Annual Manure Removal and Methods

Probably the single most important requirement in operating and maintaining a manure storage facility is to ensure that the facility does not overflow or discharge. Discharges from manure storage facilities may violate local, state, or federal regulations, result in large fines or penalties, and at the very least, represent a potential environmental hazard. Manure removal from storage according to the storage period selected is the most critical activity in preventing discharge. Many discharge problems have occurred because producers were unable to manage the activities necessary to remove manure from storage in a timely manner.

To prevent overflow and possible pollution problems, manure must be removed from any storage in a timely fashion.

Solid manure

Solid manure is usually removed from storage using front-end loaders, scrapers, or other bulk handling equipment. The size of this equipment influences the time required to load hauling equipment. Hauling equipment includes truck-mounted beater; flail or spinner-type spreader boxes; and pull-type spreaders. The size or volume of the hauling equipment used influences the number of trips required to empty manure storage facilities. The hauling distance determines the time necessary to complete a trip.

EXAMPLE 24-1

Using data in Problem 4, Lesson 21, estimate the number of trips required and total time required to haul and spread the broiler litter. Assume two spreader trucks capable of hauling 6-ton loads will have an average round-trip time (including loading and unloading) of 45 minutes.

From Problem 4, Lesson 21, litter volume is 25,872 ft^3. Assume a litter density of 33 lb/ft^3.

25,872 ft^3 x 33 lb/ft^3/2,000 lb/ton = 427 tons of litter
427 tons/6 tons/load = 71 loads, so each truck will have to make about 35 trips.

35 trips x 0.75 hrs/trip = 26 hrs, so each truck will have a total hauling time of 26 hours.

If the hauling operation is conducted in 10-hour days, 2.5 to 3 days will be required with two, full-time operators.

Slurry manure

Slurry manure should be agitated before and during pumping of the manure from storage. Agitation equipment should be selected to provide sufficient homogenization of the slurry within an acceptable time. Agitation is usually begun several hours before hauling and continued during the hauling operation. Heavy-duty chopper pumps are usually used to load slurry hauling equipment. Hauling equipment includes conventional tank wagons and some box-type spreaders designed to haul slurry. The flow rate capability of the loading pump determines the time required to load, and the size or volume of the hauling equipment determines the number of trips that must be made. Hauling distance is an important factor in total trip time.

Umbilical or "drag-hose" systems are also used in spreading slurry manure. This method offers the advantage of continuous flow, and the slurry manure is injected or incorporated into the soil during spreading. Emptying time with this method depends primarily on the pumping rate through the drag hose. The use of a flow meter is recommended with these systems to ensure that manure is applied at the proper rate.

Slurry manure may be handled in batches by tank-wagons or as a continuous flow operation using drag hose systems.

EXAMPLE 24-2

Using data in Problem 5, Lesson 21, estimate the number of trips and total time required to empty the slurry tank. Assume tank wagon volume is 6,000 gallons, and round-trip time (including loading and unloading) is 45 minutes. Compare to the time required to empty the storage with a drag-hose system operating with a flow rate of 600 gal/min.

Storage volume = 192,168 ft^3 x 7.48 gal/ft^3 = 1,437,417 gallons
1,437,417 gallons/6,000 gallons/trip = 240 trips
240 trips x 0.75 hrs/trip = 180 hours

Thus, about 18, ten-hour days would be required to haul manure from the slurry tank with the tankwagon. Pumping time with the drag-hose system is calculated as follows:

1,437,417 gallons/(600 gal/min x 60 min/hr) = 40 hours

About 40 hours of pumping time would be required to empty the storage at a flow rate of 600 gal/min with the drag-hose system. Additional time would be required to lay out mainline and drag hoses and to move this equipment from field to field.

Lagoon

Lagoons may or may not be agitated. If they are not agitated, considerable nutrient buildup in the sludge will occur and will be a factor when sludge is agitated and removed. Lagoon effluent is usually removed by pumping equipment that may be similar to irrigation equipment. Hand carry, solid set, stationary big gun, traveling gun, and center pivot equipment have all been used to land apply lagoon effluent. Drag-hose systems are also sometimes used to apply lagoon effluent. The pumping flow rate of the system is the primary determining factor in the time required to pump down a lagoon.

For management, large effluent volumes associated with lagoon systems require pumping rather than hauling equipment.

EXAMPLE 24-3

Estimate the time required to pump down the lagoon in Problem 6, Lesson 21. Assume a pumping flow rate of 500 gal/min. Assume the lagoon will not be agitated (sludge volume will not be removed). Volume to be pumped includes manure/bedding; lot runoff; runoff from the 25-yr, 24-hr storm; wash water; and the added depth on the lagoon for rainfall/evaporation and the 25-yr, 24-hr storm.

Summing the appropriate volumes:
199,290 + 59,284 + 27,780 + 146,390 = 432,744 ft^3

Estimate the volume of the added 0.5-foot depth of the 25-yr, 24-hr storm by multiplying by the area of the lagoon.
500 ft x 250 ft x 0.5 ft = 62,500 ft^3

Total volume to pump = 432,744 + 62,500 = 495,244 ft^3
495,244 ft^3 x 7.48 gal/ft^3/(500 gal/min x 60 min/hr) = 123 hours

About 12, ten-hour days (actual pumping time) would be required to pump the lagoon. Additional time would be required to lay pipe and set up travel lanes, depending on the equipment used.