

APPENDIX L - LABORATORIES WHERE HAZARDOUS CHEMICALS ARE PRESENT

1. Intent: Provide laboratory facilities that meet basic legal and industry safety standards.

2. Design References and Governing Regulations

American National Standard for Emergency Eyewash and Shower Equipment
(ANSI Standards Z358.1)
Industrial Safety Equipment Association NY
American National Standards Institute (ANSI)
Telephone: 212-642-4900

American Society of Hospital Engineering, all volumes
American Hospital Association
840 North Lake Shore Drive
Chicago, IL 60611

ASHRAE Handbook and Standards
American Society of Heating, Refrigerating and Air-Conditioning Engineers
(ASHRAE) Inc.
1791 Tullie Circle NE
Atlanta, GA 30329
Telephone: 404-636-8400

Guide for the Care and Use of Laboratory Animals
U.S. Department of Health and Human Services
Bethesda, MD
National Institute of Health, Publication No. 86-23
Telephone: 202-783-3238

Guidelines for Construction and Equipment of Hospital and Medical Facilities
The American Institute of Architects Committee on Architecture for Health
with assistance from the U.S. Department of Health and Human Services
American Institutes of Architects Press
1735 New York Avenue, NW
Washington, DC 20006
Telephone: 800-365-2724

Guidelines for Research Involving Recombinant DNA Molecules
U.S. Department of Health and Human Services
U.S. Public Health Services
National Institutes of Health
Federal Register/Vol. 51, No. 88: 16957-16985
Bethesda, MD: National Institute of Health (NIH)

Telephone: 301-496-9838

IES-RP-CCOO2 Institute of Environmental Science

Industrial Ventilation: A Manual of Recommended Practice
American Conference of Governmental Industrial Hygienists
6500 Glenway Avenue, Building D-7
Cincinnati, OH 45211

Medical Laboratory Planning and Design
College of American Pathologists
Skokie, IL
Telephone: 708-446-8800, Ext. 531

National Fire Codes
Refer to specific standards 45, 99
National Fire Protection Association (NFPA)
1 Batterymarch Park
Quincy, MA 02269-9101
Telephone: 617-770-3000

NIH Design Policy and Guidelines
Design Criteria for Research Laboratories

NIH Design Policy and Guidelines
Design Criteria for Research Laboratory Mechanical Systems

Occupational Safety and Health Standards CFR 29, Part 1910
U.S. Department of Labor
Occupational Safety and Health Administration (OSHA)
Telephone: 202-783-3238

Standard 49 for Class II (Laminar Flow) Biohazard Cabinetry
National Sanitation Foundation Joint Committee on Biohazard Cabinetry
Ann Arbor, MI: National Sanitation Foundation
Telephone: 313-769-8010

Standards for Medical-Surgical Vacuum Systems in Hospitals
Pamphlet p-21
Compressed Gas Association (CGA)

2.1. Other Codes, Rules, Regulations and Standards

- A. ANSI/AIHA Standard Z9.5 Laboratory Ventilation
- B. ANSI/ASHRAE Standard 110 -1985 Method of Testing Performance of Laboratory Fume Hoods

- C. ANSI-Z358.1
- D. Minnesota Building Code
- E. Minnesota Building Code MR Sec.1300
- F. Minnesota Fire Code
- G. Minnesota Plumbing Code MR Sec. 4715
- H. Minnesota Rules Chapter 1300 MN Uniform Building Code
- I. Minnesota Rules Chapter 7510 MN Uniform Fire Code
- J. NFPA 91 Standard for the Installation of Blower and Exhaust Systems
- K. Occupational Safety and Health Administration (OSHA) Regulations
- L. Occupational Safety and Health Administration (OSHA) Rules
- M. OSHA 29 CFR 1910
- N. OSHA 29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories
- O. Uniform Building Code

3. Procedures

3.1. The contract documents shall contain an equipment and furnishings schedule that includes necessary product identification, function descriptions, handling, mechanical and electrical equipment/accessories, hardware indications, installation accessories and finishes.

3.2. File a Hazardous Materials Inventory Statement (HMIS) and a description of laboratory activities with the Department of Environmental Health and Safety (DEHS) and the Building Code Division when a construction project is proposed. The HMIS is used to determine the hazard classification of a laboratory. If it is not feasible to prepare this information, or if it is not filed, the occupancy shall be classified as hazardous under the Uniform Building Code. DEHS may assist the A/E with the collection and evaluation of the hazard information.

3.3. Laboratories shall meet the requirements of the National Fire Protection Association (NFPA) 101, "Code for Safety to Life From Fire in Buildings and Structures." Occupancy classification shall depend upon the building in which the laboratory is located and the nature of the work performed in the laboratory. Laboratories shall be classified as one of the following occupancies:

- A. Business
- B. Healthcare
- C. Industrial

3.4. Laboratories shall conform to one of the following NFPA standards:

- A. NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals
- B. NFPA 99: Standard for Health Care Facilities

3.5. The contract documents shall contain an equipment and furnishings schedule that includes product identification, functional descriptions, handling, mechanical and electrical equipment/accessories, hardware indications, installation accessories and finishes.

3.6. Biohazard containment facilities shall comply with standards published by the Center for Disease Control and Prevention and the National Institutes of Health, "Biological Safety in Microbiological and Biomedical Laboratories."

3.7. Biohazard Containment Devices

3.7.1. PROHIBITED: Volatile hazardous chemicals in biohazard cabinetry, unless the cabinet is entirely exhausted to the outside.

3.7.2. Biohazard cabinets shall comply with Biological Standard 49 for Class II Biohazard Cabinetry. Minimal use of alcohol to clean the inside of the cabinet is permissible in cabinets that are not entirely exhausted to the outside. Provide an exhausted biohazard cabinet with a thimble and air gap. Otherwise, the cabinet manufacturer shall make arrangements and approve another arrangement.

3.7.2. Laminar flow clean air devices such as clean benches shall comply with Institute of Environmental Sciences (IES) Standard IES-RP-CC002. Laminar flow clean benches provide only product particle protection. Hazardous physical, chemical or biological agents cannot be safely used in these devices.

3.8. Compartmentalization of each laboratory unit shall be achieved by providing it with at least:

- A. One-hour fire-rated separation from adjacent laboratories or other areas
- B. Self-closing fire doors with at least a 20-minute fire rating
- C. Class A interior finishes
- D. Class I floor finishes
- E. Doors to corridors from laboratories that swing in the direction of exit

3.9. Faucets, to which a hose or similar device may be attached, shall be provided with an approved vacuum breaker. Alternately, a special laboratory water supply equipped with an RPZ back flow device to separate it from the potable water may be provided. If a laboratory water system is provided, all connected outlets shall be labeled "Not Potable."

3.10. A safety shower and eyewash shall be provided in each lab area equipped with a fume hood. In other laboratories using chemicals, eyewash shall be required. If feasible, control the water supply to a temperature between 60 degrees

F and 95 degrees F. Refer to Appendix S - Emergency Eyewash and Safety Shower Installation.

3.11. Provide a single shut-off valve for each laboratory in accessible locations for central supply of flammable, combustible or oxidizing gases. Valves shall be outside of the areas in which the gases are used. These shut-off valves are in addition to those at the points of supply and use. They may be located adjacent to the corridor exit from the lab or, if security is not a problem, in the corridor.

3.12. Storage and supply systems for compressed and liquefied gases shall comply with requirements of NFPA and ANSI. Consult the following standards:

- A. NFPA 50, Standard for Bulk Oxygen Systems at Consumer Sites
- B. NFPA 50A, Standard for Gaseous Hydrogen Systems at Consumer Sites
- C. NFPA 50B, Liquefied Hydrogen Systems at Consumer Sites
- D. NFPA 51, Design and Installation of Oxygen-Fuel Gas Systems for Cutting and Welding
- E. NFPA 54, National Fuel Gas Code
- F. NFPA 55, Compressed and Liquefied Gases in Portable Cylinders
- G. NFPA 58, Standard for the Storage and Handling of Liquefied Petroleum Gases
- H. NFPA 99, Standard for Health Care Facilities
 - Chapter 3 - Use of Inhalation Anesthetics (flammable and non-flammable)
 - Chapter 4 - Use of Inhalation Anesthetics in Ambulatory Care Facilities
 - Chapter 5 - Respiratory Therapy
- I. ANSI B31.1.0, Power Piping, including Addenda B31.1.0(a), B31.1.1.0(c) and B31.1.1.0(d)
- J. ANSI B31.2, Fuel Gas Piping
- K. ANSI B31.3, Petroleum Refinery Piping

3.13. Systems for other gases shall comply with the manufacturer's recommendations. "The Handbook of Compressed Gases" by the Compressed Gas Association and the "Matheson Gas Data Book" by Matheson Gas Products may be consulted as a reference standard.

3.14. Controls for air, gas and other utilities shall be color-coded and labeled in accordance with the Scientific Equipment and Furniture Association (SEFA) 7 as follows:

| Number | Service | Color | Code | Color of Letter |
|--------|------------|------------|------|-----------------|
| 1 | Cold Water | Dark Green | CW | White |

| | | | | |
|----|----------------------|-------------|-----------------|-------|
| 2 | Chilled Water | Brown | CH | White |
| 3 | Hot Water | Red | HW | White |
| 4 | Steam | Black | STM | White |
| 5 | Air | Orange | AIR | Black |
| 6 | Gas | Dark Blue | GAS | White |
| 7 | Vacuum | Yellow | VAC | Black |
| 8 | Distilled Water | White | DW | Black |
| 9 | Oxygen | Light Green | OXY | White |
| 10 | Hydrogen | Pink | H | Black |
| 11 | Nitrogen | Gray | N | Black |
| 12 | All Other Rare Gases | Light Blue | Chemical Symbol | Black |

3.15. Provide fire extinguishers based on the basis of the area protected and hazard class. Refer to NFPA 10. Provide an UL-listed, 5 pound multipurpose dry chemical fire extinguisher with at least a 1A20BC rating mounted near an exit for each laboratory unit.

3.16. Laboratories Using Hazardous Chemicals

3.16.1. PROHIBITED: Recirculation of exhaust air from laboratories, except in a clean room with an air lock.

3.16.2. PROHIBITED: Returned air from corridors in laboratory areas. Supply air to the corridor only.

3.16.3. Laboratories using hazardous chemicals shall be under .01 inches WG (2 PA) negative pressure with respect to adjacent areas.

3.17. Provide at least 30 percent pre-filter and an 80 percent filter meeting ASHRAE 5276 dust spot efficiency filters in the air supply. Air filters shall be located downstream of the fan.

3.18. Humidifiers shall be located downstream of fans and filters. Indirect clean steam humidifying is required.

3.19. Labs where hazardous chemicals are used in closed systems or in a fume hood shall have between six and 12 air changes per hour. Where open use of hazardous chemicals is planned, 10 or more air changes per hour shall be necessary.

3.20. Special purpose exhaust devices shall be designed with reference to the latest edition of "Industrial Ventilation: A Manual of Recommended Practice by the American Conference of Government Industrial Hygienists."

3.21. Reagent grade 3 water is adequate for central building distribution. Reagent grade 3 water, as specified by the College of American Pathologists or the National Committee for Clinical Laboratory Standards, is resistive at 25 degrees C of 0.1 megohms/centimeter and a pH between 5 and 8. If needed, higher-grade water can be generated at the point of use. Refer to Division 15, Section 15400 - Plumbing, item 3. High Purity Water Systems for more information.

3.22. Outlets shall be provided for fixed appliances, and one duplex shall be provided for each 3 feet of bench length or more often if required by the program. Identify emergency power outlets in accordance with Division 16, Section 16140 - Wiring Devices.

3.23. Provide ground fault circuit interrupters (GFIs) on electrical outlets within 6 feet of all sinks.

3.24. To facilitate long-term maintenance and remain flexible about reusing casework, metal casework shall be provided. The following items are preferred in chemical laboratories and may be required when appropriate:

- A. Metal laboratory furniture with stainless or 1-inch epoxy resin bench top
- B. Wall cabinets with a continuous enclosed front plane to the ceiling
- C. Chemical-resistant waste lines
- D. A glassware cleaning sink at least 12 inches deep

3.25. Laboratory floors, walls and doors require the following items:

3.25.1. Floors shall be covered with a smooth, non-porous, seamless sheet that is resistant to a wide range of chemicals. The sheet shall have a cove along walls and permanently placed furnishings. Floor openings shall be sealed watertight.

3.25.2. Walls and doors shall be constructed or painted with a smooth, non-absorbent, washable material.

3.25.3. Lighting fixtures shall be flush-mounted with the ceiling and have removable, easily cleaned diffusers.

3.26. When infectious agents, human body fluids and general microbiology products are generated, an autoclave shall be designated to handle decontamination. It shall be provided with a dedicated exhaust to control odors. The exhaust system shall include a canopy over the door to the autoclave.

3.27. Provide adequate storage volume for research chemicals and waste. Chemical resistant storage trays shall be furnished to contain a spill of free liquid in the storage unit. Refer to Division 12, Section 12345 - Laboratory Casework.

4. Design Review Process

4.1. The A/E or owner's representative shall meet with the user to determine preliminary program requirements. The user shall provide a chemical list and description of laboratories. The user shall complete the HMIS form.

4.2. The A/E or owner's representative shall review the preliminary program requirements with DEHS, the Building Code Division and Disability Services. The HMIS form shall be filed with DEHS.

4.3. The A/E shall complete the programming design phase.

4.4. The users, DEHS, building code officials and the owner's representative shall review and approve the program design.

**End of Appendix L - Laboratories Where Hazardous Chemicals are Present
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)**