

# NDL/POEM Safety Presentation: Working with $\text{MX}_2$ and other layered materials -- a review

1/16/18

RS & AG

# Objectives

After this training, you will know:

- Health and safety measures NDL/POEM labs have in place
  - Chemical Hygiene Plan (CHP)
  - Fume hood/Eye wash/PPE/Chemicals Inventory
  - Labeling and Inventory
- How to identify health and safety hazards of NDL/POEM laboratories in MSDS (Material Safety Data Sheets)
  - Group exercise with GaS MSDS (identify the pertinent information)
  - Individual exercise with other MSDS from MSE 254 folder & Chemical Inventory
- How best to protect yourself from hazardous and potentially hazardous exposures
  - Use of PPE
  - Use of Fume hoods
  - Proper storage
  - Proper disposal
- Safety Practices

**This training is not intended to replace UCR mandated lab safety training, but rather to highlight safety measures put in place specific to NDL/POEM laboratories citing specific examples pertinent to NDL/POEM research.**

# Training Goals

## •Specific Work Practices

- Chemical hygiene plan/lab manual
- Location & availability of MSDSs
- Specific lab safety work practices or SOPs
- Training whenever new hazards are used in the lab

## •Personal Protective Equipment

- Instruction on appropriate PPE & how to use it
- Location & availability of PPE & maintenance of reusable PPE

## •Lab Equipment

- Location & operation of eyewash stations
- Use of fume hoods, storage cabinets, refrigerators & other engineering controls

## •Waste Handling and Spill Response

- Chemical waste handling & disposal procedures
- Location & availability of spill kits & emergency checklists
- Spill response procedures

# Why Do We Care?

A *hazardous substance* is defined as a material/substance that poses a physical or health hazard.

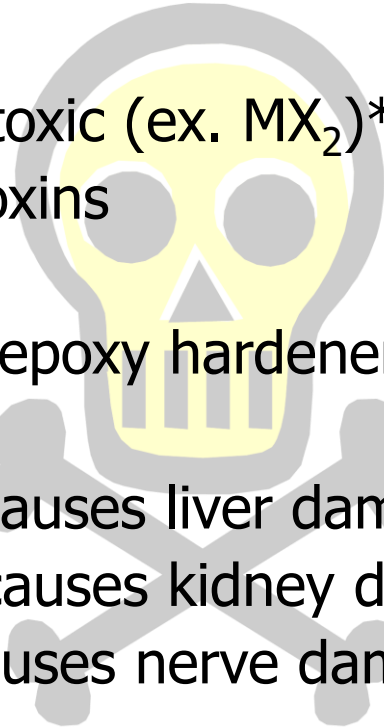
Exposure to Hazardous Chemicals Can Result in acute or chronic health effects.

❖ **Acute** – occurring within hours or days of exposure

❖ **Chronic** – occur after exposure over many years

▶ A health hazard has the following characteristics:

- ✓ Carcinogen
- ✓ Toxic or highly toxic (ex.  $\text{MX}_2$ )\*
- ✓ Reproductive Toxins
- ✓ Irritants
- ✓ Corrosives (ex. epoxy hardener, hydrochloric acid)\*
- ✓ Sensitizers
- ✓ Hepatotoxins (causes liver damage)
- ✓ Nephrotoxins (causes kidney damage)
- ✓ Neurotoxins (causes nerve damage)



\* These are used in NDL/POEM labs. Can you identify other chemicals/materials that may be health hazards?



## A physical hazard has the following characteristics:

- ✓ Explosive
- ✓ Flammable (ex. IPA, acetone, ethanol)\*
- ✓ Oxidizer
- ✓ Pyrophoric
- ✓ Organic peroxide
- ✓ Compressed gas (ex. N<sub>2</sub>)\*
- ✓ Cryogenic (ex. liquid N<sub>2</sub>)\*
- ✓ Combustible liquid
- ✓ Unstable (Reactive)
- ✓ Water-reactive



\* These are used in NDL/POEM labs. Can you identify other chemicals/materials that may be physical hazards?

# Exposure Controls

**Engineering:** Removes or Separates Hazard from Person

- Local Ventilation (Fume Hoods)

**Administrative:** Procedures that Limit Contact with Hazard i.e.:

- Lab Safety Training
- Good Housekeeping

## **Minimum Recommended PPE:**

Chemical Resistant Gloves, Splash Proof Goggles,  
Lab Coat, Face Shield, and Rubber Apron when Necessary

**Do all of you have the minimum PPE?**

You Have the  
Right to Know!

OSHA's Hazard Communication  
Standard requires that  
ALL Containers Must be Labeled With:

Chemical  
Name &  
Physical/  
Health  
Hazards

**SODIUM HYDROXIDE 50 %**

CAS NO. 1310-73-2

**WARNING! CAUSES SEVERE BURNS AVOID BREATHING VAPOR-USE WITH ADEQUATE VENTILATION**  
Avoid contact with skin or eyes. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention. Wash clothing before re-use.

**DO NOT LOAD WITH EXPLOSIVES OR HEAR ARTICLES BEARING OXIDIZER LABELS**

**IMPORTANT:** All products are sold without warranty of any kind and purchasers will, by their own tests, determine suitability of such products for their own use.

**CONTAINER HANDLING AND STORAGE:**  
Before moving container be sure closure is securely fastened. Keep out of sun and away from heat. Completely drain container before returning. Never use pressure to empty. In case of spillage, flush with plenty of water.

**WHEN HANDLING WEAR GOGGLES OR FACE SHIELD. DO NOT ADD WATER TO CONTENTS WHILE IN A CONTAINER BECAUSE OF VIOLENT REACTION. WHEN DILUTING, ADD CONTENTS TO WATER SLOWLY.**

**1824**

8

\_\_\_\_\_ LBS. NET WT.

**ABC Chemical Company**

Name &  
Address of  
the  
Manufacturer  
& Emergency  
Contact  
Numbers

100 Main St., Philadelphia, PA,  
1-800-555-1212

Are all of your containers labeled with the required information?



# Material Safety Data Sheets (MSDS)

- An MSDS Must Be on File & Available for Each Chemical in the Lab.
- An MSDS lists:
  - **Product Identity**
  - **Hazardous Ingredients**
  - **Physical Data**
  - **Fire & Explosion Hazard Data**
  - **Reactivity Data**
  - **Health Hazard Data**
  - **Precautions for Safe Handling & Use**
  - **Control Measures**

**Where is the MSDS folder in MSE 254; in B140?**

# Example MSDS: Gallium sulfide (GaS)

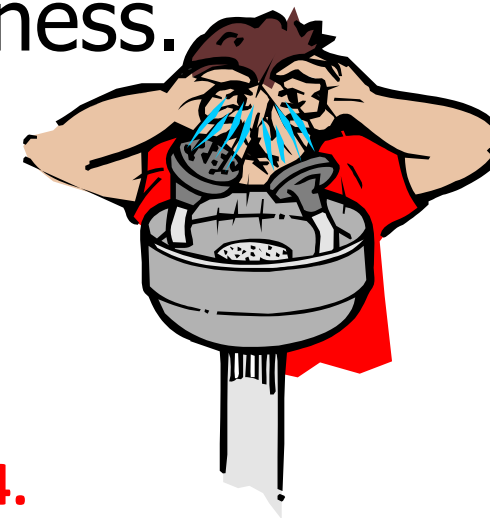


MSDS GaS

**What are the pertinent information in your MSDS sample?**

# Safety Showers and Eyewashes

- ▶ When physical hazards and health hazards exist, it is very important to know where the eye wash/safety shower is located. Unexpected accidents do occur and knowing where to go at the time of an emergency can reduce injury/illness.



**There is one eyewash at EACH entrance/exit to MSE 254.**

# Chemical Storage

## Safe Storage of Chemicals is a Necessity in Every School Laboratory!

- ❖ Minimizes Exposure to Students and Staff to Corrosive and Toxic Chemicals
- ❖ Lessens the Risk of Fire
- ❖ Prevents the Mixing of Incompatibles & the Creation of an Emergency Situation



- ▶ Chemicals can pose a significant hazard. They should be limited to the use under a properly working fume hood. Chemicals can release hazardous fumes which not only harm the environment, but they can be a major health threat. They must be handled carefully and disposed of properly.

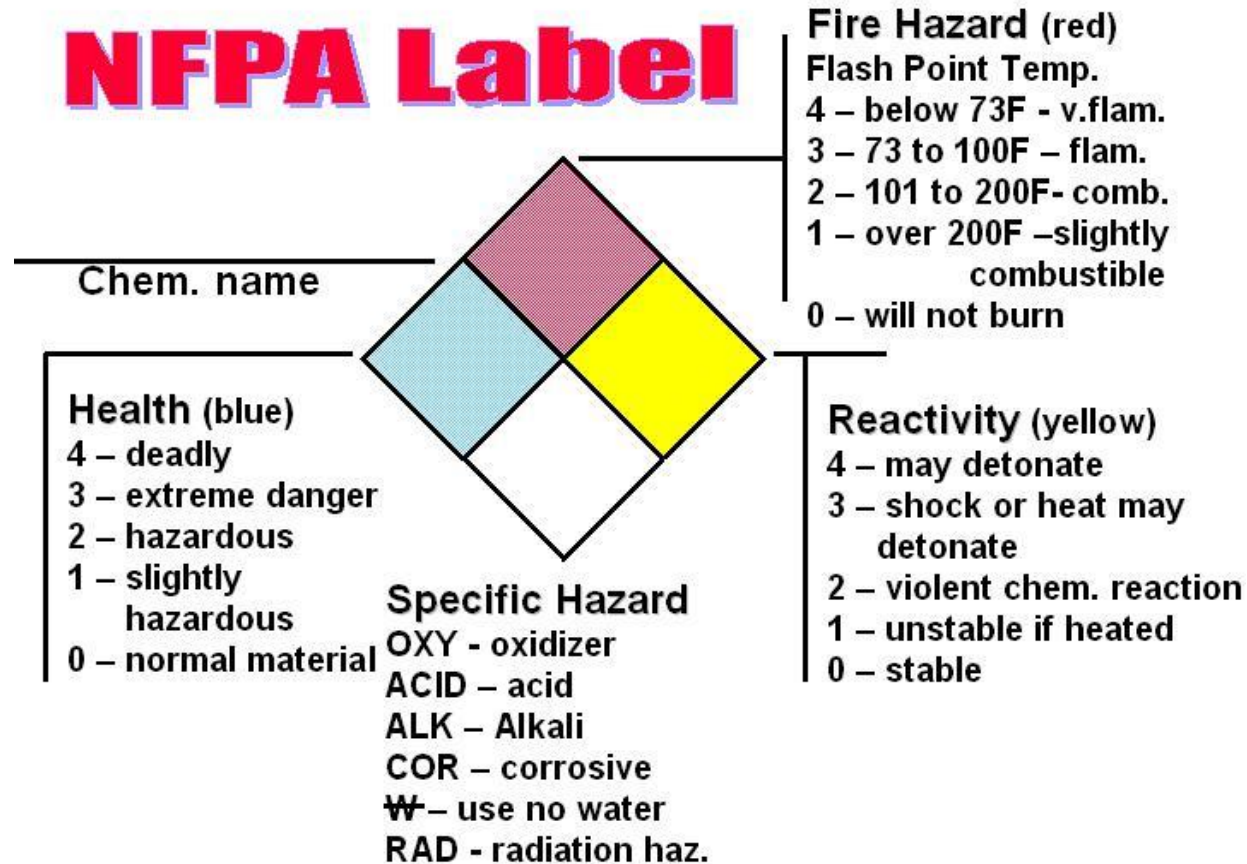
# Waste Chemical Disposal

- **Requires:**
  - **Proper storage**– same rules apply – make sure waste chemicals are compatible
  - **Proper labeling** – tags should be placed on bottles name of chemical
  - **Pre-planning** – know what waste you're creating prior to carrying out experiments; minimize purchases
  - **Record-keeping** – of all waste chemicals on hand and those already picked up for disposal
- **UCR Waste Disposal Services:**
  - <http://ehs.ucr.edu/services/waste.html>

# Safety Practices

- Safety labeling
- Fume hood safety
- Respiratory protection
- Hazardous wastes disposal
- Unsafe habits

# Safety labeling



# Fume Hoods



Check Air Flow



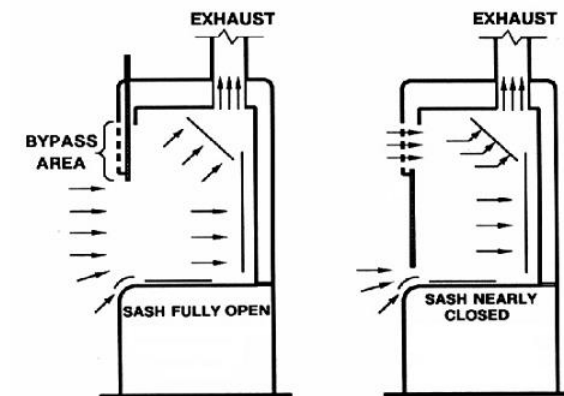
- Fume hoods are installed in laboratories to protect workers from hazardous contaminants generated by experiments.



# Fume hood sash



- Keep the sash height 18 inches or less from the working surface while working in the hood.
- The sash should be kept **CLOSED** when you are not working in the hood. This adds to your safety!
- Significant energy is consumed when sashes are left open. This results in unnecessary costs to LBNL and a waste of resources.



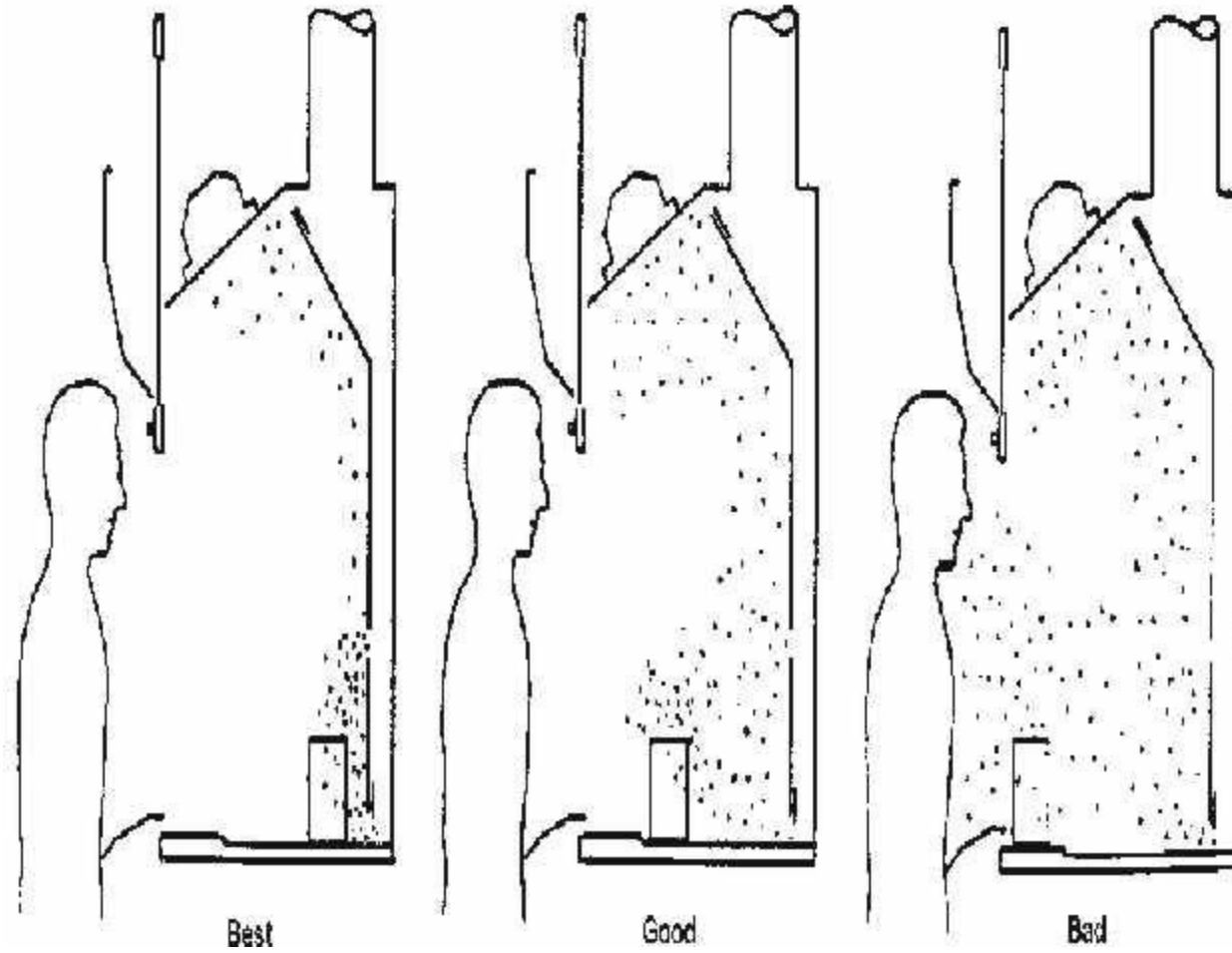
# Fume Hood safety tips

- Do not over load
- Do not block the air flow
- Don't store chemicals in hoods
- Work 6 inches inside of hood, not on the edge
- close the hood when the hood is not being used
- Keep the hood sash closed as much as possible
- Make sure that the sash is open to the proper operating level, which is usually indicated by arrows on the frame.
- Make sure fume hood is on
- Do not put your head in the hood when contaminants are being generated.
- Solvent bottles in the fume hood must be capped when not in use.
- Do not make fast movements when taking things in and out of the hood.
- Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present.

# Fume hood safety tips



# Fume hood air flow



# Using Fume Hood for MX2 materials

- TLV should be kept below the allowed TLV indicated in MSDS
- Any chemical process of MX2 materials must be done under fume hood:
  - ✓ Melting
  - ✓ Chemical Exfoliation
  - ✓ High temperature process
- Read MSDS before any chemical process on the MX2 materials to make sure its safe to be done

# Example (TaSe2)

## SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Molecular weight: 338.87

CAS #	OSHA PEL	ACGIH TLV	Other	%
12039-55-3	.2mg(Se)/m <sup>3</sup>	.2mg(Se)/m <sup>3</sup>		100

## SECTION VIII - CONTROL MEASURES

### *Protective Equipment Summary (Hazard Label Information):*

NIOSH approved respirator, impervious gloves, safety glasses, clothes to prevent contact, goggles or face shield.

### *Ventilation:*

Local Exhaust: To maintain concentration at low exposure levels.

Mechanical (General): Recommended.

### *Work/Hygienic/Maintenance Practices:*

Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

TLV: Threshold limit value

PEL: permissible exposure limits

# Respiratory protection

- Try not to make dust while working with MX2 materials
- In case of accidental release follow the instruction indicated in MSDS

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# Choosing proper respirator

particulate respirator- 99%

P-100



N-100



particulate respirator- 95%

P-95



N-95



- ✓ P shows respiratory protection is for certain oil and non-oil based particles
- ✓ N shows respiratory protection is for certain just non-oil based particles
- ✓ 100 shows 99% filtering efficiency

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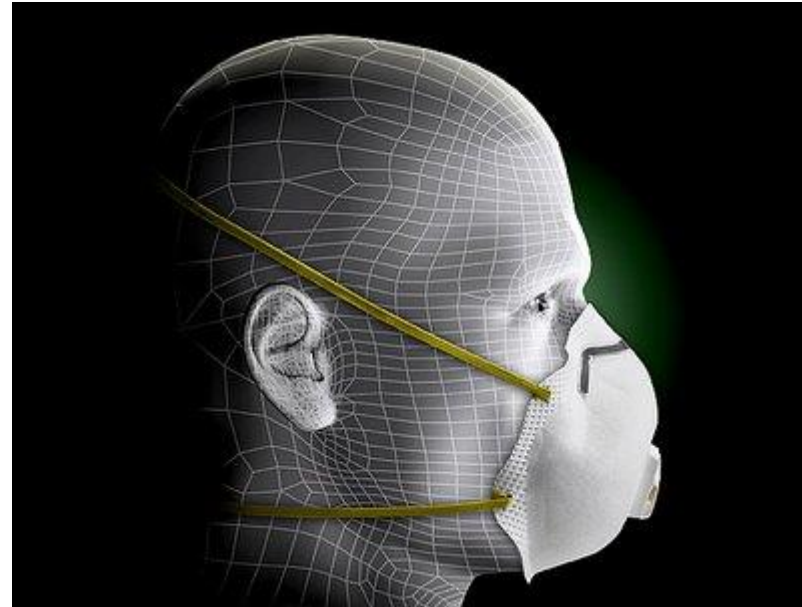
Vapor respirator



Possible protection against

- ✓ organic vapors
- ✓ acid gases
- ✓ Metal fumes
- ✓ ...

Proper way of wearing respirator



# Type of respirator- Example: GaS

## SECTION 8 ----- EXPOSURE CONTROLS/PERSONAL PROTECTION -----

Contains no substances with occupational exposure limit values.

Personal protective equipment

### Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full  
-face particle respirator type N100

(US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

### Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

### Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

### Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

# Hazardous waste Disposal

- Follow the instruction indicated in MSDS for each material
- Generally any hazardous material, should be disposed and packed separately and not in regular trash can
- Do not mix incompatible disposals together
- Label the disposals indicating the hazards
- After the container is filled follow EH&S instruction for hazardous waste pick up



# Unsafe Habits

- Having food or drink in experiment
- Making dust during working or cleaning
- Disposing hazardous material in regular trash can
- Disposing coffee, water or soda in regular trash can
  - ➔ Coffee or water can react with MX2 materials and produce hazardous gas
- Exfoliating without using disposable paper or napkin sheet underneath
- Not reading MSDS before working with any material (even if you think its safe)



No food or drink is allowed in lab working area specially while doing experiment

# Lab Attire

You should remember the following:

- ✓ No open-toed shoes
- ✓ No shorts unless a lab coat is used
- ✓ Restrain hair when working with hazardous materials
- ✓ Remove protective clothing in public
- ✓ Use the proper Personal Protective Equipment for the job



Question?