Unusual Ventilation Opportunities or Engineering Controls - 2012

Industrial Ventilation PDC
Spring Carolinas Section Meeting
Asheville, NC
Compliance with PELS

- Remove source/Change process,
- Engineering Controls,
  - Local exhausting
  - Replacement Air
- Work Practices,
- Hygiene Practices,
- Housekeeping,
- PPEs,
- Administrative Controls.
New Opportunities (Job security)

- New, finer milled Dusts (<10 micron dia.)
- More “Knife-edge” dusts are more challenging to control,
- New high-tech processes with high-tech dust issues (NiCad batteries, Pharma, radionuclides)
- Low-tech processes with high-tech dust issues (i.e. Diaper superabsorbent)
Where is the cleanest air in the world?
Operating Room Dust Control Technology

“in an industrial setting”
Laminar Diffusion of Return Air (Clean Room Concept)
Laminar (Non-turbulent) Flow Replacement Air Diffusers
HVAC Engineers hate IH’s!

There is only one way to get uniform heating and cooling.........

Turbulence!
Thaladium (heavy metal) exposure issues

- Personnel monitoring indicates high background levels (influenced by Blending and EMD areas),
- High velocity air returns cause turbulent flow issues,
- Use of “real time” monitors indicate other culprits!-Poor work practices-mules, tubs, attitude,
- Housekeeping issues,
- Engineering control issues- poor fittings, balancing, low duct velocities, hoods rework, replace flex duct with hard pipe,
- Material handling issues.
Work Practices in Utopia

Personal Samplings Mn-stof NPR

- Big bag
- Mixer
- Granulator

MnO₂ Concentration Powder Room

TARGET POWDER ROOM 2007: 0.05 mg/m³
TARGET 0.20 mg/m³
Tub tops
Work Practices

- Information System
Work Practices (continued)
ownership
Work Practice (feedback)

- Toxic Thaladium exposures posted in each department
Work Practices-
task description-repair of broken bags
Housekeeping-Thaladium Powder Room

- Plant Manager says “We treat every leak as if it were ON FIRE!”
Housekeeping-
High Velocity Return-Air Controls
**Negative pressures and their effects**

Negative pressures and their effects:

<table>
<thead>
<tr>
<th>Negative Pressure, <em>in wg</em></th>
<th>Adverse Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 to 0.02</td>
<td>Worker Draft Complaints—High velocity drafts through doors and windows.</td>
</tr>
<tr>
<td>0.01 to 0.05</td>
<td>Natural Draft Stacks Ineffective—Ventilation through roof exhaust ventilators, flow through stacks with natural draft greatly reduced.</td>
</tr>
<tr>
<td>0.02 to 0.05</td>
<td>Carbon Monoxide Hazard—Back drafting will take place in hot water heaters, unit heaters, furnaces, and other combustion equipment not provided with induced draft fan.</td>
</tr>
<tr>
<td>0.03 to 0.10</td>
<td>General Mechanical Ventilation Reduced—Airflows reduced in propeller fans and low pressure supply and exhaust systems.</td>
</tr>
<tr>
<td>0.05 to 0.10</td>
<td>Doors Difficult to Open—Serious injury may result from non-checked, slamming doors.</td>
</tr>
<tr>
<td>0.10 to 0.25</td>
<td>Local Exhaust Ventilation Impaired—Centrifugal fan exhaust airflow reduced.</td>
</tr>
</tbody>
</table>

**TABLE 10-2. Negative Pressures and Corresponding Velocities Through Crack Openings (Calculated with air at room temperature, standard atmospheric pressure, \( p_0 = 14.7 \) in wg)**

<table>
<thead>
<tr>
<th>Negative Pressure, <em>in wg</em></th>
<th>Velocity, fpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.004</td>
<td>160</td>
</tr>
<tr>
<td>0.008</td>
<td>215</td>
</tr>
<tr>
<td>0.010</td>
<td>240</td>
</tr>
<tr>
<td>0.014</td>
<td>285</td>
</tr>
<tr>
<td>0.016</td>
<td>300</td>
</tr>
<tr>
<td>0.018</td>
<td>320</td>
</tr>
<tr>
<td>0.020</td>
<td>340</td>
</tr>
<tr>
<td>0.025</td>
<td>360</td>
</tr>
<tr>
<td>0.030</td>
<td>415</td>
</tr>
<tr>
<td>0.040</td>
<td>480</td>
</tr>
<tr>
<td>0.050</td>
<td>540</td>
</tr>
<tr>
<td>0.060</td>
<td>590</td>
</tr>
<tr>
<td>0.080</td>
<td>680</td>
</tr>
<tr>
<td>0.100</td>
<td>760</td>
</tr>
<tr>
<td>0.150</td>
<td>930</td>
</tr>
<tr>
<td>0.200</td>
<td>1080</td>
</tr>
<tr>
<td>0.250</td>
<td>1290</td>
</tr>
<tr>
<td>0.300</td>
<td>1310</td>
</tr>
<tr>
<td>0.400</td>
<td>1520</td>
</tr>
<tr>
<td>0.530</td>
<td>1700</td>
</tr>
<tr>
<td>0.690</td>
<td>1800</td>
</tr>
</tbody>
</table>

**FIGURE 10-1. Occupant discomfort caused by negative building pressure**

Supply Air Systems

10-3
Solution-Diffuse the Air

- 2000 fpm through small holes will add $\frac{1}{2}''$wg of resistance, but it will reduce the air velocity to less than feeling threshold within two feet
“Sock” diffusers
Flow Rate as Distance from Hood

Exterior hoods don’t work on toxic materials
Disturbing Air Currents

- Room air currents - High velocity grills
- Negative air conditions causing inrush of air
- Machinery motion - spray gun projection
- Work practices
Enclosing hood
Work Practices

- Intervene to educate employees how to meet standards!
Push-Pull Hoods
Activated charcoal dump
Steel Manufacturing
Engineers vs. CIH

In North Carolina, Air Pollution Control Permits and design require a PE stamp.....

Shouldn’t the hood design include a CIH stamp since you will inherit the design/exposure problems?