

## APPLICATION NOTE

*RECLAIMING PROFIT:*

# LOST PRODUCT DETECTION & REDUCTION THROUGH ONLINE TOC MONITORING

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**Innovative, “dairy-designed” TOC analyzer technology can play a critical role in helping plants optimize process control and minimize product loss.**



**The Hach BioTector B7000 is a management tool designed specifically for dairies that allows plants to instantaneously view and quantify the product in process streams and wastewater.**

going down the drain that hits dairy plants the hardest, economically. More than 90 percent of a plant’s total organic waste load comes from valuable major milk components that are lost and flow into floor drains during processing, including lactose, proteins and butterfat.

Although dairy management has come to realize that product losses into wastewater are significant in both economic and environmental terms, the actual value of these product losses remains greatly underestimated.

### **For a “Typical” Plant: \$5 Million in Lost Product Value**

The International Dairy Industry estimates a “standard” loss product figure for dairy plants at 2-3% annually. This might not seem like much at initial glance, but the financial implications of this loss level are quite significant. For example, *experiencing an average 2.5% product loss level costs a “typical dairy plant” more than \$5 million per year in lost product value* (and nearly \$900,000 in extra wastewater treatment costs).

### **Overview**

Millions of dollars of opportunity exists in most dairy processing plants to reduce lost product levels. Continuous Total Organic Carbon (TOC) monitoring can unlock some of this opportunity. **Dairy-designed online TOC monitoring can act as an independent watchdog** of the plant, or process line, that can *change the daily behavior of people, processes or equipment*. Through reliable and accurate real-time monitoring of milk being discharged from the plant as wastewater, *product loss can be immediately quantified, areas for improvement initiated and loss levels reduced, often significantly.*

The early driver to reducing wastewater loadings at dairies was in reaction to rising treatment and surcharge costs. Today, however, it is the value of the actual product

## LOST PRODUCT SAVINGS MODEL OF A 'TYPICAL DAIRY PLANT'

Working with our customers and industry experts over two decades, we have developed a model of a 'Typical Dairy Plant'. This model shows that, typically, Lost Product levels can be reduced by a conservative 15% using TOC monitoring. There is a direct correlation between levels of Lost Product and Wastewater Loading. End-users report 15-40% reduction to wastewater loading as a result of using TOC Monitoring.

PROCESSING VOLUMES: MILK GALLONS PER ANNUM (PA)	LBs OF BOD PRODUCED & TREATED PA	MILK GALLONS REQUIRED TO PRODUCE 1LB OF BOD*	LOST GALLONS TO PRODUCE TOTAL BOD PA	LOST PRODUCT LEVEL	FARMGATE PRICE PER GALLON**	COST OF 2.5% LOST PRODUCT	ANNUAL SAVINGS FROM 'TYPICAL' 15% REDUCTION DUE TO TOC MONITORING
132,086,000	2,976,002	1.11	3,302,150	2.5%	\$1.54	\$5,101,492	<b>\$765,224</b>

\*Each Gallon produces .901 Lbs of BOD

% of milk lost during processing

\*\*LTO Nederland Milk Price League: 12 month average price 2011-2012

**Production and treatment of each lb. (pound) of BOD in a dairy processing environment can be costly, particularly since the average processing plant produces millions of lbs. of BOD each year. Reducing lost product levels using reliable, accurate TOC monitoring can provide for significant savings.**

Although some of this loss is simply a part of running a dairy processing facility, the incentive for reducing product loss is quite high. For example, **just a 15% reduction in a typical plant's product loss amount can lead to more than \$750,000 in annual product savings**, more than \$125,000 savings annually in wastewater treatment costs, plus reductions in local surcharges and fines from the local municipality providing wastewater treatment.

Milk solids loss will vary with each dairy plant based on its capacity utilization, operations, and product mix and storage parameters. In order to take the right steps to make proper adjustments and corrections to reduce product loss, plant managers, operators and health and safety managers must have ready access to accurate, real-time information regarding their plant's wastewater loadings. And the lack, or inadequacy, of this critical information represents the "Achilles Heel" of current product loss reduction programs at many dairy plants.

### Conventional Loss Measurement: A Hit-Or-Miss Endeavor

Water use and the volume and strength of a dairy's waste stream can be used as indicators of product loss. BOD5 (Biological Oxygen Demand) is a measure of the amount of oxygen needed to degrade the organic matter carried by the water. One pound of BOD5 in a dairy's waste stream equals 1.11 gallons of milk lost. COD (Chemical Oxygen Demand) is a related measurement method that is also often used, due to its correlation to BOD5.

Because of the lengthy lag times between sample gathering and lab data availability (5 days for BOD5 and 2 hours for COD), periodic or scheduled testing of the raw waste and final effluent can only provide plants a brief, tiny glimpse of potential excessive waste loads that result in lost income. A plant's reliance on intermittent and time-consuming laboratory analysis is typically a hit-or-miss endeavor when it comes to reducing product loss. The source of a plant's high loading incident simply cannot be easily identified due to the long delays in laboratory analysis.

### Measuring TOC

A critical element to the effectiveness of a product loss reduction program today is a dairy plant's ability to best utilize online instrumentation. The continuous measurement of Total Organic Carbon (TOC) through field proven online instrumentation can greatly help dairies identify when and where losses are occurring.

TOC is a measure of the carbon content of dissolved and undissolved organic matter in a sample. TOC is the sum of organically bound carbon present in water, bonded to dissolved or suspended matter. TOC

MEASUREMENT OPTIONS	TOC	BOD	COD
ANALYSIS CYCLE TIME	<b>7 Minutes</b>	<b>5 Days</b>	<b>2 Hours</b>
ACCURACY	<b>± 3%</b>	<b>± 20%</b>	<b>± 5%</b>
TOC FACTOR	<b>1</b>	<b>~2</b>	<b>~3</b>

**TOC is now considered by many to be a more cost-effective, accurate and timely test of wastewater than alternative parameters and it gives the ability to provide real time monitoring.**

measurement is widely considered the most cost-effective, continuous, accurate and timely test to identify the quantity of milk products in wastewater streams, because there is a direct relationship between gallons of milk lost by a dairy plant and the quantity of TOC in dairy wastewater at that point in time. **The Hach BioTector B7000 TOC analyzer was specifically developed for the Dairy Industry** and provides robust, real-time surveillance of the volume of milk in wastewater. This analyzer has more than 1,000 installations in more than 40 countries worldwide. Today, online TOC monitoring is significantly reducing product loss at many major dairies, including processing facilities run by Nestle, Carbery, Danone, Lakeland, Murray Gouldburn, and many others.

Used as a management tool, BioTector allows dairies to instantaneously view and quantify lost product in their wastewater. This provides operations and management with critical information to allow for more informed process control and incident response.

### Information Turned Into Intelligence – And Intelligence Into Action

The Hach BioTector B7000 has a Lost Product Index, LPI™, built into the analyzer that provides management and operators with a direct and precise link between the quantity of TOC in the wastewater and the gallons of milk being lost by the plant at that point in time. **Operators and management can use the LPI™ numbers and factor in their wastewater flow rates to calculate lost product levels by hour, shift, and day of week.**

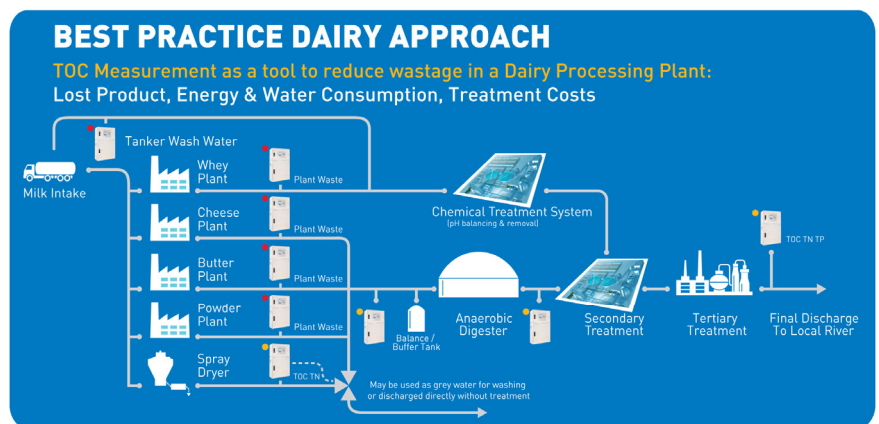
Operators, supervisors, and management throughout an organization can use the LPI™ module and the corresponding ‘numbers’ to see how various activities, processes, equipment, or incidents can affect their lost product levels. Production, Environmental and Wastewater Treatment Plant (WWTP) Departments all benefit from these numbers because, although they are all working towards the same corporate goal, each can see the numbers from the perspective of their own department.

With reliable online TOC monitoring, considerable cost savings can be realized if management takes a proactive role in the reduction process. Small daily savings can add up to large cost savings, when considered over a year’s operation. And when multiple BioTector units are installed to monitor individual process waste streams, reliable, actionable information is readily available at all times to track the performance of each component of the operation. This includes delivery operations. For example, truck drivers can sometimes become complacent and allow for fairly large amounts of product to be left in the tanker, which are then washed down the drain during the tanker flush. This is a very common issue resulting in high product loss levels. TOC monitoring can immediately detect this surge and management or operations can resolve very quickly.

Industry studies have shown that lost product can be reduced by more than 15% in dairy processing plants as a result of using accurate, reliable and continuous TOC measurement.

For proactive product loss reduction, the Hach BioTector B7000 TOC analyzer provides the unique combination of:

- 100 Exact TOC content of wastewater in real-time
- Percentage of milk present in the wastewater relative to full TOC of product
- Volume of milk being lost in real-time
- % representative sample of the wastewater stream, without filtration



**With multiple BioTector units installed to monitor individual process waste streams and integrated into a plant’s SCADA system, the responsibility for corrective action on product losses is directed to the individual plant operator level.**

## Robust, Accurate, Real-Time TOC Analysis, Designed For Dairies

Dairy is a very challenging environment, due to the fats, oils and greases (FOGs), salts and particulates that are in process streams. However, the Hach BioTector B7000 TOC analyzer will perform reliably, despite the obstacles presented in the harsh sampling and measurement conditions that are typical of a Dairy Processing Application.

The analyzer has a robust and patented Two Stage Advanced Oxidation (TSAO) technology with an aggressive oxidation process that dispenses with the restrictive norms of TOC measurement. The TSAO self-cleaning oxidation technology allows the analyzer to handle difficult samples typical in dairies by eliminating build-up problems that otherwise lead to drift. Greater sample accuracy is achieved because no filtration is required. Particulates of up to 2 mm are allowed (up to 1,000 times the maximum allowed by many conventional technologies) for obtaining highly representative sampling.

The analyzer is routinely interfaced with DCS networks, including SCADA, together with pagers and mobile phones. This instantaneous information enables production and WWTP personnel to work better together and provides for added accountability among personnel.

In addition, these TOC Analyzers work well alone or in conjunction with other methods, such as Material Balance Testing, Turbidity and cameras. In fact,, Material Balance Testing is quite often the precursor to a Hach BioTector B7000 installation.



**BioTector On-Line  
TOC Analyzer**

### Summary

As raw material costs increase, margins get tighter and competition becomes more intense. Cost management is more important than ever and process wastewater carries valuable product away from the plant.

Various methods have been employed to tackle this problem, including material balance testing, turbidity, optical measurements and cameras. These are all useful tools to identify that product losses occur, however, none quantify exact volumes as the losses happen.

Continuous TOC measurement and monitoring through Hach BioTector B7000 Analyzers allow plants to reduce levels of lost product in wastewater.. They also allow for reduced energy and water consumption, make savings in wastewater treatment costs, protect the plant from overloading, reduce potential discharge fines from municipalities and the EPA and, most importantly, reclaim valuable product that would otherwise be lost.

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