Welcome!
Environmental Control for Food Safety & Quality

Bakery Overview – Environment

Facility Considerations
Cleanrooms

- Enclosures
- Exposure Impact Factor
- ISO Specifications
- Zones
- Compressed Air Filtration
- Product Temperatures

Mold

- Spores Active vs. Dormant
- Darkness / Light
- Moisture and Humidity
- Nutrient
- Temperature 40-100F
- Greenhouse will travel
- Time 24-240 hours

Space Pressurization

<table>
<thead>
<tr>
<th>Water Column &quot;</th>
<th>0.03&quot;</th>
<th>0.05&quot;</th>
<th>0.07&quot;</th>
<th>0.09&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/1000 ft²</td>
<td>$61</td>
<td>$49</td>
<td>$66</td>
<td>$42</td>
</tr>
<tr>
<td>Electric Cost, Pan</td>
<td>$40</td>
<td>$53</td>
<td>$64</td>
<td>$74</td>
</tr>
<tr>
<td>Heating Cost</td>
<td>$646</td>
<td>$834</td>
<td>$986</td>
<td>$1,117</td>
</tr>
<tr>
<td>Wind Protection, MPH</td>
<td>7.9</td>
<td>10.2</td>
<td>12</td>
<td>13.6</td>
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</tbody>
</table>

Air Filtration

- Existing Equipment retrofits may have negative impacts.
- MERV Ratings
- Material Type: Synthetic vs. Cardboard and Fabric

**Air Filtration Description**

- Minimum Efficiency Rating Value (MERV)
- Continuous linked filters recommended to prevent air bypass.
- Antimicrobial coating NOT recommended for "Human Comfort" systems
- Energy cost based on $0.06 per kWh and 8,000 hours a year operation

<table>
<thead>
<tr>
<th>Description</th>
<th>MERV-1</th>
<th>MERV-6</th>
<th>MERV-8</th>
<th>MERV-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Roll</td>
<td>Tridim 2-Ply</td>
<td>Tridim 3-Ply</td>
<td>Tri-Cell/Pre</td>
<td></td>
</tr>
<tr>
<td>Efficiency 3.0 Microns</td>
<td>&lt;20%</td>
<td>84%</td>
<td>87%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>Pressure Drop @ 500 FPM</td>
<td>0.08</td>
<td>0.31</td>
<td>0.46</td>
<td>0.78</td>
</tr>
<tr>
<td>Usage Area</td>
<td>None</td>
<td>Existing Retrofit</td>
<td>Non-Product</td>
<td>Product Zone</td>
</tr>
</tbody>
</table>

**Equipment Air Filtration Costs**

- $4.71
- $17.46
- $25.92
- $43.94

- 4. MERV 1-8 is recommended for human comfort systems.
Sample Plant Results

Exhaust Air

Outdoor Air

1,270

Outdoor Air Infiltration 919

<table>
<thead>
<tr>
<th>Plant Condition</th>
<th>Supply Airflow (cfm)</th>
<th>Exposure Product Molds (%)</th>
<th>MERV Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Pressure 60%</td>
<td>3,006</td>
<td>275</td>
<td>240</td>
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<tr>
<td>Positive Pressure 100%</td>
<td>3,016</td>
<td>203</td>
<td>165</td>
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<tr>
<td>Spiral Cooler 100%</td>
<td>165</td>
<td>165</td>
<td>04</td>
</tr>
</tbody>
</table>

Facility Ambient Mold Impact
1. Space pressure inside plant was negative 0.015" WC
2. Sample exhaust taken at Spiral Cooler exhaust discharge

Environmental Control Systems

- Sanitation
- UV Lighting
- Air Filtration
- Outside Air Intakes
- Fabric Curtains
- Up-blast Exhaust Fans
- Location of Air Devices
- Air Distribution Types

Thank You!

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