

# Bristol-Myers Squibb Works Hard To Be a Good Neighbor

Hach LDO® technology improves the efficiency of pharmaceutical plant's wastewater treatment process, helping to protect the environment and the community

*Bristol-Myers Squibb Company's (BMS's) plant in East Syracuse, New York manually measured its waste treatment process on a periodic basis to monitor dissolved oxygen (DO). This approach did not allow operators to constantly measure the oxygen demand of the aeration tanks. As a result, they ran aeration blowers more than was really necessary to ensure complete aeration, and to provide a measure of safety to guard against variable loading rates. New technology to monitor DO on-line in the aeration tanks now provides operators with continuous, accurate DO readings. Combined with automated variable frequency drives (VFDs) that control aeration blowers on a closed-control loop in direct response to DO measurements, the system now uses roughly 75% of the power it did before, resulting in substantial cost savings in both energy and maintenance, allowing BMS to recoup the cost of the upgrade in less than a year.*



Image is representative of the application Bristol-Meyer Squibb uses.

## Introduction

Bristol-Myers Squibb (BMS) is a global pharmaceutical and related health care company with the mission to extend and enhance human life. One of the company's oldest and largest facilities was built in 1943 in East Syracuse, New York, when BMS was one of 12 companies chosen by the federal government to mass produce penicillin.

The site employs approximately 800 people on a 90-acre campus with 1.7 million square feet of office, laboratory and manufacturing space. Here, BMS develops new medicines in state-of-the-art pilot plants, and manufactures a bulk active antibiotic that is the active ingredient in penicillin. This large-volume fermentation facility is the only plant of its kind in the U.S.

## Just Part of the Neighborhood

After six decades, the manufacturing facility finds itself basically in the midst of a neighborhood. Because of this, BMS is particularly sensitive to its neighbors' concerns, and takes extraordinary measures to ensure that its processes work as effectively and efficiently as possible. One particular area of concern is the facility's wastewater treatment plant, including the control and abatement of any odor.

Until relatively recently, BMS sacrificed energy efficiency to ensure its treatment system met or exceeded target levels of dissolved oxygen (DO) in its aeration system. Today, thanks to 24x7 monitoring using Hach's on-line LDO® (Luminescent Dissolved Oxygen) technology, operators



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can monitor the system much more closely, and respond to changes in the wastewater stream almost instantaneously. This improved accuracy allows the system to operate much more efficiently in an automatic mode of operation vs. the manual mode previously employed. This has resulted in tremendous savings in energy costs, along with increased assurance that process odor is under control.

### The BMS Treatment Process

BMS outsources operation of its wastewater treatment process to Cunningham Environmental Support Inc., a business unit of Fairfield, New Jersey-based Covanta Energy Corporation. Cunninghams's Dean Merritt, supervisor of the wastewater treatment plant, works with a staff of nine Cunningham employees to run the facility. The team staffs the plant around the clock, monitors its operation, makes process decisions and ensures that effluent meets discharge permit standards. Dean and his staff are supervised by the facility's manager, BMS's Dave Dombrosky.

This pre-treatment facility processes 1.2 million gallons of waste each day, passing it to the Syracuse Wastewater Treatment Plant. "We produce a very high-quality effluent," notes Merritt. "Our effluent quality meets standards needed to discharge directly to the environment, but there are no bodies of water nearby to enable us to do that."

The system has four aeration tanks, three that hold 1.9 million gallons, and one that holds 2.5 million gallons. Three operate at a time, and one is in a denitrification cycle on a four-hour rotating basis. To aerate the tanks, the system uses a coarse air aeration system in the bottom of the tanks, driven by seven 200-horsepower positive displacement blowers for the smaller tanks, and four 300-horsepower centrifugal blowers for the larger tank.

Each tank is covered by a large dome, and the air that comes up through the process is treated as part of the odor control and abatement process. That system is driven by four 100-hp fans and a 75-hp fan to pull air through odor scrubbers. The scrubbers consist of packed media in towers, where the air is exposed to a hypochlorite and caustic solution to oxidize and remove any hydrogen sulfide it contains.

### Treatment Challenges

The biggest challenge is the high concentration of the waste, as measured by chemical oxygen demand (COD). Generally, municipal plants have influents that are in the 300 mg/L range for COD. BMS influent waste is primarily fermentation products from manufacturing that average about 7,000 mg/L COD. As a result, the retention time required to treat the waste is substantially longer – four days, or 96 hours, rather than the 12 to 18 hours that is typically required at a municipal plant. The additional retention time allows the waste to be aerated more effectively to meet target effluent COD limits.



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Until 2003, the DO level of the aeration tanks were measured manually using a handheld meter. If test results did not meet target DO values, another blower would be turned on to send more air through the aeration tanks and raise the DO reading. If system readings were substantially higher than target levels, a blower would be turned off.

This was an effective, but inefficient approach to making sure effluent quality met standards. One problem was that the aeration blowers were either on or off – running at full speed, or completely idle. If DO was too low, or on the borderline, the solution was to turn on another blower. If the DO was higher than expected, staff might turn a blower off.

A separate problem was that because DO levels were only checked periodically, operators did not know if the latest reading was persistent and steady over an extended time, or if it reflected conditions that occurred just before the test was conducted, only to quickly change again just after the sample was taken.

These factors led to running more blowers to provide a safety margin to make sure DO levels met or exceeded target levels of DO. This resulted in a tremendous amount of wasted energy, significantly higher costs to pay for that energy, and increased maintenance and downtime.

"To ensure that we were handing off quality effluent, we ran the system at the higher edge of the curve, typically over-aerating just to be safe" notes facility manager Dave Dombrosky. "As a result, we were wasting the energy equivalent of one blower."

## Ideas for Improvement

Operators had been trying to find a way to upgrade the aeration process to improve its efficiency. With on-line equipment to measure DO and call attention to any problematic readings, they would be able to measure more accurately and consistently, and reduce unnecessary use of additional blowers.

The ideal solution the team envisioned was to tie precise on-line DO monitoring to a blower control system that would adjust aeration in response to DO measurements. Using variable frequency drives (VFDs) to power the blowers would mean that a full 200-hp blower would not need to be turned on at maximum speed every time readings were just slightly off. If DO readings indicated the process needed just a little more aeration, a VFD could be used to provide just the right amount.

## One Last Hurdle

The primary factor that had prevented operators from improving the process was the lack of a reliable, repeatable online DO measurement. Because the process operates at 112° F, and the maximum operating temperature for on-line DO monitors on the market was 105° F, operators had been unable to put on-line DO monitors in the aeration tanks before.

“Automating was something we always wanted to do,” notes Merritt, “but we were limited by the operating temperature ranges of the DO monitors on the market. The technology was just not available to allow us to do continuous monitoring.”

## A Solution from Hach

When Hach introduced the Hach LDO®, which features breakthrough luminescent technology for measuring dissolved oxygen, operators were suddenly on the verge of substantially improving process efficiency. Because the maximum operating temperature range of the LDO probe tops out at 122° F, well above the process temperature, it solved the primary problem that had delayed the system upgrade. Not only would the Hach system eliminate the tedious and inconsistent manual DO testing process, it would greatly reduce the need for cleaning and maintenance in comparison to other on-line DO monitors.

The Hach LDO® system uses a sensor coated with a luminescent material. Blue light from an LED is transmitted onto the sensor surface, exciting the luminescent material, which emits red light as it relaxes. The presence of DO in the process shortens the time it takes for the red light to be emitted. By measuring the time lapse between when the blue light was transmitted and the red light is emitted, a correlation is made to the concentration of DO in the effluent or other solution. Between measurements, a red LED is used as an internal reference.

The Hach LDO® system offers several advantages over previous DO measurement methods. Maintenance is greatly reduced, since there are no membranes, electrolyte solutions or anodes and cathodes – the sensor just needs to be wiped off periodically. The only replacement part is the sensor cap, which is inexpensive and simple to replace. The internal reference calibrates the instrument with every reading, and the sensor is not affected by factors like pH, hydrogen sulfide, heavy metals or other chemicals, so the system produces stable, accurate measurements over an extended period of time. Pole mount or ball-float mount kits let users place the analyzer wherever it is needed.

## Upgrading the System

Merritt and Dombrosky learned about the Hach LDO® system from a Hach representative, and immediately realized the benefits the new technology offered, and how they could leverage it. They decided to use a Hach LDO® on a three-month trial to gather data and gauge the potential return on investment from eliminating manual sampling to monitor DO and reducing energy costs to drive their aeration blowers.

“We needed to show management that a substantial investment to fund the major cost of the upgrade – the variable frequency drives for the blowers – would pay for itself in a reasonable time,” said Dombrosky.

The trial demonstrated the potential savings of upgrading the system, and the group went to BMS’s corporate office for funds to purchase VFDs for the blowers and three more LDO analyzers for the other aeration tanks. The total project cost, including the LDO analyzers, VFDs and installation labor, was approximately \$65,000. The estimated payback period for the system was less than one year.

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Now, BMS's totally automated system is driven by Hach LDO meters on all four aeration tanks. Operators know exactly what the DO levels are in the tanks 24x7. DO readings are fed to a programmable logic controller (PLC), and when a reading indicates the need for additional aeration in one of the tanks, the PLC speeds up one of the blowers for that tank. Rather than wasting energy by turning on a 200- or 300-hp blower at full speed, the VFDs provide just the right amount of additional aeration to bring the DO level in line.

"Certainly there was a cost factor, as we needed to purchase the Hach meters and put VFDs on the blowers," notes Merritt. "But the savings and control we've realized as a result have been tremendous. We set the system to maintain 2 ppm DO, and forget it. The Hach LDO® feeds the PLC a reading, and the PLC speeds up or slows down the blowers to maintain 2 ppm DO. The DO measurements are constant, repeatable and reliable, and the system is enormously more effective and efficient than our old approach."

### On-Line Monitoring Advantages

By moving from periodic manual DO testing to on-line monitoring, operators immediately realized several key benefits. In addition to the energy cost savings realized by using VFDs, operators also had instant notification of problems or upsets in the system. Overall labor and maintenance was reduced substantially, since manual testing was eliminated, and the VFDs eased the blowers' workload.

### The Payoff

The energy savings directly attributable to the use of Hach LDO® meters to continuously monitor DO, feed that information to PLCs and have the PLCs drive the aeration blowers using VFDs in response to DO readings are startling. On each aeration tank, a Hach LDO® probe helps BMS save \$24,000/year in energy costs. With three tanks in operation at any time, the system realizes savings of \$72,000/year in energy costs alone, significant for a facility with energy costs of \$1 million/year.

"That means, just calculating energy savings, that we will have payback in less than a year for the entire system," said Dombrosky. "That includes the cost of the Hach LDO® meters, the VFDs, and the labor to install everything."

While the team has not calculated other related savings, they speculate that they are substantial. Labor, maintenance and supplies to manually sample DO and



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overhaul aeration blowers will be significantly reduced. By eliminating over-aeration, the load on the scrubbers used to treat the air as part of the odor control and abatement process has been reduced by 25%, saving additional energy, labor, supplies and maintenance costs.

Perhaps the biggest benefits likely to be realized are the most difficult to measure: operators have peace of mind, knowing that their process is under precise control.

"Before, if we got a DO level that was out of line, we would turn a blower on," notes Merritt. "What we didn't know was whether that condition had started just before the sample was taken, or had it been at that level for some time? Because we didn't want to take any chances, we wasted air and energy. Now, we always know what's going on with the system, and we use the appropriate amount of energy and air to keep it in control, automatically."

The team has also strengthened their partnership with the area's municipal wastewater treatment plant, which can count on receiving a consistently high-quality effluent from BMS. And while many of them may not realize it, BMS's neighbors can trust that the company will go out of its way to ensure that it continues to be a good neighbor, and seek out new technology to improve its operations and help protect the environment.

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To find out more about this or any Hach DO product including current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area. In the United States, contact: **HACH COMPANY** World Headquarters; Telephone: 800-227-4224 (970-669-3050 outside the USA); E-mail: [orders@hach.com](mailto:orders@hach.com) ([intl@hach.com](mailto:intl@hach.com) outside the USA)  
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