



Manure Scraper for Reducing Odor Emissions from Swine Barns

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Definition:

Mechanical manure scraper replaces standard recycle flush system to reduce odor and total reduced sulfur emissions in swine barn exhaust.

Purpose:

In commercial swine operations, pigs are raised on slatted floors within ventilated barns. Manure falls through the slats to a storage area below. With a flush system, the manure is flushed with recycled lagoon water several times daily, and the manure is transported through a subsurface pipeline to one or more treatment lagoons located outside the barn. With a pull-plug or deep-pit system, the manure is stored for a week to several months below the slats within the building. Research has shown that flushing with odorous recycled anaerobic lagoon wastewater (especially from covered lagoons) can result in unfavorable odor emissions, as can some pull-plug and deep-pit manure storage systems. Research in swine and dairy operations has shown that replacing a recycle flush system with a scraper system can reduce emissions of total reduced sulfur (TRS) and odor from the barn exhaust.

How Does This Practice Work:

Mechanical scraper systems can be retrofitted into existing flush gutters or designed into new barn construction. Scraper systems can be constructed from commercially available scraper components (Vittetoe, 2011). A typical scraper unit consists of two scrapers (2 – 3 m width) connected to a common stainless steel cable looped through several pulleys and driven by a bi-directional electric motor (Figures 1 and 2). When one scraper blade pushes manure to the end of the gutter, the other scraper blade returns to the upstream end of the adjacent gutter. The scraper blades are designed such that they rotate onto suspended legs so that manure passes beneath the scraper on the upstream traverse.

Where This Practice Applies and Its Limitations:

This odor-control practice applies to swine operations that have flush systems using recycled anaerobic lagoon flush water. With retrofitting, it may also apply to deep-pit and pull-plug operations. This odor-control practice does not apply to existing fresh water flush systems, however, a scraper system would result in water conservation.

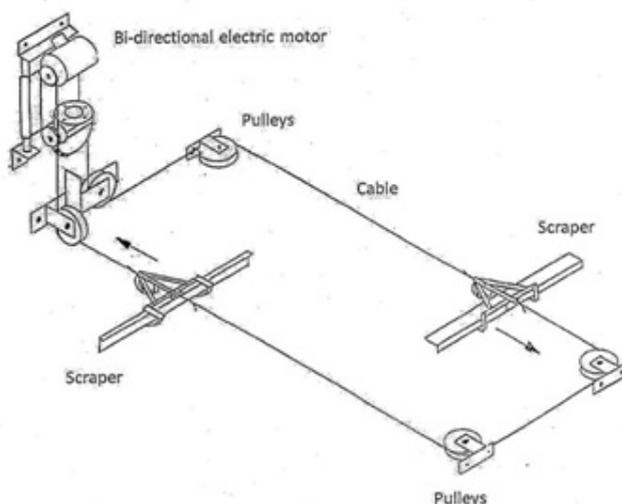
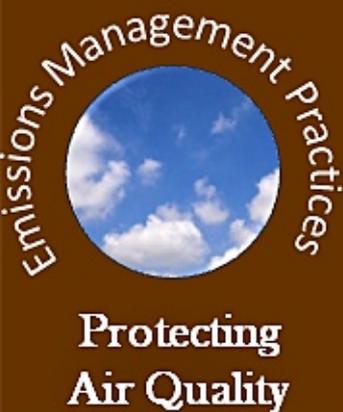


Figure 1. Schematic of a scraper system that can be installed below the slatted floors in former flush barns. (Schematic from Vittetoe, Inc., Keota, Iowa)



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Effectiveness

At a swine research facility, Predicala et al. (2007) measured 90% lower H₂S concentrations in the exhaust of small swine finishing rooms equipped with a mechanical scraper as compared to rooms with a conventional pull-plug system. In full-scale research studies at a commercial swine facility in Missouri, odor concentrations (dilutions to threshold, DT) were 75.6% lower in exhaust from scraper barns (DT = 941) than flush barns (DT = 3860) (Parker, 2011). Mean recognition thresholds (RT) were 76.4% lower in exhaust from scraper barns (RT = 494) than flush barns (RT = 2095). TRS concentrations averaged 1.59 and 0.16 ppm in flush and scraper barns, respectively, for an 89.9% reduction (Parker, 2011).

Cost of Establishing and Putting Practice in Place:

Cost of materials for an individual scraper unit consisting of one electric motor, two scrapers, cable, and pulleys is \$3,200 for a 65 m long barn. Shipping and installation costs can vary by location, but add about \$500 per unit to the cost of material. Total cost to retrofit an existing 4-gutter flush barn with two scraper units is about \$7,400. Using an electricity price of \$0.08/kW-hr, the operating cost is about \$8.00/month for a barn with two scraper units.

Operation and Maintenance:

To reduce the long-term buildup of manure on the scrapers, the scraper components should be cleaned whenever the barn is pressure-washed between rotations of pigs. It is reported that the stainless steel

cables last from one to four years, so cables should be inspected routinely. Broken or visibly damaged cables should be replaced immediately.

References:

Parker, D. B. 2011. Effectiveness of a manure scraper system for odor control in tunnel-ventilated swine finisher barns. *Trans. ASABE*. 54(1):315-324.

Predicala, B. Z., E. L. Cortus, S. P. Lemay, and C. Lague. 2007. Effectiveness of a manure scraper system from reducing concentrations of hydrogen sulfide and ammonia in a swine grower-finisher room. *Trans. ASABE* 50(3): 999-1006.

Vittetoe. 2011. Vittetoe scraper system, scraper components, and scraper blades. Keota, Iowa: Vittetoe, Inc. Available at: www.vittetoe.com/catalog/scraper_components.htm.

For Further Information:

Contact David Parker at 402-762-4277 or david.parker@ars.usda.gov.

This practice falls under the NRCS Conservation Practice Standard 634 (Waste Transfer)

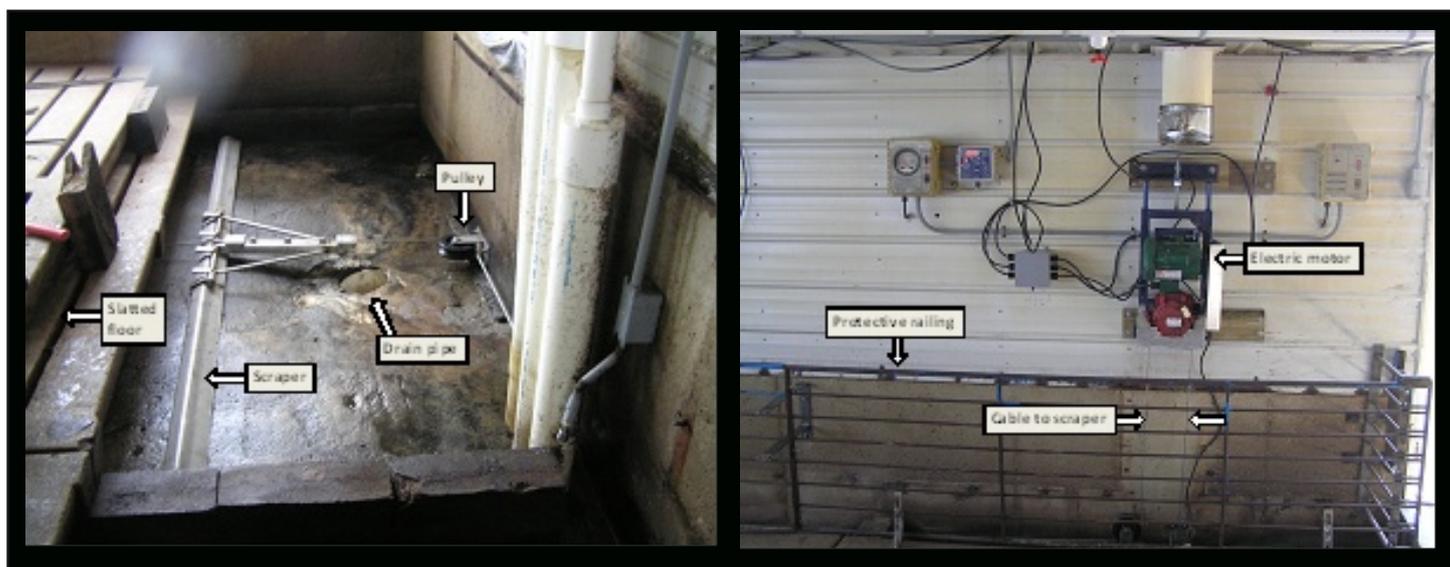


Figure 2. Photographs of a typical cable-driven scraper system. The left photo shows the scraper, pulley assembly, and PVC drain pipe that are located below the slatted floor. The right photo shows the bi-directional electric motor and protective railing.