PURPOSE: Public water systems may utilize innovative or alternate filtration systems provided the supplier demonstrates that the alternative technology is able to achieve results which are equivalent to that of conventional methods. A pilot plant study shall be performed at the water system and must show that the alternative design can consistently meet State and Federal requirements for at least six months. The water system shall submit to the State a preliminary summary report prior to the start of the pilot plant testing.

I. Submittals

A. The water system shall submit a summary package outlining the membrane installations to the District Office.

B. The package shall contain information on scope of the project, water quality, and description of each unit to be tested.

II. Pilot Study Report

A final report on the pilot plant test or the comparative on working full-scale operation shall be prepared by a professional engineer. Such professional engineer shall be licensed by the Louisiana Professional Engineering and Land Surveyors Board (LAPELS). The engineer shall affix their seal, signature and date to the front page of the report.

A. Site Plan and Locational Information

1. The name of the public water system and water treatment plant(s) involved in the pilot study.
2. The Public Water System I.D. number.
3. The name of the raw water source or sources proposed for treatment by membrane filtration and the water rights allocation.
4. A USGS 7.5-minute quadrangle map showing the location of the intake structure(s) used during the pilot study. If the location of the intake for the pilot study differs from that of the existing water treatment plant, or that of the proposed full-scale membrane water treatment plant, both locations must also be shown on the map.
5. A schematic of the pilot plant that shows chemical feed points, pretreatment facilities, pilot equipment, flow meters, and monitoring points.

B. Membrane Module Information

1. Membrane manufacturer's name;
2. Type of membrane (MF, UF**,** NF, RO);

3. Documentation that the piloted membrane unit conformed to American National Sanitation Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and has been certified by a testing organization accredited by ANSI;
4. Material the membrane fiber is constructed of;
5. Length of membrane fiber;
6. Surface area of the feed water side of the membrane module/element;
7. Flow direction (inside out or outside in)
8. Nominal and maximum pore sizes;
9. Oxidant resistance;
10. Water temperature operating range;
11. Feed water turbidity operating limit;
12. Method of operation (dead-end or cross flow);
13. Maximum recommended instantaneous filtrate flux rate;
14. Maximum allowable TMP;
15. The required direct integrity test pressure to detect a defect as small as 3.0 microns (see the most recent draft or adopted version of the ASTM document titled, Standard Practice for Integrity Testing of Water Filtration Membrane Systems);
16. Concentration factor (CF), defined as a measure of the increase in concentration of the contaminant that could occur on the high pressure side of the membrane relative to the raw water;
17. Flow from the smallest breach (3.0 microns), at the maximum recommended instantaneous filtrate flux rate, that can be detected by the direct integrity test; and,
18. Log removal value (LRV) = LOG_{10} (C_f) – LOG_{10} (C_p); where C_f = feed concentration and C_p = filtrate concentration

C. Clean-in-place (CIP) Data for each membrane module

1. All chemicals used and their concentrations;
2. Documentation that all chemicals used conformed to ANSI/NSF Standard 60 and has been certified by a testing organization accredited by ANSI;
3. Flow rate;
4. Duration (time offline);
5. Quantity of filtrate water used;
6. Disinfectant residual (if applicable);
7. pH of the chemical solution;
8. Temperature of the chemical solution;
9. Procedure;
10. Disposal method of chemical waste; and,
11. The expected chemical cleaning frequency for the full-scale membrane water treatment plant.

D. Graphs

Each of the graphs must show the time the data was collected on the x-axis and the results of the measurements on the y-axis. The scale of each axis must be such that data at four hour intervals and all chemical cleaning events can be clearly identified.

1. A graph showing the daily turbidity levels of the raw water and any time there is a change that affected the operating parameters;
2. A graph showing the total particle counts in the 2 to 15-micron range at 15-minute intervals for the feed water and at five-minute intervals for the filtrate/permeate water; or, A graph showing the turbidity levels at 15-minute intervals for the feed water and at five-minute intervals for the filtrate/permeate water;
3. A graph showing filtrate/permeate flux rates and corresponding TMP at four-hour intervals;
4. A graph showing the daily filtrate/permeate flux rates and corresponding feed water temperatures;
5. A graph showing the daily average specific flux rates (adjusted to 20^{o} C) and % recovery of specific flux; and,
6. A graph showing the % loss of original specific flux rate for each Stage 2 filtrate run and the corresponding feed water turbidity levels during the run.

E. Summary Tables

A pilot report must contain each of the following data summary tables. Each of the tables must contain the number of data points collected, the range of data values (i.e., the maximum and minimum values), the average value, and the 95^{th} percentile value if more than 10 data points were collected

1. A "log removal table" summarizing the feed water and filtrate/permeate water data and the level of daily removal achieved for each of the following parameters

    a. Turbidity; or, Particle counts;
    b. The calculated Log Removal Value; and,
    c. E. ***coli*** (if that data was collected).

2. A "membrane performance table" summarizing the following operating conditions and each membrane module's performance during the pilot study

    a. Feed water flow rate;
    b. Filtrate water flow rate;
    c. Recycle flow rate (if applicable);
    d. Reject flow rate (if applicable);
    e. Filtrate flux;
    f. TMP;

g. Feed water temperature;
h. Specific flux (adjusted to 20' C);
i. % recovery of specific flux after a CIP;
j. Each direct integrity test's beginning pressure, ending pressure and duration;
k. The calculated maximum log removal based on: LR_{max} = LOG [$Q_{filtrate}$/CF x Q_{breach}] (Where, $Q_{filtrate}$ is the actual design flow, CF is the concentration factor, and Q_{breach} is the flow rate from a 3.0-micron breach in a module's components as detected by the required direct integrity test);
l. % loss of original specific flux due to irreversible fouling;
m. Backwash frequency;
n. Backwash duration; and,
o. Backwash flow rate.

3. A "water quality table" summarizing the results of the following water quality analyses

   a. Raw water total hardness as calcium carbonate;
   b. Raw water total alkalinity;
   c. Raw water iron, manganese and aluminum;
   d. Raw water total dissolved solids (TDS), total suspended solids (TSS) and conductivity;
   e. Raw water pH;
   f. Raw water algae count;
   g. Feed water pH (if it was different from raw water);
   h. Feed water algae count (if it was different from the raw water count);
   i. Filtrate water pH;
   j. Raw and filtrate TOC levels (if a coagulant was fed); and,
   k. Filtrate water conductivity or TDS (if NF or RO membranes were piloted).
   l. If NF or RO membranes are being used to remove regulated chemical constituents, include the calculations for determining a blending ratio that will produce a finished water quality that meets all state drinking water standards.

4. If a disinfectant was applied during the study, the pilot study report must include a "disinfection data table" for each of the following that includes the number of data points collected, the range of data values (i.e., the maximum and minimum values), and the average value

   a. Each disinfectant and application point;
   b. Disinfectant dosage;
   c. All disinfectant residual levels;
   d. Total Trihalomethanes (TTHM);
   e. Haloacetic Acids (HAAS);
   f. Chlorite (if chlorine dioxide was used); and,
   g. Bromate (if ozone was used).

5. A pilot study report must include a detailed description of the site conditions and each membrane unit's testing. The following information must be included in this description

    a. A description of the raw water source, the raw water intake and all pretreatment facilities.
    b. A description of the manufacturer's required membrane preconditioning method that occurred prior to the pilot study.
    c. All rainfall events on the watershed during the pilot study.
    d. If conventional pretreatment (coagulation, flocculation, clarification) was not provided in the pilot study, then the pilot study period must have included at least one raw water spike associated with a major rainfall event or a turbidity spike created using a turbidity spiking technique. The raw water spike or turbidity spike must be representative of the source's historical raw water turbidity highs.
    e. A description of how the results of the initial Stage 1 testing resulted in the selected Stage 2 simulated full-scale operating conditions piloted for each membrane unit.
    f. A description of any equipment failures and any resulting time delays.
    g. A detailed analysis of the pilot study data for each membrane unit.

6. The pilot study report must include a list of the analytical methods and equipment used during the pilot study. It should also include the calibration procedures and frequencies for the analytical equipment and flow meters.

III. Plans Review and Inspection

A. Approval of the final pilot study report is not a permit for construction. Construction of the proposed membrane water treatment facility may not begin until engineered plans and specifications have been reviewed and approved by the District Office.

B. No later than 30 days after construction is completed, a post inspection shall be conducted on the installation as directed by the State.