POLICY STATEMENT
ON
MEMBRANE FILTRATION
FOR
TREATING SURFACE SOURCES

Low pressure membrane filtration technology has emerged as a viable option for addressing current and future drinking water regulations related to treatment of surface water sources. Recent research and applied full scale facilities demonstrate the efficient performance of both Microfiltration (MF) and Ultrafiltration (UF) as feasible treatment alternatives to traditional granular media processes. Both MF and UF effectively remove most or all of the contaminants identified in the Surface Water Treatment Rule. These contaminants include Giardia lamblia, heterotrophic plate bacteria, turbidity, and possibly enteric viruses. The following provides a brief description of the characteristics of each process as well as selection and design considerations.

Characteristics: MF and UF membranes are most commonly made from organic polymers (for example, cellulose acetate, polysulfones, polyamides, polypropylene or polycarbonates). The physical configurations include hollow-fiber, spiral wound and tubular. MF membranes can remove particles with sizes down to 0.1-0.2 microns. UF processes have a probable lower cutoff rating of .005-.01 microns.

Typical flux (rate of finished water permeate per unit membrane surface area) at 20 degrees C for MF ranges between 50-100 gallons/sq. ft./day (gsfd) whereas the typical UF flux ranges between 10-50 gsfd. Required operating pressures ranges from 5-10 psi for MF and 15-70 psi for UF.

Since both processes have relatively small membrane pore diameters, membrane fouling, caused by organic and inorganic as well as physical contaminants, frequently occurs. Reaching a targeted transmembrane pressure triggers a flushing and cleaning cycle. Typical cleaning agents utilized include acids, bases, surfactants, enzymes and certain oxidants, depending upon membrane material and foulants encountered.

The Division of Drinking Water must review overall treatment requirements and assign disinfection credits. Membrane filtration requires secondary disinfection.

Selection and Design Considerations:

1. A review of historical source raw water quality data, including turbidity and/or particle counts, organic loading, temperature differentials as well as other inorganic and physical parameters, can indicate whether either process is feasible. These analyses may also help determine whether to employ pre-treatment. Design considerations and membrane selection at this phase must also address the issue of target removal efficiencies versus acceptable transmembrane pressure differentials.

2. The useful life expectancy of a particular membrane under consideration requires evaluation. A membrane replacement frequency significantly will affect operation and maintenance cost

comparisons in the selection of the process.

3. Many membrane materials are incompatible with certain oxidants. If the system must rely on pretreatment oxidants for other purposes, for example, zebra mussel control, taste and odor control, the selection of the membrane material requires careful evaluation.

4. The source water temperature can significantly impact the flux of the membrane under consideration. At low water temperatures the flux reduces appreciably, possibly impacting process feasibility or the number of membrane units required for a full scale facility.

5. Flushing volumes can range from 5-25 percent of the permeate flow, depending upon the frequency of flushing/cleaning and the degree of fouling and may influence the number of treatment units required.

6. Evaluating membrane and housing integrity and overall filtration performance requires routine finished water monitoring. We strongly recommend using particle counters as an cornerstone of finished water monitoring, along with manual and/or automated pressure testing or air diffusion testing.

7. Final design must eliminate cross connections, particularly with regard to chemical feeds used for membrane cleaning.

8. Include redundancy of critical control components in the final design.

9. Include other post-membrane treatment processes, as required, to address other contaminants of concern such as color and disinfection by-product precursors.

10. Contact the Division of Drinking Water prior to initiating the design of a membrane treatment facility. We require a either a site- and technology-specific pilot study or a certification from the National Sanitation Foundation (NSF) Environmental Testing Verification (ETV) and comparative water monitoring results to demonstrate process performance under expected conditions.

    In many cases, a pilot plant study may help determine the best membrane to use, particulate/organism removal efficiencies, cold and warm flux, the need for pre-treatment, fouling potential, operating and transmembrane pressure and other design considerations.

    Provide the NSF virus removal rating or document virus removal through an appropriate piloting process if you desire virus removal credit. Contact the Utah Division of Drinking Water prior to conducting the pilot study to establish the pilot protocol to follow.

Acknowledgment: Much of the material presented herein comes from Recommended Standards for Water Works, 1997 Edition, Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers.