

Membrane Classification

- Pressure driven membranes are divided into four main divisions based on pore size
 - Microfiltration (MF)
 - Ultrafiltration (UF)
 - Nanofiltration (NF)
 - Reverse Osmosis (RO)

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Decreasing pore size.

Typical Operating Values

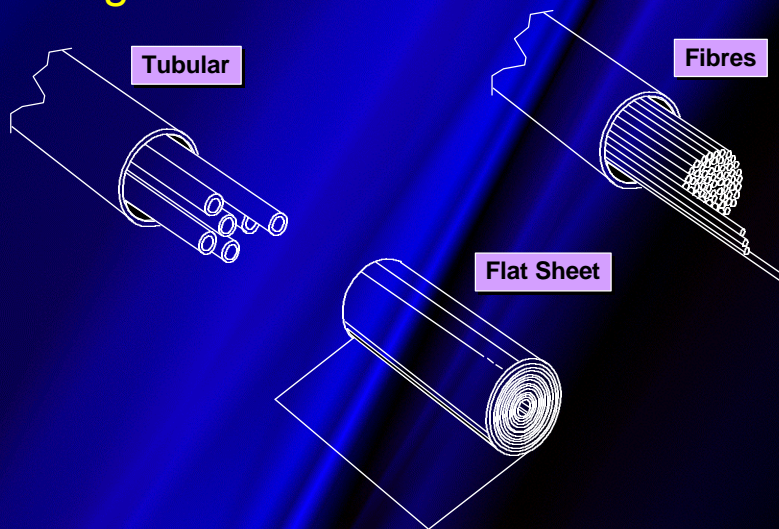
	MWCO/Pore Size	Flux	Pressure
MF	0.1 to 2 μm	115 L/m ² /h	15 to 60 psi
UF	0.005 to 0.1 μm	100 L/m ² /h	30 to 100 psi
NF	0.0005 to 0.005 μm	17 L/m ² /h	90 psi (typical)
RO	< 0.5 nm 50 to 200 daltons	n.a.	200 psi

Operational Concerns with Membrane Operation

- Membrane Fouling
 - Result of particles (bacteria, NOM, metals) attach to membrane
 - Much like sand filtration, result in an increase in operating pressure
- Solution:
 - Regular backwashing (like sand filtration)
 - Periodic solvent cleaning



Feed Driven Membrane Configurations



Feed Driven Membrane Configurations

In a feed driven system, water will “inside-out”



“Pipes” containing membranes are then added in modular form to delivered desired flow



Source: Pall Corporation, www.pall.com

Direct Membrane Filtration Plant



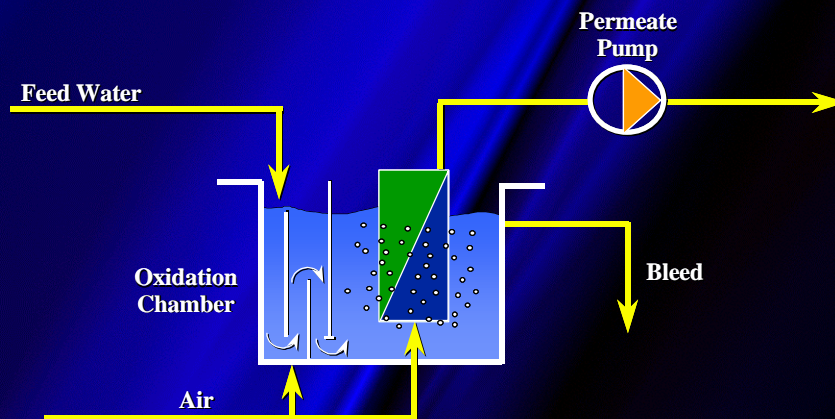
- Collingwod, ON
- Capacity
 - 8 MGD
- Design Flux
 - 30 gfd
- Design Recovery
 - 85 to 95 %

Collingwood Water Quality

	Feed	Permeate
Turbidity	up to 40 NTU	< 0.02 NTU
Particle Counts	up to 10,000 particles/100 mL	< 3 particles/100 mL

- No chemical addition.
- Water is passed **directly** through membrane.

Iron & Manganese for UF



Iron & Manganese for UF



- Rothesay, NB
- Population of 11,500
- Capacity
 - 0.8 MGD
- Manganese removal achieved with 5g/L of KMnO_4