



THE UNIVERSITY OF
TOLEDO
1872

Laboratory Safety & Plastination

ACETONE



Laboratory Safety Objectives

Industrial Hygiene

- Laboratory Hazard Recognition
- Laboratory Hazard Evaluation
- Laboratory Hazard Control

Recognition of Hazards

A full scale survey of each research and clinical lab are completed on a regular basis..

- General Laboratory Safety
- Chemical Handling and Storage
- Physical Hazards
- Waste Disposal
- Personal Protection

Recognition of Hazards

- **Routes of Exposure**
 - Inhalation
 - Skin Absorption
 - Incidental Ingestion
 - Injection
 - Mucous Membranes

Recognition and Evaluation of Hazards

- Safety Data Sheets (SDS) provides:
 - Chemical/Physical properties
 - Toxicity, Health Effects
 - Compatibility, Safe Handling/Storage
 - Appropriate spill and fire response
 - And much more information.....

Recognition and Evaluation of Hazards

Know the properties of chemicals and biological agents you use before you use or transport them

- Toxicity (select carcinogens, acutely toxic, reproductive hazard)
- Flammability
- Reactivity/Incompatibilities
- Corrosive
- Unstable
- Bio-safety Level (Bacteria, Virus, Prions etc.)

Acetone

Acute Health Effects:

- Irritating to eyes.
- HARMFUL - May cause lung damage if swallowed.
- Vapors may cause dizziness or suffocation.
- Vapors may cause dizziness or suffocation.
- Inhalation, skin contact and/or ingestion may produce health damage*.
- May produce discomfort of the respiratory system and skin*.

Chronic Health Effects:

- Repeated exposure may cause skin dryness and cracking. Cumulative effects may result following exposure*.
* (limited evidence).

Formaldehyde

Acute Health Effects:

- Causes burns.
- Risk of serious damage to eyes.
- Toxic by inhalation, in contact with skin and if swallowed.
- Vapors may cause dizziness or suffocation.
- Vapors potentially cause drowsiness and dizziness*.

Chronic Health Effects:

- May cause SENSITIZATION by skin contact.
- Limited evidence of a carcinogenic effect.
- Possible respiratory sensitizer*.
- Cumulative effects may result following exposure*.
* (limited evidence).

Methylene Chloride

Acute Health Effects:

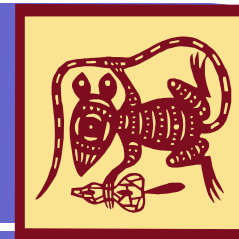
- Harmful if swallowed.
- Irritating to skin.
- Vapors may cause dizziness or suffocation.
- Inhalation and/or skin contact may produce health damage*.
- May produce discomfort of the eyes and respiratory tract*.
- Vapors potentially cause drowsiness and dizziness*.

Chronic Health Effects:

- Limited evidence of a carcinogenic effect.
- May affect fertility*
- Cumulative effects may result following exposure*.
- Repeated exposure potentially causes skin dryness and cracking*.

* (limited evidence).

Recognition and Evaluation of Hazards



Toxicity Classes: Gosselin, Smith and Hodge

Probable Oral Lethal Dose (Human)

Toxicity Rating or Class	Dose	For 70-kg Person (150 lbs)
6 Super Toxic	Less than 5 mg/kg	1 grain (a taste - less than 7 drops)
5 Extremely Toxic	5-50 mg/kg	4 ml (between 7 drops and 1 tsp)
4 Very Toxic	50-500 mg/kg	30 ml (between 1 tsp and 1 fl ounce)
3 Moderately Toxic	500-5000 mg/kg	30-600 ml (between 1 fl oz and 1 pint)
2 Slightly Toxic	5000-15,000 mg/kg	600-1200 ml (between 1 pint to 1 quart)
1 Practically Non-Toxic	Above 15,000 mg/kg	More than 1200 ml (more than 1 quart)

Acutely toxic materials (If LD50 is <50mg/kg, or LC50 is <2mg/l)

Recognition and Evaluation of Hazards

- Exposure Monitoring
 - If you are utilizing local exhaust, or small quantities of non-haz substances there is typically no need for exposure monitoring.
 - If there is reason to believe exposure levels for a substance routinely exceed action levels or Occupational Exposure Limits (OEL's) contact Safety and Health.
 - Clues to overexposure to solvents include headache, dizziness, forgetfulness etc.

Monitoring Equipment

Passive Badge



Photoionization
Detector (PID)

PID Array



Example of Monitoring Results

Table 1: Lab Data and Calculated via Passive Badge Time Weighted Averages for Acetone

Name of Personnel or Area	Sample #	Conc. Analyte (PPM)	Sample Time (min)	8-h TWA (PPM)	8-hr TWA (PPM) ACGIH TLV	15-min. STEL (PPM) ACGIH STEL	8-hr TWA (PPM) OSHA PEL
Subject #1 Plastination Process	010911-	140 PPM	44	12.83 PPM	500 PPM	750PPM	1,000 PPM

Table 2: Lab Data Real Time MiniRAE 2000 Monitoring for Acetone

Name of Personnel or Area	Conc. Analyte (PPM)	Sample Time (min)	8-h TWA (PPM)	15-min. STEL (PPM)	8-hr TWA (PPM) ACGIH TLV	15-min. STEL (PPM) ACGIH STEL	8-hr TWA (PPM) OSHA PEL
Subject #1 Plastination Process	137.7 PPM	44	11.8 PPM	738.8 PPM	500 PPM	750 PPM	1,000 PPM

Recognition and Evaluation of Hazards

● **Electrical Safety**

- Explosion Proof Versus Non-Explosion Proof
- Explosion Proof Freezers are expensive
- Monitoring can determine explosive limits
- Explosion Proof
 - Outlets
 - Plugs
 - Light Fixtures

Other Hazards

- Slips, trips and falls
- Mats and slip free surfaces



Hazard Control

- Hierarchy of Control
 - Engineering Controls
 - Local or dedicated exhaust
 - Administrative Controls
 - Policies/Procedures
 - Personal Protective Equipment (PPE)
 - Gloves, respirators?

Hazard Control

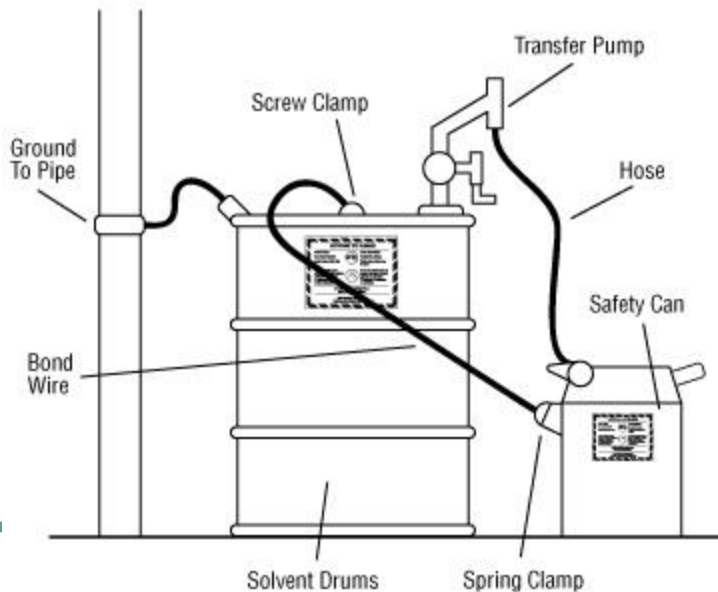
Engineering Controls

- **Local Exhaust Ventilation**
 - Dedicated exhaust with no recirculation to occupied area
 - Exhaust vacuum systems



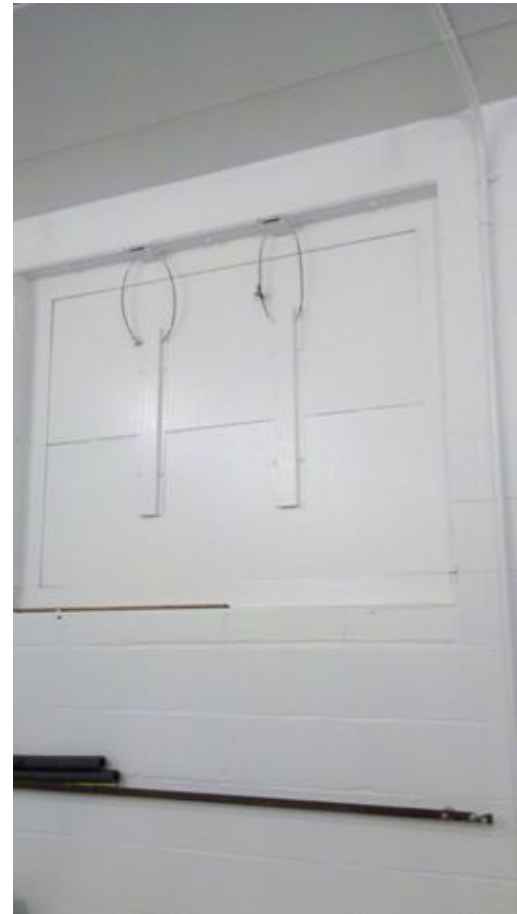
Hazard Control

- **Explosion Proof Equipment**
- **Effective Bonding and Grounding**



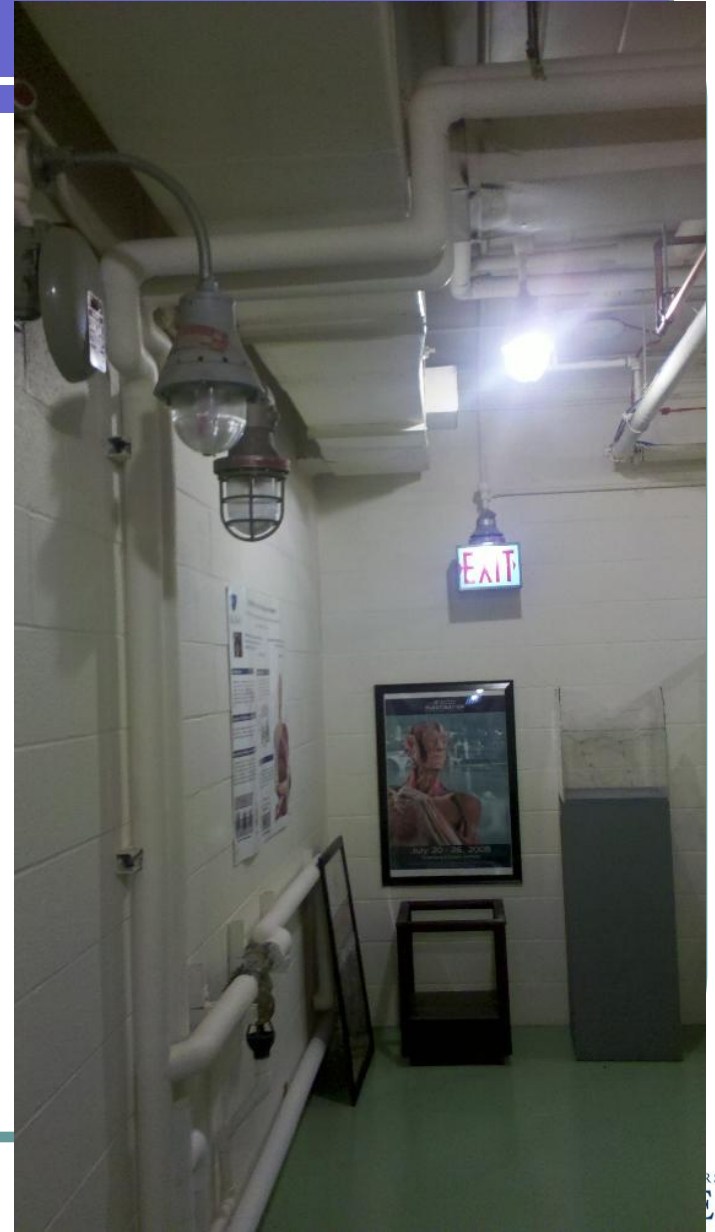
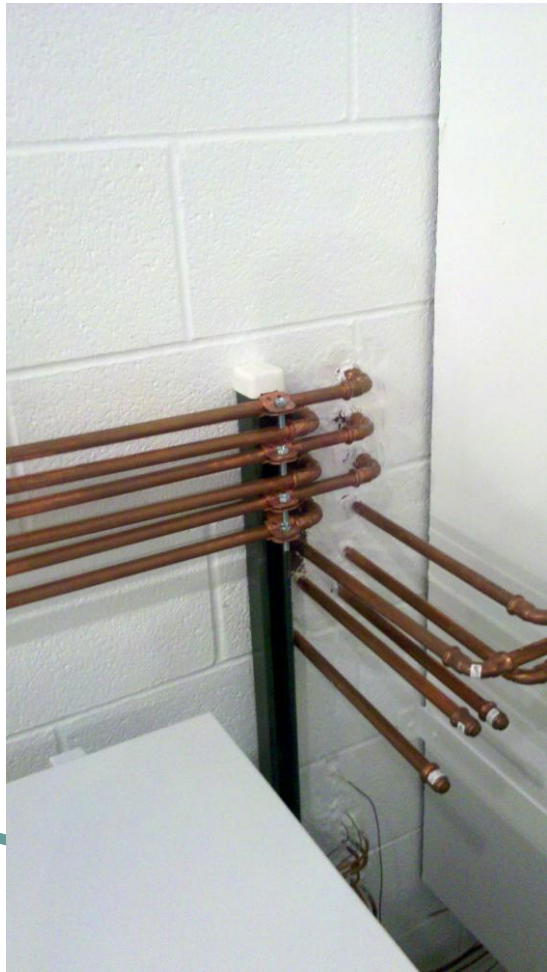
Hazard Control

- Building Design



Hazard Control

- Building Design



Hazard Control

- **Administrative Controls**
 - Employee Information and Training
 - Medical Consultation/Examinations
 - Hazard Identification
 - Use of Respirators
 - Development of Standard Operating Procedures (SOP's)



Administrative Controls

- Toxic Chemical Standard Operating Procedures
 - Select carcinogens
 - Reproductive toxins
 - Substances which have a high degree of acute toxicity

Hazard Control

- Administrative Controls
 - Medical Surveillance
 - Respirator Usage
 - Approved through Safety & Health
 - **This includes dust masks**
 - Biological Monitoring
 - Blood/Urine Sampling

Hazard Control

- Personal Protective Equipment
 - Gloves - rubber, butyl, latex, nitrile?
 - Eye Protection – chemical/splash/impact goggles, faceshields (UV protection)
 - Clothing -Labcoats, aprons, scrubs
 - Respirators
 - Open toed shoes and sandals are not acceptable footwear in laboratories or animal rooms.

Hazard Control

- Personal Protective Equipment

- Gloves

- Select gloves appropriate for the task—see glove charts.
- Check gloves for leaks.
- **Acetone** (Natural Latex, or Butyl Rubber)
- **Formaldehyde** (Neoprene, Latex, Butyl, Nitrile)
- **Methylene Chloride** (Silver Shield or Viton)

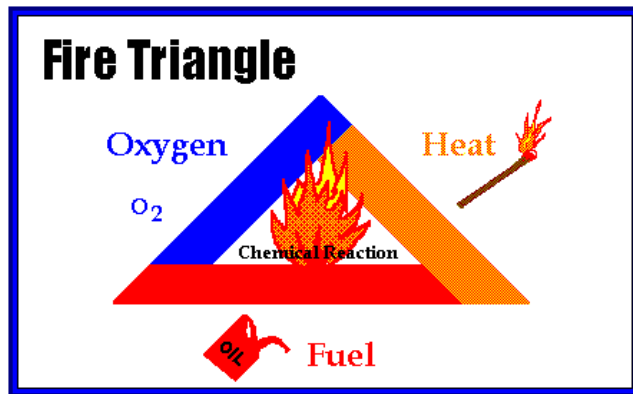
Recognition and Evaluation of Hazards

- Eating and drinking in the laboratories and animal rooms is forbidden.



Fire and Life Safety

- You need oxygen, fuel, and an ignition source to start a fire.
- Fire Safety is a must in the Plastination Lab



Chemical Storage

Flammable Storage

- Keep flammable storage to a minimum!!!
- Do not accumulate hazardous waste.
- Maximum storage limitations are based on the size of the room, sprinklers, and fire ratings.
- Where do you store 8000 liters of Acetone safely?

Laboratory Emergency Preparedness

- **All** mercury spills should be cleaned up in a timely fashion.
- Secondary Containment
- To clean Hg spills you must use a mercury vacuum and be thorough.



Laboratory Emergency Preparedness

- **R (rescue) A (alarm) - C (confine) - E (Extinguish/Evacuate)**
- **P (pull) – A (aim) – S (Squeeze) – S (Sweep)**
- **Know** that the fire extinguishers in your lab are located at the door
- **Inspection** of extinguishers is performed on a routine basis
- **Training** for staff should be hands on



Hazardous Chemical Wastes

- **In the lab**

- Label all waste containers as “Hazardous Waste” Example: **“Hazardous Waste Acetone”**
- Place that waste in a leak proof container
- Designate a space as a hazardous waste accumulation area.
- Date the container when full call for waste pickup

- **Recycling**



Thank You

- Questions?