Introduction

Choosing the highest personal protective equipment level by default is not necessarily protective of responder/worker health and safety. Each operation should be evaluated individually based on the specifics of the hazardous materials, the hazards, and site conditions, including atmospheric conditions.

Drum and container sampling can be inherently dangerous. Labels may not be accurate. Incompatibles may be mixed together. Containers may be pressurized. Containers may contain liquids, gases, mists, and/or vapors that are toxic by absorption and/or inhalation. Air purifying respirators may not provide sufficient protection.

HAZCAT operations involve opening sample containers in controlled environment and working with small sample quantities in well ventilated area. There are also options for conducting HAZCAT testing with appropriate lab equipment like a chemical fume hood. However, small volumes does not automatically equate to low or no risk. For example:

- Skin exposure to 7 ml of anhydrous hydrofluoric acid (liquid) is fatal with no treatment.
- Skin exposure to 0.1 ml of dimethyl mercury (liquid) is fatal; this material immediately moves through latex gloves.
- Eye exposure to a 10% solution of sodium hydroxide will cause permanent damage.

Test bulking based on the HAZCAT information may result in pressurization, toxic vapor generation and other hazardous reactions.

Index of Suspicion

“Index of Suspicion (IOS)” is a phrase broadly used to indicate the severity a particular situation or issue based on known, suspected, or assumed conditions and hazards; as an example:

- There is a high IOS that this Chrome Plater will have acids and cyanides stored in a manner that an exposure to toxic materials such as hydrogen cyanide is likely.
- There is a low IOS that this oil recycling facility will contain hazardous materials that are toxic by absorption or inhalation.

To determine your level of Personal Protective Equipment, develop an Index of Suspicion based on the following:

- Type of facility
- Condition of the facility
- Container labels
- Facility chemical inventory or receipt records
- Condition of containers
- How the material reacted during sampling
- Direct reading instruments

Meters and Direct Reading Instruments

Use meters to help with the PPE decision and to further determine the index of suspicion. The initial evaluation must be completed with a 4-gas meter. If the oxygen concentration is less than 19.5%, Level B PPE is warranted. Do not enter an area that has ≥10% of the LEL (remember, your LEL
concentrations may not be accurate if your O₂ level is <19.5% or >23.0%; ventilate the area prior to entry.

**Unknown Situations:**

If there is a high index of suspicion that exposure to toxic materials is likely, consider Level B until additional information is gathered. Remember, knowledge of the specific hazardous material(s) present and the concentration is necessary to determine if an air purifying respirator (APR) will provide the protection necessary. Try not to assume that an APR will be sufficient based on container volumes, natural ventilation, etc. The PPE Chapter of the Health and Safety Manual provides PPE Level recommendations for unknown situations based on PID/FID data.

### Vapor/Gas Concentration from Photo-ionization (PID) or Flame Ionization (FID) Direct Reading Instrument

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Suggested Level of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 to 1,000 PPM</td>
<td>Level A</td>
</tr>
<tr>
<td>5 to 500 PPM</td>
<td>Level B</td>
</tr>
<tr>
<td>Background to 5 PPM</td>
<td>Level C</td>
</tr>
</tbody>
</table>

**NOTE:** A PID can only detect materials that have an Ionization Potential (IP) that is less than the lamp output. Also consider reviewing the correction factors.

**Known Hazardous Materials and Concentrations**

**Step 1**

Use data from PID/FID and other direct reading Instruments to determine the Hazard Ratio.

Consider respiratory protection at ½ the published TLV/PEL.

**Hazard Ratio** must be less than the **Assigned Protection Factor (APF)** in order to use the specific respirator type.

<table>
<thead>
<tr>
<th>Respirator Type</th>
<th>Assigned Protection Factor (APF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ Face Air Purifying</td>
<td>10</td>
</tr>
<tr>
<td>Full Face Air Purifying</td>
<td>50</td>
</tr>
<tr>
<td>Full Face Powered Air Purifying (PAPR)</td>
<td>1000</td>
</tr>
<tr>
<td>Supplied Air (SAR)</td>
<td>1000</td>
</tr>
<tr>
<td>Self Contained Breathing Apparatus (SCBA)</td>
<td>10000</td>
</tr>
</tbody>
</table>

**Hazard Ratio** = **Known Concentration**

PEL or TLV

Compare Hazard Ratio to the APF in the table above. Choose a respirator type where the APF is greater than the Hazard Ratio. Do not forget about eye protection, a full face respirator provides respiratory protection as well as splash, spray and mist protection.

Also consider Maximum Use Concentration (MUC) for the type respirator. MUC is the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator. The MUC is determined by multiplying the assigned protection factor specified for a respirator by a published exposure limit.

**MUC = APF x PEL/TLV**
Step 2

If Level C PPE is chosen, check your respirator cartridges and choose the cartridge that protects against all of the known contaminants.

- SCOTT Multi-Cartridges are good for organic vapors, chlorine, chlorine dioxide, hydrogen chloride, hydrogen fluoride, hydrogen sulfide (escape only), sulfur dioxide, ammonia, methyamine and formaldehyde; 99.97% efficient against solid or liquid particles including oil-based particles.
- SCOTT P100 Cartridges are 99.97% efficient against solid or liquid particles including oil-based particles.
- SCOTT Mercury Cartridges are good for mercury vapor.

Chemical Protective Clothing Recommendations

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Hazards/Conditions</th>
<th>Targeted Minimum PPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum/Tank Sampling</td>
<td>Unknown chemicals.</td>
<td>Level B (Upgrade/Downgrade based on knowledge of contaminants and monitoring with PID/FID, radiation detector, LEL/O₂ per HASP/ SOSGs)</td>
</tr>
<tr>
<td>Container opening</td>
<td>No CBRN.</td>
<td><strong>Respirator:</strong> Scott or MSA Full Face</td>
</tr>
<tr>
<td>Continuous air monitoring</td>
<td>Potential splash hazard.</td>
<td><strong>Suit Type:</strong> Saranex</td>
</tr>
<tr>
<td>Product sampling</td>
<td>Physical hazard controls in place.</td>
<td><strong>Inner Glove:</strong> Nitrile, Neoprene, Viton, PVC</td>
</tr>
<tr>
<td></td>
<td>Assumes no initial hazardous atmosphere.</td>
<td><strong>Outer Glove:</strong> Heavy Duty Butyl, Nitrile, Other</td>
</tr>
<tr>
<td></td>
<td>Ensure availability of water source for emergency DECON/shower/eyewash.</td>
<td><strong>Other:</strong> ANSI Approved Splash Shield</td>
</tr>
<tr>
<td></td>
<td><strong>Required Work Practice:</strong> Immediate PPE Change-out (i.e. gloves, etc.) upon contact with chemicals.</td>
<td><strong>Outer Steel Toe Boot Cover:</strong> Latex HazMaster Booty and rely on suit boot material for permeation protection.</td>
</tr>
<tr>
<td></td>
<td><strong>Required Work Practice:</strong> Must follow standard air monitoring protocol.</td>
<td><strong>Steel Toe/Steel Shank Boots:</strong> ASTM F-2413/ANSI Z41</td>
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Hazardous Categorization Testing (HAZCAT)

- Opening sample containers in controlled environment
- Working with small sample quantities in well ventilated area
- Conducting HAZCAT testing with appropriate lab equipment

- Assumes known chemical classes and site situation/background.
- No CBRN suspected.
- Assumes immediate suit removal if contaminated and frequent glove changes.
- **Required Work Practice:** Immediate PPE Change-out (i.e. gloves, etc.) upon contact with chemicals.
- **Required Work Practice:** Must follow standard air monitoring protocol.

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