The Predictive Aeration Logic - PAL - Experience

BioChem believes firmly in its products, and the practice of under-promising and over delivering when it comes to making our control systems as autonomous, robust, and beneficial to the end user as possible. To this end, BioChem has embraced a culture of continual improvement where the latest developments in science and engineering are continually being incorporated to improve our control solutions. This drive, combined with years of experience in optimizing wastewater operations, allows for BioChem to provide a holistic perspective in system design and integration representing an unprecedented value to our customers and partners in the industry.

> *"BioChem has proven themselves as a resourceful and collaborative entity adding value beyond the definition of the project scope."*
>
> *Eric Bennett, Aerzen USA*
> *Applications Engineer*

The potential benefits of implementing our advanced aeration control systems, such as the PAL, can best be demonstrated by bringing past experiences and successes into focus. In this way, we can allow our customers and proven track record of success speak clearly and plainly of the quality and range of offerings BioChem Technology can provide to plant operators, systems integrators, and engineers.

Quincy WA – 2 SBR Aeration Control System

Standard Features Included at Quincy:

- Blower Main Control Panel Functionality – supporting Modbus, Ethernet IP, and analog 4-20 mA communication protocols
- Dissolved Oxygen setpoint tracking

- Custom HMI development
- Full System Integration & Commissioning

The Quincy WRF, as a result from installing the PAL was able to demonstrate a reduction in aeration energy of 57%. Despite the region's low power cost of $.0413 per kWh (less than 58% of the national average), this savings results in a savings of 96,807 /year. The performance criteria of this facility qualified it for an energy rebate from the local utility, and it is estimated that the entire system upgrade (including the purchase and installation of two new blowers) will pay for itself in a 3 year 8 month period. The system was fully brought online and tuned during a single 1 week on-site commissioning, and it's success highlights how even the most the most simple wastewater applications can greatly benefit from the PAL. For more information regarding the methodologies of how we were able to make Quincy a success please refer to our WEFTEC Publication: IMPLEMENTATION AND EVALUATION OF ENERGY SAVINGS FOCUSED AERATION DESIGN AND CONTROL OF SEQUENCING BATCH REACTORS IN WASHINGTON.

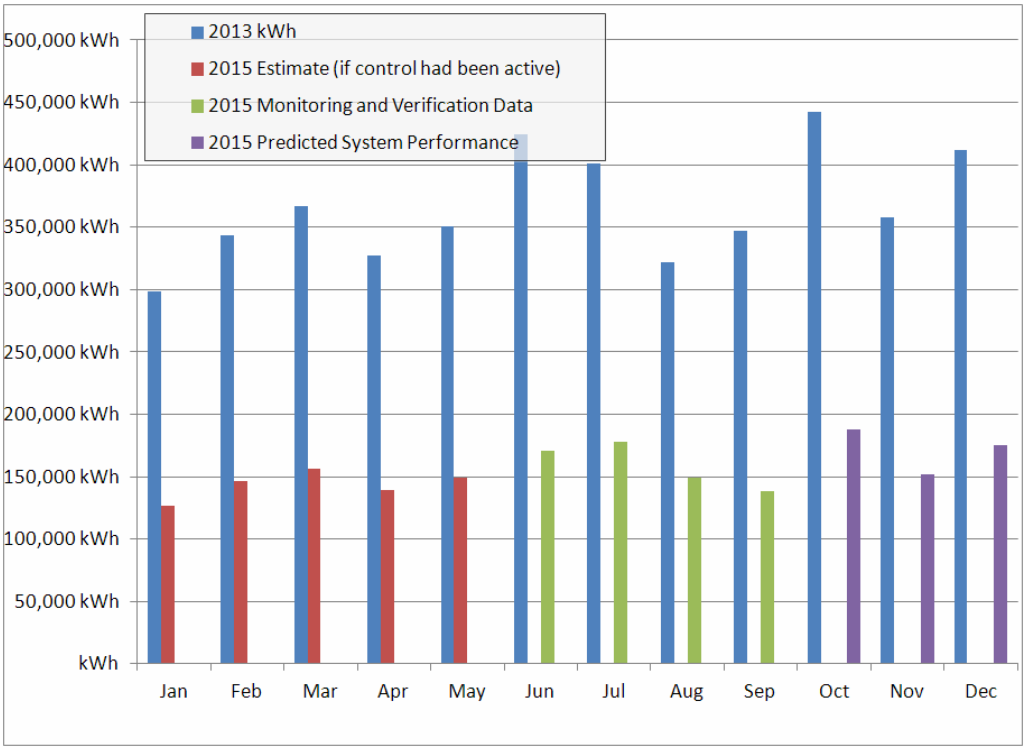

Figure 1. Power usage for 2013 compared to 2015 measured and expected potential power usage

Lebanon PA – 3 Trains, 15 aeration control zones MLE with automated swing zone control & nitrogen control; optimized for IFAS operation

Some of the Standard PAL Features to be found in Lebanon:

- Airflow Based Blower Control for Siemens Turblex blowers

- Dynamic Disolved Oxygen Setpoint which modulates to achieve plant specified effluent nitrogen targets
- Dissolved Oxygen Setpoint Tracking for each of the 15 aeration zones
- Dynamic Most open valve control
- Field device IO monitoring and direct instrument and IMLR control
- Custom HMI development
- Full System Integration & Commissioning

The Lebanon WWTP, as a result from installing BioChem's control solution was able to demonstrate a reduction in aeration of 47.4% compared to aeration requirements measured before the system was commissioned. By flipping the switch into auto, the facility simultaneously gains the full benefit and peace of mind of automated nitrogen control and saves close to 50% on their aeration budget.

> *"Our Operators find the Bioreactor Process Control System very easy to navigate and make changes. However, very few changes need to be made when everything is in Auto. Today, we are exceeding our original goals and can reduce Total Phosphorous to as low as .4 mg/L and Total Nitrogen to 3 mg/L in large part to the robust system that was designed by Biochem."*
>
> *Frank DiScuillo Jr., Wastewater Systems Director*
> *City of Lebanon Authority*

To speak of the robustness and performance criteria the PAL is capable of, please consider the following figure which demonstrates DO control to within .5 mg/L for over 96.7% of all conditions observed.

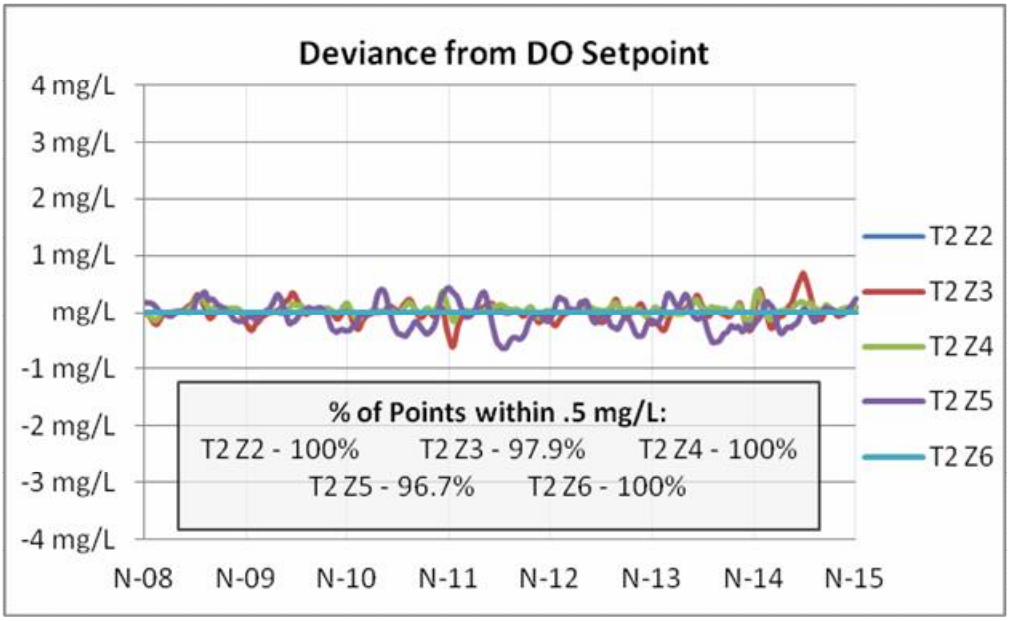

Figure 2. Dissolved Oxygen deviation from setpoint over an 8 day period