

MILK HOUSE WASTE



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Funding for this project was provided to the Bioproducts and Biosystems Engineering Department through two US EPA 319 grants administered by the Minnesota Pollution Control Agency. Additional significant matching funding was provided by other state and local agencies and the cooperating dairy producers. The purpose of the project was to design, install and monitor sixteen milk house wastewater treatment systems in four counties in Minnesota.

The results were used to develop design and management guidelines. Additional information can be found at www.manure.umn.edu/applied/milkhouse_waste.html.

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MILK HOUSE WASTEWATER CHARACTERISTICS

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Introduction

The milk house is a critical place on a dairy farm for maintaining sanitation to produce high quality milk. The milk house is where the milk is brought from the barn by pipeline, cooled and stored. A milk house may also have a utility room, storage room, or office space. Milk houses contain a bulk tank for storing the milk, a milk receiver jar where the pipeline empties, a filtration device, in-line cooling equipment, automatic cleaning controls, and a place to wash and store milking equipment. The walls and floor are cleaned daily to maintain proper sanitation for safely handling milk.

Milking equipment and pipelines are cleaned after each milking. Bulk tanks are cleaned each time they are emptied, typically once a day or every other day. The typical milking equipment cleaning regime is usually has four cycles (Havard, 2002).

1. *First rinse*- is performed immediately following the milking process. It's function is to wash out most of the excess raw milk remaining in the lines. This rinse usually removes up to 92% of the suspended solids.

2. *Detergent wash*- removes attached organic material. It immediately follows the first rinse. The amount of active chlorine is 100 mg/L. The amount of detergent added to the solution is dependent upon the water hardness and should create a solution with a pH greater than 11.
3. *Acid rinse*- The acid wash is used to remove the inorganic deposits from the piping, neutralize the alkaline detergent residue, and lower the pH to prevent bacteria from developing. Typically this is at a pH of 3.5.
4. *Sanitizing rinse*- is performed immediately before the milking process to ensure that the milk lines are free of any microorganisms that may have formed since the acid rinse. The sanitizer is usually chlorine-based with recommended chlorine content of 200 mg/L.

Milk house wastewater includes wash water from cleaning bulk tanks, milk pipelines, milking units, miscellaneous equipment and the milk house floor. Milk house wastewater commonly includes residual milk (i.e. milk that remains in the pipeline, receiver, and bulk tank after emptying), cleaning chemicals (i.e. detergents, sanitizers and acid rinses), water softener recharge water, small amounts of manure, bedding, feed, grit and dirt from the floor.



Milking system

Toilet wastes, if there is a toilet in the milk house, should not be mixed with the milk house wastes. Toilet wastes must be handled with a system be designed according to MN Rules Chapter 7080 which regulates human wastewater and septic systems.

To properly handle milk house wastewater environmentally and economically it is important to know the amount and characteristics of milk house wastewater generated on typical dairy barns. A lack of detailed design and management information about milk house wastewater treatment systems for cold climates led to the funding of two US EPA 319 projects. The purpose of the two projects was to design, install and monitor 16 milk house wastewater treatment systems in four counties in Minnesota. This publication provides a summary of the milk house wastewater characteristics and flow rates data collected on the



16 dairy farms that collaborated on the two projects. More information about the project is available on the web at www.manure.umn.edu/applied/milkhouse_waste.html

Sixteen dairy producers from four counties participated in the projects. Fourteen farms had stall barns with pipeline milking systems. Two farms had parlors with parlor wastewater mixed in with the milk house wastewater. Milking herd sizes ranged from 40 to 130 cows.



Bulk Tank and floor drain.

Water meters were installed in the milk house in a location to get the best measure of water ending up in the wastewater. Typically, the water meter was installed prior to the water softener. Cooperating producers were asked to

document and subtract any water usage that might have been measured by the water meter but did not contribute to the wastewater, e.g. water for feeding calves, washing tractors, used in fertilizer or herbicide tanks.

Typical water usage was between 2 to 7 gal/cow/day with most farms using less than 5 gal/cow/day. This variability was not a function of animal numbers, type of milking system, or any other parameter monitored in this project.

While it is best to install a water meter to measure water usage for two months, data from this project suggests that 5 gal/cow/day may be used for designing a milk house wastewater treatment system unless site specific data is available.

All of the milk house wastewater treatment systems studied included pre-treatment in septic tanks. Wastewater strength coming directly from the milk house varies considerably with the different milk equipment cleaning cycles.

To reduce this variability and obtain representative wastewater samples, the samples were taken from the outlet of the first septic tank. Samples were taken once per month for at least one year on all the systems. Samples were analyzed for total suspended solids (TSS), biochemical oxygen demand (BOD₅), phosphorus (P), nitrogen



(ammonia, nitrate, and total Kjeldahl), pH, temperature and fats/oils/grease (FOG). The table below gives average wastewater characteristics of the effluent from the first septic tank and recommended concentrations used for designing treatment systems.

Table 1. Milk house wastewater characteristics. Reported ranges are average values on the various farms.

	First tank effluent mg/L	Design mg/L
BOD ₅	500-2600	1200
TSS	200-1000	450
Fats, Oils, & Grease	90-500	225
Total Nitrogen	30-100	65
Total Phosphorus	20-100	55
pH	6.2-8.0	7.5
Temperature	53-70	-

Raw milk has a BOD₅ concentration of approximately 100,000 mg/L (Wright and Graves, 1998). This is about 100 times greater than the septic tank effluent concentrations

measured in this study. Cleaning of the bulk tank, pipeline, and milking equipment result in approximately 2-3 gallons of milk entering the wastewater system each day. Additional contributions of raw milk from treated cows or colostrum from fresh cows will quickly overwhelm any milk house waste treatment system. As such, this waste milk must be disposed of by other means such as feeding it to other farm animals or applying it to cropland.

Additional Information

For additional information visit www.manure.umn.edu/applied/milkhouse_waste.html or contact your local Minnesota Extension Service.

References

- Havard, P. 2002. Development and testing of methods for reducing the milkhouse wastewater from dairy farms. Final report to the Prince Edward Island Research Investment Fund Inc. and P.E.I. Dairy Producers Association. <http://nsac.ca/eng/research/peireport2002a.pdf>
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