NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

WASTE TREATMENT

(No.)
CODE 629

DEFINITION

The mechanical, chemical or biological treatment of agricultural waste.

PURPOSE

To use mechanical, chemical, or biological treatment facilities and/processes as part of an agricultural waste management system:

- To improve ground and surface water quality by reducing the nutrient content, organic strength, and/or pathogen levels of agricultural waste.
- To improve air quality by reducing odors and gaseous emissions
- To produce value added byproducts
- To facilitate desirable waste handling, storage, or land application alternatives.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the form and characteristics of agricultural waste make it difficult to manage so as to prevent it from becoming a nuisance or hazard or where changing the form or composition provides additional utilization alternatives, and where conventional waste management alternatives are deemed ineffective. More specifically:

- Liquids and solids need to be separated for further processing or for effective transport and subsequent utilization.
- Raw agricultural waste contains excess nutrients for land application based on crop utilization requirements or nutrient ratios need to be modified to be more consistent with crop utilization requirements.
- There is a need to reduce the potential for leaching or runoff of nutrients.
- Odors and/or gaseous emissions from livestock production facilities and waste storage/treatment system components must be reduced.
- Value-added byproducts can be produced to offset treatment costs.
- Reduction of pathogens is required.

CRITERIA

General Criteria Applicable to All Waste Treatment Purposes.

Laws and Regulations. Waste treatment facilities and processes must be planned, designed, and constructed to meet all federal, state, and local laws and regulations.

Components. Waste treatment facilities and processes may consist of multiple components. Where criteria for individual components are described in existing NRCS practice standards, those practice standards and their specific criteria shall be used for planning, designing, and installation of that component.

Monitoring. Equipment needed to properly monitor and control the waste treatment facility or process shall be installed as part of the system. Process control parameters to be monitored shall include those parameters identified in the design documentation. Parameters considered critical to proper system operation shall be identified in the Operation and Maintenance Plan. Run status of critical equipment and unit processes shall be monitored.

Byproducts. Implementation of a waste treatment process or operation of a waste treatment facility shall not result in discharge of byproducts harmful to the environment.

All byproducts shall be handled and stored in such a manner as to prevent nuisances to neighbors or to the public at large.

Byproducts land applied to supply plant nutrients shall meet the criteria in NRCS Conservation Practice Standard 633, Waste Utilization and NRCS Conservation Practice Standard 590, Nutrient Management, and requirements in applicable laws and regulations.

Any unmarketable or unused byproducts shall be handled and disposed of in accordance with all applicable federal, state, and local laws and regulations. A plan for dealing with such byproducts shall be prepared and approved by NRCS prior to utilization of the process or installation of the waste treatment facility, and shall include a listing of any permits or permissions required for the execution of the plan.

Byproducts shall be recycled to the extent possible without causing a hazard to the environment.

Safety. Design of the process or facility shall include safety features to minimize hazards. Guards and shields shall be provided for moving parts of the equipment used in the treatment process. Waste treatment facilities shall be fenced and warning signs shall be posted where needed to prevent children and others from entering a hazardous area.

All treatment processes shall be carried out in accordance with all safety regulations. Protective clothing shall be utilized when handling potentially harmful chemicals that may be used in the process. Proper ventilation shall be provided.

Additional Criteria for Commercial and Proprietary Systems.

Design. The system provider shall complete and supply to the land owner/operator a detailed design of the facility/process clearly outlining the objectives and anticipated outcomes of implementation.

The design documentation shall include a process diagram containing, at a minimum, the following information:

1. Volumetric flow rates including influent, effluent, and recycle streams.
2. Waste load projections including volume, mass, and characteristics of the waste important to the waste treatment facility or process.
3. Unit process volumes and hydraulic retention times where appropriate.
4. Air emissions projections from the system.
5. Nutrient fate projections within the system.
6. Process monitoring and control system requirements as described below in the Monitoring section of the criteria.

Independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations shall be provided.

Where use of a waste treatment facility or process to improve one resource concern negatively impacts another, impacts and mitigation measures, if required by state or local agencies, are to be documented. The mitigation measures shall become a required component of this practice.

Plans and Specifications to document this practice shall be as described below.

Components. Where components of a facility or process are not described in a current NRCS practice standard, the system provider shall furnish a one year warranty on all construction or applied processes. In addition, the manufacturer shall provide a warranty that describes the service life of each component and what the warranty covers.

The waste treatment facility or process shall have a minimum practice life of ten years. Where components have less than a ten year service life, their planned replacement during the life of the practice shall be clearly identified in the Operation and Maintenance Plan.

Expected System Performance. The expected system performance shall be clearly documented prior to system installation. At a minimum, the expected system volumetric flow rate, expected macro-nutrient reductions or change in form, expected pathogen reductions, gaseous ammonia

and hydrogen sulfide emissions reductions (or increases) shall be documented.

Operating Costs. Where components of a facility or process are not described in a current NRCS Conservation Practice Standard, the system provider shall furnish an annual estimate of operating costs for the system. Operating costs not based on actual systems data shall be clearly identified as estimates.

Specific Criteria for Milking Center Wastewater Treatment.

These criteria include treatment of milking center wastewater from cleaning of pipelines, bulk tanks, and similar equipment necessary for the production of milk, cheese, ice cream and other dairy products, and for wastewater from small milk bottling plants (bottling production of 15,000 gallons per week or less). They do not apply to the treatment of barn and holding area manure runoff, waste or colostrum milk, highly concentrated milk solids (e.g. cheese whey), and sewage from restrooms and laundry facilities.

Inventory & Evaluation Report. An inventory & evaluation (I&E) shall be prepared with a report incorporated into the design. This assessment shall be performed with the owner/operator to determine the milking center waste sources, volumes, and characteristics; opportunities and recommendations for source control of the wastewater; landowner objectives; available resources; and to explore waste treatment alternatives and their associated operation and maintenance requirements. The I&E will include a site assessment of physical features that would influence the placement, construction, operation, and maintenance of the treatment alternatives. Examples include location of buildings, wells, and impacted resources; existing waste facilities; and soil properties. The report will document the feasibility of the alternatives considered, and will include the strategy for utilization, storage, and/or land application of the wastes following treatment.

Criteria for All Methods of Treating Milking Center Wastewater.

1. Siting. Treatment systems should be located outside of the 100 year floodplain. However, if site restrictions require location within a floodplain, protect them from inundation or damage from a 25-year flood event, or larger if required by law.

   Locate the entire treatment system to comply with the Massachusetts Wetlands Protections Act, with a minimum of 50 feet from surface water or a wetland, and at least 100 ft from a drinking well.

2. Soil investigation. A soils investigation shall be performed within the proposed treatment area site. A minimum of two test pits will be made, designating the USDA textural classifications of all soil horizons to a minimum depth of 4 feet or to bedrock, whichever is less. The soil consistency of each soil horizon shall be noted. Depth of the water table or seasonal water table indicators shall also be noted.

3. Protection. Design and install the treatment system with measures to protect from freezing conditions, surface water runoff from adjacent areas, and from damage by livestock.

4. Volume of wastewater. Base the volume of milkhouse wastewater on specifically measured farm data whenever possible. For parlor systems, a flow meter is recommended. If measurement of actual flow volumes is not possible, then use a minimum of 4 gallons per day per cow, except for milking parlor operations, where a minimum of 8 gallons per day per cow shall be used. Refer to the references section for additional information.

5. Use of Existing Storage Facilities. On farms where a waste storage facility exists that can handle liquids, direct wastewater to the waste storage facility whenever practical.

6. Source Control. Control of the volume of wastewater shall be accomplished whenever practical through changes to equipment and management to minimize the size of the treatment system. Refer to the references section of this standard for additional information.

7. Exclusion of raw milk. Raw milk from treated cows, collostrum or transitional milk, waste milk, and other sources of high fat milk products, such as cheese whey, will be excluded from all treatment systems. A flow diverter valve shall be installed to divert the

above sources of raw milk from the treatment system, or a comparable method used to ensure raw milk does not reach the treatment system. A plan is needed to deal with instances where waste milk must be disposed, so that the treatment area is protected.

Raw milk from the first rinse of pipelines and pre-rinsing of bulk tanks shall be collected and fed to livestock whenever practical.

8. Dosing. The wastewater shall be dosed under pressure to deliver the minimum head required by each method of treatment. A separate pump tank is required. Provide pump float switches and/or timer switches to turn the pump on and off at the correct dosing volume, and provide a high alarm float switch to notify the operator of a system failure. A flout may be used if it can provide the dosing volume and head required by the specific treatment method.

9. Plumbing. Provide a sanitary trap in all systems to prevent gasses and odors from flowing into the milking center from the treatment system. All pipe connections shall be watertight.

Additional Criteria for Soil Infiltration (Bark Bed) Treatment System.

This method of treatment consists of two pretreatment tanks, a pump tank, and a soil infiltration area with a cover of organic bark material. The wastewater is periodically pressure dosed to the bark bed, relying primarily on the soil profile to reduce BOD_5 levels of the wastewater. The bark material provides some aeration of the soil surface, and insulates the infiltration area in the winter.

Two types of systems are used to assist in the infiltration process. A gravel bed system consists of at least 6 inches of drainfield gravel under the distribution pipes to help spread the effluent over the infiltration area. The chamber system is designed to have the distribution pipes hung within the chamber to help spread the effluent under the area covered by the chamber.

Bark beds are to be designed and constructed according to the most recent *Milk House Wastewater Design Guide* by the University of Minnesota Extension, with the following additional requirements:

1. Primary treatment. The wastewater shall be pretreated in two pretreatment tanks, each with a minimum storage capacity of 3 days of wastewater production. The tanks shall be liquid tight and have the capacity to resist all imposed loads from the site. The first tank will be a septic tank, and the second will be a grease trap. A commercial size effluent filter shall be installed at the outlet of the second tank.

   A double compartment tank may be used for small systems, where the 3 day storage capacity is less than 500 gallons. Provide an effluent filter on the outlet of the second compartment.

2. Infiltration area.

   a. The bottom of the bed shall be at least 2 feet above the seasonal groundwater table and at least 3 feet above bedrock.

   b. Maximize the length to width ratio to the extent reasonable for the site. The length to width ratio shall be at least 2:1.

   c. The maximum bed width will be 30 feet.

   d. The loading rate for milking systems other than a parlor system shall meet the maximum loading rate in Table 2 of the Design Guide. Parlor milking systems shall have a maximum loading rate of one half of the values in Table 2.

   e. The bottom of the bed shall be at an elevation of at least 6 inches lower than the adjacent ground, or a dike shall be provided to ensure containment of the wastewater within the bark bed. Construct the bottom of the bed as high as possible to maintain maximum separation to groundwater and bedrock.

   f. The bark material shall be coarse bark or bark shreds, at least 2 inches average size, to form large pore spaces within the bed. Small particles and fines are to be removed prior to placement. Hardwood bark is recommended.

3. Distribution system.

   a. Distribute wastewater using either a gravel bed or a manufactured polyethylene effluent chamber system as described in the Design Guide. Chamber systems are preferred, as they allow for better unrestricted flow through the holes in the pipe during dosing, and provide for better vacuum relief during draining of the pipe.

   b. Space the distribution laterals a minimum of 6 feet apart, with a maximum of 10 feet.

   c. The size and spacing of the holes in the distribution laterals shall promote uniform delivery of the wastewater.

   d. For gravel bed systems, install at least one air vent/vacuum release valve to allow air to enter the pipes during draining. Drilling of holes in the end caps of cleanouts is not recommended.

   e. For chamber systems, drill a minimum 1/8" hole in the end cap of each distribution line.

   f. Pipe connections between the distribution lines and the manifold and between the manifold and the service mainline shall promote full drainage of the pipeline after each dosing.

   g. Design and install the distribution system to be free draining to prevent freezing in the winter. Drill a weep hole in the mainline pipe in the pump tank to allow water to drain back to the tank after each dose.

4. Dosing. Use a timer or set the pump float switches so that the milkhouse wastewater is dosed at least once each day to the bark bed to minimize freezing issues.

Additional Criteria for Bark Media System (Bark Mound).

This method of treatment consists of two pretreatment tanks, a pump tank, and a rectangular bark mound area. The wastewater is periodically pressure dosed to the upper portion of the bark mound, and the water flows downward through the bark media, which reduces the BOD_5 and the nutrients from the wastewater before infiltrating the underlying soil. The bark material also provides aeration of the soil surface, and insulates the infiltration area in the winter.

Bark mounds are to be designed according to the following criteria.

1. Primary treatment. The wastewater shall be pretreated in two septic tanks, each with a minimum storage capacity of 3 days of wastewater production. The tanks shall be liquid tight and have the capacity to resist all imposed loads from the site. The first tank will be a septic tank, and the second will be a grease trap. A commercial size effluent filter shall be installed at the outlet of the second tank.

   A double compartment tank may be used for small systems, where the 3 day storage capacity is less than 500 gallons. Provide an effluent filter on the outlet of the second compartment.

2. Bark Mound.

   a. The bark mound will be sited so that the bottom of the mound is at least 2 feet above the seasonal groundwater table and at least 3 feet above bedrock.

   b. The bottom of the bed shall be level in all directions.

   c. Maximize the length to width ratio to the extent reasonable for the site. The length to width ratio shall be at least 2:1.

   d. Minimize the width of the bark mound according to site constraints. The maximum mound bottom width at the ground surface should be 20 feet.

   e. Use Table 2 from the most recent *Milk House Wastewater Design Guide* by the University of Minnesota Extension to determine the maximum loading rate for milking systems other than a parlor system. Parlor milking systems shall have a maximum loading rate of one half of the values in Table 2. The effective area of application shall be the overall width of the multiple chambers times the length of the chambers.

f. The bottom of the bed shall be at an elevation of at least 6 inches lower than the adjacent ground, or a dike shall be provided to ensure containment of the wastewater within the bark mound.

g. The bark material shall be coarse bark or bark shreds, at least 2 inches average size, to form large pore spaces within the bed. Small particles and fines are to be removed prior to placement. Hardwood bark is recommended.

3. Distribution system.

a. Distribute wastewater using a manufactured polyethylene effluent chamber system, with the distribution pipe inside of the chambers. The pipe shall be securely hung in the chamber. Provide end caps on the ends of each chamber.

b. Install the chambers adjacent to each other so that the pipe spacing is approximately equal to the width of each chamber.

c. Install the chambers and distribution pipe level, at least 3 feet above the underlying soil, and support with metal fence posts or similar devices so the chambers remain level as the bark mound settles.

d. Distribution pipe within the chambers shall be at least 1.5" Schedule 80 PVC, with 3/16" diameter orifice holes drilled at 2 feet spacing. The holes shall be pointed up, at the 12 o'clock position, to promote uniform distribution of water in the chamber.

e. Provide a minimum of 2.5 ft of head at the orifices.

f. To ensure uniformity in the distribution system, the minimum dose is to be 5 times the volume of the manifold and distribution laterals. Provide a minimum of 2 feet per second velocity in the pipe.

g. Drill 1/8" drain holes in the bottom of the distribution pipe to allow the pipe to drain after dosing. The weep holes should be located centered between each support, with a spacing equal to the support spacing.

h. Drill a 1/8" hole in the end cap of each distribution line to allow air to escape from the last few feet of pipe, downstream of the last dosing hole.

i. Pipe connections between the distribution lines and the manifold and between the manifold and the service mainline shall promote full drainage of the pipeline after each dosing.

j. Place at least 1 foot of bark over the top of the chambers. Provide at least 2 feet of horizontal distance around the perimeter of the chambers to the edges of the bark mound.

k. Design and install the distribution system to be free draining to prevent freezing in the winter. Drill a weep hole in the mainline pipe in the pump tank to allow water to drain back to the tank after each dose.

4. Dosing. Use a timer or set the pump float switches so that the milkhouse wastewater is dosed at least once each day to the bark mound to minimize freezing issues.

Additional Criteria for Vegetated Treatment Area.

This method of treatment consists of one or two pretreatment tanks, a pump tank, and a rectangular vegetated treatment area. The wastewater is periodically pressure dosed through a manifold pipe at one end of the area where the water travels down the strip and infiltrates, or through sprinkler irrigation. The vegetation utilizes the nutrients in the wastewater. Refer to the Vegetated Treatment Area (635) practice standard for planning and design of this treatment method.

CONSIDERATIONS

Location. The waste treatment facility should be located as near the source of manure or other waste as practicable and as far from neighboring dwellings or public areas as possible. Proper location should also consider slope, distance of manure and other waste transmission, vehicle access, wind direction, proximity of streams and flood plains, and visibility.

In determining the location of the facility, consider elevation and distance from various components to take advantage of gravity flow where possible.

Manure Characteristics. Waste treatment may require specific total solids and nutrient contents of the waste stream. Pretreatment options such as dilution or settling could be used to adjust the solids content before entering the waste treatment facility or process.

Visual Screening. The visual impact of the waste treatment facility or process should be evaluated within the overall landscape context. Screening with vegetative plantings, landforms, or other measures may be implemented to alleviate a negative impact or enhance the view.

Milking Center Wastewater

Consider liquid storage for operations generating more than 300 gallons per day of wastewater.

Water from sanitizing and rinsing bottles for a bottling operation should be treated separately from the other milking center wastewater. Water from bottle washing is typically high in volume and low in contaminates, although generally has a high pH. The water from the bottle washing facility should be tested prior to treatment or disposal according to applicable laws and regulations.

Install a sump in the milkroom to trap solids before flowing to the treatment system.

For bark mound systems, consider installing at least one 4" observation port in the top of each lateral. Provide a cap on each port.

PLANS AND SPECIFICATIONS

Plans shall include engineering drawings and supporting documentation as well as other plans required to manage the system; e.g. a nutrient management plan for proper land application of byproducts.

Plans and specifications for waste treatment facilities shall be prepared in accordance with the criteria of this standard and good engineering practice.

As a minimum, the plans and specifications shall provide the following:

1. Layout and installation details of livestock facilities, waste collection points, waste transfer components, waste treatment and storage facilities.
2. Location of all inflow and discharge pipelines, pipeline materials, diameter and slope.
3. Details of support systems for all components of the treatment facility.
4. Fencing and signage as appropriate for safety purposes.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed and reviewed with the owner/operator prior to construction of a waste treatment facility or implementation of a waste treatment process. The O&M plan shall be consistent with the proper operation of all system components and shall contain requirements including but not limited to:

- Recommended loading rates of the waste treatment facility or process for hydraulic and critical pollutant parameters.
- Proper operating procedures for the waste treatment facility or process, including the amount and timing of any chemicals added.
- Operation and maintenance manuals for pumps, blowers, instrumentation and control devices, and other equipment used as components of the waste treatment facility or process.

- Description of the planned startup procedures, normal operation, seasonal operating methods, safety issues, and normal maintenance items. This includes procedures for the planned replacement of components with less than a ten year service life.
- Statement to the operator that operational changes at the farm can affect the quantity and quality of the wastewater, and significantly impact the level of treatment. The designer of the treatment system should review proposed operational changes prior to implementation.
- Alternative operation procedures in the event of equipment failure.
- Troubleshooting guide.
- Monitoring and reporting plan designed to demonstrate system performance on an ongoing basis.

Milking Center Wastewater components shall also contain requirements for:

- Routine inspections of distribution system, including septic tanks, grease traps, dosing tanks, pumps, flouts, distribution piping, effluent filter, and holes and slots as applicable, to ensure proper operation and dosage.
- Cleanout schedule of sumps, septic tanks, grease traps, and pump tanks as required to maintain capacity and minimize the transfer of solids to the bark bed or mound.
- How waste milk will be handled to protect the treatment area.
- For bark beds and bark mounds, replacement of the bark when required to maintain effective treatment. The bark is expected to last at least 5 years. Care must be taken to remove and replace the distribution system within the bark mound.

REFERENCES

Milkhouse Wastewater Design Guide, University of Minnesota Extension (M1207), 4/15/08

Agricultural Waste Management Field Handbook, Part 651, National Engineering Handbook, USDA-NRCS.

Dairy Practice Council, Guideline for Milking Center Wastewater, DPC 15. Northeast Regional Agricultural Engineering Service (NRAES-115), 1998.

Milking Center Wastewater Management Fact Sheets, University of Wisconsin Extension Service.

- Controlling Milking Center Wastewater: An Overview (A3608)
- Estimating The Volume Of Wastewater (A3609)
- Managing Waste Milk (A3610)
- Conserving Water In The Milking Center (A3613)

Massachusetts Soils Database, National Soils Information System (NASIS).

Pollution Control Guide for Milking Center Wastewater Management, North Central Regional Extension Service, NCR549, 1995.