

**DEPARTMENT OF CHEMISTRY
WEST VIRGINIA UNIVERSITY
EBERLY COLLEGE OF ARTS AND SCIENCES**

***SAFETY RULES AND REGULATIONS FOR UNDERGRADUATE
STUDENTS IN RESEARCH LABORATORIES
IN THE CHEMISTRY RESEARCH LABORATORY BUILDING (CRL)***

I certify that I have read and I understand the *Safety Rules and Regulations for Undergraduate Students in Research Laboratories*, adopted by the Department of Chemistry Safety Committee. In consideration of being permitted to participate in a research laboratory in the Chemistry Research Laboratory Building, I will abide by these rules and regulations. At all times I will use safe laboratory procedures.

SIGNATURE

Date

I will make every effort to assist this student in complying with all of the safety rules and regulations of the Department of Chemistry at West Virginia University.

RESEARCH ADVISOR

Date

**THE RESEARCH ADVISOR MUST RETURN SIGNED
FORM TO THE SENIOR FACILITIES MANAGER,
ROOM 217 CLARK HALL.**

**Effective May 1996
Revised January 2000**

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**Effective May 1996
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These safety rules must be obeyed by all undergraduate students at all times in the research laboratories. Undergraduate students who violate these safety rules will be subject to dismissal from the research laboratory. These safety rules are meant to assist clear thinking, reasonable judgment, and the exercise of foresight in the design and implementation of any experiment. It is essential that you study this material in order to understand what is expected of you while you work in a research laboratory. Everyone is responsible for safe laboratory practices and is expected to exercise all due caution and prudence when working in research laboratories.

Telephones have been installed in all laboratories in the CRL. An emergency telephone is located near the water fountain on each floor in the CRL. Emergency 9.911Public Safety Office 293.3136

I. RULES FOR PERSONAL PROTECTION

UNDERGRADUATE RESEARCH STUDENTS MUST BE SUPERVISED BY THE FACULTY MEMBER OR A DESIGNATED SURROGATE DURING THE NORMAL WORK DAY(8:15 A.M. - 4:45 P.M.). DURING OTHER HOURS THE FACULTY MEMBER MUST BE PRESENT IN THE LABORATORY OR THE IMMEDIATE VICINITY WHEN THE STUDENT IS WORKING IN THE LABORATORY.

Eye protection must be worn by all persons in a laboratory.

A. Safety goggles must be worn by all undergraduate students in chemistry research laboratories.

B. Shoes, not sandals, must be worn at all times in the research laboratory. You are advised to wear clothing (preferably not shorts) that covers your legs. You must wear a laboratory coat or apron at all times in the research laboratory.

C. Hair longer than shoulder length and loose clothing must be confined when working in the laboratory.

D. The use of contact lenses in the laboratory is strongly discouraged. You may ask your research advisor for permission to wear contact lenses in the laboratory, in which case you must wear goggles without vents. All undergraduate students who work in research laboratories must sign a statement that states that they will accept responsibility for any injury caused by their wearing of contact lenses.

E. Notify your Research Advisor about any sensitivities that you may have to particular chemicals before undertaking any experimental work with such chemicals.

F. If any chemical spills onto your skin, immediately wash the affected area with water. You or a co-worker must immediately notify the research advisor.

G. When the fire alarm sounds you must evacuate the building immediately. Extinguish all flames and turn off all equipment, as appropriate, before exiting.

H. You are advised to avoid wearing synthetic finger nails in the chemistry laboratory. Synthetic finger nails are made of extremely flammable polymers which burn to completion and are not easily extinguished.

I. No chemical should ever be tasted. When you are instructed to smell a chemical, do so by gently fanning the vapors toward your face.

J. When heating or carrying out a reaction in a test tube or flask, never point the apparatus toward your co-workers or yourself.

K. Do not attempt to dry glassware by inserting a towel wrapped around a glass rod.

L. Eating or drinking in laboratory rooms is prohibited. No chemical apparatus should ever be used for eating or drinking purposes in any location whatsoever. Food and/or drink must not be stored in refrigerators designated for chemical storage.

M. In all experiments, including distillations, in which explosions, implosions, or violent reaction is possible, the operator and neighbors should be protected by safety shields.

N. When diluting concentrated acids always pour the acid slowly into the water with stirring; **NEVER ADD WATER TO CONCENTRATED ACIDS** because of the danger of splattering.

O. All hazardous chemicals not packaged for shipping must be transported within the buildings in “safety-carriers” (such as a rubber pail with a handle).

P. Equipment operated by a motor-driven belt (such as a vacuum pump) must be protected by a suitable belt shield or guard.

Q. Those working with lasers must wear suitable protective eye wear. Research Advisors who are directing work using lasers must post warning signs about the hazards of lasers.

R. Research advisors who supervise work involving microwave generators or X-ray generators must periodically check for leakage and make appropriate correction if there is leakage.

S. Special equipment utilizing high voltage components, radiation devices (e.g., X-ray generators or electron capture detectors), intense ultraviolet sources, high pressure components, and other such equipment must incorporate commonly accepted safety features. Suitable warnings must be posted on entry doors.

T. Floor drain traps must be kept filled with water to prevent vapors from being released into the laboratory.

U. Wash your hands at the end of your laboratory work before you exit the laboratory.

V. Remove gloves before you exit the laboratory.

II. RULES FOR GENERAL SAFETY

A. Unauthorized experimentation and work in the laboratory are forbidden.

B. Unauthorized personnel are not permitted in a laboratory.

C. Excessive noise and boisterous conduct are forbidden.

D. No laboratory work involving any hazard may be carried out unless responsible assistance is available nearby in the event of an accident. Responsible assistance is interpreted to mean Department of Chemistry graduate students, postdoctoral research associates, and Research Advisors.

E. Any personal injury or accident that may occur in the laboratory must be reported to the research advisor in charge, or, if he or she is not immediately available, to some other faculty member and the Senior Facilities Manager. The research advisor

receiving such information shall submit an Accident Report Form to the Senior Facilities Manager within 24 hours.

F. Vocal warning should be given to those working nearby in case of fire, explosion, spillage of dangerous chemicals, release of toxic fumes, etc. The information should be reported to the research advisor in charge and any other person who might be affected by such an occurrence. Written notification of the use of a fire extinguisher should be made to the Senior Facilities Manager as soon as possible (within 24 hours).

G. Each undergraduate student must know the location and proper use of fire extinguishers, safety showers, eyewash stations, fire blankets, and first aid kits that are available in that section of the building in which he or she is working. Your research advisor will instruct you in the proper usage of the emergency equipment.

H. All water, gas, air, electrical, and other service connections must be made in a safe and secure manner. All worn, frayed, or damaged cords and plugs on all electrical equipment must be replaced by satisfactory cords and plugs. Electrical components, power cords, etc., should be kept off of the floor in case of flooding. All tubing for water must be securely fastened.

I. Hoses for a water condenser or other cooling unit must be in good condition (not cracked or brittle) and must be clamped or wired to the condenser or cooling unit. The drain-end of the hose must be secured in the drain to ensure that the end does not come out of the drain. The attachment of an inverted funnel to the drain-end of the hose works very well to keep the hose end in the drain. When operating a condenser, use water only when it is needed and use only the necessary flow-rate; usually this is a slow flow-rate. If it is necessary to provide cooling water to an apparatus overnight or longer (e.g., heating a solution at reflux), be sure all connections are made correctly and have your apparatus checked by your research advisor before you leave it.

J. Solid materials (paper, matches, towels, broken glass, stoppers, rubber tubing, etc.) must be kept out of the sinks at all times to minimize the danger of plugging drains.

K. Exposure of most chemicals to direct sunlight should be avoided when reasonably possible.

L. Reactions that are chemically or mechanically hazardous must not be left unattended. If a room contains a special hazard, a sign designating the presence and nature of the hazard must be posted on the door.

M. Good housekeeping is essential. Aisles, emergency exits, and breakout panels must be unobstructed. Hoods must be available for work. Benchtops must be kept as free from

unnecessary apparatus as possible. Clean up chemical spills (including water) immediately. Do not leave spilled chemicals on the benchtop or floor. Keep glassware clean. Chemicals, including those in a refrigerator, must be in labeled containers. Coats, bags, and other personal items should be stored in the proper areas in the laboratory room; not on the benchtops or in the aisles. Sinks should not be filled with dirty glassware.

N. Clear visibility from corridors into laboratories must be maintained. Only authorized warning signs and directories are permitted on the glass of the laboratory doors; no posters, etc. are permitted. Specific exceptions will be made where a dark room is required or protection from lasers is needed.

O. In the event of a mercury spill, contact the Research Advisor and Academic Laboratory Manager I, Room 304 Clark Hall, for assistance. All mercury spills must be cleaned up promptly and appropriately.

P. As a reminder of University policy, smoking is prohibited in all Chemistry facilities.

III. FLAMMABLE LIQUIDS

A. All flammable liquids are to be stored in approved safety cabinets.

EVERYONE IS URGED TO MINIMIZE THE TOTAL VOLUME OF FLAMMABLE LIQUIDS STORED IN A LABORATORY. All flammable solvents from bulk (large metal containers) should be dispensed into Department-approved safety cans. Flammable liquids not stored in a Department-approved safety can should be stored in the safest possible manner and in the smallest quantity appropriate for the intended use. Experience has established that the most serious laboratory fires have involved large volumes of flammable solvents in a laboratory.

B. Very volatile flammable substances must not be heated in open containers near a flame or laboratory equipment where the flammable substance may ignite. Before very volatile substances are heated, the area must be carefully inspected for the presence of open flames, hot plates, potential electric sparks, etc. If in doubt about the flammability of a substance, consult your research advisor.

C. Flammable substances boiling below ca. 150EC at atmospheric pressure must be distilled only with the aid of a suitable heating bath or mantle and the receiver must be so vented that uncondensed vapors are led into a suitable trap.

D. The concentration of non-aqueous solutions should be done by distillation, NOT by evaporation or vaporization into the laboratory atmosphere. MOST ORGANIC SOLVENTS ARE HIGHLY TOXIC. A rotary evaporator should not be used to remove toxic/flammable solvents unless they are condensed. **Solvents should be recovered and reused (recycled) whenever possible in order to minimize the generation of chemical waste.**

E. In certain equipment assemblies where an electric motor is mounted near the top of a reflux condenser, the condenser top must be vented by way of a right angle glass bend and suitable length of hose to prevent ignition of fumes by the motor. If the reaction is conducted under an inert atmosphere in a closed system, the vent for the system must be well removed from the motor.

IV. GASES AND TOXIC FUMES

A. All cylinders containing gases under pressures of more than 100 lbs/sq. in. and/or more than 36 inches in height must be handled or transported only on suitable trucks. **Such cylinders in use or in storage inside a laboratory must be secured by a cylinder strap or a chain positioned approximately 1/4 of the way down the cylinder. Compressed gases must be transported with the safety cap covering the valve (i.e., no regulators).**

The regulator must be removed and replaced with a safety cap prior to transport of a gas cylinder.

B. Cylinders containing poisonous, corrosive, or flammable gases must not be opened by any operator who has not used them previously without permission and instruction from the research advisor in charge or other proper authority. Furthermore, such cylinders may be opened only when properly connected to apparatus contained in a hood under draft. Adequate traps must be placed between the cylinders and other apparatus.

C. Experiments involving odorous, lachrymatory, vesicant, toxic, corrosive, or otherwise obnoxious substances must be carried out in a hood under draft and not on the bench top. Provisions should be made to absorb corrosive, toxic, and obnoxious fumes. Obnoxious and dangerous gases must not be released into the laboratory.

D. Reactions or operations involving high or low pressure - especially those using or generating hazardous or explosive gases - must be properly contained and/or vented.

E. Gas valves must be kept closed except when a burner is in use.

V. ACTIVE METALS AND PYROPHORIC SUBSTANCES

A. Metallic sodium, potassium, etc., lithium aluminum hydride, sodium borohydride and pyrophoric substances of all kinds must be stored under an inert liquid or in a dry box or desiccator under nitrogen or argon as may be proper for the particular case. In general, all such substances must be stored separately (i.e., not in the same container) and must be kept out of contact with air and moisture.

B. Scraps of active metals such as sodium shavings as well as organometallics should be disposed of in small amounts, as generated, by reaction with organic reagents as specified by the Aldrich Chemical Catalog.

VI. WASTE CHEMICAL DISPOSAL

A. Waste chemicals are to be stored in separate glass containers and labeled using all of the following general categories that apply (specified by the WVU Department of Environmental Health and Safety). Halogenated materials must be stored separately from non-halogenated materials and must be labeled as “halogen-containing” as well as with the appropriate general categories.

1. **FLAMMABLE**
2. **CORROSIVE**
3. **REACTIVE**
4. **TOXIC**
5. **SOLID**

Waste chemicals should be stored in the smallest container possible (i.e., not 500 mL in a 2L bottle). The container should be reasonably full (but with 1-2 inches of headspace) prior to pickup. Waste liquids and solids should be treated and stored (i.e., temperature conditions, labeling, and packaging) as new material is stored.

(See “Hazardous Chemical Waste Management: A Guide for Laboratory Personnel”, WVU Department of Environmental Health & Safety, 1986). All chemical waste must be collected in appropriate containers, properly labeled, and submitted with the proper paperwork to the Academic Laboratory Manager I in Room 304 Clark Hall. Standard University waste collection forms are provided to each laboratory.

B. Waste corrosive chemicals including inorganic acid chlorides, active metals, metal hydrides, and organometallics must be deactivated in the laboratory.

C. DO NOT POUR CHEMICALS DOWN THE DRAIN.

VII. GLASSWARE

A. Tubing ends must be fire-polished or ground smooth. Towels or gloves must be used to protect the hands when inserting glass tubing into corks or stoppers. Lubricants such as soapy water, mineral oil, or glycerol may be useful.

B. Do not use cracked glassware. Flasks, etc., used for vacuum distillation must be inspected carefully before use.

C. Apparatus intended for use at atmospheric pressure must not be used under vacuum. Erlenmeyer flasks larger than 25 mL must not be used as receivers for vacuum distillations.

D. Glass tubes must extend well through rubber stoppers so that closure of the tubes does not occur if the rubber stoppers swell.

E. Heavy pieces of apparatus must be supported with clamps suitably protected with pads and also with bottom support such as tripods or rings.

F. Vacuum desiccators not in a protective cage and Dewar flasks without a metal case must be completely wrapped with electrical or duct tape.

G. Broken glass should be disposed of in containers (available in the Stockroom, Room 308 Clark Hall) specifically designed for that purpose, not in the normal trash containers. Contact the Academic Laboratory Manager I in Room 304 Clark Hall to remove broken-glass containers when they are full.

H. Reagent bottles may be cleaned and returned to the Academic Laboratory Manager I in Room 304 Clark Hall for re-use.

VIII. COURTESY

A. In the daily operation of these rules, the laboratory worker is to be considerate of the safety, comfort, and welfare of his or her neighbors.

B. Radios must not be audible from outside the immediate laboratory or office and use must be discontinued if potentially hazardous situations exist or if it disturbs coworkers.

IX. ENFORCEMENT

A. An inspection team consisting of, or organized by, the Department of Chemistry Safety Committee will inspect laboratories regularly and will make a written report of its inspection.

B. Persons repeatedly cited for violation of safety rules will be subject to disciplinary action.

GENERAL REFERENCES

1. *“Prudent Practices in the Laboratory: Handling and Disposal of Chemicals”*, National Research Council, National Academy Press, Washington, D.C., 1995.
2. *“Merck Index”*, 12th edition.
3. *“Aldrich Catalog Handbook of Fine Chemicals”*, see Forward and Waste Disposal Methods sections of the most recent edition.