Laboratory Safety and Hazardous Waste Training Refresher

Kostas Center and Microfabrication Laboratory
Kostas Center and Microfabrication Laboratory Training Goals

- Labeling Waste
- Review chemical types used in clean rooms
- Review proper storage and disposal of clean room chemicals
Labeling

Four Critical Items

- Label must say “Hazardous Waste”
- Must identify a date when container is filled
- Must identify the physical hazards of chemical
- Must list full name(s) of the chemical

Useful Links

- Hazardous Waste Listed and Characteristic Waste
- Harvard University Labeling Tool
HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

Northeastern University
Office of Environmental Health & Safety
229 Forsyth Building
Boston, Massachusetts 02115
(617) 373-2769
http://www.ehs.neu.edu

Investigator: _________________________________ Phone: ________________________
Dept: ________________________________ Room # / Bldg: ______________________
Date Container Filled: _______________ Container Size(s): ______________________
Principal Constituents (Give % and Full Chemical Name): ______________________
_________________________________________________________________________
_________________________________________________________________________
Hazardous Waste Classification (Check at least one):
_____ Ignitable (Includes Flammable liquids, solids and gasses)
_____ Corrosive (pH of 2 or less, or 12 or greater, and/or can corrode steel)
_____ Reactive (Is unstable, can detonate or reacts violently with water)
_____ Toxic (Contains heavy metals, certain organics or pesticides)
_____ Listed (Appears on the F, U, P or M List)
_____ Other (Specify): ________________________________________________
Hazardous Waste References

What is MF 321 or SU-8?
# Chemical Types Used in the Microfabrication Laboratories

**OSHA Defined Hazardous Chemicals**

<table>
<thead>
<tr>
<th>Physical Hazards</th>
<th>Health Hazards</th>
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<tbody>
<tr>
<td>Flammable and Combustible Liquids</td>
<td>Carcinogens</td>
</tr>
<tr>
<td>Compressed Gasses</td>
<td>Reproductive Toxins</td>
</tr>
<tr>
<td>Explosives</td>
<td>Sensitizers</td>
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<tr>
<td>Organic Peroxides</td>
<td>Irritants</td>
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<tr>
<td>Oxidizers</td>
<td>Corrosives</td>
</tr>
<tr>
<td>Pyrophorics</td>
<td>Neurotoxins (nerve)</td>
</tr>
<tr>
<td>Water Reactives</td>
<td>Hapatoxins (liver)</td>
</tr>
<tr>
<td></td>
<td>Nephrotoxins</td>
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<tr>
<td></td>
<td>Agents that act on the hematopoietic system (blood)</td>
</tr>
<tr>
<td></td>
<td>Agents that damage the lungs, skin, eyes or mucus membranes</td>
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</tbody>
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Acids and Etchants

- Acetic Acid
- Buffered Oxide Etch (BOE - Ammonium Fluoride + HF Mixtures)
  - BOE 20:1
  - BOE 7:1
- Chrome Etch (Ceric ammonium nitrate + Perchloric Acid)
- Hydrochloric Acid (HCl)
- Hydrofluoric Acid (HF)
- Hydrofluoric Acid 1% (Premix HF and water)
- Hydrofluoric Acid 10% (Premix HF and water)
- Nitric Acid
- Phosphoric Acid
- Sulfuric Acid (H2SO4)
- Gold Etchant
- BOE 10:1
- Aluminum Etchant
# Corrosives, Developers and Gases

## Corrosives
- Ammonium Hydroxide
- Potassium Hydroxide
- Sodium Hydroxide
- Tetramethylammonium Hydroxide

## Developers
- AZ 300 MIF Developer
- AZ 400 K Developer
- MF 319 Developer
- SU-8 Developer
- MF 321

## Gases
- Forming Gas (N2:H2; <5.7% H2 - Nonflammable)
- Helium (He)
- Hydrogen (H2)
- Nitrogen (N2)
- Oxygen (O2)
- Sulfur Hexafluoride (SF6)
- Siline and inert (N2, He or Ar) mixture
- Trifluromethane ("Halocarbon 23" CHF3)
- Argon
# Solvents, Photoresist and Oxidizers

## Solvents

- Acetone ((CH3)2CO)
- Anisole (C6H5OCH3)
- Chlorobenzene (C6H5Cl)
- Ethanol
- Isopropanol ((CH3)2 CHOH)
- Methanol (CH3OH)
- Methyl Isobutyl Ketone
- Trichloroethylene (C2HCl3)
- Toluene (C6H5-CH3)

## Photoresist

- AZ4620
- AZ5214-E
- NANO 495 PMMA
- S 1813
- SU-8
- S 1818
- S 1827
- S 1805
- Adhesion Promoter 100
- Adhesion Promoter 150 NAAPS
- Nano 950 PMMA

## Oxidizers

- Hydrogen Peroxide
EPA's Chemical Compatibility Chart

<table>
<thead>
<tr>
<th>EPA's Chemical Compatibility Chart</th>
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</thead>
<tbody>
<tr>
<td><strong>Methodology</strong>: This chart provides a visual representation of chemical compatibility, allowing users to quickly identify suitable combinations. The chart is organized into rows and columns, each representing different chemicals. A 'X' indicates incompatibility, while a 'V' signifies compatibility. The chart includes a legend that explains the symbols used.</td>
</tr>
<tr>
<td><strong>Legend</strong>:</td>
</tr>
<tr>
<td>- X: Not recommended</td>
</tr>
<tr>
<td>- V: Viable combination</td>
</tr>
<tr>
<td>- N/A: Not available</td>
</tr>
<tr>
<td>- VM: High risk of contamination</td>
</tr>
<tr>
<td>- DC: Decoupled connection</td>
</tr>
<tr>
<td>- D: Dispersion</td>
</tr>
<tr>
<td>- G: Ignition</td>
</tr>
<tr>
<td>- S: Special handling</td>
</tr>
<tr>
<td>- M: Mild irritation</td>
</tr>
<tr>
<td>- Severe irritation</td>
</tr>
<tr>
<td>- H: High irritation</td>
</tr>
<tr>
<td>- L: Lack of data</td>
</tr>
<tr>
<td>- H: High severity</td>
</tr>
<tr>
<td>- M: Medium severity</td>
</tr>
<tr>
<td>- L: Low severity</td>
</tr>
</tbody>
</table>

The chart is designed to help users make informed decisions about chemical interactions, ensuring safety and efficiency in handling and storage.
Proper Storage of Chemicals

- Flammable Storage Cabinets
- Corrosive Storage Cabinets
- Shelving
- Spill Pallets
- Rubbermaid Tubs
Hazardous Waste Disposal Options
Hazardous Waste Satellite Accumulation and Disposal

- Scheduling Disposal
- Appropriate Containers
- Labeling
- Designated Storage Area
- Training
- Improper Disposal
- Waste Minimization
- Emergency Spill Response

Please review the following requirements to ensure that you comply with environmental regulations and safe handling procedures for hazardous waste.

EMERGENCY SPILL RESPONSE

- Designated Storage Area
- Waste Minimization
- Scheduling Disposal
- Labeling

For disposal of hazardous waste, please call the Office of Environmental Health and Safety (EHS) at x2769 or use our on-line disposal request form available on our website (http://www.ehs.neu.edu). Training requirements must be completed prior to use.

If the waste is hazardous waste (e.g., flammable, corrosive, reactive, infectious, toxic), please follow the disposal procedures outlined by EHS.

For safety and environmental reasons, hazardous waste must be stored in a designated "Satellite Accumulation Area," (e.g., flammable storage cabinet, bench top). These must be located at or near the point of generation.

All hazardous waste containers must be labeled at the time the waste is first placed into the container. Labels must include the following information: 1) the word "Hazardous" (e.g., if the container is for hazardous waste); 2) the chemical name (e.g., "sulfuric acid"); 3) the date when the container becomes full or is no longer needed; 4) the date when the container becomes unwanted waste (e.g., "corrosive"); etc. Please call EHS if you need labels.

Generators of hazardous waste are required to incorporate waste minimization into the process generating their waste. Waste minimization includes changing procedures, reducing scale and substituting materials. EHS also provides instructions for recycling excess chemical stock (http://www.ehs.neu.edu/chemrecy.htm).

In the event of a spill or other emergency, the University Emergency Coordinators can be reached by calling x2769 (day) or x3333 (24 hours). Fire extinguishers are located in each laboratory and should be used as necessary. The Boston Public Safety Division emergency numbers are located at the bottom of each floor.

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Wastewater Alert

Waste Water Alert!
To meet MWRA requirements we need your cooperation.

We must keep the following materials from reaching the environment through our sewer system:

- Strong Acids and Bases (Solutions with pH < 5.5 or > 12.0)
- Mercury and other Heavy Metals (ALL Mercury-containing materials)
- Volatile Organic Compounds (Common Laboratory Solvents)

Please call Environmental Health & Safety for assistance in evaluating your waste disposal needs.
Questions?