

**Ovivo USA, LLC**  
2404 Rutland Drive  
Austin TX  
78758  
USA

Telephone: 512.834.6000  
Facsimile: 512.834.6039  
[www.ovivowater.com](http://www.ovivowater.com)



## **Bellefonte P.A.D<sup>®</sup>-M Case Study**

Bryen Woo, P.E., Ovivo Aeration/Aerobic Digestion Product Manager

Chuck Thompson, P.E., Nittany Engineering & Associates, LLC Project Engineer

## History and Objectives

Bellefonte Wastewater Treatment Plant (WWTP) in Bellefonte, Pennsylvania currently operates an Ovivo Pre-thickened Aerobic Digester using a Mechanical Thickener (P.A.D.<sup>®</sup>-M) Process and was commissioned on July 7, 2009.

The City of Bellefonte increased the capacity of their wastewater treatment plant from a 2.0 MGD to a 3.2 MGD flow rate. Nittany Engineering & Associates, LLC was contracted by the City of Bellefonte to design a Class B biosolids handling facility for land application. Nittany Engineering proposed to retrofit an existing equalization tank into aerobic digestion tanks to minimize costs. Ovivo recommended the P.A.D.<sup>®</sup>-M Process to Nittany Engineering. By pre-thickening the waste activated sludge (WAS) up to 4% solids with a P.A.D.<sup>®</sup>-M Process, the construction of additional tanks was not required, because this allowed for the existing equalization tank volume to provide the necessary solids retention time (SRT) that complies with the time temperature Class B Pathogen Reduction criteria at the 3.2 MGD expansion.

## Bellefonte WWTP P.A.D.<sup>®</sup>-M Process Design

The Bellefonte WWTP P.A.D.<sup>®</sup>-M Process design converted the existing equalization tank into three aerobic digestion tanks to be operated in series. Each aerobic digester tank was designed with an Airbeam<sup>®</sup> Cover integrating Ovivo's MS<sup>®</sup> diffusers and shear tubes to provide maximum mixing and aeration efficiency of thickened solids, minimize odors, and provide optimum temperature control during winter operations when Class B biosolids is most difficult to achieve.

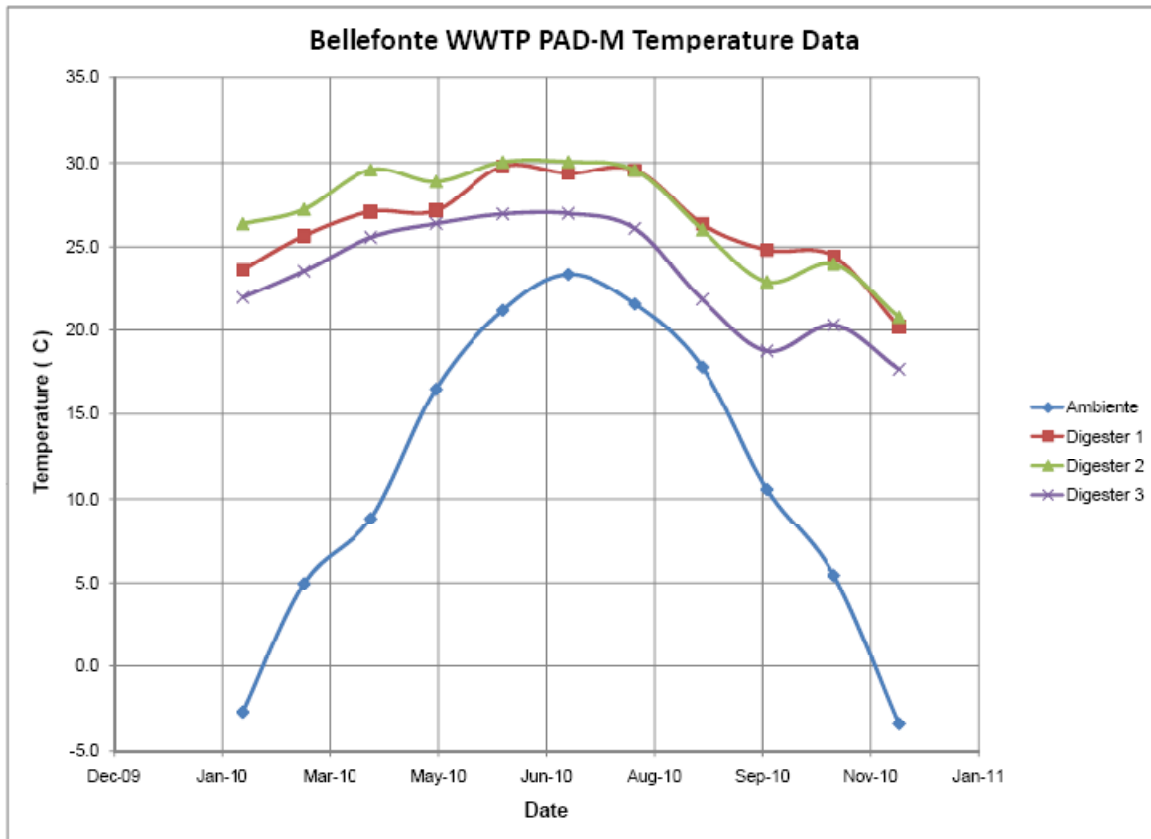
**Figure 1. Bellefonte WWTP P.A.D.<sup>®</sup>-M Facility**



### Bellefonte WWTP P.A.D.-M Process Temperature Control

Temperature control is essential to a successful aerobic digestion process. Ovivo provided an Airbeam® Cover design for each aerobic digester tank in the Bellefonte P.A.D.-M Process to aid in temperature control primarily during winter operations. Temperatures between 20°C to 35°C provide the most favorable aerobic digestion conditions. Temperatures lower than 10°C inhibit nitrification and can create odor issues, while temperatures greater than 37°C create thermophilic conditions. With average ambient temperatures in Bellefonte, Pennsylvania reaching as low as -3.37°C during the 2010 operations, the aerobic digesters were able to sustain average temperatures no lower than 17°C from this period. Figure 2 shows the average temperature maintained in each aerobic digester tank comparing with the average ambient temperature of each month from 2010 operations. As shown in Figure 2 below each aerobic digester tank consistently maintained a temperature that achieves optimum aerobic digestion performance. The data also demonstrates excellent temperature control most notably when average ambient temperatures are lower than 10°C.

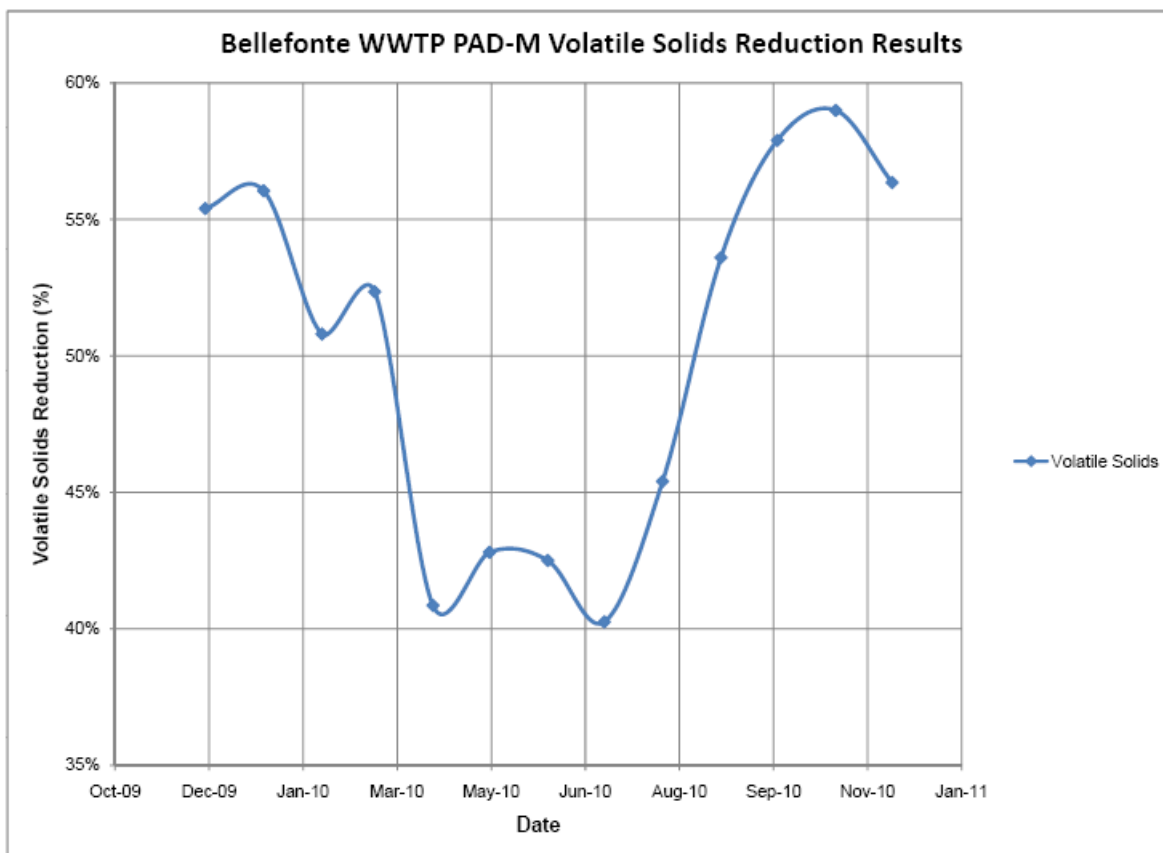
**Figure 2. Bellefonte WWTP P.A.D.-M Process Temperature Data**



### Volatil Solids Reduction Results

WAS is pre-thickened up to 4.0% solids from a gravity belt thickener (GBT) before entering the aerobic digesters to provide a longer SRT for enhanced volatile solids reduction (VSR). Excellent VSR is achieved at this facility due to longer SRT, complimented by outstanding temperature control maintained in the aerobic digester tanks as noted above. As shown in Figure 3 below, a VSR of 40% to 59% was achieved from December 2009 to January 2011 at this facility. This performance exceeds the minimum CFR 40 Part 503 Class B Vector Attraction regulations of 38% VSR.

**Figure 3. Bellefonte WWTP Volatile Solids Reduction Performance**



### Pathogen Results

The Bellefonte P.A.D.<sup>®</sup>-M Process was able to produce a sludge with pathogens ranging from 10,400 to as low as 57 colony-forming units (CFU) per dry gram during operations from February to November 2010 based on a geometric mean from seven repetitions from each sample analyzed. As shown in Table 1 below these results well exceed the CFR 40 Part 503 Class B Pathogen Reduction regulations of less than 2,000,000 CFU per dry gram.

**Table 1. Bellefonte WWTP 2010 Calendar Year Pathogen Reduction Data, Membrane Filter Fecal Coliform Test Results**

First Quarter 2010		Second Quarter 2010	
Rep Number	CFU/Dry Gram	Rep Number	CFU/Dry Gram
1	175	1	268
2	4,715	2	704
3	934	3	1,622
4	173	4	1,679
5	1,117	5	2,370
6	970	6	2,647
7	5,048	7	414
<b>Geometric Mean</b>	<b>956</b>	<b>Geometric Mean</b>	<b>1,040</b>
Third Quarter 2010		Fourth Quarter 2010	
Rep Number	CFU/Dry Gram	Rep Number	CFU/Dry Gram
1	2,360	1	268
2	2,785	2	83
3	164	3	380
4	976	4	269
5	179	5	633
6	602	6	10,400
7	<59	7	<57
<b>Geometric Mean</b>	<b>480</b>	<b>Geometric Mean</b>	<b>364</b>

**Conclusions**

Due to excellent temperature control and enhanced mixing efficiency of thickened solids from the Airbeam® Cover aeration system, the Bellefonte WWTP P.A.D.®-M Process consistently produces a Class B treated sludge for land application.