PLANT NAME/LOCATION: Middlebury WWTP/ Middlebury, VT

TYPE OF PLANT: Municipal and Industrial Wastewater

DESIGN DAILY FLOW: 2.72 MGD (10,296 m^3/day) **PEAK FLOW:** 4.60 MGD (17,413 m^3/day)

AQUA-AEROBIC PRODUCTS: 4-basin AquaSBR® System

OPTIMIZING BIOLOGICAL PHOSPHORUS REMOVAL FROM AN AQUASBR® SYSTEM

The Middlbury Wastewater Treatment Plant located in Middlebury, Vermont treats domestic and industrial waste received from a local dairy and a brewery. Its original treatment system consisted of a flow-through activated sludge process with primary clarifiers, anaerobic digesters, and a four-train Rotating Biological Contactor (RBC) system. The RBC system was installed in 1980 but by the mid 1990s was plagued with mechanical failures. The plant was unable to meet its effluent requirements for BOD, TSS and Total Phosphorus. Since the plant was located in the center of town, the surrounding area was also burdened with odor problems from the facility's primary clarifiers and aerated pre-equalization tank. Middlebury realized it was time to explore other secondary treatment technologies in order to alleviate its current problems and upgrade its facility to meet more stringent requirements.

Two of the four AquaSBR basins at Middlebury WWTP.

Middlebury upgraded its facility in February 2000 by replacing the flow-through activated sludge process and RBC system with a four-basin AquaSBR® sequencing batch reactor system. The AquaSBR technology was chosen due to its ability to efficiently provide effluent with low values of BOD and TSS, as well as its ability to remove phosphorus biologically. The new system also eliminated the need for primary clarifiers so the potential odor problem was greatly reduced.

Shortly following start-up Middlebury's operational staff recognized the valuable power savings and process optimization that could be gained by incorporating active aeration control via on-line dissolved oxygen monitoring. In 2002, Middlebury contacted Aqua's Controls staff to incorporate their dissolved oxygen meters into the AquaSBR operation. With Aqua's MixAir system, the blower run-times could be adjusted automatically according to the naturally variable loads produced by the nearby industries.

PRODUCTS

Aqua-Jet®
Surface Aerator

Aqua-Jet II®
Contained Flow Aerator

AquaABF®
Automatic Backwash Filter

MixAir®
Aeration System

AquaDDM®
Direct Drive Mixer-Blender

AquaSBR®
Sequencing Batch Reactor

AquaDisk®
Cloth-Media Filter

AquaDiamond™
Cloth-Media Filter

AquaDrum™
Cloth-Media Filter

ThermoFlo®
Spray Cooler

Aqua EnduraDisc®
Fine Bubble Diffuser

Aqua EnduraTube™
Fine Bubble Diffuser

Aqua CB-12™
Coarse Bubble Diffuser

Aqua CB-24®
Coarse Bubble Diffuser

AquaMB Process ™
Multiple-Barrier Membrane System

MSBR®
Modified Sequencing Batch Reactor

SERVICES

Process and Mechanical Engineering

Quality Manufacturing

Aftermarket Sales & Service

International Expertise

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AQUASBR® SYSTEM PROCESS

The AquaSBR system operates on a simple concept of introducing a quantity of waste to a reactor, treating the waste in an adequate time period, and subsequently discharging a volume of effluent plus waste sludge that is equal to the original volume of waste introduced to the reactor. This "Fill and Draw" principle of operation involves the basic steps of Fill, React, Settle, Decant, and Sludge Waste. The system may be designed to include seven individual phases of operation but the inclusion or duration of any individual phase is based upon specific waste characteristics and effluent objectives.

Where nutrient removal is required, a simple adjustment to the SBR's operating strategies permits nitrification, denitrification, and biological phosphorus removal. Optimum performance is attained when two or more reactors are utilized in a predetermined sequence of operation.

DESIGN CHARACTERISTICS

Middlebury's four-basin AquaSBR system is designed to treat an average daily flow of 2.72 MGD with a design peak flow of 4.60 MGD. The plant's actual average daily flow is currently 1.0 MGD. Each of the four basins is designed to operate five cycles per day.

The plant receives variable phosphorus loads from the local dairy and brewery (often **4x** the design loading). When these higher loads are observed, minimal amounts of alum (metal salt) is added to the system to assist in achieving the low Total Phosphorus effluent objective required of Middlebury.

2003 AVERAGE OPERATING DATA

Loading	Design Influent	Avg Influent	Avg Effluent	Design Effluent
Avg Flow mgd	2.72	1.0	--------	--------
Peak Flow mgd	4.60	--------	--------	--------
BOD5 mg/l	388	390	4.9	30
TSS mg/l	258	314	4.1	30
Total P mg/l	6	19.8	0.47	0.8

According to the Plant Superintendent, Robert Wells, "*The AquaSBR system was selected for the Middlebury project due to its ability to perform biological phosphorus removal, as well as its ability to handle variations in hydraulic and organic loads.*"

AQUASBR® SYSTEM ADVANTAGES:

- All components available as retrievable
- Tolerates variable hydraulic loads
- Controls filamentous growth
- Tolerates variable organic loads
- Provides quiescent settling
- Separation of aeration and mixing
- Lower installation costs
- Return activated sludge pumping eliminated
- Small footprint
- Simple to expand or upgrade
- One company accountability

Each of the four basins at Middlebury WWTP measures 82'x55' with an 11.2' LWL and an 18.0' HWL.