Housekeeping and Maintenance

Hazard Communication

Right to Know

OSHA 29 CFR 1910.1200

COMAR 09.12.33

You have a Right to Know about the hazards that you might encounter on the job.

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Introduction

The University of Maryland Center for Environmental Science (UMCES) recognizes the responsibility of protecting the safety and welfare of our campus communities and visitors. **Hazard Communication (HC)** is also termed the Employee **Right to Know Law (RTK)**. You have a Right to Know about the hazards that you might encounter on the job. Employees who work with or around hazardous material must have some knowledge of the materials and have a right to understand how the materials can hurt them and how to protect themselves from such harm. Hazard Communication is a requirement of State and Federal laws:

- Occupational Safety and Health Administration (OSHA) regulation
  - 29 CFR 1910.1200
- Maryland regulations
  - COMAR 09.12.33 and
  - Title 5, Subtitle 4, §5-401 thru 410 of the Annotated Code of Maryland – Labor and Employment Article (Access to Information about Hazardous and Toxic Substances).

In order to ensure chemical safety in the workplace, information about the identities and hazards of the chemicals must be available and understandable to all workers. Housekeeping and Facility personnel need to know about the detergents, cleaners, paints, aerosols, gases, etc. that they use. Everyone including the business personnel and students who do not work with hazardous materials need to know how to work safely around the hazardous materials others use on campus. For instance, you may need to ask a question of someone working in a laboratory that uses hazardous materials. You need to recognize the hazards to avoid injury or to identify the material if there is a spill. How does this affect you? Did you know and ordinary cleanser can actually be toxic, flammable and/or explosive under certain conditions?

Although the Hazard Communication Standard applies mainly to employers, hazard communication is not effective unless you also do your part in working safely with materials. As an employee, you must be able to identify the possible hazards of using a chemical before you start to use it. Don't wait until you have already been exposed to find out that you've put yourself in danger. Read the labels on all containers and the Safety Data Sheets (SDSs) before using the material. Check with your Safety Officer for the location of the hardcopy files of all the SDS' on site. You can also search the web using the name of the chemical and the manufacturer and "SDS". To view a Safety Data Sheet for any chemical go to: https://login.ehs.com/ and login with ID: **SViewer** and your Password is **UMCESchemicals$2**. Type in the name of the chemical and hit search. Click on view pdf (it is the adobe pic to the left of the chemical name). The Safety Data Sheet will come up and you can review all the precautions you need to work with it safely.

Always follow instructions and warnings about how to use hazardous materials safely. These instructions can be found on labels, Safety Data Sheets (SDSs), and verbal instructions you may receive from supervisors. All the safety information in the world won't help protect you if you don't listen, pay attention, or understand the information you are given. Remember, you should never hesitate to ask questions so that you clearly understand what it takes to protect yourself from hazards of potentially dangerous materials.

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". Hazardous materials are grouped into classes, based on: the hazards they present and the safety precautions needed when working with them.

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

A combination of these different classes of these materials can be found in laboratory refrigerators, freezers, cabinets, and bench tops, maintenance shops, housekeeping closets and storage areas, and even in the business offices. Never eat or store your lunch and snacks in areas where hazardous materials are used or stored (laboratories, maintenance shops, or storage areas containing hazardous materials). Surfaces, appliances, machines and equipment in these areas have all had hazardous materials in or on them at some time and you do not want to contaminate what you will be eating.

Do not throw food wrappers or containers in the laboratory trashcans – this is a state and federal regulation and could incur a fine if OSHA were to visit. No food/beverage or their containers should ever be found in the lab or lab trashcans. Why? Because if food and beverage containers and wrappers appear in a lab or lab trashcan you cannot prove that, you did not consume that product in the lab. You may have casually tossed it there as you passed by. However, you can't prove that to the inspectors! Keep the labs free of consumables.

RISKS

The risks associated with the possession and use of a hazardous chemical are dependent upon a multitude of factors, all of which must be considered before acquiring and using a hazardous chemical. Important elements to examine and address include:

- the knowledge of and commitment to safe chemical use practices of all who handle the chemical;
- its physical, chemical, and biological properties and those of its derivatives;
- the quantity received and the manner in which it is stored and distributed;
- the manner in which it is used;
- the manner of disposal of the substance and its derivatives;
- the length of time it is on the premises, and
- the number of persons who work in the area and have open access to the substance.

The decision to procure a specific quantity of a specific hazardous chemical is a commitment to handle it responsibly from receipt to ultimate disposal. The manner in which chemicals are handled and each period between operations presents opportunities for misadventure.

HAZARDS

There are two types of harmful hazardous materials:

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

Health Hazards

A "health hazard" is a product for which there is statistically significant evidence that acute or chronic health effects may occur in exposed employees. 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.

Health hazards, depending on the exposure, may cause significant changes in the body. These changes are generally indicated by the occurrence of signs and symptoms in the over-exposed person, such as shortness of breath, skin irritant, headache, feeling ill, or getting cancer. 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. Not all people are affected to the same degree by the same material. Each individual has different levels of susceptibility depending on a variety of factors including: age, inherited characteristics (relating to body chemistry and metabolism), weight, general health, and etcetera. Any material that meets any of the following definitions is considered health hazards. However, this is not intended to be an exclusive categorization.

- **Carcinogens** and **Suspected Carcinogens**
  - These chemicals are often linked to cancer.
  - Carcinogens disrupt the normal pattern cells in the human body follow to reproduce and grow. This causes cells to grow abnormally.
  - Specific "target" organs that carcinogens affect include the lungs, liver, kidneys, and reproductive system.
  - Symptoms do not show up until years after the exposure.
  - Asbestos is a carcinogen and can be found in floor tiles, pipe insulation, fireproofing, automotive brake and clutch linings.
- **Suspect Carcinogens** are believed to increase the chance of getting cancer. No direct link has been established yet. Suspect Carcinogens include formaldehyde, PCB's, and carbon tetrachloride.
- **Other Risk Factors** affect the chances of getting cancer.
- **Smoking** increases the chances of getting cancer by tens or even hundreds of times. Quitting is the biggest step in preventing cancer.
- **Toxic** or **highly toxic** materials:
  - Have the potential to disrupt physical processes such as breathing, coordination, and other bodily functions.
  - Can cause illness, organ damage, and possible death.
  - Toxic materials include pesticides, cleaners, solvents, gases, and polymers. Toxic gases include the fumes produced when heating, burning or welding some metals.
- **Corrosives and Irritants:**
  - **Corrosives** can cause serious, even permanent damage to any part of the body coming into contact with the material
  - Acids are corrosive and can be found in dyes, paints, petroleum processing, and automobile batteries.
  - Bases are also corrosive, such as Caustic Soda, which is used in soaps, detergents, water treatment chemicals.
  - Corrosive material in contact with your skin can cause redness, swelling, blisters, and severe burns.
  - Eye contact can result in permanent eye damage, even blindness
  - Swallowing corrosives can result in extreme pain, severe internal injuries, and even death.
  - Inhaling corrosives can seriously damage the tissues of the nose, mouth, throat, and lungs.
- **Irritants** are often diluted forms of corrosive substances and include ammonia, antifreeze, thinners, degreasers, and acids.
  - Other irritants are by products generated during combustion such as

nitrogen dioxide found in automobile exhaust.

- Irritants generally cause only minor, temporary inflammation or swelling at the point of contact.

- **Sensitizers** cause an allergic reaction in normal tissue after repeated exposure to the chemical.

Health Effects

There have been many attempts to categorize health 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 may be of short duration. The acute effects referred to most often are irritation, corrosion, sensitization, narcosis (light headedness) and death.
- "**Delayed effects**" appear hours after exposure. Delayed pain and irreversible damage is begun before you are aware of it. Delayed effects may begin from the slow onset of disease after exposure.
- "**Chronic**" effects generally occur as a result of long-term exposure, and may be of long duration. Similarly, the term chronic effects is often used to cover only **carcinogenesis** (cancer**), teratogenesis**, (effects on the unborn) and **mutagenesis** (chromosomal damage). These effects are obviously a concern in the workplace, but do not adequately cover the area of chronic effects, including, for example, such **as anemia, chronic bronchitis** and **liver atrophy**.

Toxicology

The science of toxicology is based on the principle that there is a relationship between a toxic reaction (the response) and the amount of poison received (the dose). An important assumption in this relationship is that there is almost always a dose below which no response occurs or can be measured. A second assumption is that once a maximum response is reached, any further increases in the dose will not result in any increased effect. Knowing the dose/response relationship is a necessary part of understanding the cause and effect relationship between exposure and illness. "The right dose differentiates a poison from a remedy".

One of the more commonly used measures of toxicity is the LD50. The LD50 (the lethal dose for 50 percent of the animals tested) of a poison is usually expressed in milligrams of chemical per kilogram of body weight (mg/kg). A chemical with a small LD50 (like 5 mg/kg) is very highly toxic. The more toxic a material, the smaller amount necessary to cause harm. A chemical with a large LD50 (1,000 to 5,000 mg/kg) is practically non-toxic. Recognize that <u>the LD50 says nothing about non-lethal toxic effects</u> though. A chemical may have a large LD50, but may produce illness at very small exposure levels. <u>*It is incorrect to say that chemicals with small LD50s are more dangerous than chemicals with large LD50s, they are simply more toxic.*</u> The more toxic a material is, the smaller the amount of it necessary to be absorbed before harmful effects are caused. The lower the toxicity, the greater the quantity is needed for it to be absorbed and be harmful. The danger, or risk of adverse effect of chemicals, is mostly determined by how they are used, not by the inherent toxicity of the chemical itself.

PHYSICAL HAZARDS

Physical hazard means a material that 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 (29CFR 1910.1200—Physical Hazard Criteria). 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.

Flammables and Combustibles include gasoline, kerosene, acetylene, and toluene.

- **"Flashpoint"** is the key in determining whether a chemical is flammable or combustible. This is the temperature at which the chemical releases vapors that can burn. It is not the liquid that burns, but the vapor.
  - Liquids that have a flashpoint of less than 100°F are considered flammable.
  - Liquids that have a flashpoint between 100°F and 200°F are combustibles. Combustibles are easier to control because they have to be heated before they will produce burnable vapors.
- Liquid fuels are not the only flammables and combustibles. Smoking near an open can of paint or a bottle of rubbing alcohol could cause a fire.
- Flammable gases have their own unique set of hazards and include hydrogen, methane, propane, butane, and acetylene.
- **Auto ignition temperature** or kindling point of a substance is the lowest temperature at which it will spontaneously ignite in a normal atmosphere without an external source of ignition, such as a flame or spark.

Fuel	**Flash Point**	**Auto ignition temp.**
Gasoline	-43°C (-45°F)	280°C (536°F)
Ethanol 70%	16.6°C (61.9°F)	363°C (685°F)
Diesel	>62°C (144°F)	210°C (410°F)
Jet Fuel >	>60°C(140°F)	210°C (410°F)
Kerosene	>38°-72°C(100-162°F)	220°C (428°F)
Vegetable Oil	327°C (621°F)	
Biodiesel	>130°C (266 °F)	

Explosive material causes a sudden almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

- The lower explosion limit (**LEL**) or lower flammable limit (**LFL**) is the lowest concentration of vapor in air which will burn or explode upon contact with a source of ignition. Below the LEL/LFL, the mixture is too lean (i.e. there is insufficient fuel) to burn or explode.
- The upper explosion limit (**UEL**) or upper flammable limit (**UFL**) is the highest concentration of vapor in air which will burn or explode upon contact with a source of ignition. Above the UEL, the mixture is too rich (i.e. there is insufficient oxygen) to burn or explode. The LEL and UEL are usually indicated by the percentage by volume of vapor in air. Example - For diethyl ether, the LEL is 1.9% and the UEL is 36% by volume of air. The range between 1.9% and 36% is the dangerous range of diethyl ether.

LEL/LFL and UEL/UFL

Fuel	LEL/LFL %	UEL/UFL %
Acetaldehyde	4	60
Ethyl Alcohol,	3	19
Benzene	1.35	6.65
Gasoline	1.4	7.6
Fuel Oil	0.7	5
Hydrogen sulfide	4.3	46
Toluene	1.27	6.75

Compressed gas
- Causes asphyxiation, fire, explosions, and can penetrate the skin like a needle injection.

Oxidizers
- Bring about an oxidation reaction causing a fire of itself or through the release of oxygen or other gases.

Pyrophoric materials
- Ignite spontaneously in air at 130^{0}F or below without an ignition source.

Reactive chemicals
- Cause damage by the release of gases that will burn, explode, or produce high pressure that can cause injury to a person. Organic peroxides, unstable materials, and water reactive materials are examples of reactive chemicals.

Exposure Limits

To guard against both acute and chronic health effects, scientists have identified exposure limits for different kinds of materials.
- The **PEL**, or permissible exposure limit, is often expressed as the quantity of hazardous chemical that an average employee can safely be exposed to in an 8-hour workday without ill effects.
- Threshold limit values (**TLV***s*) are air quality standards developed by the American Conference of Governmental Industrial Hygienists. They are the model for many other air quality limits such as OSHA's PELs. TLVs are the amounts of materials in the air that almost all healthy adult workers are predicted to be able to tolerate without adverse effects.
- Time-weighted average (**TWA**) refers to the average time, over a given work period (such as an 8-hour workday) of a person's exposure to a hazardous materials l or agent.
- Short-term exposure limit (**STEL**) is the maximum concentration to which workers can be exposed to a hazardous materials or agent for a short period of time (15 minutes) four times throughout the eight hour day, with at least one hour between exposures.
- Concentrations of hazardous materials in the environment are most commonly expressed as parts per million (**ppm**) and parts per billion (**ppb**). Government tolerance limits for various poisons usually use these abbreviations.

Routes of Entry

In order for a chemical to become hazardous to a person's health, it must first contact or enter the body and the chemical must have some biological effect on the body. There are four major routes of entry:
- **Inhalation** (breathing)

Breathing of contaminated air (fumes, dusts, mists, vapors) is the most common way that workplace chemicals enter the body. Use the fume hood when opening or using chemicals that produce harmful vapors (i.e. acids; bases; flammable and explosive materials).

- **Absorption** (skin/eye contact)
  Some hazardous materials, when contacted, can be absorbed through the skin into the blood stream, especially organic solvents, materials dissolved in the solvents, acids, and bases. The eyes may also be a route of entry.
- **Ingestion** (eating)
  Less commonly, workplace hazardous materials may be swallowed accidentally if food, chap-stick, lipstick, gum, your hands, or cigarettes are contaminated. For this reason workers should not drink, eat, or smoke, chew gum, or apply chap-stick or lipstick in areas where they may be exposed to toxic chemicals. Never eat or store your lunch and snacks in the lab. Surfaces and appliances have all had hazardous materials in or on them at some time and you don't want to contaminate what you will be eating. Do not throw food wrappers or containers in the laboratory trash cans – this is a State and Federal regulation and could incur a fine if OSHA were to visit. No food/beverage or their containers should ever be found in the lab.
- **Injection**
  Injection is the fourth way hazardous materials may enter the body. While uncommon in most workplaces, it can occur when a sharp object (e.g., needle, shard of glass or a stream of high pressure gas) punctures the skin and "injects" a chemical or bio-hazard directly into the bloodstream. For example: If a beaker contains a chemical solution and it breaks and a piece of the glass gets injected into your foot, hand, etc. it will inject the chemical that is adhered to the piece of glass.

Regardless of the way the hazardous materials gets into the body, once it is in the body it is distributed throughout the body by the blood stream. In this way, the chemicals can attack and harm organs which are far away from the original point of entry as well as where they entered the body.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

When adequate engineering controls (i.e. fume hoods) and administrative hazard controls are not technically, operationally, or financially feasible, personal protective equipment must be considered as a supplement. "**Personal protective equipment**" **(PPE**) includes a wide variety of items worn by an individual to isolate the person from chemical hazards. PPE includes articles to protect the eyes, skin, and the respiratory tract (e.g. goggles, face shields, coats, aprons, gloves, shoes, and respirators). PPE does not eliminate hazards but merely minimizes damage from hazards. The effectiveness of PPE is highly dependent on the user. Each type of PPE has specific applications, advantages, limitations, and potential problems associated with their misuse. PPE must match the hazards and the conditions of use and be properly maintained in order to be effective. Those using PPE must be fully knowledgeable of these considerations. Their misuse may directly or indirectly contribute to the hazard or create a new hazard. The material of construction must be resistant with the chemical's hazards and must maximize protection, dexterity, and comfort. Employers must provide appropriate personal protective equipment (PPE) for employees.

Respirators

Respirators should never be used in lieu of using a fume hood. When effective engineering controls are not feasible, appropriate respirators shall be used. Using a respirator may place a physiological burden on employees that varies with the type of respirator worn, the job, and workplace conditions in which the respirator is used, and the medical status of the employee. If you need to wear a respirator please contact your Safety Officer who will walk you through the necessary steps.

Gloves

No single glove type can serve as protection from all chemicals. Protective gloves should be worn when handling hazardous materials, toxic chemicals, corrosive chemicals, radioactive materials, bio-hazardous materials, rough or sharp edged objects, and very hot or very cold materials. Disposable latex, vinyl or nitrile gloves are usually appropriate when handling chemicals in a laboratory. These gloves will offer protection from incidental splashes or contact. The appropriate glove material should be selected based on chemical compatibility. The following characteristics should be considered when selecting the appropriate material:

- Degradation
- Breakthrough time
- Permeation rate.

Degradation is the change in one or more of the physical properties of a glove caused by contact with a hazardous material. Degradation typically appears as hardening, stiffening, swelling, shrinking, or cracking of the glove. The worst example is that the material may actually dissolve in the chemical. The slower the degradation occurs in the presence of a chemical the more protective the material is for that specific chemical. There is no standardized test for degradation; each manufacturer generally has its own test.

Breakthrough time: Breakthrough time is how much time it takes from the initial contact of the hazardous material until it is detected on the opposite side of the glove (essentially, when it begins to soak through). Obviously, the greater the breakthrough time, the more protective the material is for that particular chemical. Breakthrough is measured using a standardized test (ASTM F739).

Permeation rate: Permeation rate is a measurement of how quickly a chemical passes through a material at the molecular level. It can be thought of as a slow leak, similar to how air seeps through plastic soda bottles and makes your soda go flat (hence the expiration date on the bottles!). Thicker materials tend to have slower permeation rates. Permeation rates are reported differently by different manufacturers, but a higher number generally means a quicker penetration rate. Please note, however that permeation and degradation do not always correlate.

Gloves should fit the user's hands comfortably – they should not be too loose or too tight. Gloves are sometimes worn for several hours and need to stand up to the task. Once contaminated, gloves can become a means for spreading infectious materials to yourself, others or environmental surfaces. Therefore, the way YOU use gloves can influence the risk of hazards in your work setting. These are the most important dos and don'ts of glove use:

- Work from clean to dirty—this will help prevent contamination
- Don't touch your face or adjust PPE with contaminated gloves
- Don't touch environmental surfaces – doorknobs, keyboards, computer mouse, and cell phone. This means when leaving the laboratory TAKE OFF YOUR GLOVES. If you need to wear a glove in the hallway to carry a hazardous material, make sure that the gloved hand is carrying the material and the non-gloved hand is operating door handles, elevator buttons, etc.
- Change gloves as required according to the manufacturer and the hazardous material(s) you are working with.
- Discard gloves inside out after use, never wash or reuse disposable gloves.

Guide to the Selection of Skin Protection		
Hazard	**Degree of Hazard**	**Protective Material**
Abrasion	Severe	Reinforced heavy rubber, staple-reinforced heavy leather
	Less Severe	Rubber, plastic, leather, polyester, nylon, cotton
Sharp Edges	Severe	Metal mesh, staple-reinforced heavy leather, Kevlar® aramid-steel mesh
	Less Severe	Leather, terry cloth (aramid fiber)
	Mild with delicate work	Lightweight leather, polyester, nylon, cotton
Chemicals and fluids	Risk varies according to the chemical, its concentration, and time of contact among other factors. Refer to the manufacturer, or product SDS.	**Dependent on chemical**. Examples include: Natural rubber, neoprene, nitrile rubber, butyl rubber, PTFE (polytetrafluoroethylene), Teflon®, Vitom®, polyvinyl chloride, polyvinyl alcohol, Saranex™, 4H®, Chemrel®, Responder®, Trellchem®
Cold		Leather, insulated plastic or rubber, wool, cotton
Heat	High temperatures (over 350 ^{0}C)	Asbestos, Zetex®
	Medium high (up to 350 ^{0}C)	Nomex®, Kevlar®, neoprene-coated asbestos, heat-resistant leather with linings
	Warm (up to 200 ^{0}C)	Nomex®, Kevlar®, heat-resistant leather, terry cloth (aramid fiber)
	Less warm (up to 100 ^{0}C)	Chrome-tanned leather, terry cloth
General Duty		Cotton, terry cloth, leather
Product Contamination		Thin-film plastic, lightweight leather, cotton, polyester, nylon
Radiation		Lead-lined rubber, leather, nitrile, latex, etc. depending on the type of radioactive material.

Note: The mention of trade name products in the above table is not intended as a recommendation or endorsement of any product.. This document lists trade names of protective clothing material mentioned in "OSHA Answers". Check with your supplier or the manufacturer to find out if a particular glove meets your requirements. This list is not intended to be comprehensive; you may know of other products that meet your needs.

Proper Glove Removal

Just as important as knowing what is the proper glove to wear, is knowing how to remove a disposable glove without contaminating yourself and other surfaces.

- Grasp one of the gloves and cuff and pull it partway off. The glove will turn inside out. It is important to keep the first glove partially on your hand before removing the second glove. This protects you from touching the outside of either glove with your bare hands.
- Leaving the first glove over your fingers, grasp the second glove near the cuff and pull it part of the way off. The glove will turn inside out. It is important to keep the second glove partially on your hand to protect you from touching the outside surface of the first glove with your bare hand.
- Pull off the two gloves at the same time, being careful to touch only the inside surfaces of the gloves with your bare hands.
- Dispose of the gloves by placing inside out and wash hands.

Eye Protection – ANSI Z87.1

Thousands of people are blinded each year from work-related eye injuries that could have been prevented with the proper selection and use of eye and face protection. Appropriate eye or face protection is required when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation. There are numerous commercial products available which meet the standards for eye protection in OSHA 29 CFR 1910.133. This standard is based on ANSI standard Z87.1-1989.

Safety glasses protect from impact of flying particles and objects. Side shields are used to protect the eyes from flying objects from the side. Personal prescription lenses do not provide optimal eye protection and should not be used as a substitute for safety glasses. Safety glasses are not effective protection from chemical splash and vapors.

Goggles should be selected when the hazard assessment calls for protection from chemical splash. Goggles should fit snuggly over and around the eyes or personal prescription lenses. The goggles should "breathe" (they should not fog up). They should provide good peripheral vision. Goggles must also be sufficiently comfortable to be accepted by the users. A pair of goggles pushed up on the forehead or lying on the bench top does not afford eye protection.

Face shields protect from impact hazards such as flying fragments, objects, large chips, and particles. If the probability of a vigorous reaction appears to be substantial, or the material involved in the work in progress is very corrosive to tissue, a face mask should be used to supplement the goggles and provide additional protection to the face and throat. Where there is a risk of a minor explosion, an explosion shield should be placed between the worker and the reaction vessel. The face shield should cover the forehead, extend below the chin, and wrap around the side of the face. When worn alone, face shields do not protect employees from impact hazards. Use face shields in combination with safety spectacles or goggles, even in the absence of dust or potential splashes, for additional protection beyond that offered by spectacles or goggles alone. Face shield windows are made with different transparent materials and in varying degrees or levels of thickness. These levels should correspond with specific tasks.

Contact lenses were historically prohibited in chemical environments. This was based upon the best medical judgment and opinions of healthcare professionals concerned with the absorption and adsorption of chemicals to the contact lens surface, as well as complications associated with emergency treatment for chemical splashes to the eye. In June 2005, the National Institute for Occupational Safety and Health (NIOSH) reviewed these guidelines and they recommended that workers be permitted to wear contact lenses when handling hazardous chemicals. Their recommendations do not address hazards from heat, radiation, or high-dust or high-particulate environments. However, contact lenses are not eye protective devices, and wearing them does not reduce the requirement for eye and face protection. An eye injury hazard evaluation should be conducted and at a minimum include:

- Concentration of material
- Permissible exposure limits,
- Known eye irritant/injury properties,
- Form of chemical (powder, liquid, or vapor),
- Possible routes of exposure.

The assessment for contact lens wearers should include a review of the available information about lens absorption and adsorption for the class of chemicals in use.

Protective Clothing

Lab coats and aprons can serve a number of purposes – protection from chemical splash, fire resistance, and clothing protection. There is a wide variety of protective clothing available (chemical resistant, water proof, protective against thermal hazards - i.e. hot work, protection from cuts and molten metal, etc.). . Protective clothing also has permeation, breakthrough, and degradation properties just like gloves. Check with your supervisor or vendor to choose the material that will protect you from the hazardous materials you will be working with. The presence of certain physical hazards or other specific elements of the procedure may dictate caution in the choice of style so as to not create additional hazards, for example, short sleeves may be preferable if there is a possibility that long sleeves could get caught in a mechanical operation. Disposable outer garments (i.e., Tyvek suits) may be useful when cleaning and when decontamination of reusable clothing is difficult. Loose clothing, skimpy clothing (such as shorts), torn clothing and unrestrained hair may also pose a hazard. Take the time to minimize your exposure to the hazards present.

Closed-toed shoes should be worn at all times in work areas. Exposed toes are a magnet for chemical spills, dropped objects, mower blades, heavy equipment, and trip hazards. The top of your foot is just as susceptible as your toes. Sandals and perforated shoes should <u>not</u> be worn in laboratories, or by maintenance or housekeeping personnel. Such shoes offer no barrier between the worker and chemicals, broken glass, or heavy objects. Steel-toed safety shoes may be necessary when there is a risk of heavy objects falling or rolling onto the feet. Shoes with open backs are allowed at the discretion of the Supervisor. Sandals or flip flops may be worn <u>while at your desk</u> and to and from work <u>only if</u> you have an appropriate pair of closed toe shoes, chemical resistant boots, or steel toed shoes with you to wear in the work area.

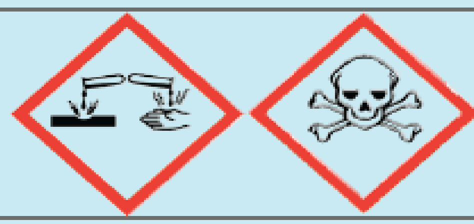
GLOBAL HARMONIZATION STANDARD (GHS)

The Hazard Communication Standard (HCS)/Right to Know (RTK) is aligned with the Globally Harmonized System of Classification and Labeling of Chemicals. This revision of OSHA's Hazard Communication standard is a UN approved universal communication system for the handling of potentially hazardous materials. It is designed to replace the various classification and labeling standards used in different countries by using consistent criteria for classification and labeling on a global level. This update to the Hazard Communication Standard will provide a common and coherent approach to classifying chemicals and communicating hazard information on labels and Safety Data Sheets (SDSs). By June 1, 2015, manufacturers and distributors had to reclassify their chemicals and produce GHS-formatted Safety Data Sheets (SDSs) to replace the current Material Safety Data Sheets (MSDSs) and labels for their products. Employers must be fully compliant with OSHA's adoption of GHS. Employers must complete necessary updates to their hazard programs and labeling procedures, and all affected employees must be trained on the new hazard SDSs and signage on labels. Once fully implemented it will:

- Enhance worker comprehension of hazards, especially for low and limited literacy workers, reduce confusion in the workplace, facilitate safety training, and result in safer handling and use of chemicals;
- Provide workers quicker and more efficient access to information on the SDSs.
- Result in cost savings to American businesses of more than $475 million in productivity improvements, fewer safety data sheet and label updates and simpler new hazard communication training; and
- Reduce trade barriers by harmonizing with systems around the world.

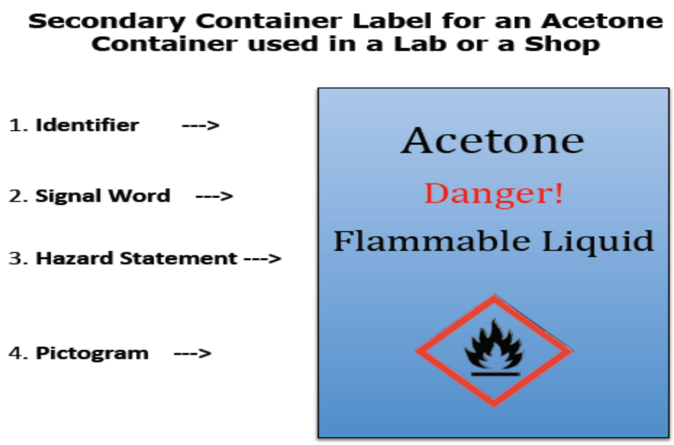
Labels

There will be six important components to all GHS labels:

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

Secondary Labels

Secondary labels are those that are placed on containers used to hold material transferred from a different container. The person using the material must label all secondary containers. Labels help protect you. Should you accidentally knock over or break a container when no one is around, you automatically want to clean it up and then find someone to inform them. However the material may be very caustic and you could be injured as you tried to clean it up. If there was a label on it you would be more likely to take the appropriate precautions or find someone to notify rather than jumping in and getting hurt. Even if the material is going to be in that container for a very short period of time it must have the following four components on the label:



(This information can be copied from the original container.)

Two important hazard labeling systems used are:

- the Hazardous Materials Identification System (**HMIS®**) which uses the bar code and
- the National Fire Protection Association (**NFPA**) which uses the diamond code.

At first glance, the HMIS® and NFPA labeling systems appear quite similar:

- Both have four sections colored blue, red, yellow and white.
- The colors indicate the type of hazard with blue indicating the level of **health hazard**, red for **flammability**, orange for a **physical hazard**, and white for **personal protection**.
- The number ratings range from 0-4. Zero is no hazard and 4 is a severe hazard.

The HMIS system was developed by the American Coatings Association as a compliance aid for the OSHA Hazard Communication Standard. The NFPA system was developed for emergency response personnel for short term, often acute exposure to materials under conditions of fires or spills. An important difference between NFPA/HMIS systems and GHS HazCom is the way they use numbers.

- With GHS, the lower the categorization number, the greater the severity of the hazard. This is opposite of the way numbers and severity relate to each other under NFPA and HMIS.
- With NFPA, the higher the number, the greater the severity.

The numbers in the GHS system, as adopted by OSHA, do

GHS vs NFPA/HMIS

GHS
1 = Severe
Hazard 4 =
Minor Hazard

NFPA/HMIS
1 Minor Hazard
4 = Severe Hazard

not show up on the label, instead they are used to determine what goes on the label. The numbers do appear on GHS formatted Safety Data Sheets (SDSs), in Section 2. OSHA believes the use of numbers there will be less confusing since there is much more contextual information available to help the reader understand the hazard information.

SIGNAGE

Hazard warning signs are posted at the entrance(s) to each laboratory or other areas that utilize hazardous materials. This signage is designed to fulfill regulatory signage requirements as well as alert everyone to specific hazards located in individual laboratories. It also gives emergency contact information for the Principal Investigator, laboratory safety, radiation safety, and a number for after hour facility maintenance. Please note the signage prior to entering a lab so you are aware of the dangers present. If you have an area that needs signage contact the Safety Officer.

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

STORAGE OF HAZARDOUS MATERIALS

The improper storage or mixing of hazardous materials can result in serious accidents and even disasters. Violent reactions could occur due to the storing or mixing incompatible materials. Designate a storage place for each hazardous material (cleaning products, paints, paint thinners, gasoline, etc.) and return it to that place after each use. Inspect hazardous storage areas for outdated or unneeded items, illegible labels, leaking containers, etc. Housekeeping, maintenance, and the Principal Investigators are to maintain an inventory of their hazardous materials stored and used. The following information is to offer guidance on the basic principles of safe storage and segregation of hazardous materials.

- Ensure all containers of hazardous materials are properly labeled with identity of the hazardous chemical(s) and appropriate hazard warnings.
- Segregate incompatible materials – (e.g. oxidizing acids and flammable solvents in separate locations) to prevent inadvertent mixing of incompatible chemicals which can produce harmful gases/vapors, heat, fire and explosions. The color codes on labels can be used as a guide for storage groups. Store the flammables (red color code) together; reactive/physical hazard materials (yellow/orange color code) together, and health hazard materials (blue color code) together. Each storage group should have its own separate storage area.
- Store hazardous materials away from heat and direct sunlight.
- Do not store hazardous materials under sinks.
- Do not store hazardous materials alphabetically except within a grouping of compatible chemicals.
- Ensure caps and lids are securely tightened on containers.
- Use approved U.L. flammable storage lockers or flammable storage containers to store flammable and combustible liquids. Flammable solvents should not be stored in fume hoods or vented cabinets, since the airflow will fan any fire and spread it quickly.
- Liquids should be stored in unbreakable or double-contained packaging, should the container break/leak.
- Store inorganic acids in corrosive or acid storage cabinets
- Store acids in a dedicated acid cabinet.
- Bleach should be stored in a cool and dry environment with the lid of the storage container tightly sealed. Bleach fumes can be dangerous and, when inhaled by individuals with compromised bronchial systems, can cause difficulty in breathing. Always store bleach in well ventilated areas. High temperatures can also cause bleach to degrade, and bleach should never be stored where it can freeze.
- Avoid stockpiling hazardous materials.
- Only compressed gas cylinders that are in use and secured in place (to prevent the cylinder from falling over) shall be kept in the work area. All others, including empties shall be sent to the compressed gas cylinder storage area.

GHS SAFETY DATA SHEETS (SDSs)

The GHS has dropped the word "material" from Material Safety Data Sheet (MSDS). It will now be called the Safety Data Sheet or SDS. It provides comprehensive information about the product that allows employers and workers to obtain concise, relevant and accurate information that can be put in perspective with regard to the hazards, uses and risk management of the product in the workplace. Manufacturers are required to supply an SDS for all hazardous materials they produce. The SDS contains 16 sections. While there were some differences in existing industry recommendations, and requirements of countries, there was widespread agreement on a 16 section SDS that includes the following headings in the order specified:

1. Identification of the substance or mixture and of the supplier
2. Hazards identification
3. Composition/information on ingredients
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information including information on preparation and revision of the SDS

EMERGENCY PROCEDURES

Knowing proper emergency procedures is another important part of hazardous material safety. Check each of your UMCES Safety websites for specific instructions and information. Having read the SDS for the hazardous materials you work with can help your respond appropriately in case you or a co-worker is overexposed. For emergencies, including fires, accidents, explosions, and medical emergencies, dial 911.

Medical Emergencies

Take the SDS of the chemical that caused the injury to the Emergency Room if possible. Know where eyewash stations, emergency showers, and first aid kits are located for your work area. Emergency procedures may include:

- Flushing eyes with water for 15 minutes in case of chemical contact.
- Washing skin with soap and water, and removing contaminated clothing;
- Moving to fresh air if a person has been inhaling hazardous dust, fumes, or vapors
- Getting emergency medical assistance if a person has swallowed a hazardous chemical. There are no general first aid measures for swallowing – vomiting may cause more harm, diluting with water or milk may increase the risk. Call **911** or the Poison Hotline (**1-800-222-1222**) and have the appropriate SDS available.

Chemicals on Skin or Clothing

- Flush with water for no less than 15 minutes. For larger contamination the safety shower should be used. Do not waste time because of modesty. Remove all contaminated clothing or jewelry.
- Solvents such as paints, varnishes, lacquers, adhesives, glues, and

degreasing/cleaning agents, and in the production of dyes, polymers, plastics, textiles, printing inks, agricultural products, and pharmaceuticals are capable of dissolving or dispersing one or more other substances dissolved in them. Do not use solvents to wash skin. Solvents remove the natural protective oils from the skin and can cause irritation, inflammation and the absorption of toxics into your body.

- For flammable solids on skin, first brush off as much as possible, then flush with water for at least 15 minutes. Read the SDS and make sure the flammable solid is not reactive with water before you rinse.
- In all cases of severe contamination seek medical attention.

Inhalation

- Close containers, move to fresh air.
- If symptoms such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention. Explain what chemicals you were using and if possible take the appropriate SDS with you.

Ingestion

- Call 911 or the Poison Control Center (1-800-222-1222).
- **Do not induce vomiting** unless directed to do so by a health care provider.

Injection

- Wash area with soap and water and seek medical attention, if necessary.

Spills

All hazardous material spills must be properly cleaned up in order to prevent adverse impacts to the campus environment. Prevention and control of hazardous material spills will ensure a safe campus working environment and prevent illegal discharges to the environment. It is the responsibility of each employee to be aware of the proper storage, handling, and spill clean-up of hazardous materials. Clean up all minor spills and leaks immediately using the spill control material and personal protective equipment in your area. If it is a larger spill or very hazardous spill:

- Notify persons in the immediate area about the spill
- Evacuate all personnel from the spill area and adjoining areas that may be impacted by vapors or a potential fire, if necessary
- If the spilled material if flammable turn off all potential ignition sources but, do not unplug machinery or equipment (this could cause sparks). Avoid breathing vapors of the spilled materials. Be aware that some materials either have no odors or induce olfactory fatigue (ie the odor is detectable only briefly)
- Leave on or establish exhaust ventilation if it is safe to do so.
- Close doors to slow down the spread of odors.
- Notify safety and facilities management
- Essential personnel familiar with the incident need to stay in communication with responders.
- Get medical help if necessary.

Fires

Individuals are not required to fight fires, but those who choose to do so may fight small, incipient fires (no bigger than a wastepaper basket) <u>as long as they have been trained in the proper use of fire extinguishers</u>. Proper use of an extinguisher is:

1. P – pull the pin
2. A – Aim the nozzle at the base of the fire
3. S- Squeeze the handle
4. S – Sweep nozzle across base of fire.

Fight the fire from a positon where you can escape and only if you are confident that you will be successful. If the fire is large or spreading activate the fire alarm. Evacuate the building and wait for the fire department's arrival to inform them of the exact location, details of the fire, and chemicals that are stored and used in the area.

Other Safety Tips:

- Do not purchase hazardous materials in quantities greater than can be used in the specified storage time period.
- Label containers with receiving, opening and disposal dates.
- Consult safety references (i.e. SDSs) before working with hazardous compounds.
- Bleach is often stored with other cleaning compounds (this can be a deadly combination). Should bleach be accidentally mixed with a cleaning agent containing ammonia, a chemical reaction occurs that releases poisonous chloramine gas. Mixing bleach with acids like vinegar, window cleaners, toilet bowl cleaners, or lime removal products allows chlorine gas to be given off. Any chloramine gas is going to present breathing problems if inhaled, even in otherwise healthy individuals. Damage to nose, throat, and lung membranes can also occur.
- Hazardous materials cannot be thrown into the regular trash. Check with your supervisor or your Safety Officer for proper disposal.

RADIATION SAFETY

Another occupational hazard present at UMCES is **radioactive materials (RAM)**. Radiation is not usually associated with chemicals but, it can cause serious damage to the body's cells and tissues. Radioactive materials are powerful research tools in biological and physical research. Strict exposure limits apply. As a result of controls which are in effect, the risk of work involving exposure to these sources of radiation is insignificant. No one may use, bring, purchase, or remove any radioactive material or radiation producing devices without the approval of the Radiation Safety Officer and the Radiation Safety Committee at UMCP. Contact UMCES' ESCO for more information

UMCES works under the Broad Scope Radioactive Material License held by University of Maryland College Park (UMCP). Maryland is an "Agreement State". This means that Maryland has signed a formal agreement with the U. S. Nuclear Regulatory Commission (NRC) pursuant to Section 274 of the Atomic Energy Act authorizing the State of Maryland to regulate certain uses of radioactive materials within the State. This license is monitored and strictly audited by Maryland Department of the Environment.

Restricted Area

Any laboratory that stores or uses radioactive material or radiation producing devices is classified as a "**restricted area**" by the Code of Maryland Regulations (COMAR) 26.12.01.01. A pre-requisite of entering that area requires that you are informed of the hazards involved. These areas (labs) are indicated by the radiation symbols which are on the outside of the door to the lab. Outside each lab there is a notice posted for personnel who do not use radioactive materials. This notice must be read and signed prior to entering the restricted area.

Pregnant Employee

If a pregnant employee encounters a restricted area in the course of designated work, she can make a declaration in writing of her pregnancy to her supervisor and the ESCO. She will then be provided with special monitoring devices during the course of pregnancy to ensure that her exposure does not exceed 10% (0.5rem) of that normally allowed for adult workers (5rem). This declaration is fully optional to the individual.

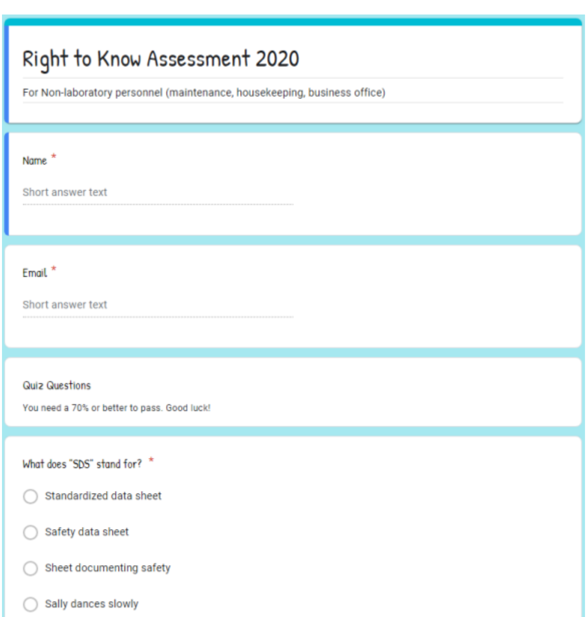
ALARA Policy

At all times, the amount of radiation received by an individual is to be kept -- **A**s **L**ow **A**s **R**easonably **A**chievable (**ALARA**). Qualifications of each applicant are thoroughly reviewed by the Radiation Safety Committee (RSC) to ensure that they have the required formal training, on the job training, history of past use of radioactive material, etc. All protocols are reviewed and approved by the RSC and the RSO prior to use. Personnel using radioactive material are trained in ALARA techniques (time, distance, and shielding). Users of radioactive material keep logs that record any contamination and the immediate measures to remove any contamination after doing an experiment or, monthly whichever comes first. In addition, the ESCO checks these records on a monthly basis and does a wipe survey quarterly for each laboratory with radioactive material, UMCP Radiation Safety does an annual audit and Maryland Department of the Environment Radiation Section occasionally does an unannounced inspection. During these audits/inspections, the licensee (user) must defend their results and methods of carrying out ALARA.

Radioactive material and radiation producing devices are labeled with the same radioactive symbol that is on the door signage. When the radioactive materials are not being actively used by a trained employee, they must be secured behind a locked area (refrigerator, freezer, cabinet or laboratory door). If you need to work in a laboratory or consult with someone in a laboratory that has radioactive materials or equipment present, check with the Principal Investigator where and how the material is stored, or if anyone is actively using radioactive material. If radioactive material/samples are not in a locked cabinet, refrigerator or freezer, the main door(s) to that laboratory must be locked at all times.

Do not perform housekeeping or maintenance in any laboratory without first getting permission from the Principal Investigator and the Safety Officer. They must assure you that the surfaces you need to have contact with are "clean" and fee of any radioactive material. Never empty a trash can that is identified with the radioactive sign which may be taped on the trash can or the bag.

For additional information concerning radioactive material and the training program contact UMCES' Environmental Safety Compliance Officer (umces-safety@umces.edu).



Congratulations! You have now completed Hazard Communication/Right to Know training. Please click the link to the left.

It will direct you to a quiz that you MUST take.