CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board
Division of Drinking Water

October 23, 2015

Mr. Peter J. Hall
MIH Water Treatment, Inc.
253 Belaire Court
Danville, CA 94526

Mr. Timothy Peschman
Evoqua Water Technologies LLC
2430 Rose Place
Roseville, MN 55113

CONDITIONAL ACCEPTANCE FOR THE EVOQUA BIOLOGICAL DENITRIFICATION SYSTEM USING MEMCOR MEMBRANES AND THE HALL BIOLOGICAL REACTOR

Dear Mr. Hall and Mr. Peschman:

The Water Treatment Committee (WTC) of the Division of Drinking Water, California State Water Resources Control Board (Division), has reviewed the following document submitted with your request to gain acceptance of using the Evoqua Biological Denitrification System using Memcor Membrane and the Hall Biological Reactor as a means of removing nitrate from drinking water source(s) prior to distribution as part of the public water supply. Results from the conditional acceptance challenge testing were presented to the Division in the following reports and electronic correspondence:

Preliminary Data Review – Evoqua Nitrate Remediation Biological Pilot with the Hall Reactor and Memcor Post Filtration Protocol Testing, prepared by Tim Peschman – Evoqua Water Technologies, dated March 11, 2015

Discussion with DDW – Questions and Comments from 03/17 Concall, e-mail dated April 13, 2015

Second Pilot Testing – Evoqua Nitrate Remediation Biological Pilot with the Hall Reactor and Memcor Post Filtration Protocol Testing, prepared by Tim Peschman – Evoqua Water Technologies, dated August 4, 2015

Based on the review of the above documents, the WTC hereby confirms that the Hall Reactor, in conjunction with the Evoqua Memcor filtration and hypochlorite feed system, (Evoqua Hall Biological Treatment System) has been demonstrated to remove nitrate from some sources of water. The pilot study results indicate that the required treatment

objectives for biological nitrate treatment can be achieved through the use of a properly designed and operated Hall Reactor for biological reduction in conjunction with an aeration system, an Evoqua ultrafiltration system and a sodium hypochlorite continuous control loop feed system.

Included below are several important caveats that are being incorporated into the conditional acceptance of the Evoqua Hall Biological Treatment System.

The WTC accepts Evoqua Hall Biological Treatment System to remove or reduce nitrate from some source water(s) for potable supply subject to the following conditions:

1. The treatment system shall be operated in a manner that maximizes steady state conditions (raw water flow rate and quality) and minimizes rapid changes in flow (e.g., it is preferred that the treatment plant is operated continuously, with gradual flow changes).

2. Upon restart of the Hall Reactor following an extended rest periods (a few hours) or unplanned shutdown, water containing hydrogen sulfide (due to sulfate reduction) may be present in the biological reactor. The treatment plant's operations plan must specify treatment objectives for the bioreactor (nitrate effluent, odor, hydrogen sulfide concentrations, etc.) and include procedures for system restarts to ensure that the treatment objectives are met prior to resuming normal delivery of product water to consumers.

3. Continuous on-line monitoring systems for water flow, feed and effluent nitrate concentration, chemical feed, turbidity, chlorine residual and dissolved oxygen shall be incorporated into the process design with adequate alarm strategies detailed in the treatment plant's operation plan to ensure reliable and consistent operation.

4. Efficiency of the biological treatment process shall be monitored to determine if there is a reduction in performance over time and whether seasonal changes in raw water quality (in particular, nitrate concentration, temperature, available micro and macro nutrients, etc.) may impact the overall process.

5. All chemicals used in the system shall be NSF/ANSI standard 60 certified by an ANSI accredited certifying organization.

6. All materials that come into direct contact with the drinking water must be NSF/ANSI standard 61 certified by an ANSI accredited certifying organization.

7. Following biological, filtration, disinfection and other treatment processes, the product water will be required to meet the following performance standards:

    a. 4-log virus inactivation must be achieved by the end of the disinfection treatment process continuously.

b. Treated water must be coliform free. Weekly or monthly samples collected at the end of the disinfection treatment process will be required.

c. Treated water must contain HPC of less than 500 cfu/mL. Weekly or monthly samples collected at the end of the disinfection treatment process will be required.

d. Combined filtered water effluent turbidity must be less than 0.3 NTU. Continuous monitoring of combined filter effluent will be required.

e. Corrosivity of the effluent water must be monitored and controlled prior to distribution.

f. Distribution system disinfectant by-products samples must be collected based on the Stage 2 Disinfectant / Disinfection By-Products Rule and must comply with the Locational Running Annual Average (LRAA) TTHM and HAA5 MCLs.

g. Treated water must meet all primary and secondary drinking water standards prior to distribution to consumers.

h. Treated water needs to have sufficient oxygen to stabilize the water prior to distribution to consumers.

8. A chemical flow monitor with alarm shall be provided for each of the critical treatment chemicals to ensure continuous operation. As a minimum, the loss of chemical feed for the electron donor or disinfectant shall trigger an immediate alarm to the treatment system operator. Extended loss of disinfectant chemical feed shall trigger an immediate shutdown.

9. Proper operator certification of the facility will be required based on the capacity and complexity of the full scale treatment system.

10. An operator training program for the biological treatment system shall be provided as part of the start-up process for the full scale treatment system.

It is important to note that the Evoqua Hall Biological Treatment System has not been proven to work on all water sources. Additional pilot study of the biological treatment process shall be performed prior to full scale implementation at other wells, a combination of wells or at other public water systems to confirm that the local water conditions is amendable to biological treatment.

As part of the site-specific pilot testing, the choice and dosage (based on influent nitrate concentration) for the electron donor should be identified and optimized. Simulated distribution system disinfection by-products (SDS DBP) tests should be performed to confirm that the treated water will not exceed the drinking water maximum contaminant

levels for disinfection by-products in the distribution system. The SDS DBP sample should be evaluated based on water quality that will be delivered to the distribution system, which includes filtration, disinfection and blending with untreated water. The SDS DBP test may be performed on a bench scale using treated water from the biological pilot unit followed by bench scale filtration and disinfection. The test procedure may be modified based on the disinfectant concentration used and residual maintained by the public water system.

To ensure the acceptability of the pilot study, prior to starting, the local SWRCB Division of Drinking Water district office or local primacy agency should be consulted to ensure that the pilot study is conducted with sufficient details so that adequate information is gathered to identify the critical design and operating factors of the full scale treatment plant.

Be advised that the approval for the design and use of this technology in any drinking water application will be handled on a case-by-case basis by the Division's district offices or local primacy agencies. The individual offices, based on specific site requirements, may specify additional unit treatment processes. Approval is granted through the domestic water supply permitting process. Information such as the pilot study results, technical drawings, plans and specifications will need to be submitted with the application and will be used for the development of the water supply permit.

Finally, as an alternative treatment technology, a one-year operation report summarizing the performance of the treatment plant is to be submitted by the water utility to the DDW. This report is due within 60 days after the first year of operation. The report is to include, as a minimum, results of all water quality tests performed, an evaluation of compliance with established performance standards under actual operating conditions, an assessment of problems experienced and corrective actions taken or needed, and a schedule for providing needed improvements. These reports should be comprehensive, detailing problems encountered during the first year of operation as well as during startup and commissioning. Production volume treated, treatment performance issues (such as biological upsets, loss in efficiency of the biological process, biological fouling, etc.), issues with chemical feed, filtration or alarm systems, etc. should be adequately covered in the report and should cover the period immediately following start-up (commissioning; troubleshooting) through the first year of production.

In addition, for the first full-scale application of the Evoqua Hall Biological Treatment System, the WTC will be interested in learning the conditions of the MIH patented sponge-like carriers after one year of operation. Please share with the WTC your findings regarding the physical conditions (observed deterioration) of the sponges and whether additional carriers were added as part of the first year operation report.

We would like to thank you and your colleagues for working with us during the development and testing of this technology. Should you have any questions regarding the content of this letter, please free to contact me at (510) 620-3460.

Sincerely,

Eugene H. Leung, P.E.
Senior Sanitary Engineer
Technical Operations Section

cc: Water Treatment Committee
SWRCB DDW District Engineers

West Valley Water District
855 West Base Line Road
Rialto, CA 92376-3103