NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

(No.)
CODE 313

DEFINITION

A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To temporarily store wastes such as manure, wastewater, and contaminated runoff as a function of an agricultural waste management system.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies

- Where the storage facility is a component of a planned agricultural waste management system.
- Where temporary storage is needed for organic wastes generated by agricultural production or processing.
- Where the storage facility can be constructed, operated and maintained without polluting air or water resources.
- Where site conditions are suitable for construction of the facility.
- To facilities utilizing embankments with an effective height of 35 feet or less where damage resulting from failure would be limited to damage of farm buildings, agricultural land, or township and country roads.
- To fabricated structures including tanks, stacking facilities, and pond appurtenances.

CRITERIA

General Criteria Applying to All Waste Storage Facilities.

Laws and regulations. All planned work shall comply with all Federal, state, and local laws and regulations.

Storage period. The storage period is the maximum length of time anticipated between emptying events. The minimum storage period shall be based on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, management and local, state, and Federal regulations.

Design storage volume. The design storage volume, equal to the required storage volume, shall consist of the total of the following as appropriate:

a. Manure, wastewater, and other wastes accumulated during the storage period.

b. If the facility is uncovered, normal precipitation less evaporation on the surface area (at the design storage volume level) of the facility during the storage period.

c. Normal runoff from the facility's drainage area during the storage period.

d. If the facility is uncovered, 25-year, 24-hour storm precipitation on the surface (at the required design storage volume level) of the facility.

e. 25-year, 24-hour storm runoff from the facility's drainage area.

f. Residual solids after liquids have been removed.

g. Additional storage as may be required to meet management goals or regulatory requirements.

Inlet. Inlets shall be of any permanent type designed to resist corrosion and plugging damage, and ultraviolet ray deterioration while incorporating erosion protection as necessary.

Protection. To control erosion, embankments and disturbed areas surrounding the facility shall be vegetated according to NRCS conservation practice standard, Critical Area Planting, Code 342.

Flexible membranes. Flexible membranes shall meet or exceed the requirements of flexible membrane linings as specified in NRCS conservation practice standard, Pond Sealing or Lining, Code 521.

Location. To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, waste storage facilities shall be protected from inundation or damage from a 25-year, 24-hour storm event, or larger if required by laws, rules, and regulations. Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized; and separation distances are such that prevailing winds and landscape elements such as building arrangement, landforms, and vegetation minimize odors and protect aesthetic values.

Waste storage facilities shall be located as close to the source of waste and as far from neighboring dwellings or other areas of public use as practical and as allowed by federal, state, and local laws.

Safety. Designs shall include appropriate safety features to minimize the hazards of the facility.

Entrance ramps shall be designed for safe entrance based on the type of equipment used. Warning signs, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock.

Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation.

Pipelines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings.

Additional Criteria for Waste Storage Ponds

Hazard classification. The area downstream of the embankment shall be evaluated to determine the impact from damage from a sudden breach of the proposed embankment on both structural and environmental features. This evaluation must consider all improvements and those improvements that may reasonably be expected to be made during the useful life of the structure. The results of this examination provide for the proper hazard approval classification of the embankment. Only hazard class (a) embankments are to be designed under this standard. See National Engineering Manual Part 520.23 for guidance in documenting hazard classification.

Soils and foundation. The pond shall be located in soils with an acceptable permeability that meets all applicable regulation, or the pond shall be lined. Soil investigations must evaluate soils to a depth no less than two feet below the final grade of any excavation. Information and guidance on controlling seepage from waste storage ponds can be found in the NEH, Part 651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 7 and Appendix 10D.

The pond shall have a bottom elevation that is a minimum of 2 feet above the seasonal high water table unless features of special design are incorporated that address buoyant forces, pond seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of perimeter drains, if feasible, to meet this requirement.

Liners. Liners shall meet or exceed the criteria in NRCS conservation practice standard, Pond Sealing or Lining, Code 521.

Waste storage ponds constructed in high water table soils. Waste storage ponds constructed in high water table soils shall be based on a detailed risk assessment. The risk assessment shall include an analysis of the potential for ground water pollution considering the hydrogeology, ground water transmissivity, soil permeability, etc. Decisions to install waste storage facilities in high water table soils without liners must provide reasonable assurances that the facility will not cause surface or ground water pollution.

If during the risk assessment, it is determined that the site is a potential hazard to ground water pollution, it shall be designed with a liner to prevent contamination of ground water. Methods to maintain the liner integrity shall be considered in the design.

Storage volume for waste storage ponds constructed in high water table soils shall be the volume above the natural high water level elevation.

Inlet. Inlets may be pushoff ramps, paved slopes, or pipe inlets.

Pushoff ramp slopes shall be no steeper than 4 horizontal to 1 vertical (4:1). Paved slopes shall be no flatter than 1 percent or greater and preferably 1.5 percent or greater and will not be used when appreciable bedding material are used.

Pipe inlets may be steel, concrete, aluminum, HDPE, or PVC as required in NRCS conservation practice standard, Pond, Code 378.

All pipes shall be designed to carry the required flow and shall be installed on a slope of 1 percent or greater and preferably 1.5 percent or greater. Where solids are being conveyed, the pipe diameter shall be sized to prevent plugging.

Pumped inlets shall be sized to meet the requirements of the pumping equipment.

Gravity flow inlet pipes for liquids only may outlet at or above the maximum operating level which is the design volume less the volume contribution of precipitation and runoff from the 25-year, 24-hour storm event. The slope of the pond at the pipe outlet shall be protected from erosion by paving or by extending the pipe outlet to a point where the discharge will not fall on the slope. Pipes shall be supported on pilings of pressure treated wood, steel, concrete, or masonry and anchored to prevent dislodging or flotation.

Large diameter gravity loading pipes for solids and liquids shall outlet at the bottom of the pond, and the effective head (vertical difference between the top of drop inlet and the design volume elevations) shall be no less than 4 feet.

Embankments. The minimum elevation of the top of the settled embankment shall be 1 foot above the required storage volume for waste storage pond without emergency spillways and 1 foot above the design depth of flow in the emergency spillway for storage pond with emergency spillways. This height shall be increased by the amount needed to ensure that the embankment top elevation will be maintained after settlement. This increase shall be not less than 5 percent.

The minimum embankment top width shall be as shown in Table 1.

Table 1 – Minimum Embankment Top Width

Total Height of Embankment, Feet	Minimum Top Width, Feet
< 15	8
15 to 20	10
>20 to 25	12
>25 to 30	14
>30 to 35	15

The combined side slopes of the settled embankment shall be not less than 5 horizontal to 1 vertical (5:1), and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1). All slopes must be designed to be stable. Where embankments are to be mowed; 3 horizontal to 1 vertical (3:1) or flatter slopes are recommended.

Compaction of the embankment fill material shall be in accordance with the specified design requirements for compaction and moisture content. As a minimum compaction shall be equivalent to, or better than, the following:

1. Layers of fill shall not exceed 9 inches in thickness before compaction. Compaction shall be accomplished by routing the hauling and spreading equipment over the fill in such a manner that every point on the surface of each layer of fill will be traversed by not less than two complete passes of the loaded equipment traveling in a direction parallel to the main axis of the fill.
2. Clayey soils shall be compacted with a "sheepsfoot" or tamping roller. (See AWFMH-Appendix 10D for guidance on compaction.)

Excavated ponds. Side slopes shall be stable and shall not be steeper than 1.5 horizontal to 1 vertical (1.5:1). A low embankment shall be constructed to prevent surface runoff from entering the pond. The embankment shall meet the criteria contained in the section "Embankments", of this standard.

Outlet. No outlet shall automatically release storage from the required storage volume. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.

Emergency spillway. An emergency spillway, combination of spillways, or additional storage shall be provided to protect the waste storage pond from over topping when a 25-year, 24-hour storm event is exceeded and the design volume is filled. The crest of the emergency spillway shall be located at or above the same elevation as the top of the 25-year, 24-hour storm storage. The emergency spillway shall be designed to pass a 25-year, 24-hour storm without overtopping. There shall be a minimum of 1 foot of freeboard above the designed depth of flow in the emergency spillway. Emergency spillway requirements, however, do not apply to waste storage ponds without drainage areas and with less that 3 feet of depth above natural ground.

The emergency spillway shall be placed in undisturbed soil when possible. When it must be placed in fill material, precautions shall be taken to ensure the integrity of the structure.

Where a waste storage pond empties into another waste storage pond and the liquid level is positively controlled by an adequately sized overflow pipe, no emergency spillway is required for the primary waste storage pond.

Pipe emergency spillways shall have a minimum diameter of 6 inches and equipped with trash racks, antivortex devices, and antiseep collars as required in NRCS conservation practice standard, Pond, Code 378. Pipes may be steel, concrete, aluminum, HDPE, or PVC as required in NRCS conservation practice standard for Pond.

Emptying facilities. Some type of component shall be provided for emptying the pond. It may be a facility such as a pipe, dock, pumping platform, retaining wall, or ramp. Features to protect against erosion, tampering, and accidental release shall be incorporated as necessary.

Where agitators are used in ponds with liners, the tip of the propeller shall be a minimum of 3 feet from the liner surface or the liner shall be protected by a concrete pad.

Provision shall be made for periodic removal of accumulated solids to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the size and shape of the pond and type of seal, if any.

Waste removed from storage facilities shall be utilized in accordance with NRCS conservation practice standard, Waste Utilization, Code 633 or Nutrient Management, Code 590, as appropriate.

Staff gage. A staff gage or other permanent marker shall be placed in the waste storage pond to clearly indicate the maximum level of storage allowed to accumulate before emptying must be initiated. The marker shall indicate the level at which sufficient storage remains to contain the 25-year, 24-hour runoff and precipitation.

Safety. The pond shall be fenced according to NRCS conservation practice standard, Fence, Code 382, and warning signs shall be posted to prevent children and others from using it for other than its intended purpose.

Additional Criteria for All Fabricated Structures

Service life and durability. Planning, design, and construction shall ensure that the structure is sound and of durable materials commensurate with the anticipated service life, initial and replacement costs, maintenance and operation costs, and safety and environmental considerations.

Foundation. The foundations of fabricated waste storage facilities shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or applied loads may create highly variable foundation loads, settlement should be calculated from site specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available. If no test data is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 2 or another nationally recognized building code. In using presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing movements in the structure.

Table 2 - Presumptive Allowable Bearing Stress Values [1/]

Foundation Description	Allowable Stress
Crystalline Bedrock	12000 psf
Sedimentary Rock	6000 psf
Sandy Gravel or Gravel	5000 psf
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3000 psf
Clay, Sandy Clay, Silty Clay, Clayey Silt	2000 psf

[1/] Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Structural loading. Waste storage structures shall be designed to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and load combinations in compliance with this standard and applicable local building codes.

The lateral earth pressures should be calculated from soil strength values determined from the results of appropriate soil tests. Lateral earth pressures can be calculated using the procedures in Technical Release (TR) - 74. If soil strength tests are not available, the presumptive lateral earth pressure values indicated in Table 3 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the structural stiffness or wall yielding as follows:

Rigid frame or restrained-wall - Use the values shown in Table 3 under the column “Frame Tanks", which gives pressures comparable to the at-rest condition.

Flexible or yielding wall - Use the values shown in Table 3 under the column "Freestanding Wall”, which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of backfill ratio not more than 0.085.

Internal lateral pressure used for design shall be 65 lb/ft^2 where the stored waste is not protected from precipitation. A value of 60 lb/ft^2 may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurements of actual pressures of the waste to be stored. If heavy equipment will be operated near the wall, an additional two feet of soil surcharge shall be considered in the wall analysis.

Structural design. The structural design shall consider all items that will influence the performance of the structure, including loading assumptions, material properties and construction quality. Design assumptions and construction requirement shall be indicated on the plans.

Minimum requirements for fabricated waste storage structures are as follows:

Steel. “Manual of Steel Construction", American Institute of Steel Construction.

Timber. “National Design Specifications for Wood Construction”, National Forest and Products Association. All lumber in contact with the ground, manure or compost shall be pressure-treated in accordance with ASTM D1760.

Concrete. “Building Code Requirements for Reinforced Concrete, ACI 318”, American Concrete Institute.

Masonry. “Building Code Requirements for Masonry Structures, ACI 530”, American Concrete Institute.

Table 3 - Lateral earth pressure values[1/]

		Equivalent fluid pressure (lb/ft^2/ft of depth)			
Soil		Above seasonal high water table[2/]		Below seasonal high water table[3/]	
Description[4/]	Unified Classification[4]	Free-standing walls	Frame tanks	Free-standing walls	Frame tanks
Clean gravel, sand or sand-gravel mixtures (maximum 5% fines)[5/]	GP, GW, SP, SW	30	50	80	90
Gravel, sand, silt and clay mixtures (less than 50% fines) Course sands with silt and/or clay (less than 50% fines)	All gravel/sand dual symbol classifications and GM, GC, SC, SM, SC-SM	35	60	80	100
Low-plasticity silts and clays with some sand and/or gravel (50% or more fines) Fine sands with silt and/or clay (less than 50% fines)	CL, ML, CL-ML, SC, SM, SC-SM	45	75	90	105
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL, ML, CL-ML	65	85	95	110
High plasticity silts and clays (liquid limit more than 50)[6/]	CH, MH	-	-	-	-

[1/] For lightly compacted soils (85% to 90% maximum standard density.) Includes compaction by use of typical farm equipment.
[2/] Also below seasonal high water table if adequate drainage is provided.
[3/] Includes hydrostatic pressure.
[4/] All definitions and procedures in accordance with ASTM D 2488 and D 653.
[5/] Generally, only washed materials are in this category.
[6/] Not recommended. Requires special design if used.

Concrete slabs on grade. Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness shall be 4 inches with a minimum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-tightness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, Design of Slabs-on-Grade.

When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure incorporating a subgrade resistance parameters such as ACI 360 shall be used.

If the facility is to have a roof, wind loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads. If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Additional Criteria - Holding Tank

Holding tanks are used for liquid and slurry waste and may be open or covered, within or outside of enclosed housing, or beneath slotted floors. Holding tanks shall be essentially watertight.

Depending on the hazard involved to the environment, tanks shall be constructed of reinforced masonry, coated or glass-fused steel or reinforced concrete. Tanks designed as buried structures shall have exterior drainage or a minimum safety factor of 1.3 against uplift, when empty.

Holding tanks shall be sufficiently watertight to retain liquids required for agitating and pumping and to function as planned. Effluent seepage in amounts that would pollute surface or ground water shall be prevented by watertight construction or collected and disposed of in a safe manner. Influent seepage in amounts that would infringe on the designed holding capacity shall be prevented by watertight construction or site drainage.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. The openings in covered holding tanks shall be designed to accommodate equipment for loading, agitating, and emptying, and shall have grills or secure covers for safety, odor, and vector control. Central loading from an elevation at or above the top of the sidewall of open holding tanks allows more complete and uniform filling, particularly with manure containing bedding. Steel and other corrodible materials shall be adequately protected with concrete, paint, or other protective coatings to prevent corrosion.

Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in ASAE EP378.3, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASAE EP393.2, Manure Storages, shall be the minimum used. The actual axle load for tank wagons having more than a 2,000 gallon capacity shall be used.

All structures shall be underlain by free draining material.

A minimum of 6 inches of residual solids storage shall be provided for tanks.

Additional Criteria - Stacking Facilities

Solids stacking implies that the manure has a consistency that does not flow, but remains in place even during the wettest time of the storage period. Facilities receiving 100 percent of the manure production, with no provision for liquid separation, shall not be designed as stacking facilities.

Stacking facilities may be open or roofed and are used for wastes which behave primarily as a solid. The anticipated stacking angle of the manure must be considered in determining the wall height.

Stacking facilities shall be constructed of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. They shall be designed with adequate safety factors to prevent failure due to internal or external pressures, including hydrostatic uplift pressure and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure. Lumber shall not be used for walls which support moving stacking elevators or similar loads.

Structural design criteria for stacking facilities shall be in accordance with the criteria for the various

materials listed in the section "Structural Design" of this standard.

Floor Slabs and Walls. Floors shall slope away from the entrance. Suggested grade of the floor is 0.2 or 0.3 percent.

Where concrete floors contact wood walls or posts, the concrete and wood shall be separated by 1/2-inch preformed bituminous expansion joint material. The expansion joint material is not required where wood walls rest on top of concrete and the resultant joint is horizontal.

Timber Walls. All other timber shall be pressure-treated in accordance with ASTM D1760. Posts shall have a minimum size of 6 inches by 6 inches and be placed in the ground from 3 to 6 feet deep, depending on the design analysis. Side planking shall be treated lumber with a minimum thickness of 2 inches.

Seepage. Effluent seepage in amounts that would pollute surface or ground water shall be prevented by watertight construction or collected and disposed of in a safe manner. Influent seepage in amounts that would infringe on designed storage capacity shall be prevented by watertight construction or site drainage.

Internal Drainage. Drainage of some liquids, including rainfall from the stacking area (especially those without a roof), should be considered. This is best accomplished by use of a timber wall with the boards installed vertically, leaving 3/4-inch cracks. The timber wall drainage section may be included in a concrete or masonry block wall. Design criteria shall be the same as for timber walls. Seepage shall be collected in a tank or waste storage pond, or properly treated in a lagoon or infiltration strip.

CONSIDERATIONS

Waste storage facilities should be located as close to the source of waste and polluted runoff as practicable. In addition, they should be located considering prevailing winds and landscape elements such as building arrangement, landform, and vegetation to minimize odors and visual resource problems.

To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains.

An auxiliary (emergency) spillway and/or additional embankment height should be considered to protect the embankment. Factors such as drainage area, pond size, precipitation amounts, downstream hazards, and receiving waters should be evaluated in this consideration. A minimum of 0.5 feet of freeboard for waste storage tanks should be considered.

Non-polluted runoff should be excluded from the waste storage facility to the fullest extent possible, except where its storage is advantageous to the operation of the agricultural waste management system.

Solids separation. To minimize frequency of solids removal from waste storage ponds, route polluted runoff through vegetative filter strips, low-gradient channels, or debris basins to remove readily settleable solids. Settling facilities should have adequate capacity to store settled solids for a time period based on climate, equipment, clean out frequency, and method of disposal. If animal manure, such as from dairy cows, is flushed into a storage pond, a solids separator may be provided for removing fibrous solids to facilitate pumping and irrigation. Solid separators, debris basins, etc., shall be designed to prevent seepage to the groundwater.

Water quantity. Waste storage facilities will have an affect on the water budget. The affect will be dependent upon the size of the waste storage facility. The waste storage facility will cause an increase in evaporation and a decrease in downstream runoff where drainage is designed to the facility. The waste storage facility will not increase water demand at the site.

Water quality. The waste storage facility should have an overall positive impact on water quality by storing animal waste and polluted runoff until it can be safely applied to the land. Where ponds are used for waste storage, there can be a positive effect on water related wildlife habitat by providing open water bodies. Water quality can be adversely impacted during initial construction due to erosion of the site but will be minimal using proper construction pollution prevention measures.

Due consideration should be given to economics, environmental concerns, the overall waste management system plan, and safety and health factors.

Considerations for minimizing the potential for and impacts of sudden breach of embankment or accidental release from the required volume.

Features, safeguards, and/or management measures to minimize the risk of failure or

accidental release, or to minimize or mitigate impact of this type of failure should be considered when any of the categories listed in Table 4 might be significantly affected.

Table 4 - Potential Impact Categories from Breach of Embankment or Accidental Release

1. Surface water bodies -- perennial streams, lakes, wetlands, and estuaries
2. Critical habitat for threatened and endangered species.
3. Riparian areas
4. Farmstead, or other areas of habitation
5. Off-farm property
6. Historical and/or archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places.

The following should be considered either singly or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 4 may be significantly affected:

1. An auxiliary (emergency) spillway
2. Additional freeboard
3. Storage for wet year rather than normal year precipitation
4. Reinforced embankment -- such as, additional top width, flattened and/or armored downstream side slopes
5. Secondary containment

The following options should be considered to minimize the potential for accidental release from the required volume through gravity outlets when one or more of the potential impact categories listed in Table 4 may be significantly affected:

1. Outlet gate locks or locked gate housing
2. Secondary containment
3. Alarm system
4. Another means of emptying the required volume

Considerations for minimizing the potential of waste storage pond liner failure.

Sites with categories listed in Table 5 should be avoided unless no reasonable alternative exists. Under those circumstances, consideration should be given to providing an additional measure of safety from pond seepage when any of the potential impact categories listed in Table 5 may be significantly affected.

Table 5 - Potential Impact Categories for Liner Failure

1. Any underlying aquifer is at a shallow depth and not confined
2. The vadose zone is rock
3. The aquifer is a domestic water supply or ecologically vital water supply
4. The site is located in an area of solutionized bedrock such as limestone or gypsum.

Should any of the potential impact categories listed in Table 5 be affected, consideration should be given to the following:

1. A clay liner designed in accordance with procedures of NEH, Part 651, AWMFH Appendix 10D with a thickness and coefficient of permeability so that specific discharge is less than 1×10^{-6} cm/sec
2. A flexible membrane liner over a clay liner
3. A geosynthetic clay liner (GCL) flexible membrane liner
4. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness

Considerations for minimizing the impact of odors.

An anaerobic lagoon instead of a waste storage pond should be considered for sites located in rural areas where odors are a concern. This should be especially considered where odors would affect neighboring farms having enterprises that do not cause odors and/or neighbors who earn a living off-farm. The recommended loading rate for anaerobic lagoons at sites where odors must be minimized is one-half the values given in the NEH, Part 651, AWMFH Figure 10-22.

For sites located near urban areas practices such as the following should be considered to reduce odor emissions:

1. Covering the storage facility with a suitable cover.
2. Using naturally aerated or mechanically aerated lagoons.
3. Using composting in conjunction with a solid waste system rather than a liquid or slurry system.
4. Using a methane digester and capture system.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Engineering plans (drawings), specification and reports shall include:

a. Plan view of system layout. Surveying notes.
b. Type and number of animals the structure is designed to serve.
c. Storage period.
d. Structural details of all components.
e. References to components supplied by others (pumps, etc.).
f. Special safety requirements.
g. Vegetative requirements.
h. Quantities.
i. Drainage/Grading plan if one is needed.
j. Soil and foundation findings.
k. Signature of performance checker.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The waste storage facility should be inspected periodically to ensure that all components are operating as planned.

The O&M plan shall contain the operational requirements for emptying the storage facility. It shall include clean out intervals, maximum operating and other operating levels and reference to the staff gauge(s). O&M requirements shall be provided for all structural components (concrete, pumps, etc.).

The O&M plan shall include the requirement that waste shall be removed from storage and utilized at locations, times, rates, and volume in accordance with NRCS conservation practice standard, Waste Utilization, Code 633 and/or Nutrient Management, Code 590. In addition, the O&M plan for ponds shall include the requirement that following storms, waste shall be removed at the earliest environmentally safe opportunity to ensure that sufficient capacity is available to accommodate subsequent storms.

Waste storage ponds are to be routinely agitated and pumped according to an operational and maintenance schedule to prevent the accumulation of excessive sludges. The waste storage facility shall be operated so as to maintain the storage capacity for the 25-year, 24-hour storm.

The embankment and other vegetated areas shall be mowed and fertilized to maintain a protective vegetative cover.

Development of an emergency action plan should be considered for waste storage facilities where there is a potential for significant impact from breach or accidental release. The plan shall include site-specific provisions for emergency actions that will minimize these impacts.

REFERENCES

ACI 318, 360, 530
ASTM D 653, D 2488
ASAE Specifications: EP378.3, EP393.2, EP288.5
Basic Building Code, 12th Edition
Chapter 62-522 and 62-670 F.A.C.
ASTM D1760
“Manual of Steel Construction", American Institute of Steel Construction.
“National Design Specifications for Wood Construction”, American Forest and Paper Association.
National Engineering Manual, Part 520
NRCS National Engineering Handbook, Part 651
AWMFH, Chapter 7
AWMFH, Appendix 10D
NRCS Conservation Practice Standards
Critical Area Planting, Code 342
Fence, Code 382
Nutrient Management, Code 590
Pond, Code 378
Pond Sealing or Lining, Code 521
Waste Utilization, Code 633
Technical Release TR-74