Safety and Standards

Geoff Cmar
GreenFumeHood Sales Engineer
Southeast Regional Sales Engineer
Erlab, Inc.

About Erlab

ABOUT ERLAB – Erlab is a global leader in air filtration solutions. Since 1968 we have been protecting laboratory personnel from harmful chemical and bio-aerosol emissions, improving the air we breathe both inside and out. We have a long-storied history starting with the invention of what is now know as ductless fume hood technology. Today, we continue to invent and improve upon the technologies we deliver with significant investments into our R&D employing several PhD’s in molecular sciences, filtration and bio-aerosols.

Geoff Cmar – Regional Sales Engineer
About ERLAB

Chemical Handling Risk Assessment

Why it’s needed?
- Captured and Retained
- Detected
- Expected filter life

Required by:
- ANSI Z9.5
- CSA Z316.5
- NFPA 45-2023
- AFNOR NF X 15-211
- SEFA 9A
Chemical Handling Risk Assessment

SEFA 9A compliant review:
• Chemicals
• Quantities
• Processes
• Container type: open or closed
• Temperatures

Standards

• ANSI Z9.5
  • Ductless Hoods
    • Chemical Risk Assessment is required
    • Redundant Safety Filter
    • Automatic detection of filter breakthrough
    • Detection of filter breakthrough at <25% TLV
    • Chemical list with capacity
  • Ducted Hood
    • Uses dilution to eliminate pollution.
    • Takes 450 feet from stack to achieve 1% concentration levels.
    • allowed to entrain up to 20% of allowable concentrations under normal operating condition for routine emission events and 100% for emergency emission events.

Appendix 3- Evaluating the Performance of Laboratory Exhaust System – Design Criteria Development
NFPA 45 2023 (draft)

- Second Revision draft completed, publishing Jan 2023
- Fully incorporates “Ductless Hoods”, not “Ductless Enclosure”
  - Traditional fume hood superstructure with Airfoil and Plenum
  - Redundant Safety filter
  - Automatic detection
  - Chemical List with capacity
  - Signage and labeling on each hood
  - 4” air gap between top of hood and ceiling
  - Annual reviews of usage

Ductless Hoods Standards Harmonization?

<table>
<thead>
<tr>
<th>Subject</th>
<th>ANSI Z9.5-2022</th>
<th>NFPA45-2023 draft</th>
<th>CSA Z316.5-2020</th>
<th>AFNOR NF X 15-211 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Review</td>
<td>Required</td>
<td>Per SEFA-9A RP</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Chemical Lists</td>
<td>Required w/Capacity</td>
<td>Required w/Capacity</td>
<td>Required</td>
<td>Required w/Capacity</td>
</tr>
<tr>
<td>Fume Hood Structure</td>
<td>Same as ducted FH</td>
<td>Same as ducted FH, otherwise “Ductless Enclosure”</td>
<td>Same as ducted FH</td>
<td>Not specified, filtration test standard only</td>
</tr>
<tr>
<td>Layers of Filtration</td>
<td>2 Layers (redundant)</td>
<td>2 Layers (redundant)</td>
<td>2 Layers (redundant)</td>
<td>Class 1 = 2 layers Class 2 = 1 layer</td>
</tr>
<tr>
<td>Breakthrough Detection</td>
<td>Continuous &amp; automatic</td>
<td>Continuous &amp; automatic</td>
<td>Continuous &amp; automatic</td>
<td>Class 1 = Continuous &amp; automatic</td>
</tr>
<tr>
<td>Detection Accuracy</td>
<td>&lt;25% TLV</td>
<td>As per ANSI Z9.5</td>
<td>Fraction of OEL</td>
<td>&lt;1% TLV</td>
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<tr>
<td>Containment Testing</td>
<td>ASHRAE 110 Std. or as set by owner</td>
<td>ASHRAE 110 Std. as specified by owner</td>
<td>References ASHRAE 110 Std.</td>
<td>AFNOR XP X 15-206 Std.</td>
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</table>
Erlab's R&D Testing Laboratories

Approved Chemical Lists

- Hundreds of chemicals, (represents thousands of chemicals within their chemical families)
- 98% of the commonly used chemicals,
- Required by SEFA 9 RP and AFNOR NF X 15-211
Materials and Processes Not Allowed

Not retained well: gaseous @ STP and low molecular weight.
1. Acetylene
2. Carbon Dioxide
3. Carbon Monoxide
4. Ethane
5. Ethylene Oxide
6. Helium and all Noble Gases
7. Hydrogen
8. Methane
9. Nitrogen Monoxide
10. Propylene
11. Propyne, Propane
12. SOx and NOx

Applications not recommended:
• Perchloric Acid, Radioisotope or Acid Digestion Hoods
• Highly exothermic reactions
• Mercury - Well retained but remains extremely toxic (TLV = 0.05 ppm) and difficult to detect
• High Toxicity compounds (e.g. organophosphorus)
• Lethal (e.g. Hydrogen Cyanide)

Applications that require specialty ducted hoods are likely not good candidates for filtration.

Chemical Listing

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Formula</th>
<th>CAS number</th>
<th>Suitable filter</th>
<th>Retention capacity (g)</th>
<th>Vapor pressure (kPa)</th>
<th>MM (g/mol)</th>
<th>Boiling point (°C)</th>
<th>NIOSH 8h</th>
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<tbody>
<tr>
<td>AMINOCYCLOHEXANE</td>
<td>C6H11NH2</td>
<td>108-91-8</td>
<td>Neutrodine Unisorb</td>
<td>630</td>
<td>1.2</td>
<td>99</td>
<td>135</td>
<td>10 ppm</td>
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<tr>
<td>AMINODETHANE</td>
<td>C2H7N</td>
<td>75-04-7</td>
<td>Neutrodine Unisorb</td>
<td>114</td>
<td>1.6</td>
<td>45</td>
<td>17</td>
<td>10 ppm</td>
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<tr>
<td>AMINOMETHANE</td>
<td>CH3N</td>
<td>74-89-5</td>
<td>Neutrodine Unisorb</td>
<td>36</td>
<td>3.5</td>
<td>31</td>
<td>-7</td>
<td>10 ppm</td>
</tr>
<tr>
<td>AMMONIA (30% solution)</td>
<td>NH3</td>
<td>7664-41-7</td>
<td>PF Ammonia + Neutrodine Unisorb</td>
<td>384</td>
<td>1003</td>
<td>17</td>
<td>-33</td>
<td>25 ppm</td>
</tr>
<tr>
<td>AMMONIUM CHLORIDE</td>
<td>NH4Cl</td>
<td>12125-02-9</td>
<td>PF + HEPA or Neutrodine Unisorb</td>
<td>-</td>
<td>0.13</td>
<td>53,49</td>
<td>-</td>
<td>10 mg/m²</td>
</tr>
<tr>
<td>AMMONIUM CHLORIDE FUMES</td>
<td>NH4Cl</td>
<td>12125-02-9</td>
<td>PF + HEPA or Neutrodine Unisorb</td>
<td>-</td>
<td>0.13</td>
<td>53,49</td>
<td>-</td>
<td>10 mg/m²</td>
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<tr>
<td>AMYL ALCOHOL</td>
<td>C5H12O</td>
<td>71-41-0</td>
<td>Neutrodine Unisorb</td>
<td>3416</td>
<td>0.259</td>
<td>88</td>
<td>138</td>
<td>-</td>
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<tr>
<td>ANHYDROUS HYDROGEN BROMIDE</td>
<td>HBr</td>
<td>10035-10-6</td>
<td>Neutrodine Unisorb</td>
<td>1626</td>
<td>0.15</td>
<td>80,91</td>
<td>-66</td>
<td>-</td>
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<tr>
<td>ANILINE</td>
<td>C6H5NH2</td>
<td>62-53-3</td>
<td>Neutrodine Unisorb</td>
<td>1944</td>
<td>0.09</td>
<td>93</td>
<td>184</td>
<td>-</td>
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<tr>
<td>AQUA FORTIS</td>
<td>HNO3</td>
<td>76-97-37-2</td>
<td>Neutrodine Unisorb</td>
<td>1608</td>
<td>6.39</td>
<td>63</td>
<td>120</td>
<td>2 ppm</td>
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</table>
Enhancing Safety

Performance & Compliance

Documentation

Ductless fume hoods must be accompanied by a booklet containing an exhaustive list of the chemical agents, that the manufacturer certifies, can be handled in the fume hood:

• The name of the chemical agent, its formula, its CAS number, its boiling point, its molecular weight, its vapor pressure, etc.

• The reference of the adapted filter and its retention capacity in accordance with the NF X 15-211 standard.

• The type of air quality monitoring recommended to control filter efficiency

Thank you
# Enhancing Safety

## Table

<table>
<thead>
<tr>
<th>Type of handling</th>
<th>CHEMICAL NAME</th>
<th>TYPE OF CONTAINER</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recrystallization in Water</td>
<td>Acetanilide</td>
<td>BEAKER</td>
<td>Opened</td>
<td>100%</td>
<td>100°C</td>
<td>From 1 to 4</td>
<td>From 21 to 30 min</td>
<td></td>
</tr>
<tr>
<td>Recrystallization in Water</td>
<td>Benzene</td>
<td>BEAKER</td>
<td>Opened</td>
<td>100%</td>
<td>100°C</td>
<td>From 1 to 4</td>
<td>From 21 to 30 min</td>
<td></td>
</tr>
<tr>
<td>Recrystallization in Water</td>
<td>Allyl Alcohol</td>
<td>BEAKER</td>
<td>Opened</td>
<td>100%</td>
<td>100°C</td>
<td>From 1 to 4</td>
<td>From 21 to 30 min</td>
<td></td>
</tr>
<tr>
<td>EVAPORATION</td>
<td>Water</td>
<td>BEAKER</td>
<td>Opened</td>
<td>100%</td>
<td>100°C</td>
<td>From 1 to 4</td>
<td>From 21 to 30 min</td>
<td></td>
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<tr>
<td>WEIGHING</td>
<td>Activated Carbon</td>
<td>BEAKER</td>
<td>Opened</td>
<td>100%</td>
<td>100°C</td>
<td>From 1 to 4</td>
<td>From 21 to 30 min</td>
<td></td>
</tr>
<tr>
<td>THIN LAYER CHROMATOGRAPHY</td>
<td>Acetic Acid</td>
<td>TLC DEVELOPING TANK</td>
<td>Closed</td>
<td>100%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
</tr>
<tr>
<td>THIN LAYER CHROMATOGRAPHY</td>
<td>Ethyl Acetate</td>
<td>TLC DEVELOPING TANK</td>
<td>Closed</td>
<td>100%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
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<tr>
<td>THIN LAYER CHROMATOGRAPHY</td>
<td>Hexane</td>
<td>TLC DEVELOPING TANK</td>
<td>Closed</td>
<td>100%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
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<tr>
<td>WEIGHING</td>
<td>Aspirin</td>
<td>TUBE</td>
<td>Opened</td>
<td>1%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
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<tr>
<td>WEIGHING</td>
<td>Acetaminophen</td>
<td>TUBE</td>
<td>Opened</td>
<td>1%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
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<tr>
<td>VAPOURING</td>
<td>Caffeine</td>
<td>TUBE</td>
<td>Opened</td>
<td>100%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
</tr>
<tr>
<td>DISOLUTION</td>
<td>Ethanol</td>
<td>TUBE</td>
<td>Opened</td>
<td>90%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 5 to 10 min</td>
<td></td>
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<tr>
<td>THIN LAYER CHROMATOGRAPHY</td>
<td>Silica Gel (on TLC plate)</td>
<td>TLC DEVELOPING TANK</td>
<td>Closed</td>
<td>100%</td>
<td>25°C</td>
<td>From 1 to 4</td>
<td>From 21 to 30 min</td>
<td></td>
</tr>
</tbody>
</table>

## Feasibility Study

Reference: GFH-218US769-0218

### Containment
- ✔️ Detection
- ✔️ Neutroide Unisorb Compatibililty
- ✔️ Neutroide Unisorb Estimated Life Expectancy

### Filtration

- ✔️ GFH Model
- ✔️ M1: 30 months
- ✔️ M2: 30 months
- ✔️ M3: 36 months
- ✔️ M4: 48 months
- ✔️ M5: 48 months
- ✔️ M6: 48 months

- ✔️ Acrid propration
- ✔️ Ammonia propration

### Detection

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecod Sevols</td>
<td>Low</td>
</tr>
<tr>
<td>Molecod Acids</td>
<td>High</td>
</tr>
</tbody>
</table>