Phosphorus: reducing releases from dairy processing facilities

Dairy plants are a significant asset to Minnesota's economy, but they also discharge waste that is high in BOD, TSS and phosphorus This fact sheet includes several examples of ways to reduce dairy processing facility waste.

Minnesota's waters must be clean and healthy in order to sustain aquatic life and provide recreational use. Although phosphorus is a nutrient for plant growth, excess phosphorus can speed up the aging process of lakes and streams by stimulating algae growth. This creates high biochemical oxygen demand (BOD) as algae decomposes and uses up available oxygen supplies, sometimes threatening the survival of fish and other aquatic organisms.

The Minnesota Pollution Control Agency (MPCA) has established effluent phosphorus limits and monitoring requirements for new or expanding municipal wastewater treatment facilities that have discharges of more than 1,800 lbs of phosphorus per year. To meet these limits, facilities are asking industrial users to reduce phosphorus discharges to the treatment plant.

Approximately 70 dairy processing facilities operate in Minnesota. These plants are a significant asset to Minnesota's economy, but they also discharge waste that is high in BOD, total suspended solids (TSS), and phosphorus. Cleaning production lines, scraping food preparation vats, cleaning and rinsing equipment, disposing of product to the drain, and using floor cleaning chemicals are all ways phosphorus enters the wastewater.

This fact sheet includes several examples of ways to reduce dairy processing facility waste.

Spills and Leaks

Avoid spilling ingredients and finished product on the floor to minimize product loss. This can be accomplished by upgrading old production equipment to help prevent leaks. Additionally, incorporating a preventive maintenance program can help minimize spills and leaks at your facility.

Marigold Foods
At the Minneapolis plant, six leaky pipe connections were clamped down. In addition to lowering its wastewater BOD loading, Marigold saved about ten gallons of milk per hour.

Cleaning

Janitorial operations and process cleaning or sanitizing can be sources of significant amounts of phosphorus released to wastewater treatment plants.

Air Sparges & Optical Sensors

Air sparge and optical sensors are two mechanical options for recovering excess material prior to cleanup that can make your process more efficient. Before cleaning production lines, use an air sparge to remove food products from the lines so they can be used rather than washed down the drain. An air sparge pushes food product out of lines with a burst of air instead of water.

An optical sensor maximizes the amount of product going to production. It uses a light beam to detect how many solids are in the flow. The sensor is programmed to automatically shift a valve to send the flow to production or to the sewer, based on the amount of solids. This keeps product out of the sewer and prevents too much water from mixing with product.

Pride of Mainstreet Dairy
To reduce product loss when unloading cream from tanker trucks, Pride of Mainstreet Dairy in Sauk Centre, used air to flush excess cream through a three-inch hose into a storage silo. Previously, product would empty down the drain.

Dairy Farmers of America, Inc. (DFA)
The Zumbrota DFA plant installed an optical sensor to help prevent loss of product down the drain during startup and shutdown when flows through its equipment were switched between milk for production and water for cleaning. DFA documented reduced BOD for its wastewater.

Dry Cleanup Techniques

Using dry cleanup techniques before wet cleanup can help reduce the amount of waste in your wastewater. For example, before washing the production floor with water, use a squeegee and a dust pan to cleanup any product that is on the floor. Although this product may not be suitable to return to your production process, it may be able

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to be used as animal feed, for composting, or landspreading.

Associated Milk Producers, Inc. (AMPI)
A team at the AMPI plant in Dawson installed a holding tank for food by-products. Rather than going down the drain, 30,000 to 50,000 pounds of by-products were pumped out of the tank daily for farmers to use as livestock feed. The plant saved $60,000 in the first year through by-product recovery and reclaiming its vacuum pump water.

Product-Dedicated Equipment

Dedicating specific pieces of equipment to each product will minimize the need for shutdown and startup and reduce cleaning frequency. Product-dedicated equipment only needs to be cleaned at the end of the production day. This helps cut the amount of usable product lost down the drain.

Schroeder Milk Company
Installing a second pasteurizer for processing only white milk saved Schroeder Milk Company in St. Paul $180,000 worth of product per year and 8,600 gallons of water each day. Previously only one pasteurizer was used to process both white and chocolate milk. Adding a second pasteurizer eliminated waste generated from cleaning the original pasteurizer before product changeovers.

Clean-in-Place System (CIP)

A clean-in-place (CIP) system eliminates the need to dismantle equipment for cleaning and can help you carefully control water and chemical use at your facility. Many production facilities manually run CIP systems, but fully automated CIP systems are more consistent than manual operations and are typically more effective. Using final CIP rinses as the pre-rinse for the next cleaning cycle can reduce the amount of wastewater generated.

A Minnesota dairy
Most of the dairy processing facility's CIP systems were centrally controlled and monitored by a computer that ran pumps and valves, and designated time, temperature and conductivity requirements. However, the company was overloading its water pretreatment plant with water volume and BOD. The facility speculated that the flushes and rinses of its CIP systems were too long, contributing to the problem. A MnTAP intern worked with the plant to optimize CIP rinse times. Pre- and post- rinses were shortened slightly and wash rinses between solutions were shortened substantially. By requiring operators to flush systems before being routed to the drain at the end of the day, the plant reduced the amount of solid waste exiting the equipment from 20% to 5-6%. With the intern's help, the dairy facility decreased its water use by 8.5 million gallons annually and decreased its BOD loading by 2.5%.

Other Cleaning Alternatives

High-pressure, low-volume cleaning systems can help cut the amount of wastewater at your facility. Because of the effectiveness of a higher pressure, employees will be more likely to use less water during cleanup to achieve specified cleanliness.

Compared to traditional phosphorus cleaners, low- and non-phosphorus cleaning and sanitizing chemicals are as effective and are comparable in cost. Ask your chemical supplier for more information about changing chemicals.

Water Use

Before you can cut water use, you need to understand how and where it is being used at your facility. Water meters can help you see where the most water is being used. Water use may differ between shifts. Monitoring during each shift creates an accurate picture of your overall water use. Using automatic shutoff nozzles can be one simple way to reduce water use and save you money.

Marigold Foods
Sixteen automatic shutoff valves were installed at the Minneapolis plant to reduce the amount of water lost to the sewer from water unnecessarily left running.

Additional Resources

For more information see the following MnTAP fact sheets online at <www.mntap.umn.edu>:

- Feeding Food Processing By-products to Livestock
- Composting and Land Spreading Food Processing By-products
- Water Conservation Tips
- Reducing Releases from Industrial Cleaning and Sanitizing Operations