Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WASTE TRANSFER

CODE 634

(no)

DEFINITION

A system using structures, pipes or conduits installed to convey wastes or waste byproducts from the agricultural production site to storage/treatment or application.

PURPOSE

To transfer agricultural waste material associated with production, processing, and harvesting to:

- A storage facility
- A treatment facility
- A handling or loading area
- Agricultural land for agronomic application

CONDITIONS WHERE PRACTICE APPLIES

The transfer component is part of a comprehensive nutrient management plan or planned agricultural waste management system.

The waste transfer system is included as an element of the agricultural production area, storage/treatment facility and/or land application areas of the agricultural operation.

The practice applies where it is necessary to transfer waste material generated by livestock production or agricultural product processing from:

- The generation site to the application area,
- The generation site to a storage/treatment facility,
- The storage/treatment facility to land for agronomic application.

This practice does not apply to hauling waste material with equipment or vehicles. Criteria for land application of manure are included in NRCS conservation practice standard, Nutrient Management (590).

CRITERIA

General Criteria Applicable to All Purposes

Waste transfer components shall be planned, designed, and installed to meet all federal, state, local, and tribal laws and regulations.

Structures

Structures including concrete pits, tanks, hoppers, manholes, and channels used for waste transfer, prefabricated or cast in place, must meet the criteria in NRCS conservation practice standard, Waste Storage Facility (313) for concrete and structural strength, regardless of materials used for construction.

Design all structures, including those that provide a work area around pumps to withstand the design static and dynamic loading. Design structures to withstand earth and hydrostatic loading as specified for comparable structural criteria in NRCS CPS Waste Storage Facility (313).

In locating structures, utilize existing topography to the greatest extent possible to generate head on effluent flow and reduce pumping requirements.

Size reception pits (areas established to temporarily accumulate effluent flow) to contain a minimum volume of one full day's waste production. Provide additional storage for reception pits receiving stormwater runoff to contain the volume of precipitation and runoff from the 25-year, 24-hour storm plus any required freeboard and emergency storage.

Reducing a reception pit design volume by flood routing the design storm runoff storage may be used only when there is dependable back-up power supply for pumps and where no impact to surface water can occur, should the reception pit pump fail.

Where a pump station is needed for transition of direction or lift in elevation, and no additional flow will be added to the pipe at that station, size the pump station to accommodate the peak flow, taking into account the designed outflow.

Reception pits shall be installed above the water table where practicable. When it is necessary to install a reception pit within the water table, the reception pit shall be designed with a factor of safety of at least 1.2 for buoyant forces and shall meet all other requirements for a fabricated structure as defined in NRCS conservation practice standard, Waste Storage Facility (313).

Design floor openings to structures that receive manure from alley scrape collection, with a minimum of 9 square feet, having one dimension of that opening 4 feet or larger. Equip floor grate with openings wide enough to pass the waste and engineered to support the anticipated live loads. Provide safety features to prevent accidental entry to the waste reception pit.

Construct curbs in conjunction with structures that meet the purpose of this standard and design criteria in NRCS, conservation practice standard, Waste Storage Facility (313). Design curbs to be anchored to withstand working loads. Construct curbs of sufficient height to ensure all waste flows into the transfer structure.

Pipelines/Conduits-General

Design transfer pipeline/conduits in accordance with sound engineering principles, taking into account the waste material properties, management operations, pipe exposure, static and dynamic loads on the pipe, working pressure, transfer system pressure rating, required capacity and all applicable design factors. Pipe pressure rating required may need adjustment based on effluent temperatures and consistency.

Use water tight or sewer grade pipelines and connection devices for waste transfer pipelines. The type of liquid waste material and total solids content will determine the transfer pipe designs to convey the required flow without plugging.

The minimum pipeline/conduit design capacity from collection facilities to a storage/treatment facility is the maximum anticipated peak flow.

Design the pipeline capacity from the storage/treatment facility to the land application area, to empty the facility within the time as outlined in NRCS, Nutrient Management Plan or a Comprehensive Nutrient Management Plan (CNMP).

Pipelines used for transferring materials to an irrigation system shall meet the requirements of NRCS conservation practice standard, Irrigation Pipeline (430).

Protect pipes exposed to sunlight from ultraviolet radiation by selecting UV resistant pipe materials or by painting the pipe exterior to withstand UV damage throughout the intended life of the pipe.

Install pipe properly at all locations to accommodate any traffic crossing, farming operations, frost depth, subsurface saturation, or bedrock elevations. Protect pipe from uplift if subjected to hydrostatic forces.

Provide thrust control designed in accordance with National Engineering Handbook (NEH) Part 636, Chapter 52 for all buried pressure pipe 4 inches and larger in diameter and all angled fittings and valves.

Maintain the integrity of a wall or liner at pipe penetrations of waste storage structures, reception tanks, and channels. The section of pipe that penetrates the liner of a waste storage facility wall will have a minimum length of 10 feet and will be supported with a cast-in-place concrete restraint. Provide a mechanical joint restraint, concrete thrust block or concrete restraint for all joints within 25 feet of the waste storage facility wall (measured along the length of the pipe). Protect storage structure liners from hydrostatic pressures that may be caused by preferential flow paths along installed pipe.

If cold weather pipeline operation is planned, design transfer pipe to be: insulated, heated, buried below anticipated frost depth, constructed of freeze resistant material, or installed such that it can be drained after each use by gravity or compressed air.

Provide clean-out access for all pipelines transferring waste material to allow for removal of settled solids or obstructions. For transferring waste to storage/treatment facilities, space clean-outs for pipelines at a maximum interval of 150 feet along the pipe length, or a maximum interval of 300 feet along the pipe length if bi- directional clean-outs are used. For pipes that are transferring low solid content wastewater to cropland for application, incorporate a method to clean plugged pipes into the design.

Install pipelines with appropriate backflow prevention devices to prevent return siphoning of waste.

Install air vents and vacuum relief valves where necessary to eliminate air locks, as well as to protect the pipe against negative pressures.

Pipelines-Pressure
Select pipe and appurtenance material that meets the design working pressure criteria of the system which also includes air and water pressures used to clear the pipe.

The pipeline working pressure must not exceed 72% of the pipe rating.

For a pumped system use design velocities between 3 to 6 feet per second. Limit the waste stream velocity to 5 feet per second or less if transfer pipe is not buried or tightly secured. Fluid velocities in a buried or secured pipelines may exceed 5 feet per second only if the pipeline is installed without gates or valves, and discharges freely to a tank or pond.

The 3 feet per second lower limit does not apply to a system that is powered by a pump such as a ram plunger or piston type pump that operates by pushing semi-solid waste material in a periodic stroke cycle.

Install a check valve near the outlet of each pump except where backflow is incorporated into the design.

Provide a pressure relief valve near the pump(s) to protect the pipe against any pump shut-off head due to a blockage (unless the pump shut- off head is less than the working pressure of the transfer system).

Provide a pressure relief valve or properly sized water hammer arrestor on the pressure side of shut-off valves to protect against water hammer due to the sudden closing of a valve.

Size pressure relief valves to be no smaller than ¼-inch for each inch of the pipe diameter. Set pressure relief valves to open at a pressure no greater than 5 psi above the transfer system working pressure.

Pipeline-Gravity
In a gravity flow pipe system, a minimum head is required, depending upon the consistency of the material.

Minimum feet of hydraulic head - consistency

4 feet - heavily bedded undiluted manure

2 feet - slurry or semi-liquid manure

<1 foot - liquids and 1:1 dilute liquid manure

Gravity pipes outletting into a waste storage facility, head is measured from the inlet invert of the pipe to the maximum operation level elevation in the storage facility.

Gravity discharge pipes used for emptying a storage/treatment facility shall have a minimum of two gates or valves, one of which shall be manually operated in-line valve as close to the storage facility as practical. If an automatic valve is used for a gravity loading or transfer system on the pipeline, the automatic valve will be in addition to the manually operated in-line valve.

For a dilute manure gravity pipeline over 100 feet in length increase minimum feet of head by an additional 1% of the transfer pipe length exceeding 100 feet. Ensure that the design flow velocity is at least 3 feet per second.

Convey waste into and through the pipeline to minimize ponding in the production area. Design the gravity pipe to follow as direct a route as possible. Horizontal curves or bends in the pipe joints of a gravity pipeline require special design considerations except for minor deflections of less than 10 degrees.

Gravity Pipelines for Bedded Manure
Minimum diameter of gravity pipe is 24 inches for heavily bedded high solids content manure. The pipe grade shall not exceed five-percent (5 percent).

Gravity Pipelines for Non-Bedded Manure
The minimum diameter shall be 6 inches with a minimum of one-percent (1 percent) grade. Pipes for non-bedded manure shall enter at least 3 feet above the pond or structure bottom. A clean-out shall be installed for pipes entering below the design bottom elevation.

In a gravity flow design that transfers diluted sand laden manure, account for the process of sand settling out of the waste stream. See section; “CONSIDERATIONS Transfer Operations”. The minimum gravity pipe flow velocity for dilute manure with sand is 5 feet per second.

Other Conduits
The minimum design velocity for waste transfer in open ditches and channels is 1.5 feet per second.

A reinforced cast-in-place concrete lined ditch or channel for waste transfer will have a minimum concrete thickness of 5 inches.

Concrete used for conduits must be proportioned so that it is plastic enough for thorough consolidation and stiff enough to stay in place. A dense durable product is required.

Contraction joints in a concrete conduit, if required, must be formed transversely to a depth of about one-third the thickness of the lining at a uniform spacing in the range of 8 to 15 feet. Provide steel reinforcement or other uniform support to the joint to prevent unequal settlement.

Pumps
Use the NRCS conservation practice standard, Pumping Plant (533) for a waste transfer pump where needed.

Select the pump to transfer the waste material at the system pressure head and volume (rate) required. The type of pump will be determined by the consistency of the material and the type of solids. Use pump manufacturer’s recommendations for the installation requirements.

Correct the total dynamic head for viscosity and specific gravity of the liquid waste used in pump selection. Reference AWMFH, Chapter 11, Waste Utilization, for increased friction losses caused by higher fluid viscosity and Chapter 12, Waste Management Equipment, for pump selection guidance.

Solid/liquid waste separation
Use NRCS conservation practice standard, Waste Separation Facility (632) to design a filtration or screening device, settling tank, settling basin, or settling channel to separate a portion of the solids from the manure or liquid waste stream, as needed.

Safety
The system design shall address the safety of humans and animals during construction and operation.

Open structures shall be provided with covers or barriers such as gates, fences, etc.

Include ventilation provisions for an enclosed structure. Provide warning signs as necessary to warn of the danger of entry and to reduce the risk of explosion, poisoning, or asphyxiation possible with the waste transfer system.

Include a water-sealed trap and vent or similar devices where necessary to control gases from a pipeline entering an enclosed building or reception pit.

Prevent tractors and other equipment from slipping into waste collection, storage, or treatment facilities by placing barriers on push- off ramps.

Provide covers or barriers, such as gates, fences, grates, etc., across openings to a manure storage structure.

Identify pipe at risk to being damaged by equipment or livestock by placing fences or markers along the pipeline.

Provide a secure cover or otherwise restrict access to any manually operated in-line valves of a discharge pipe from a waste storage structure to prevent unauthorized release of effluent.

Permits
Landowner and/or contractor are responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures. The landowner is also required to obtain all necessary permits for project installation prior to construction.

Temporary Storage, Headland Stacking, or Stockpiling of Solid Manure
Solid manure may be temporarily stored in cropland intended for final utilization only under the following conditions:

1. The temporary storage is included as part of a Comprehensive Nutrient Management Plan or Nutrient Management Plan. The plan will identify locations and sizes of temporary storage, nitrate leaching index at the planned locations, and planned quantity of manure to be temporarily stored.
2. Records are maintained documenting temporary storage field identification, transfer date to temporary storage location, end date of temporary storage or dates of application to cropland, quantity of manure temporarily stored, and date of vegetation re-establishment.
3. The manure is handled as a solid. It has bedding such as straw or other materials that binds it so it can be stacked and handled with loaders.
4. The temporary storage period does not exceed:
   - 20 calendar days for locations where the nitrogen leaching index is high, or
   - 90 calendar days where the nitrogen leaching index is medium or low.
5. The Bray P1 soil test level in the agricultural land at the planned temporary storage location prior to use as temporary storage is less than 300 lb/ac (150 ppm).

6. The manure quantity temporarily stored does not exceed the nutrient needs as identified in the nutrient management plan for the cropland where it will be utilized.
7. The land slope in the temporary storage location is 3 percent or flatter.
8. No subsurface or surface drainage systems are located within 20 feet of the temporary storage location.
9. The bedrock at the temporary storage location is at least 2 feet below the soil surface. Avoid temporary storage in known karst areas.
10. The bottom elevation of the temporary storage location is at least 2 feet above the seasonal high water table as defined in Web Soil Survey for the soil series at the temporary storage location.
11. The temporary storage location is outside any areas where runoff concentrates and/or ponds.
12. The temporary storage location is at least 150 feet from any natural or constructed water course.
13. The temporary storage location is outside the 25 year floodplain or flooding area.
14. The temporary storage location is at least 50 feet from property lines where the adjoining property is not owned or leased by the farm operation utilizing the manure.
15. The temporary storage location is at least 500 feet from a residence not owned by the titleholder and/or lessee of the cropland, a commercial enterprise, a bona fide religious institution, an educational institution, or a public use area.
16. The temporary storage location is at least 400 feet from any private well and at least 800 feet from any Type IIb and III Public well.
17. The temporarily stored manure is piled as high as practicable with available equipment and is shaped in a conical manner (cross section view) that creates a distinct peak in order to shed as much water as possible.
18. Manure at the temporary storage location is removed to the fullest extent practicable. Any remaining residual manure is incorporated into the soil as part of vegetation re-establishment.
19. After removal and utilization of the manure, vegetative cover is re-established at the temporary storage location either through a crop or grass planting. Tillage prior to establishment is required to redistribute nutrients and salts that will affect establishment.

CONSIDERATIONS

General

Consider the potential effects of installation and operation of waste transfer components on the cultural, archeological, historic, and economic resources.

Consider economics (including design life), overall nutrient management system plans, and health and safety factors.

Consider the timing and location of agitation and transfer activities to minimize odor formation and the breeding of insects within the material.

Consider covering and/or minimizing the amount or number of times the material is disturbed to reduce the likelihood of air emissions formation and release of particulate matter, volatile organic compounds, methane, and ammonia.

Consider abandonment, relocation, or additional flood proofing for existing reception structures located in flood prone areas. For additional information on flood proofing structures, see “Flood proofing Non-Residential Structures,” FEMA 102, May 1986, Federal Emergency Management Agency.

Transfer Operations

Consider installation of permanent above-ground or buried pipe to replace hoses and temporary pipe that is used on a regular basis to transfer waste.

Consider potential loss of loss of pipe integrity due to internal erosion by the materials being transported for a flow velocity exceeding 6 feet per second.

Consider designing the maximum flow area of a gravity pipe, for a flume system with dilute manure, at 50% of the pipe depth to maintain the scouring effect of the flow.

Positive displacement pumps should be considered for liquid waste with total solids exceeding 8%.

Consider increasing the total dynamic head up to 30% for pumping manure slurries with 3-8% total solids (wet basis).

Consider the use of a wet sump and agitation pump to reduce solids separation within the gravity reception structure.

Consider pump selection with a low RPM for manure slurries which contain abrasives such as sand.

Consider a semi-open impeller pump to handle manure slurry with straw, twine, hair and sludge. Pumps with cutting knives and re-circulation agitation capacity also reduce plugging.

Consider installing a clean-out or vent riser within 10 feet of the reception structure on gravity transfer systems in order to reduce the risk of air lock in the pipe.

Consider using pre-manufactured manholes as risers at stations to change direction for needed transitions.

Consider the operating space requirements of loading and unloading of equipment in the vicinity of the transfer components.

When applicable and compatible, consider the dual use of waste transfer pipelines for irrigation water delivery and the irrigation system design requirements.

Consider installing a locator wire in the trench with transfer pipelines.

Chemistry of waste material may need consideration for corrosion resistance and water tightness in the selection of pipe material and joints.

Consider the potential for struvite phosphate (magnesium ammonium phosphate), mineral deposition in smaller diameter pipes. Preventative measures may be needed, such as acid washing the pipe to prevent deposits.

Consider the need for additional check valves, clean-outs, vent risers, knife valves, anti-siphon protection, vacuum relief valvesand open air breaks, as appropriate, on all transfer pipe systems.

Consider the use of leak detection methods and equipment for monitoring and periodic pressure testing of waste transfer systems installed in sensitive areas, having large daily flow volumes, long flow lengths or high flow pressures.

Consider installing a manually operated shut off valve for isolation purposes for gravity discharge pipe used for transferring waste from one structure to another.

Consider posting a warning sign on all risers indicating the transfer system pressure rating.

Consider provisions for removing solids from conveyance conduits such as concrete lined channels, etc.

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.

Support data documentation requirements for Temporary Storage, Headland Stacking, or Stockpiling of Solid Manure are as follows:

- Comprehensive Nutrient Management Plan or Nutrient Management Plan for the cropland where the temporarily stored manure will be utilized and the quantity of manure to be temporarily stored.
- Map showing planned location(s) of temporary storage
- Soils inventory data including soil type, slope percent, karst areas, and nitrogen leaching index at the planned location(s) of temporary storage
- Web Soil Survey documentation of the seasonal high water table depth from surface at planned location(s) of temporary storage.

Support data documentation requirements for all other waste transfer are as follows:

- Inventory and evaluation records
    - Assistance notes or special report
- Survey notes, where applicable
    - Design survey
    - Construction layout survey
    - Construction check survey
- Design records
    - Physical data, functional requirements, and site constraints, where applicable
    - Details and specifications of all structures to ensure that the project can be properly constructed.
    - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
    - Location map
    - “Designed by” and “Checked by” names or initials
    - Approval signature
    - Job class designation
    - Initials from preconstruction conference
    - As-built notes
- Construction inspection records
    - Assistance notes or separate inspection records
    - NRCS acceptance requires pressure testing of a pressure pipe system prior to waste transfer service. Include the test protocol and results in the as-built documentation.
    - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

Biosecurity

Handle waste products according to the state veterinarian or Michigan Depart of Agriculture guidance on biosecurity for animal waste material.

Sanitize equipment leaving the farm as appropriate to prevent the spread of disease.

REFERENCES

NRCS National Engineering Handbook, Title 210, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Agricultural Waste Management System Component Design.

NRCS National Engineering Handbook, Title 210, Part 651, Agricultural Waste Management Field Handbook, Chapter 11, Waste Utilization

NRCS National Engineering Handbook, Title 210, Part 651, Agricultural Waste Management Field Handbook, Chapter 12, Waste Management Equipment

NRCS National Engineering Manual, Title 210, Part 536.20, Design Criteria for Reinforced Concrete

NRCS National Engineering Handbook, Title 210, part 642, Chapter 2, National Standard Construction Specifications

NRCS National Engineering Handbook, Title 210, Part 642, Chapter 3, National Standard Material Specifications.