

# CSM Chemical Hygiene Program

## Policy

The Colorado School of Mines (CSM) is committed to providing a safe working environment for faculty, staff and students and believes these individuals have a right to know about health hazards associated with their work. This knowledge is essential if these individuals are to make knowledgeable decisions about personal risk. This Chemical Hygiene Plan includes policies, procedures, and responsibilities designed to develop in faculty, staff and students an awareness of potential hazards in their workplaces, and to train them in how to acquire the necessary tools and knowledge to evaluate and mitigate risks in their workplace.

It is CSM policy that faculty, staff and students assume responsibility for their safety. The individuals who work in any given laboratory are best able to detect potential hazards in their facility or in their work procedures due to their familiarity with day to day operations in their workplace.

All faculty, staff and students will have access to pertinent safety information through supervisors and the Environmental Health and Safety office so that they can acquire the knowledge necessary to exercise responsibility for their own safety and the safety of the facilities they use. When safety concerns arise, faculty, staff and students are encouraged to contact their supervisor or the Environmental Health and Safety office.

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# Responsibilities

## A. Environmental Health and Safety Office

1. Works with administrators, laboratory supervisors, and workers to develop and implement appropriate chemical hygiene and safety policies and practices.
2. Monitors procurement, use, and disposal of regulated materials in laboratories.
3. Administers Safety Committee yearly laboratory inspections.
4. Provides consulting services to help laboratory supervisors customize the Chemical Hygiene Plan for their laboratories.
5. Provides consulting services about standard practices and the current regulatory requirements regarding regulated substances.
6. Maintains the campus wide model Chemical Hygiene Plan.
7. Maintains a campus wide chemical inventory.
8. Maintains a campus wide MSDS repository.
9. Maintains all medical records concerning medical surveillance, and medical consultations and exams, that involve regulated materials.
10. Performs all respirator fit testing.
11. Provides the campus Chemical Hygiene Officer. The Chemical Hygiene Services Technician is the Chemical Hygiene Officer.
12. Provides training for independent users of regulated materials.

## Department Heads/Directors

1. Ensure that all laboratory supervisors adopt and implement this campus Chemical Hygiene Plan.
2. Ensure that all personnel receive the required training.

### Laboratory Supervisors

1. Have total responsibility for chemical hygiene and safety in their laboratories.
2. Ensure that the minimum required standard operating procedures are followed in their laboratory.
3. Require laboratory workers to wear necessary personal protective equipment and assure that it is used and maintained properly.
4. Ensure that facilities, equipment, and training are adequate for any material being used or stored in the laboratory.
5. Report any accidental exposure or release of regulated materials.
6. Ensure that all containers of chemicals in the laboratory are properly labeled and stored.
7. Ensure that the laboratory has a current MSDS file for the chemicals in their laboratory.
8. Provide training for regulated material users when directly supervising them in the laboratory setting.

### Laboratory workers

1. Assume responsibility for the safety and health of themselves and their co-workers while they are working in the laboratory.
2. Plan and conduct each operation in accordance with their laboratory's Chemical Hygiene Plan.
3. Develop good personal chemical hygiene practices.
4. Periodically review their laboratory's Chemical Hygiene Plan to ensure compliance.
5. Ensure that they use and maintain any personal protective equipment properly.
6. Keep their work area clean and uncluttered, with chemicals and equipment being properly labeled and stored.
7. Clean the work area upon completion of an operation or at the end of each day.

# Standard Operating Procedures (SOP)

Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals have been designed. These procedures have been designed with the intent of minimizing chemical exposures and minimizing safety hazards.

The following set of generic standard operating procedures will serve as minimum standard operating procedures for all laboratories on the CSM campus. Since the types and amounts of chemicals used in each laboratory vary greatly, each laboratory supervisor is encouraged to customize these minimum standard operating procedures by adding other standard operating procedures specific to their laboratory. **Laboratory supervisors are responsible for ensuring these SOPs are followed in their laboratories.**

## General Safety Principles

The following guidelines have been established to minimize hazards and to maintain basic safety in the laboratory.

1. Examine the known hazards associated with the materials being used. Never assume all hazards have been identified. Carefully read the label before using an unfamiliar chemical. When appropriate, review the Material Safety Data Sheet (MSDS) for special handling information. Determine the potential hazards and use appropriate safety precautions before beginning any new operation.
2. Be familiar with the location of emergency equipment - fire alarms, fire extinguishers, emergency eyewash and shower stations and know the appropriate emergency response procedures.
3. Avoid distracting or startling other workers when they are handling hazardous chemicals.
4. Use equipment and hazardous chemicals only for their intended purposes.
5. Always be alert to unsafe conditions and actions and call attention to them so that corrective action can be taken as quickly as possible.
6. Wear eye and face protection when appropriate.
7. Always inspect equipment for leaks, tears and other damage before handling a hazardous chemical. This includes fume hoods, gloves, goggles, etc.
8. Avoid tasting or smelling hazardous chemicals.

## Health and Hygiene

The following practices have been established to protect laboratory employees from health risks associated with the use of hazardous chemicals:

1. Avoid direct contact with any hazardous chemical. Know the types of protective equipment available and use the proper type for each job.
2. Confine long hair and loose clothing and always wear footwear which fully covers the feet.
3. Do not mouth pipette.
4. Use appropriate safety equipment whenever exposure to gases, vapors or aerosols is suspected and ensure exhaust facilities are working properly.
5. Wash thoroughly with soap and water after handling chemicals, before leaving the laboratory and before eating or drinking.
6. Replace personal protective equipment as appropriate.
7. Laboratory employees shall be familiar with the symptoms of exposure for the chemicals with which they work and the precautions necessary to prevent exposure.

## Food and Drink in the Laboratory

The following is the accepted practice on food and drink in laboratories and should be followed at all times:

1. There shall be no food, drink, smoking or applying cosmetics in laboratories which have radioactive materials, bio-hazardous materials or hazardous chemicals present.
2. There shall be no storage, use or disposal of these 'consumable' items in laboratories (including refrigerators within laboratories).

## Housekeeping

Safety follows from good housekeeping practices. Use the following guidelines to maintain an orderly laboratory:

1. Keep work areas clean and uncluttered with chemicals and equipment. Clean up work areas upon completion of an operation or at the end of each work day, including floors.
2. Dispose of waste using the CSM Chemical Recycling and Waste Disposal Program.

3. Clean minor spills immediately and thoroughly. In case of large spills contact the EHS office.
4. Do not block exits, emergency equipment or controls or use hallways and stairways as storage areas.
5. Assure hazardous chemicals are properly segregated into compatible categories.

### Chemical Handling and Storage

The decision to use a hazardous chemical is a commitment to handle and use the chemical properly from initial receipt to disposal.

1. Information on proper handling, storage and disposal of hazardous chemicals and access to related Material Safety Data Sheets should be made available to all laboratory employees prior to the use of the chemical.
2. Always purchase the minimum amount necessary to maintain operations.
3. Chemical containers with missing or defaced labels or that violate appropriate packaging regulations should re-label or repackaged immediately..
4. Chemicals utilized in the laboratory must be appropriate for the laboratory's ventilation system.
5. Chemicals shall be segregated by compatibility.
6. Chemical storage areas must be labeled as to their contents.
7. Storage of chemicals at the lab bench or other work areas shall be kept to a minimum.
8. Any chemical mixture shall be assumed to be as toxic as its most toxic component.
9. Substances of unknown toxicity shall be assumed to be toxic.

### Personal Protective Equipment

- Where chemicals are stored or handled eye protection is required for all persons, including visitors,
- \* Appropriate gloves are required whenever the potential for contact with toxic materials exists.
- Respiratory protection is used when air contaminant concentrations are not reduced to safe levels by engineering controls

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## Compressed Gasses

Special systems are needed for handling materials under pressure. Cylinders pose mechanical, physical and/or health hazards, depending on the compressed gas in the cylinder.

1. When storing or moving a cylinder, have the valve protection cap securely in place to protect the stem.
2. Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains, or stands to support cylinders against an immovable object, such as a bench or a wall, during use and storage. Do not allow cylinders to fall or lean against one another.
3. Use an appropriate cart to move cylinders.
4. Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.
5. Oil or grease on the high pressure side of an oxygen cylinder can cause an explosion. Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder. Use an oxygen approved regulator.
6. Always wear goggles or safety glasses with side shields when handling compressed gases.
7. Always use appropriate gauges, fittings, and materials compatible with the particular gas being handled.

## Unattended Operations

At times, it may be necessary to leave a laboratory operation unattended. Follow these basic guidelines in the design of an experiment to be left unattended:

1. Always check with your laboratory supervisor to determine if it is necessary to leave a laboratory operation unattended. If necessary, develop a protocol with your laboratory supervisor for the unattended operation of potentially dangerous equipment or methods. Develop a protocol for potential interruptions in electric, water, inert gas and other services and provide containment for toxic substances as part of the protocol.
2. A warning notice must be posted in the vicinity of the experiment if hazardous conditions are present.

### Working Alone

Working alone in the labs is not allowed if the procedures being conducted are hazardous.

### Storage and Disposal of Hazardous Waste

For guidelines on the storage and disposal of hazardous wastes from laboratory operations at CSM, refer to the chemical storage and waste disposal sections of this program.

### Use of Fumehoods

1. Hoods are to be used for any operations which might result in release of toxic chemical vapors or dust.
2. Hoods will be used for all operations using chemicals whenever feasible.
3. Before using hazardous materials in a hood the user should inspect the hood and insure it has been tested for adequate face velocity in the last year by checking the inspection tag located on the front of the hood.
4. The hood is to be closed at all times except when operations within the hood are being performed.
5. The quantity of material stored in the hood is to be kept to a minimum and must not block vents or air flow. Items in the hood should be at least six inches back from the lip of the hood

## **Chemical Inventory**

All chemicals used in teaching and research laboratories are received at the Chemical Storage and Distribution Facility (CSDF). When chemicals are recieved at the CSDF each container is bar coded with an individual identifying number. This number along with information such as the chemical name, manufacturer, container size, location, physical state, and other identifying information is entered into a computer database. This database is searchable by chemical name or can be browsed alphabetically. This database is available to any campus user who has access to a computer that is hooked to the campus intranet.

## **Material Safety Data Sheets**

Materials Safety Data Sheets (MSDS) are available through several campus sources. The campus intranet has a link to a searchable database that contains thousands of MSDSs. If the needed MSDSs cannot be found on the campus intranet, the Chemical Storage and Distribution Facility ( CSDF ) maintains files of all MSDSs received from manufacturers and also has more than 100,000 generic MSDSs on CD-Rom.

# Chemical Storage

Storage of the wide variety of chemicals used in academic teaching and research laboratories, does not easily conform to standard methods used in industry. These general guidelines have been designed to allow the flexibility necessary to allow all laboratories on the CSM campus to comply while still meeting required health and safety goals. **Each laboratory supervisor is encouraged to establish a storage scheme for their laboratory that meets these minimum requirements but also addresses the specific needs of their laboratory. Laboratory supervisors are responsible for ensuring that their laboratory storage of chemicals meet the following minimum requirements.**

1. Volume of chemical storage is to be kept as small as practical.
2. Stored chemicals will be segregated according to chemical compatibility. A general segregation scheme is as follows:
  - a. Acids
  - b. Bases
  - c. Flammable Liquids
  - d. Oxidizers
  - e. Other
3. Not more than a total of 10 gallons of a flammable or combustible liquid may be stored outside of a flammable liquid storage cabinet. Similarly, containers of flammable or combustible liquids of sizes which are equal to or greater than 5 gallons must be stored in flammable liquid storage cabinets.
4. Significant quantities of other chemical classes such as acid, bases or oxidizers will also be stored in cabinets which are constructed and labeled for storage of that particular chemical class.
5. Floor storage of chemicals is discouraged. Floor storage of chemicals in glass containers is prohibited.
6. Cylinders of compressed gases should be properly secured to a wall or bench top to prevent them from being accidentally knocked over. When not in use cylinder caps should be fixed securely in place. Gas cylinders should not be stored near sources of heat or ignition. Empty cylinders should be promptly removed from the laboratory to an empty cylinder storage area.

# Labeling

Proper identification and labeling of chemical containers is essential in informing laboratory users of possible hazards in the laboratory. **The laboratory supervisor is responsible for ensuring that all containers of chemicals in the laboratory are properly labeled.** The following are minimum requirements for labeling. Each laboratory supervisor is encouraged to add additional requirements that will aid their laboratory users in properly identifying and labeling chemical containers.

## Purchased Chemicals

1. Labels on an original container will not be defaced or obscured while it still contains the original product.
2. If the original container label becomes illegible a new label that contains the chemical name or trade name of the product, and any hazard warnings that were on the original label, will be made and attached to the container.
3. If a new chemical container, for the product, is created in the laboratory, a label will be affixed that lists the chemical name of the product and references the chemical id number (bar code number) of the original container.

## Chemicals Manufactured in the Laboratory

1. Name of product or of chemical if not a mixture.
2. The percentage that each constituent/product comprises of the whole product if it is a mixture.
3. Contact/generator's name and department.
4. Date of creation.
5. Any appropriate hazard warning.

## Chemical Containers Generated by the CSDF

1. Name of product or of chemical if not a mixture.
2. CSDF barcode label.
3. Any appropriate hazard warning.
4. If it is practical a National Fire Protection Association (NFPA) label with the appropriate warning numbers will be affixed.

## Administrative Controls

The following chemicals require prior approval from the Environmental Health and Safety (EHS) office before being procured, used, or stored on the CSM campus.

1. any explosive
2. any material that deteriorates over time to become explosive
3. any material that is a regulated chemical waste and is also radioactive
4. natural radioactive minerals
5. sodium or potassium cyanide
6. water-reactive or air-reactive materials (pyrophoric materials, alkali metals, white phosphorus, etc.)
7. picric acid
8. perchloric acid
9. azides
10. fulminates
11. chromic acid
12. organic peroxides (benzoyl peroxide, MEK peroxide)
13. peroxide forming organics including:
  - i) isopropyl ether
  - ii) divinyl acetylene
  - iii) vinylidene chloride
14. sodium amide
15. mercury (excluding sealed fused glass equipment)
16. hydrazine compounds
17. pentachlorophenol
18. lecture bottles of specialty gases which cannot be returned to vendor

In addition, the chemicals listed in Attachment 1 are subject to even more stringent control by RCRA and are categorized in the regulation as "acutely hazardous waste." The chemicals listed in Attachment 2 are considered primary health hazards in the workplace by the Occupational Safety and Health Administration. Procurement, use, or storage of any of the materials listed in Attachment 1 or 2 should also be authorized by EHS personnel.

## Engineering Controls

All laboratory fume hoods are inspected at least annually. If the laboratory fume hood meets required specifications for face velocity, a tag is attached showing the inspection date. If a tag is not attached to the hood, notify the EHS office before using the hood for hazardous materials. If a laboratory fume hood does not meet the required minimum face velocity specifications, it is labeled as "not for hazardous material use". Ventilation systems that serve laboratory fume hoods receive maintenance that consists of checking belts, motors and filters at least every six months. *See Standard Operating Procedures use of fumehoods for when and how hoods will be used.*

# Personal Protective Equipment (PPE)

The proper uses and maintenance of PPE are critical in preventing chemical exposure to laboratory workers. **It is the responsibility of the Laboratory Supervisor to ensure that any necessary personal protective equipment is provided and that the PPE is worn and maintained properly and is suitable for the job being performed.** The following are minimum requirements for personal protective equipment. Each laboratory supervisor is encouraged to add additional requirements that will aid the laboratory users in properly maintaining and using their PPE. The EHS office can provide support in the proper selection, use and maintenance of PPE.

1. All laboratory workers are required to wear gloves when the worker has potential for direct skin contact with blood, hazardous chemicals, or infectious materials.
2. Eye protection is required of all persons, including visitors, where chemicals are stored or handled.
3. In areas where the potential exists for chemical splashes appropriate splash protection should be worn.
4. All PPE should be removed immediately upon leaving the work area and stored away or disposed of.
5. Respirators should not be worn without prior approval from the EHS office.
6. All respirator users will receive a fit test every six months. Fit testing will be performed by the EHS office. At the time of the fit test respirators will be inspected for proper maintenance and the user quizzed about use and care of the respirator.

# Waste Disposal

**Individuals who procure or use chemicals which eventually become wastes are assigned primary responsibility for ensuring that the waste is properly managed in the laboratory and is subject to timely collection. This responsibility cannot be delegated. Knowledge of, and participation in, the institutional waste management program is mandatory for persons who generate regulated waste in university teaching or research facilities.** Requirements for waste disposal can be found in the CSM Hazardous Materials Management Guide. Some specific responsibilities of individual waste generators include:

1. Only authorized persons can purchase, handle, and dispose of regulated materials. Authorization is granted following attendance at a annual Hazardous Waste Generator Training course.
2. The individual generator must identify waste material and initiate collection in a timely manner which minimizes both the quantity of stored waste and time that the waste is in storage. The individual waste generator accomplishes these goals by attaching tags to waste containers and by submitting waste disposal forms to the EHS office.
3. When an individual generator plans to retire, move, graduate, etc., he or she must ensure that any leftover chemicals or chemical wastes are subject to collection and proper disposal or redistribution before he or she leaves. This includes any waste or chemicals which may be kept in common storage areas.
4. The individual generator must ensure that waste containers are accurately labeled.
5. The individual generator ensures that wastes are kept in containers which are equipped with secure screw-on caps and which are made of materials that are compatible with contents.
6. The individual generator ensures that wastes are stored in secure chemical storage cabinets/locations and that containers of incompatible wastes are effectively segregated.
7. The individual generator ensures that incompatible wastes are not mixed in the same container and that strict control is maintained over the addition of material to bulk containers of mixed waste.
8. When applying for grants, planning future experiments, developing teaching projects, etc., individual researchers and instructors must keep in mind that disposal of waste can be extremely costly and that sources of funds for waste disposal must be identified before the generation of waste begins.
9. In teaching laboratories the instructor is responsible for devising a system for collecting wastes generated by students. The system should conform with the general guidelines provided in the CSM Hazardous Materials Management Guide.

## Medical Consultations

When necessary, chemical exposure, medical examinations and consultations will be performed by a licensed physician. These medical examinations will be without cost to the worker, without loss of pay, and at a reasonable time and place. **The EHS office will be responsible for maintaining all medical consultation and medical surveillance for hazardous materials related exams.**

This includes the following conditions: if overexposure has probably occurred (spills and leaks), if signs or symptoms of overexposure develop, or if monitoring indicates exposures are routinely over the American Conference of Governmental and Industrial Hygienists Threshold Limit Values or the Occupational Health and Safety Administration Permissible Exposure Limits.

If an exposure has occurred, the worker should do the following:

1. Let the immediate supervisor know as soon as possible.
2. Notify the Environmental Health and Safety office.
3. Notify the CSM Human Resources office.

The worker or CSM will provide the evaluating physician with the following information:

1. The identity of the hazardous material or materials to which the employee was potentially exposed.
2. A description of the conditions under which the exposure occurred.
3. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

The evaluating physician will provide a written opinion to CSM that includes:

1. Any recommendation for further medical follow-up.
2. The results of the medical examination and any associated tasks.
3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous material found in the workplace.
4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

# Training

**The EHS office is responsible for providing chemical hygiene training to all independent users of regulated substances.** All independent users of regulated substances will receive the Hazardous Waste Generator Training at least annually.

**Laboratory instructors are responsible for providing training to all regulated material users that are directly supervised in a classroom situation.** Training needs to be updated, anytime new processes are initiated or new users are added to the laboratory. The following items need to be addressed in this training.

1. Methods and observations that may be used to detect the presence or release of a regulated material in that laboratory.
2. The physical and health hazards of chemicals used in that laboratory.
3. The measures that users can take to protect themselves from exposure to these chemicals.
4. Inform the users of the standard operating procedures for that laboratory.