

STATE OF COLORADO

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Executive Director and Chief Medical Officer

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department
of Public Health
and Environment

February 17, 2012

James Bell
Executive Vice President
Bio-Microbics, Inc.
8450 Cole Parkway
Shawnee, KS 66227

Subject: Acceptance of the Bio-Microbics BioBarrier® Membrane Biological Reactor Technology as a
New Technology for Use in Domestic Wastewater Treatment Works in Colorado

Dear Mr. Bell:

The Water Quality Control Division (the Division) has received and reviewed information for the Bio-Microbics, Inc. BioBarrier® Membrane Biological Reactor (MBR) Technology in accordance with Section 1.6.1 of *Design Criteria Considered in the Review of Wastewater Treatment Facilities Policy 96-1* (Wastewater Design Criteria). The Bio-Microbics BioBarrier® Technology design is accepted for use as a New Technology subject to the design criteria in Table 1. This acceptance is not intended as a third-party certification of the technology.

This acceptance addresses the following item:

- Bio-Microbics BioBarrier® MBR Technology System.

This acceptance applies only to the Bio-Microbics BioBarrier® Technology as described below and does not constitute construction approval for installation in domestic wastewater treatment facilities. **Review and approval for the design of any domestic wastewater facility proposing to use this technology will be further reviewed on a site-specific basis by the Division** as required by Section 22.11(1) of the *Site Location and Design Approval Regulations for Domestic Wastewater Treatment Works 5CCR 1002-22* (Regulation 22) and the Colorado Water Quality Control Act (Act), Section 25-8-702, C.R.S. which states in part that: "No person shall commence the construction of any domestic wastewater treatment works or the enlargement of the capacity of an existing domestic wastewater treatment works, unless the site location and the design for the construction or expansion have been approved by the division."

Any modifications to the physical attributes or characteristics of this treatment technology must be submitted to this office for review and acceptance by the Division prior to sale in Colorado. This condition includes changes made to the manufactured model (e.g., media, piping, mechanisms). The Division will review any additional third party verification reports and issue a revised acceptance letter, or denial, as appropriate.

Table 1. Bio-Microbics BioBarrier® MBR Technology Design Criteria:

Design Criteria
1. Colorado's current wastewater design criteria, Policy 96-1, does not contain criteria specific to the design of the MBR components of a wastewater treatment system. This acceptance is directed at the use of

- membranes as the solids separation process. Criteria for the complete mix activated sludge treatment portion are currently included in Policy 96-1.
2. Unit process design shall be established in accordance with current Colorado wastewater design criteria at the time of the design submittal and this acceptance for items not in the design criteria. During the site-specific design review, calculations shall be submitted to justify the basis of design for the biological process including, but not limited to, aeration basins, aeration, anoxic zones, mixing, recycle, and sludge wasting. The design shall identify the minimum solids retention time (SRT) to be maintained. The design shall incorporate consideration of mixed liquor concentrations ranging from 2,000 mg/L to 10,000 mg/L MLSS. The aeration system design shall provide sufficient air transfer for 10,000 mg/L MLSS using an appropriate α -value and sufficient air to ensure complete mixing. Supplemental aeration shall be added as necessary. For membranes to be located in the aeration basin(s) rather than separate membrane tank(s), the design must provide aeration basin(s) volume sized for complete nitrification. Use of oxygen or alkalinity credits from denitrification must be justified based on the specific process design (e.g., anoxic zone location, supplemental carbon, recycle, seasonal operation) to assure denitrification will occur.
 3. Approved facility design capacity shall be based on the maximum monthly average flow and loading. The design hydraulic loading rate (i.e., maximum monthly average) to a BioBarrier® MBR, to a minimum wastewater temperature of 6 °C, shall be limited to:
 - 3,000 gpd for a Model HSMBR 3.0
 - 4,500 gpd for a Model HSMBR 4.5
 - 6,000 gpd for a Model HSMBR 6.0
 - 9,000 gpd for a Model HSMBR 9.0
 4. Primary settling compartment or tank with a \leq 1/16-inch Bio-Microbics SaniTEE® fine screen effluent filter must precede the treatment unit compartment or tank to remove oil, grease, scum, grit, and floating debris. The primary settling compartment or tank must provide at least 12-hours hydraulic residence time (HRT) at the maximum monthly average flow capacity. If a recycle stream returns flow/solids to the primary chamber or other upstream point such as an equalization basin, the minimum HRT shall be 12-hours at the maximum monthly average flow including additional design recycle flows.
 5. Pretreatment for non-residential kitchens must include a separate grease separator tank prior to the primary septic tank(s), providing a minimum HRT of 4 days based on the kitchen's design maximum daily flow.
 6. If multiple treatment basins are included in parallel, adequate flow splitting devices must be provided to control the maximum design flow to each unit.
 7. Treatment Credit. The domestic wastewater treatment plant must meet appropriate effluent discharge limits (e.g., Preliminary Effluent Limits or PELs, permit effluent limits, regulatory standards) as justified in the design basis noted in item 2 above.
 8. Aeration and Pump Equipment. Aeration equipment, mixers, and recycle pumps shall be provided. The design must demonstrate adequate blower size, mixer size, and pump size, and capacity based on site-specific conditions and treatment requirements including, but not limited to, elevation, temperature (e.g., seasonal, air, wastewater), pipe sizes, bends, etc. (e.g., developed in consultation with Bio-Microbics, Inc.).
 9. Alkalinity. Nitrification requires alkalinity, at least 7.14 pounds as CaCO₃ per pound ammonia oxidized. The wastewater must be shown to have sufficient alkalinity (i.e., minimum of 50 mg/L CaCO₃ in excess of stoichiometric requirement) or chemical treatment must be included to provide adequate alkalinity.
 10. Carbon Source for Denitrification. The designer must ensure that a sufficient amount of organic carbon (soluble COD) is present in the influent wastewater to denitrify the nitrates such that the effluent total nitrogen concentration is in compliance with the discharge limitations. The design must provide supporting documentation/calculations demonstrating the sufficient amounts of available carbon for this process. If calculations show that adequate soluble COD is not available in influent wastewater, provisions must be included for a supplemental carbon source to be fed directly to the anoxic reactor. The

design must demonstrate TKN loading, carbon feed rates/ratios, temperature, reaction kinetics based on the type of supplemental chemical, process controls, and downstream organic polishing.

11. If recycle is proposed, the design must indicate from where, to where, and how recycle flow is directed and managed (e.g., as developed in consultation with Bio-Microbics, Inc.).
12. Site pretreatment processes shall be incorporated into the process train, as required, to ensure that anticipated peak loads (e.g., hydraulic, organic, nutrient) are accommodated and mitigated to maintain treatment performance. The treatment technology is intended for domestic wastewater without industrial sources.
13. For facilities where ambient air temperatures can be below freezing, the design shall include adequate cold weather provisions such as heat trace lines, and/or installation in a temperature-controlled enclosure for above ground wet components.
14. Alarm. Blower and pump malfunction alarms must be provided. The design must identify how the alarm signal will notify operators of alarm activations, when the facility is attended and unattended.
15. Design Redundancy. At least two equal trains of membrane systems (i.e., separate functionality for controls, float switches, blowers, vacuum pumps) shall be installed, each with a design flow of at least 50 percent of the total design capacity. Fixed capacity (i.e., all units operating) for aeration, mixing, and pump capacity shall be capable of providing design requirements (e.g., enable the design oxygen transfer). Firm capacity (i.e., largest unit out of service) for aeration, mixing, and pump capacity shall be available at the site to provide design requirements (e.g., enable the design oxygen transfer). It is permissible for the backup unit to be an uninstalled unit, provided the installed unit can be easily removed and replaced. The air diffusion system for a basin shall be designed such that the largest section of diffusers can be isolated without significantly impairing the oxygen transfer capability of the system.
16. Other Processes Required. Although the treatment technology has major unit process components of a treatment plant, it does not constitute a complete package treatment plant and the particular site-specific design must include other unit processes (e.g., influent and effluent flow metering, chemical addition, disinfection, phosphorus removal) to be a fully functioning wastewater treatment plant and meet effluent discharge limits and associated discharge permit requirements. These other supporting unit processes will be evaluated during the site location and design reviews.
17. Tank Design. Design must include adequate provisions to protect against tank buoyancy. Tanks holding BioMicrobics equipment must be sized in accordance with manufacturer minimum specifications and be documented to provide adequate treatment volume during the design review. Tanks must be installed below grade or insulated appropriately to maintain temperature and prevent freezing.
18. Maintenance Access. Design shall include provisions that allow the operator to access, operate, and maintain all equipment without entering a confined space or requiring heavy equipment to lift a concrete lid if possible.
19. Manufacturer Review. A review letter issued by the manufacturer indicating the installation was designed in accordance with manufacturer recommendations must be included with the site-specific design submittal. The manufacturer's review may not supersede the criteria in this acceptance or be substituted for all required engineering documentation and calculations stamped and signed by a Colorado licensed Professional Engineer.

Additional Operations and Maintenance Criteria

1. Design must include provision of at least one spare membrane rack/cassette and associated diffuser for replacement during periodic chemical cleaning or repair.
2. Design must include discussion of residuals management considerations, including the management of mixed liquor concentration, the expected solids generation quantities and quality, and a discussion of the

method of final sludge disposal, if applicable.

3. Design shall include provision for operator training including, but not limited to: start-up operations, normal operations, membrane cleaning and maintenance, hydraulic fluctuations, temperature impacts, sludge monitoring, removal, and residual management.
4. An Operations and Maintenance (O&M) Manual shall be provided for all installations. The document should be available for review by the Division during compliance inspections.
5. Individual operations plans shall include scheduled inspections, assessments, and maintenance of the grease tank, solids accumulation in the treatment tanks, primary tank effluent filters, and membrane cleaning and maintenance as an operational safeguard. Inspection and maintenance (e.g., grease removal, solids and scum removal, filter cleaning, membrane cleaning and replacement) frequency may change with time as media condition changes and performance experience is gained.
6. Certified Operator. The domestic wastewater treatment works with this technology will be required to be under the control of an operator with a Class C or Class B Domestic Wastewater Treatment Facility Certification, depending upon the system complexity and sensitivity of the receiving water, in accordance with Regulation 100 Water and Wastewater Facility Operators Certification Requirements.

The owner of the domestic wastewater treatment works is responsible for proper design, operation, and maintenance of the facility to meet permit effluent requirements.

Please be aware that any point source discharges of water from treatment facilities are potentially subject to a discharge permit under Colorado's State Discharge Permit System. Any point source discharges to state waters without a permit are subject to civil or criminal enforcement action.

As part of this review, the Division has evaluated the following documents:

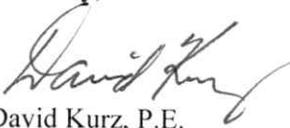
- December 21, 2011 Submittal from Bio-Microbics, Inc. requesting new technology acceptance for Bio-Microbics BioBarrier® Membrane Biological Reactor (MBR) Technology.
- Various additional correspondences.

Please direct any further correspondence regarding this acceptance to:

David Kurz, P.E.
Colorado Department of Public Health and Environment
Water Quality Control Division
4300 Cherry Creek Drive South
Denver, CO 80246

If you have any questions or comments, please contact David Kurz at david.kurz@state.co.us or 303-692-3552.

Sincerely,



David Kurz, P.E.
Lead Wastewater Engineer
Engineering Section
Water Quality Control Division

cc: Tim Petz, ITS, Inc.
CDPHE-WQCD-ES