Pit Recharge
Manure Management System

Livestock Industry Facilities & Environment

A pit recharge system is a manure management system in which a pit is periodically drained by gravity to a lagoon, and then recharged with a new liquid, usually recycled lagoon water. The theory behind recharging is that the addition of water to the pit on a regular basis will keep most manure solids in suspension, making them more easily removed the next time the pit is drained.

A major benefit of using the pit recharge system is to provide better air quality inside livestock buildings for operators and animals, and to minimize deterioration of equipment. The pit recharge system offers the same advantages as does pit flushing; however, it is less expensive and easier to adapt to existing deep pit systems under confinement buildings than a flushing system.

Installation

Figure 1 shows a recommended layout for plumbing in the recharge and drain lines. A lateral pipe to supply liquids is installed in each pit wall, preferably opposite the drain outlet. The lateral pipe can either be stubbed from an underground main directly into the pit wall with a conveniently located and protected butterfly valve, or it can enter the building wall near the ceiling level and drop down into the pit. In Iowa, where freezing conditions can be a problem, the lateral pipe should enter the building from underground. Do not reduce the diameter of the lateral pipe between the main line and the outlet.

The discharge point of the lateral pipe should be located between the slotted floor and the maximum liquid level of the pit, as shown in Figure 2. Many older buildings were constructed with a

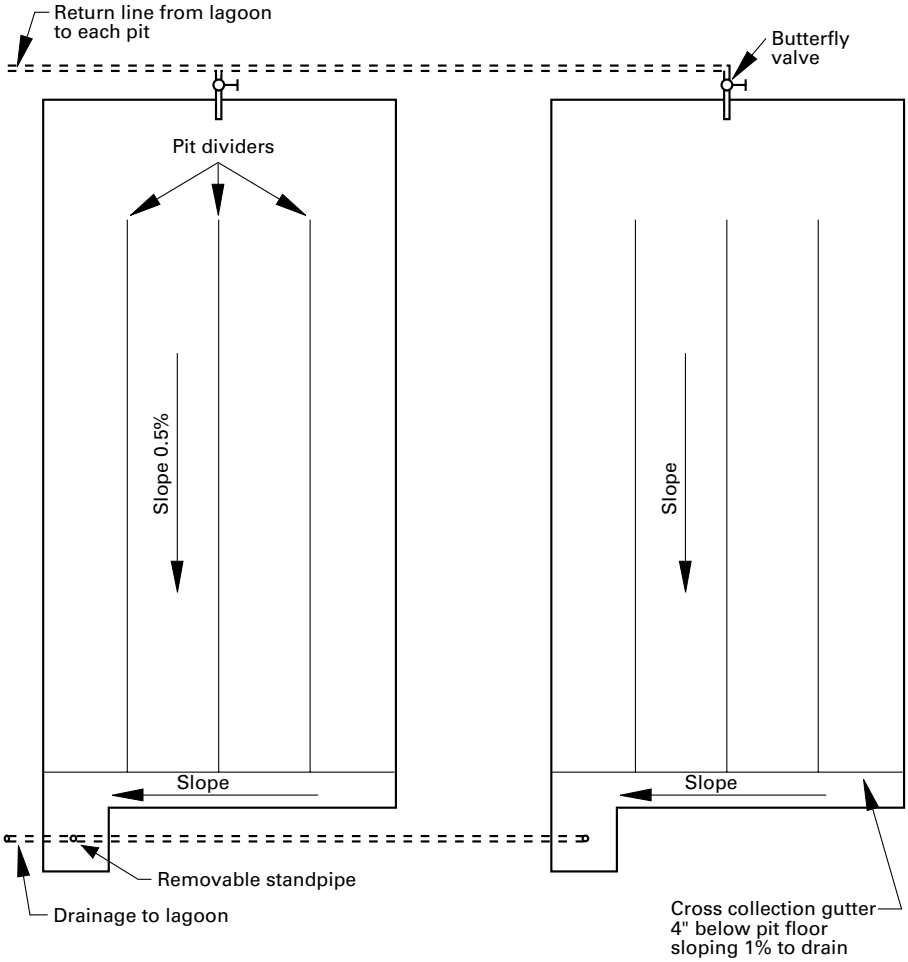

Figure 1. Layout for the swine finishing floor of a pit recharge system

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minimum pit slope of about 1 inch in 20 feet to overcome uneven concrete construction. If the entire pit floor is sloped, the pit must be deep enough so that when it is recharged, the upper end of the pit floor is still covered by at least 3-6 inches of liquid. A general rule is to allow for an average depth of 12 inches for recharge liquid and an additional 12 inches for accumulated manure and spilled water between pit draining. At least another 12 inches should be provided between the maximum level of the pit liquid and the slotted floor.

Whether the pit is recharged with fresh water or recycled lagoon water, enough capacity from the liquid supply source should be available to recharge the pit in a relatively short period of time. Provide enough capacity to put 12 inches of liquid into the pit within 4 hours.

An example

Suppose that you wanted to know the pump capacity needed to recharge a pit that is 16 feet wide and 160 feet long under a swine finishing building. You would need to know the surface area of the pit to determine the volume of liquid needed for recharging. Then you could determine the size of pump needed to pump that volume within 4 hours.

1. Determine surface area of the pit.

Pit surface area (ft^2) = Width (feet) × Length (feet)
= 16 feet × 160 feet
= 2,560 ft^2

2. Determine the liquid volume needed to recharge the pit, a depth of 1 foot. (Assume that one gallon is 7.5 cubic feet.)

Liquid volume = Pit surface area (ft^2) × Desired depth (feet) × 7.5 gallons/ft^3
= 2,560 ft^2 × 1 foot × 7.5 gallons/ft^3
= 19,200 gallons

3. Determine the size of the pump (usually rated at gallons per minute, or gpm) that can pump this volume within 4 hours.

Pump capacity = Liquid volume/4 hours/60 minutes/hour (to get gpm rate)
= 19,200 gallons/4 hours/60
= 80 gpm

Therefore, to effectively recharge a 16 × 160-foot underfloor pit, you would need an 80 gpm pump to handle the amount of water needed for recharging within a 4-hour period.

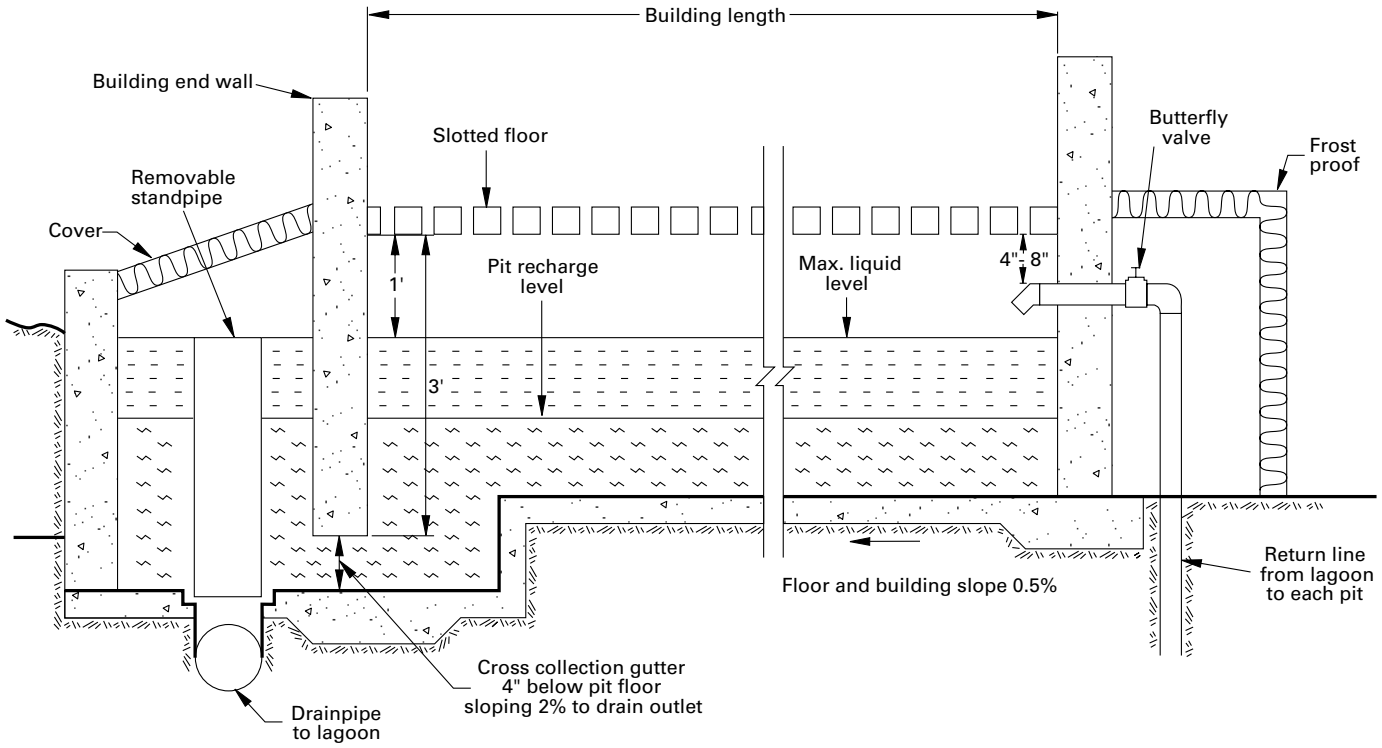

Figure 2. Cross-section of a pit recharge system

Figure 2 shows pit drain details for this example. The most desired plumbing system would be an outlet enclosed by a removable standpipe and connected to an underground drain line. A smooth-walled drainpipe at least 8 inches in diameter is sufficient for draining one pit; however, a 10-inch diameter pipe is needed when the entire building is drained. The drain line should be on at least a 1 percent grade to the lagoon.

Recharge frequency

Pits drained and recharged frequently will have more manure solids removed than less frequently drained and recharged pits. This reduces the potential for generation of manure gases, which can be both a nuisance and safety hazard. Studies have shown that manure must be removed from the livestock building at least every 5-7 days to minimize odor and gas levels.

Recharge liquid quality

Although fresh water can be used to recharge a pit, recycled water from anaerobic lagoons for livestock manure management is more practical. Lagoons must be large enough to produce an adequate amount of high quality water needed to recharge a pit. The use of inadequately treated lagoon water to recharge a pit can threaten air quality in livestock buildings rather than improve it by contributing to the generation of manure gases.

Lagoons must be sized and managed properly to use lagoon water in pit recharge systems. More information about lagoon sizing and operation can be found in another publication in the LIFE series, *Design and Management of Anaerobic Lagoons in Iowa for Animal Manure Storage and Treatment,* Pm-1590. This publication is available at any Iowa State University Extension office.

References

Barker, J. C. and L. B. Driggers. (1985) "Pit Recharge System for Managing Swine Underfloor Manure Pits," in proceedings of the 5th International Symposium on Agricultural Wastes, Dec. 16-17, Chicago, IL: pg. 575-581.

Muehling, A. J. (1987) "Pit Recharge System and Flow-through System for Reduced Odors in Swine Buildings," in proceedings of the 1987 Livestock Waste Management Conference, March 24, Champaign, IL: pg. 41-47.

Additional resources

Other publications in the LIFE series, available from any Iowa State University Extension office, include:

Environmental Guidelines for Confinement Swine Housing, Pm-1586

Choosing Fans for Livestock and Poultry Ventilation, Pm-1587

Health Hazards in Swine Confinement Housing: How Bad Is Bad? Pm-1588

Concrete Specifications for Agriculture, Pm-1589

Design and Management of Anaerobic Lagoons in Iowa for Animal Manure Storage and Treatment, Pm-1590

Vented Plumbing for Livestock Manure Handling Systems, Pm-1600

Watering Systems for Grazing Livestock, Pm-1604

Tunnel Ventilation to Alleviate Animal Heat Stress, Pm-1606

You Can't Afford Not *to Haul Manure,* Pm-1609

Freestall Housing for Livestock, Pm-1610

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