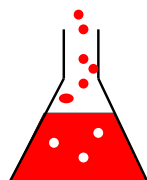


Chemical Handling



Most Important Fact

“A commitment to purchase a chemical is a commitment to handle and store the chemical safely and to dispose of the chemical in an environmentally acceptable fashion.”

The technology and management systems exist to handle all chemicals safely.

Steps in Chemical Handling

1. What are the hazardous properties of the chemical?
2. How much to purchase?
3. How do I keep track of the chemical?
4. How do I store the chemical?
5. How do I handle the chemical?
6. How do I dispose of the chemical?
7. What do I do if a chemical spill occurs?

Step 1: What are the hazardous properties of the chemical?

Sources of information:

- MSDS sheets, either on-line, from manufacturer or other.
- What do these hazardous properties mean?
- Can we handle this chemical safely?
- Is the chemical regulated?

MSDS

Provide critical safety data.

Manufacturer of chemical is required by law to provide an MSDS.

Data on MSDS is not confirmed.

Many times data fields are blank.

I would recommend reviewing data from a number of different sources.

MSDS



MSDS library must be in the lab in an easily accessible and visible location.

In my lab, I also include department Safety Manual and JSA sheets for procedures in laboratory.

MSDS

Parts of a typical MSDS:

- **Physical / Chemical Characteristics:** Boiling point, vapor pressure, specific gravity, appearance.
- **Fire and Explosion hazard data:** Flash point, flammable limits, fire fighting procedures, explosion hazards.
- **Reactivity data:** stability, incompatibility, decomposition by-products.
- **Health Hazard Data:** Routes of entry, signs and symptoms of exposure

MSDS

- **Precautions for safe handling and use:** waste disposal, storage
- **Control Measures:** Personal Protective Equipment (PPE)

NFPA Diamond

Ratings: 0-4
 0 : no hazard
 4: max. haz.

Used for firefighters

HEALTH HAZARD

4 - Deadly
 3 - Extreme danger
 2 - Hazardous
 1 - Slightly hazardous
 0 - Normal material

FIRE HAZARD

Flash Point
 4 - Below 73° F
 3 - Below 100° F
 2 - Below 200° F
 1 - Above 200° F
 0 - Will not burn

SPECIFIC HAZARD

Oxidizer OXY
 Acid ACID
 Alkali ALK
 Corrosive COR
 Use NO WATER
 Radiation Hazard

REACTIVITY

4 - May detonate
 3 - Shock and heat may detonate
 2 - Violent Chemical change
 1 - Unstable if heated
 0 - Stable

NFPA Diamond

Acetone

See Safety Manual

Can we handle the chemical safely?

Depends on your capability, the condition of your laboratory facility, the equipment available, and the confidence in managing the chemical properly.

Some chemicals I will not handle: phosgene, ethylene oxide, regulated chemicals, others.

Regulated Chemicals

OSHA publishes a list of about 30 regulated chemicals.

- Each chemical has a standard (see OSHA.gov)
- Most require explicit measurement of exposure concentrations.
- Most require annual medical physicals for workers potentially exposed.

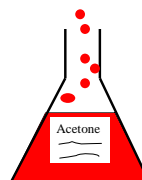
Common chemicals on list: benzene, benzidine, ethyleneimine, acrylonitrile, formaldehyde, 1,3 butadiene, methylene chloride

Step 2: How much to purchase?

Order only what you need! Keep inventories to a minimum. Remember, what you don't have can't hurt you!

Step 3: How do I keep track of the chemical?

- Chemical Inventory



- Labeling of container

Chemical Inventory

Not required by regulation but an excellent idea.
 Software programs are available (one is on your CD).
 Laboratory user must take ownership of the inventory.
 Should track chemicals from acquisition to disposal.
 Should include same information as chemical label.

Chemical Inventory Program

No.	Chemical Name	State	DOT	Quantity	Units	Location	Owner	Acquired	Expires	Note
1	Methane	Gas	2.1	1		cylinder	209	Crowl	2/2/2001	
2	Propane	Liquid	3.0	1		cylinder	209	Crowl	1/26/2...	
3	Butane	Liquid	2.1	5	kg	209	Crowl	1/26/2...		
4	Isopropyl ether	Liquid	3.0	1		Liter	209	Crowl	7/29/2... 1/29/2...	Peroxidab...

Chemical Inventory Program

```

Isopropyl ether
-----
State: liquid
Quantity: 1 liter
DOT Class: 3.0
Classific: 209
Chem: Crowl
MIME: 7/29/2002
Acquired: 1/26/2001
Expire: 1/29/2003
Peroxidizable ether*

FLAMMABLE/COMBUSTIBLE liquid
NSEARCH Laboratory
Michigan Tech University
207-209 Chemical Sciences
    
```

Label printed by program

Chemical Inventory Program

```

Chemical Inventory
Date: 11/15/2003
Page 1
-----
Chemical State DOT Qam. Dist. Sec. Owner Acquired Expire/Note
-----
1 Methane Gas 2.1 1 cyl. 209 Crowl 2/2/2001
2 Propane LIQUID 3.0 1 cyl. 209 Crowl 1/26/2001
3 Butane LIQUID 2.1 5 kg 209 Crowl 1/26/2001
4 Isopropyl ether LIQUID 3.0 1 Liter 209 Crowl 7/29/2002 1/29/2003 Peroxidizable ether!
    
```

Inventory printed by program.

Chemical Labeling

A chemical label is required for any chemical or sample that will not be in your physical possession at any time.

Parts of the label:

- Identity of contents
- Date chemical was acquired
- Disposal date (for unstable chemicals)
- Responsible person
- Hazardous characteristics
- Other pertinent safety information.

Chemical Labeling

- Label container prior to use.
- Chemical label must be legible, in English.
- Must have actual chemical name, not a number.
- Must not obscure existing labels or safety information.

Chemical Labeling



Hazards Laboratory

Chemical Name: _____

Date Rec'd: ___/___/___ Disposal Date: ___/___/___

Dept: _____ Location: _____

Responsible Party: _____

Safety Info: _____ Remarks: _____



Step 4: How do I store the chemical?

- MSDS sheets must be available for all chemicals.
- All chemical must be properly labeled and inventoried.
- Do not store chemicals on top of lab benches, out in open, or above eye level.
- Storage in hoods is not recommended.
- Keep incompatible chemicals separated (see table in safety manual).
- Flammables stored in flammable storage cabinet.
- All cabinets containing chemicals must be labeled.

Chemical Storage – Acids and Bases



Chemical Storage - Flammables





Chemical Storage

Identify locations in lab where chemicals are stored.

Chemical Storage - Signs



Chemical Storage - Signs




Chemical Storage - Signs



Step 5: How do I handle the chemical?

- Depends on properties of chemical.
- Usually involves personal protective equipment.
 - Gloves (see compatibility chart in Safety Manual)
 - Aprons
 - Others
- Try to minimize exposure by minimizing transport and handling.

Chemical Transport



This method provides stability and containment.

Step 6: How do I dispose of the chemical?

Michigan Tech has a waste disposal program, however, they collect and dispose of chemicals on an infrequent basis, dependent on volume. The user must pay for the service. This service is very costly if the material is unknown (factor of ten).

See Chemical Engineering Waste Disposal Manual.

This will be discussed later.

Step 7: What do I do if a chemical spill occurs?

If spill is minor, you may be capable of clean-up or response - see Safety Manual. Spill kits are very valuable here.

If spill is major, leave spill site immediately and call Public Safety at 1-2-3 or 9-1-1.



Legal Requirements

- MTU is a State institution, so we do not come under Federal OSHA authority.
- However, we are under Michigan OSHA authority.
- Michigan is an OSHA certified state, meaning that all regulations are consistent with Federal regulations.
- Two major regulations:
 - * Hazard Communication
 - * Hazardous Work in Laboratories

Hazard Communication

Designed to make information about hazardous chemicals available to exposed employees.

Applies to any business that uses hazardous chemicals.

Does not depend on number of employees.

Part 42: Hazard Communication

The program must include a written hazard communication document, which addresses:

1. Container labeling.
2. Employee training.
3. MSDSs library development and maintenance.
4. A list of hazardous chemicals.
5. Informing employees about the hazards of non-routine tasks, such as maintenance or repair.
6. Information exchange between employees, sites and contractors.

Part 42: Hazard Communication

In addition, the program must address:

1. Employee training in the identification, use, and hazards of chemicals they may work with.
2. MSDS sheets must be maintained in an orderly fashion.
3. Containers and pipes must be labeled.

Part 431: Hazardous Work in Laboratories

Major Parts:

1. Exposure Monitoring
2. Chemical Hygiene Plan
3. Employee Information and Training
4. Medical Surveillance
5. Hazard Identification
6. Respiratory Protection
7. Record keeping

1. Exposure Monitoring

Must measure exposure to any regulated chemicals and notify the employee within 15 working days of results.



2. Chemical Hygiene Plan

Chemical hygiene plan must:

1. provide the means of protecting employees from chemical exposures.
2. provide methods to keep exposures below limits.
3. be readily accessible.
4. have the following elements:
 - a. Standard Operating Procedures (SOP)
 - b. Criteria for control measures
 - c. methods to insure lab hood functions

2. Chemical Hygiene Plan (cont'd)

- d. employee information and training.
- e. prior approval for hazardous operations.
- f. provisions for medical consultations.
- g. assignment of chemical hygiene officer.
- h. provisions for working with particularly hazardous substances.
- i. designation of exposure areas, including usage of hoods, waste removal and decontamination procedures.
5. Must review and update plan annually.

3. Employee Information and Training

1. Employee must know and understand the hazards of chemicals in the workplace.
2. Information and training must be provided prior to chemical use and must be updated for new exposure situations.
3. Employees shall be informed of the following:
 - a. The chemical hygiene plan.
 - b. The PEL's for workplace chemicals
 - c. Signs and symptoms of exposure.
 - d. The availability of reference materials.

3. Employee Information and Training (cont'd)

4. Employee training must include the following:
 - a. Methods used to detect chemicals in workplace.
 - b. Physical and health hazards of chemicals.
 - c. Protection methods.
5. The employee must be trained on the employer's chemical hygiene plan.

4. Medical Surveillance

1. Employers must provide the following medical services:
 - a. appropriate medical examination after exposures.
 - b. if exposures are above required levels for regulated chemicals, then medical surveillance must be established.
2. Medical examinations must be provided without cost to the employee.
3. The employer must provide to the physician:
 - a. the identity of the chemical

4. Medical Surveillance (cont'd)

- b. a description of the conditions under which the exposure occurred.
 - c. a description of the signs and symptoms of exposure.
4. Employer must obtain a written report of the examining physician.

5. Hazard Identification

1. Existing labels on containers must not be defaced or removed.
2. MSDS sheets must be maintained and available to employees.
3. Unknown chemicals must be treated as hazardous until proper determinations are made.

6. Use of Respiratory Equipment

Respiratory equipment must be provided at no cost to employee.



This also applies to any safety equipment required for the job.

7. Record Keeping

1. Employers must maintain accurate records of exposure measurements, medical consultations, and medical tests.
2. Must be protected from unauthorized disclosure.

