

# Bio<sup>M</sup>x™ — Technology

## Key Benefits

- 60%+ power savings versus leading submersible mechanical mixer
- Greatly reduced maintenance
- Complete mixing with insignificant oxygen transfer
- PLC controlled with customizable operating parameters to meet varying mixing requirements
- Basis for EnviroMix nutrient removal process (BioCycle™)

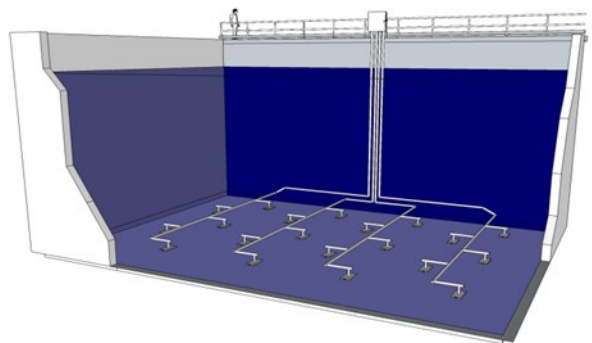
## Introduction

All Bio<sup>M</sup>x installations provide mixing in liquids by firing programmed short bursts of compressed air through patented engineered nozzles affixed to the floor of the tank. Electrical power requirements are limited to the power to operate the compressed air source and the programmable logic controllers in the Bio<sup>M</sup>x control panels. Studies have identified a **60%+ reduction** in power usage versus the leading submersible mechanical mixer in comparably-sized applications.

The Bio<sup>M</sup>x controllers incorporate programmable logic controllers (PLCs) that control the firing of the air injection valves. Compressed air is intermittently fired in fractional second durations to completely mix a process tank. Standard firing parameters of 0.5 second duration at 4.0 to 5.0 second intervals provide proven, effective mixing. The mixing parameters may be manually changed for optimum mixing and power utilization, or automated variable process feedback may be used.

The relatively small amount of expanded air produces an array of softball-sized bubbles that transfer an insignificant amount of oxygen into the liquid. Since oxygen transfer is inversely proportional to the surface area interface between the air and liquid, the larger the bubble, the less oxygen transfer. As examples, one ft<sup>3</sup> of diffused air produces 51,600 coarse ( $\pm 0.4'' \text{ } \varnothing$ ) spherical bubbles with 180 ft<sup>2</sup> of surface area, or 51,566,200 fine ( $\pm 0.04'' \text{ } \varnothing$ ) bubbles with 1800 ft<sup>2</sup> of surface area. By comparison, the same volume yields just 60 softball-sized (3.8''  $\varnothing$ ) bubbles with 18.9 ft<sup>2</sup> of surface area—**a reduction of 90% (coarse bubble) or 99% (fine bubble)**.

## Bio<sup>M</sup>x Installation Example



*Note:* Bio<sup>M</sup>x controller mounted on railing. Main air supply header is located on tank wall at catwalk level. Engineered in-tank air supply piping connects air control valves (inside controller) to nozzle headers and nozzles anchored to tank floor.

## All Bio<sup>M</sup>x installations share the following characteristics:

- Bottom-up mixing in basins of any geometry
- No mechanical or electrical components in the wastewater
- Non-clogging, self-cleaning in-tank components
- Zero maintenance of in-tank components
- Minimal scheduled maintenance of other components (compressor, air control valves) in controlled environments

## Bio<sup>Mx</sup>™ — Technology (cont.)

### Specifications

- Nozzles, nozzle headers, and header supply pipe of 304 Stainless Steel
- Rotary screw, variable speed air compressor(s)
- Custom NEMA 4X enclosures for valve control panels
- Allen-Bradley® programmable logic controllers
- MAC® air control valves
- Compatible with SCADA and DCS

### Demonstrated Applications and Test Results

Insignificant Oxygen Transfer. Bio<sup>Mx</sup> was evaluated to determine the amount of oxygen transferred by the Bio<sup>Mx</sup> mixing system. ASCE Clean Water testing by a third-party evaluation firm found the oxygen transfer rate to be insignificant ( $\pm 0.08 \text{ lb O}_2/\text{Hr}/1000 \text{ ft}^3$ ), thus validating the use of Bio<sup>Mx</sup> in anoxic environments.

Energy-Efficient Anaerobic Mixing. A full-scale demonstration project at the state-of-the-art 60 MGD F. Wayne Hill Water Resources Center in Gwinnett County, Georgia showed that compressed air Bio<sup>Mx</sup> provides comparable anaerobic mixing to submersible propeller mixers, but used 60%+ less power required than for the mechanical mixers. Further, oxidation reduction potential (ORP) averaged -210 mV in the anaerobic selector cell, validating Bio<sup>Mx</sup> compatibility with anaerobic environments.

Thickened Sludge. In Summerville, SC, a Bio<sup>Mx</sup> system in a sludge holding tank demonstrated successful mixing of a sludge concentration of up to 3.7 percent solids using significantly less power than existing coarse bubble diffusers, while controlling odors, maintaining pH, increasing settleability, improving sludge concentration, and reducing disposal transport and disposal costs.

### Other WWTP Applications

- Equalization tank mixing
- Channel mixing
- Pump stations
- Biological nutrient removal (BioCycle™)

### Major System Components

#### Control Unit Example



NEMA 4X stainless steel enclosure houses the Allen-Bradley® programmable logic controller (PLC). Easily-replaceable, modular 25-million-cycle rated solenoid air control valves are mounted to an air supply manifold. Allen-Bradley® user interface provides for system parameter change.

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#### Bio<sup>Mx</sup> Nozzle



Stainless steel nozzles mount directly to tank floor. Spacer below top plate has engineered channels for optimal air flow direction and bubble size.

### Contact Your Local Representative