Improving Ventilation in Calf and Heifer Housing

Brian Holmes
Extension Agricultural Engineer
UW – Madison
Biological Systems Engineering

Young Stock Facilities College & Tour
Calumet County
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Defining Terms

Ventilation = Air Exchange
= Bad Air Out & Good Air In

Air Circulation = Moving Air within Barn
≠ Ventilation

Draft = ?

Types Of Ventilation Systems:

Natural Ventilation

Mechanical Ventilation
Negative Pressure
Positive Pressure

Natural Ventilation - Winter

Natural ventilation uses the forces of nature to cause air exchange

Wind is the primary force

Types Of Ventilation Systems:

Natural Ventilation
Uses forces of nature for most of ventilation
Barns w/o Ceilings
Open Ridge and Eaves in Winter
Open Sidewalls in Summer
Located to Catch Wind
Can be Supplemented w Positive Pressure Tubes and Fans or Circulating Fans
Natural Ventilation - Summer

Air In → Air Out

Silos Obstruct Natural Ventilation In Summer

Corn Field
Trees
Hill

Summer Wind

Natural Ventilation Design

Ridge Opening: 2 in. / 10 ft Width
Eve Opening: 1 in. / 10 ft Width
Openable Sidewalls
10 ft Minimum Width
Types Of Ventilation Systems:

**Mechanical Ventilation - Positive Pressure**
- Fans Cause Air Exchange
- Fans Force Air Into Barn
- Ducts Distribute Fresh Cold/Cool Air
- Requires Outlets
- Barns w Ceilings
- Tight Construction Not Required

**Variations:**
- Adjustable Slot Inlet in Duct
- Holes in Duct - Single Flow Rate
- Fans Blow in w/o Duct in Warm Weather

**Mechanical Ventilation - Negative Pressure**
- Fans & Inlets Cause Air Exchange
- Fans Exhaust from Barn
- Barns w Ceilings
- **Tight Construction**
- Designed Inlets Distribute Fresh Air

**Variations:**
- Adjustable Slot Inlet
- Circulating Tubes
- Area Inlets
- Positive Pressure Tubes
- Wind Tunnel

Choosing Type Of Ventilation

Positive Pressure Tubes = Winter Supplement
Natural Ventilation to Remedy a Design Deficiency

Three or four sided pens
Upwind obstructions (includes lean-too’s)
Eave inlets too small
Ridge outlet too small or non-existent

Compliments of K. Nordlund, 2007

<table>
<thead>
<tr>
<th>Location</th>
<th>August 2004</th>
<th>Feb. 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pens, cfu/m³</td>
<td>177,453</td>
<td>42,807</td>
</tr>
<tr>
<td>Alleys, cfu/m³</td>
<td>26,459</td>
<td>16,716</td>
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</tbody>
</table>

After supplementation, respiratory disease treatments estimated to be 25% of previous years
Duct Arrangements – Narrow Barns

Duct Arrangements – Wider Barns

WI Ideal Calf Pen

Nesting score = 3
Legs generally not visible when lying down
Mechanical Ventilation for Individual Calf Pen Barns

Spreadsheet Available:
Sheboygan Co. - Calf & Heifer Mgt.
Hoffman - Calf & Heifer Mgt.

I want to put my calves in this barn. How do I ventilate it?
### Cumulative Ventilation Rates for Warm Dairy Barns

<table>
<thead>
<tr>
<th>Animal Group</th>
<th>Cold</th>
<th>Mild</th>
<th>Hot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calves (0-2 mo.)</td>
<td>15</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Heifers 2-12 mo.</td>
<td>20</td>
<td>60</td>
<td>130</td>
</tr>
<tr>
<td>Heifers 12-24 mo.</td>
<td>30</td>
<td>80</td>
<td>180</td>
</tr>
</tbody>
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* 4 Air Changes/hr - Alternative Vent. Rate
** 60 Air Changes/hr - Alternative Vent. Rate

MWPS-7

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### Duct Arrangements – Narrow Barns

#### Single Duct

![Single Duct Diagram]

#### Double Duct

![Double Duct Diagram]

### Duct Arrangements – Wide Barns

#### Three Ducts

![Three Ducts Diagram]

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Positive Pressure Fans Forcing Air Into Duct Through Mow Wall (Optional Two Fan System)
Positive Pressure Mechanical Ventilation for Calf Barns

### Duct Design

<table>
<thead>
<tr>
<th>Room Dimensions</th>
<th>Number of Slot Inlets</th>
<th>Width (ft)</th>
<th>Length (ft)</th>
<th>Rectangular Ducts That Can Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>30</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

### Number of Ducts (Maximum of Two)

- 1 Rectangular Duct

### Heights (ft/inches)

- Width (inches) = 12
- Height = 8

### Total Number of Calves

- Total: 40

### Duct Cross Section Area (sq ft/duct)

- 3.8

### Duct Cross Section Area (sq ft)

- 3.8

### Ventilation Rate Options

- **Ventilation Rate (15 CFM/calf Minimum)**: 15
- **Ventilation Rate (50 CFM/calf Spring/Fall)**: 50
- **Ventilation Rate (100 CFM/calf Hot)**: 100

### Condition Operating Adjustable

- **Ventilation Rate Minimum Winter Continuous (CFM)**: 600
- **Ventilation Rate Spring/Fall (CFM)**: 2,000
- **Ventilation Rate Hot (CFM)**: 4,000

### Ventilation Rate (15 CFM/calf Minimum) = 15

- Number of Ends of Each Duct with Fans: 1

### Ventilation Rate Spring/Fall (50 CFM/calf)

- Number of Ends of Each Duct with Fans: 3

### Ventilation Rate Hot (100 CFM/calf)

- Number of Ends of Each Duct with Fans: 6

### Ventilation Rate Minimum Winter Continuous (CFM) = 1,280

- **Minimum Winter (CFM)**: 1,280
  - Fans located on sidewall(s) blowing in, locate about 30 ft apart.

### Ventilation Rate Spring/Fall (50 CFM/calf)

- **Spring/Fall (CFM)**: 3,840
  - Room Volume (cu ft) = 19,200
  - Hot (CFM) = 19,200
  - Fans located on sidewall(s) blowing in, locate about 30 ft apart.

### Minimum Number of Air Changes

- **Minimum Winter Continuous Four Air Changes/Hr**: 1,280
- **Spring/Fall Sixteen Air Changes/Hr**: 3,840
- **Hot Weather Sixty Air Changes/Hr**: 19,200

**Selected Cumulative Ventilation Rate**

- **Ventilation Rate Minimum Winter Continuous (CFM)**: 1,280
- **Ventilation Rate Spring/Fall (CFM)**: 3,840
- **Ventilation Rate Hot (CFM)**: 19,200

**Inputs**

**Duct Choices**

**Selected Cumulative Ventilation Rate**

**Fan Information**

**Slot Information**

**QUESTIONS?**