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SowBridge
Air Filtration Systems for Sow Barns

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SowBridge

Breeding Herd Education Series
2010
Timely, relevant & convenient learning

SowBridge

SDEC research update: Filtration

• Large sow herds
  • 2/10 filtered farms infected
  • 19/21 non-filtered farms infected
    • 5/19 infected 2x
    • 2/19 infected 3x
• Scott Dee research

Sites Surrounding 3000 Sow Facility

Scott Dee’s Research Studies
Testing filters to preventing airborne PRRSV spread from chamber 1 to chamber 2 at concentrations ranging from 1-9 logs of virus

Evaluating a Facility for Filtration

• Does the present ventilation system meet industry standards?
• What types and sizes of filters are needed?
• What will happen to overall ventilation system performance when filters are put in place?
• How much will it cost to install a complete filtration system?
• What is the longevity of the filters under these conditions?
Design Considerations

• What types of ventilation system facilitates filtration
  - Ceiling inlets
  - Cool cells

• Static pressure effects on the ventilation system

• MERV-16 filters vs. MERV-14 filters

Recommended Ventilation Rates (cfm/pig)

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Mild</th>
<th>Hot weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sow &amp; Litter (cfm/sow)</td>
<td>20</td>
<td>80</td>
<td>500</td>
</tr>
<tr>
<td>Finishing 150-250#</td>
<td>10</td>
<td>35</td>
<td>120</td>
</tr>
<tr>
<td>Gestating Sows</td>
<td>12</td>
<td>40</td>
<td>150</td>
</tr>
<tr>
<td>Breeding Sows</td>
<td>14</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>Boars</td>
<td>14</td>
<td>50</td>
<td>300</td>
</tr>
</tbody>
</table>

Typical Filter Set-ups

Main Types of Systems

Negative Pressure 'Exhaust'
- Slight vacuum
- Most common for livestock buildings

Positive Pressure 'Pushed Air'
- Rise in pressure
- Think grain drier

Neutral Pressure 'Push-Pull'
- Balanced pressure

Fan Test Data (52-inch Fan)

<table>
<thead>
<tr>
<th>Static pressure</th>
<th>Speed</th>
<th>Airflow</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>in. H2O</td>
<td>rpm</td>
<td>cfm</td>
<td>cfm/W</td>
</tr>
<tr>
<td>0.00</td>
<td>649</td>
<td>29,500</td>
<td>23.8</td>
</tr>
<tr>
<td>0.05</td>
<td>647</td>
<td>28,100</td>
<td>21.5</td>
</tr>
<tr>
<td>0.10</td>
<td>646</td>
<td>26,600</td>
<td>19.5</td>
</tr>
<tr>
<td>0.15</td>
<td>645</td>
<td>25,000</td>
<td>17.7</td>
</tr>
<tr>
<td>0.20</td>
<td>643</td>
<td>23,200</td>
<td>15.7</td>
</tr>
</tbody>
</table>

Airflow Ratios

Airflow ratio = [airflow at 0.20”s.p. divided by airflow at 0.05” s.p.]
Example: 51-inch fan
Ratio = 21,100 cfm/28,300 cfm
Ratio = 0.75
**Fan Test Data (52-inch Fan)**

<table>
<thead>
<tr>
<th>Static pressure (in. H₂O)</th>
<th>Speed (rpm)</th>
<th>Airflow (cfm)</th>
<th>Efficiency (cfm/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>448</td>
<td>25,500</td>
<td>29.5</td>
</tr>
<tr>
<td>0.05</td>
<td>446</td>
<td>23,200</td>
<td>25.6</td>
</tr>
<tr>
<td>0.10</td>
<td>445</td>
<td>20,600</td>
<td>22.2</td>
</tr>
<tr>
<td>0.15</td>
<td>445</td>
<td>16,800</td>
<td>18.1</td>
</tr>
<tr>
<td>0.20</td>
<td>447</td>
<td>9,900</td>
<td>11.5</td>
</tr>
</tbody>
</table>

BESS Lab  Airflow ratio = 9,900 cfm/ 23,200 cfm = 0.43  “Not very good”

**Static Pressure and Airflow Resistance**

- **Airflow resistance**
  - Restricts airflow
  - Increases static pressure
  - Makes fans work harder
  - Less efficient

- **Desired static pressure**
  - 0.05” H₂O
  - No more than 0.12” H₂O

**Static Pressure Points**

- Air intake (less than 0.04 inches)
- Air inlet (0.04 to 0.10 inches)
- Fan pit transitions (less than 0.05)
- Filters (without push fans)
  - Pre-filter (from 0.03 inches to 0.08 inches)
  - MERV 16 or 14 filters (less than 0.15 inches)
- Cool cells (0.05 inches)

Note: Static pressures are additive and should not exceed 0.20 inches

**Filter Ratings, ASHRAE 52.2**

- MERV (minimum efficiency reporting value)
- Based on the efficiency at various particle sizes and airflow rates
- **ASHRAE 52.2**
- Currently using:
  - MERV 8 as a pre-filter (2” depth)
  - MERV 16 as the PRRS capturing filter or,
  - MERV 14

[www.mwps.org](http://www.mwps.org) to order

Or

access fan data online at:
[www.bess.uiuc.edu](http://www.bess.uiuc.edu)
Stages of Fan Operation: 2600 Sow Facility

<table>
<thead>
<tr>
<th>Stage</th>
<th>Pre-Filter Diameter</th>
<th>Cfm at 0.10</th>
<th>Cfm at 0.15</th>
<th>Cfm at 0.20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1:</td>
<td>24&quot;</td>
<td>47,200</td>
<td>50,880</td>
<td>54,960</td>
</tr>
<tr>
<td>Stage 2:</td>
<td>26&quot;</td>
<td>67,200</td>
<td>63,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Stage 3:</td>
<td>51&quot;</td>
<td>84,000</td>
<td>78,600</td>
<td>72,500</td>
</tr>
<tr>
<td>Stage 4:</td>
<td>51&quot;</td>
<td>99,600</td>
<td>92,400</td>
<td>84,800</td>
</tr>
<tr>
<td>Stage 5:</td>
<td>51&quot;</td>
<td>149,400</td>
<td>133,800</td>
<td>115,200</td>
</tr>
<tr>
<td>Stage 6:</td>
<td>51&quot;</td>
<td>149,400</td>
<td>133,800</td>
<td>115,200</td>
</tr>
</tbody>
</table>

Total Ventilation: 543,200 cfm/2600 sows = 209 cfm/sow

Two Inch Pre-Filter

MERV 16 Filter
- 24” X 24” Filters (L9 Camfil-Farr)
- 2000 cfm at 0.8 inches static pressure
- Typically 400 to 500 cfm per 24” x 24” filter with MERV-8 pre-filter

MERV 14 Filter
- 24” X 24” Filters (L6 Camfil-Farr)
- 2000 cfm at 0.37 inches static pressure
- Typically 500 to 700 cfm per 24” x 24” filter with pre-filter

Airflow with Pre-filter
- L6 = 175 cfm/ft²
- L9 = 112 cfm/ft²

@ 250 cfm/crate gestation
- L9 = 1.8 crates/filter
- L6 = 2.8 crates/filter
Selecting filters

- Work with factory representatives to obtain documentation showing the new MERV ratings for their products.
- Not all filters are alike.
- MERV ratings encourage filter selection based on particle size requirements.
- Inspect filter installations for good sealing and damage. No filter can stop particles that bypass the media.
- What is filter effectiveness at low airflow rates
- Confirm that filters have manometers to indicate the time for change-out, and monitor filters regularly.

Filter Longevity

Pre-filter: Approximately 6 months to one year

MERV 16 or 14 Filters: Unknown

A 1200 cfm ceiling inlet would require a 2’ x 4’ filter box

Problem Areas

2600 Sow Facility with Cool Cells
Building Airflow

Filtration Costs
- Without cool cells: $150 to $175 per sow
- With cool cells: $220 to $250 per sow
- 3000 sow unit: 100 cases of caulk (4 men and 2 weeks)
- Unexpected cost (the plywood ceiling started to come down)

Summary
- Apply good design practices
- Understand the effects of static pressure on the ventilation system
- Use high quality filters
- Lots of planning and caulking
- New facilities being built with MERV-14 Camfil-Farr filters or MERV-16 Clarcor
- Remember: All other bio-security measures need to be in place before considering filtration

Conclusions
- It is feasible from a ventilation standpoint to install a filtration system
- Cost of filtration is influencing decision makers
- So far so good for boar studs and sow units

Thank You

Questions???