O
dor, gas, and dust emissions from livestock and poultry
facilities may result in complaints from neighbors or
exceed state or federal ambient air quality standards.
Biofiltration is a simple, low-cost technology, used by industry for
many years, that has been adapted for use on livestock farms.
Biofiltration can reduce odor and hydrogen sulfide emissions by as
much as 95% and ammonia emissions by up to 80%.

What is a biofilter?
A biofilter is simply a bed of organic material (medium), typically a
mixture of compost and wood chips or shreds, about 10 to 18 inches
deep. As air passes through the biofilter the microbes on the organic
material convert odorous gases to carbon dioxide and water. The
effectiveness of the biofilter is primarily a function of the amount of
time the odorous air spends in the biofilter (contact time) and the
moisture content of the filter material. Contact time is part of the
biofilter design while moisture content is a function of good
management. The size (footprint) of the biofilter depends
primarily on the amount of air needing treatment. A typical
biofilter will require 50 to 85 square feet per 1000 cubic feet per
minute (cfm) of airflow.

How much does it cost?
Biofilters are easy to design and build, and are relatively inexpen-
sive. The costs are a function of specific design and the materials
used. Construction costs range between $100 and $150 per 1000
cfm of air to be treated. Design air flow rates for some facilities
are shown in the table above. Operation and management costs of
a biofilter are approximately $3.00/1000 cfm per year. Annual
operating costs for the biofilter include the increased electrical cost
used to blow the air through the biofilter, moisture additions to the
biofilter medium with a water sprinkling system, and the replace-
ment of the medium every three to five years.

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Summer ventilation requirements per animal space (cfm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery</td>
<td>35</td>
</tr>
<tr>
<td>Finishing</td>
<td>120</td>
</tr>
<tr>
<td>Gestation</td>
<td>150</td>
</tr>
<tr>
<td>Farrowing</td>
<td>500</td>
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<tr>
<td>Broiler</td>
<td>7</td>
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<tr>
<td>Dairy</td>
<td>335</td>
</tr>
</tbody>
</table>

How can biofilters be used?

Mechanically ventilated buildings
Biofilters effectively remove odors from any mechanically ventilated livestock or poultry facility. In these buildings each exhaust fan is attached to an air duct that brings the air into a plenum under the biofilter material. The air is treated as it is forced through the biofilter by the building exhaust fans. Excessive dust concentrations in some poultry barns may create the need for additional dust filtration prior to the biofilter to prevent biofilter plugging.

Biofilter installation on existing buildings usually requires replacing the existing exhaust fans. Typical exhaust fans do not have enough power (static pressure) to both ventilate the building and push the air through the biofilter.

Naturally Ventilated Buildings
In naturally ventilated buildings, air that is exhausted through the building pit fans can be passed through a biofilter. But air passing through the building sidewalls or ridge openings cannot be captured and treated with a biofilter. During cold weather, when most of the building air is ventilated through the pit fans, odor reduction is approximately 95%. However, during periods of hot weather, when the majority of air is moving out of the building through the sidewalls or ridge vents, the effect of the biofilter on odor emissions is limited. One way to improve the efficiency of biofilters on naturally ventilated buildings is to increase the capacity of the pit fans to include mild weather ventilation rates. This change results in a higher percentage of ventilation air passing through the biofilter and better odor control.

Manure Storage
Biofilters may also be used to treat the air exhausted from a covered manure storage. Any manure storage that is covered with an impermeable membrane such as concrete or plastic requires a vent to allow the odorous gases produced by the microbial degradation of the manure to escape. If not vented, these gases create significant pressures under the cover. A biofilter can be used to clean these vented gases.

For more information…
Visit http://www.bae.umn.edu/extens/manure/ for more information on biofilters, or contact the University of Minnesota Department of Biosystems and Agricultural Engineering at 612-625-9733.