NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE SEPARATION FACILITY

(No.)

CODE 632

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

To partition solids, liquids and/or their associated nutrients to:

- 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 facilities.
- reduce solids content in waste stream so liquids 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 the waste stream to improve handling and application of nutrient management.

CRITERIA

General Criteria Applicable to All Purposes

Laws and Regulations. Plan, design and construct waste treatment facilities to meet all Federal, state, local and tribal regulations.

Location. Position waste separation facilities so that the waste stream can be safely routed to and from the facility.

Solid/Liquid Waste Separation Facilities shall not be located within the 100-year floodplain unless the structure is protected from inundation and damage that may occur during the 100-year flood event. For a structure to be protected from inundation, the lowest elevation of the top of the storage structure or floor of a roofed structure shall be at least 1 foot above the water surface elevation of the 100-year flood.

The water surface elevation of the 100-year flood can be determined by using Federal Emergency Management Agency (FEMA) 100-year floods, United States Geological Survey (USGS) 100-year flood prone maps, and/or completing a hydrologic and hydraulic analysis. If no FEMA or USGS 100-year flood delineation is available for the location of the waste storage structure, the 100-year flood elevation must be determined by completing a hydrologic and hydraulic analysis.

To determine the 100-year flood elevation using a hydrologic and hydraulic analysis, a 100-year flow must first be estimated by using

USGS published peak-flow 100-year frequency estimates, using USGS flow-frequency regression equations, or utilizing a rainfall runoff model. If using a rainfall runoff model, a 100-year frequency, 24-hour duration storm peak flow estimate shall be determined. Manning's equation or a step-backwater program such as Hec/Ras must then be used to determine the 100-year flood elevation corresponding to the 100-year flow estimate.

Waste Separator Selection. Table 1 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. Base the type of waste separator selected, whether mechanical or non-mechanical, on site specific data for the waste streams and management conditions where specific management objectives are to be met. A combination of separation unit processes may be necessary to achieve the desired or required results.

Separation Efficiency. Base the volume or percentage of solids separated on estimates of daily waste water (if applicable) and the total solids capture efficiency for the type of separation device selected. Manufacturer separation equipment performance is generally reported as concentration reduction or mass removal efficiency. 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 Table 1 can be used to estimate the amount of separated material generated.

Chemical Amendments. To enhance the separation process, chemical amendments, such as metal salts and polymers, can be used to flocculate manure solids to enhance the separation process. Addition of chemicals to the liquid waste stream for improving total solids capture efficiencies must be done according to the criteria in Conservation Practice Standard 591, Amendments for Treatment of Agricultural Waste.

Table 1

Solid/Liquid Separators	Total Solids Capture Efficiency
Static Inclined Screen	10-20%
Inclined Screen with Drag Chain	10-30%
Vibratory Screen	15-30%
Rotating Screen	20-40%
Centrifuge	20-45%
Screw or Roller Press	30-50%
Settling Basin	40-65%
Weeping Wall	50-85%
Dry Scrape	50-90%
Geotextile Container	50-98%
Membranes	60-99%
Sand Settling Lanes	50-70%
Mechanical Sand Separator	50-95%

Storage of Separated Solids. Provide adequate storage areas for separated solids unless they are transported directly from the separator to the final utilization location.

Design storage facilities for separated solids in accordance with requirements of Conservation Practice Standards (CPS) Waste Storage Facility (313) and Roofs and Covers (367).

Discharges. Capture any seepage or discharge from solid or sand storage, waste separation facility, or associated appurtenances in a waste storage or treatment structure unless it meets local, state and federal regulations regarding discharge to surface and ground water.

Conveyance System. Design waste transfer components for separated solids in accordance with requirements of CPS Waste Transfer (634).

For conveyance systems, maintain sufficient velocities to keep solids in suspension until material reaches desired separation process or storage area.

Outlets. Provide adequate outlet capacity for a 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% open area for screening used to separate solids at the outlet of settling basins. Screens shall have a one-inch maximum opening size. The use of corrugated polyethylene pipe or corrugated polypropylene pipe are not allowed as outlets.

Inlets. The use of corrugated polyethylene pipe or corrugated polypropylene pipe are not allowed as inlets.

Additional Criteria for Mechanical Separators

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.

Structural Design. Design structural supports for filtration and screening devices in accordance with the requirements of CPS Waste Storage Facility (313).

For proper functioning of mechanical separation equipment, environmental conditions may require roofing and or building enclosure. Design roofs and enclosures in accordance with the requirements of CPSs Roofs and Covers (367) and Waste Storage Facility (313).

Additional Criteria For Sediment Basins Included in Animal Waste Management Systems

Structures designed under this standard may be used to separate agricultural waste solids from liquids as a component of an agricultural waste management system (AWMS).

Sediment basin embankments, foundations, and fabricated structures (concrete, metal, wood) must meet structural requirements outlined in the CPS Waste Storage Facility (313).

Liquids and solids removed or discharged from the sediment basin must be delivered to a waste storage facility, waste treatment lagoon, or other appropriate component of the AWMS. Solids removed from the sediment basin and land applied must be land applied in accordance with the SD NRCS CPS Nutrient Management (590).

Design Storage Volume

Specific design storage volume criteria, which includes both solids and liquid storage, is listed below. The minimum elevation of the top of the settled embankment shall be one foot above the elevation within the sediment basin that contains the entire design storage volume.

Sediment basins must be designed to allow for sediment removal using available equipment. Sediment basins that are a component of an AWMS must provide the minimum solids capacity as determined by the following:

Volume of Solids = (0.5 ft^3 * A * B * C) / D

Where: Volume of Solids is in ft^3

A = Number of 1,000 lb animal units

B = Number of confinement days

C = Lot Slope factor; use the following factor for the following lot slopes:

3% or less = 0.25

3% to 6% = 0.50

6% to 10% = 0.75

Over 10% = 1.00

D = Number of feedlot cleanings per year

Sediment basin drainage structures (screen with 1 inch maximum opening size, perforated riser, slatted wall, v-notch weir, etc.) or filtered pumping systems must be provided to remove liquids from sediment basins within 72 hours or less of runoff events.

The NRCS Curve Number (CN) method must be used in computing runoff from feedlot surfaces and other contributing runoff areas. The soil cover complex number (runoff CN) used in computing runoff from feedlot surfaces shall not be lower than 97 for paved lots and 90 for unpaved lots.

The required design storm event for animal feeding operations that commenced construction (or had significant expansion) after February 12, 2003, that require permitting through SD Department of Environment and Natural Resources (DENR), and that involve waste from swine, poultry, or veal shall be the 100-year frequency, 24-hour duration storm event. Systems that do not meet the above criteria shall use the 25-year frequency, 24-hour duration storm event.

The required design storage volume must be one of the following:

1. The entire runoff volume from the design storm event with the design solids volume contained in the sediment basin.

2. Flood routing the design storm event through the sediment basin with the design solids volume contained in the sediment basin. The maximum liquid elevation during the flood routing is considered the top of the design storage volume.

Additional Criteria for Sediment Basins for Vegetated Treatment Areas (VTA)

Structures designed under this standard may be used to separate solids prior to application of runoff to a VTA.

Sediment basin embankments, foundations, and fabricated structures (concrete, metal, wood) must meet the structural requirements outlined in the CPS Waste Storage Facility (313).

Liquids discharged from the sediment basin must be delivered to a VTA. Solids removed from the sediment basin and land applied must be land applied in accordance with the SD NRCS CPS Nutrient Management (590).

Controlled outflow from the sediment basin with the use of shut-off valves, pumps, etc., to the VTA is encouraged, but not required. Application of liquids from the sediment basin to the VTA should be done as soon as possible. During periods of wet conditions or dormant vegetation within the VTA, storage of liquids for more than 72 hours may be necessary to properly manage the timing of application of liquids to the VTA.

Design Storage Volume

The criteria for the design storage volume for a sediment basin with outflow to a VTA shall have the same design storage volume as a sediment basin as part of an AWMS except that the required design storage volume must be one of the following:

1. For sediment basins that have controlled outflow to the VTA with the use of shut-off valves, pumps, etc., the design liquid volume is the entire runoff volume from the design storm event with the design solids volume contained in the sediment basin.

2. For sediment basins that have uncontrolled outflow to the VTA, the design storage volume can either be the entire runoff

volume from the design storm event with the design solids volume contained in the sediment basin or flood routing the design storm event through the sediment basin with the design solids volume contained in the sediment basin. If using the flood routing method, the maximum liquid elevation during the flood routing is considered the top of the design storm volume.

General Criteria for 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. Provide adequate capacity for the system design to handle the required manure and sand loadings.

Sand Storage. Provide adequate storage of separated sand to allow for additional liquid drainage from the sand.

Additional Criteria for Non-Mechanical Sand Separation and Reuse

Velocity. Design the waste stream velocity between 1 and 2 feet per second. Adjust flow velocity according to sand size and distribution.

Volume. Provide a minimum settling area storage volume to correspond to the maximum cleanout period. Design the bottom width to be compatible with the removal equipment, but not be less than eight feet.

Hydraulic Retention Time. Design the hydraulic retention time to be between a minimum of three minutes and a maximum of five minutes. Make adjustments according to sand size and distribution.

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 for locating waste separation facilities.

Other considerations for locating waste separation facilities include vehicle access, wind direction, neighboring dwellings, proximity of streams and floodplains, and visibility.

Sediment Basins for AWMS

Where possible, the sediment basin surface area should be at least five percent of the size of the sediment contributing area for effective removal of light weight sediment from liquids. Sediment basin bottoms should be relatively flat with positive slope toward the sediment basin outlet where possible, to facilitate sediment removal.

All known outlet structure designs for agricultural waste settling basins can become plugged or frozen and should be designed for easy cleaning.

Consider sediment basins that have concrete bottoms with curbs or walls (for machine buckets to push against while loading) which will allow sediment removal in less than ideal weather.

Consider exclusion of livestock from the sediment basin to reduce the chance of damage to the embankments and outlet/drainage structures.

If earth basins are used, consider including two basins so one can dry out for cleaning while the other is being used to settle solids.

Sediment basins for agricultural waste require continuing management and maintenance. They should have solids removed frequently to function properly.

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 a 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 is partitioned with the fine fraction. The coarse material, consisting mostly of shavings and feathers, has a lower nutrient content and could 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 and for more aesthetic conditions.

Rainfall. Rainfall falling 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 of solids storage facilities in locations where high rainfall amounts occur.

Sand System Abrasion Resistance. Where sand is a major component of the liquid waste stream, encourage the use of abrasion resistant waste transfer piping and pumps to reduce frequency of repairs.

PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard and good engineering practice. Include all details necessary for construction and completion of the waste separation facilities in the plans and specifications.

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

1. Layout of waste production facilities, waste collection points, waste transfer pipelines, waste treatment and storage facilities.

2. Location of all inflow and discharge pipelines and a description of pipeline materials, diameter and slope.

3. Details of support systems for waste separation devices.

4. Fencing and signage as appropriate for safety purposes.

5. Operating characteristics.

Warranties. If a manufactured waste separation device is installed, the manufacturer shall provide a warranty that describes the design life of the device and what the warranty covers.

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 the following elements in the operation and maintenance plan:

1. Documentation of design factors related to operation and maintenance.

2. Design capacity for the facility.

3. A description of normal operation of the facility, safety issues, and normal maintenance items.

4. Alternative operation procedures in the event of equipment failure.

5. Daily and/or periodic (as described in the plan) inspection of the following:

    - Separation device and support structure.

- Screens and outlets.
- Remaining capacity in storage facilities.

Ensure that the owner and operator understand the level of operation and maintenance (O&M) required for the type of separator selected to operate as intended.

REFERENCES

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