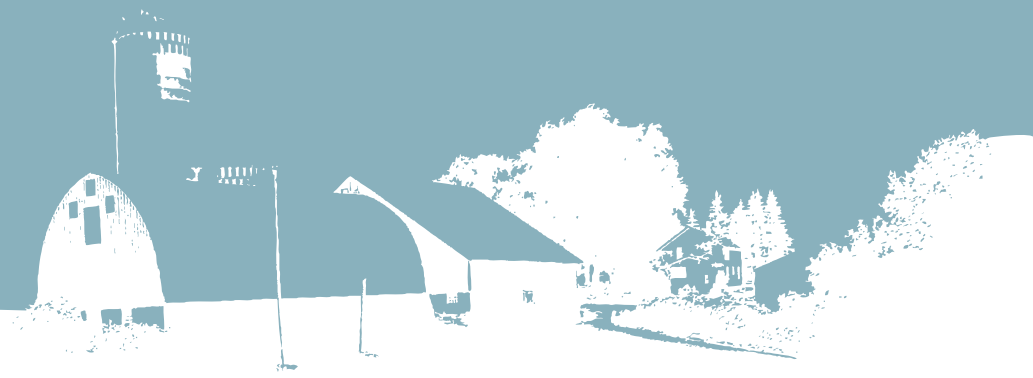
MILK HOUSE WASTE



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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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AEROBIC TREATMENT UNIT - A MILK HOUSE WASTEWATER TREATMENT OPTION

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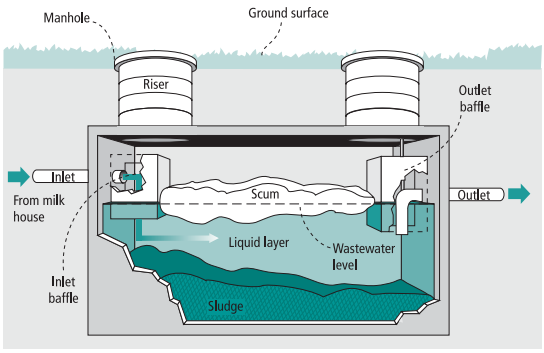
Introduction Milk house wastewater includes residual milk (i.e. milk that remains in the pipeline, milking units, receiver and bulk tank after emptying) and the wash water that cleans them, the miscellaneous equipment, and the milk house floor. This wastewater commonly includes, cleaning chemicals (i.e. detergents, sanitizers and acid rinses) water softener recharge water, and small amounts of manure, bedding, feed grit and dirt. Concentrations of this material require that this wastewater not be discharged to the environment or discharged to a standard septic system. Several options are currently available to treat and disperse milk house wastewater. Each of these systems has specific site specific requirement that must be considered in the design, construction and maintenance. This publication provides an overview of the aerobic treatment unit option.

What is an Aerobic Treatment Unit (ATU)?

ATU systems are used to provide additional treatment after a septic tank and distribute milk house wastewater into a soil infiltration area, typically a drainfield trench similar to what is used with household septic systems. The ATU reduces the organic material concentration to levels similar to house-



Cross section of septic tank

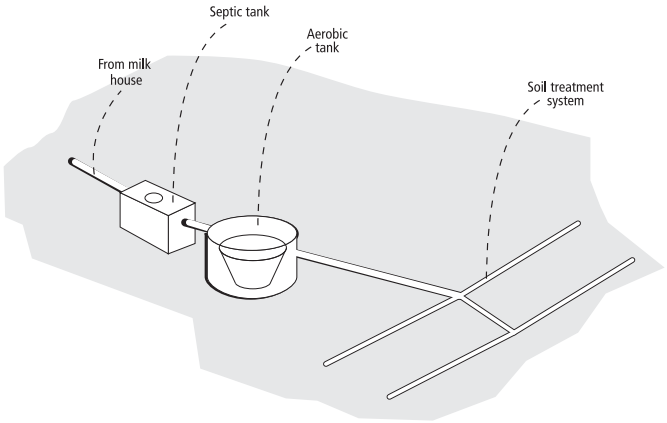
hold wastewater which the soil can treat over the long term. If milk house wastewater is directly discharged to a drainfield trench system without treatment the organic material and milk fat in the waste will quickly plug up the soil and restrict infiltration.

Typically two septic tanks in series are used to reach a 3-6 day hydraulic retention time. These tanks allow lime and other heavy materials to settle out and lighter materials to float. Naturally occurring anaerobic bacteria begin to breakdown the organic material in the wastewater. The septic tanks are a critical component of the overall process but this effluent needs additional treatment before being distributed to a soil infiltration area.

Milk house vs. Parlor Wastewater

This publication does not address milking systems which combine parlor wastewater with milk house wastewater. Treatment systems for these combined wastewaters are more challenging due to the amount of manure and larger volumes of wastewater. Also note that toilet waste cannot be handled with any milk house waste system because they are not designed to handle human pathogens.

The septic tank effluent flows by gravity, or is pumped to the ATU tank. Air is blown into the ATU tank and mixed with the wastewater where aerobic (oxygen loving) bacteria break down the organic material into carbon dioxide and water. A blower, which runs continuously, supplies air to the unit to provide enough oxygen to the aerobic bacteria to breakdown the waste. The ATUs are all proprietary products and are designed on a site specific basis based on the wastewater flow rate (gallons per day) and the strength of the organic material to be treated. The amount of organic matter in the wastewater is described by the Biochemical Oxygen Demand over 5 days (BOD_5). The BOD_5 of milk house wastewater ranges from 500-5,000 mg/L depend on how much milk and other organic material being discharged into the system.



ATU System Layout

Treated effluent from the ATU flows by gravity or is pumped to the soil infiltration area, typically a series of drainfield trenches where the remaining organic matter is further broken down, remaining contaminants filtered out, and the water recycled back into the environment. ATUs could also be used in combination with bark beds to add longevity or with irrigation systems to reduce solids and odors.

How Big Are ATU Systems?

Sizing of the ATU system is a function of the volume of wastewater produced and the soil conditions in the infiltration area. The septic tanks and ATU unit generally require about 200 square feet of space while the infiltration area (drainfield) requires about 3,000 square feet with space requirements primarily a function of soil type. The septic tank, ATU and drainfield need to meet state and local setback requirements from buildings, wells, and surface waters. Drainfield trenches must be level and not more than three feet below the soil surface. Trenches can be constructed on hillsides with slopes of up to 25%. Sizing and layout of these trenches is very site specific.

Inside ATU Tank

What Other Things Should I Know?

Each type or brand of ATU is designed to handle a specific wastewater flow and amount of organic material (i.e. BOD_5). For an ATU and subsurface infiltration field to have a useful life of 10 years or more, it is important that that the ATU be able to reduce the organic load of the wastewater going to the infiltration field to less than 200 mg/L BOD_5. If the wastewater flow rate or organic loading exceeds the capcity of the ATU, it will not be able to effectively treat the wastewater. To enhance system life it is important to fix water leaks in the milk house and keep waste milk, from fresh or treated cows (colostrums or waste milk), out of the system. Colostrum and waste milk must be disposed in another way such as feeding to other farm animals or land applying it with the manure. In addition, provisions must be made if the bulk tank needs to be dumped because this amount of milk would overwhelm the ATU and drainfield trenches.

The subsurface infiltration area must be designed and installed with a minimum of two feet of separation between the bottom of the trench and the seasonally high water table or bedrock. If two feet of separation is not available a raised system (mound) is required. Drainfields are designed and constructed similar to household septic systems.

Chambered Trench System

How Much Maintenance is Required?

Buildup of solids and scum in the septic tanks will allow excess organic material to enter the ATU. To prevent overwhelming the ATU, septic tanks must be inspected quarterly for solids and scum layer buildup. Septic tanks typically require pumping once per year. The ATU tanks will also build up sludge overtime and require annual pumping. The effluent from the septic tanks and ATU can be applied to cropland. This activity may be performed by a septic system Pumper/Maintainer or the producer. If this effluent is applied on land owned by the producer, it must be applied in accordance with farm's manure management plan.

ATU Blowers

The life of the drainfield trenches following the ATU is directly related to the treatment achieved in the ATU. Over time, if the effluent leaving the ATU has too much organic material it can cause the drainfield to fail and the wastewater will come to the surface. Quarterly visual observations of the media and effluent will help indicate the performance of the unit. The media should be covered with a brown growth (not gray/black) and the effluent should be musty in odor and relatively clear. Most commercial ATUs systems are sold with a maintenance agreement to assure the unit is performing over the long term.

It is critical that the blower on the ATU perform at all times. Many units have alarms to indicate if the blower stops, but occasional observations inside the tank are recommended to assure air delivery.

Economics

Capital investment for an ATU system is between $10,000 and $20,000 for flows less than 500 gallons per day. These costs include labor for installation, the septic tanks, ATU, piping and drainfield. Operating cost is estimated at $300 per year which would include the cost of pumping the septic and ATU tanks and the electric cost for running the blower.

Additional Information

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

Economic Evaluation

In evaluating costs of milk house waste treatment systems it is important to compare the costs of the system to the alternative treatment systems. Is the proposed system cheaper than building long term storage and applying the effluent to cropland using a slurry tank applicator? Manure application costs about $10 per 1000 gallons ($0.01 per gallon). Using average values, each milk cow will produce about 1825 gallons of effluent per year (5 gallons per cow per day). Using this volume, application costs would be $18 per cow per year without any consideration for storage costs. If the useful life of the system is 15 years, the per cost cow is $275. Over 15 years a 50-cow dairy would pay $13,750 ($275 x 50) for mik house waste application. This value should be compared to the cost of the treatment system.