Cornell’s Laboratory Ventilation Design Standard

Aligning Stakeholders

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Learning Objectives

• Apply flexible design strategies that meet health and safety, code and sustainability needs.

• Formulate methods for designing labs that consider chemical safety and ventilation effectiveness in order to reduce airflow volumes.

• Communicate lab ventilation design goals without increasing project costs.
The Basics

• Directional airflow to control fugitive odors

• Air is continually ventilated, preventing increase of air concentrations of toxic substances

• General ventilation alone “should not be relied on for protection from highly toxic substances released into the laboratory”

• Containment devices should be used to provide personal protection from specific hazards

• Building and Mechanical Codes (i.e. ASHRAE)
Three Systems Working Together

Microscale Laboratory Ventilation
Control Banding = Generic strategy that groups similar hazards into “bands” and then applies the same protections; for laboratory ventilation it is based on which chemicals are involved and how they are used.

Rooted in CFD modeling, our approach to operating general ventilation rates starts with 8/4 (occupied/unoccupied) minimum ACH and looks for opportunities to go 6/3 ACH when the chemistry permits.

These target rates can be overridden by exhaust or temperature requirements.
Risk Assessment Process

Step 1: Review chemistry for flammability, toxicity or odor concerns outside of local exhaust.
- Significant chemical sources outside local exhaust systems
  - Maintain normal operating rate of 8/4 ACH

No concerns

Step 2: Consider ventilation effectiveness in the room.
- Development of "dead zones" likely
  - Maintain normal operating rate of 8/4 ACH

No concerns

Step 3: Assess housekeeping practices.
- Specific housekeeping issues found
  - Maintain normal operating rate of 8/4 ACH

No concerns

Reduce operating ventilation rate to 6/3

8/4 ACH

6/3 ACH
# Hood Housekeeping Score (HHS)

<table>
<thead>
<tr>
<th>Hood Housekeeping Score (HHS)</th>
<th>Reason for concern</th>
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<tbody>
<tr>
<td><strong>1</strong> Hood decommissioned</td>
<td>None</td>
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<tr>
<td><strong>2</strong> Hood on, used for a single chemical process or well organized multiple purposes</td>
<td>None</td>
</tr>
<tr>
<td><strong>3</strong> Hood on, but empty or being used for storage</td>
<td>Sustainability</td>
</tr>
<tr>
<td><strong>4</strong> Hood on, crowded or used for competing multiple chemical uses</td>
<td>Safety</td>
</tr>
<tr>
<td><strong>5</strong> Hood on and contamination evident</td>
<td>Safety</td>
</tr>
</tbody>
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*The higher the Hood Housekeeping Score, the more serious the concern.*
Updating the Cornell Lab Design Standard and Process

• Include stakeholders from the design and operations processes:
  • Facilities Engineering
  • Energy Management
  • EHS

• Align the design standard with operational parameters; particularly energy conservation considerations.

• Provides more guidance in ventilation system sizing, mechanical requirements and interactions between departments during a lab design process.
Health and Safety Elements

- Definition of “laboratory” and the limits of the standard.
- Definitions for lab-scale, hood hibernation, and lab vacancy.
- NYS mechanical code section 510 requirements concerning Hazardous Exhaust Systems.
- Encourages laminar flow in the lab to improve ventilation effectiveness (impacts location of casework and hoods).
- Requirement for CFD modeling tied to size of project budget.
Sustainability Elements

- Encourages opportunity for commissioning hoods at lower face velocity (80 fpm).
- Lower minimum air volumes for fume hoods (150 ACH~ 10 cfm/ft²) permitted.
- Mechanical and Controls capability for hood hibernation and vacancy mode.
- Stops on fume hoods at 18 inches- maximum flow-rate calculated at 18 inches, not full open.
- De-couple of room occupancy from sash position.
Upcoming

Organizing **workshop** around fume hood performance criteria for institutional design specifications:

- Appropriate applications for fume hoods (other ventilated enclosures)
- “as-installed” and “as-used” performance testing
- Ergonomic concerns with use of fume hoods
- Limitations of fume hood materials
Questions