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PWS CG\_Travis\_CO\_20211022\_Challenge

## TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

*Protecting Texas by Reducing and Preventing Pollution*

October 22, 2021

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

Re: ZeeWeed® 1000 V4 Ultrafiltration Membrane Modules - 550 ft<sup>2</sup>  
Review and Approval of Challenge Testing for the Removal of Microbial  
Contaminants

Dear Mr. Lipski,

On March 21, 2021, the Texas Commission on Environmental Quality (TCEQ) received a copy of the December 2010 report of the challenge study conducted on the ZeeWeed® 1000 V4 ultrafiltration (UF) membrane modules. The TCEQ has reviewed the challenge study conducted on two ZeeWeed® 1000 V4 modules for compliance with 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<sub>C-Test</sub>), 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.

### **CHALLENGE STUDY DATA FOR ZEEWEED® 1000 V4 UF MEMBRANE MODULES**

The submitted challenge study data was reviewed 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 the *California Department of Public Health, Conditional Acceptance Testing for ZeeWeed® 1000 V4 Membrane*, prepared by MWH Americas, Inc., in a report dated February 2010 for GE/Zenon. Based on the review, **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<sub>C-Test</sub>) and the NDPT for production membrane modules that do not undergo challenge testing.

**TCEQ-APPROVED LRV<sub>C-TEST</sub>**

For the ZeeWeed® 1000 V4 UF modules, the TCEQ is approving a **LRV<sub>C-Test</sub> of 5.3** for the removal of *Cryptosporidium* for systems operated in deposition (direct) mode. The LRV<sub>C-Test</sub> 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	ZeeWeed® 1000 V4 Modules
Number of Independent Modules Tested	2
Criterion of Selected Modules	Compromised modules (1 pinhole) that failed the manufacturer's NDPT
Serial Numbers of Tested Modules	1008710000025027 and 1008710330025000
NDPT	Bubble testing for the elimination of damaged fibers followed by a pressure decay test with a minimum starting test pressure of 13 pounds per square inch (psi), water temperature 20° to 25° C, a hold-up volume of 5.1 liters, and a duration of 2 minutes.
QCRV for Pressure Decay Test*	0.27 psi/min (allowable decay rate)
Challenge Particulate	0.5 µm fluorescent latex microspheres as a surrogate for <i>Cryptosporidium</i>
Detection Limit	10 particles per liter
Feed Concentration Range**	1.9 x 10 <sup>6</sup> to 8.2 x 10 <sup>6</sup> particles per liter
Max Filtrate Flux Rate	60 gallons per square-foot per day (gfd) at 20 °C
Mode of Operation / Flow Configuration	Deposition mode / Outside-In

\* Any membrane module that does not pass the manufacturer's NDPT demonstrating an allowable decay rate equal to, or less than QCRV is not eligible for the approved LRV<sub>C-Test</sub> of 5.3-log. Note that the QCRV, as identified in the MWH Americas challenge study report, was 0.20 psi per minute with system hold-up volume of 7.27 liters and a starting pressure of 12.5 psi. Based on supplemental information provided by Suez Corporation on October 6, 2021, the TCEQ is satisfied that these two QCRVs are sufficiently equivalent and that the two modules that were challenge tested would have failed the manufacturer's NDPT (meaning that any module passing the manufacturer's NDPT should demonstrate log removals equal or better than the challenge tested modules). It is also important to note the starting pressures of the manufacturer's and MWH's NDPT satisfy the 3-micron resolution requirement of the federal rule.

\*\* 40 CFR §141.719(b)(2)(iii) limits the maximum allowable feed water concentration during a challenge test to 3.16 x 10<sup>6</sup> x Filtrate Detection Limit. Based on a filtrate detection limit of 10 particles per liter, all of the feed concentrations in shown in the challenge study report comply with this requirement.

**LIMITS OF TCEQ-APPROVED LRV<sub>C-TEST</sub>**

The TCEQ-approved LRV<sub>C-Test</sub> is valid only for the ZeeWeed® 1000 V4 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 ZeeWeed® 1000 V4 module must comply with the following specifications to receive the TCEQ-approved LRV<sub>C-Test</sub>:

- 1) Specifications of the approved ZeeWeed® 1000 V4 modules:
  - a) Polyvinylidene fluoride (PVDF) hollow fiber membranes;
  - b) Active membrane area per module of 550-ft<sup>2</sup> (square feet);
  - c) Nominal membrane pore size of 0.02 µm (microns);

- d) Approximate Size of Element - 4.2" x 27.2" x 27";
  - e) Active length of fiber - 21.38 inches;
  - f) Inside diameter of fiber - 0.47 millimeters (mm);
  - g) Outside diameter of fiber - 0.95 mm;
  - h) Number of fibers per element - 31,536;
  - i) An outside-to-inside flow path;
  - j) Operational mode: Direct (no cross-flow);
  - k) Maximum filtrate flux: 60 gallons per square-foot per day (gfd) at 20°C;
  - l) Maximum operating temperature: 40°C;
  - m) Maximum turbidity: 250 Nephelometric Turbidity Units (NTU);
  - n) Maximum trans-membrane pressure (TMP) of 13 psi;
  - o) Operating pH range: 5.0 - 10.0;
  - p) Allowable pH range for cleaning of 2.0 to 12.0; and
  - q) Maximum chlorine/oxidant tolerance: 500,000 parts per million (ppm)-hours.
- 2) Prior to shipment to a Texas public water system (PWS), each new ZeeWeed® 1000 V4 UF module must have passed the manufacturer's NDPT, a bubble test for the elimination of damaged fibers followed by a pressure decay test, with an initial starting pressure of at least 13.0 psi, water temperature 20° to 25° C, a hold-up volume of 5.1 liters, a duration of 2 minutes, and an allowable pressure decay rate of 0.27 psi/minute.
  - 3) If the ZeeWeed® 1000 V4 UF module fails the NDPT (membranes having pressure decay rates greater than 0.27 psi/min), the TCEQ will not approve the ZeeWeed® 1000 V4 UF module to be installed at any Texas PWS for microbial contaminant removal credit.
  - 4) The manufacturer must notify the TCEQ in writing if the ZeeWeed® 1000 V4 modules (as challenge-tested by the CDPH) are modified or if the NDPT method is modified in any manner. After receiving written notification, the TCEQ shall determine if the modified ZeeWeed® 1000 V4 module shall be required to undergo challenge testing or if the modified NDPT method is acceptable.
  - 5) The results of the ZeeWeed® 1000 V4 UF module's NDPT must be recorded with the module's assigned unique serial number. The NDPT result for each ZeeWeed® 1000 V4 UF module delivered to a Texas PWS must be provided upon delivery of the ZeeWeed® 1000 V4 UF module to a system.
  - 6) 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  $LRV_{C-Test}$ ; or
    - b. The maximum removal efficiency that can be verified through a membrane unit's site specific direct integrity test ( $LRV_{DIT}$ ).
  - 7) Each ZeeWeed® 1000 V4 UF module must conform to ANSI/NSF Standard 61 and must be certified by a testing organization accredited by ANSI.
  - 8) Please note that the approved  $LRV_{C-Test}$  is for the current Federal and Texas statutes, and the USEPA and TCEQ rules. If these statutes or rules are revised, the TCEQ-approved  $LRV_{C-Test}$  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:

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- A granted TCEQ exception for any Texas PWS to use the ZeeWeed® 1000 V4 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 ZeeWeed® 1000 V4 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. Erin Guerra, P.E. at the letterhead address, by e-mail at PTRS@tceq.texas.gov, or by telephone at (512) 239-4691.

Sincerely,

A handwritten signature in black ink, appearing to read "Joel Klumpp". The signature is fluid and cursive, with the first name "Joel" being more prominent and the last name "Klumpp" following in a similar style.

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

JPK/erg/db