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PWS_CG_Travis_CO_20200106_Challenge

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

January 6, 2020

Mr. Yosei Fujita
Toray Industries, Inc.
1-1-2, Nihonbashi-Muromachi
Chuo-ku, Tokyo 103-8666
Japan

Re: Toray HFU-B2315AN Hollow Fiber Ultrafiltration Membrane
Review and Approval of Challenge Testing
Removal of Microbial Contaminants

Dear Mr. Fujita:

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-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 August 23, 2019, the TCEQ received a copy of the August 15, 2019 report of the challenge study conducted on the Toray Industries, Inc., (Toray) HFU-B2315AN hollow-fiber (HF) ultrafiltration (UF) membrane modules.

The NSF International (NSF) challenge study was conducted in accordance with NSF/American National Standards Institute (ANSI) Standard 419-2015: 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 QCRV.

CHALLENGE STUDY DATA FOR TORAY HFU-B2315AN HF UF 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 Toray HFU-B2315AN HF UF 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-Test}) and the approved NDPT for production membrane modules that did not undergo challenge testing.

TCEQ-APPROVED LRV_{C-TEST}

For the Toray HFU-B2315AN HF UF membrane modules, the TCEQ is approving a **LRV_{C-TEST} of 5.05** for the removal of *Cryptosporidium* for systems operated in deposition mode. The LRV_{C-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	Toray HFU-B2315AN HF UF Membrane Modules
Number of Independent Modules Tested	5
Criterion of Selected Modules	None*
Serial Numbers of Tested Modules	F418097001, F418097002, F418097005, F418097008, and F418097009
Nondestructive Performance Testing (NDPT) Process	Pressure-Decay Test
Quality Control Release Value (QCRV)	0.040 pounds per square-inch per minute (psi/min) (max)
Challenge Particulate	<i>Bacillus atrophaeus</i> American Type Culture Collection (ATCC) number 9372 (as a surrogate for <i>Cryptosporidium</i>) 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	1.69 x 10 ⁶ CFU/100 mL to 2.84 x 10 ⁶ CFU/100 mL**
Test Flux Rate (temperature corrected to 20° C)	107.57 - 119.94 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 0.040 psi/min based on the highest observed average pressure decay results for the five modules (including an additional test on a module with a poked hole) that were tested to establish the LRV_{C-TEST} as required by 40 CFR 141.719(b)(2)(vii) (and as discussed on page 35 of the NSF International Test Report). The average pressure decay results ranged from 0.002 psi/min to a maximum of 0.040 psi/min. Any membrane module that does not meet the QCRV established in the challenge study is not eligible for the approved LRV_{C-TEST} of 5.05-log.

** As allowed by 40 CFR 141.719(b)(2)(iii), the maximum allowable feed concentration is 3.16 x 10⁶ 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 6.26 log (1.8 x 10⁶ CFU/100 mL) in order to account for less than 100% recovery of the spiked challenge organism concentration and variability associated with counting of microorganisms. The actual feed concentration ranges (excluding the damaged fiber tests) are shown in the table above.

LIMITS OF TCEQ-APPROVED LRV_{C-TEST}

The TCEQ-approved LRV_{C-TEST} is valid for only the Toray HFU-B2315AN HF UF 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 Toray HFU-B2315AN HF UF membrane module must comply with the following specifications to receive the TCEQ-approved LRV_{C-TEST}:

- Specifications of the approved Toray HFU-B2315AN HF UF membrane modules:
 - a) Constructed of hydrophilic polyvinylidene fluoride (PVDF) hollow-fiber membranes;
 - b) Number of fibers per element is 6,800;
 - c) A nominal membrane pore size of 0.01 microns;
 - d) A fiber inside diameter of 0.8 millimeters (mm);
 - e) A fiber outside diameter of 1.1 mm;
 - f) Fiber active length of 81.34 inches (2,066 mm);
 - g) Active membrane area per module of 646-ft²;
 - h) An outside-to-inside flow path;
 - i) Operational mode: Deposition;
 - j) Maximum operating temperature range of 0 °C to 40°C (104°F);
 - k) Maximum trans-membrane pressure (TMP) of 43.5 pounds per square-inch (psi);
 - l) A pH operating range of 1 to 10;
 - m) Allowable pH range for cleaning of 0 to 12; and
 - n) Maximum oxidant tolerance during cleaning of 3,000 mg/L (Cl₂) .

- For use by public water systems (PWSs) in Texas for microbial contaminant removal credit, only Toray HFU-B2315AN HF UF modules that have been certified for performance by NSF are allowed. As defined in the NSF challenge study report (pages 4 and 36), this means only modules that have passed a NDPT with a QCRV of 0.040 psi/min (from a starting pressure of 18.85 psi).

- The manufacturer, Toray Industries, Inc., must record the results of each HFU-B2315AN HF UF membrane module's NDPT with the module's assigned unique serial number. The NDPT result for each HFU-B2315AN HF UF membrane module delivered to a Texas PWS must be provided upon delivery of the HFU-B2315AN HF UF membrane modules to a PWS.

- The manufacturer, Toray Industries, Inc., must notify the TCEQ in writing if the Toray HFU-B2315AN HF 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 Toray HFU-B2315AN HF UF 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-Test}; or,
 - b) The maximum removal efficiency that can be verified through a membrane unit's site-specific direct integrity test (LRV_{DIT}).

- Each Toray HFU-B2315AN HF UF 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-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-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 Toray HFU-B2315AN HF 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 Toray HFU-B2315AN HF UF membrane module; or
- TCEQ approval for a Texas PWS's required concentration time (CT) study.

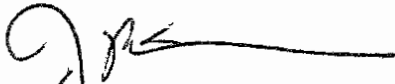
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If you have any questions concerning this letter, or if we can be of additional assistance, please contact Bill Melville, P.E., at the letterhead address, by email at Bill.Melville@tceq.texas.gov or by telephone at (512) 239-4729.

Sincerely,



Bill Melville, 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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JPK/wrm