

# Chapter 16 - Laboratory Safety

(Includes any area where hazardous chemicals are used or stored.)

## General

1. Safety takes precedence over all other considerations.
2. Do not work alone while performing dangerous chemical procedures. Be sure there is someone in the immediate vicinity you can reach in case of emergency.
3. Know the location of and how to use eyewash fountains, deluge showers, and fire blankets.
4. Be sure you understand the hazards involved in a procedure and take all necessary safety precautions before beginning.
5. Food products (lunches, snacks, juices, condiments, etc.) are not to be stored in laboratory refrigerators. Consumption of food and beverages or smoking is not permitted in laboratory operation areas.
6. Unsafe facilities, equipment, or behavior should be reported to your supervisor.
7. Unattended equipment and reactions are major causes of fire, floods, and explosions. Be sure all utility connections are secure. Anticipate hazards that would result from failure of electrical, water, or gas supply. Use hose keepers on water condenser lines.

## Personal Protection, Clothing, and Hair

8. Be sure all containers are properly labeled.
9. Wear approved eye and face protection suitable for the work at hand. Safety glasses or goggles should be worn at all times while working with chemicals at the counter or laboratory hood. A face shield should be worn when working with potentially eruptive substances.
10. Custodians, maintenance workers, and visitors must observe safety rules, including eye protection, while in the laboratory.
11. Wear protective gloves and clothing whenever handling corrosive or other hazardous chemicals.
12. Wear closed-toe shoes at all times in the lab.
13. Be sure that moving parts of mechanical apparatus are guarded to prevent hazardous contact.
14. Maintain your lab area reasonably neat and uncluttered.
15. Use the fume hood for all operations involving harmful gases or fumes and for flammable or explosive materials. Check the hood to see that it is operating adequately and has been inspected annually.
16. Use a safety shield or barrier to protect against explosion, implosion, and flash fires when performing reactions with large volume of flammable liquids or unstable material.
17. Inspect glassware for cracks, sharp edges, and contamination before using. Broken or chipped glassware should be repaired and polished or discarded.

18. Always use a lubricant (e.g., water, glycerol) when inserting glass tubing into rubber stoppers or grommets. Protect hands in case tubing breaks.
19. Broken glass should be put in impervious containers that are large enough to completely contain the glass. These containers are to be placed into the building trash dumpsters by laboratory personnel, not by custodians.
20. Do not handle radioactive isotopes without concurrence of the Radiation Safety Officer.

## **Chemical Handling**

21. Use a safety pail for transporting dangerous or flammable liquids of more than a small quantity (one pint). Use means to prevent tipping of containers when transporting materials on a cart.
22. Do not work with large quantities of reactants without special precautions.
23. Never pour anything back into a reagent bottle.
24. Use caution when adding anything to a strong acid, caustic, or oxidant. Add slowly.
25. Never add solids (boiling chips, charcoal, etc.) to a hot liquid.
26. Never pipette chemicals by mouth. Use pipette filler.
27. Do not point the mouth of a vessel being heated toward any person, including you.
28. When working with biohazardous material, guard against infection by skin contact, inhalation of aerosols, and contamination of food and beverages.
29. Known carcinogens, mutagens, and teratogens should not be used or stored in normal laboratory situations. Such substances require extreme precaution, tight security, limited access, and appropriate safety procedures, and should be used in conjunction with the OSU Carcinogen Safety program.
30. Never heat a flammable solvent in an open vessel in the presence of sparks or flame. Use only steam, hot water or a grounded heating mantle for heating flammable liquids.
31. Be sure natural gas lines in the laboratory are shut off at the line valve rather than at the equipment when not in use.
32. Always locate energized electrical equipment or other devices that may emit sparks or flame at least six inches above the floor.
33. All electrical apparatus must be properly grounded. Except for dual-insulated equipment, laboratory electrical apparatus should have a three-conductor cord that connects to a grounded electrical outlet.
34. All electrical wiring for experiments, processes, etc. should be done neatly, and must conform to electrical safety code requirements.
35. All experiments involving ether and other volatile flammable liquids should be considered fire or explosive hazards.
36. Strong oxidants such as nitrates, chlorates, perchlorates, and peroxides should be stored in a dry area apart from organic materials.
37. Perchloric acid digestion must be done in specially designed wash-down laboratory hoods.

## Chemical Storage

38. All chemical substance containers shall be labeled to identify contents. All flammable liquid containers shall be labeled "Flammable" or "Ignitable".
39. Quantities of flammable solvents should be stored in NFPA-approved, flammable-liquid storage cabinets, or in approved solvent-storage rooms. Not more than 10 gallons of flammable liquids combined shall be stored in the laboratory outside of approved storage mentioned above.
40. Unsealed containers of peroxide-forming compounds should not be stored in the lab. Organic peroxides may detonate by shock, friction, or heat. Compounds with dangerous tendencies to form peroxides by reaction with oxygen include certain ethers, unsaturated hydrocarbons, aldehydes, and ketones. These peroxide-forming compounds have a limited shelf life and should in no case be stored for longer than one year.
41. Do not store caustic liquids above eye level.
42. Do not store glass containers of hazardous liquids on the floor unless they are inside protective containers or pans.
43. Inventory chemicals periodically and discard old, no-longer-needed substances through the campus hazardous waste disposal program. See *Safety Bulletin #30* for more information on chemical storage.

## Pressure and Vacuum Systems

44. Do not perform experiments that develop high pressure or vacuum unless consequence of explosion has been considered and provided for.
45. Never heat reactants of any kind in a fully closed system without an approved pressure release system.
46. Never open a pressurized vessel (autoclave, etc.) until pressure has been fully released.
47. Compressed gas cylinders must be secured in an upright position at all times to prevent them from falling. Do not move or store compressed gas cylinders without the protective caps in place.
48. Do not interchange regulators designed for specific cylinders.
49. Flammable gas cylinders must not be stored next to exits or oxygen cylinders.
50. Don't move bottled gas cylinders by lift truck or hand truck unless approved racks or securing devices are used.
51. Never use oxygen as a substitute for compressed air. Do not use oil on gauges or regulators for oxidizing gases. Oxygen under pressure reacts violently with oil or grease.
52. Never use compressed gas from a cylinder without a reduction of pressure through a suitable pressure regulator.
53. Pressure adjusting screws on regulators shall always be FULLY RELEASED BEFORE the regulator is attached to a cylinder. Always open the valves on cylinders slowly. Do not stand in front of pressure regulator gauge faces when opening cylinder valves.
54. Do not strike valves with tools, or use excessive force in making connections.

55. Avoid mixtures of acetylene and oxygen or air prior to use except at a standard torch.
56. Cylinders not provided with fixed handwheel valves shall have keys or handles provided on valve stems at all times when cylinders are in use.
57. Cylinders should not be dropped, bumped violently, skidded or rolled horizontally. Compressed gas cylinders are high-pressure vessels and should be handled accordingly.
58. Do not store cylinders in direct sun, or in boiler or furnace rooms.

### **Container Handling**

59. Be sure that all containers are properly labeled.
60. Do not reuse a food container without first removing the original label completely.
61. Chemical transport containers are not to be used for non-compatible chemicals or for food products at any time.
62. Never place uncapped vessels of chemicals in a refrigerator, on benches, or in hoods.
63. Refrigeration of flammable materials must be done in spark-proof or explosion-proof refrigerators.

### **Chemical Spills and Disposal of Chemical Wastes**

64. Devise a plan to deal with spills before one occurs. POST the plan in the lab. Quickly and thoroughly clean up any liquid or solid chemical spill in the laboratory or area of operations. If any uncertainty exists, seek assistance of supervisor or call Environmental Health & Safety.
65. Dispose of chemical wastes by approved methods only. Unwanted or no-longer-useful chemicals become chemical wastes. Contact Environmental Health & Safety for waste disposal guidelines.
66. Reagent bottles should be thoroughly cleaned of any hazardous material prior to disposal