PWS CG_Travis_CO_20241022_Challenge

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

October 22, 2024

Mr. Dave Holland, Senior Process Engineer
Aqua-Aerobic Systems, Inc.
6306 North Alpine Road
Loves Park, Illinois 61111-7655

Re: Aqua Aerobic Systems, Inc. Aqua MultiBore® C-Series Microfiltration Ceramic Membrane Modules
Review and Approval of Challenge Testing
Removal of Microbial Contaminants

Dear Mr. Holland:

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 ($LRV_{C\text{-}Test}$) as required by Title 30 of the Texas Administrative Code (30 TAC) §290.42(g)(3). 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.

On February 26, 2024, the TCEQ received a copy of the December 12, 2018 report of the challenge study conducted on the Metawater (NGK) model 431011 ceramic membrane module by Aqua-Aerobic Systems, Inc. On September 12, 2024, the TCEQ received a copy of the *Test Report* prepared by NSF International, dated September 11, 2024, of the challenge testing results conducted on the Aqua Aerobic Systems, Inc. Aqua MultiBore® C-Series ceramic membranes. As clarified in an e-mail from you on September 16, 2024, the Aqua MultiBore C-Series ceramic membranes are the same membrane elements as the Metawater (NGK) model 431011 ceramic membrane module tested in the December 12, 2018 challenge study report. The TCEQ has **reviewed and accepted** the September 11, 2024 challenge study for conformance with the NSF/ANSI Standard 419-2018: Public Drinking Water Equipment Performance – Filtration. According to the *Test Report*, the NSF/ANSI Standard 419 is based on the Environmental Technology Verification (ETV) *Generic Protocol for the Product Specific Challenge Testing of Microfiltration or Ultrafiltration Modules* (May 2011) and the product-specific challenge testing requirements in the United States Environmental Protection Agency (USEPA) Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The NSF certification of performance is based only on reduction of *Cryptosporidium* as it is linked to the QCRV.

CHALLENGE STUDY DATA FOR AQUA MULTIBORE C-SERIES CERAMIC MEMBRANE MODULES
We reviewed the submitted challenge study data for compliance with the *Cryptosporidium* treatment requirements in the LT2ESWTR. The criteria for compliance is 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 USEPA Membrane Filtration Guidance Manual (EPA 815-R-06-009). Based on our review of the challenge study data for the Aqua MultiBore C-Series ceramic membrane modules, we have determined that the challenge study is compliant with LT2ESWTR 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 approved NDPT for production membrane modules that did not undergo challenge testing.

TCEQ-APPROVED $LRV_{C\text{-}TEST}$

For the Aqua MultiBore C-Series ceramic membrane modules, the TCEQ is approving a **$LRV_{C\text{-}Test}$ of 5.92** for the removal of *Cryptosporidium* for systems operated in deposition mode. The $LRV_{C\text{-}Test}$ approval by the TCEQ does not apply to systems operated in a crossflow mode as this hydraulic configuration was not demonstrated in this challenge test study. The following are the parameters of the approved challenge study:

Full-scale module tested	**Aqua MultiBore C-Series Ceramic Membrane Modules**
Number of Independent Modules Tested	5
Criterion of Selected Modules	None*
Serial Numbers of Tested Modules	1, 2, 3, 4, and 5
Nondestructive Performance Testing (NDPT) Process	Pressure-Decay Test
Quality Control Release Value (QCRV)	0.005 pounds per square-inch per minute (psi/min)
Challenge Particulate	*Bacillus atrophaeus* American Type Culture Collection (ATCC) number 9372 (as a surrogate for *Cryptosporidium*) with an average diameter of 0.8 microns (µm) and an average length of 1.8 µm
Detection Limit	1 colony forming unit (CFU) per 100 milliliters (mL)
Feed Concentration Range	1.32×10^6 CFU/100 mL to 2.88×10^6 CFU/100 mL**
Test Flux Rate (temperature corrected to 20˚ C)	379.4 – 388.2 gallons per square-foot per day (gfd) @ 20˚ C
Mode of Operation	Deposition mode

* In regard to the selection of modules for testing, there was no consideration of manufacturing variability. However, the challenge study established a QCRV of 0.005 psi/min based on the highest observed average pressure decay results for the five modules that were tested to establish the $LRV_{C\text{-}Test}$ as required by 40 CFR 141.719(b)(2)(vii) (and as discussed on pages 33 and 34 of the NSF International Test Report). The average pressure decay test results ranged from 0.0039 psi/min to a maximum of 0.0050 psi/min. Any membrane module that does not meet the QCRV established in the challenge study is not eligible for the approved $LRV_{C\text{-}Test}$ of 5.92-log.

** As allowed by 40 CFR 141.719(b)(2)(iii), the maximum allowable feed concentration is *3.16×10^6 x Filtrate Detection Limit*. The goal for the *Bacillus atrophaeus* challenges was to be able to measure the highest feasible log reductions. Therefore, NSF International selected a target of 6.25 log (1.79×10^6 CFU/100 mL) in order to account for less than 100% recovery of the spiked challenge organism concentration and the variability associated with the counting of microorganisms. The actual feed concentration ranges are shown in the table above.

LIMITS OF TCEQ-APPROVED $LRV_{C\text{-}Test}$

The TCEQ-approved $LRV_{C\text{-}Test}$ is valid for only the Aqua MultiBore C-Series ceramic membrane modules operated under the parameters used for the challenge testing and only for modules that have passed the NDPT. Per our review of the challenge study, an acceptable Aqua MultiBore C-Series ceramic membrane module must comply with the following specifications to receive the TCEQ-approved $LRV_{C\text{-}Test}$:

- Specifications of the approved Aqua MultiBore C-Series ceramic membrane modules:
  - Constructed of alumina oxide (AL_2O_3) ceramic material
  - Active membrane area (feed side surface area) of 269-ft^2
  - Module outside diameter: 8.625 inches
  - Module length: 72.04 inches
  - Module volume: 5.81 gallons (22 liters)
  - Potting material: Glass
  - Module casing material: 316 SS
  - Fiber inside diameter (feed channel): 2.5 millimeters (mm)
  - Fiber active length: 1,500 mm
  - Inside-to-outside flow path
  - Operational mode: Deposition
  - Maximum design flux at 20˚ C: 400 gfd
  - Maximum inlet module pressure: 100 psi
  - A temperature tolerance range of 2˚ C to 50˚ C
  - Maximum trans-membrane pressure (TMP) of 55 psi
  - A pH tolerance range of 2 to 12
  - Allowable pH range for cleaning of 1 to 13
  - Maximum oxidant tolerance for normal operation: 50 mg/L (chlorine Cl_2)
  - Maximum oxidant tolerance for cleaning: 5,000 mg/L (chlorine Cl_2)

- For use by public water systems (PWSs) in Texas for microbial contaminant removal credit, only Aqua Aerobic Systems, Inc. Aqua MultiBore C-Series ceramic membrane modules that have been certified for performance by NSF are allowed. As defined in the NSF challenge study report (see Table 21 on page 34 and the module integrity test description on page 9), this means only modules that have passed a NDPT with a QCRV of 0.005 psi/min (from a starting pressure of 22 psi).

- The manufacturer, Aqua Aerobic Systems, Inc., must record the results of each Aqua MultiBore C-Series ceramic membrane's NDPT with the module's assigned unique serial number. The NDPT result for each Aqua MultiBore C-Series membrane module delivered to a Texas PWS must be provided upon delivery of the Aqua MultiBore C-Series ceramic membranes to a PWS.

- The manufacturer, Aqua Aerobic Systems, Inc., must notify the TCEQ in writing if the Aqua MultiBore C-Series ceramic membrane modules are modified or if the manufacturer's NDPT method is modified in any manner (from a starting pressure of 22 psi tested). After receiving written notification, the TCEQ shall determine if the modified Aqua MultiBore C-Series membrane module shall be required to undergo challenge testing or if the modified NDPT method is acceptable.

- 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}).

- Each Aqua Aerobic Systems, Inc. Aqua MultiBore C-Series ceramic membrane module must conform to ANSI/NSF Standard 61 and must be certified by a testing organization accredited by ANSI.

- Please note that the approved $LRV_{C\text{-}Test}$ is for the current Federal and Texas statutes, and the USEPA 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 Aqua Aerobic Systems, Inc. Aqua MultiBore C-Series ceramic 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 an Aqua Aerobic Systems, Inc. Aqua MultiBore C-Series ceramic membrane module; or

- TCEQ approval for a Texas PWS's required concentration time (CT) study.

If you have any questions concerning this letter, or if we can be of additional assistance, please contact Mr. David Williams, P.E., at the letterhead address, by email at david.williams@tceq.texas.gov or by telephone at (512) 239-4674.

Sincerely,

David Williams, P.E.
Technical Review and Oversight Team
Plan & Technical Review Section
Texas Commission on Environmental Quality

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

JPK/daw