TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

September 24, 2021

Mr. Aaron Balczewski
DuPont – Memcor Products
455 Forest St
Marlborough, MA 01752

Attn: William Boyland

Re: Memcor® S10N$_{v2}$, L10N$_{v2}$ and L20N$_{v2}$ Ultrafiltration Membrane Modules
Review and Approval of Challenge Testing
Removal of Microbial Contaminants

Dear Mr. Balczewski.:

In accordance with Title 30 of the Texas Administrative Code (30 TAC) §290.42(g)(3), membrane filtration systems installed on, or replaced after, April 1, 2012 for the removal of *Cryptosporidium* and *Giardia* must undergo challenge testing to evaluate the membrane's removal efficiency and for the Texas Commission on Environmental Quality (TCEQ) to establish a challenge test log removal value (LRV$_{C\text{-}Test}$). In addition, these TCEQ regulations require a membrane manufacturer to provide the non-destructive performance test (NDPT) and associated quality control release value (QCRV) that will be used to verify that all manufactured membrane modules that were not subject to challenge testing will achieve at least the same log removal as those that were challenge tested.

CHALLENGE STUDY DATA FOR THE MEMCOR® S10N$_{v2}$, L10N$_{v2}$ AND L20N$_{v2}$ MODULES
We reviewed the submitted challenge study data for compliance with the *Cryptosporidium* treatment requirements in the Long Term 2 Enhanced Surface Water Treatment Rule (LT2). The criteria for compliance are found in Title 40 of the Code of Federal Regulations (40 CFR) §141.719(b)(2). Additional guidance for compliance with these requirements can be found in the United States Environmental Protection Agency (USEPA) Membrane Filtration Guidance Manual (EPA 815-R-06-009). The TCEQ reviewed challenge study data, prepared by NSF International (NSF) and dated November 21, 2018, for Evoqua Water Technologies, LLC (now DuPont - Memcor Products), providing the results of the NSF/American National Standards Institute (ANSI) Standard 419-2015 testing of Memcor® S10N$_{v2}$ ultrafiltration (UF) membrane modules. The test was performed using a submerged and pressurized configuration. Based on our review, we have determined that the challenge study is compliant with LT2 requirements. Please review the conditions in the following pages regarding the approved log removal value demonstrated during challenge testing (LRV$_{C\text{-}Test}$) and the NDPT for production membrane modules that did not undergo challenge testing.

TCEQ Approved LRV$_{C\text{-}Test}$
The TCEQ is approving an **LRV$_{C\text{-}Test}$ of 6.10** for the removal of *Cryptosporidium* for the Memcor® S10N$_{v2}$, L10N$_{v2}$, and L20N$_{v2}$ membrane modules. The following are the parameters of the approved challenge study:

Full-scale Module Tested	Memcor® S10N$_{v2}$ UF Membrane Module[1]
Number of Independent Modules Tested	5
Criterion of Selected Modules	None
Serial Numbers of Tested Modules	WPH7P34, WPH7N23, WPH7P44, WPH7P41, WPH7M22
NDPT Process	Diffusive Airflow Test (DAF)
Quality Control Release Value (QCRV)	9 seconds per milliliter (s/mL) - maximum allowable time for displacement of water for the S10N$_{v2}$ and L10N$_{v2}$ modules 6 s/mL - maximum allowable time for displacement of water for the L20N$_{v2}$ module
Challenge Particulate	*Bacillus atrophaeus* as a surrogate for *Cryptosporidium*
Detection Limit	1 colony forming unit (CFU) per 100 milliliters (mL)
Feed Concentration Range	1.26E+06 to 1.87E+06 CFU per 100 mL[2]
Test Flux Rate	155 gallons per square-foot per day (gfd)
Mode of Operation	Deposition mode in a tank (for submerged tests) Deposition mode (for the pressurized test)

[1] This letter also approves the Memcor L10N$_{v2}$, and L20N$_{v2}$ modules for an LRV$_{C\text{-}Test}$ of 6.10. The L10N$_{v2}$, and L20N$_{v2}$ modules employ the same polyvinylidene fluoride fibers, potting resin, and maximum recommended flux as the S10N$_{v2}$ modules. NSF International has certified all of the modules with the same log removal value.

[2] The allowable feed concentration is limited to the demonstration of no more than 6.5 log removal (3.16×10^6 x detection limit). All feed concentrations during this challenge study were in compliance with this requirement.

Limits Of TCEQ-Approved LRV$_{C\text{-}Test}$

The TCEQ-approved LRV$_{C\text{-}Test}$ is valid for only the Memcor® S10N$_{v2}$, L10N$_{v2}$, and L20N$_{v2}$ UF membrane modules operated under the parameters used for the challenge testing and only for modules that have passed the NDPT. From our review of the challenge study, an acceptable Memcor® S10N$_{v2}$, L10N$_{v2}$, and L20N$_{v2}$ UF membrane module must comply with the following specifications to receive the TCEQ-approved LRV$_{C\text{-}Test}$:

1) Specifications of the approved Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane modules:
   - Constructed of polyvinylidene fluoride (PVDF) hollow-fiber membranes;
   - A fiber inside diameter of 0.510 millimeters (mm);
   - A fiber outer diameter of 0.850 mm;
   - A nominal membrane pore size of 0.04 micrometers (µm);
   - Membrane surface area of:
     - 302 square feet (ft^2) for the S10N$_{v2}$,
     - 277 ft^2 for the L10N$_{v2}$, and
     - 453 ft^2 for the L20N$_{v2}$.
   - Flow direction of outside – in.
   - Operational mode:
     - S10N$_{v2}$ - Deposition mode in a tank
     - L10N$_{v2}$ and L20N $_{v2}$ - Deposition mode pressurized
   - Maximum operating temperature range of 0°C to 40°C (104° F):
   - Maximum design trans-membrane pressure (TMP):
     - S10N$_{v2}$ – 12 psi vacuum, and
     - L10N$_{v2}$ and L20N $_{v2}$ – 22 psi pressure.

2) Prior to shipment to a Texas public water system (PWS), each new Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane module must have passed the NDPT, a pressure-decay test as specified in the NSF 419 Report:
   - Open the filtrate port to the atmosphere, close the feed side of the membrane, and drain the water from the filtrate side of the membrane.
   - Apply 17.4 psi of air pressure to the filtrate side of the membrane.
   - Allow pressure to stabilize for 1 minute.
   - Allow flow into the sight tube.
   - Record the amount of time it takes for 10 mL to flow into the sight tube.

   For the Memcor® S10N$_{v2}$ and L10N$_{v2}$, UF membrane modules, the TCEQ accepts a QCRV of greater than 9 seconds/mL. For the Memcor® L20N$_{v2}$, UF membrane module, the TCEQ accepts a QCRV of greater than 6 seconds/mL.

3) If the Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane modules fails the NDPT (where the measured decay rate was greater than the QCRV), the TCEQ shall not allow that Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane module to be installed at any Texas PWS for microbial contaminant removal credit.

4) The Memcor® manufacture must notify the TCEQ in writing if the Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane modules are modified or if the NDPT method is modified in any manner. After receiving written notification, the TCEQ shall determine if the modified UF membrane modules shall be required to undergo challenge testing or if the modified NDPT method is acceptable.

5) The TCEQ shall grant log removal credits to Texas PWSs using membrane filtration for *Giardia* and *Cryptosporidium.* The log removal credits shall not exceed the lower of:
   a. The TCEQ-approved LRV$_{C\text{-}Test}$; or
   b. The maximum removal efficiency that can be verified through a membrane unit's site-specific direct integrity test (LRV$_{DIT}$).

6) Each Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane module must conform to ANSI/NSF 61 and must be certified by a testing organization accredited by ANSI.

7) Please note that the approved LRV$_{C\text{-}Test}$ is for the current Federal and Texas statutes, and the EPA and TCEQ rules. If any of these statutes or rules are revised, the TCEQ-approved LRV$_{C\text{-}Test}$ in this letter may also be revised.

Please provide a copy of this letter to each of your Texas PWS customers. This letter is **not** to be construed as:

- A granted TCEQ exception for any Texas PWS to use the Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane modules. Each Texas PWS must request and receive site-specific approval to use membrane filtration in accordance with 30 TAC §290.42(g) and §290.39(l);
- TCEQ approval for a Texas PWS to install a Memcor® S10N$_{v2}$, L10N$_{v2}$, or L20N$_{v2}$ UF membrane module; or
- TCEQ approval for a Texas PWS's required concentration time (CT) study.

If you have any questions about this letter, or if we can be of additional assistance, please contact Ms. Marlo Wanielista Berg, P.E., at the letterhead address, by e-mail at marlo.berg@tceq.texas.gov, or by telephone at (512) 239-6967.

Sincerely,

Joel Klumpp, Section Manager
Plan and Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

JPK/mew/db