Introduction to Research Safety

(SECTION-1)

Overview

Working in a research laboratory can be a complex and dangerous endeavor. There are plenty of rules and regulations related to safety in the workplace, but **your most basic obligation is to actively protect yourself and others from undue risks of harm**.

This section covers the principles of safety you must follow and who is available to assist you to conduct safe and compliant research.

This researcher dispensing liquid nitrogen (N_2) has an obligation to use gloves, a lab coat, and a face-shield to protect himself from frostbit.

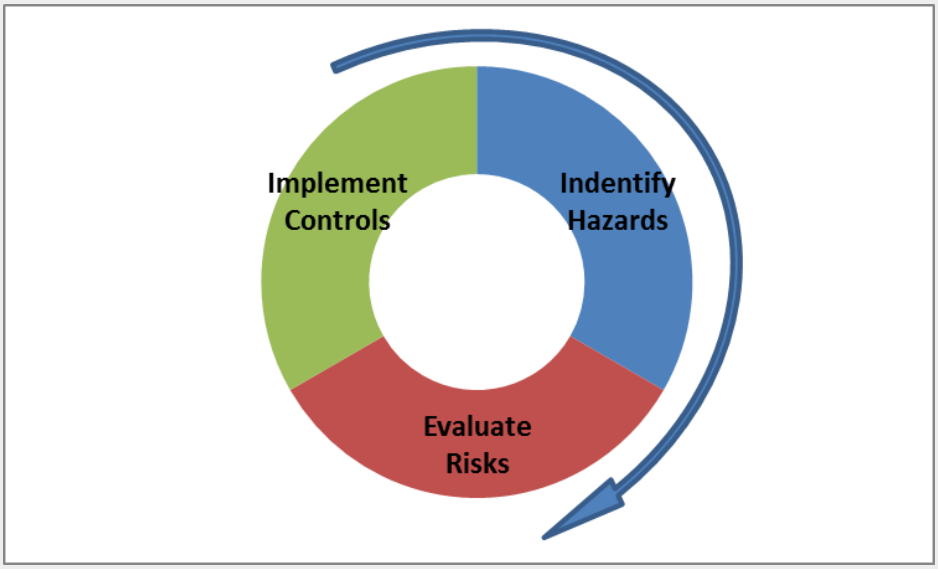
Principles of Safety

Although safety is a shared responsibility at the University of Minnesota, the person most responsible for your safety is you. To reduce the risk of harm to yourself and others, and to meet

regulatory obligations, it's important to follow a basic 3-step planning process. The 3-step planning process, recognized by safety experts as very effective, includes the following steps:

- Recognizing Hazards
- Evaluating Risks of Harm
- Implementing Controls

Consistently follow these three principles, as you plan and perform your work, and you can significantly reduce the risk of harm to yourself and others regardless of your research area. Additional safety modules, along with training provided by your department and PI should provide the basis for you to be successful in following these principles.



Safety Resources: PIs & Lab Supervisors / DSOs / LSOs

Your Principal Investigator (PI) or Laboratory Supervisor is the person most directly responsible for providing guidance to help you be safe and compliant. Your PI or Laboratory Supervisor is supported by your Departmental Safety Officer (DSO) and, in some instances, your Laboratory Safety Officer (LSO).

Principal Investigators/Laboratory Supervisors

PIs and/or Laboratory Supervisors must ensure that you are informed of potential safety hazards and procedures to assist you in protecting yourself and others while you are working for their research program. They must also be sure that you understand and follow standard operating procedures (SOPs) within their laboratories.

SOPs are formal written protocols for research procedures that identify any hazards, the steps necessary to mitigate the hazards, and the steps to take in the event of an emergency. You are required to follow written SOPs whenever conducting potentially hazardous research activities. Your PI must either write the SOPs or approve SOPs you have written.

If you are not certain about the safety of a procedure, you have several options. Your first option should generally be to discuss your concern with your PI or supervisor. But you are also encouraged to discuss with your Departmental Safety Officer, Laboratory Safety Officer, or Research Safety Professional. Safety is a shared responsibility and you are encouraged to get input from several sources.

Departmental Safety Officers

All departments/units conducting research have designated a Departmental Safety Officer (DSO). The DSO is a liaison between DEHS and your department. They have a good understanding of protocols and procedures within your department as well as organizational activities, such as waste collection, training requirements, and where to find additional help.

Laboratory Safety Officers

Some, but not all, research programs have designated one or more Laboratory Safety Officers (LSOs). LSOs are most often graduate students or lab staff who are readily accessible to answer your questions about protocols and procedures in your laboratory. In some departments, such as Chemistry and Chemical Engineering, the LSOs have been empowered to form student-led safety committees and teams to assist in improving safety practices in those departments.

Safety Resources: DEHS

The Department of Environmental Health and Safety (DEHS) is available and expected to provide consultative guidance and support in helping protect the health and safety of the research community.

The primary services provided to the research community, include:

- Assisting researcher in identifying and analyzing hazards
- Educating the research community on best practices for safety performance
- Assisting research programs and departments with continuous improvement efforts
- Interpreting regulations and providing guidance on compliance
- Providing resources and programs to support safety performance (e.g., exposure assessments, air monitoring, etc.)

DEHS has established a service partner model in which expert safety staff (Research Safety Professionals) have been assigned to each research college. The Research Safety

Professionals are the University's experts in the safety policies and procedures across the campuses and are available and expected to assist all researchers and research departments.

If you have questions about safety issues in your laboratory, first contact your PI and try to solve it locally with your LSO or DSO. They are most familiar with the research procedures within your lab. However, you should feel free to contact your DEHS Research Safety Professional for additional assistance. You can call DEHS at (612) 626-6002 or send email to dehs@umn.edu.

(SECTION-2)

Organizational Structure for Safety-1

Safety starts with you. However, recognizing and maintaining safety at such a large entity involves many factors. This section provides an overview of the systems in place to help foster safe, compliant, and responsible research at the University.

Accountability for safety is shared at the University, and all members of the research safety community—from the President of the University to the student lab worker—have responsibilities.

The Organizational Structure

The responsibility for ensuring a safe research environment starts with the president, provosts, deans, directors, and department heads. These administrators make appropriate resources available, delegate responsibilities, and hold their direct reports accountable for safety performance in their service areas. The Office of the Vice President for Research, the Department of Environmental Health and Safety (DEHS), along with the Departmental Safety Officers and Lab Safety Officers serve as resources, providing useful tools, guidance, and assistance.

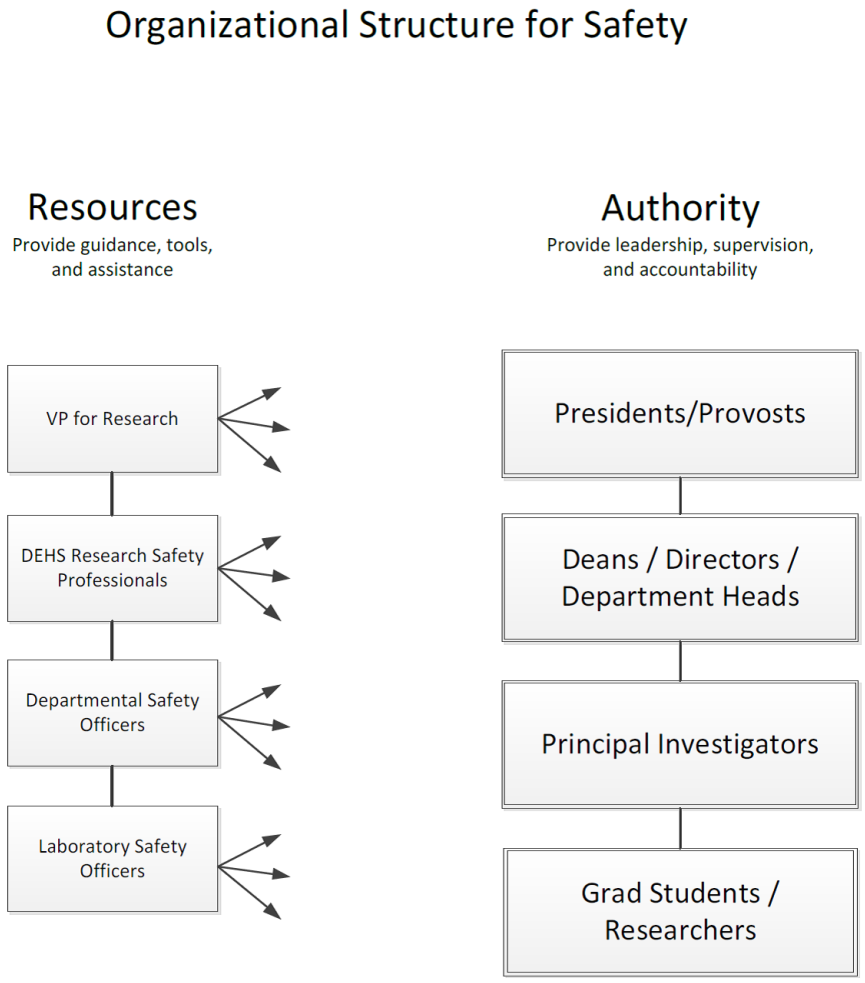
Every department or area conducting hazardous research designates a Departmental Safety Officer (DSO) to act as liaison between:

- His/her department head
- DEHS
- Lab/research workers

The DSO works directly with DEHS to keep informed about safety requirements and best practices relevant to their work. They impart this information to the Principal Investigators (PIs) and facilitate continuous safety improvement in their departments. The PI is directly responsible for ensuring those working in his/her lab are properly trained, capable, and diligent in identifying hazards and implementing appropriate controls to protect themselves and others in the lab.

Where You Fit into the Organization

All of the regulations, resources, and oversight are only effective if you are personally aware of and follow the safety practices and regulations relevant to your area of research. The person most responsible for your safety, and the safety of those you directly work with, is you, whether you are a DSO, PI, researcher, lab worker, or student worker.



Regulatory Agencies

There are a number of regulatory agencies with rules directed at research operations. Most of these regulations originate from the following agencies:

- Occupational Health and Safety Administration (OSHA)
- Environmental Protection Agency (EPA)
- Minnesota Pollution Control Agency (MPCA)
- Drug Enforcement Agency (DEA)

- Centers for Disease Control (CDC)
- U.S. Department of Agriculture (USDA)
- Nuclear Regulatory Commission (NRC)
- Alcohol Tobacco and Firearms (ATF)

The University also has internal policies and guidelines designed to help maintain your safety and the safety of others working or studying on campus. If you do not follow these policies in your research area, you are placing yourself and others at risk of injury and putting your laboratory program and the University at risk of regulatory citation**.**

Common Regulatory Requirements

Regulatory agencies generally require one or more of the following:

- Employee safety training
- Recordkeeping
- Registration and/or tracking
- Security of research areas and/or materials
- Implementation of written safety protocols and practices
- Permits

You may have to comply with specific regulations if your research involves:

- Live humans and animals
- Select agents, and/or toxins
- Bloodborne pathogens
- Controlled substances (e.g., cocaine)
- Hazardous chemicals
- Disposal of hazardous materials (e.g., infectious substances and chemicals)
- Radioactive materials

Your PI, DSO, and DEHS can help you figure out which regulations apply to your work and how to comply.

This researcher, involved in a study of aflatoxins and rats, must comply with regulations that affect the use of chemicals, biological toxins, live animals, and disposal of hazardous waste.

Common Regulatory Deficiencies

Here are ten common deficiencies found in research areas:

1. Containers with hazardous materials not labeled
2. Walkways to doors and emergency equipment obstructed
3. Safety equipment not working or tested regularly
4. Wearing shorts, short skirts, and open-toed shoes
5. Cluttered benchtops and work areas
6. Doors propped open
7. Sash open on fume hood
8. Incompatible chemicals stored together
9. Peroxidizable chemicals not tested or labeled properly
10. Eating and drinking in a lab (including applying makeup, chewing gum, taking medicine)

If a regulatory agency finds an instance of non-compliance, they can impose fines, shut down laboratories, and even shut down research at the entire University. If a laboratory/research area

is found to be in violation of regulations, the PI is named in the citation, and the department or program must pay any fines and remediation costs imposed by a regulatory agency.

Departments and programs may incur substantial fines if cited by regulatory agencies for infractions such as propping open laboratory doors and storing research materials in hallways.

Food and drink is not allowed in labs using hazardous materials.

(SECTION-3)

Key Regulations

There are a number health and safety regulations that impact your work in a laboratory or while conducting field research. This section provides summaries of the most broadly applicable regulations in research. Information about more specific regulations are discussed in our other Research Safety tutorials.

Occupational Safety and Health Act

The broadest regulation, impacting all employers and employees in the United States, is OSHA's federal Occupational Safety and Health Act of 1970. This law requires employers to provide you, and all other employees, with work and workplaces that are free from recognized hazards that cause or are likely to cause death or serious physical harm.

The act enables OSHA to establish regulations to ensure employers provide safe and healthful working environments for all their employees. The specific regulations which may affect your work as a researcher at the University include the:

- Hazard Communication Standard
- Laboratory Safety Standard

A stipulation in the OSHA act gives you the right to refuse to perform activities or procedures that you reasonably believe are unsafe.

OSHA's broad reaching regulatory efforts affect many occupational areas.

Hazard Communication Standard

The Hazard Communication standard is a federal regulation which states that all employees must be aware of the dangers associated with any hazardous chemical that they might be exposed to in their workplaces.

briefly, the Hazardous Communication standard states that employers must:

- Make chemical hazard information readily accessible to employees in their work areas
- Inventory and evaluate hazardous chemicals in the workplace
- Implement and maintain a hazard labeling system or other warning methods
- Develop a written plan that discusses the points above and safe working procedures
- Provide initial, pre-assignment, and annual safety training to those employees

Occupational Exposure to Chemicals in the Laboratory Standard

The standard was designed specifically for highly trained and educated researchers, so its directives are intentionally flexible and adaptable to allow researchers to develop safety practices that are most effective for their research. Primarily, this standard requires you to write and follow standard operating procedures. We are required to explain all of its parts.

Hazard Identification

To guide hazard identification, the standard requires you to determine:

- The inherent hazardousness of the chemicals you will be using
- How the hazard may change as you conduct your experiments (i.e., will the chemicals react to form new hazards)
- The possible routes of exposure (e.g., inhalation, skin absorption, general contact)
- The permissible exposure limits (PELs) for numerous OSHA regulated substances that are listed
- If air monitoring is required to assess the potential levels of exposure
- Labeling requirements for chemical containers used during your experiments
- How you will access relevant Safety Data Sheets (SDS)

Evaluate the Risk

Determine the level of potential exposure at the beginning, during, and after your procedures. Determine the potential exposures or reactions that are likely to cause harm.

Hazard Control

To control the hazards of working with chemicals, the standard states that you must not experience exposure levels to any OSHA regulated substances that exceed Permissible Exposure Limits (PELs), or are likely to cause harm (e.g., explosions, burns, pressure release, etc.). Your employer must provide you with appropriate protections. Common forms of protection include wearing gloves and other personal protective equipment and working in fume hoods.

Chemical Hygiene Plan

The standard requires employers to develop and implement a Chemical Hygiene Plan (CHP), which comprehensively details ways to protect employees from the health hazards associated with the chemicals used in their laboratories. Several sections of the Laboratory Safety Standard provide employers with guidance and list resources to assist with the development of an appropriate CHP.

In response to the requirement to develop a CHP, the University requires laboratories to follow the University's CHP. This plan is the primary reference for understanding and following

regulations that affect your research. The CHP will be discussed in further detail on the next page.

Training

The Laboratory Safety Standard requires your employers to provide you with appropriate information about all the hazards in their research, and how to control them. This training must include:

- The signs and symptoms of exposure to hazardous chemicals
- Information about any hazards present in your laboratory and how to protect yourself
- The contents and location of the University's CHP and the location of relevant safety resources
- The PELs

Medical Treatment

The University is required by the Laboratory Safety Standard to pay for physician's examination and any necessary treatment if:

- You have signs or symptoms associated with exposure to a hazardous chemical used in your laboratory
- Exposure monitoring of your laboratory reveals an exposure level that is above the PEL
- You are exposed during in a leak, spill, explosion, or other hazardous occurrence in your laboratory

Recordkeeping

The standard requires employers to keep the following records for each of their employees:

- Exposure monitoring
- Medical consultations and examinations (including tests or opinions written by examining physicians)
- Training sessions

Chemical Hygiene Plan (CHP)

To comply with all regulatory obligations, University departments and employees must follow the policies and practices established within the CHP. The CHP contains the following:

- Guidelines for developing and/or using standard operating procedures (SOPs) that University researchers must follow when working with chemical, physical, and/or biological hazards

- Directives for when and how to implement appropriate controls for safety (e.g., fume hood use, biological safety cabinets, air monitoring, etc.)
- Standards for safety equipment and protective clothing (e.g., installation requirements, placement, etc.)
- Training requirements
- Circumstances requiring prior approval
- Medical consultations/exams
- Responsible personnel
- Additional protective measures (for particularly hazardous and highly reactive substances)

UHS GHS Classification and Labeling of Chemicals Training (part-1)

This training is required by OSHA's revised HAZCOM standard for all University staff, faculty, and students who use or purchase chemicals. This standard adopts the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and requires that everyone who works around hazardous materials be trained on the new standard.

This module covers changes to OSHA's hazard communication policy that affect the:

- Chemical labeling requirements for manufacturers
- Format and name of Safety Data Sheets (SDSs), formerly known as Material Safety Data Sheets (MSDSs)

This training explains the changes you will see on chemical containers labeled by manufacturers. This training will not cover your responsibilities for labeling chemicals in your laboratory space. For instructions on how chemical hazards should be communicated in your lab or work space, contact your Department Safety Officer or Research Safety Partner.

Pre-test Quiz

There is a pretest to assess your initial understanding of GHS terminology. This quiz will not count toward your final quiz grade.

Resources

Training

- Hazard Communication Standard: Dec. 1st, 2013 Training Requirements for the Rev. Standard Fact (OSHA FS-3642 - 2013)

SDS

- Hazard Communication Safety Data Sheets (OSHA 3493 - 2012)

- Hazard Communication Standard: Safety Data Sheets - Brief (OSHA BR-3514 - 2013)

Label Elements

- Hazard Communication Standard Pictogram (OSHA 3491 - 2012)
- Hazard Communication Standard: Labels and Pictograms - Brief (OSHA BR-3636 - 2013)
- Hazard Communication Standard Labels (OSHA 3492 - 2012)

What is GHS?

The Globally Harmonized System (GHS) is a standardized system of chemical hazard classification and communication. If you order or use chemicals, OSHA's adoption of the system will change the chemical information provided to you. You will soon see changes to the:

- Chemical labeling requirements for manufacturers
- Format and name of Safety Data Sheets (SDSs), formerly known as Material Safety Data Sheets (MSDSs)

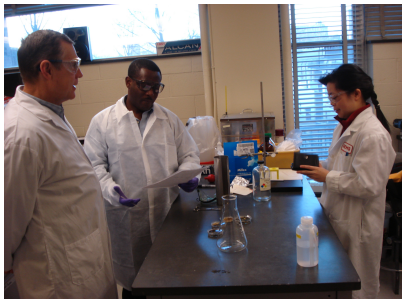
Hazard Communication in Your Lab

OSHA's HAZCOM standard has changed its focus from an employee's right to know about chemical hazards in the workplace to an employee's right to understand these hazards. This means that hazards for materials must be easily accessible and clearly communicated to:

- Anyone working in the area where chemicals are used or stored
- Visitors to this area
- Emergency responders

What is your responsibility?

Under OSHA's "Right to Understand" requirements, the chemical hazards in your work area must be clearly communicated to everyone who enters your lab or work space.



Chemical hazard information must be easily accessible and clearly communicated to anyone who enters your lab or work area.

UHS GHS Classification and Labeling of Chemicals Training (part-2)

Hazardous Communication

Many countries' hazard communication standards require chemical manufacturers to generate and provide safety data sheets (SDSs) and chemical labels for the chemicals they produce. The labels and SDSs are used by the manufacturer to communicate the known hazards about their products. OSHA requires that by December 1, 2015, all manufacturer-produced chemical labels and SDSs will display a new standardized format. The standardized format is intended to improve understanding of chemical hazards. Knowing how to consult an SDS and recognize the different label elements will help you determine what steps are necessary to work safely with your materials.

This lesson will help you:

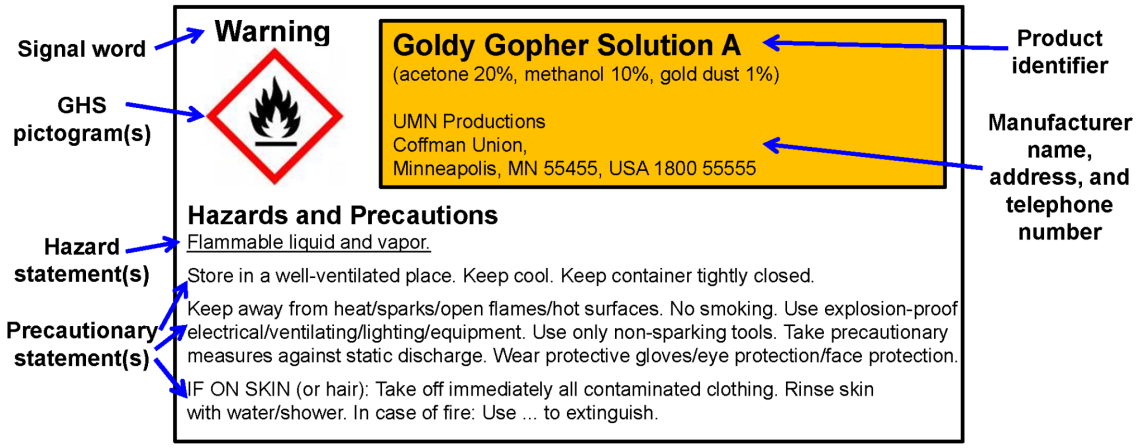
- Recognize the required elements of the chemical label
- Understand the organization of information on the SDS
- Locate essential information on the chemical label and SDS

Required Label Elements

As of June 1, 2015, manufacturers will be required to label chemicals using the GHS standardized system, which requires:

1. Product identifier
2. Manufacturer name, address, and telephone number
3. Signal word
4. GHS pictogram(s)
5. Hazard statement(s)
6. Precautionary statement(s)

These label elements, shown in the sample label below, will be described further on the following slides.



GHS Pictogram

GHS pictograms are red-bordered with a black hazard symbol on a white background. The black hazard symbol identifies an environmental, health, or physical hazard. The table to the right shows the nine GHS pictograms.

Listed below each pictogram is the list of possible hazards each pictogram may represent. If a chemical exhibits more than one type of hazard, a label may contain more than one pictogram. For example, a material that is both flammable and corrosive will have both the flame and corrosive symbol. Several symbols, such as the flame symbol, can be used for more than one type of hazard.

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment** **(Non-Mandatory)**  • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

Source: OSHA Brief, "Hazard Communication Standard: Labels and Pictograms"

Look Beyond the Pictogram

Several pictogram symbols, such as the flame symbol to the right, can be used for more than one type of hazard. The flame symbol represents flammables, pyrophorics, self-heating materials, materials that emit flammable gas, self-reactives, and organic peroxides. Treating these hazards the same could lead to unsafe situations. Reading the hazard and precautionary statements (discussed in the following slides) as well as looking at the pictogram will identify the type of hazard and how it can be safely managed.

One symbol can represent materials with different hazards.

The chart below shows some of the hazard and precautionary statements for flammable pyrophoric and water-reactive materials. Some of the precautionary statements are the same, but some are very different.

- The procedure for handling a flammable liquid, "Rinse the skin with water," is not recommended by the prevention precaution statement for a water reactive chemical, "Do not allow contact with water."
- The procedure for storing a flammable, "Store in a well-ventilated place," is not recommended by the prevention precaution statement for a pyrophoric liquid, "Do not allow contact with air."

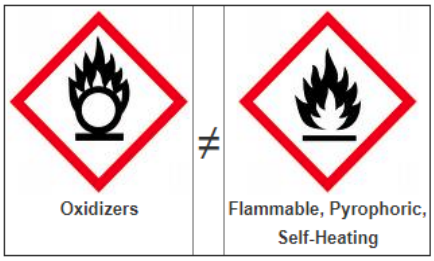
Category	Hazard Statement	Precautionary Statement		
		Storage Precaution	Response Precaution	Prevention Precaution
Flammable liquids	Flammable liquid and vapour	**Store in a well-ventilated place.** Keep cool.	IF ON SKIN (or hair): **Rinse skin with water/shower.** Take off immediately all contaminated clothing. In case of fire: Use ... to extinguish.	Keep away from heat/sparks/open flames/hot surfaces. No smoking Keep cool. Ground/bond container and receiving equipment Use explosion-proof electrical/ventilating/lighting/.../equipment. Use only non-sparking tools. **Take precautionary measures against static discharge.** Wear protective gloves/protective clothing/eye protection/face protection.
Pyrophoric liquids	Catches fire spontaneously if exposed to air	**Store contents under ...**	IF ON SKIN: **Immerse in cool water/wrap in wet bandages.** In case of fire:	Keep away from heat/sparks/open flames/hot surfaces. No smoking **Do not allow contact with air.** Wear protective gloves/protective clothing/eye protection/face protection.
Water-reactive materials	In contact with water releases flammable gas	Store in a closed container. **Store in a dry place.**	**Brush off loose particles from skin** Immerse in cool water/wrap in wet bandages. In case of fire: Use ... to extinguish	Protect from moisture. **Do not allow contact with water.** Handle under inert gas. Wear protective gloves/eye protection/face protection.

Hazard and Precautionary Statements for Flammable Pyrophoric and Water Reactive Materials.

Flammable vs. Oxidizer Pictogram

The GHS symbols for flammable materials and oxidizers are similar and should not be confused. Note that the symbol for oxidizers uses an "O" at the base of the flame to distinguish it from the symbol for flammable materials.

The flame pictogram is used for flammables, pyrophorics, self-heating materials, materials that emit flammable gasses, self-reactives, and organic peroxides. The flame over a circle is used for oxidizers.



GHS Pictograms vs. Transportation Pictograms

The red-bordered GHS pictograms do not replace and are not acceptable substitutes for DOT pictograms. DOT pictograms must still be displayed on the outside of a shipping package. DOT pictograms are also not acceptable substitutes for GHS pictograms. A shipped package of chemicals will have both DOT pictograms and GHS pictograms.

Expect to see:

1. *GHS pictogram(s) on the product label, (as illustrated on the bottles above)*
2. *DOT pictogram(s) on the outer shipping package (as seen on the box)*

Signal Word

A signal work is used to emphasize hazards and indicate the relative level of severity of the hazard. The possible signal words are: danger and warning. "Danger" is used for the more severe hazards, and "Warning" for the less severe hazards. Some lower-level hazard categories do not need signal words, so no signal word will appear on the label.

Signal Word Meaning

Signal Word	**Severity**
Danger	Most hazardous
Warning	Intermediate hazard
No Signal Word	Not hazardous enough to merit a signal word

Only one signal word corresponding to the class of the most severe hazard should be used on a label. Therefore, no label will say: **“Danger, Warning”.**

Hazard Statement(s)

The hazard statement is a standardized phrase assigned to a material based on information known about its particular hazard class and category that describes the nature of the hazard. The statement may describe a physical, health or environmental hazard. More than one statement is allowed. If multiple statements could apply, the most protective statement applicable will be used.

Modifiers

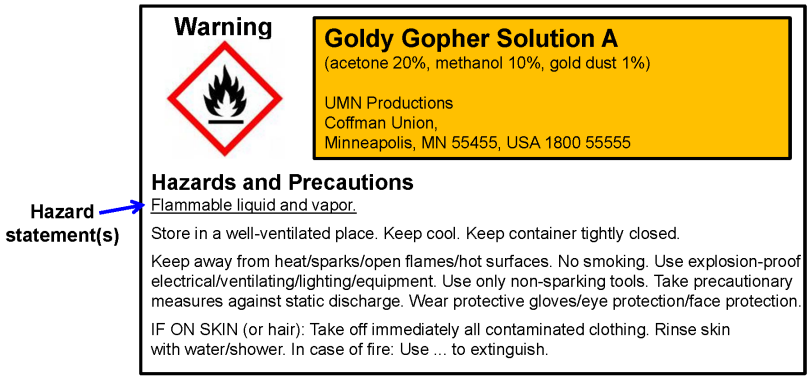
Modifier such as:

- May
- Highly
- Extremely
- Very

Help to distinguish severity or likelihood of the hazard. Use them to help compare products.

Alternate Scales

Other scales may be used as well. "Fatal" is worse than "toxic" which is worse than "harmful." Similarly, "flammable" is worse than "combustible."



Example Hazard Statement

Physical	Health	Environmental
Unstable explosive	Fatal if swallowed	Very toxic to aquatic life
Explosive; mass explosion hazard	Toxic if swallowed	Toxic to aquatic life
Explosive; severe projection hazard	Harmful if swallowed	Harmful to aquatic life
Explosive; fire, blast or projection hazard	May be harmful if swallowed	Very toxic to aquatic life with long lasting effects
Fire or projection hazard	May be fatal if swallowed and enters airways	Toxic to aquatic life with long lasting effects
May mass explode in fire	May be harmful if swallowed and enters airways	Harmful to aquatic life with long lasting effects
Extremely flammable gas	May be harmful if swallowed and enters airways	
Flammable gas	Fatal in contact with skin	
Extremely flammable material	Toxic in contact with skin	
Flammable material	Harmful in contact with skin	
Extremely flammable liquid and vapor	May be harmful in contact with skin	
Highly flammable liquid and vapor	Causes severe skin burns and eye damage	
Flammable liquid and vapor	Causes skin irritation	
Combustible liquid	Causes mild skin irritation	
Flammable solid		

Precautionary Statement(s)

A precautionary statement is a phrase (and/or pictogram) which describes recommended measures that should be taken to minimize or prevent adverse effects. The statement may describe a general, storage, prevention, or response precautionary measure. More than one statement is allowed. If more than one statement could apply, the most protective statement will be used.

Modifiers

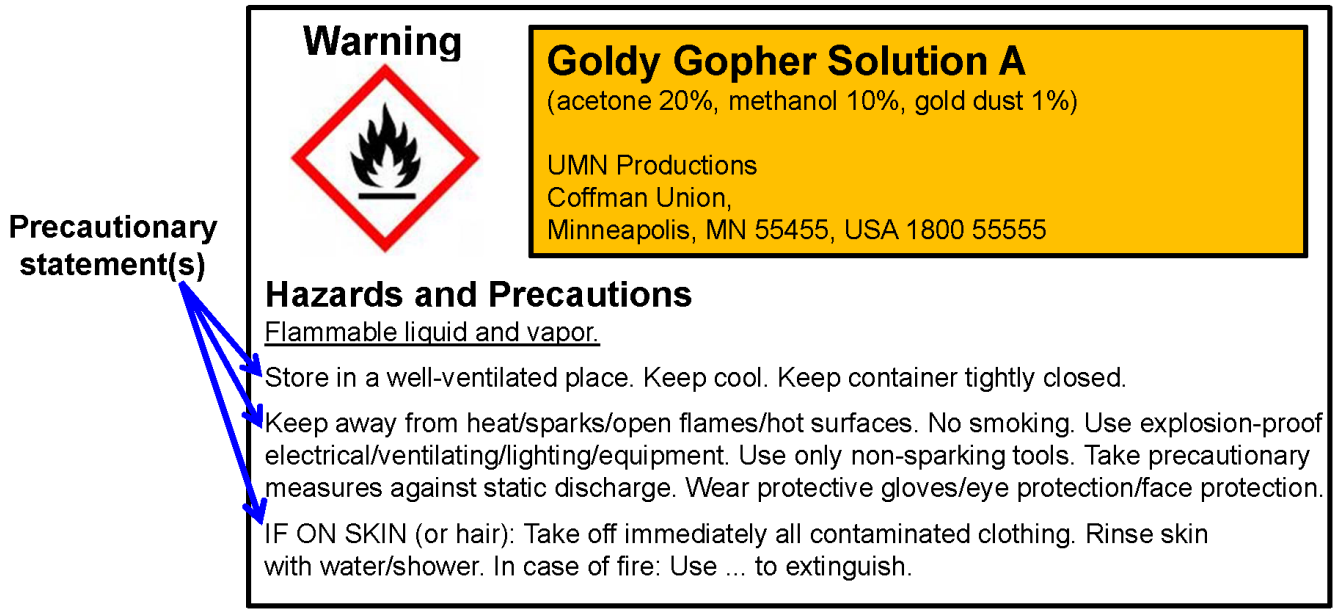
Modifiers such as

- Immediately
- If you feel unwell

help to distinguish severity or likelihood of the hazard. You can use them to help compare products.

Alternate Scales

Other scales may be used as well. Statements encouraging the involvement of a poison center identify situations that are more severe than statements suggesting you seek medical advice.



Example Precautionary Statements

General	Disposal	Storage	Prevention	Response
• If medical advice is needed, have product container or label at hand • Keep out of reach of children • Read label before use	• Dispose of contents/container to ...	• Store locked up • Store in a corrosive resistant/... container with a resistant inner liner • Protect from sunlight • Store at temperatures not exceeding ... °C/... °F • Store contents under ... • Store in a well ventilated place. • Keep container tightly closed	• Obtain special instructions before use • Do not handle until all safety precautions have been read and understood • Keep away from heat/sparks/open flames/hot surfaces – No smoking • Do not spray on an open flame or other ignition source • Keep/Store away from clothing/.../combustible materials • Take any precaution to avoid mixing with combustibles • Do not allow contact with air • Keep away from any possible contact with water, because of violent reaction and possible flash fire • Keep wetted with ... • Handle under inert gas • Protect from moisture • Keep container tightly closed • Keep only in original container	• IF SWALLOWED: • IF ON SKIN: • IF ON SKIN (or hair): • IF INHALED: • IF IN EYES: • IF ON CLOTHING: • IF exposed: • IF exposed or concerned: • IF exposed or you feel unwell: • Immediately call a POISON CENTER or doctor/physician • Call a POISON CENTER or doctor/physician • Call a POISON CENTER or doctor/physician if you feel unwell • Get medical advice/attention • Get medical advice/attention if you feel unwell • Get immediate medical advice/attention • Specific treatment is urgent (see ... on this label) • Specific treatment (see ... on this label)

Safety Data Sheets

Safety Data Sheets, formerly known as Material Safety Data Sheets, have changed both their name and their format under OSHA's GHS policy. Safety Data Sheets will now have a standardized format with 16 sections, allowing users to easily find the product and safety information they need. Hazard information will be provided as follows:

Section 1, Identification:

Includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification:

Includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients:

Includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures:

Includes important symptoms/ effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures:

Lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures:

Lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage:

Lists precautions for safe handling and storage, including incompatibilities.

Section 8, Exposure controls/personal protection:

Lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties

Lists the chemical's characteristics.

Section 10, Stability and reactivity:

Lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information:

Includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information

Section 13, Disposal considerations

Section 14, Transport information

Section 15, Regulatory information

Section 16, Other information

Includes the date of preparation or last revision.

Missing Information on the Safety Data Sheets

Safety Data Sheets may be missing information in some sections. The absence of this information does not indicate that the material is non-hazardous. There are two acceptable reasons:

"No applicable information was found" or **"No relevant information available"**
The absence of information does not mean that the material is non-hazardous. It is possible that the material is dangerous, but no studies have confirmed the existence of hazards.

Use of **"trade secret"**
In Section 3: Composition/information on ingredients, the contents of the material may not be listed if considered a "trade secret." However, if hazards are known, they must be disclosed in the other relevant sections of the SDS.

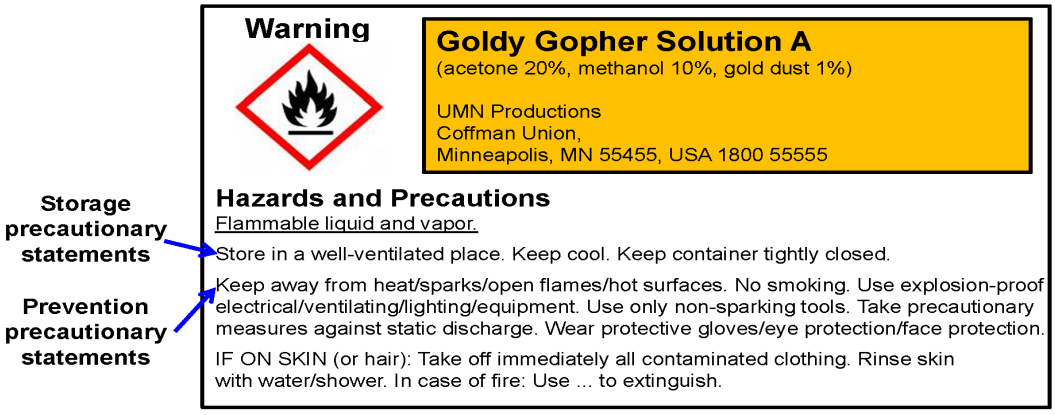
Using the Label and Safety Data Sheet

The same criteria are used to communicate hazard information on both the label and the SDS. Therefore, a label should be a condensed version of the SDS.

To determine where to store a material:

On the label, look for:

- Storage precautionary statements
- Prevention precautionary statements



On the SDS, look at:

- Section 7: Handling & Storage, which include precautions for safe handling and conditions for safe storage
- Section 10: Stability & Reactivity, which include information on chemical stability, potential for hazardous reactions, conditions and materials to avoid, and hazard decomposition products.

Section 4: First Aid Measures

General advice

- Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

Section 5: Fire Fighting Measures

Conditions of flammability

- Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Section 6: Accidental Release Measures

Personal precautions

- Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.

Section 11: Toxicological Information

Acute toxicity

- Oral LD50

  LDLO Oral - Human - 143 mg/kg
  Remarks: Lungs, Thorax, or Respiration: Dyspnea. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

  LD50 Oral - rat - 1,187 - 2,769 mg/kg

Safety Data Sheet (SDS)

Section 1, Identification:

Includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification:

Includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients:

Includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures:

Includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures:

Lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures:

Lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage:

Lists precautions for safe handling and storage, including incompatibilities.

Section 8, Exposure controls/personal protection:

Lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties

Lists the chemical's characteristics.

Section 10, Stability and reactivity:

Lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information:

Includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information

Section 13, Disposal considerations

Section 14, Transport information

Section 15, Regulatory information

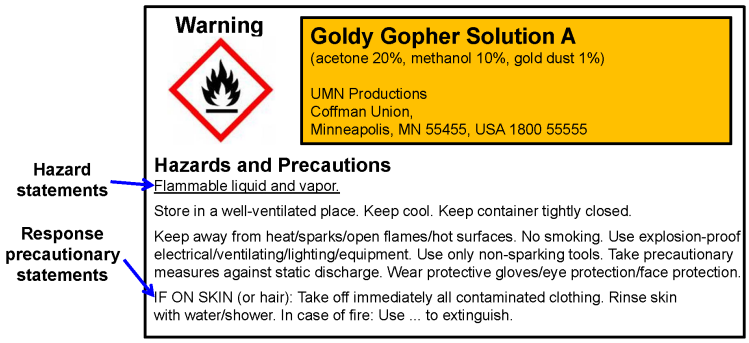
Section 16, Other information

Includes the date of preparation or last revision.

To prepare for an emergency:

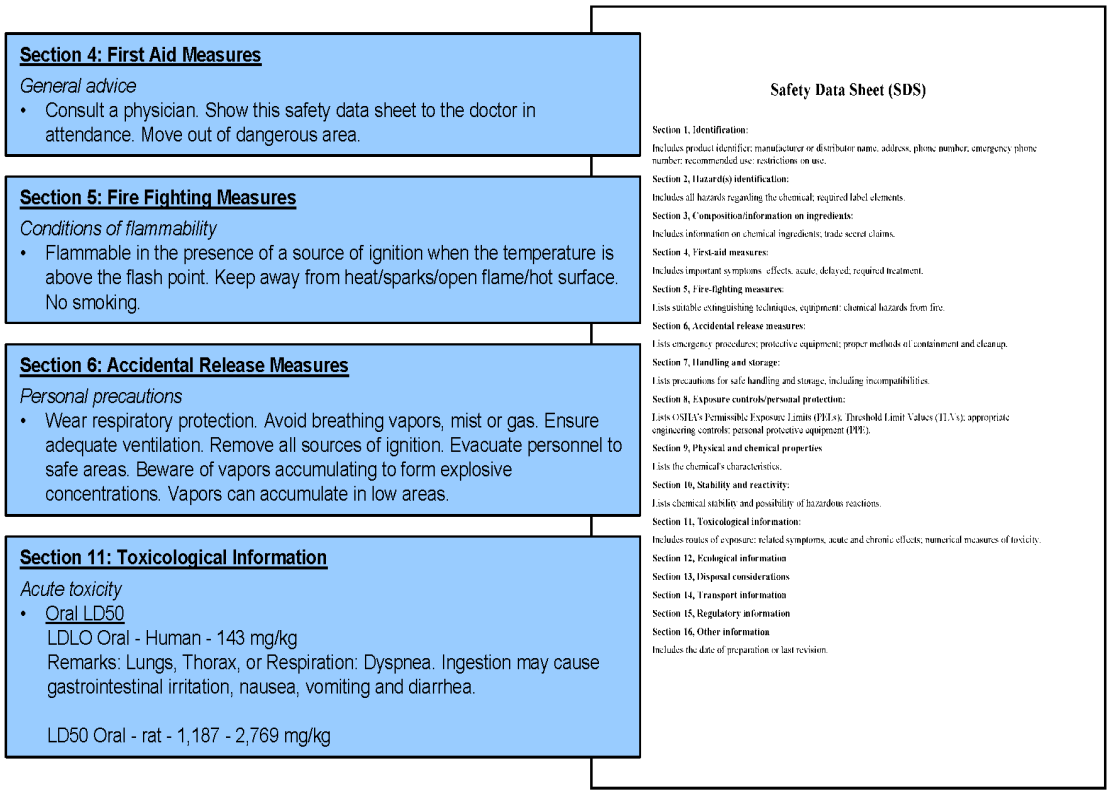
On the label, look for:

- Hazard statements
- Response precautionary statements



On the SDS, look at:

- Section 4: First Aid Measures, which includes general advice
- Section 5: Fire Fighting Measures, which includes conditions of flammability
- Section 6: Accidental Release Measures, which includes personal precautions
- Section 11: Toxicological information, which includes information on toxicity



(SECTION-4)

Safety Resources

As we stated at the beginning of this tutorial, working in a research laboratory can be a complex and dangerous endeavor. Every researcher at the University should understand and use the many excellent safety resources.

In this section, we highlight some of the resources available to help you maintain safety at the University.

Training

You must receive training on the following:

General:

- Safe work practices
- Standard operating procedures (SOPs) followed in your laboratory
- How to access additional information and the location of the University's Chemical Hygiene Plan (CHP)

Training must be provided:

- Initially: when you first start working for the University
- Annually: your DSO and PI must ensure you receive a review of relevant safety information and the CHP every year
- Before a new procedure: whenever you start (or change) a procedure which introduces new or unexpected risk, you must receive training

Your PI is responsible to maintain documentation of the safety training you receive.

Training Providers

The following members of the research community provide health and safety training to others. Depending on your position within the University research community, you will need to receive training from some or all of these members.

PIs and/or Supervisors

Principal Investigators (PIs) and/or Laboratory Supervisors must ensure you are informed about the safety requirements particular to their laboratories. They must be sure that you understand how to effectively identify hazards, write appropriate SOPs, and control the hazards you may encounter while performing your work.

DSOs

Your Departmental Safety Officer (DSO) must inform you about the following:

- Departmental and University safety procedures and requirements
- The location and the contents of the UMN CHP
- How to access departmental and University safety resources and assistance

Contact DEHS if you do not know your department's DSO.

DEHS

The Department of Environmental Health and Safety provides training in a variety of health and safety areas.

Reference Materials

There are a number of reference materials to help you be safe and meet your obligations.

University Safety Documents

SOPs

You must follow written standard operating procedures (SOPs) when conducting your research. It is important to update the SOPs when procedures are modified to ensure the hazard controls match your practices. Your PI and DSO are your first stop for assistance understanding the SOP requirements for your lab.

The Chemical Hygiene Plan (CHP)

The UMN Chemical Hygiene Plan (CHP) should be your second point of reference for evaluating and controlling the hazards of your work.

DEHS References

DEHS staff have developed numerous materials to assist researchers at the University, including a number of fact sheets and guidance documents.

Outside References

There are many outside reference materials that researchers use to evaluate and control hazards, such as:

- Material Safety Data Sheets and Safety Data Sheets: Many different companies and institutions have developed data sheets that list hazards for chemicals, biological materials, pesticides, pharmaceuticals, and more.
- Prudent Practices: The National Research Council (NRC) has developed a principal laboratory reference, called *Prudent Practices in the Laboratory*, which details safe

and compliant practices for using chemicals and managing the waste. Many people develop their own SOPs based on the NRC's prudent practices.
- Safety Equipment Selection Charts: There are numerous charts and other resources to help you correctly select safety equipment (such as gloves, respirators, cabinets) to make your research safe and compliant.

Emergency Services

These units are available to help you prepare to respond emergency situation:

- DEHS
- The University's Department of Emergency Management
- The University Police Department

Emergency Situations

The following types of events should be treated as an emergency:

- Fires, explosions, or if you see smoke
- A spill or exposure to radioactive, chemical, or biological materials
- An injured person or medical crisis, such as:
    - Uncontrolled bleeding
    - Loss of consciousness
    - Difficulty breathing

General Emergency Procedure

In the event of an emergency, be sure to do the following:

1. Notify everyone around you of the emergency situation.
2. Evacuate the area, if necessary.
3. Call 112.
    - Be sure to call 112 for any situation similar to those described above, even if you are not sure if the situation is an emergency. The dispatcher will help sort it out.
    - Be sure to tell the dispatcher of your location, and clearly describe the incident.
4. Administer First Aid, if necessary.

Safety Equipment

Within your laboratory or research area, there is safety equipment provided to control the hazards you might be subjected to. You should familiarize yourself with the purpose of, location

of, and how to use the safety equipment provided. You should also routinely check each piece to ensure it is fully functional.

Some examples of safety equipment include:

- Fume hoods
- Biological safety cabinets
- Fire extinguishers
- Eyewashes
- Emergency showers
- Personal protective equipment

You will find information about how to use the safety equipment necessary for your research within your laboratory's SOPs. If you have any questions about how to use the equipment, ask your PI.

General Safety Questions

Occasionally, you might question your standard operating procedures (SOPs) as not being protective enough, or that the requirements are difficult to follow.

In general, if you question current work practices, you should follow these steps:

1. First, talk to your Lab Supervisor or Principal Investigator about your concerns. Often, there is a straightforward solution to the situation, which your PI could suggest.
2. If you are the PI, or if after talking to the PI you find there are still concerns, you should contact your DSO. The DSO will work with your PI/you to develop effective SOPs.
3. In instances where additional assistance is required, you or your DSO will work with DEHS to address appropriate solutions and correct unsafe practices. DEHS and the DSO will also work together to share learning across the department and entire research community.