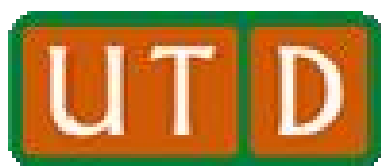


# The University of Texas at Dallas Chemical Safety Manual



# CHEMICAL SAFETY

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## INTRODUCTION

The purpose of the Chemical Safety Section is to provide information useful in the recognition, evaluation, and control of workplace hazards and environmental factors existing within and/or associated with the laboratories of the University.

This section is not intended to be an exhaustive reference, but rather, a guide to assist investigators, laboratory managers, and other technically qualified individuals. Further advice concerning the hazards associated with specific substances may be obtained from The Office of Environmental Health and Safety or from your supervisor.

Each program shall provide a supplement to this Chemical Safety Section which addresses specific hazards in its program area. A copy of this supplement should be provided to the Office of Environmental Health and Safety, which will provide it to the local fire department and other emergency responders as appropriate.

The University Radiation Safety Section should be consulted for specific safety information concerning radioactive materials and/or radiation-producing devices.

## CHEMICAL LABORATORY SAFETY GUIDELINES

The following guidelines provide an overview of the areas to be considered during the planning and conduct of laboratory activities involving chemical usage.

These guidelines are divided into nine categories.

Please contact the Office of Environmental Health and Safety (ext. 4111) if you have any questions or require further information.

### **I. PERSONNEL**

- A. The principal investigator and all laboratory personnel must review the University safety policies and understand their responsibilities.
- B. Laboratory personnel must attend appropriate training courses (i.e., Radiation Safety Short Course, fire safety seminars, chemical and biological safety seminars, Texas Hazard Communication Act training).
- C. Laboratory personnel must receive specific training from principal investigators/laboratory supervisors regarding hazardous materials and procedures.

### **II. GENERAL LABORATORY PRACTICES**

- A. Mouth pipetting is prohibited.
- B. Required/appropriate caution and warning signs must be posted and removed when necessary.
- C. Personnel working with extremely hazardous materials are prohibited from working alone in the laboratory. They should wash their hands frequently and before leaving the laboratory.
- D. Personnel are required to confine long hair, loose clothing, ties, jewelry, etc., when working in the laboratory.
- E. The wearing of contact lenses is prohibited (see Appendix 3).
- F. Glassware must be checked for cracks, sharp edges, and defects and discarded in approved marked receptacles (see Waste Disposal Manual, VII, C for further instruction on "sharps").
- G. The use of laboratory glassware, ice, chemical or other laboratory materials for human use/consumption is prohibited.
- H. Doors must be locked when the laboratory is unoccupied for

extended periods of time (e.g., lunch break, end of the work day, weekend, etc.).

- I. Storage of food and drink in laboratory refrigerators is prohibited.
- J. Eating and drinking are prohibited in the laboratory.

### **III. WORKING ENVIRONMENT**

#### **A. HOUSEKEEPING**

- 1. Working surfaces must be kept clean and orderly.
- 2. Absorbent padding used on work surfaces must be changed regularly.
- 3. Floors must be kept clean and clear of obstructions, slip and trip hazards.
- 4. Adequate lighting must be provided for each task.

#### **B. VENTILATION**

- 1. Local ventilation (i.e., dilution or exhaust) must be provided where necessary.
- 2. Laboratory personnel must review the University guidelines for Chemical Fume Hood Use (see Appendix 7).
- 3. Fume hoods should be used primarily for handling and not for storage of hazardous materials.
- 4. Work within fume hoods should be conducted at least 6 inches inside the front face of the hood.
- 5. Materials that must be stored in fume hoods should be stored in secure and supported shelves.
- 6. Fume hood air flows are to be measured at least semi-annually by the Safety Department.
- 7. Laboratory personnel should be aware of and respect notices posted on fume hoods concerning maintenance and repair activities.
- 8. Unobstructed space should be available within and in front of the fume hood to allow sufficient air flow into the hood and access by all personnel.
- 9. Portable non-exhausting fume hoods are not to be used to control fugitive emissions on a permanent basis.

## **IV. MATERIAL HANDLING AND STORAGE**

### **A. GENERAL**

1. An inventory is to be maintained of all hazardous chemical, biological, and radioactive materials in the laboratory.
2. All primary and secondary containers of hazardous materials must be properly labeled.
3. Cabinets and shelves shall be secured and supported.
4. Hazardous materials, especially liquids, are not to be stored at or above 5 feet.
5. Large or heavy containers shall be confined to lower shelves.
6. Protective edges are to be provided on laboratory bench island shelves.
7. Catch trays shall be used for containment of hazardous liquids when necessary.
8. Carrier buckets or carts with side rails should be used to transport chemicals.
9. Containers of hazardous liquids (e.g., over 5 gallons) are not to be kept in the laboratory.
10. Proper physical separation of incompatibles must be maintained (i.e., segregation of acids from bases and flammables from oxidizers).
11. Chemical storage areas must be adequately ventilated.
12. Perchloric acid or concentrated nitric acid is not to be stored near organics (i.e., wood, organic solvents).
13. The University policy concerning the handling and storage of Peroxide Forming Chemicals in Appendix 4 should be followed.
14. Face shields and/or suitable barriers are provided for work with highly reactive or explosive materials.

## **V. FIRE SAFETY**

### **A. GENERAL**

1. An explanation of the University fire emergency procedures is to be posted in the laboratory and must be reviewed by all laboratory personnel.
2. Fire extinguishers must be available in the laboratory.
3. Personnel must be trained in the use of portable fire extinguishers.

#### B. FLAMMABLES AND COMBUSTIBLES

1. University guidelines are to be followed regarding possession limits for flammable and combustible materials located outside of approved storage cabinets. (See Appendix 6.)
2. Flammable liquids that must be refrigerated should be stored only in laboratory-safe or explosion- proof refrigerators and/or cold rooms.
3. Volatile liquids are to be stored away from sources of heat or electrical spark and sunlight.
4. Flammable or combustible materials may only be heated using appropriate laboratory appliances.
5. Open flame devices are not to be utilized in areas where flammable or combustible liquids or gases are in use.

### VI. COMPRESSED GASES/CRYOGENS

#### A. COMPRESSED GASES (See Compressed Gas Cylinder Safety Manual)

1. The contents of all gas cylinders must be legibly identified.
2. Fuel gases and oxygen cylinders must be stored separated.
3. All gas cylinders should be secured against falling by the use of appropriate clamps and/or brackets.
4. Cylinders, when not in use, must always be shut off at the main valve stem and not through the use of regulators.
5. Appropriate regulators are to be used to control gas flow from cylinders.
6. Valve protection caps should be in place when cylinders are not in use and also during transport.

7. Empty and full gas cylinders should be stored in separate storage areas.

**B. CRYOGENS**

1. Cryogenics (liquified gases or dry ice) are to be used only in well ventilated areas.
2. Cryogenic fluids should be used and transported in appropriate containers.
3. Personnel should not accompany an asphyxiant in an elevator.
4. Tygon tubing must not be used for conveying cryogenics.

**VII. EQUIPMENT**

- A. Indicator lights on all equipment must be in working order.
- B. Operation manuals for all laboratory equipment must be provided if available.
- C. Protective guards are to be provided for machinery moving parts.
- D. Hoses and tubing must be free of cracks and abrasions.
- E. Electrical cords must be free of breaks, exposed wires, or poor insulation.
- F. Electrical equipment should not be operated in areas containing explosive vapors.
- G. Refrigerators are to be clearly labeled as either laboratory safe, explosion-proof, or non-explosion proof.
- H. All electrical outlets and equipment must be grounded. Ground fault interrupters should be installed in all outlets within 6 feet of a water source.
- I. Overloading of circuits is prohibited.
- J. Electrical panels are to be identified and to be accessible.

**VIII. WASTE DISPOSAL**

- A. All laboratory personnel should be familiar with the UTD waste disposal procedures for chemicals (Waste Disposal Manual).
- B. All waste containers must be properly segregated and clearly marked regarding contents, hazards, and other pertinent information.

- C. Waste materials are not allowed to accumulate excessively in the laboratory and in no case longer than 180 days. The date accumulation began should be marked on the container.
- D. Needles and broken glassware are to be segregated in appropriately labeled containers away from other waste (see section Waste Disposal Manual, VII, C).
- E. Chemicals are prohibited from being disposed of through the sanitary sewer system.
- F. Liquid and solid organic waste must be segregated.
- G. Inorganic liquid waste should be segregated from other waste.
- H. Chlorinated solvent waste should be segregated from non-chlorinated solvent waste.
- I. Chemicals that have become hazardous or unstable because of age are to be disposed of properly (see Waste Disposal Manual).

#### **IX. PERSONAL PROTECTION AND EMERGENCY EQUIPMENT**

- A. Personal protective equipment is to be made available for all laboratory personnel including appropriate eye and face protection, hand protection, foot protection, body protection and respiratory protection.
- B. Laboratory personnel are required to wear body, hand, and eye and face protection for all laboratory procedures involving hazardous materials.
- C. Water-tap eye wash stations are to be made available in working order.
- D. Squeeze bottle-type eye wash stations are prohibited in the laboratory.
- E. Safety showers and eye wash stations are to be accessible to all laboratory personnel.
- F. Spill control kits or suitable absorbents must be in each lab.
- G. The UTD emergency phone number label and sign should be posted in the laboratory.
- H. A first-aid kit is to be available in each lab.
- I. At least one member of the laboratory must have completed first aid training.

## HAZARDOUS MATERIALS DEFINITION

A hazardous material is defined as any material or substance which by its inherent properties or if improperly handled can be damaging to health or the environment.\*

Such materials cover a broad range of types which may be classified as follows:

1. Poisons or toxic agents including drugs, chemicals, and natural or synthetic products that are in any way harmful, ranging from those that cause death to skin irritants and allergens, and also including genotoxic substances causing cancer, mutations, and/or birth defects.
2. Biological materials including all laboratory specimens or materials consisting of, containing, or contaminated with blood, plasma, serum, urine, feces, or other human or animal tissues or fluids, as well as inoculated media, cultures, and other potentially infectious materials such as bacteria, fungi, viruses, parasites, spores, etc., that must be either sterilized by autoclaving before disposal or must be incinerated.
3. Corrosive chemicals, such as sodium hydroxide or sulfuric acid, that burn or otherwise damage the skin and mucous membranes on external contact or through inhalation.
4. Flammable materials including (a) organic solvents, (b) finely divided metals or powders (e.g., magnesium or sodium), and (c) chemicals that either evolve or absorb oxygen during storage, thus constituting a fire risk in contact with organic materials.
5. Explosives and strong oxidizing agents such as peroxides and nitrates.
6. Materials in which dangerous heat build-up occurs on storage, either by oxidation or microbiological action (e.g., organic waste materials).

\*This definition was referenced from the Condensed Chemical Dictionary, 10th Edition. This classification is intended to be advisory and not exhaustive in format. For further classification or consultation, contact the Office of Environmental Health and Safety. See also the term "hazardous substance" found in CERCLA at 42 U.S.C. §9601 (14).



15. Is the Laboratory Safety Poster displayed?
16. Are the following items available for use in the lab? — —
- Lab coats — —
- Eye protection — —
- Respirators — —
17. Are fire extinguishers available in the lab? — —
18. Have personnel been trained in the use of portable fire extinguishers? — —
19. Is a fire blanket readily accessible to lab personnel? — —
20. Are eyewash stations available and accessible? — —
21. Are eyewashes and showers positioned so they can be used simultaneously? — —
22. Are a safety shower and eyewash accessible to all laboratory personnel? — —
23. Is the University emergency phone number sign and label posted in the laboratory? — —
24. Does the University Emergency Poster have responsible person's name, office, and home telephone number on it? — —
25. Is a first aid kit readily available, accessible, and properly stocked? — —
- FUME HOODS
26. Are fume hoods used primarily for handling and not storage of materials? — —
27. Is work within fume hoods conducted at least six inches inside the front face of the hood? — —
- GAS CYLINDERS
28. Are the contents of all gas cylinders legibly identified? — —
29. Are all gas cylinders secured against falling by the use of appropriate clamps and/or brackets? — —
30. Are cylinders always shut off at the main valve stem and not through the use of regulators? — —
31. Are valve protection caps on cylinders in place when not in use and during transport? — —
32. Are empty and full gas cylinders stored in separate storage areas?

WASTE MATERIALS

33. Are all waste containers properly segregated and clearly marked regarding contents, hazards, and other pertinent information? — —

34. Is there no more than one container of each type of hazardous waste stored in the lab? — —

35. Are spill control kits available and accessible for emergencies?

36. In case of a spill, are the following items available? — —

Respirators

Protective clothing — —

37. Does this lab use hypodermic needles or scalpels? — —

38. If yes, is there a labeled sharps disposal container? — —

MISCELLANEOUS

39. Are desks not being used as lab work benches? — —

40. Is a notice posted about handling chemical waste?

# RADIATION LABORATORY SAFETY REPORT

	YES	NO
1. Is laboratory identified by radiation sign at all hallway entrances?	_____	_____
2. Is Texas Radiation Control Form 22-1 posted in this lab?	_____	_____
3. Is film badge report posted in lab?	_____	_____
4. Are lab benches and hoods identified where radiation is used?	_____	_____
5. How many personnel are in lab during inspections?	_____	_____
6. How many personnel are wearing film badges?	_____	_____
7. Is storage of food and drink in lab refrigerators prohibited and enforced?	_____	_____
8. Are beta boxes in hall refrigerator locked?	_____	_____
9. Is a waste container for radioactive waste marked by using orange plastic bags?	_____	_____
	_____	_____

## **EYE AND FACE PROTECTION POLICY**

Protective eye and face equipment shall be worn where there is a reasonable possibility of injury that could be prevented by such equipment. Suitable eye protectors shall be provided and worn where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation, or a combination of these factors.

The type of eye or face protection required depends on the hazard. For most situations, safety glasses are adequate. Where there is danger of splashing chemicals, glasses with side shields or special goggles are necessary. For more hazardous operations, a face shield or a combination face shield and safety goggles or glasses should be used.

Contact lenses do not provide eye protection. The capillary space between the contact lenses and the cornea may trap material present on the surface of the eye. Chemicals trapped in this space cannot readily be washed off the surface of the cornea. If the material causes pain in the eye or the contact lens is displaced, muscle spasms will make it very difficult to remove the lens. Therefore, contact lenses must not be worn by persons exposed to hazardous chemicals.

Emergency eye wash facilities should be available in areas where corrosive or caustic materials are handled.

Assistance for supervisory personnel and employees in identifying "Eye-Hazard Areas" is available from the Office of Environmental Health and Safety.

## Appendix 4

### PEROXIDE FORMING CHEMICAL POLICY

List A: Peroxide Hazard Upon Storage (Discard 3 months after initial opening)

- Isopropyl ether
- \* Potassium metal
- \* Sodium amide
- 90% hydrogen peroxide

List B: Peroxide Hazard on Concentration (Discard or Test 6 months after initial opening)

- \* Ethyl ether
- \* Tetrahydrofuran
- \* Dioxane
- Methyl-isobutyl ketone
- Ethylene glycol dimethyl ether (diglyme)
- \* Dicyclopentadiene
- Cumene
- \* Cyclohexene
- Anisole
- Phenetole & derivatives
- Decahydronaphthalene (Decalin)
- Furan
- Methylcyclopentane

List C: Hazard due to peroxide initiation of polymerization (Discard or test 12 months after initial opening)

- Styrene
- Chloroprene
- Butadiene
- Vinyl acetate
- Acrylic acid
- Acrylonitrile
- Methyl methacrylate

Note: The items indicated by an \* must be kept fresh in the chemical storeroom. The others must be ordered through chemical stores and can be added to a permanent inventory list only if a demonstrated continuous demand exists on campus.

## **TRANSPORT/SHIPPING POLICY**

Effective immediately, transport or shipment of any substance listed as a "hazardous material" by the U.S. Department of Transportation (DOT) from any operating unit of The University of Texas at Dallas must be packaged and transported in strict accordance with concurrent U.S. DOT regulations and other pertinent international, Federal, State and local rules, regulations and/or guidelines as appropriate.

Hazardous materials affected by this policy will include:

- All regulated radioactive materials and/or devices,
- All substances listed as "hazardous materials" or "hazardous substances" by the Texas Hazard Communication Act (THCA), the Federal or State Solid Waste Disposal Act, Department of Transportation (DOT), International Air Transporters Association (IATA), and other applicable regulations,
- All compressed gases as defined by the Compressed Gas Association.

Under no circumstances may any of the subject materials be removed from University buildings or grounds without the specific approval of the Office of Environmental Health and Safety.

Each package to be transported and/or shipped from the University will be inspected for safety by a designated representative of the Radiation Safety Office (for radioactive materials and/or devices) or the Office of Environmental Health and Safety (for all other hazardous materials), and for compliance with transportation regulations by a designated representative of the Shipping and Receiving Department.

Contents of all packages covered by this policy will be clearly characterized. The hazardous material will be identified using Chemical Abstracts Service (CAS) number or equivalent recognizable nomenclature; quantities of each substance will be separately listed using either English or metric units.

All costs for inspection and transport or shipping will be assessed to the originating department or operating unit.

All required documentation for each package will be completed to the extent possible by the originating department. Inspection and transport/shipping records will be maintained by the Office of Environmental Health and Safety and the Shipping and Receiving Department for an interval dictated by U.S. DOT and/or other pertinent regulations.

## FLAMMABLE AND COMBUSTIBLE MATERIALS

### A. DEFINITIONS

1. "Combustible Liquid" — a liquid having a flash point at or above 100 F (37.8 C). Liquids shall be subdivided as follows:
  - a. Class II liquids shall include those having flash points at or above 100 F (37.8 C) and below 140 F (60 C),
  - b. Class IIIA liquids shall include those having flash points at or above 140 F (60 C) and below 200 F (93.4 C),
  - c. Class IIIB liquids shall include those having flash points at or above 200 F (93.4 C).
2. "Flammable Liquid" — a liquid having a flash point below 100 F (37.8 C) and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 F (37.8 C) and shall be known as a Class I liquid. Class I liquids shall be subdivided as follows:
  - a. Class IA shall include those liquids having flash points below 73 F (22.8 C) and having a boiling point below 100 F (37.8 C),
  - b. Class IB shall include those liquids having flash points below 73 F (22.8 C) and having a boiling point at or above 100 F (37.8 C),
  - c. Class IC shall include those liquids having flash points at or above 73 F (22.8 C) and below 100 F (37.8 C).
3. "Safety Can" — a UL or FM approved container, of not more than five gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.
4. "Flammable Storage Cabinet" — a cabinet designed and constructed to limit internal temperature to no more than 325 F when subjected to a 10 minute fire test. Cabinets shall be labeled in conspicuous lettering, FLAMMABLE-KEEP AWAY.
5. "Reactive Material" — a material that is readily capable of detonation or of explosive decomposition or explosive reaction at normal or elevated temperatures/pressures.

### B. QUANTITIES OF CHEMICALS IN LABORATORY

1. The quantities of chemicals within each laboratory area shall not exceed the following maximum quantities per 100 square feet (excludes quantities in storage cabinets):

Flammable Liquids		
Class I, IA, IB, IC	5 gallons	(19 liters)
Class II, IIIA, IIIB	8 gallons	(30 liters)
Reactive Materials	2 ounces	(50 grams)

2. Quantity of Flammable and Combustible Liquids in Storage Cabinets:
  - a. No more than 50 gallons of flammable or combustible liquids may be stored in storage cabinets.
  - b. No more than three storage cabinets may be in one lab area.
3. Containers for Flammable and Combustible Liquids:
  - a. Approved containers, other than safety containers, shall not exceed a capacity of one (1) gallon.
  - b. Glass containers shall not exceed a capacity of thirty-two (32) ounces. Exception: Class IA and IB flammable liquids may be stored in glass containers of not more than one (1) gallon capacity if the required liquid purity would be affected by storage in metal containers or if liquid would cause excessive corrosion of metal containers.
4. Refrigerators:
  - a. Flammable and combustible liquids shall not be stored in refrigerators not designed and approved for such storage.
  - b. Each refrigerator shall be prominently labeled to indicate whether it is or is not suitable for storage of flammable liquids.

## **GUIDELINES FOR CHEMICAL FUME HOOD USE**

1. Observe posted notices regarding annual hood inspection. Contact the Office of Environmental Health and Safety (4111) if fume hood face velocities have not been evaluated within the last 12 months.
2. Observe notices posted by Physical Plant Utility Operations specifying schedules for shut down of fume hood exhaust fans for routine maintenance and repairs.
3. Ensure working condition of exhaust fan prior to hood use.
4. Remove all items from the hood which are not necessary for the immediate operation of experiment.
5. All equipment necessary for the performance of experiments should be located at least six inches inside the front face of the hood.
6. All work that will release noxious vapors, fumes or aerosols should be performed at least six inches inside the front face of the hood.
7. Limit the quantity of chemicals and/or number of activities conducted within the hood that have potential for creating an explosion or fire situation.
8. The hood sash should be placed at the proper working height for procedures involving the handling of hazardous materials within the hood area.
9. Fume hoods must not be used for the handling and/or storage of hazardous materials during scheduled periods of hood maintenance and/or repair.

## CHEMICAL INCIDENT EMERGENCY PROCEDURES

1. Remove all personnel (patients, students, employees) from the immediate danger area.
2. In the event of a chemical emergency involving a victim exposed to contamination, follow the procedure as listed below:
  - Immediately decontaminate the victim with running water for at least 15 minutes,
  - While the victim is under running water, remove contaminated clothing,
  - Following the 15-minute decontamination, take the victim and any involved rescuers for medical attention. Bring the following information (when available) to the medical facility:
    - Identity or other description of the chemical,
    - The label, if it can be removed from the container,
    - The Material Safety Data Sheet (MSDS) for the chemical.
3. Avoid breathing vapors or dust from spilled material.
4. If spilled material is flammable, turn off all ignition and heat sources, if possible.
5. Leave any chemically contaminated materials (i.e., lab coats, gloves, etc.) in the laboratory or area of spill.
6. If spill occurs in a laboratory, close and lock the door and post a "DO NOT ENTER" sign on the door,
7. If spill occurs, notify the University Police (911) (if not an emergency, call 2331),
8. Notify the Office of Environmental Health and Safety (4111) of the spill — the following information is necessary:
  - Name or other description of chemical spilled,
  - Location of spill (building, floor, room number),
  - Determination regarding whether chemical is radioactive,
  - Quantity of chemical spilled,

- Any injuries resulting from the spill.

If spill occurs at a time other than during normal working hours (8:00 a.m. to 5:00 p.m., Monday through Friday), notify the University Police Department (911). If not an emergency, call 2331. Provide the University Police Department with information in item 8. The University Police Department will notify Safety Office personnel.