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PWS_6000800_CO_20170907_Challengy Study

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

September 7, 2017

Mr. Chris Lipski
GE Water & Process Technologies
3239 Dundas Street West
Oakville, ON L6M 4B2
Canada

Re: GE ZeeWeed 700B - 8060/UF10 and 10060 Ultrafiltration Membrane Modules Review and Approval of Challenge Testing for the Removal of Microbial Contaminants

Dear Mr. Lipski,

On March 6, 2017, the Texas Commission on Environmental Quality (TCEQ) received a copy of the April 22, 2016 report of the challenge study conducted on the GE ZeeWeed 700B - 8060/UF10 and ZeeWeed 700B-10060 ultrafiltration (UF) membrane modules. We have reviewed the challenge study for these two modules for compliance with the state and federal rules.

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 membranes' removal efficiency, and for the 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) to verify that all manufactured membrane modules not subject to challenge testing will achieve at least the same log removal as those which were challenge tested.

The NSF International challenge study was conducted in accordance with NSF International (NSF)/American National Standards Institute (ANSI) Standard 419-2015: Public Drinking Water Equipment Performance - Filtration. According to the Test Report, NSF/ANSI Standard 419 is based on the Environmental Technology of Microfiltration Verification (ETV) *Generic Protocol for the Product Specific Challenge Testing of Microfiltration or Ultrafiltration Membrane 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 criteria for compliance are found in Title 40 of the Federal Code of Regulations (40 CFR) §141.719 and described in the USEPA *Membrane Filtration Guidance Manual* (MFGM). The NSF certification of performance is only based on the reduction of *Cryptosporidium* as it is linked to the QCRV.

CHALLENGE STUDY DATA FOR GE ZeeWeed 700B-8060 AND 700B-10060 ULTRAFILTRATION MEMBRANE MODULES

We reviewed the submitted challenge study data for compliance with the *Cryptosporidium* treatment requirements in the LT2ESWTR. Specifically, the criteria for compliance is found in 40 CFR §141.719(b)(2). Additional guidance for compliance with these requirements can be found in the USEPA MFGM. Based on our review of the challenge study data for the GE ZeeWeed

700B – 8060/UF10 and 700B – 10060 UF membrane modules, the TCEQ has 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 GE ZeeWeed 700B – 8060/UF10 and ZeeWeed 700B – 10060 UF modules, the TCEQ is approving a **$LRV_{C\text{-}Test}$ of 5.41** 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 cross flow 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 modules tested	GE ZeeWeed 700B – 8060/UF10 and 700B – 10060 Modules
Number of Independent Modules Tested	7 (700B- 8060/UF10) 2 (700B-10060)
Criterion of Selected Modules	None*
Model Number / Serial Numbers of Tested Modules	ZW700B-8060/UF10, #1 (260128374), ZW700B-8060/UF10 #2 (120128036), ZW700B-8060/UF10 #3 (10329361), ZW700B-8060/UF10 #4 (151227803), ZW700B-8060/UF10 #5 (20128033), ZW700B-8060/UF10 #6 (190734159), ZW700B-8060/UF10 CF (70532260) ZW700B-10060 #1 (200633324), ZW700B-10060 #2 (160532262)
Nondestructive Performance Testing (NDPT) Process	Pressure decay test with a minimum starting test pressure of 14.5 pounds per square inch (psi)
Quality Control Release Value (QCRV) for Pressure Decay Test	0.251 psi/min (allowable decay rate)
Challenge Particulate	*Bacillus atrophaeus* (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 mL
Feed Concentration Range	1.5×10^6 to 3.66×10^6 CFU per 100 mL
Max Filtrate Flux Rate	100 gallons per square-foot per day (gfd) at 40 °C
Mode of Operation / Flow Configuration	Deposition mode / Inside-out

* The challenge study established a QCRV of 0.251 psi/min, based on the highest average pressure decay rate observed from the tested modules used to establish the $LRV_{C\text{-}Test}$ (as required by 40 CFR §141.719(b)(2)(vii)). 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 5.41-log.

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

The TCEQ-approved $LRV_{C\text{-}Test}$ is valid only for the GE ZeeWeed 700B – 8060/UF10 and 700B-10060 modules operated under the parameters used for this challenge testing and only for modules that have passed the NDPT. From our review of the challenge study, an acceptable GE ZeeWeed 700B – 8060/UF10 and 700B-10060 module must comply with the following specifications to receive the TCEQ-approved $LRV_{C\text{-}test}$:

1) Specifications of the approved GE ZeeWeed 700B – 8060/UF10 modules:
   a) Polyethersulphone (PES) hollow fiber membranes;
   b) Nominal membrane surface area of 431 ft^2 (square feet);
   c) Nominal membrane pore size of 0.02 μm (microns);

d) Module diameter - 220 mm (millimeters);
e) An inside-to-outside flow path;
f) Operational mode: deposition (no cross-flow);
g) Maximum filtrate flux: 100 gallons per square-foot per day (gfd);
h) Maximum filtrate flow: 29.9 gallons per minute (gpm);
i) Maximum operating temperature range: 40°C;
j) Maximum inlet pressure: 58 psi;
k) Maximum trans-membrane pressure (TMP) of 36 psi;
l) Operating pH range: 2 - 11; and
m) Maximum chlorine tolerance: 200 mg/L.

2) Specifications of the approved GE ZeeWeed 700B - 10060 modules:
a) Polyethersulphone (PES) hollow fiber membranes;
b) Nominal membrane surface area of 646 ft^2;
c) Nominal membrane pore size of 0.02 μm;
d) Module diameter - 250 mm;
e) An inside-to-outside flow path;
f) Operational mode: deposition (no cross-flow);
g) Maximum filtrate flux: 100 gfd;
h) Maximum filtrate flow: 44.85 (gpm);
i) Maximum operating temperature range: 40°C;
j) Maximum inlet pressure: 109 psi;
k) Maximum TMP of 36 psi;
l) Operating pH range: 2 - 11; and
m) Maximum chlorine tolerance: 200 mg/L.

3) Prior to shipment to a Texas public water system (PWS), each new GE ZeeWeed 700B - 8060/UF10 and ZeeWeed 700B - 10060 UF module must have passed the NDPT, a pressure decay test, as specified below:
a. Drain the water from the feed side of the membrane.
b. Pressurize the filtrate side of the membrane to 14.5 psi, and allow the feed side of the membrane to be left open to the atmosphere.
c. After the air pressure stabilizes, isolate the compressed air source from the outlet side of the module.
d. Record the air pressure on the filtrate side of the membrane over a period of five to 10 minutes.
e. For the GE ZeeWeed 700B - 8060/UF10 and ZeeWeed 700B - 10060 UF modules, the QCRV is 0.251 psi/min (allowable decay rate over the quality control test period).

4) If the GE ZeeWeed 700B - 8060/UF10 or ZeeWeed 700B - 10060 UF module fails the NDPT (membranes having pressure decay rates greater than 0.251 psi/min), the TCEQ will not approve the GE ZeeWeed 700B - 8060/UF10 or ZeeWeed 700B - 10060 UF module to be installed at any Texas PWS for microbial contaminant removal credit.

5) For use by a PWS in Texas for microbial contaminant removal credit, only GE ZeeWeed 700B - 8060/UF10 and ZeeWeed 700B - 10060 UF modules that have been certified by performance by NSF International are allowed. As defined in the NSF International challenge study report of your submittal (page 15), only modules that have passed a NDPT with a QCRV for the pressure decay test of 0.251 psi/min will be approved for use (membranes having pressure decay test values greater than 0.251 psi/min are rejected).

6) The results of the GE ZeeWeed 700B - 8060/UF10 and ZeeWeed 700B - 10060 UF module's NDPT must be recorded with the module's assigned unique serial number. The NDPT result for each GE ZeeWeed 700B - 8060/UF10 and ZeeWeed 700B - 10060 UF module delivered to a Texas PWS must be provided upon delivery of the GE ZeeWeed 700B - 8060/UF10 or ZeeWeed 700B - 10060 UF module to a system.

7) GE Water & Process Technologies must notify the TCEQ in writing if the GE ZeeWeed 700B - 8060/UF10 module, ZeeWeed 700B - 10060 UF module or the NDPT method are modified in any manner. After receiving written notification, the TCEQ shall determine if the modified modules will be required to undergo challenge testing or if the modified NDPT method is acceptable.

8) The TCEQ will 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}).

9) Each GE ZeeWeed 700B - 8060/UF10 or ZeeWeed 700B - 10060 UF module must conform to ANSI/NSF Standard 61 and must be certified by a testing organization accredited by ANSI.

10) Please note that the approved $LRV_{C\text{-}Test}$ is for the current Federal and Texas statutes, and the USEPA and TCEQ rules. If 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 **may not** be construed as:

- A granted TCEQ exception for any Texas PWS to use the GE ZeeWeed 700B - 8060/UF10 or ZeeWeed 700B - 10060 UF module. Each Texas PWS must request and receive site-specific approval to use membrane filtration in accordance with 30 TAC §290.42(g)(3) and §290.39(1);

- TCEQ approval for a Texas PWS to install a GE ZeeWeed 700B - 8060/UF10 or ZeeWeed 700B - 10060 UF module. All engineering plans and specifications must be approved by the TCEQ prior to installation; 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. Katie Cunningham, at the letterhead address, by e-mail at katie.cunningham@tceq.texas.gov, or by telephone at (512) 239-1374.

Sincerely,

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