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PWS_6000800_CO_20160526_Challenge Study

Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

May 26, 2016

Ms. Irene Körbl, Coordinator Approvals, X-Flow BV
P.O. Box 739
7500 AS Enschede
Netherlands

Re: Pentair X-Flow Aquaflex and Xiga 40m² and 46m² Ultrafiltration Membranes
Revision to Previous Approval of Challenge Test Data
Removal of Microbial Contaminants

Dear Ms. Körbl:

On April 8, 2016, the Texas Commission on Environmental Quality (TCEQ) received supplemental information from Mr. Jaime Kypuros, Jr., P.E. of Tetra Tech requesting that the TCEQ consider approving a LRV_{C-Test} for the Aquaflex and Xiga 40 square meter (m²) and 46 m² ultrafiltration (UF) membranes based on a previously approved challenge study. On November 5, 2015, the TCEQ approved an LRV_{C-Test} of 4.95 to include all Pentair X-Flow Aquaflex HP and Xiga HP modules with active membrane areas of 55 m² and 64 m². The TCEQ has reviewed the differences in the specifications of these various Pentair X-Flow modules for any significant differences in the membrane media, hydraulic configuration, or any other difference that could potentially affect the removal efficiency or the non-destructive performance test (NDPT) parameters. In this case, the primary difference between the challenge-tested module, Aquaflex HP 55 m², and the Aquaflex and Xiga 40 m² and 46 m² UF membranes is packing density. Because these modules have an inside-to-outside flow configuration, the differences in packing density between these modules should not significantly affect the removal efficiency. Therefore, based on our review of the module specifications and the supporting documentation, additional challenge testing is not required for the Aquaflex and Xiga 40 m² and 46 m² UF Membranes modules.

With this letter, the TCEQ is extending the approved LRV_{C-Test} of 4.95 to include all Pentair X-Flow Aquaflex and Xiga modules with active membrane areas of 40 m² and 46 m².

CHALLENGE STUDY DATA FOR PENTAIR X-FLOW AQUAFLEX HP UF MEMBRANE 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 (LT2ESWTR). 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 presented in *Pentair Challenge Testing Results, Technical Memorandum, X-Flow Aquaflex HP Ultrafiltration Membrane Systems*, prepared by Carollo Engineers, in a report dated March 2014, for Pentair. Based on our review, 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 NDPT for production membrane modules that did not undergo challenge testing.

TCEQ-APPROVED LRV_{C-TEST}

The TCEQ is approving a LRV_{C-TEST} of 4.95 for the removal of *Cryptosporidium* for systems operated in deposition mode for the Pentair X-Flow Aquaflex and Xiga UF membrane modules specified in this letter. 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	Pentair X-Flow Aquaflex HP UF Membrane Modules
Number of Independent Modules Tested	2
Criterion of Selected Modules	Modules that had failed the Non-Destructive Performance Test (NDPT) were selected for testing in accordance with California Department of Public Health Requirements
Serial Numbers of Tested Modules	12DA6709 and 12HA3282
Nondestructive Performance Testing (NDPT) Method	Diffusive Airflow Test
Quality Control Release Value (QCRV)	350 milliliters per minute (mL/min)
Challenge Particulate	0.5 micron microspheres (as a surrogate for <i>Cryptosporidium</i>)
Detection Limit	1 microsphere per 100 mL
Feed Concentration Range	1.7 x 10 ⁴ to 3.7 x 10 ⁴ microspheres/mL
Test Flux Rate	75 gallons per square-foot per day (gfd) @ 20° C
Mode of Operation	Deposition mode

LIMITS OF TCEQ-APPROVED LRV_{C-TEST}

The TCEQ-approved LRV_{C-TEST} is valid for only the Pentair X-Flow Aquaflex and Xiga membrane modules operated under the parameters used for the challenge testing and only for modules that have passed the NDPT. An acceptable Pentair X-Flow Aquaflex or Xiga UF membrane module must comply with the following specifications to receive the TCEQ-approved LRV_{C-TEST}:

- 1) Specifications of the approved Pentair X-Flow Aquaflex and Xiga 40 m² or 46 m² UF membrane modules:
 - a) Constructed of hydrophilic Polyethersulfone (PES)/Polyvinylpyrrolidone (PVP) polymer blend hollow-fiber membranes
 - b) Number of fibers per element is 11,000
 - c) Active membrane area: 430-ft² or 495-ft²
 - d) A nominal membrane pore size of 0.02 microns
 - e) A fiber inside diameter of 0.8 millimeters (mm) or 0.9 mm
 - f) A fiber outside diameter of 1.2 mm
 - g) Module length of 60 inches
 - h) An inside-to-outside flow path
 - i) Operational mode: Deposition
 - j) Maximum operating temperature of 40°C (104°F)
 - k) Maximum trans membrane pressure (TMP) of 43.7 pounds per square-inch (psi)
 - l) Maximum feed pressure of 43.7 psi

- 2) Prior to shipment to a Texas public water system (PWS), each new Pentair X-Flow Aquaflex and Xiga UF membrane module must have passed the NDPT, a diffusive airflow test as specified below:
 - a) Flush for 10 minutes with reverse osmosis water
 - b) Drain the water from one side of the membrane
 - c) Pressurize the drained side of the wetted membrane to 1.4 bar (20.3 psi).
 - d) Set and maintain a constant pressure on the airside of the membrane lumen
 - e) Monitor the diffusive airflow for 5 minutes
 - f) For the Pentair X-Flow Aquaflex and Xiga UF membrane module, the QCRV is 350 milliliters per minute
- 3) If the Pentair X-Flow Aquaflex or Xiga UF membrane module fails the NDPT (where the measured air flow was greater than the QCRV), the TCEQ shall not allow that Pentair X-Flow UF membrane module to be installed at any Texas PWS for microbial contaminant removal credit.
- 4) Pentair must notify the TCEQ in writing if the Pentair X-Flow Aquaflex and Xiga 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 Pentair X-Flow UF membrane module 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-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 Pentair X-Flow Aquaflex and Xiga UF membrane module must conform to American National Standards Institute/NSF International (ANSI/NSF) Standard 61 and must be certified by a testing organization accredited by ANSI.
- 7) 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 Pentair X-Flow Aquaflex and Xiga 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)(3) and §290.39(l);
- TCEQ approval for a Texas PWS to install a Pentair X-Flow Aquaflex or Xiga 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 about this letter, or if we can be of additional assistance, please contact David Williams, P.E., at the letterhead address, by e-mail at david.a.williams@tceq.texas.gov, or by telephone at (512) 239-0945.

Sincerely,



David A. Williams, P.E.
Technical Review and Oversight Team
Plan and Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality



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

JPK/DAW

cc: Mr. Jaime Kypuros, Jr., P.E., Tetra Tech, One Riverwalk Place, 700 North Saint Mary's Street, Suite 300, San Antonio, Texas 78205

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bcc: William R. Melville, P.E., TCEQ Technical Review and Oversight Team, MC-159