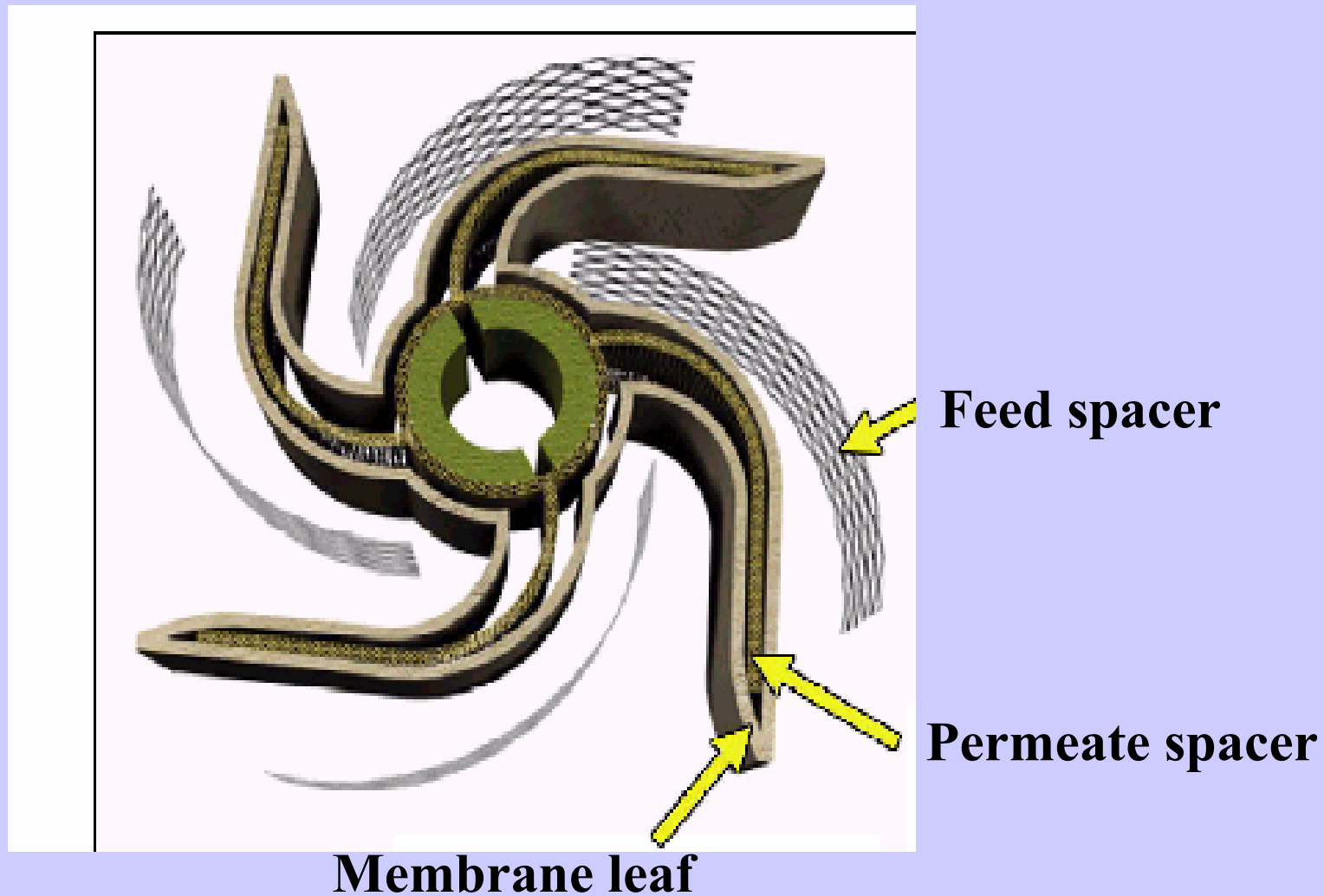
Pore = 0.1  $\mu\text{m}$   
Mat'l = PVDF  
Mode = Outside-In

# How a Spiral Wound Element Works

Selective Separation of Feedwater  
by Passage through Membrane

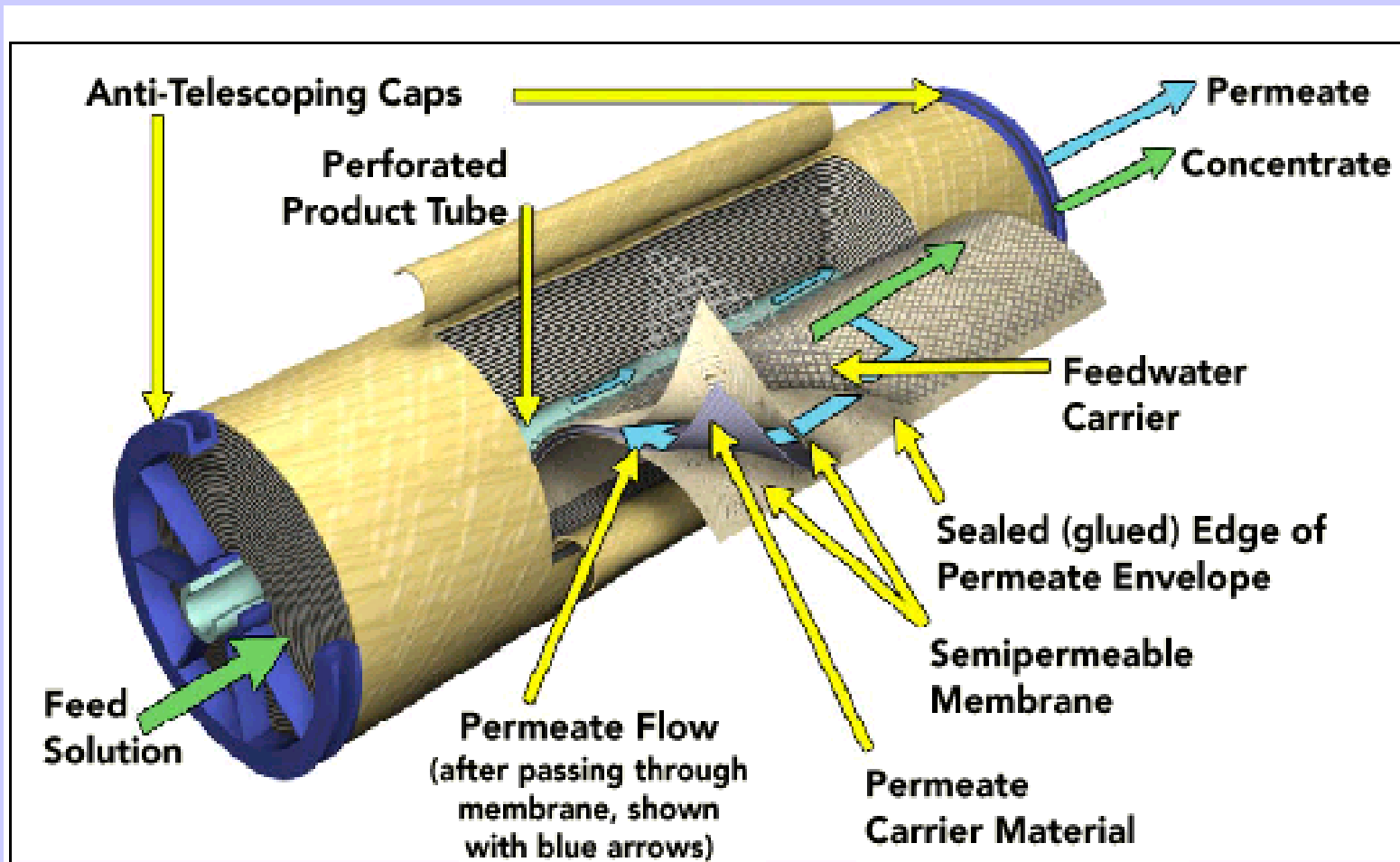


# Spiral Design



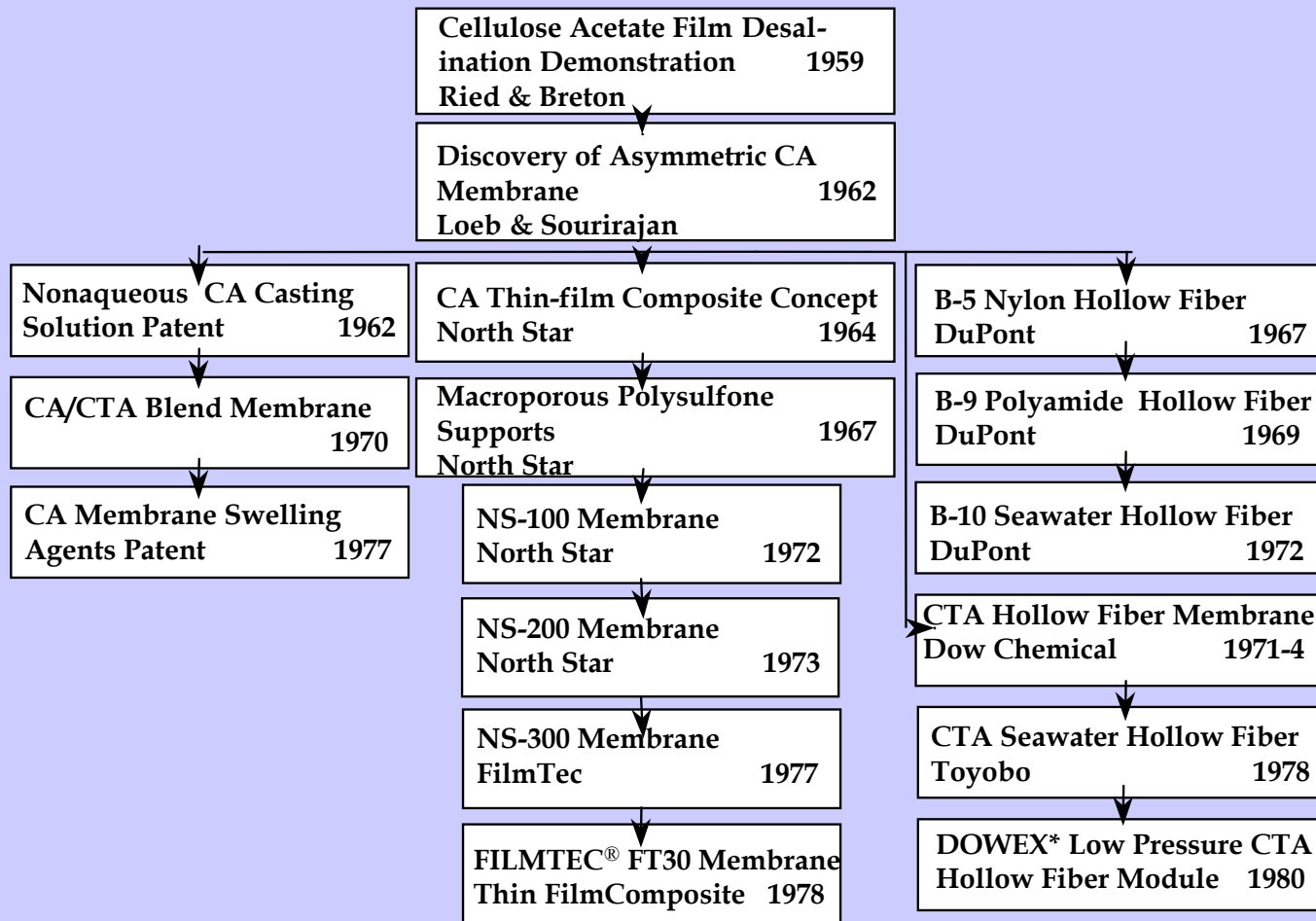
# Membrane arrangement

## Membrane element



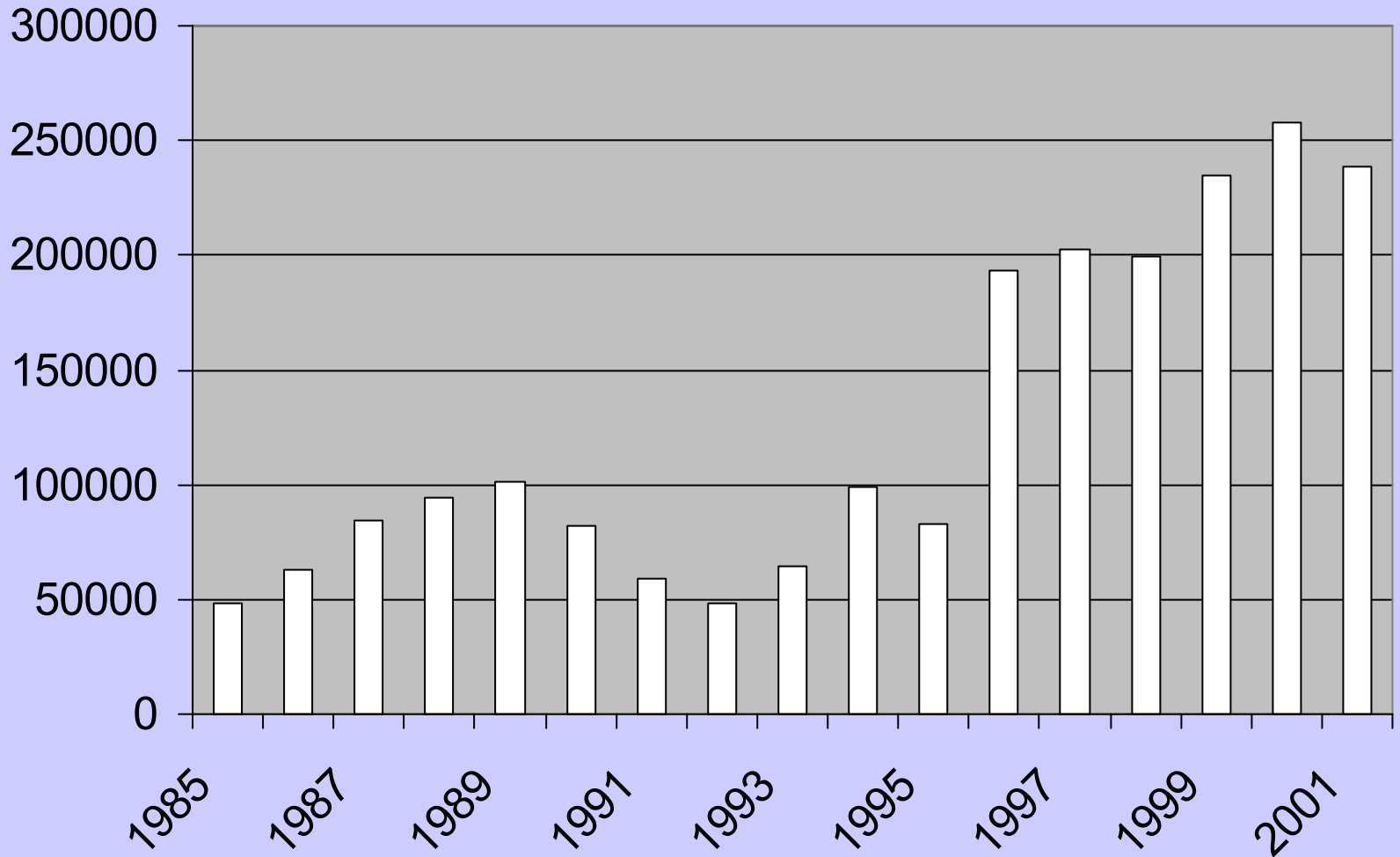
# POU Reverse Osmosis

# History of RO membranes

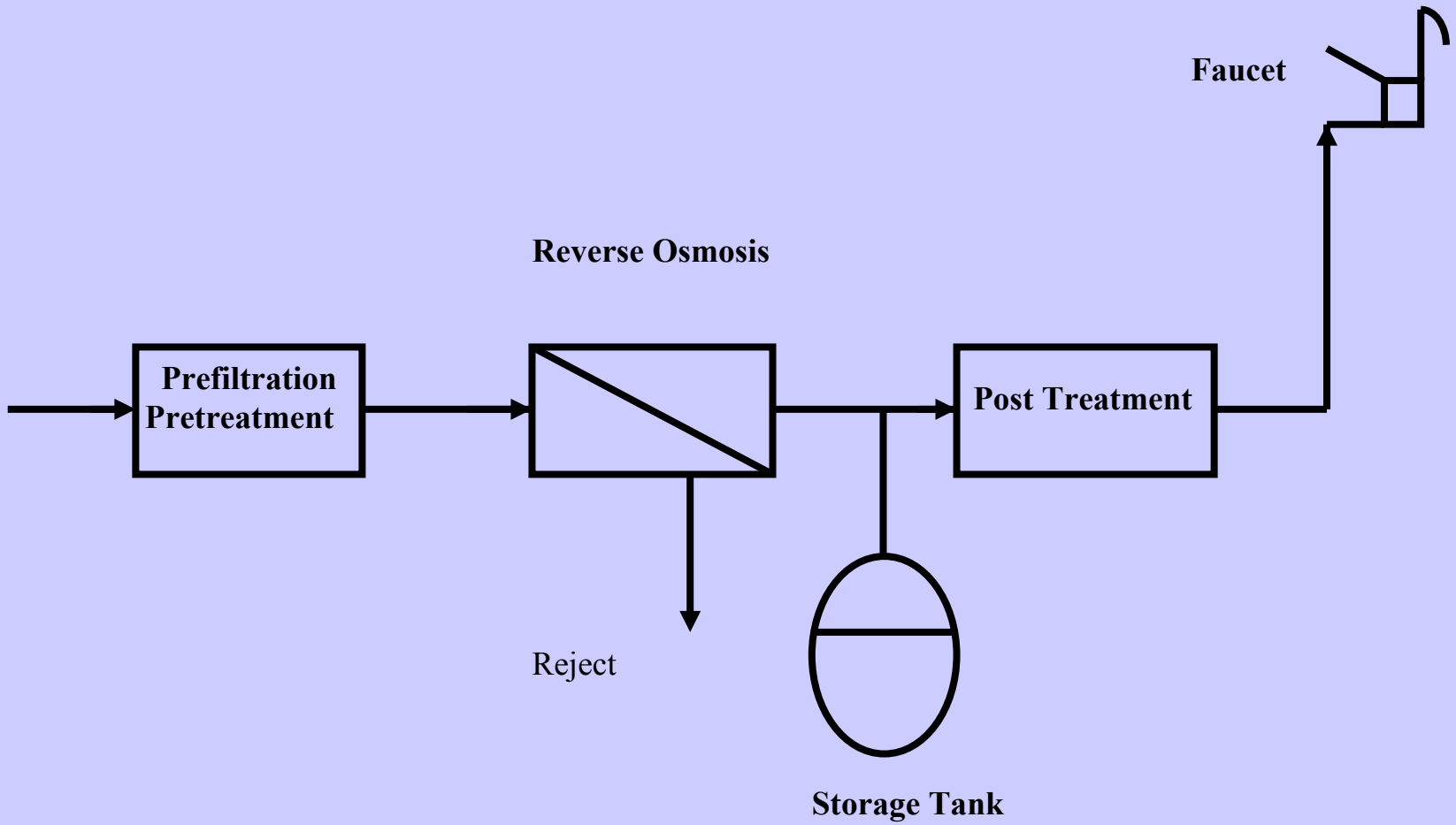


\* Trademark of The Dow Chemical Company

# POU RO Units by Year



Data from WQA yearly RO Shipment Data USA Only



**Typical POU RO System**











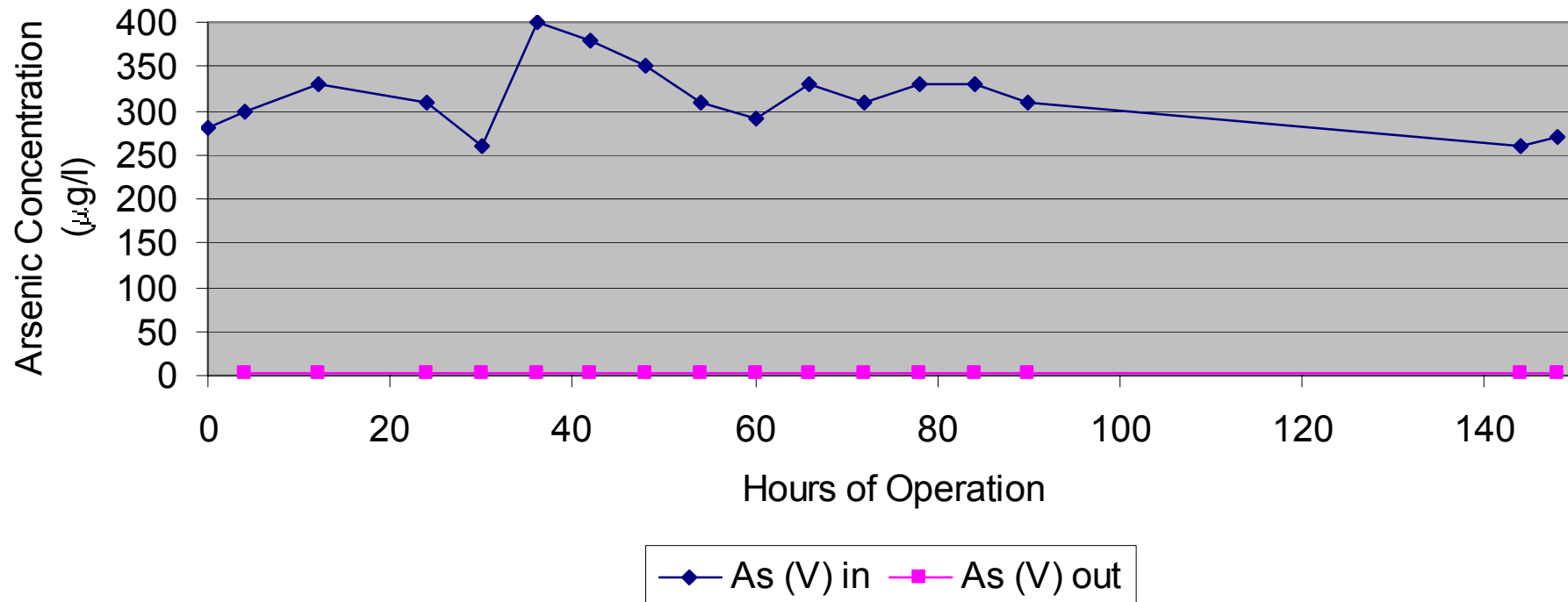
# Contaminants addressed by POU RO Systems

- Arsenic
- Nitrate
- Heavy Metals
- Organics- Pesticides, THMs
- Cysts
- Virus and Bacteria ( developing)
- Radionuclides
- TDS- Sodium, Sulfates, etc
- Other tastes/odors

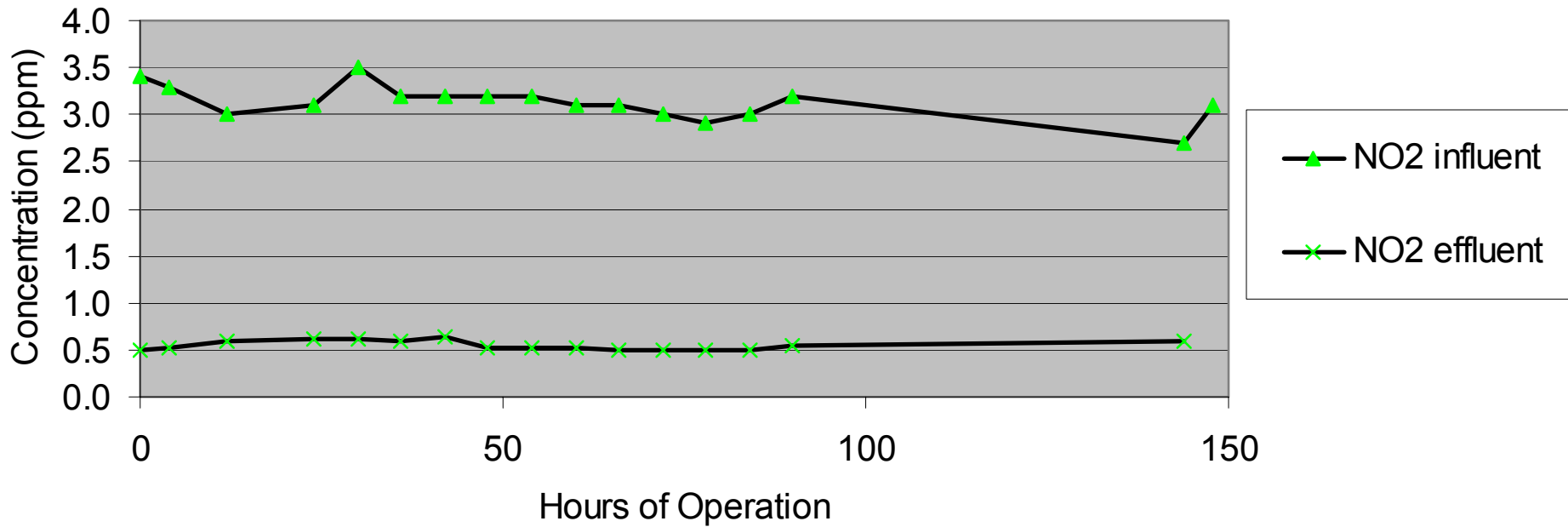
# RO- Typical Rejections

- Bacteria 99%+
- Cysts 99.9%+
- Organics
  - MW>300 75-99%
  - MW<300 0-95%
- Dissolved Ions
  - monovalent 80-98%
  - divalent 90-99%
  
- Factors - Pressure, Temperature, Concentration, Chemistry

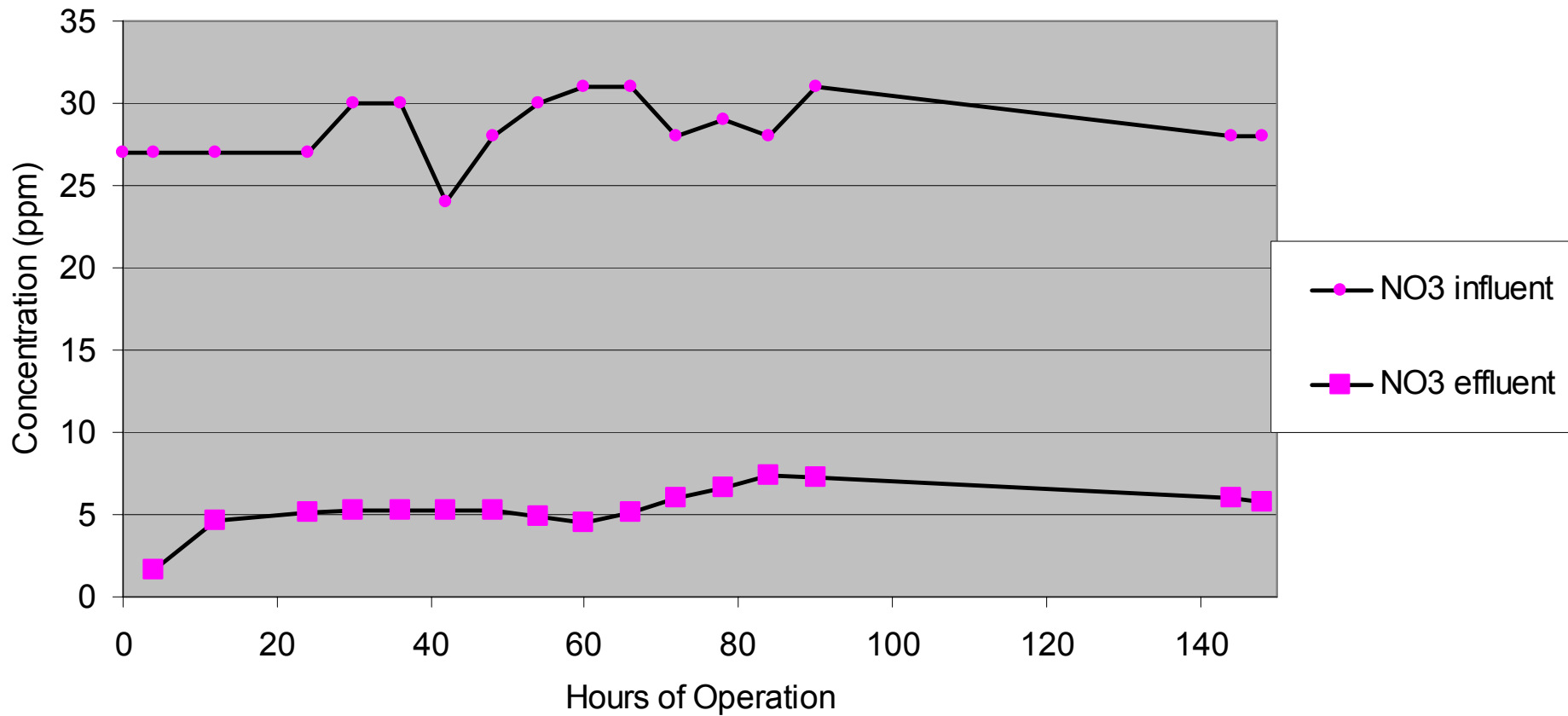
### Test of Arsenate Removal with Kinetico Drinking Water System+VX (TFC Reverse Osmosis)



# Test of NO<sub>2</sub> Removal with Kinetico Drinking Water System+VX (TFC Reverse Osmosis)



Test of NO<sub>3</sub> Removal  
with Kinetico Drinking Water System+VX (TFC Reverse Osmosis)



# POE Membrane Systems

- Reverse Osmosis
- UF/MF

# Contaminants addressed by POE Membranes

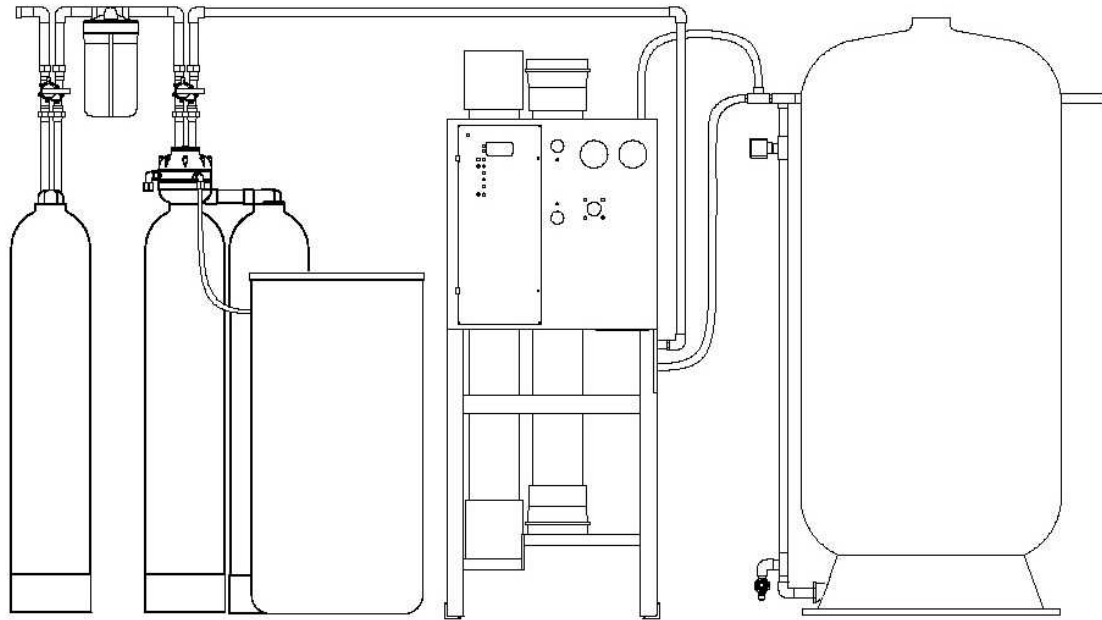
## RO

- Arsenic
- Nitrate
- Organics
- TDS
- Cysts, Virus\*, Bacteria\*
- Heavy Metals
- Tastes/Odors
- Radionuclides

## UF

- Organics
- Cysts, Virus\*, Bacteria\*
- Tastes/ Odors





<b>Components</b>	<b>PN</b>	<b>Description</b>
Carbon Filter	10286	Dechlorinator Filter, 8" x 40" tank
	6820B	By Pass (with adapters)
Prefilter	57544	Prefilter Mounting Bracket
	59125	Prefilter Housing (4.5" x 10")
	65027	25 micron Cartridge (4.5" x 10")
Softener	104	Model 60 Softener
	6820B	By Pass (with adapters)
TL RO	7507B	2,000 gpd System, 220V, 60 Hz
	8510A	2,000 gpd System, 400V, 50 Hz
Storage Tank	7482	40 gallon, Pressurized Storage Tank
	7483	80 gallon, Pressurized Storage Tank
Tank Accessories	10284	Pressure Switch, NO (Reverse Acting)
	7916	Pressure Relief Valve

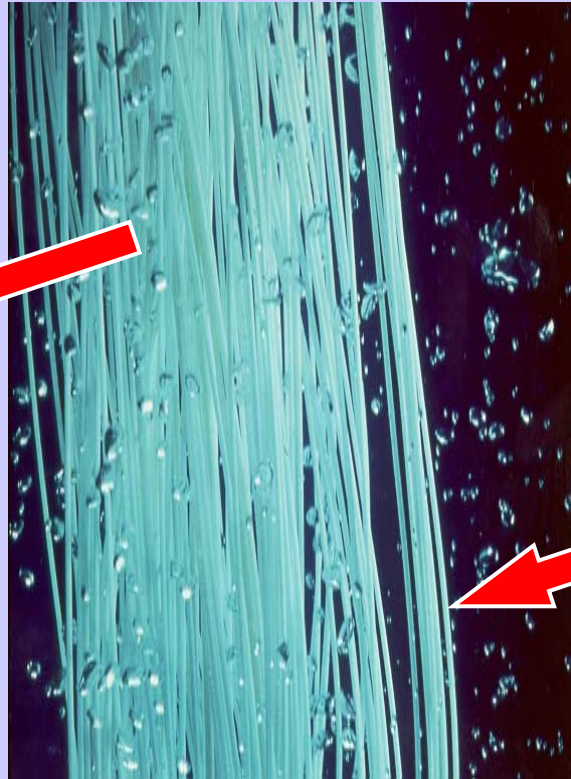
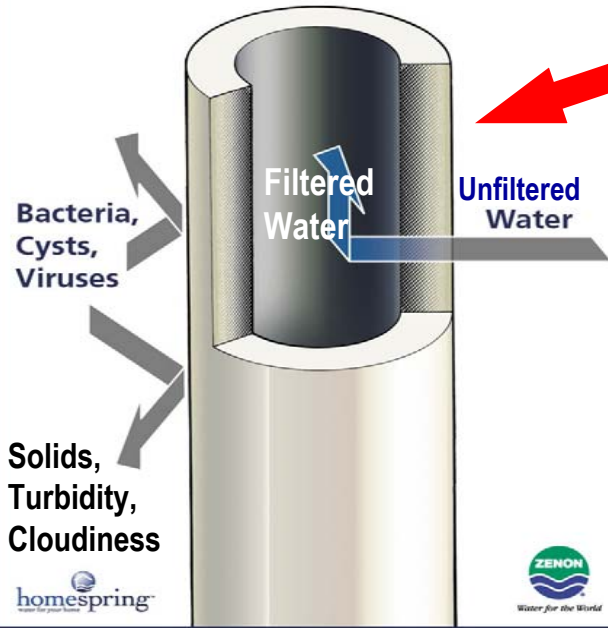
<b>Connections</b>	
Inlet/Outlet to Carbon Filter	¾" Copper
Inlet/Outlet to Prefilter	¾" FNPT
Softener Connections	
Bypass Inlet/Outlet	¾" Copper
Drain	½" PE Tube
Brine Line	¾" PE Tube
Brine Tank Overflow	¾" PE Tube
RO System Connections	
Inlet	¾" FNPT
Permeate	½" Tubing
Reject	½" Tubing
Permeate Flush Inlet	½" FNPT
Storage Tank Connection	1" FNPT
Pressure Switch	¼" MNPT
Pressure Relief	
Pressure Inlet	¼" FNPT
Relief Drain	¼" FNPT



# ***Point of Entry Water Filtration System***



# The Hollow Fiber Membrane



# POE Features / Benefits

## Raw Water Inlet

This low energy System filters municipal, well, cistern, lake and river water. The UF 100 can easily be adopted to work with existing household piping.

## Drain

Rejected impurities are flushed to drain during the automated cleaning cycle.

## Outlet

Clean, filtered water is distributed to every tap in your home.



## Prefilters

Removes large particles from source water before the Membrane. Activated Carbon improves taste and minimizes unwanted odours by reducing aesthetic chlorine.

## Ultrafiltration Membrane

Microscopic pores physically block out bacteria, cysts and viruses from the water.

## Continuous Supply

Thousands of ultrafiltration membranes filter water 'on demand' without the need for a storage tank.

## Automatic Cleaning System

Uses filtered water to clean membrane fibers every day.



# Assurance of Performance for POU/POE Membrane Systems

- Product Certifications
  - NSF/ANSI STD 58, STD 53, STD 42... ( STD 55)
- Monitors
  - Conductivity Lights (RO Only)
- Usage Meters
- Periodic Maintenance
  - Certified Technicians

# Conclusions

- Proven Membrane Products Exist Today
  - technology and designs improving all the time
- Certification Processes and Standards in Place
  - products
  - technicians
- Monitoring and Sensors Improving
- Many Consumers are already “Practicing”
  - Bottled Water
  - Faucet Devices
  - POU
  - POE
- Costs (?)- Case by Case