United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

CODE 313

(no)

DEFINITION

An agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure.

PURPOSE

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

- To store manure, agricultural by-products, wastewater, and contaminated runoff to provide the agricultural operation management flexibility for waste utilization

CONDITIONS WHERE PRACTICE APPLIES

Use where regular storage is needed for wastes generated by agricultural production or processing and where soils, geology, and topography are suitable for construction of the facility. For reception pits, use the NRCS Conservation Practice Standard (CPS) Waste Transfer (Code 634).

For liquid waste storage facilities implemented with an embankment, this practice applies only to low hazard structures as defined in the NRCS National Engineering Manual (NEM), Part 520.23.

This practice does not apply to the storage of human waste or routine animal mortality.

CRITERIA

General Criteria Applicable to All Waste Storage Facilities

Laws and Regulations

Plan, design, and construct the waste storage facility to meet all Federal, State, and local laws and regulations.

The Alabama Department of Environmental Management (ADEM) Rules require owners/operators of animal feeding operations (AFO's) and associated waste management systems to fully implement and regularly maintain effective best management practices (BMP's) that meet or exceed NRCS technical standards and guidelines to prevent discharges and to ensure groundwater and surface water quality.

ADEM AFO rules require that operators retain records documenting that (1) all designs and plans for any structures were prepared and certified by a professional engineer registered in the State of Alabama (PE), (2) construction was supervised by a PE, (3) once construction was completed, a PE certified that the completed facility was constructed in accordance with the approved plans and met or exceeded good engineering practices and NRCS technical standards and guidelines, and (4) any modifications or repairs made to the structures were supervised and certified by a PE.

All construction activities must include adequate stormwater management BMP's. In addition, to comply with the National Pollutant Discharge Elimination System (NPDES) Phase II Rule, all construction activities involving one acre or more of land disturbance shall have and follow a construction best management practices plan (CBMPP) until construction is complete and all disturbed areas are stabilized.

Location
Locate and design the waste storage facility such that it is 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 100 -year flood event. Additionally, follow the policy found in the NRCS General Manual (GM) 190, Part 410.25, Flood Plain Management, which may require providing additional protection for storage structures located within the floodplain.

Locate waste storage facilities 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. Locate storage facilities on well drained topography and divert surface runoff as necessary to prevent it from impacting the facility and facility access.

Locate waste storage facilities to meet the minimum buffer distance requirements from water(s), wells, property lines, and public or private facilities as defined in the ADEM Administrative Code, Chapter 335-6-7, as amended.

Storage Period
The storage period is the maximum length of time anticipated between emptying events. Base the minimum storage period on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, State, and Federal regulations. The minimum storage period will be thirty (30) days for all methods of disposal, except milk parlor waste that is conveyed with sprinkler irrigation will have a minimum storage period of seven (7) days.

Design Storage Volume
Size the facility to store the following volumes as appropriate:

Operational Volume

- Manure, wastewater, bedding, and other wastes accumulated during the storage period.
- For liquid or slurry storage facilities, include normal precipitation (omit diverted roof runoff) less evaporation during the storage period. For precipitation use the maximum collection area at the inside top of the facility. For evaporation use the average surface area during the storage period. Design for the storage period during the months in which precipitation and evaporation will produce the largest storage volume.
- Normal runoff from the facility's drainage area during the storage period.
- Planned maximum residual solids. Provide a minimum of 6 inches for tanks unless a sump or other device allows for complete emptying.
- Additional storage when required to meet management goals or regulatory requirements.

Emergency Volume (liquid storages only)

- 25-year, 24-hour precipitation on the surface of the liquid or slurry storage facility at the maximum level of the required design storage.
- 25-year, 24-hour runoff from the facility's drainage area.
- In accordance with ADEM's and EPA's animal feeding operation (AFO) rules, liquid storage facilities for AFO's must have an additional 12 inch depth of emergency depth in addition to the 25-year, 24-hour storm runoff.

Freeboard Volume
(for liquid or slurry waste storage exposed to precipitation)

Freeboard is the depth above the operational and emergency volumes/depth.

- Minimum of 6” for vertical walled tanks.
- Minimum of 12” for all other facilities.

Exclude non-polluted runoff from the structure to the fullest extent practical except where including the runoff is advantageous to the operation of the agricultural waste management system.

Inlet
Design inlets to resist corrosion, plugging, freeze damage, and ultraviolet deterioration. Incorporate erosion protection as necessary. Pipes conveying liquids with a significant amount of solids should be at least 6 inches in diameter. Pipe cleanouts should be provided at a spacing of 150 feet or less. Inlet structures within liquid waste impoundments must be designed to maintain liner integrity.

Waste Removal
Provide components for removing waste such as gates, pipes, docks, wet wells, pumping platforms, retaining walls, or ramps. Incorporate features to protect against erosion, tampering, and accidental release of stored waste as necessary. Design ramp slopes to accommodate anticipated equipment and traction available. Use NRCS CPS Nutrient Management (Code 590) for land application of stored material or follow other disposal options outlined in a Comprehensive Nutrient Management Plan (CNMP).

Accumulated Solids Removal
To preserve storage volume, make provision for periodic removal of accumulated solids. The anticipated method for solids removal must be accommodated in design, particularly in determining the configuration of impoundments and the type of liner to be used.

Maximum Operating Level
The maximum operating level for liquid storage structures is the level that provides the operational volume.

Staff Gauge
Place a staff gauge or other permanent marker in the liquid storage facility to clearly indicate the following elevations:

- Maximum operating level (top of the operational volume).
- Emergency level (top of the design storage volume).

For storages where the contents are not visible and a staff gauge would not be visible, such as below a slatted floor, identify the method for the operator to measure the depth of accumulated waste in the Operation and Maintenance Plan.

Safety
Include appropriate safety features to minimize the hazards of the facility (refer to American Society of Agricultural and Biological Engineers (ASABE) Standard EP470, Manure Storage Safety for guidance, as needed).

Provide warning signs, fences, ladders, ropes, bars, rails, and other devices as appropriate, to ensure the safety of humans and livestock. Provide ventilation and warning signs for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation.

Design covers and grating over openings such that livestock or humans cannot accidentally displace them and fall into the facility.

Design pipelines with a water-sealed trap and vent, or similar device, if there is a potential for gases from the pipe to accumulate in confined spaces.

Place a fence around impoundments and uncovered tanks which have exposed walls less than 5 feet above ground surface. Use the NRCS CPS Fence (Code 382) for design of a fence that will prevent accidental entry by people or animals likely to be onsite. Post universal warning signs to prevent children and others from entering liquid waste storage structures.

Roofs and Covers
Use NRCS CPS Roofs and Covers (Code 367) for design of waste storage facility covers or roofs, as needed.

Treated Wood
Use criteria from NRCS CPS Roof and Covers (Code 367) for treated wood and fasteners.

Erosion Protection
Establish vegetation on embankments and other disturbed areas surrounding the facility in accordance with Alabama NRCS conservation practice standard, Critical Area Planting, Code 342

Flexible Membranes
Design flexible membranes to meet or exceed the requirements of flexible membrane linings as specified in Alabama NRCS conservation practice standard, Pond Sealing or Lining(Flexible Membrane), Code 521A

Liners
Liners will be designed and constructed in accordance with the Alabama NRCS conservationpractice standard, Waste Treatment Lagoon, Code 359

Seepage
Prevent effluent and influent seepage in amounts that would pollute surface or ground water, infringe on the designed storage capacity, or disrupt the proper operation of the facility, by performing watertight construction, providing a low permeability liner, by site drainage, or by collecting and utilizing wastes in a safe manner.

Separate the bottom of fabricated structures or liners from foundations consisting of bedrock with joints, fractures, or solution channels, by a minimum of one foot of low permeability soil [type III or IV as described in the National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook (AWMFH),Chapter 7 and Appendix 10D] or by an alternative that will achieve equal protection.

Additional Criteria for Liquid Waste Storage Impoundments

A liquid waste storage impoundment is a facility where the stored material does not consistently stack and is either a natural topographic depression, manmade excavation, or diked area formed primarily of earthen materials, such as soil (although the unit may be lined with manmade materials) .

Foundation
Locate the impoundment in soils with a permeability that meets all applicable regulations or line the impoundment with suitable material. Use liners which meet or exceed NRCS CPS Pond Sealing or Lining (Codes 520, 521, or 522). Earthen pond linings must have a permeability of 1x10-7 cm/sec or less, or a maximum allowable operational specific discharge of no more than 0.0028 ft/day. (NOTE: These rates may be reduced one order of magnitude due to manure sealing).

Perform subsurface investigations for all waste storage impoundments sufficient in detail and analysis to support the design in accordance with NRCS NEM, Part 531, Geology. Describe the soil material encountered, location of any seeps, depth-to-high-water table, depth to bedrock, and presence of sink holes in karst topography. Soil investigations must evaluate soils to a depth no less than 2 feet below the final grade of any excavation, except subsurface investigation in soils underlain by the Demopolis or Mooreville Chalk formations of the Selma Chalk group in the Blackland Prairie major land resource area may terminate at a depth of 1 foot below the surface of the chalk.

Information and guidance on controlling seepage from waste storage ponds can be found in the AWMFH,Chapter 7 and Appendix 10D.

For the design of a liner on a site located in a floodplain and other locations where there is potential for uplift, include an evaluation of all potential buoyant uplift forces on the liner. Limit projected uplift head under clay liners to a gradient of less than 0.5 ft/ft in the clay liner. The gradient is determined as the difference in total head between the top and the bottom of a clay liner when buoyant forces exist (such as when the floodplain is flooded) divided by the thickness of the clay liner.

Design Bottom Elevation
Locate the impoundment bottom elevation a minimum of 2 feet above the seasonal high water table unless special design features are incorporated that address buoyant forces, impoundment seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of drains to meet this requirement.

Outlet
An outlet that can automatically release stored material is not permitted except for septic tanks that feed a treatment system such as a waste treatment strip or leaching field or outlets leading to another storage facility with adequate capacity. Design a permanent outlet that will resist corrosion and plugging. Provide a backflow prevention measure for an outlet that pumps wastewater to secondary storage located at a higher elevations.

Multiple cells
When multiple cells are used, the volume of the initial cell(s) shall be, as a minimum, the sum of the manure, wastewater, and other wastes accumulated during the storage period plus the planned solids accumulation between cleanout events, plus 12 inches of emergency storage. Subsequent cells will have storage volumes determined in accordance with the operational needs of the facility plus at least 12 inches of emergency storage. All cells preceding the final cell will have overflow structures capable of passing the 25- year, 24-hour precipitation. Cells preceding the final cell do not require an auxiliary spillway. The final cell will have storage sufficient to contain the normal precipitation, 25-year, 24-hour storm precipitation from the previous cells and drainage area, plus 12 inches of emergency storage. The final cell will have an auxiliary spillway set at the elevation of the required storage. The spillway may be a pipe, concrete spillway, earthen spillway, or other structure capable of passing the 25-year, 24-hour storm runoff without overtopping the embankment, assuming water is at the auxiliary elevation at the time of the storm. The final cell will have a minimum of 12 inches of freeboard between the auxiliary spillway elevation and top of embankment.

Embankments
For an impoundment with greater than one acre of surface area and where wave action is a concern, increase the embankment height to account for calculated wave height. In all cases, increase the constructed embankment height by at least 5 percent to allow for settlement. Stabilize all embankments to prevent erosion or deterioration.

Minimum embankment top widths are shown in table 1. If the embankment top is to be used as a road, the minimum top width shall be 16 feet for one-way traffic and 26 feet for two-way traffic, and provisions shall be made for protecting the auxiliary spillway from damage. Design the combined side slopes of the settled embankment to be equal to or flatter than 5 horizontal to 1 vertical, with neither slope steeper than 2 horizontal to 1 vertical unless provisions are made for stability. The total embankment height is the difference in elevation between the settled top of the embankment and the lowest point in the cross section taken along the centerline of the embankment.

Table 1. Minimum Top Widths

Total embankment height (ft)	Top width (ft)
Less than 15	8
15–19.9	10
20–24.9	12
25–30	14
30–35	15

Embankment fill requirements, including placement methods and/or minimum density and moisture content of the fill material, will be in accordance with the design requirements for achieving the desired permeability and stability values. Fill placement and compaction requirements will be clearly stated in the specifications and/or on the drawings.

Spillway or Equivalent Protection

Embankment waste storage ponds having a maximum operating level against the embankment of 3 feet or more above natural ground shall be provided with an auxiliary spillway, overflow structure, or combination to protect the embankment from overtopping. The auxiliary spillway will be located at an elevation at or above the emergency volume elevation and at least one foot above the maximum operating level. The spillway may be a pipe, concrete spillway, earthen spillway, or other structure capable of passing the 25-year, 24-hour storm runoff without overtopping the embankment, assuming water is at the auxiliary elevation at the time of the storm Locate auxiliary spillways in undisturbed soil where possible and provide measures to insure the integrity of the spillway. Design pipe spillways that pass through the embankment in accordance with Alabama NRCS conservation practice standard, Pond, Code 378.

Excavations

Design excavated side slopes to meet the requirements of the liner used, see NRCS CPS Pond Sealing or Lining, Compacted Soil Treatment (Code 520), Pond Sealing or Lining, Flexible Membrane (Code 521a) or Pond Sealing or Lining, Concrete (Code 522), .

<u>Additional Criteria for Fabricated Structures</u>

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, (O&M) costs, and safety and environmental considerations.

Foundation

Based on subsurface investigation, provide a foundation for fabricated waste storage structures to safely support all superimposed loads without excessive movement or settlement. Perform subsurface investigations for all fabricated structures sufficient in detail and analysis to support the design in accordance with NRCS NEM, Part 531, Geology. Describe the soil material encountered, location of any seeps, depth to high water table, depth to bedrock, and presence of sink holes in karst topography.

Where a non-uniform foundation cannot be avoided or where applied loads may create highly variable foundation loads, calculate settlement based upon 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 are available, use presumptive bearing strength values for assessing actual bearing pressures obtained from Table 2 or another nationally recognized building code. In using presumptive bearing values, provide adequate detailing and articulation to avoid distressing movements in the structure.

For bedrock foundations with joints, fractures, or solution channels, separate the floor slab and the bedrock by:

- A minimum of 1 foot of soil.
- A liner that meets or exceeds NRCS CPS Pond Sealing or Lining (Codes 520, 521, or 522)).

- Other appropriate method or alternative that achieves equal protection.

Table 2. Presumptive Allowable Foundation and Lateral Pressure[1]

Class of materials	Allowable foundation pressure (psf)	Lateral bearing (psf/ft) below natural grade	Coefficient of friction	Cohesion (psf)
Crystalline bedrock	12,000	1,200	0.70	-
Sedimentary and foliated rock	4,000	400	0.35	-
Sandy gravel or gravel (GW and GP)	3,000	200	0.35	-
Sand, silty sand, clayey sand, silty gravel, clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	-
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	-	130

[1] International Building Code (IBC), 2015, International Code Council (ICC)

Structural Loadings
Design the waste storage structure to withstand all anticipated loads in accordance with the requirements in NRCS NEM, Part 536, Structural Engineering. Such loads should include internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, and water pressure due to seasonal high water table, frost or ice.

Calculate loading from lateral earth pressures using soil strength values determined from the results of appropriate soil tests and procedures described in Technical Release 210-74, Lateral Earth Pressures. Table 3 provides minimum lateral earth pressure values when soil strength tests are not available. If heavy equipment will operate near the wall, use an additional soil surcharge or an additional internal lateral pressure in the wall analysis as appropriate.

For the lateral load from stored waste not protected from precipitation, use a minimum 65 lb/ft2/ft of depth as the design internal lateral pressure. Use a minimum value of 60 lb/ft2/ft of depth for the lateral load from stored waste protected from precipitation and not likely to become saturated. Use a minimum internal lateral pressure of 72 lb/ft2/ft of depth for sand-laden manure storage if the percentage of sand exceeds 20%. Designers may use lesser values if supported by measurement of actual pressures of the waste to be stored.

Description of backfill material [c]	Unified soil classification	Design lateral soil load (lb/ft2/ft of depth) [a]	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-sand mixes	GC	45	60
Well-graded, clean sands; gravely sand mixes	SW	30	60
Sand-silt clay mix with plastic fines	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	CL-ML	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note [b]	Note [b]
Inorganic clayey silts, elastic silts	MH	Note [b]	Note [b]
Inorganic clays of high plasticity	CH	Note [b]	Note [b]
Organic clays and silty clays	OH	Note [b]	Note [b]

[1] Table 1610.1, Lateral Soil Load, International Building Code (IBC), 2015, International Code Council (ICC).

[a] Design loads based on moist conditions for the specified soils at optimum density. Include the weight of the buoyant soil plus hydrostatic pressure for submerged or saturated soil.

[b] Unsuitable as backfill material.

[c] Base the definition and classification of soil in accordance with ASTM D 2487.

Structural Design

Design structures with reinforced concrete, steel, wood, or masonry materials in accordance with NRCS-NEM, Part 536, Structural Engineering. Account for all items that will influence the performance of the structure, including loading assumptions, durability, serviceability, material properties and construction quality. Ensure that the material used for a fabricated structure is compatible with the waste product to be stored.

Tanks may be designed with or without a cover. Design openings in a covered tank to accommodate equipment for loading, agitating, and emptying. Equip these openings with fencing, grills or secure covers for safety, and for odor and vector control as necessary. Tanks or pits may be inside or outside of enclosed housing, or beneath slotted floors. Tanks shall be watertight or have their in-ground portion completely contained by a liner as described in the section “Liners” of this standard. ADEM requires that above-ground tanks have secondary containment structures and a leak detection and groundwater monitoring system installed under the facility.

Non-reinforced concrete slabs designed in accordance with ACI 330R will have welded wire fabric greater than or equal to 6 X 6-W 1.4 X W 1.4. The sole function of the welded wire fabric is to hold together the fracture faces if/when cracks form. Contraction joints will be spaced at maximum spacing of 10 feet for slabs up to 4.5 inches thick. Contraction joint spacing for thicker slabs will be determined by guidance contained in ACI 330R.

Sensitive Environmental Settings

Where liquid-storage is to be provided in sensitive environmental settings (i.e., tanks in areas with shallow wells in surface aquifers, high-risk karst topography, or other site-specific concerns), design the storage structure as a reinforced concrete hydraulic or environmental structure according to NRCS NEM, Part 536, Structural Engineering . Alternatively, use a flexible liner membrane, designed and constructed in accordance with standard engineering and industry practice, to provide secondary liquid containment for structures constructed with other methods described in NRCS NEM, Part 536, Structural Engineering .

Additional Criteria for Stacking Facilities

A stacking facility may be open, covered, or roofed and is used for wastes which behave primarily as solid. Determine the wall height using the anticipated stacking angle of the waste material. Construct a stacking facility of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. Design the stacking facility 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.

Seepage

Prevent leachate in amounts that would pollute surface or groundwater with collection and disposal of liquids in a safe manner as necessary. Prevent influent seepage in amounts that would infringe on designed storage capacity. Seepage control may not be necessary on sites that have a roof, waste material with little seepage potential or in certain climates.

Internal Drainage

Make provisions for drainage of leachate, including rainfall from the stacking area (especially those without a roof). Collect leachate in a tank or waste storage impoundment, or properly treat in a lagoon or vegetated treatment area.

Poultry Litter Stacking Facility

To reduce the potential for spontaneous combustion damage to wood walled facilities, design the height of the litter stack not to exceed 7 feet, with litter to wood contact limited to 5 feet.

CONSIDERATIONS

For exposed liners utilizing HDPE or similar materials that are slippery when wet, consider the use of textured liners or addition of features such as tire ladders that would allow for escape from the waste storage structure.

Consider solid/liquid separation of runoff or wastewater entering impoundments to minimize the frequency of accumulated solids removal and to facilitate pumping and application of the stored waste.

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

Since the economics and risks associated with waste storage facilities are quite high, consider providing the operator with the cost to close the facility. Cost should include removal of the planned sludge accumulation volume and the waste stored at the maximum operating volume.

Considerations for Siting

Consider the following factors in selecting a site for waste storage facilities:

- Proximity of the waste storage facility to the source of waste.
- Access to other facilities.
- Ease of loading and unloading waste.
- Compatibility with the existing landforms and vegetation, including building arrangement, to minimize odors and adverse impacts on visual resources.
- Adequate maneuvering space for operating, loading, and unloading equipment.

Consider siting the storage facility to meet the minimum distances shown in Table 4.

Table 4. Minimum Distance Requirement for Waste Storage Facilities

Public or Private Use Facilities	**Minimum Distance from Waste Storage Facility**
Any public use area or DCSHP [1/]	700 feet – liquid 330 feet – dry new 165 feet - dry expansion
Well, up-gradient	100 feet - dry 150 feet - liquid
Well, down-gradient	300 feet
Natural Water Courses and Lakes	200 feet
Milking Parlor	100 feet
Drainage Ditches	100 feet
Area specified by state or local ordinance	Greater of state or local distance or distance shown above

[1/] DCSHP: Non-owner existing occupied Dwelling, Church, School, Hospital, or Park

Considerations for Minimizing the Potential for and Impacts of Sudden Breach of Embankment or Accidental Release from the Waste Storage Facility

Consider 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 when any of the categories listed below might be significantly affected.

Potential impact categories from breach of embankment or accidental release include—

- Surface water bodies—perennial streams, lakes, wetlands, and estuaries.

- Critical habitat for threatened and endangered species.
- Riparian areas.
- Farmstead, or other areas of habitation.
- Off-farm property
- Historical and archaeological sites or structures that meet the eligibility criteria for listing in the National Register of Historical Places.

Consider the following either singly or in combination to minimize the potential of or the consequences of sudden breach of embankments:

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

Options to consider to minimize the potential for accidental release from the waste storage facility through gravity outlets include—

- Outlet gate locks or locked gate housing.
- Secondary containment.
- Alarm system.
- Another non-gravity means of emptying the waste storage facility.

Considerations for Minimizing the Potential of Waste Storage Pond Liner Failure

Avoid sites with categories listed below unless no reasonable alternative exists. Potential impact categories for liner failure are—

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

For a site with one or more of these site conditions, consider providing a leak detection system in conjunction with the planned liner to provide an additional measure of safety.

Considerations for Stacking Facilities

Internal seepage collection within a stacking facility can be 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. Use the design criteria for timber walls.

For any facility that is an organic producer or that sells manure to organic producers, consider using rot-resistant or treated lumber that meets the requirements for organic production. The producer should consult with the organic certifier as to the use and acceptability of treated lumber for waste storage.

Considerations for Improving Air Quality

Liquid manure storage may result in emissions of volatile organic compounds, ammonia, hydrogen sulfide, methane, nitrous oxide, and carbon dioxide. Solid manure storage may result in emissions of particulate matter, volatile organic compounds, ammonia, carbon dioxide, and nitrous oxide.

To reduce emissions of greenhouse gases, ammonia, volatile organic compounds, particulate matter and odor, other NRCS CPSs such as Anaerobic Digester (Code 366), Roofs and Covers (Code 367), Waste Treatment (Code 629), Amendments for Treatment of Agricultural Waste (Code 591), Composting Facility (Code 317), and Air Filtration and Scrubbing (Code 371) can be added to the waste management system.

Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility but may increase odor when waste is surface applied—see NRCS CPS Nutrient Management (Code 590).

Some fabric and organic covers have been shown to be effective in reducing odors.

Maintain appropriate manure moisture content for solid manure storage facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use. As a minimum, include the following in the engineering plans and specifications:

- Plan view of system layout.
- Structural details of all components, including reinforcing steel, type of materials, thickness, anchorage requirements, lift thickness.
- Requirements for mechanical components supplied by others (pumps, etc.).
- Locations, sizes, and type of pipelines and appurtenances.
- Requirements for foundation preparation and treatment.
- Construction specifications.
- Soil and foundation information pertinent to construction.
- Vegetative requirements.
- Quantities.
- Approximate location of utilities and notification requirements.
- CBMPP if one is needed.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design, including the type and number of animals the structure is designed to serve.

The O&M plan shall contain the operational requirements for emptying the storage facility. It shall include maximum operating levels of the waste storage facility, clean-out intervals, operation requirements of structural components, etc. The O&M plan shall include the requirement that waste shall be removed from storage and utilized in locations, times, rates, and volumes in accordance with the overall waste management system plan. Include a reference to the Nutrient Management Plan and Alabama NRCS conservation practice standard Nutrient Management, Code 590, for requirements related to keeping records of waste application.

For impoundments and other liquid storages include an explanation of the staff gauge or other permanent marker to indicate the maximum operating level. For storages where the contents are not visible and a staff gauge would not be visible, such as below a slatted floor, identify the method for the operator to measure the depth of accumulated waste.

Include a provision for emergency removal and disposition of liquid waste in the event of an unusual storm event that may cause the waste storage structure to fill to capacity prematurely.

Include instructions as needed for ventilating confined spaces according to ASABE Standard S607, Venting Manure Storages to Reduce Entry Risk.

Develop an emergency action plan for waste storage facilities where there is a potential for significant impact from breach or accidental release. Include site-specific provisions for emergency actions that will minimize these impacts.

Include a description of the routine inspection and maintenance needed for each component of the facility. Also include provisions for maintenance that may be needed as a result of waste removal or material deterioration.

REFERENCES

ACI 330R

ADEM Administrative Code, Chapter 335-6-7, as amended

American Society for Testing and Materials. Annual Book of ASTM Standards. Standards D 653, D 698, D 1760, D 2488. ASTM, Philadelphia, PA.

ASABE Standard S607 and EP470+

EPA CAFO Final Rule, 40 CFR Parts 9, 122,123,412

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USDA NRCS. 1992. Agricultural Waste Management Field Handbook. USDA-NRCS, Washington, DC.

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USDA Soil Conservation Service. 1989. Technical Release Number 74, Lateral Earth Pressures, USDA-SCS, Washington, DC.