Hazardous Materials

HAZARDOUS MATERIALS

The University of Maryland at the Horn Point Laboratory recognizes that certain job activities require employees to risk contact with hazardous substances as a result of assigned duties.

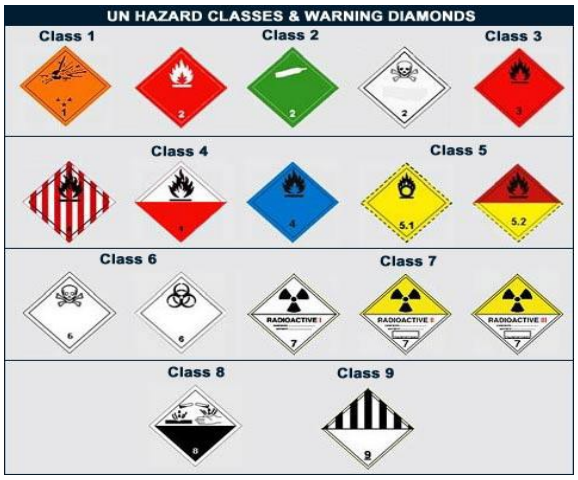
It is the intent of the HPL to eliminate or minimize the risk of occupational exposure to potentially hazardous substances by utilizing a combination of engineering controls, employee training/education, personal protective equipment, vaccinations (if necessary), and implementation of recommended safe work practices.

What is a Hazardous Material?

DOT Definition of Hazardous Material: "Any substance which may pose an unreasonable risk to health and safety of operating or emergency personnel, the public, and/or the environment if not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal, or transportation.

There are nine classes of hazardous materials.

- Class 1 Explosives
- Class 2 Compressed Gases
- Class 3 Flammable Liquids
- Class 4 Flammable solids
- Class 5 Oxidizing Materials
- Class 6 Poisonous Materials
- Class 7 Radioactive Materials
- Class 8 Corrosives
- Class 9 Miscellaneous



HAZARD COMMUNICATION

The Hazard Communication Standard (HCS), also known as the "Right-to-Know Law", was enacted on November 25, 1983, by the Occupational Safety and Health Administration (OSHA). In 1984 the Maryland General Assembly enacted legislation designed to give employees information about hazardous substances in their workplaces. This law is sometimes called the "Right-to Know" law or Hazard Communication Standard. In 1990, the Maryland Right-to-Know law was amended to include the provisions of the federal standard, 29CFR 1910.1200. This law requires employers to obtain, maintain and submit certain information about hazardous substances.

On March 26, 2012, OSHA adopted portions of the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS), Revision 3 into the HCS with an effective date of 60 days thereafter (May 25, 2012) and a four-year transition period.

The revised HCS provides harmonized criteria for classifying chemicals and requires specific label elements on shipped containers and mandatory 16-section standardized safety data sheets (SDSs). Prior to this revision, information was conveyed on labels and material safety data sheets (MSDSs) in whatever formats the supplier chose.

The purpose of the HCS has remained the same since it was first enacted–to ensure that the hazards of all hazardous chemicals imported, produced or used in U.S. workplaces are evaluated and that the information is transmitted to affected employers and potentially exposed employees. This transfer of information is to be accomplished by means of a comprehensive hazard communication program that includes container labeling and other forms of warning, Safety Data Sheets (SDS) and employee training.

Hazard Communication Standard 29CFR 1910.1200

The HCS contains six major categories:

1. **Hazard Classification (**29 CFR1910.1200(d))
2. **Written Hazard Communication Program** (29 CFR 1910.1200(e))
3. **Labels and other Forms of Warning** (29 CFR 1910.1200(f))
4. **Safety Data Sheets (SDS)** (29 CFR 1910.1200(g))
5. **Employee Information and Training** (29 CFR 1910.1200(h))
6. **Trade Secrets** (29 CFR 1910.1200(i))

1. **Hazard Classification**
   Hazard Classification is found in the Code of Federal Regulations (CFR) - 29CFR 1910.1200 (d) requires chemical manufacturers and importers to evaluate the chemicals produced in their workplaces or imported by them to determine the hazard classes, and, where appropriate, the category of each class. Mandatory classification considerations are given in 29 CFR 1910.1200 Appendix A (Health Hazard Criteria) and Appendix B (Physical Criteria). When classifying mixtures they produce or import, chemical manufacturers and importers of mixtures may rely on the information provided on the current safety data sheets of the individual ingredients, except where the chemical manufacturer or importer knows, or in the exercise of reasonable diligence should know, that the safety data sheet misstates or omits information required by this section.

2. **Written Hazard Communication Program** -(29 CFR 1910.1200(e))
   Employers shall develop, implement, and maintain at each workplace, a written hazard communication program which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, safety data sheets, and employee information and training will be met. It must also include a list of the hazardous chemicals known to be present and how they will inform employees of hazards of non-routine tasks and hazards associated with chemicals in their work areas. A copy of the written program must be made available, upon request, to all employees and OSHA officials.

HPL employee information about (1) the regulatory requirements of the Hazard Communication Standard; (2) the presence, identity and location of hazardous chemicals in the workplace; and (3) the location and availability of this Written Hazard Communication Program and the SDS files is presented in the Hazard Communication/Right to Know (HC/RTK) training. New employees and students are required to receive Hazard Communication/Right to Know training prior to their initial assignment.

3. **Labels and other Forms of Warning** (29 CFR 1910.1200(f)
   Manufacturers, importers or distributors must ensure that each container of hazardous chemicals leaving their workplace is labeled, tagged or marked with the following six elements:
   I. **Product Identifier** - name or number used for a hazardous chemical on a label or SDS and a unique means to identify the chemical.
   II. **Pictogram** - symbol plus other graphic elements to convey specific hazard information. There are nine pictograms under GHS. The HCS

requires eight of the nine - environmental hazards are not governed by OSHA.

III. **Signal Word** is used to indicate the relative level of severity of hazard. DANGER is used for the more severe hazards and WARNING is used for less severe hazards.

IV. **Hazard Statement** - describes the nature and degree of the hazard(s).

V. **Precautionary Statement** - phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure or improper storage or handling.

VI. **Supplier Information** - name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.

The signal word, hazard statement(s), and pictogram(s) must be grouped together on the shipped container label and NOT separated on the container or outside packaging.

1. Product Identifier	**Sulfuric Acid**
2. Pictogram(s)	
3. Signal Words	**Danger**
4. Hazard Statement	Causes severe skin burns and eye damage. Fatal if inhaled, harmful to aquatic life
5. Precautionary Statement	Do Not breathe dust/fume/gas/vapors/sprays Wear protective gloves, cloths, eye, and face protection
6. Supplier Information	Sigma Aldrich, Any town USA, 46414, Phone: 218-777-6666, Fax: 1-800-889-9999

With this revision to the HCS, OSHA is continuing to give employers the flexibility to determine what types of workplace labels they will use (GHS or OSHA) for secondary labels.

HPL will use and preserve the labels already on containers as provided by the chemical manufacturers or suppliers. Whenever substances are transferred, the secondary container will be labeled immediately with the chemical name (or product name) as it appears on the manufacturer's label. The new container label will also include the appropriate hazard warnings. Secondary container labels can be printed from the MDSDonline Chemical Inventory Program for HPL.

Secondary Container Label for an Acetone Container used in a Lab or a Shop

1. **Identifier** --->
2. **Signal Word** --->
3. **Hazard Statement** --->
4. **Pictogram** --->

GHS Pictograms and Hazards

GHS chemical hazard pictograms are intended to provide the basis for or to replace national systems of hazard pictograms. Transport pictograms come in a wider variety of colors and may contain additional information such as subcategory number.

CMR (carcinogenetic, mutagenicity and toxicity for reproduction)
Specific Target Organ Toxicity (STOT)

4. Safety Data Sheets (SDS) (29 CFR 1910.1200(g)

Chemical manufacturers, importers, or distributors are required to provide SDSs for each hazardous chemical sent to the consumer. SDSs are now presented in a consistent 16-section format. Each lab is responsible to initially populate their chemical inventory into the

MSDSonline Chemical Inventory Program and the Environmental Safety Compliance Officer (ESCO) will maintain and update the inventory on all new chemical substances that are added subsequently. A complete list of chemicals used per laboratory area (PI, room number) is available online at MSDSonline.com after you receive a user ID and password from the ESCO.A brief description of each section is given below:

I. **Identification** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restriction on use.
II. **Hazard Identification** includes all hazards regarding the chemical; required label elements.
III. **Composition / information on ingredients** include information on chemical ingredients; trade secret claims.
IV. **First-aid measures** include important symptoms/ effects acute, delayed; and required treatment.
V. **Fire-fighting measures** list suitable extinguishing techniques, equipment; and chemical hazards from fire.
VI. **Accidental release measures** list emergency procedures, protective equipment; proper methods of containment and cleanup.
VII. **Handling and storage** lists precautions for safe handling and storage, including incompatibilities.
VIII. **Exposure controls / personal protection** list OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; and personal protective equipment.
IX. **Physical and chemical properties** list the chemical's characteristics.
X. **Stability and reactivity** list chemical stability and possible hazardous reactions.
XI. **Toxicological information** includes routes of exposure; related symptoms, acute and chronic effects and numerical measures of toxicity.
XII. **Ecological information** provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment.
XIII. **Disposal considerations** provide guidance on proper disposal practices, recycling or reclamation of the chemical or its container and safe handling practices.
XIV. **Transport information** provides guidance on classification information for shipping and transporting of hazardous chemicals by road, air, rail or sea.
XV. **Regulatory information** provides guidance on classification information for shipping and transporting of hazardous chemicals by road, air, rail or sea.

XVI. **Other information** includes the date of preparation or last revision

5. Employee Information and Training (29 CFR 1910.1200(h)

This category requires employers to provide employees with information and training on hazardous materials in their work place. The training must include methods to detect the presence or release of the hazardous material, the physical and health hazards, protective measures, labeling and explanation of the SDS.

HPL employee information about (1) the regulatory requirements of the Hazard Communication Standard; (2) the presence, identity and location of hazardous chemicals in the workplace; and (3) the location and availability of this Written Hazard Communication Program and the SDS files is presented in the Hazard Communication/Right to Know (HC/RTK) training. New employees and students are required to receive Hazard Communication/Right to Know training prior to their initial assignment.

Individual responsibilities of the employee include the following:

- Become familiar with safety procedures by taking HC/RTK course, attending briefings on health and safety, and reading the SDSs of the chemicals you will be using before you begin to use them.
- Read and follow the Standard Operating Procedure (SOP) in your lab before conducting hazardous experiments, e.g.; What are the potential hazards? What's the worst that could happen? How would I handle such a problem? What are the practices and equipment needed to minimize the risk of exposure? What procedures should be followed in the case of a spill?
- Use the appropriate personal protective equipment (PPE).
- Know the location of the nearest fire extinguishers, emergency shower, eyewash station, first-aid kit, blood-borne pathogen kit, fire blanket, burn kit and hazardous spill kit.
- Learn basic first-aid techniques.
- Never perform hazardous experiments alone. Always let someone know what you are doing, where you will be, and how long you expect to be there for your own safety. If you do not show up by the expected deadline they must come looking for you to ensure you are O.K.
- Label all chemicals as per the GHS Standard. Read all labels before and after removing chemicals from their containers.
- Dispense chemicals slowly. Observe results after dispensing a small amount, and wait a few minutes before continuing.
- Treat chemicals or mixtures of unknown composition as hazardous. Contact your supervisor of the ESCO if you have any questions.

- Report all accidents to the Environmental Safety Compliance Officer (ESCO), whether or not you were involved.
- After working with hazardous chemicals, wash exposed parts of your body with soap and water before leaving the lab.
- Individuals using radioactive materials must have taken and passed a radiation safety course approved by the Radiation Safety Committee at College Park. Contact the ESCO for more information.

Retraining is required whenever new hazards are introduced into the workplace. Employees are expected to contact the Environmental Safety Compliance Officer (ESCO) before using new chemicals or procedures for which they have not been trained. Appropriate instruction will be provided by their supervisor or the ESCO.

The HPL training course consists of the following:

1. Introduction
2. What is a hazardous material
3. Communication Standard
4. Risks
5. Physical and Health hazards
6. Routes of Entry
7. Personal Protective Equipment (PPE)
8. Global Harmonization Standard (GHS)
   - Labels
   - Signage
   - GHS Pictograms and Hazards
9. Storage of hazardous materials
10. Safety Data Sheets (SDS)
11. Emergency Procedures
    - Medical emergencies
    - Spills
    - Fires
12. Other Safety Tips
13. Radiation Safety

Outside Contractors

Outside contractors must attend Hazard Communication/Right to Know for Contractors given by the ESCO before performing work in a laboratory on the HPL campus.

6. Trade Secrets (29 CFR 1910.1200(i)

The chemical manufacturer may withhold the chemical identity, including the chemical name and other specific information, from the SDS. If a

trade secret is claimed, it must be indicated on the SDS. However, under special conditions, the substance's proprietary information may be obtained by health care professionals immediately if a medical emergency exists or requested in a non-emergency situation. Provisions for a written statement of need and confidentiality agreement will be based on the situation circumstances.

Sources

29 CFR 1910.1200, Hazard Communication

United Nations' Globally Harmonized System of Classification and Labeling of Chemicals, Revision 3

HAZARDS

There are two types of harmful hazardous materials:

- those that cause **physical hazards** and
- those that cause **health hazards** or **both**.

PHYSICAL HAZARDS

Physical hazardous material is classified as posing one of the following hazardous effects: explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid or gas); self-reactive; pyrophoric (liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; or in contact with water emits flammable gas.

Some chemicals have both health and physical hazards associated with them. Physical hazards are the most common and will be present in most workplaces at one time or another. They include unsafe conditions that can cause injury, illness and death. Physical hazards may manifest as fires, explosions, excessive temperatures, or the release of large volumes of gas or toxic or flammable gases or vapors.

PHYSICAL HAZARDOUS DEFINITIONS

1. **Explosive**- Explosive substance means a solid or liquid substance (or mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.

2. **Flammable Gas** - A gas having a flammable range with air at 20 C and a standard pressure of 101.3 kPa.
3. **Flammable Liquid**- A flammable liquid means a liquid having a flash point of not more than 93 C.

4. **Flammable Solid** - A flammable solid is a solid which is readily combustible, or may cause or contribute to fire through friction.

5. **Self-Reactive Substance** Self-reactive substances are thermally unstable liquid or solid substances liable to undergo a strongly exothermic decomposition even without participation of oxygen (air). This definition excludes substances or mixtures classified under the GHS as explosive, organic peroxides or as oxidizing.
6. **Pyrophoric** - A liquid or solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.
7. **Self-Heating Substances**- A self-heating substance is a solid or liquid, other than a pyrophoric substance, which, by reaction with air and without energy supply, is liable to self-heat. This endpoint differs from a pyrophoric substance in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).
8. **Oxidizer**- a chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials by providing oxygen, (perchloric acid, bromates, hydrogen peroxide).

9. **ORGANIC PEROXIDE -** a liquid or solid organic substance which contains the bivalent -0-0- structure and may be considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term also includes organic peroxide formulation (mixtures). Such substances and mixtures may:
    - be liable to explosive decomposition;
    - burn rapidly;
    - be sensitive to impact or friction;
    - react dangerously with other substances.
10. **SUBSTANCES CORROSIVE TO METAL** - A substance or a mixture that by chemical action will materially damage, or even destroy, metals

HEALTH HAZARDS

Although safety hazards related to the physical characteristics of a chemical can be objectively defined in terms of testing requirements (e.g. flammability), health hazard definitions are less precise and more subjective. Health hazards may cause measurable changes in the body-such as decreased pulmonary function. These changes are generally indicated by the occurrence of signs and symptoms in the exposed employee-such as shortness of breath, a non-measurable, subjective feeling. Employees exposed to such hazards must be apprised of both the change in body function and the signs and symptoms that may occur to signal that change.

The determination of occupational health hazards is complicated by the fact that many of the effects or signs and symptoms occur commonly in non-occupationally exposed populations, so that effects of exposure are difficult

to separate from normally occurring illnesses. Occasionally, a substance causes an effect that is rarely seen in the population at large, such as angiosarcomas caused by vinyl chloride exposure, thus making it easier to ascertain that the occupational exposure was the primary causative factor. More often, however, the effects are common, such as lung cancer. The situation is further complicated by the fact that most chemicals have not been adequately tested to determine their health hazard potential, and data do not exist to substantiate these effects.

There have been many attempts to categorize effects and to define them in various ways. Generally, the terms "acute" and "chronic" are used to delineate between effects on the basis of severity or duration. "Acute" effects usually occur rapidly as a result of short-term exposures, and are of short duration. "Chronic" effects generally occur as a result of long-term exposure, and are of long duration.

The acute effects referred to most frequently are - irritation, corrosion, sensitization and lethal dose. Although these are important health effects, they do not adequately cover the considerable range of acute effects which may occur as a result of occupational exposure, such as, for example, narcosis.

Similarly, the term chronic effect is often used to cover only carcinogenicity, teratogenicity, and mutagenicity. These effects are obviously a concern in the workplace; but again, do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasia (such as enema), chronic bronchitis and liver atrophy.

The goal of defining precisely, in measurable terms,, every possible health effect that may occur in the workplace as a result of chemical exposures cannot realistically be accomplished. This does not negate the need for employees to be informed of such effects and protected from them.

Definitions

1. **Carcinogen:**
   Any substance or a mixture that is an agent directly involved in causing cancer. This may be due to the ability to damage the genome or to the disruption of cellular metabolic processes.

2. **Skin Corrosion:** Skin corrosion means the production of irreversible damage to the skin following the application of a test substance for up to 4 hours.

3. **Highly toxic:** A substance that is both toxic and reactive

and whose potential for human injury is high if released. Highly hazardous chemicals may cause cancer, birth defects, induce genetic damage, cause miscarriage, injury and death from relatively small exposures.

3. **Irritant:**
   An irritant is a chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.

4. **Sensitizer:**
   A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.
5. **Toxic:** Any chemical which, through its chemical action on life processes can cause death, temporary incapacitation, or permanent harm to humans or animals.

Target organ effects:

The following is a target organ categorization of effects which may occur, including examples of signs and symptoms and chemicals which have been found to cause such effects. These examples are presented to illustrate the range and diversity of effects and hazards found in the workplace, and the broad scope employers must consider in this area, but are not intended to be all-inclusive.

1. Hepatotoxins**:** Chemicals which produce liver damage
   a. Signs & Symptoms: Jaundice; liver enlargement
   b. Chemicals: Carbon tetrachloride; nitrosamine
2. Nephrotoxins**:** Chemicals which produce kidney damage
   a. Signs & Symptoms: Edema; proteinuria
   b. Chemicals: Halogenated hydrocarbons; uranium
3. Neurotoxins: Chemicals which produce their primary toxic effects on the nervous system
   a. Signs & Symptoms: Narcosis; behavioral changes; decrease in motor functions
   b. Chemicals: Mercury; carbon disulfide
4. Agents which act on the blood or hematopoietic system: Decrease hemoglobin function; deprive the body tissue of oxygen
   a. Signs & Symptoms: Cyanosis; loss of consciousness
   b. Chemicals: Carbon monoxide; cyanides
5. Agents which damage the lung: Chemicals which irritate or damage the pulmonary tissue
   a. Signs & Symptoms: Cough; tightness in chest; shortness of breath

b. Chemicals: Silica; asbestos

6. Reproductive toxins: Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses teratogenesis)
    a. Signs & Symptoms: Birth defects; sterility
    b. Chemicals: Lead; DBCP
7. Cutaneous hazards: Chemicals which affect the dermal layer of the body
    a. Signs & Symptoms: Defatting of the skin; rashes; irritation
    b. Chemicals: Ketones; chlorinated compounds
8. Eye hazards: Chemicals which affect the eye or visual capacity
    a. Signs & Symptoms: Conjunctivitis; corneal damage
    b. Chemicals: Organic solvents; acid

PROCEDURES FOR ORDERING, RECEIVING, AND STORING HAZARDOUS CHEMICALS

Ordering

Before ordering hazardous materials:

- Authorized faculty and staff, should check that suitable materials are not available (declared excess by another researcher or lab by utilizing the online MSDS chemical inventory system).
- Procure the smallest quantities available which meet the maximum usage requirements for a reasonable time period.
    - Disposal costs per package frequently are at least 25% less with smaller units than larger containers
    - Packages are emptied faster-there is less chance for decomposition of reactive compounds when small containers are used
    - The risk of accident and exposure to the hazardous material is reduced when handling a smaller container
    - The large "economy size" often requires other equipment -such as smaller transfer containers, as well as funnels, pumps, and labels. Additional labor to subdivide the larger quantities into smaller containers, and extra personal protective equipment also may be needed.

- There is a place on all requisition purchase orders to indicate if the item ordered is hazardous material; please use this indicator when appropriate.

- Inform the ESCO of the material being ordered (name, quantity, manufacturer/supplier) so it may be placed in your chemical inventory online. This allows the inventory to remain current.

Receipt of Hazardous Material

When the hazardous material is received:

- The material shall be stored in accordance with the manufacturer's SDS or label warnings. Store like "storage codes" together.
- The expiration date of the material must be sent to the ESCO to be placed in the inventory program. This will flag the material when it has reached its expiration date.
- Read the Safety Data Sheet associated with the hazardous material before its use.
- When handling or using the hazardous material use the personal protective equipment (PPE) as noted in the SDS.
- Once the hazardous material is unacceptable for future use or has no future need it will be declared hazardous waste by contacting the ESCO and having it removed from your inventory and your lab.

Storage

Simply shelving chemicals and chemical compounds is not sufficient under OSHA requirements. Chemicals need to be separated and stored by their particular class, preferably in separate cabinets.

- Chemicals that have a negative interaction with one another should be stored some distance apart to avoid accidentally triggering a hazardous situation. For example,
    - Ammonium nitrate: Ammonium nitrate should be stored in isolation from all other chemicals.
    - Acids: All inorganic acids (except nitric acid), and all regulated organic acids should be stored in a cabinet constructed of corrosion resistant material. Acids may be stored with bases, but fumes from acids and bases may produce an annoying coating of salt crystals on the outside of reagent containers. Nitric acid should be stored separately from acetic acid, either in an isolated portion of the acid cabinet, or in the Styrofoam container in which it was shipped. Fuming nitric acid should never be used.
    - Bases: All strong bases, such as sodium hydroxide, potassium hydroxide, or ammonium hydroxide should be stored in a dedicated corrosive chemicals cabinet that is coated with corrosion-resistant material.
    - Flammables: Flammables should be stored in a dedicated flammable materials cabinet, 8 meters away from all oxidizers.

The cabinet should be coated with flame retardant paint, and should be appropriately labeled with the notice: FLAMMABLE LIQUID STORAGE. KEEP FIRE AWAY!

- Poisons: Highly toxic substances such as cyanides should never be used. Poisons approved by state should be stored in a locked cabinet away from the acids cabinet.
- Compressed Gases: Compressed gas cylinders should be strapped to the wall. Oxidizing gases such as oxygen should be stored far away from flammable liquids, gases, and metals. Flammable gases should be separated from oxidizers and oxidizing gases by a one-hour fire wall or a distance of 8 meters.
- Low Hazard Chemicals: Many weak bases, oxides, sulfides, indicators, amino acids, sugars, stains and carbonates are classified as low-hazard chemicals. These chemicals may be stored on open shelves with bars to prevent accidental spillage.

- Storage Codes
  Some manufacturers provide color-coded labels to categorize chemicals for storage purposes. Chemicals with a particular storage color may be stored together, except when indicated otherwise. Chemicals with different storage color labels should be stored in different areas. The following is a commonly accepted code.
  - R Storage code red Flammable. Store in area designated for flammable reagents.
  - Y Storage code Yellow Reactive and oxidizing. These chemicals may react violently with air, water, or other substances. They should be stored away from flammable and combustible materials.
  - B Storage code blue Health hazard. These chemicals are toxic if inhaled, ingested, or absorbed through the skin. They should be stored in a locked cabinet.
  - W Storage code White Corrosive. These chemicals may harm skin, eyes, and mucous membranes. They should be stored away from red, yellow, and blue-coded reagents.
  - G Storage code Gray: Moderate or minimal hazard. According to current data, these chemicals do not pose more than a moderate hazard in any category.

SHIPPING HAZARDOUS MATERIAL

You must have DOT and or IATA training, to package, ship or otherwise transport hazardous materials. Please see the Environmental Safety Compliance Officer (ESCO) about sending chemicals, treated samples, standards, etc. via air, ship or ground. This includes the return of unopened packages to the original sender.

Vacuum-pumps and other types of pumps will not be serviced by some manufacturing companies because they occasionally receive contaminated pumps. Any pump or other equipment sent via mail, UPS, or other carriers must be free of contaminants. You may be subject to heavy fines and possible third party law suits if you inadvertently ship a contaminated piece of equipment. Contact the ESCO for shipping.

Inventory Control

- The inventory of all chemicals on campus is up-dated each time a chemical is ordered by notifying the ESCO of the chemical order.
- Finally, a complete list of all the chemicals on campus, and their location, are maintained at MSDSonline. This list will be used by fire and rescue personnel from the community if a major disaster occurs.

EMERGENCY PROCEDURES

Most accidents can be prevented with effective planning, good housekeeping and proper training. HPL employees are encouraged to contact the Environmental Safety Compliance Officer (ESCO) for assistance when planning experiments and upgrading their safety skills.

Employees are to respond to emergencies only if they are trained and feel competent to manage the accident. At no time should an employee jeopardize their own safety or that of a fellow colleague. If unsure of the correct response it is best to call for help at 9-911 or the Environmental Safety Compliance Officer (ESCO). Emergency phone numbers can be found on all laboratory doors and other areas of potential danger.

All accidents, no matter how small, are to be reported to the ESCO; near misses or close calls are also reported so that the ESCO can then eliminate a potential accident from happening. All injuries are to be reported to your immediate supervisor, regardless of the treatment or non-treatment of any injury.

Spills

Spill clean-up kits, buckets and absorbent material are stored at strategic locations in all buildings where hazardous chemicals are in use. Users of hazardous chemicals and individuals working in these spaces must be familiar with procedures for cleaning up and reporting spills. Caution is to be used to prevent contamination of the environment; damming, diking, and blocking may be used to prevent accidental pollution of the environment.

Employees are requested to respond to small spills; less than or equal to one liter of material. If the employees is unsure of the danger caused by the spill they will vacate the area and contact the Environmental Safety Compliance Officer (ESCO).

Large spills are to be reported to the ESCO immediately; all personnel in danger from the spill are to evacuate the area. If the spill is determined to be immediately dangerous to life and/or property, 911 will be activated and HPL authorized personnel will assist the local response teams from the fire and rescue companies.

Fire
After implementing evacuation procedures and contacting the fire company via 9-911, personnel may attempt to put out or contain the fire using fire extinguishers located in strategic locations throughout each building. Fire blankets are also available to smother clothing fires. Never put yourself in danger when responding to an emergency; if the task looks too dangerous or you are unsure of the correct procedures please leave the job for someone trained for the task.

First-aid
CPR/AED AND First Aid Classes are scheduled by the ESCO. Please contact for the next available class(es). Comprehensive first-aid kits are available in lab buildings, research vessels, and the maintenance complex. Portable field kits for first aid are also available from Facilities Management Office. Safety showers and eyewash stations are available throughout the campus. Familiarize yourself with the locations of the eyewash and emergency showers.

Please report any accident, even if you treat yourself, to your immediate supervisor and the ESCO.

PROTECTING AGAINST CHEMICAL HAZARDS

Checklist for Safe Use of Chemicals:
The following checklist is your guide to protecting against chemical hazards before they become chemical emergencies:

- Read Container labels and Safety Data Sheets (SDS). They will list safe handling procedures and proper personal protective equipment (PPE)"
- Make sure that PPE fits properly and that you know how to use it.
- If you need to wear a respirator contact the Environmental Safety Compliance Officer (ESCO) to complete the Respiratory Fit Program before you can use a respirator. When using respirators, match your

canister or cartridge to the correct respirator and the particular chemical and replace when necessary.

- Contact lenses are not eye protective devices, and wearing them does not reduce the requirement for eye and face protection. Review the available information about contact lens absorption and adsorption for the class of chemicals in use.
- Know the location of eyewash stations and safety showers and how to use them. (In most cases, if you are exposed to a chemical splash, they will be your first emergency treatment.)
- Slowly mix corrosives or solvents, or dip parts into them.
- Always add acids to water (not the other way around) to prevent boiling over and splashing.
- Never sniff a chemical to identify its type or location.
- Never put your hands into corrosives or solvents even if you are wearing gloves.
- Always wash your hands well before eating or smoking, and before and after every session in the laboratory.
- Use engineering controls, including fans, exhaust hoods, and other ventilation systems installed for your protection.
- Know emergency first aid procedures.
- Be aware that some products readily available in the tgeneral consumer marketplace are not designated as hazardous, yet are considered “hazards” in the workplace.
- If you are unclear about your laboratory's safety procedures for handling chemical substances, speak to your supervisor or the Safety Officer. Make sure you understand everything you need to know about protecting yourself from chemical hazards.

EMPTY CHEMICAL CONTAINERS

The following list represents the proper way to discard empty chemical containers:

1. Rinse each container 3 times;
2. Save the first & second rinse as hazardous waste;
3. The third rinse can go down the drain;
4. Remove or deface ALL markings and labels;
5. Do not recap.

The rinsing of the containers before disposal is not only mandated by EPA but, more importantly, it protects workers from possible exposure to a hazardous substance.

EXPLOSIVE MATERIALS

HPL suggests the following regarding picric acid, perchloric acid and ether:

- Solid **picric acid** must be kept wet at all times. For example, all bottles containing solid picric acid must have a quantity of water (e.g. 10 ml) added every month and records must be kept showing when water was added and who added it.
- **Perchloric acid** must be stored in an explosion proof safe.
- **Ether** must be disposed of before it becomes unstable (explosive). Please refer to the Material Safety Data Sheets for methods of detection for unstable products.
- Before any of the above chemicals are picked up by the Environmental Safety Compliance Officer (ESCO), the investigator must add water to the picric acid and insure that the perchloric acid and ether are stable chemicals by giving the original purchase date and conditions under which the chemicals were stored.
- HPL encourages all investigators to find alternatives for these chemicals.
- The purchasing dept. will be asked not to accept orders on picric acid, perchloric acid and ether without prior approval by the ESCO.

CARCINOGEN MYTHS

Phenol

- The International Agency for Research on Cancer (IARC) and the EPA have determined that phenol is not classifiable as to its carcinogenicity to humans. In the context of health effects with emphasis on cancer, phenols are generally not genotoxic, that is, they cannot modify the gene and therefore, they are not considered to be direct cancer risks. However, while not genotoxic, phenols as a class can be co-carcinogens or promoters, increasing the effects of environmental genotoxic carcinogens. The promoting effect is, however, highly dependent on the dosage and chronicity of exposure. Therefore, the public needs to be much more aware of the importance of dosage and extent of exposure, rather than be told that a chemical is a "carcinogen" with the resulting concern and sometimes expensive, indeed unwarranted, actions.

Acetone

- Acetone has been studied extensively and is generally recognized to have low acute and chronic toxicity if ingested and/or inhaled. Acetone is not currently regarded as a carcinogen, a mutagenic chemical or a concern for chronic neurotoxicity effects. EPA EPCRA Delisting (1995). EPA removed acetone from the list of "toxic chemicals" maintained under Section 313 of the Emergency Planning and Community Right to Know Act (EPCRA). In making that decision,

Toluene

- Studies in workers and animals exposed to toluene generally indicate that toluene is not carcinogenic The International Agency for Research on Cancer (IARC) determined that toluene is not classifiable as to its carcinogenicity in humans. The EPA determined there is inadequate information to assess the carcinogenic potential of toluene. The National Toxicology Program (NTP) has not considered the carcinogenic potential of toluene.

STORAGE OF PRESERVED SPECIMENS

Collection and preservation of field samples can be expensive, time consuming and destructive to the species, their habitat and those dependent on them as a food source. It is imperative then that specimen collection be conducted with a responsible attitude and that preservation, storage, and disposal of the specimen be done systematically and with state-of-the-art techniques which will preserve the samples for as long as possible. Please be aware that the storage of preserved specimens is regulated by EPA as hazardous material and therefore must follow the guidelines set up by EPA.

Each and every container of preserved specimens must contain:

- Name of the preservative, percentage of preservative, date of preservation and name of investigator. The labels must also contain the specific GHS Hazard signal word, hazard statement, and pictogram.
- If vials are too small to accommodate complete labels, you may indeed fully label the outer box and cross-reference to a code on the individual vial. The vials must have some sort of label, be it just a letter, number or color sticker, to identify the contents.

You can print labels for the outer boxes from the MSDSonline program. Color-coded stickers from office supply stores can be used for the inner vials. You would have to add a description of your system to our Chemical Hazard Communication Program and to the Chemical Hygiene Plan for HPL and train personnel accordingly. Periodic inspections are important to ensure that labels are still legible and still attached.

PROCEDURED FOR HANDLING SEVERELY HAZARDOUS CHEMICALS

Before work with a severely hazardous material is undertaken, specific safety procedures and guidelines must be developed to insure the safety of employees. At a minimum, this information will include the following:

- Procedures and containment devices designed to keep exposure within permissible limits.

- Specification of areas for handling severe hazards. Such designated areas must be posted and their boundaries clearly marked.
- Level of training need to be authorized to work with the severe hazard. The ESCO will determine those who are adequately trained to work with a particular severe hazard.
- Storage areas to be used for the severe hazard must be separate from other chemical storage and must have controlled access.
- Plans for proper disposal of wastes and decontamination of work areas.

FORMALDEHYDE AND CANCER

In 1987, the U.S. Environmental Protection Agency (EPA) classified formaldehyde as a probable human carcinogen under conditions of unusually high or prolonged exposure. In 1987, OSHA established a Federal standard that reduced the amount of formaldehyde to which workers can be exposed over an 8-hour workday from 3 ppm to 1 ppm. In May 1992, the standard was amended, and the formaldehyde exposure limit was further reduced to 0.75 ppm. Since that time, some studies of humans have suggested that formaldehyde exposure is associated with certain types of cancer. The highest concentration that a worker can be exposed to is 2 ppm, and that can only occur over 15 minutes. The International Agency for Research on Cancer (IARC) classifies formaldehyde as a human carcinogen. In 2011, the National Toxicology Program, an interagency program of the Department of Health and Human Services, named formaldehyde as a known human carcinogen in its *12th Report on Carcinogens*. Formaldehyde can also be toxic and allergenic.

Short term health effects of formaldehyde include watery eyes; burning sensations in the eyes, nose, and throat; coughing; wheezing; nausea; and skin irritation. Some people are very sensitive to formaldehyde, whereas others have no reaction to the same level of exposure.

Handling and Use

Formaldehyde levels should be monitored and the use of fume hoods or respirators and protective clothing provided as needed to limit exposure. At all times, formaldehyde should only be handled, mixed or added to specimen containers with the upmost caution, in ventilated areas such as open air table if in the field and under an appropriate fume hood if in the laboratory. Formaldehyde should never be opened or mixed while inside a vehicle. If there is the possibility of splashing, a face shield should be worn while mixing or pouring formaldehyde. At all times, disposable gloves must be worn to prevent dermal exposure when handling and/or mixing this product. NEVER smoke or have an open flame while working with formaldehyde.

Storage
Formaldehyde should be stored in a cool, dry, well-ventilated area and properly labeled. Formaldehyde should never be stored in vehicles except to transport to and from field during sampling operations. Used formaldehyde, either from spill clean-up or from activities generated from the process of change-out of sample containers must be stored in a properly labeled hazardous waste container and made available for recycling under Resources Conservation Recovery Act (RCRA) protocols. Storage of waste formaldehyde should be in an area not frequented by the general population or duty workers and should be in an area not subject to heat cycles and well ventilated

Disposal
Spilled or used formaldehyde is considered a hazardous waste and must be handled as a solid waste under RCRA. Less hazardous waste generated is the goal of HPL. If your research and SOP for formaldehyde can neutralize the material making it non-hazardous – this is recommended. However, once it is considered "waste" HPL is not allowed "treatment" of waste. There are also new formulations available for preserving some material that is not considered hazardous material. Please consider using a non-hazardous if one is available. Contact the ESCO for all hazardous waste pick up.

REFERENCE REGULATIONS

1. 29 CFR 1910.1000 (OSHA) Toxic and Hazardous Substances
2. 29 CFR 1910.1048 (OSHA) Formaldehyde
3. 29 CFR 1910.1200 (OSHA) Hazard Communication
4. 29 CFR 1910.1048 (OSHA) Formaldehyde, Irritant and Potential Cancer Hazard
5. 29 CFR 1910.1450 (OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories
6. 40 CFR 262 (EPA) Standards Applicable to Generators of Hazardous Wastes
7. 49 CFR 172.101 (DOT) Table of Hazardous Materials and Special Provisions

ARE FORMALDEHYDE AND FORMALIN THE SAME SUBSTANCE?

Both formalin and formaldehyde have the same chemical formula, which is represented by CH_2O. But there are some differences in their physical state and chemical activities. Basically, formaldehyde is a colorless, water-soluble, flammable gas at room temperature with a sharp, irritating smell. However, formalin is a liquid, which is prepared by mixing formaldehyde gas and

water. This is the main difference between formalin and formaldehyde. Generally, a saturated solution of formalin contains about 40% (by volume) or 37% (by weight) of formaldehyde gas and a stabilizer (the general stabilizer is 10-12% methanol) to prevent formaldehyde polymerization. Without stabilizer, formaldehyde solution is very unstable, and it tends to polymerize, forming macromolecules that are insoluble. Complete hydration of formaldehyde gas mostly yields methylene glycol. Subsequently, it leads to the production of paraformaldehyde by polymerization.

INFORMATION SOURCES FOR HAZARDOUS MATERIALS

The following is a list of available data sources which the chemical manufacturer, importer, distributor, or employer may wish to consult to evaluate the hazards of chemicals they produce or import:

- Any information in their own company files, such as toxicity testing results or illness experience of company employees.
- Any information obtained from the supplier of the chemical, such as material safety data sheets or product safety bulletins.
- Condensed Chemical Dictionary https://archive.org/details/ost-chemistry-cu31924002976961
- *The Merck* Index: https://www.rsc.org/merck-index
- Industrial Hygiene and *Toxicology,* by F.A. Patt
- *Chemical Hazards in the Workplace*
- *Handbook of Chemistry and Physics*
- 29 CFR 1910.1200, Hazard Communication
- United Nations' Globally Harmonized System of Classification and Labeling of Chemicals, Revision 3

For more information and/or suggestions contact the Environmental Safety Compliance Officer (ESCO) at Ext. 8441 or Email umces-safety@umces.edu