Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WASTE SEPARATION FACILITY

CODE 632

(no)

DEFINITION

A filtration or screening device, settling tank, settling basin, or settling channel used to partition solids and/or nutrients from a waste stream.

PURPOSE

This practice is used to accomplish one or more of the following:

- Improve or protect air quality
- Improve or protect water quality
- Improve manure handling methods or serve as a pre- or post-treatment for other processes

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the waste separation facility will—

- Remove solids from a liquid waste stream as a primary treatment process and facilitate further treatment processes.
- Reduce problems associated with solids accumulation in liquid waste storage or treatment facilities.
- Reduce solids content in a waste stream so liquids and solids can be recycled for other uses.
- Reduce solids content in a waste stream to better facilitate land application of liquids using irrigation techniques.
- Assist with partitioning nutrients in a waste stream to improve handling and application.

CRITERIA

General Criteria Applicable to All Purposes

Laws and regulations

Plan, design, and construct the waste separation facility to meet all Federal, State, local, and Tribal regulations. Notify landowner and/or contractor of their responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures. The landowner is also required to obtain all necessary permits for project installation prior to construction.

Safety

Include appropriate safety features in the design to minimize the hazards of the facility. Provide warning signs, fences, ladders, ropes, bars, rails, and other devices, as appropriate, to ensure the safety of humans and livestock. Ensure that proper ventilation and adequate warning signage is provided for waste separation equipment in an enclosed facility or confined area, as necessary, to prevent explosion, poisoning, or asphyxiation.

Location
Position the waste separation facility so the waste stream can be safely routed to and from the facility. Locate facilities outside the 100-year floodplain unless site restrictions require locating it within the floodplain. If located in the floodplain, protect the facility from inundation or damage from a 25-year flood event. Additionally, follow the policy found in the NRCS General Manual (GM) (Title 190), Part 410, Subpart B, Section 410.25, “Flood Plain Management,” which may require providing additional protection for structures located within the floodplain.

Waste separator selection
Base the type of waste separator, whether mechanical or nonmechanical, on site-specific data for the waste stream and management conditions. A combination of separation unit processes may be necessary to achieve the desired or required results. NRCS National Engineering Handbook (NEH) (Title 210), Part 637, Chapter 4, “Solid-Liquid Separation Alternatives for Manure Handling and Treatment,” provides guidance on different types of solid/liquid separators available. Capture efficiency varies widely for each type of separator depending on the type and consistency of the waste to be treated.

Separation efficiency
Base the volume or percentage of solids separated on estimates of daily waste water production, if applicable, and the total solids capture efficiency for the type of separation device selected. Where manufacturer information or local data concerning total solids capture efficiencies are not available for the type of waste separation device selected, the efficiencies in 210-NEH-637-4 can be used to estimate the amount of separated material that will be generated.

Chemical amendments
Chemical amendments, such as metal salts and polymers, can be used to treat manure to enhance the separation process. The addition of chemicals to the liquid waste stream for improving total solids capture efficiencies must be in accordance with manufacturer’s guidelines and requirements.

Storage or treatment of separated solids
Provide adequate storage for separated solids unless they are transported directly from the separator to the final utilization location. Base the design for solid storage on the requirements in NRCS Conservation Practice Standard (CPS) Waste Storage Facility (Code 313).

Design treatment facilities in accordance with the appropriate practice standard for the treatment process, such as NRCS CPS Composting Facility (Code 317) or other needed practice standards.

Discharges
Capture any discharge or runoff from the waste separation facility, the temporary solid or sand storage area, or associated appurtenances in a waste storage or treatment structure.

Conveyance system
Design waste transfer components in accordance with requirements of NRCS CPS Waste Transfer (Code 634).

Outlets
Provide adequate outlet capacity for the waste separation facility to safely convey the design load to a storage or utilization location.

Outlets may include pipelines, perforated or slotted pipe risers, porous plank walls or dams, or screened walls. Provide at least 10 percent open area for screening used to separate solids at the outlet of settling basins.

Use emergency overflow appurtenances, such as notched weirs, or pipe bypasses to control flows exceeding design capacity. For separation facilities exposed to precipitation, design emergency overflow appurtenances to pass and contain the contaminated runoff from the drainage area of the facility for a 25-year 24-hour storm frequency plus the normal waste stream discharge.

Mechanical separators
Manufactured separators are separators such as screen separators, centrifuges, hydrocyclones, and presses (screw or belt type).

Performance
The performance of mechanical separators is generally reported for a given throughput or flow rate. If different flow rates are required, obtain separator efficiencies from the manufacturer.

Flow rate and velocity
Follow manufacturer's recommendations for the design flow rate and liquid waste stream velocity for filtration and screening devices.

For proper functioning of mechanical separation equipment, environmental conditions may require roofing and/or building enclosure. Design roofs for enclosures in accordance with the requirements of NRCS CPS Roofs and Covers (Code 367).

Settling basins
Construct the settling basin with a durable liner such as concrete, geosynthetic material, compacted soil, or geomembrane liner that is adequate to support cleanout equipment

Do not use the settling basin to store manure scraped from feedlots or other areas. Additional solid storage should be used for scraped manure. If needed, leachate from solid storage area may be directed to the settling basin.

Velocity
Do not exceed 1.5 feet per second liquid waste stream flow velocity through settling basins.

Depth
Provide sufficient depth for solid and liquid storage and for the depth of influent flow. Include a minimum of 1 foot freeboard.

Base the minimum volume of the settling basin on a hydraulic retention time of at least 30 minutes.

Bottom width
Base the minimum bottom width for the settling basin on the cleanout equipment used, but not less than 4 feet.

Access
Establish the minimum top width of earthen embankments for settling basins at 15 feet when equipment access is needed for cleanout. Where access to the settling basin is not required for cleanout, base the minimum top width on the equipment used to construct the embankment or berm, but not less than 4 feet.

Construct the side slopes of earthen embankments no steeper than 2 horizontal to 1 vertical (2:1). For earthen embankments greater than 3 feet in height, construct the side slopes no steeper than 3:1 on the outside and 2:1 on the inside of the embankment.

Design access ramps to allow entry into the basin for cleanout by normal loading equipment at no steeper than 10:1. Steeper access ramps are acceptable where special surfacing of the ramp is provided for traction purposes and the equipment used can accommodate the increased slope, but no steeper than 4:1.

Settling basins receiving lot runoff
Settling basins used with or without screening to remove solids from process-generated liquid waste streams (i.e., flush water from covered freestall barns or milking parlor waste water) that include significant external drainage fall into this category.

Flow rate

Base the minimum design flow rate for a settling basin that receives lot runoff on the normal liquid waste stream from the operation plus the peak runoff from the 10-year 1-hour storm from the drainage area of the basin.

Volume

Base the design volume for settling basins receiving lot runoff on the total depth needed for liquid and solids storage and the minimum surface area required for the basin. Where no specific information is available on sludge accumulation rates from lot surfaces, use 0.05 cubic feet per square foot of surface area per month for unpaved lots and 0.01 cubic feet per square foot of surface area per month for paved lots. Increase these values by 50 percent if lots are steep or poorly maintained. The minimum solids accumulation storage period is 1 month.

Settling basins that exclude lot runoff

Settling basins used with or without screening to remove solids from process generated liquid waste streams (i.e., flush water from covered freestall barns or milking parlor waste water) and do not receive significant external drainage fall into this category.

Flow rate

Design the capacity for a settling basin that excludes lot runoff on the normal liquid waste stream from the operation.

Volume

Base the design volume for settling basins that exclude lot runoff on the volume needed to provide solids storage for a specified treatment period plus temporary liquid storage necessary during dewatering. Use a minimum temporary liquid storage based on the volume of the liquid waste stream for 1 day.

Sand separation and reuse

Separation processes that remove sand from water and organic material fall into this category.

Dilution

Provide adequate dilution water for sand-laden manure to keep organic solids in suspension for proper sand separation. Use a minimum water to sand-laden manure dilution ratio of 2:1 (volume basis).

Capacity

Design the system to provide adequate capacity to handle the required manure and sand loadings.

Sand storage

Provide storage of separated sand to allow additional time for liquid to drain from the sand. Collect the drainage and route it back into the waste handling stream.

Nonmechanical sand separation and reuse

Sand separation techniques that rely on the velocity of the waste stream to settle out sand fall into this category.

Velocity

Design the waste stream velocity between 1 and 2 feet per second. Base the flow velocity on the site-specific sand gradation curve.

Include a transition area between flush system or waste transfer system and the sand lane that will lower the velocity to the design waste stream velocity that will allow the sand to settle out. Size sand lane outlets large enough to prevent flow constriction that will cause excessive settling of organic solids.

Volume

Provide a minimum settling area storage volume based on the maximum time between cleanouts. Design the bottom width to be compatible with the removal equipment, but not less than 8 feet.

Hydraulic retention time

Design the hydraulic retention time of at least 3 minutes and not more than 5 minutes. Make adjustments using the site-specific sand gradation curve.

CONSIDERATIONS

General Considerations

Location

When locating waste separation facilities, consider elevation and distance from the source of material to be separated and the location of long-term liquid and solid waste storage facilities. Take advantage of gravity flow wherever possible. Other considerations for locating waste separation facilities include vehicle access, proximity to wells, wind direction, neighboring dwellings, proximity of streams and floodplains, required setback distances, and visibility.

Biosecurity

Consider how waste separation facilities and the disposal of waste products will affect the biosecurity for the farm and neighboring areas.

Weeping walls

To maximize drainage and solid-liquid separation, install weeping walls around the entire perimeter of the waste to be treated and maintain drainage paths to and through the walls. Consider waste particle size, particle size distribution, and length of flow paths when selecting screen opening size and spacing. Ensure drainage is transferred to a liquid storage facility.

Sand bedding

When sand bedding is reused, select uniformly sized sand to improve separation efficiency.

Solid/solid separation

When separating poultry litter into fine and coarse fractions, a higher percentage of the nutrients are partitioned with the fine fraction. The coarse material, consisting mostly of shavings and feathers, has a lower nutrient content and can be reused as bedding or as an energy source.

Visual screening

Consider using vegetative screens or other methods to shield waste separation facilities from public view for aesthetics.

Precipitation

Rainfall on the solids storage areas associated with waste separation facilities can result in increased waste water discharge into the long-term storage facility. Consider covering solids storage facilities in high precipitation areas.

Sand system abrasion resistance

Where sand is a major component of the liquid waste stream, consider the use of abrasion-resistant waste transfer piping and pumps to increase the useful life and reduce frequency of repairs.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, the plans and specifications will include—

- Plan view of the waste separation facility showing the entire waste management system, including waste production facilities, waste collection points, waste transfer pipelines, waste treatment, storage facilities, and related appurtenances.
- Location of all inflow and discharge structures with a description of materials, sizing, profiles, and critical elevations.
- Detail drawings for all components to be constructed.

- Details of support systems for manufactured waste separation devices.
- Fencing and signage as appropriate for safety purposes.
- Written specifications describing installation requirements and operating characteristics, such as design flow, volume, and/or retention time.

OPERATION AND MAINTENANCE

Develop and review an operation and maintenance (O&M) plan with the owner and operator prior to constructing the waste separation facility. Ensure that the O&M plan is consistent with the purposes of the waste separation device chosen, its intended life, safety requirements, and the criteria for its design. As a minimum, include—

- A description of the normal operation of the facility, safety issues, and normal maintenance items to ensure that the owner and operator understand the level of O&M required for the separator to operate as intended.
- Operation instructions for any manufactured waste separation devices.
- Alternative operation procedures in the event of equipment failure or other emergency.
- Daily and/or periodic inspection of—
  - Separation device and support structure.
  - Screens and outlets.
  - Remaining capacity in storage facilities.

REFERENCES

Burns, R.T. and L.B. Moody. 2003. Development of a Standard Method for Testing Mechanical Manure Solids Separators. American Society of Agricultural Engineers – CIGR Meeting Paper No. 034131. American Society of Agricultural and Biological Engineers. St. Joseph, MI.

Ford, M. and R. Fleming. 2002. Mechanical Solid-Liquid Separation of Livestock Manure Literature Review. Ridgetown College – University of Guelph, Ridgetown. Ontario, Canada.

Manure Management System Series – Outdoor Air Quality. 2002. MidWest Plan Services Handbook 18, Section 3. MidWest Plan Service, Iowa State University. Ames, IA.

Mukhtar, S., J.M. Sweeten, and B.W. Auvermann. 1999. Solid-Liquid Separation of Animal Manure and Wastewater. Texas A&M AgriLife Extension Service. College Station, TX.

Livestock and Poultry Environmental Learning Community. 2019. “Solid-Liquid Manure Separation.” Accessed May 20, 2021. https://lpelc.org/solid-liquid-manure-separation/

USDA NRCS. 2019. National Engineering Handbook (Title 210), Part 637, Chapter 4, Solid-Liquid Separation Alternatives for Manure Handling and Treatment. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. 2012. National Engineering Handbook (Title 210), Part 651, Agricultural Waste Management Field Handbook. Washington, D.C. https://directives.sc.egov.usda.gov/