IOWA odor CONTROL DEMONSTRATION PROJECT

Anaerobic Digestion

TECHNOLOGY DESCRIPTION

Anaerobic digestion is used by municipalities, industries, and a few animal operations to stabilize waste solids, generate methane gas, and control odors. One cooperator is demonstrating anaerobic digestion in the Odor Control Demonstration Project.

In an anaerobic digestion system, a tank holds the manure while anaerobic bacteria break it down, releasing anaerobic gases (methane, ammonia, hydrogen sulfide, carbon dioxide). The digester size is based on the detention time and the pounds of volatile solids (the ones that will biodegrade) produced by the animals each day. For efficient waste stabilization, the solids must be held for 10 to 15 days to allow the bacteria to work. Traditional digesters hold the solids and liquid together. A new system called a sequencing batch reactor (SBR) has been developed by Iowa State University researchers to separate the solids detention time and the liquid detention time.

An SBR is designed to hold the solids as long as necessary while allowing liquid to move through more quickly. This design results in smaller and more efficient digester tanks. For any anaerobic digester, an additional large storage tank must follow the digester to hold the treated liquid until pump-out time, because very little volume reduction occurs in the digester.

Anaerobic digester for 200 sow farrow-to-finish operation. The concrete digester tank is underground for heat conservation. Control equipment is in small buildings shown.

Control room for small anaerobic digester

IOWA STATE UNIVERSITY
University Extension

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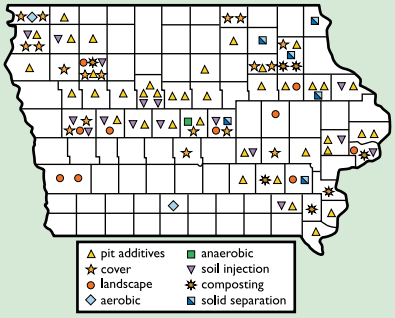
ODOR CONTROL
DEMONSTRATION PROJECT



In 1997, 80 Iowa livestock producers began demonstrating technologies to control odor from animal production. The Odor Control Demonstration Project is administered by Iowa State University and funded by the Iowa Legislature. Participants received up to half of their expenses for the odor-control technologies used on their operations.

Producers with all sizes of operations and all species of livestock were eligible to participate. They could demonstrate one or a combination of the following technologies: aeration, biocovers, composting, landscaping, pit additives, anaerobic digestion, synthetic covers, soil injection, and solids separation.

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FOR MORE INFORMATION
Agriculture and Biosystems Engineering
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EFFECTIVENESS

Anaerobic digesters are very effective at controlling odors, nearly eliminating them from associated manure storage structures. Odors remain within the sealed digester during biodegradation. When the biologically-stabilized liquid and solids are transferred to the storage pit they produce very little odor. Very thick manure might require dilution ahead of the digester.

COST

Agricultural use of anaerobic digestion has been limited by high construction costs and high management requirements for keeping the digester operating properly and safely handling the gas that is generated.

Based on an SBR for a 3,000-head finishing facility, which is funded in part by an Odor Control Demonstration grant, the initial cost for a digester is estimated at $65 per head of finishing swine capacity (This does not include gas harvesting equipment.). Amortized at 10 percent, the cost per head marketed ranges from $1.10 (assuming a 20-year life) to $4 per head marketed (assuming a 10-year life) An additional 30 cent-per-head expense of storing the liquid must be included. (The liquid storage is necessary with or without the digester).

The producers can harvest energy from methane gas by using an engine and generator at an equipment cost of about $40 per head of capacity. The methane equivalent to an estimated 0.15 kw-hr/head/day could be captured. At 7 cents per kw-hr, the energy produced annually would be worth $3.00 per head capacity.