**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 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

### General Criteria Applicable to All Purposes

**Permits.** Notify landowner and/or contractor of 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.

**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 (CPS) *Waste Storage Facility* (Code 313) for liquid tightness 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* (Code 313).

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

Investigate the subsurface conditions (i.e., depth to bedrock, soil classification, water table, etc.) when locating and designing structures.

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.

Where an intermediate station along a pipeline 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 direction transition station or lift station to accommodate the peak flow, taking into account the designed outflow.

Design floor openings with 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 CPS *Waste Storage Facility* (Code 313). Design curbs to be anchored to withstand working loads. Construct curbs of sufficient height to ensure all waste flows into the transfer structure.

Use the NRCS CPS *Roofs and Covers* (Code 367) to design covers where needed for structures.

**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 CPS *Nutrient Management* (Code 590) or a Comprehensive Nutrient Management Plan (CNMP).

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. Separate pipe installed near bedrock with at least 6 inches of bedding. Excavation of bedrock is acceptable to provide bedding depth.

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

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.

Minimum diameter of gravity pipe is 24 inches for heavily bedded high solids content manure.

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.

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

For a pipeline designed to gravity discharge liquid waste from a waste storage or treatment facility, install a 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.

**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 CPS *Pumping Plant* (Code 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 CPS *Waste Separation Facility* (Code 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**. 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.

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.

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.

## CONSIDERATIONS

**General**. 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 floodproofing for *existing reception structures* located in flood prone areas. For additional information on floodproofing structures, see "Floodproofing 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.

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 valves and 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.

For solid waste material only, exported off-farm, consider NRCS CPS *Waste Recycling* (Code 633).

## PLANS AND SPECIFICATIONS

Prepare plans and specifications for constructing a waste transfer system that describe the requirements for applying this practice to achieve its intended use.

Construction plans and specifications must include a location map, plan view, profiles, cross sections, details and specifications of all structures, etc., to ensure that the project can be properly constructed.

Pipeline construction and installation specifications may be taken from the National Engineering Handbook sections listed in the References.

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.

## OPERATION AND MAINTENANCE

Prepare an O&M Plan for review with the landowner or operator responsible for the application of this practice. Provide specific instructions in the O&M Plan for proper operation and maintenance of each component of this practice and any detail needed for the level of repairs to maintain the effectiveness over the useful life of the practice.

Evaluate the overall functionality of the waste transfer system for possible malfunctions that could lead to a spill or release of waste material. Address the identified potential failures in the inspection procedures of the operation and maintenance plan. Prepare an emergency response plan to be implemented in the event of such a failure**.**

For the purpose of land application, adequately agitate liquid or slurry waste material prior to transfer.

Flush pipelines used for transferring waste material with clean water after use, to reduce the risk of gas build up and pipeline explosion.

Make provisions for removing solids from conveyance conduits such as concrete lined ditches, grates, etc., during management operations.

**Biosecurity**. Handle waste products according to the state veterinarian 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.