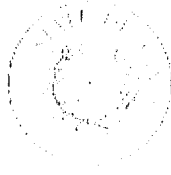


Bryan Shaw, Ph.D., *Chairman*
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Toby Baker, *Commissioner*
Zak Covar, *Executive Director*



Texas Commission on Environmental Quality

Protecting Texas by Reducing and Preventing Pollution

June 26, 2013

Mr. Paul R. Lambert, Senior Process Engineer
Koch Membrane Systems
850 Main Street
Wilmington, MA 01887

Re: Koch Membrane Systems Targa® II Ultrafiltration Cartridges
Review and Approval of Challenge Testing

Dear Mr. Lambert:

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 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 KOCH TARGA® II ULTRAFILTRATION 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 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 United States Environmental Protection Agency (USEPA) Membrane Filtration Guidance Manual (EPA 815-R-06-009). The TCEQ reviewed challenge study data presented in *California Department of Public Health Conditional Acceptance Testing for Koch Targa® II Membrane*, prepared by MWH Americas, Inc. (October 2012). Based on our review, we have determined that the challenge study is compliant with LT2ESWTR requirements. Please review the following in regards to the approved log removal value demonstrated during challenge testing (LRV_{C-Test}) and the non-destructive performance test (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 **4.6** for the removal of *Cryptosporidium* for the Koch Membrane Systems Targa® II ultrafiltration membrane modules. The following are the parameters of the approved challenge study:

Full-scale module tested ¹	Koch Membrane Systems Targa® II 8048-35
Number of Independent Modules Tested	2
Criterion of Selected Modules	None- Modules intentionally compromised to fail Non-Destructive Performance Test in accordance with California Department of Public Health Requirements
Serial Numbers of Tested Modules	CDPH-1 and CDPH-2
Nondestructive Performance Testing (NDPT) Process	Koch Standard Quality Control Test (see Item 2 below)
Challenge Particulate	0.5 µm fluorescent latex spheres (as a surrogate for <i>Cryptosporidium</i>)
Detection Limit	10 objects per unit volume
Feed Concentration Range	3.0 x 10 ⁶ particles per liter(L) to 3.2 x 10 ⁶ particles per L
Maximum Flux Rate	80 gallons per square-foot per day (gfd) at 20° C
Mode of Operation ²	Crossflow (suspension)
Volumetric Concentration Factor ³	VCF _{max} = 100 VCF _{avg} = 97.71
Duration of Filtration Cycle for Calculated VCF	20 minutes
Maximum Transmembrane Pressure (TMP)	30 psi
Recovery in Recirculation Mode	99 %

¹ Koch Membrane Systems manufacture the Targa® II HF modules with 8.4-inch and 10.75-inch nominal diameters, and with lengths of 48 and 72 inches. The Koch Targa® II 8048-35 module was selected for the challenge testing by MWH Americas, Inc. based on the size of the pilot unit and the ability to operate at higher flux values. The shorter 48-inch cartridge was considered a more conservative selection for the challenge testing since the lumen velocity of the shorter cartridge is higher at the same pressure drop. In addition to the Koch Targa® II 8048-35 module, **the TCEQ also accepts this challenge study for the Koch Targa® II 8072-35, 10048-35, and 10072-35 modules.**

² As required by 40 CFR §141.719(b)(2)(iii), the challenge testing must be conducted under representative hydraulic conditions at the maximum design flux and maximum design recovery specified by the manufacturer. Effectively, this also means operating the challenge test under the conditions that demonstrate removal efficiency under the highest expected Volumetric Concentration Factor (VCF). Since deposition mode systems do not have a significant impact on suspended solids

concentration, **the TCEQ also accepts this challenge study for Koch Targa® II systems operated in deposition (or dead-end) mode.**

³ Note that the California Department of Public Health Conditional Acceptance Testing for Koch Targa® II Membrane, prepared by MWH Americas, Inc., stated that the VCF_{max} and VCF_{avg} were 43.7 and 21.8, respectively. These VCF values were calculated using the small volume crossflow system models characterized by Equations 2.30 and 2.31 of the USEPA Membrane Filtration Guidance Manual. Koch Membrane Systems, in a letter dated May 23, 2013 to the TCEQ, stated that the hydraulic configuration of the Challenge Study more closely fits the Continuous Stirred Tank Reactor (CSTR) Model characterized by Equations 2.37 and 2.38 of the USEPA Membrane Filtration Guidance Manual. Using the CSTR Model, the calculated VCF_{max} and VCF_{avg} are 100 and 97.71, respectively.

LIMITS OF TCEQ APPROVED LRV_{C-TEST}

The TCEQ approved LRV_{C-TEST} is only valid for the Koch Membrane Systems Targa® II hollow-fiber membrane modules operated under the parameters that were used for the challenge testing and only for modules that have passed the nondestructive performance test (NDPT). From our review of the challenge study, an acceptable Koch Membrane Systems Targa® II membrane module must comply with the following to receive the approved LRV_{C-TEST} :

- 1) Specifications of the approved Koch Membrane Systems Targa® II modules:
 - a) Constructed of semi-permeable polyethersulfone hollow-fiber membranes;
 - b) A liquid-membrane contact angle of 48 degrees;
 - c) Membrane charge- slightly negative;
 - d) Membrane surface characteristics- hydrophillic;
 - e) A nominal pore size of 0.02 microns;
 - f) An inside to outside flow path;
 - g) Operated in cross-flow (recirculation) or deposition (dead-end) mode;
 - h) Maximum filtrate flux rate of 80 gfd;
 - i) Maximum operating temperature range of 32° F to 104° F;
 - j) Maximum transmembrane pressure of 30 pounds per square-inch (psi);
 - k) A pH operating range of 1.0 to 10.0 (long-term operation);
 - l) Allowable pH range for cleaning of 1.5 to 13.0; and
 - m) Maximum chlorine tolerance of 500,000 parts per million (ppm) hours.
- 2) Prior to shipment to a Texas public water system, each new Koch Membrane Systems Targa® II membrane module must have passed the NDPT, a standard quality control test as specified by Koch Membrane Systems and as generally described below:
 - a) Module pressurized to 15 psi;
 - b) Place cartridge horizontally on rollers in leak detection tank;
 - c) Allow 30 to 60 seconds for trapped air to escape;
 - d) Rotate cartridge and look for steady streams of air bubbles from fibers or permeate tube;
 - e) Pinpoint leaking fiber(s) and pin;
 - f) Turn-off pressure to cartridge and allow pressure to drop to zero psi; and,
 - g) Send cartridge for repair of detected leaks, if needed, then re-test cartridge.
- 3) All Koch Membrane Systems Targa® II membrane modules installed at a Texas public water system for microbial contaminant removal credit must have passed the NDPT as described above.
- 4) Koch Membrane Systems must notify the TCEQ in writing if the Koch Membrane Systems Targa® II membrane modules as challenge tested by MWH Americas, inc. are modified or the NDPT

Mr. Paul R. Lambert
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method is modified in any manner. After receiving written notification, the TCEQ will determine if the modified Koch Membrane Systems Targa® II membrane module shall be required to undergo challenge testing or if the modified NDPT method is acceptable.

- 5) The TCEQ will grant Texas public water systems using membrane filtration log removal credits for *Giardia* and *Cryptosporidium* that shall not exceed the lower of:
 - a) The TCEQ approved LRV_{C-Test} ; and
 - b) The maximum removal efficiency that can be verified through a membrane unit's site-specific direct integrity test (LRV_{DIR}).
- 6) Each Koch Membrane Systems Targa® II membrane module must conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and be certified by a testing organization accredited by ANSI.
- 7) Please note that the approved LRV_{C-Test} is based on current Federal and Texas statutes and EPA 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 public water system customers and their consulting engineers. This letter is **not** to be construed as:

- A TCEQ granted exception for any Texas public water system to use the Koch Membrane Systems Targa® II membranes. Each Texas public water system 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 public water system to install Koch Membrane Systems Targa® II membranes; or
- TCEQ approval for a Texas public water system's required concentration time (CT) study.

If you have questions concerning 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
Texas Commission on Environmental Quality



Ada Lichaa, P.G., Manager
Plan and Technical Review Section
Water Supply Division
Texas Commission on Environmental Quality

AL/DAW