



Kreider Farms Dairy

**Bion BNR Environmental
Management System**

Technology Performance

Submitted To:

PennVest

By:

Bion PA1, LLC

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Biological Nutrient Reduction Performance

1.0 Executive Summary

The below data presentation documents the nutrient reduction performance of Bion’s Biological Nutrient Removal System (BNR) located at the Kreider Dairy Farm in Manheim, PA as required by the Technology Guaranty between the Pennsylvania Infrastructure Investment Authority (PennVest) and Bion Environmental Technologies, Inc. dated November 3, 2010 (included as Attachment A to this document).

The overall Bion BNR System removal capability as measured over the almost five month evaluation period (consisting of a total treated waste stream of nearly 2.5 million gallons) is summarized in Table 1 for Total Kjeldahl Nitrogen (TKN) and Table 2 for phosphorus. The removals for each unit process are presented along with its resulting contribution to overall system removal for both nitrogen and phosphorus. As may be seen, during steady, long term operation ***an overall removal efficiency of 77% for nitrogen and 86% for phosphorus were demonstrated, which meets the PennVest performance standard of 70% nitrogen and 75% phosphorus removal.***

Table 1 System TKN Removal Efficiencies

Evaluation Period Date Range	System TKN Removal Efficiencies								
	System Total TKN Removal Efficiency	Screw Press		Bioreactor		Decanter		Disc	
		Individual Removal Efficiency	System Contribution to Removal Efficiency	Individual Removal Efficiency	System Contribution to Removal Efficiency	Individual Removal Efficiency	System Contribution to Removal Efficiency	Individual Removal Efficiency	System Contribution to Removal Efficiency
1/16/2012 to 06/02/2012	77.1%	18.5%	18.5%	29.0%	23.7%	42.9%	34.9%	0.0%	0.0%

Table 2 System Phosphorus Removal Efficiencies

Evaluation Period Date Range	System Phosphorus Removal Efficiency								
	System Total TKN Removal Efficiency	Screw Press		Bioreactor		Decanter		Disc	
		Individual Removal Efficiency	System Contribution to Removal Efficiency	Individual Removal Efficiency	System Contribution to Removal Efficiency	Individual Removal Efficiency	System Contribution to Removal Efficiency	Individual Removal Efficiency	System Contribution to Removal Efficiency
1/16/2012 to 06/02/2012	85.9%	29.4%	29.4%	41.7%	29.4%	38.4%	27.1%	0.0%	0.0%

Note that two different removal efficiencies are shown on the above tables – the first shows the removal efficiency of the specific process unit, and the second shows the cumulative removal efficiency of the system. The PV technology guaranty is based upon the total cumulative removal efficiency of the system.

1.1 Background

The purpose of this report is to provide the data and analysis showing that under long term operation, the Bion BNR System operating at Kreider Farms Dairy has met the Performance Standard of the Bion’s Technology Guaranty with PennVest. All sample collection and data analysis was generated consistent with the Kreider Farms Dairy Bion BNR Environmental Management System Technology Performance Verification Plan submitted to the PA DEP July 2011. In addition, as a part of the WQM permitting process, Bion developed and the PA DEP reviewed, and commented on a Kreider Dairy Farm/Bion BNR Nutrient Credit Verification Plan that was initially submitted July 2011, which has been amended and approved by DEP and made part of the Part II Water Quality Management (WQM) permit issued to Bion on August 1, 2012 (permit number 3609201-1). The PennVest performance verification plan (included as Attachment B) outlines measurement and sampling approaches, test methods, analytical tests, etc. related to the treatment efficiency of the Bion system.

As per the recently issued WQM permit, Total Nitrogen [TN] is defined as Total Kjeldahl + nitrates + nitrites. Typically however, when high concentrations of bioavailable organics [cBOD₅] in wastewater streams, under anaerobic conditions, nitrite/nitrate is usually zero. As anticipated, given the very low dissolved oxygen range at which the Bion Bioreactor operates and the active population of denitrifying bacteria present, all nitrate produced is completely removed by denitrification as evidenced by sample results. TKN is therefore used to represent Total Nitrogen. Attachment C provides the sampling reports from the Pennsylvania certified analytical laboratory for all data analyzed.

To support DEP complete evaluation/assessment of the data collected, we have also included a corresponding Excel workbook of presented data in this report as Attachment D. Figure 1.1 provides a full system process flow diagram of the Bion BNR System.