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.

The installation and operation of this practice shall comply with all federal, state and local laws, rules, and regulations. All permitting authorities such as Tennessee Department of Environment and Conservation (TDEC), U.S. Army Corps of Engineers (USACE), Tennessee Valley Authority (TVA), etc. shall be consulted or polices reviewed in order to check requirements for permit coverage (i.e. TDEC-ARAP, USACE 404, TVA 26a).

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

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 313, Waste Storage Facility and 367, Roofs and Covers.

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 Conservation Practice Standard 634, Waste Transfer.

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.

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 the peak runoff from the drainage area of the facility for a 25 year-24 hour storm frequency plus the normal waste stream discharge.

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 Conservation Practice Standard 313, Waste Storage Facility.

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 Conservation Practices 367, Roofs and Covers and 313, Waste Storage Facility.

General Criteria Applicable to Settling Basins

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

Depth. Provide sufficient depth for solids and liquids storage and for the depth of influent flow as needed. Include a minimum of one foot freeboard for earthen settling basins. The total depth for settling basins that are to be cleaned out using conventional front-end loading equipment shall be 5 feet or less. Safety concerns during cleanout shall be addressed where the total depth for settling basins will exceed 5 feet.

Base the minimum liquid depth of settling basins on a minimum hydraulic retention time of 30 minutes.

The maximum solids settling rate used for design shall be 4 feet per hour for settling basins with a total storage depth greater than 2 feet and 2 feet per hour for settling basins with a total storage depth equal to or less than 2 feet.

Bottom Width. Establish the minimum bottom width for settling basins on the removal equipment used, but not less than 4 feet.

Construct settling basins of concrete and/or lined with a geosynthetic, compacted soil, or geomembrane liner. Design a settling basin not utilizing a concrete slab for the basin floor to provide adequate support for clean out equipment. Ensure that settling basins constructed according to these criteria also meet appropriate criteria in Conservation Practice Standard 313, Waste Storage Facility.

Access. Establish the minimum top width of earthen embankments for settling basins at 15 feet when equipment access is needed for clean out. Where no access is required to the settling basin for clean out, 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 clean out by normal front end loading equipment at no steeper than 10:1. Allow steeper sloped access ramps where special surfacing of the ramp is done for traction purposes and the equipment used can accommodate the increased slope but in no case steeper than 4:1.

Safety. Include in the design appropriate safety features 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.

Additional Criteria for Settling Basins Receiving Lot Runoff

Settling basins used in conjunction with or without screening to remove waste 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. Design the flow rate for a settling basin that receives lot runoff on the normal liquid waste stream discharge from the operation plus the peak runoff from the drainage area of the basin computed using a 10 year-1 hour storm frequency.

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% if lots are steep or poorly maintained. The minimum accumulation storage period is one month.

Additional Criteria for Settling Basins that Exclude Lot Runoff

Settling basins used in conjunction with or without screening to remove waste 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 discharge 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 one-day.

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 8 feet.

Hydraulic Retention Time. Design the hydraulic retention time to be between a minimum of 3 minutes and a maximum of 5 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.

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

APL Solid Separation Study. 2002. Part B – Case Studies of Solids Separation Systems. FSA Environmental. Australian Port Limited.

Burns, R.T. and Moody, L.B.. 2003. Development of a Standard Method for Testing Mechanical Manure Solids Separators. ASAE-CIGR Meeting Paper No. 034131. St. Joseph, MI.: ASABE.

Ford, Mary and Fleming, Ron. 2002. Mechanical Solid-Liquid Separation of Livestock Manure Literature Review. Ridgetown College – University of Guelph.

Manure Management System Series – Outdoor Air Quality. Mid West Plan Services Handbook 18, Section 3. 2004.

Mukhtar, Saqib and et. al.. 1999. Solid-Liquid Separation of Animal Manure and Wastewater. Texas Agricultural Extension Service.

Solid-Liquid Manure Separation. 2009. Livestock and Poultry Environmental Learning Center.

USDA – NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.1992, Last revised, October 2010.