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Species: Swine, Dairy

Use Area: Animal Housing

Technology Category: Biofilter

Air Mitigated Pollutants: Hydrogen Sulfide,
Ammonia, Methane, Volatile Organic Compounds,
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Biofiltration-Mitigation Odor and Gas Emissions from Animal Operations

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System Summary:

A biofilter is simply a porous layer of organic material, typically wood chips or a mixture of compost and wood chips, that supports a population of microbes. Odorous building exhaust air is forced through this material and is converted by the microbes to carbon dioxide and water. The compounds in the air are transferred to a wet biofilm that grows on the filter material where microorganisms breakdown the odorous compounds.

Biofiltration can reduce odor and hydrogen sulfide (H₂S) emissions by as much as 95% and ammonia by 65%. The method has been used in industry for many years and was recently adapted for use in livestock and poultry systems. Biofilters work in mechanically ventilated buildings or on the pit fans of naturally ventilated buildings. Biofilters can also treat air vented from covered manure storage.

Two configurations of biofilters are being used to treat exhaust air from swine buildings: a horizontal media bed and a vertical media bed. Horizontal biofilters require more land area but are less expensive than vertical biofilters. Horizontal beds can be shallow (< 0.45 m) or deep (> 0.75 m).

Applicability and Mitigating Mechanism:

Key factors influencing biofilter size and performance:

- time the odorous gases spend in the biofilter
- volume of air treated
- moisture content of the filter material
- sizing the biofilter media volume
- selecting fans capable to push the air through the biofilter
- choosing biofilter media

Limitations:

- Biofilters are only effective when there is a captured air stream
- Media moisture content effects the biofilter performance, i.e. dry media results in poor odor reduction
- Media porosity is related to the fan's ability to move air through the biofilter. If media is less than 50% porosity most agriculture ventilation fans will not perform satisfactorily

Cost:

Costs to install a biofilter include the cost of the materials—fans, media, ductwork, plenum—and labor. Typically, cost for new horizontal biofilter on mechanically ventilated buildings will be between \$150 and \$250 per 1,700 m³/hr (1,000 cfm). A vertical biofilter is approximately 1.5 times the cost of a horizontal biofilter.

Annual operation/maintenance of the biofilter is estimated to be \$5-\$10 per 1,700 m³/hr (1,000 cfm). This includes the increase in electrical costs to push the air through the biofilter and the cost of replacing the media after 5 years.