Progress Report: Phase I
(Qualitative HVAC and Initial Ventilation Assessment)

Presented by:
Malek Alaouie, CIE

10/04/21
What is Industrial Hygiene?

- Recognition
- Environmental Factors and Stressors
- Anticipation
- Evaluation
- Control
Hazard Risk Assessment

Hazard

- Physical
- Chemical
- Biological
- Ergonomic
COVID-19 Transmission

Primary route

Person-to-person

Airborne

Surface
Hierarchy of Controls

NIOSH HIERARCHY OF CONTROLS

- Most effective
  - Elimination: Physically remove the hazard
  - Substitution: Replace the hazard
  - Administrative controls: Change the way people work
  - Engineering controls
  - PPE: Protect the worker with PPE

- Least effective
Scope of Work

- **Phase I:**
  - Qualitatively assess condition of the HVAC system.
  - Initial ventilation assessment of identified buildings.

- **Phase II:**
  - Re-evaluation of HVAC systems.
Site Assessment

- The following campuses/locations were included in the site assessment:
  - College of Alameda (42 units)
  - Berkeley City College (5 units)
  - Merritt College (40 units)
  - Laney College (54 units)
  - District Offices (30 units)
Package Unit Typical Concept

- Fresh Air
- Filtered Air
- Return Air

- Dampers
- Bird screen
- Filters
- Insulation
- Coils
- Fan
- Supply duct
- Fan belt
- Condensate pan
- P-trap
- Return duct
- Indoor space(s)
Filters
Outdoor Air Intake
Insulation
Mechanical Equipment Rooms
Condensate line and Coils
Corrosion
Fan belts and Expansion Joints
## Phase I Summary (System functionality)

<table>
<thead>
<tr>
<th>Observation</th>
<th>No. of Units</th>
<th>No. of Buildings</th>
<th>No. of Campuses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overdue filters</td>
<td>121</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Damaged filters</td>
<td>34</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Mold infested filters</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Overloaded filters</td>
<td>127</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Damaged/Loose fan belt</td>
<td>30</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Contamination source</td>
<td>21</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Damaged coils</td>
<td>8</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Corrosion</td>
<td>114 (8 ▼)</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>Deteriorated insulation</td>
<td>83</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Missing bird screen</td>
<td>12</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Tear in duct</td>
<td>20</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

In-house

Professional

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## Mitigation (Filters replacement)

<table>
<thead>
<tr>
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<td>Tear in duct</td>
<td>20</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>
Deteriorated Insulation

Colleges

- Laney: 33%
- Merritt: 27%
- COA: 19%
- BCC: 20%
- District: 1%

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Corrosion

Colleges

- Laney: 39%
- Merritt: 21%
- COA: 11%
- BCC: 3%
- District: 26%
Damaged Coils

Colleges

- Laney: 50%
- Merritt: 25%
- COA: 13%
- BCC: 13%
- District: 0%
Missing bird screen

Colleges

- Merritt: 42%
- COA: 25%
- BCC: 25%
- Laney: 8%
- District: 0%
Tear in Duct
Phase I: Ventilation Assessment

• Ventilation assessment of selective rooms representing different functional spaces in buildings with replaced filters (MERV 13)

• 2 – 3 rooms per building while HVAC system is running – Total of 106 rooms
Ventilation Assessment Tool

### COVID-19 Site Risk Assessment

Note: These practices are current as of the revision date. Since the COVID-19 pandemic is evolving rapidly, extra diligence should be used in watching for updates to these practices. The following recommendations should supplement existing infection prevention and control protocols.

<table>
<thead>
<tr>
<th>Site</th>
<th>Berkeley City College</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>2050 Center Street, Berkeley, CA 94704</td>
</tr>
<tr>
<td>Category</td>
<td>Science Lab</td>
</tr>
<tr>
<td>Room #</td>
<td>513</td>
</tr>
<tr>
<td>Description</td>
<td>Biology Lab</td>
</tr>
<tr>
<td>Date</td>
<td>9/22/2021</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area ft²</th>
<th>1110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling ft</td>
<td>11</td>
</tr>
</tbody>
</table>

#### Air Changes and Particle Removal

<table>
<thead>
<tr>
<th>Droplet Nuclei</th>
<th>Time required for airborne contaminant removal (min)</th>
<th>Occupancy</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Air Changes</td>
<td>6-feet 50%</td>
<td>15</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Natural Ventilation</th>
<th>No</th>
<th>MERV rating</th>
<th>Temp</th>
<th>RH%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor Air</td>
<td>174</td>
<td>Pressure Out</td>
<td>74.6</td>
<td>52</td>
</tr>
<tr>
<td>Total Supply</td>
<td>1160</td>
<td>HEPA CADR</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

#### Recommendations

<table>
<thead>
<tr>
<th>Ventilation (Mechanical)</th>
<th>Occupancy</th>
<th>Target effective ACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Flow Direction</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Minimum Total CFM</td>
<td>Out</td>
<td>440</td>
</tr>
<tr>
<td>Percent outdoor Air CFM</td>
<td>100%</td>
<td>440</td>
</tr>
<tr>
<td>Minimum Outdoor Air CFM</td>
<td>90%</td>
<td>440</td>
</tr>
<tr>
<td>Advent Air CFM (ASHRAE 62.1)</td>
<td>Occupable Space</td>
<td>15</td>
</tr>
<tr>
<td>Net sf²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To achieve 3 ACH with MERV 13 filters, 0 cfm of CADR (clean air delivery rate) are recommended.
Effective Air Changes

• Effective air changes per hour (eACH) are calculated based on the equivalent outdoor air to effectively remove droplet nuclei:
  – MERV rating of installed filters
  – Total supply air (cubic feet per minute – cfm)
  – Outdoor air (percentage of total supply air)
Target Air Changes

• Target air changes are defaulted as 3 ACH or based on the minimum outdoor air requirements for breathing zones as per ASHRAE standard 62.1, whichever is greater.

• 3 ACH = 95% reduction in airborne contaminants (ASHRAE technical resources for building re-occupancy)
Target Air Changes (cont’d)

• Minimum requirement for outdoor air as per ASHRAE 62.1 is calculated based on:
  – Square footage of space
  – Occupancy
  – Space category (e.g., classroom, office, conference…etc.)
## Locations Breakdown

<table>
<thead>
<tr>
<th>Space Type</th>
<th>Percentage</th>
<th>Pass rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>20%</td>
<td>76%</td>
</tr>
<tr>
<td>Science Lab</td>
<td>8.5%</td>
<td>100%</td>
</tr>
<tr>
<td>Computer Lab</td>
<td>5%</td>
<td>80%</td>
</tr>
<tr>
<td>Offices / Cubicles</td>
<td>40%</td>
<td>88%</td>
</tr>
<tr>
<td>Conference rooms</td>
<td>10%</td>
<td>73%</td>
</tr>
<tr>
<td>Break rooms</td>
<td>6%</td>
<td>83%</td>
</tr>
<tr>
<td>Locker rooms</td>
<td>3%</td>
<td>67%</td>
</tr>
</tbody>
</table>
Ventilation Performance Overview

- 83% (Majority)
- 17% (Minority)

Colleges:
- Laney: 37%
- Merritt: 22%
- COA: 24%
- BCC: 14%
- District: 4%
Phase II

- Expand the ventilation assessment sample
- Post-remediation inspection of HVAC units
- Final report for building readiness
Thank You!

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Right People.
Right Perspective.
Right Now.