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

SAFETY RULES AND REGULATIONS FOR RESEARCH LABORATORIES

I certify that I have read, understand, and will abide by the Safety Rules and Regulations adopted by the Department of Chemistry Safety Committee at West Virginia University.

_____ _____

SIGNATURE DATE

_____ _____

WITNESS DATE

RETURN SIGNED FORM TO THE SENIOR FACILITIES MANAGER, ROOM 217 CLARK HALL.

Revised May 1992
Revised January 2000

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SAFETY RULES AND REGULATIONS FOR RESEARCHERS IN THE CHEMISTRY RESEARCH LABORATORY BUILDING (CRL)

Revised May 1992
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These safety rules are meant to assist clear thinking, reasonable judgment, and the exercise of foresight in the design and implementation of any experiment. 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. GENERAL

A. Unauthorized experimentation and work in the laboratory is 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 authorized graduate students, postdoctoral research associates, and chemistry faculty.

E. Any personal injuries that occur in the laboratory must be reported to the faculty member in charge, or, if he or she is not immediately available, to some other faculty member and the Senior Facilities Manager. The faculty member 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 faculty member in charge and any other person who might be affected by such 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) so that the extinguisher can be recharged.

G. Each worker must know the location and proper use of fire extinguishers, safety showers, fire blankets, and first aid kits that are available in that section of the building in which he or she is working.

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. 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.

J. Good housekeeping is essential. Aisles, emergency exits, and breakout panels must be unobstructed. Hoods must be available for work. Desk tops should be tidy. Chemicals, including those in a refrigerator, must be in labeled containers. Refrigerators should be routinely cleaned and freezers should be defrosted on a regular basis. Sinks should not be filled with dirty
glassware.

K. 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.

L. Transport of chemicals (including gas cylinders) and equipment in crowded hallways when students are traveling between classes should be avoided.

M. All spills must be dealt with promptly and appropriately. Mercury spills should be reported to the Academic Laboratory Manager I in Room 304 Clark Hall.

N. Remove gloves before you exit the laboratory.

II. PERSONAL PROTECTION

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

A. Safety goggles must be worn by all personnel in hazardous situations; approved safety glasses (purchased by the Department of Chemistry) will suffice for nonhazardous work. Each faculty member is responsible for setting rules as to when safety goggles are to be worn in his or her laboratory.

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. According to the West Virginia University Chemical Hygiene Plan, 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.

D. 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.

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

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

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

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

I. Research Directors who supervise work involving microwave generators must periodically check for leakage and make appropriate correction if there is leakage.

J. 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.

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

III. FLAMMABLE LIQUIDS

A. All flammable liquids are to be stored under ventilation hoods or 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.

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).**

Regulators 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 faculty member 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. Because carbon monoxide is such a highly toxic gas and yet is completely odorless, it must be used with extreme caution. All work involving CO or compounds which produce CO must be done in a hood which has received the Department of Environmental Health and Safety approval as being safe for such usage. The apparatus should be leak-free and any CO evolved or purged must be vented up the hood without the possibility of backflow into the laboratory. Additionally, a laboratory using CO should install a reliable CO detector equipped with a digital read-out and an audible alarm. Research Directors should contact the Senior Facilities Manager to arrange for monthly ventilation inspections when work involving CO is planned.

F. The extensive use of inert gases, mainly nitrogen and argon, in the CRL could lead to the generation of a potentially lethal oxygen-deficient atmosphere if the ventilation system should fail to operate. Workers in the CRL should carefully study pages 56-58 of the Chemical Hygiene Plan to be aware of the dangers involved.

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 especially 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 Catalog Handbook of Fine Chemicals"*.

VI. DISPOSAL OF WASTE CHEMICALS

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 ANY 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 tube does not occur if the rubber swells.

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 the 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. CLARIFICATIONS AND OTHER PRECAUTIONS

A. 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 insure that the end does not come out of the drain. The attachment of a funnel to the drain-end of the hose works very well to keep the hose end in the drain. In operating a condenser, use water only when it is needed and use only the necessary flow-rate; usually this is a slow flow-rate. Never leave flowing water in a non-permanent apparatus unattended.

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

C. Exposing chemicals to direct sunlight should be avoided when reasonably possible.

IX. COURTESY

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

B. Radios must not be audible from outside the immediate laboratory or office. Use of a radio must be discontinued if potentially hazardous situations exist or if it disturbs coworkers.

X. 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.

4. *"West Virginia University Chemical Hygiene Plan"*, 1991.