ENVIRONMENTAL HEALTH & SAFETY

UNM Laboratory Design Standards

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ACRONYMS & DEFINITIONS

§	Shorthand for "section," as in a specific section of a referenced document.
ABCWUA	Albuquerque Bernalillo County Water Utility Authority; The ABCWUA provides water and wastewater services to the greater Albuquerque metropolitan area.
ABSL	Animal Biosafety Level
ACGIH	American Conference of Governmental Industrial Hygienists; ACGIH is a professional association of industrial hygienists and practitioners of related professions that advances occupational and environmental health.
ACH	Air Changes per Hour
ANSI	American National Standards Institute; ANSI is a private nonprofit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States.
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers; ASHRAE is an American professional association seeking to advance heating, ventilation, air conditioning, and refrigeration systems design and construction.
BAS	Building Automation System
BMBL	Biosafety in Microbiological and Biomedical Laboratories; issued by CDC & NIH.
BOD	Biological Oxygen Demand
BSL	Biosafety Level
CAV	Constant Air Volume
CDC	U.S. Centers for Disease Control and Prevention; The CDC is the national public health agency of the United States. It is a United States federal agency under the Department of Health and Human Services.

CFR	Code of Federal Regulations; CFRs are the codification of the general and permanent rules published in the Federal Register by the departments and agencies of the Federal Government.
Chemical Cabinet	A piece of laboratory equipment designed to store chemicals with specific control measures that minimize the likelihood and impact of hazards, such as fire, spillage, and harmful vapors.
Chemical Cabinet (Vented)	A chemical cabinet that is vented outdoors to reduce harmful air contamination from escaping into the lab.
Chemical Cabinet (Flammable)	A chemical cabinet that is designed to store flammable materials. A/K/A: Flammable Cabinet or Flam Cabinet.
Chemical Fume Hood	A piece of laboratory equipment designed to minimize a person's exposure to hazardous substances. The fume hood draws away harmful air so lab employees can work with chemicals without the risk of accidental exposure. The air is extracted from the hood and may be filtered to remove dangerous vapors and then exhausted outside of the building. Chemical fume hoods are the primary and most important engineering control used to protect laboratory personnel from exposure to hazardous airborne chemicals and substances. A/K/A: Fume Hood, Vent Hood, Laboratory Chemical Hood, Exhaust Hood, and Chemical Exhaust Hood.
CHP	UNM's Chemical Hygiene Plan, available at https://ehs.unm.edu/assets/documents/sop-copies/chem-hygiene-plan.pdf Note: UNM Health Science Center's Chemical Hygiene Plan is available at https://hsc.unm.edu/research/compliance/chemsafety.html
COD	Chemical Oxygen Demand
DEA	U.S. Drug Enforcement Administration; The DEA is a United States federal law enforcement agency under the U.S. Department of Justice tasked with combating drug trafficking and distribution within the U.S.
DRM	NIH's Design Requirements Manual

EHS	UNM's Department of Environmental Health and Safety
ELF	Equivalent Linear Feet; An effective tool for comparing one research facility against another, an ELF Ratio counts the total linear footage of bench + write-up work station + chemical fume hoods + equipment within the primary, as well as support laboratory areas. This ratio is divided by the number of bench researcher stations for the building or a given area to yield ELF.
Emergency Spill	An emergency spill is a situation that poses an immediate threat to personal safety and health, the environment, or property that cannot be controlled and corrected safely and easily by individuals at the scene.
EPA	U.S. Environmental Protection Agency; The EPA is an independent executive agency of the United States federal government tasked with environmental protection matters.
FDA	U.S. Food and Drug Administration; The FDA is responsible for protecting public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, and medical devices; and by ensuring the safety of our nation's food supply, cosmetics, and products that emit radiation.
FLPPS	Federal Laser Product Performance Standard; see 21 CFR 1040.
FM	UNM’s Facilities Management Department
FM E&ES	UNM Facilities Management’s Division of Engineering & Energy Services
FOG	Fats, Oils, or Greases
fpm	Feet Per Minute
Glove Box	A special type of Chemical Fume Hood with a sealed chamber designed to allow lab personnel to manipulate air-sensitive chemicals or materials in an atmosphere other than air. The unit includes a transparent wall and reach-through gloves for access to the materials within.
HDPE	High-Density Polyethylene

HEPA Filter	High-Efficiency Particulate Air Filter
HVAC	Heating, Ventilation, and Air Conditioning
IBC	International Building Code, latest adopted version.
IDLH	Immediately Dangerous to Life and Health, as defined by OSHA.
LEDG	PDC's *Learning Environments Design Guidelines (LEDG v. 1.0)*, available at https://pdc.unm.edu/assets/documents/0-LEDG-v.1.0-120224.pdf
MAQ	Maximum Allowable Quantity
mmHg	millimeters of mercury
NFPA	National Fire Prevention Association; The NFPA is an international nonprofit organization devoted to eliminating death, injury, property, and economic loss due to fire, electrical and related hazards.
NH_3N	Ammonia nitrogen
NIH	The U.S. National Institute of Health; NIH is the primary agency of the United States government responsible for biomedical and public health research. It is part of the United States Department of Health and Human Services.
NM CID	Construction Industries Division; The CID, under the New Mexico Regulation & Licensing Department, protects consumers by regulating the industry through policies that promote business growth, safety, and the general welfare of the public.
NMAC	New Mexico Administrative Code; NMAC is the official collection of current rules (regulations) written and filed by state agencies to clarify and interpret laws passed by the Legislature.
NMED	New Mexico Environment Department; NMED is a state government agency responsible for "protecting and restoring the environment of the state of New Mexico to foster a healthy and prosperous New Mexico for present and future generations."

Non-emergency Spills	A non-emergency response is appropriate in the case of an incidental release of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by personnel in the immediate area or by maintenance personnel.
NRC	Nuclear Regulatory Commission; The NRC is an independent agency of the United States government tasked with protecting public health and safety related to nuclear energy.
O_2	Oxygen
OSHA	The U.S. Department of Labor's Occupational Safety and Health Administration
PDC	UNM's Planning, Design, & Construction Department
PPE	Personal Protective Equipment, as defined by OSHA.
PVC	Polyvinyl Chloride
RSM	UNM's Radiation Safety Manual, available at https://hsc.unm.edu/research/compliance/radiation-safety/_media/radiation-safety-manual.pdf.
SDS	Safety Data Sheet, as defined by OSHA.
STEL	Short-Term Exposure Limit, as defined by OSHA.
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TWA	Time-Weighted Average, as defined by OSHA.
UNM	The University of New Mexico
UNMH	The University of New Mexico Hospital
VAV	Variable Air Volume

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1. Introduction

1.1. Purpose

The University of New Mexico (UNM) regularly modernizes and upgrades its facilities to maintain its highly-coveted designation as the state's only "R1" institution. As such, UNM practices "very high research activity" to produce robust science, exquisite arts, and distinguished literature.[1] To help retain that status, UNM relies on various types of laboratories (i.e., labs), which have significant requirements from municipal, state, and federal regulations concerning local environmental health, occupational safety, and general security.

Beyond complying with regulatory requirements, the purpose of the *UNM Laboratory Standards* (i.e., Standard) is to:

(1) Facilitate a culture of safety through risk management best practices, education consultation, and collaboration;

(2) Provide a safe environment for lab personnel to conduct their work;

(3) Protect local environmental health;

(4) Offer university faculty, staff, and planning personnel a comprehensive lab design guide; and

(5) Support the retention of UNM's R1 designation.

1.2. Applicability

Generally, all UNM-owned or operated labs are subject to this Standard. However, UNM Hospital (UNMH) labs are not subject to this Standard unless the lab is partially or entirely owned or operated by UNM.

1.2.1. Relation to the *UNM Design Standard*

This Standard promotes a culture of laboratory safety at the highest level within and across UNM. As a result, this Standard provides comprehensive rules and resources for designing labs. However, those rules and resources originate inside and outside of UNM. For example, the Engineering & Energy Services division of the UNM Facilities Management department publishes and maintains the *UNM Design Standard*. Therefore, where contradictions may exist between the two UNM standards, the *UNM Design Standard* shall have precedent over this *UNM Laboratory Design Standard* so long as deviations from the latter are demonstrably safe.

1 This framework for classifying colleges and universities in the U.S. is maintained by the Carnegie Classification of Institutions of Higher Education, available at https://carnegieclassifications.acenet.edu/. “R1” is considered the premier designation for any research university.

1.3. Scope

All matters relating to the planning, design, construction, and demolition of laboratories are within the scope of this Standard. Review the UNM Planning, Design, & Construction (PDC) department's additional design guidelines at https://pdc.unm.edu/standards-and-guidelines/

1.3.1. Acknowledgment

The scope of this Standard was drafted using various industry standards and universities' laboratory design standards. UNM's Environmental Health & Safety (EHS) department extends its full appreciation to those institutions for their efforts to publish these guides.

1.4. Authority

UNM delegates authority to EHS to issue and maintain this Standard. EHS writes this Standard and enforces it to:

(1) Achieve compliance with regulations (e.g., U.S. Code of Federal Regulations);

(2) Implement industry standards (e.g., national and international safety guidelines); and

(3) Engage in best practices (e.g., expert knowledge).

1.5. Maintenance

To aid the campus community, EHS maintains this Standard and revises it to incorporate novel topics that arise. Feedback, comments, or recommendations are accepted year-round by emailing EHSweb-L@list.UNM.edu.

2. Laboratory Planning & Design Standards

When planning and designing laboratories, but before construction or laboratory work commences, the hazards and risks associated with a research activity should be determined, and the necessary safety precautions implemented. General precautions should be adopted for handling all laboratory chemicals, and specific guidelines should be implemented for chemicals that are used frequently or that are particularly hazardous.[2] Planning personnel should reference the UNM Chemical Hygiene Plan to assist in characterizing risks – the plan is available at https://ehs.unm.edu/assets/documents/sop-copies/chem-hygiene-plan.pdf.
The UNM Health Science Center's Chemical Hygiene Plan is also available for review at https://hsc.unm.edu/research/compliance/chemsafety.html.

[2] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.1. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

2.1. Planning

2.1.1. Designer Qualifications

A. Lab designers must have appropriate professional licenses in a relevant field of expertise (e.g., Professional Engineer, Registered Architect, Industrial Hygienist).

2.1.2. Risk Assessment

No matter how well-designed a laboratory is, improper usage of its facilities will always defeat the engineered safety controls. Proper education of facility users is indispensable, but training is outside the scope of this Standard.

Therefore, all environmental health and safety risks must be anticipated and evaluated so that protective controls can be incorporated into the design. Risk determinations should occur during early planning phases and be based on both immediate and long-term use, accounting for anticipated hazards, exposures, and vulnerabilities. To inform each of those three factors, consider past accidents, process conditions, chemicals and equipment expected to be used, particularly hazardous chemicals expected to be used, security measures, and the long-term use of the laboratory. All labs require basic (i.e., minimal) safety controls – regardless of a short-term analysis demonstrating zero or negligible risk – because long-term lab operations will often change and introduce unforeseeable hazards, exposure, or vulnerabilities.

A. Perform risk assessments for chemical, physical, and procedural hazards prior to laboratory design:[3]

Callout Box 1 – Example Risk Assessment
(complete prior to lab design)

The five questions below are the minimum inquiries that lab designers should investigate during early planning and design phases:

(1) What are the hazards?

(2) What is the worst thing that could happen?

(3) What can be done to prevent this from happening?

(4) What can be done to protect from these hazards?

(5) What should be done if something goes wrong?

(1) Identify chemicals to be used, amounts required, and circumstances of use in experiments and research. Consider any special employee or laboratory conditions that could introduce or increase a hazard. Physical hazards in the laboratory include combustible liquids, compressed gases, reactives, explosives, and flammable chemicals, as well as high-pressure/energy procedures, sharp objects, and moving equipment. Security hazards include theft or diversion of chemicals, biologicals, radioactive materials, proprietary materials, mission-critical or high-value equipment, plus threats from activist groups, intentional release of

[3] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.1. - 2. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

(or exposure to) hazardous materials, sabotage or vandalism of chemicals or high-value equipment, loss or release of sensitive information, and rogue work or unauthorized laboratory experimentation.

(2) Evaluate the hazards posed by the chemicals, processes, and experimental conditions. Consult EHS, UNM Biosafety, UNM Radiation Safety, and experienced scientists to ensure that those conducting the risk assessment have sufficient knowledge and expertise. Safety Data Sheets (SDS) for each specific chemical to be used in a lab should be evaluated. The evaluation should cover toxic, physical, reactive, flammable, explosive, radiation, and biological hazards, as well as any other potential hazards posed by the chemicals.

(3) For a variety of physical and chemical reasons, reaction scale-ups pose special risks, which merit additional prior review and precautions.

B. After performing a risk assessment, the designers must adhere to the "hierarchy of controls" during the planning and design phases to mitigate risks.[4] The following hierarchy of controls is listed in the order in which they should be implemented to reduce adverse risks.

(1) **Engineering controls** (e.g., vent hoods, locks, mechanical safety guards),

(2) **Administrative controls** (e.g., employee scheduling, housekeeping, training),

(3) **Work practices** (e.g., Chemical Hygiene Plans [CHPs], Standard Operating Procedures [SOPs]), and

(4) **Personal Protective Equipment** [PPE] (e.g., respirator, safety glasses, gloves).

It is the responsibility of the planners to ensure safe engineering controls are implemented prior to commissioning a lab. It is the responsibility of department heads and lab Principal Investigators (PIs) to ensure administrative controls, work practices, and PPE are in place before commencing lab activities.

2.1.3. User Input

A. Laboratory personnel (i.e., lab users) must have the opportunity to provide input during the design phase to ensure the proposed facilities meet the users' needs.[5] Designers will systematically liaise with the users to solicit feedback and the responsible UNM department to ensure the correct users provide input in a timely manner.

B. Laboratory personnel is required to provide designers with quantities by chemical name and by type, as referred to by the Hazardous Materials tables in the International Building Code. See the Maximum Allowable Quantity Per Control Area of Hazardous Materials Posing a Physical Hazard and Posing a Health Hazard.[6]

[4] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.3. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[5] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.A.

[6] International Code Council, Inc. *2024 International Building Code® (IBC®).* See Ch. 3, § 307. Available at https://codes.iccsafe.org/content/IBC2024V1.0.

2.1.4. Environmental Permits

A. Project managers and lab planners/designers must consult with EHS to identify permitting and engineering requirements for the building. For example, development greater than or equal to one acre in size requires an EHS design review for compliance with the EPA's stormwater permit.

Consultation should begin well before key resource allocation decisions are made, as some environmental permits can take more than a year to acquire (e.g., air quality Authority-To-Construct permits).

Email EHSweb-L@list.UNM.edu to begin the consultation process.

2.2. Design

2.2.1. Activity & Use Segregation

A. Labs should segregate laboratory and non-laboratory activities.

(1) Desks for laboratory personnel should be located outside of the lab space. Locating the office zones very close to the laboratory, preferably within the line of sight achieved via the use of glass walls or walls with viewing windows, will provide easy access, visibility, and communication. Locating offices and write-up desks outside the laboratory environment allows for a safer workspace where food can be consumed, quiet work can be done, and more paper and books can be stored.

(2) Where it is necessary to have offices or write-up desks within research areas, there must be adequate separation between the lab area and the office areas. Adequate separation can be achieved through a combination of distance and/or physical barriers (e.g., partitions or walls), such that Personal Protective Equipment (PPE) is not required while sitting at desks. Note: See § 2.2.13 for details about requirements for furniture, including benchtops and desks.

(3) When write-up desks are located within the laboratory, they must be at the entrance of the laboratory, with the wet lab benches, chemical fume hoods, biosafety cabinets, and equipment using or storing chemicals, biological materials, and radioactive materials located on the opposite side of the laboratory; this allows laboratory personnel and visitors to enter the laboratory without traveling through the hazardous materials zone of the lab. Different flooring between the office and laboratory zones is desirable, as it can provide a visual cue between the office/write-up desk area of the lab and the area where hazardous materials are used and stored.

(4) Class laboratories (i.e., learning labs) are equipped to serve the needs of a particular discipline for group instruction in regularly scheduled classes. Review section 5.05 of the PDC department's *Learning Environments Design Guidelines (LEDG v. 1.0)*, available at https://pdc.unm.edu/assets/documents/0-LEDG-v.1.0-120224.pdf.

(5) The design of the building must incorporate adequate additional facilities for food storage/consumption and personal hygiene tasks.[7]

B. Lab design should also separate inter-lab activities based on expected use (e.g., wet vs. dry labs).

(1) Wherever possible, separate wet chemical areas or those with a higher degree of hazard from other areas with a physical barrier, such as a wall, divider, or control device. If separation is not possible, PPE may be required for use.[8, 9]

2.2.2. Spacing

A. Lab designs must account for industry spacing considerations.

(1) Typical chemistry laboratories should be designed to provide from 28 to 30 Equivalent Linear Feet (ELF) per person. Quality control, biology, and analytical laboratories should range from 20 to 28 ELF per person.[10] Note:

i. An effective tool for comparing one research facility against another, or a proposed facility against one that exists, is to measure the specific areas that are used by researchers. The ELF Ratio counts the total linear footage of the bench + write-up workstation + chemical fume hoods + equipment within the primary, as well as support laboratory areas. This total linear footage is divided by the number of bench researcher stations for the building or a given area.[11]

ii. ELF can be divided into two categories: bench and equipment. Bench ELF is the required length of benchtop on which instruments can be set and where preparatory work takes place, as well as the length of laboratory chemical fume hoods. Equipment ELF includes the length of floor space for equipment that does not fit on a bench.[12]

(2) The space between adjacent workstations and laboratory benches should be five feet or greater to provide ease of access. In a teaching laboratory, the desired spacing is six feet. Bench spacing shall be considered and included in specifications and plans.[13]

[7] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.1.1.

[8] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.1.

[9] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[10] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.4.

[11] Research Facilities Design 2022. Innovations, Services, Benchmarking, Equivalent Linear Feet Ratio. Raleigh, NC. https://www.rfd.com/innovations/benchmarking. Copyright © 2007-2022.

[12] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.4.

[13] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.1.

i. Current open and adaptability design practices include locating fixed elements such as chemical fume hoods and sinks at the perimeter of the laboratory, ensuring maximum mobility of interior equipment and furniture. Although fixed casework is common at the perimeters, moveable pieces are at the center to maximize flexibility. The central parts of the laboratory are configured with sturdy mobile carts, adjustable tables, and equipment racks.[14]

(3) Sufficient facilities must also be provided for the storage, donning, and doffing of Personal Protective Equipment (PPE) used in the lab.

(4) Designated storage space should be provided for lab carts and other necessary equipment (e.g., safety equipment). Similarly, each lab design must include storage space for a spill kit sufficient to contain **non-emergency**[15] spills. Before use, the lab must have installed the spill kit.[16] The location must not reduce the width of corridors or aisles to less than code-required widths.

(5) Spaces between benches, cabinets, and equipment must be accessible for cleaning and allow for regular equipment and utility maintenance.

2.2.3. Safety Equipment

A. Safety equipment, including spill control kits, safety shields, fire safety equipment (e.g., extinguishers, fire blankets), PPE, safety showers and eyewash units, and emergency equipment (e.g., first aid kits) should be available in well-marked, highly visible locations in all laboratories.[17] Note: the New Mexico Environment Department (NMED) requires laboratory spill kits to be readily accessible and marked with signage.

2.2.4. Security

A. There are four integrated domains when considering lab security:

- **Physical or architectural security** – doors, walls, fences, locks, barriers, controlled roof access, and cables and locks on equipment;
- **Electronic security** – access control systems, alarm systems, password protection procedures, and video surveillance systems;
- **Operational security** – sign-in sheets or logs, control of keys and access cards, authorization procedures, background checks, and security guards; and

[14] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.1.

[15] A **non-emergency** response is appropriate in the case of an incidental release of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by personnel in the immediate area or by maintenance personnel. An emergency is a situation that poses an immediate threat to personal safety and health, the environment, or property that cannot be controlled and corrected safely and easily by individuals at the scene.

[16] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 6.C.10.5.

[17] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.8. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

- **Information security** – passwords, backup systems, shredding of sensitive information.

These domains are complementary, and each should be considered when devising security protocols. Any security system should incorporate redundancy to prevent failure in the event of power loss or other environmental changes.

B. Labs shall be completely separated from outside areas (i.e., they must be bound by four walls).

C. At a minimum, labs must utilize locking doors with traditional locks and proxy or key-card access for easy ingress and robust recordkeeping of lab entrants.

2.2.5. Illumination

A. Laboratory areas shall be provided adequate natural or artificial illumination to ensure sufficient visibility for operational safety.

B. Lab lighting levels should be roughly 50 foot-candles or implement the recommendations of the Illuminating Engineering Society.

C. Generally, the Correlated Color Temperature (CCT) for lab lighting should be 4,000 CCT.[18]

D. Labs shall use light controls, providing only ON/OFF switches with no occupancy restrictions or timer controls.[19]

E. Egress lighting must comply with the recommendation and requirements of the National Fire Protection Association[20] and International Building Code[21].

2.2.6. Signage

A. Prominent signs of the following types shall be posted:[22]

(1) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers, including the following language:

> Immediately **REPORT** all **ACCIDENTS**, **INCIDENTS**, & **SPILLS** by calling **505-951-0794**. Alternatively, submit an online report by visiting ehs.unm.edu and then clicking '**Accident, Incident & Spill Reporting**,' or visit: https://ehs.unm.edu/incident-reporting/index.html.

[18] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 26 51 13 Interior Lighting 3. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[19] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 26 09 23 Lighting Control Devices 6b Lab. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[20] National Fire Protection Association (NFPA). 2018. See NFPA 101 Chapter 7 § 8 – Illumination of Means of Egress. Available at https://up.codes/viewer/florida/nfpa-101-2018/chapter/7/means-of-egress#7.8.

[21] International Building Code (IBC). 2018. See IBC Chapter 10 (1008.3.4). Available at https://codes.iccsafe.org/content/IBC2018/chapter-10-means-of-egress#IBC2018_Ch10_Sec1008.

[22] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.7. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

(2) Warnings at areas or equipment where special or unusual hazards exist; and

(3) Location signs for spill kits, safety showers, eyewash stations, other safety and first aid equipment, and exits.

Note: the New Mexico Environment Department (NMED) requires laboratory spill kits to be readily accessible and marked with signage.

B. Review the UNM PDC department's *Interior Signage Standards (2020)*, available at https://pdc.unm.edu/assets/documents/unm-interior-design-standards-2020.pdf.

2.2.7. Electrical

A. Labs shall be designed to meet electrical codes outlined in the National Fire Protection Association's *NFPA 70 - National Electrical Code*, available at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70.

2.2.8. Flooring

A. Review the UNM PDC department's *Flooring Standards (2023), available* at https://pdc.unm.edu/standards-and-guidelines/flooring-standards.pdf.

B. Resilient Sheet Goods are most commonly used in labs. Sheet goods are usually preferable to floor tiles because floor tiles may loosen or degrade over time, particularly near chemical fume hoods and sinks.[23]

C. Wet laboratory areas should have chemically resistant, impermeable, slip-resistant flooring.[24]

D. Floors above areas with sensitive equipment, such as lasers, should be sealed to prevent leaks.[25] In these locations, floor penetrations should receive special attention.

E. Likewise, see section 2.2.21 Wastewater Drains (i.e., Sink & Floor Drains).

2.2.9. Windows & Glass

A. Windows or other large sections of glass shall be tempered glass.

B. Operable windows should be prohibited in new lab buildings and should not be used on modifications to existing buildings, particularly if there are chemical fume hoods or other local ventilation systems in the lab.[26, 27]

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[23] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.4.

[24] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.1.(c). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[25] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.4.

[26] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.1.(f). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[27] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.5.

(1) Labs that require operable windows must be fitted with insect screens.

2.2.10. Walls

A. Walls should be finished with material that is easy to clean and maintain.[28] Applicable building codes may require certain doors, frames, and walls to be fire-rated.[29] Note: Biosafety Labs may have different requirements (see § 2.13 for details).

B. Review the PDC department's *Interior Paint Standards (2021),* available at https://pdc.unm.edu/standards-and-guidelines/paint-standards.pdf.

2.2.11. Doors

A. Laboratory doors shall be self-closing and able to be opened with an 'opening force' as defined by applicable accessibility guidelines.

B. Laboratory doors should open in the direction of egress.[30]

(1) In labs utilizing negative (atmospheric) pressure, doors may resist opening outward. Likewise, an inward opening may interfere with obtaining adequate seals under normal operations if the negative pressure is stronger than the door's ability to self-close. In either circumstance, contingency plans must be evaluated and implemented to ensure ease of operability.

(2) Lab designers may also utilize automatic supply/exhaust air shutoff mechanisms in the event that a chemical fume hood fails to ensure pressure does not become so great as to render doors inoperable.

(3) Note: See NFPA 45 and reference UNM FM Engineering Design Standards for direction regarding interlocked laboratory supply and exhaust air to prevent excessive negative pressures within a lab.

C. Laboratory doors should also have view panels (i.e., window panes) to prevent collisions and to allow individuals to visually assess conditions in the lab in the event of an emergency.[31]

2.2.12. Egress

A. Labs shall have a minimum aisle clearance of at least 60 inches for a double-loaded bench aisle.

[28] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.1.(d). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[29] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.5.

[30] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.5.

[31] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.1.(e). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

2.2.13. Benchtops & Furniture

A. Laboratory furniture (e.g., chairs, stools) must be impervious and easy to clean/decontaminate. Cloth or upholstered furniture is prohibited. All work surfaces (e.g., bench tops, counter spaces, chemical fume hoods panels) must be impervious to the chemicals used, easy to clean/decontaminate, heat resistant, and chemically inert. The countertop should incorporate a lip to help prevent small run-off spills onto the floor.[32]

B. Laboratory furniture and work surfaces in clean rooms must not become subject to rust or chalking. Most lab personnel prefer not to use materials with painted surfaces, which may chalk or peel over time, or wood products that may form dust and absorb substances. Stainless steel and thermoplastics are the most recommended materials.[33]

C. Laboratory furniture must support anticipated uses and loads.[34]

2.2.14. Ergonomics

A. Work areas, including computers, should incorporate ergonomic features, such as adjustability, task lighting, and convenient equipment layout.

B. Benchwork should also allow for chairs or stools utilizing knee space.[35]

C. In addition to being impervious and easy to clean/decontaminate, laboratory furniture must comply with basic UNM ergonomic specifications (see PDC's *Learning Environments Design Guidelines* [LEDG] available at https://pdc.unm.edu/assets/documents/0-LEDG-v.1.0-120224.pdf).

2.2.15. Vibration & Noise Control

A. During the early planning stages, all equipment should be discussed regarding any unique noise or vibration sensitivity in order to locate the equipment properly.

   (1) To manage equipment vibrations, clarify the tolerance requirements with the user and equipment manufacturer during the equipment-programming phase, or early design process, so that the appropriate structure can be designed and the construction cost can be estimated more accurately. Equipment that often vibrates includes centrifuges, shakers, water baths, and pumps. Typical equipment that requires minimal vibration includes analytical equipment such as Nuclear Magnetic Resonance (NMR) systems, sensitive microscopes, mass spectrometers, and equipment utilizing light amplification (i.e., lasers).[36]

[32] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.1.(a). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[33] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.E.2.3.

[34] CDC/NIH's *Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th ed*, freely available at https://www.cdc.gov/labs/bmbl/?CDC_AAref_Val=https://www.cdc.gov/labs/BMBL.html. See § IV.D.5.

[35] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.2.

[36] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.6.

(2) Sound baffles or external acoustical insulation at the source should be used for noise control.

2.2.16. Shelving

A. Chemical, medical, or radiation storage shelves shall not be placed above laboratory sinks.[37]

B. Laboratory shelves should not be installed at heights and distances which require workers to reach 30 centimeters above shoulder height and extend arms greater than 30 centimeters while holding objects 16 kg or less when standing on the floor or on a 12" step stool.

C. Placing items on top of shelves is often a fire code violation, as objects may interfere with emergency fire sprinkler operations. Accordingly, shelves should not be placed at a height where placing items on top of the shelf would put the placed items within 18" from the ceiling for rooms with sprinklers or 24" from the ceiling for rooms without sprinklers. Alternatively, shelving should have deterrent methods (e.g., slopped tops) to limit the utilization of this space.

D. Open shelves used for chemical storage should be secured to the wall and contain 3⁄4-inch lips for non-emergency spill containment and to prevent containers from falling. Secondary containment devices should be used as necessary.[38]

2.2.17. Material Storage

A. Sufficient space or facilities (e.g., storage cabinets with partitions) shall be provided so that incompatible chemicals/gases (including waste and non-waste) can be physically separated and stored. This should be based on a chemical inventory and use projection provided by the Principal Investigator(s) expected to operate each lab.

2.2.18. Material Security

A. Labs shall have means of securing (e.g., lockable doors, lockable cabinets) specifically regulated materials such as DEA (U.S. Drug Enforcement Administration) controlled substances and CDC (U.S. Centers for Disease Control and Prevention) select agents and radioactive materials. Review the DEA's storage rules (21 CFR 1301.72) regarding physical security controls for controlled substances, available at https://www.ecfr.gov/current/title-21/chapter-II/part-1301/subject-group-ECFRa7ff8142033a7a2/section-1301.72.

2.2.19. Hygiene

A. Labs shall be designed, constructed, and maintained to facilitate cleaning, decontamination, and housekeeping.

(1) Carpets and rugs are prohibited.

[37] Albuquerque Bernalillo County Water Utility Authority (ABCWUA), Sewer Use and Wastewater Control Ordinance § 3-2-1-C. https://www.abcwua.org/wp-content/uploads/2021/08/Section-3-Sewer-Use-and-Wastewater-Control.pdf.

[38] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.2.(h). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

(2) Spaces between benches, cabinets, and equipment must be accessible for cleaning.

(3) Seams, floors, walls, and ceiling surfaces must be sealed. Spaces around doors and ventilation openings should be capable of being sealed to facilitate space decontamination.

(4) Floors should be slip-resistant, impervious to liquids, and resistant to chemicals. Flooring should be seamless, sealed, or poured with integral cove bases.

(5) Walls and ceilings should be constructed to produce a sealed, smooth finish that can be easily cleaned and decontaminated.

2.2.20. Sinks

A. Labs must contain a sink for handwashing.[39]

B. Where particularly hazardous materials may be used, the sink should have elbow, foot, or electronic pollution prevention controls.[40]

C. Do not install more cup sinks than are needed. Unused sinks may develop dry traps that result in odor complaints.[41]

D. Sink edges shall have lips that protect sink drains from spills.

E. Chemical, medical, or radiation storage shelves shall not be placed above laboratory sinks.[42]

2.2.21. Wastewater Drains (i.e., Sink & Floor Drains)

A. Laboratories equipped with a safety shower/eyewash unit must also incorporate an associated floor drain that is set below the flooring grade, and the floor shall be sloped towards the drain. The drain must be located in the immediate vicinity of the shower/eyewash unit. These floor drains must be either:

(1) Fitted with a plug that can be removed when the safety shower/eyewash unit is activated. The plug must be designed for continuous installation and may not introduce hazards (e.g., trip/fall). The intent of the floor drain block is to prevent spills or intentional discharge; or

(2) Designed with a permanent sump, approximately 4’x4’x2’ (225 gallons) into which the shower water is discharged and by which it is contained until it can be sampled (either directly beneath the safety shower with a flush floor grate or remotely, with a drain). The intent is that the discharge from a safety shower must remain contained until it can be sampled. If the effluent is contaminated, it must be

[39] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.2.

[40] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.1.(b). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[41] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.5.2.

[42] Albuquerque Bernalillo County Water Utility Authority (ABCWUA), Sewer Use and Wastewater Control Ordinance § 3-2-1-C. https://www.abcwua.org/wp-content/uploads/2021/08/Section-3-Sewer-Use-and-Wastewater-Control.pdf.

removed and treated. Otherwise, if there is just water, it may be released to the municipal sewer system.

B. Floor drains are prohibited in areas or rooms used exclusively for the bulk storage of chemicals (e.g., lab chemicals and commercial cleaning products).[43]

C. Provide ProSet Trap Guards for all sink and floor drains that do not see daily water flows.[44]

D. Pursuant to a 2008 agreement between UNM and NM CID (New Mexico Regulation & Licensing Department, Construction Industries Division), sanitary waste systems within laboratory buildings shall be constructed of plastic material as appropriate for required chemical compatibility and fire/smoke ratings. Neutralizing tanks are not to be installed.[45]

E. Polypropylene or Polyvinyl Chloride (PVC) shall be used for laboratory waste systems and connections to lab sinks and similar equipment. Joints and fittings shall be made by socket fusion. CPVC may be used with prior UNM FM E&ES (Facilities Management, Division of Engineering and Energy Services) approval based on material and chemical compatibility, but only for indirect waste streams.[46]

F. Labs shall be designed to prevent or minimize the potential for accidental discharge of any **pollutant** (defined below) to the wastewater sewer.[47] Typical sewer connections include sink and floor drains.

Pollutant here is defined as:

- "Dredged spoil,
- solid waste,
- incinerator residue,
- filter backwash,
- sewage,
- sewage sludge,
- garbage,
- munitions,
- chemical wastes,
- biological materials,
- heat,
- wrecked or discarded equipment,
- rock,
- sand,
- cellar dirt,
- municipal, agricultural and industrial wastes,
- substances that create a fire or explosion hazard**,**
- substances having a pH less than 5.0 or more than 12.0,
- solid or viscous substances in amounts that will cause obstruction of sewer flow,
- noxious or malodorous liquids, gases, and solids,

[43] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 22 13 00 Facility Sanitary Sewerage. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[44] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 22 13 00 Facility Sanitary Sewerage. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[45] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 22 13 00 Facility Sanitary Sewerage. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[46] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 22 13 00 Facility Sanitary Sewerage. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[47] Albuquerque Bernalillo County Water Utility Authority (ABCWUA), Sewer Use and Wastewater Control Ordinance § 3. https://www.abcwua.org/wp-content/uploads/2021/08/Section-3-Sewer-Use-and-Wastewater-Control.pdf.

- Total Petroleum Hydrocarbons (TPH), in amounts that will cause interference or pass through to the Waste Water Treatment Plant,
- Fats, Oils, or Greases (FOG) of animal or vegetable origin in concentrations greater than 200 mg/l.,
- characteristics that deleteriously affect pH, temperature, Total Suspended Solids (TSS), turbidity, color, odor, toxicity, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), or Ammonia nitrogen (NH_3N) levels
- medical wastes, defined as:
    - "Isolation wastes, infectious agents, human blood and blood products, pathological wastes, sharps, body parts, contaminated bedding, surgical wastes, potentially contaminated laboratory wastes, dialysis wastes, and any other biohazardous waste materials. and
- any radioactive wastes or isotopes."

  Note: Hospitals and specialized clinics for radiation treatment may discharge low-level radioactive waste when all of the following conditions are met:
  (1) A user is authorized to use radioactive materials by the Radiation Protection Bureau of the New Mexico Environment Department or an applicable federal agency;
  (2) The waste is discharged in strict conformity with applicable laws and regulations of the Radiation Protection Bureau or any other agency having jurisdiction; and
  (3) A copy of permits received from the Radiation Protection Bureau or any other agency having jurisdiction has been filed with the ABCWUA Industrial Pretreatment Engineer.

2.2.22. Gas & Vacuum Line Utilities

A. Labs should have auxiliary valves for gas and vacuum lines located outside the lab. Flexible connections should be used for connecting gas and other plumbed utilities to any freestanding device, including but not limited to incubators and liquid nitrogen freezers.

   (1) Biosafety cabinets should not be plumbed for gas to prevent fires and damage to the HEPA filters.

B. Flexible connections should be appropriate for the pressure requirements and should be constructed of material compatible with the transport gas. A shutoff valve should be located within sight of the connection and clearly marked. Note: flexible hoses are not recommended for vented gas cylinder cabinets.

2.2.23. Fire Safety

A. In general, all labs should meet the minimum design specifications outlined in 10.25.5 NMAC – *New Mexico Fire Code*, which incorporates by reference the International Code Council's *International Fire Code (IFC), 2015 ed.*

10.25.5 NMAC is freely available at https://www.srca.nm.gov/parts/title10/10.025.0005.html.

The International Fire Code is freely available at https://codes.iccsafe.org/content/IFC2024V1.0.

B. In general, the quantity limits for the storage and handling of flammable, combustible, and toxic materials in laboratories are subject to the *International Building Code (IBC)* and its companion *International Fire Code (IFC)*.[48] For non-quantity provisions, consult the minimum design specifications outlined in *NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals*, which is freely available at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=45.

C. Sprinkler systems may be required by the building code and are almost always recommended. The use of water sprinkler systems is resisted by some laboratories because of the presence of electrical equipment or water-reactive materials, but it is still generally safer to have sprinkler systems installed. A fire large enough to trigger the sprinkler system would have the potential to cause far more destruction than local water damage. For areas with water-sensitive equipment or materials, consider early-warning smoke detection.[49, 50]

2.2.24. Operation & Maintenance Plans

A. As-built operation and maintenance plans must be provided to EHS, FM, and lab users.

(1) As-built plans must describe typical maintenance and operations for managing and mitigating risks to environmental health and safety. For example,

i. If the lab includes floor drains that close to contain chemical spills, then as-built plans must describe how to operate and maintain them.

ii. If chemical fume hoods have a filter replacement schedule or similar schedules for other components or inspections, they should be included in as-built operation and maintenance plans.

2.3. VENTILATION

The general goal of providing ventilation is to keep exposure to hazards as low as reasonably achievable. However, the steady increase in the cost of energy, coupled with a greater awareness of the risks associated with the use of chemicals in the laboratory, has caused a conflict between the desire to minimize the costs of heating, cooling, humidifying, and dehumidifying laboratory air and the need to provide laboratory personnel with adequate ventilation. Therefore, cost considerations must never take precedence over ensuring that personnel is protected from hazardous concentrations of airborne toxic substances.

2.3.1. General

A. Determine whether the chemicals to be used are flammable or reactive or if they pose health hazards from inhalation. If no significant risk exists, the work does not likely require

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[48] International Code Council, Inc. *2024 International Building Code® (IBC®).* Available at https://codes.iccsafe.org/content/IBC2024V1.0.

[49] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.2.(b). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[50] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.B.7.

any special ventilation. If a potential risk does exist, investigate the physical properties of the chemical, specifically its vapor pressure and vapor density (details below).

Vapor pressure is usually measured in millimeters of mercury. A low vapor pressure (<10 mmHg) indicates that the chemical does not readily form vapors at room temperature. General laboratory ventilation or an alternative such as the elephant trunk or snorkel may be appropriate unless the material is heated or in a higher temperature room that might promote vapor formation. High vapor pressure indicates that the material easily forms vapors and may require the use of a ventilated enclosure, such as a chemical fume hood.

Vapor density is compared to that of air, which is measured at 1. A chemical having a vapor density greater than 1 is heavier than air. If the vapors need to be controlled, a chemical fume hood or a ventilation device that draws air from below, such as a downdraft table or a slot hood, or an elephant trunk with the exhaust aimed low, may be appropriate. Conversely, a chemical with a vapor density of less than 1 is lighter than air. Besides a chemical fume hood, a ventilation device that draws air from above, such as an elephant trunk or snorkel with the exhaust positioned above the source, may work best.

B. Consider whether ventilation might cause radioactive or biological materials to aerosolize or become airborne and whether inhalation poses a risk to health or the environment. Determine whether filtration or trapping is required or recommended. If the lab will utilize biological materials, the University Biosafety Officer must be consulted in the early planning phase. Likewise, each individual or group who wishes to initiate a program that has radiological implications shall submit a written proposal to the UNM Radiation Safety Office.

C. Determine if manipulation of hazardous or toxic solid particles will create hazards within or near equipment with high airflows, which may be too turbulent. Weighing boxes or ventilated balance enclosures may be a better fit for such work.

D. Evaluate if a chemical fume hood might be too turbulent for manipulating nanomaterials. Also, consider whether the exhaust containing these tiny particles should be filtered. Studies have shown that high-efficiency particulate air (HEPA) filters are very effective for nano-size particles. Containment tests for chemical fume hoods allow for a minimal amount of leakage into the breathing zone of the user. For chemical vapors, such an amount may be insignificant, but in the same volume of nanoparticles, the number of particles may be quite large, and biosafety cabinets or gloveboxes would be better.[51]

2.3.2. Climate Control

A. Climate control should be provided. Heating and cooling should be adequate for the comfort of laboratory occupants, storage of anticipated substances, and operation of laboratory equipment.[52, 53]

[51] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.1.

[52] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.4. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[53] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.

a. Note: For more details, see Facilities Management, Engineering & Energy Services' 2025 UNM Design Standards. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

2.3.3. Continuous Air Ducts

A. Air exhausted from labs shall not pass un-ducted through other areas. In other words, there shall be no return of chemical fume hood and laboratory exhaust back into the building. Laboratory air must be exhausted directly outdoors.[54]

2.3.4. Supply & Exhaust Air

A. Supply system air should meet the technical requirements of the laboratory work and the requirements of the latest version of the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) Standard 62 - Ventilation for Acceptable Indoor Air Quality. Standard 62 is available by contacting ASHRAE (1-800-527-4723 or 404-636-8400) or by visiting https://www.techstreet.com/ashrae/standards/ashrae-62-1-2019?product_id=2088533.

B. The air in chemical laboratories should be continuously replaced with fresh outside air (OSA) so that concentrations of odoriferous or toxic substances do not increase during the workday.[55, 56] Additional requirements are below:

(1) Continuous vs. variable systems.

CAV, or Constant Air Volume, systems assume constant exhaust and supply airflow rates throughout the laboratory. They are relatively simple but are high energy consumers and limit flexibility.

VAV, or Variable Air Volume, systems work in coordination with chemical fume hoods with face velocity controls, and they increase and decrease airflow depending on use. Variable systems provide many opportunities for increased safety and energy conservation that cannot be accomplished with a continuous system, but expert-level design is highly recommended for VAV systems.

(2) In general, VAV laboratory designs shall be used.[57]

[54] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.4. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[55] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.4. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[56] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 23 30 00 HVAC Air Distribution sub-§§ 4-14. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[57] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 23 09 00 Laboratory Equipment. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

(3) Controls for laboratory VAV systems shall integrate with ALC or Delta Building Automation System (BAS), allowing remote monitoring and airflow control via that controller.[58]

(4) Laboratory spaces shall be designed and equipped with variable airflow control valves for each chemical fume hood exhaust, room exhaust, and room supply air.

(5) Each lab shall have a BAS controller which accepts input signals corresponding to the position, flow, temperature, or pressure values and which provides automatic and remote monitoring, alarming, and control of all laboratory and chemical fume hood air flows, pressures, and temperatures.

(6) Laboratory VAV system controllers shall be ALC or Delta, as applicable to the Building Automation System (BAS), and all wiring, actuators, chemical fume hood alarm display panels, and graphical user interfaces for the lab controls shall be installed as part of the BAS. Third-party controllers – for example, those provided by hood or airflow valve manufacturers – shall not be used.

(7) Each chemical fume hood shall be provided with a sash position sensor which will output a voltage signal proportional to the sash opening (either as a percentage of the full operating sash height or in inches of vertical opening). The sash position signal will be an analog input to the BAS room controller.

(8) Each chemical fume hood exhaust duct shall be provided with an airflow velocity sensor which will output a voltage signal proportional to the airflow rate.

(9) The BAS lab controller shall modulate each chemical fume hood air control valve actuator to control hood face velocity, maintaining specified face velocity at all times and for all sash positions. Any time the airflow is outside that specified range, the BAS controller shall initiate an alarm at the hood alarm display panel, alerting the user to close the sash and vacate the area.

(10) The BAS lab controller shall modulate each lab room supply air control valve and associated reheat coil control valve to maintain the room temperature set point.

(11) The BAS lab controller shall modulate each lab general exhaust control valve to maintain an exhaust flow rate equal to the room supply flow rate and an offset amount. The offset airflow is determined during testing & balancing of the room to be the amount required to establish a specified differential pressure between the lab and surrounding spaces (typically 0.03" wc – 0.05" wc lab negative relative to surrounding spaces).

(12) All exhausted chemical fume hoods shall incorporate proximity sensors to be capable of being used for fume hood sash alarms. Typically, these controls are purchased by either the electrical subcontractor or the controls installation subcontractor.

[58] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 11 53 00 Instrumentation and Control for HVAC (General Information). Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

(13) As a safety and energy conservation measure, the BAS lab controller shall initiate an audible alarm whenever a chemical fume hood has been vacated for more than 30 seconds, and the sash has been left more than 5% open. The audible alarm shall be easily distinguishable from other types of hood alarms (e.g., flow alarms), shall be physically separate from other audible alarms, and shall only be capable of being silenced by either occupying the working space of the hood or closing the sash. The alarm condition is determined at the BAS controller via inputs from the sash position transducer and the hood proximity sensor. The BAS controller powers an alarm buzzer mounted near the hood face.[59]

i. There is often resistance by users to install such alarms because they are perceived as a nuisance. However, demonstrable safety results warrant this requirement for their use.

(14) Laboratory exhaust fans shall have measurement capability and means to control fan speed (or stack discharge area) to continuously meet minimum stack discharge velocity requirements and fan inlet bypass damper position to continuously meet minimum system static pressure requirements.

i. If the laboratory airflow is constant-volume or variable-volume, but the lab has no chemical fume hoods, then supply and exhaust air shall be controlled by VAV dampers and coils to maintain the required ventilation, pressurization, and temperature in the lab. VAV boxes may be of commercial HVAC quality; controls shall be via the Building Automation System (BAS).

ii. If the laboratory airflow is variable-volume and the lab has chemical fume hoods, then each hood exhaust flow shall be controlled by a variable-volume hood exhaust air valve to maintain the required face velocity at the hood. The lab shall also have a room general exhaust air valve to make up any difference between hood exhaust and room supply that is required to maintain specified room pressurization and a room supply air valve that modulates to maintain minimum ventilation and temperature in the lab. Laboratory airflow control valves shall be of laboratory quality, fast-acting, tight-sealing, and shall have a functioning inlet pressure of 0.5" wc or less. Laboratory airflow control valves requiring pressures higher than 0.5" wc shall not be permitted. Each airflow control valve shall have an airflow measurement device that outputs a signal proportional to airflow through the valve.[60]

C. Exhausts should be placed away from all building's HVAC intakes. Likewise, consider the expected conveyance paths (via wind) of emissions adjacent to other HVAC intakes to avoid contaminating those air supplies.

[59] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 23 09 23 Direct-Digital Control System for HVAC sub-§ 5. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[60] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 23 09 23 Direct-Digital Control System for HVAC sub-§ 7. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

D. A corridor should not be used as a **plenum**[61].

E. Room air currents at the chemical fume hood should not exceed 20% of the average face velocity to ensure hood containment. Tracer gas containment testing of chemical hoods reveals that air currents impinging on the face at a velocity exceeding 30 to 50% of the face velocity reduce the containment efficiency by causing turbulence and interfering with the laminar flow of the air entering the hood.[62]

F. There should be no areas where air remains static or areas that have unusually high airflow velocities. These systems should be designed only by an experienced engineer or industrial hygienist.[63]

G. In the event of an isolated HVAC or makeup-air system failure, exhaust fans that remain operable must be designed to be dampened to maintain the pressure for which the lab was originally designed.

2.3.5. Ventilation Rates

A. General laboratories using hazardous materials shall have a minimum of six air changes per hour (ACH). Greater rates are often required.[64] The air velocity volume in each duct should be sufficient to prevent condensation or liquid or condensable solids on the walls of the ducts. Likewise, UNM does not set a universal maximum ACH rate. Instead, maximum rates should be based on the lab's operations, and the ACH must prioritize personnel safety while accounting for energy consumption.

   a. Note: For more details, see Facilities Management, Engineering & Energy Services' 2025 UNM Design Standards. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

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Table 1 – General Ventilation Controls for Personnel Protection

E. showcases engineering controls for emissions of hazardous materials in the laboratory for a particular operation or material.

[61] **Plenum** – An enclosed chamber where a treated substance collects for distribution, as heated or conditioned air through a ventilation system.

[62] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.

[63] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.4. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[64] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2021. *UNM Design Standards*. See § 23 30 00 HVAC Air Distribution sub-§ 5. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

Table 1 – General Ventilation Controls for Personnel Protection[65]		
Type of Ventilation	**Air Changes or Face Velocity[66] in Linear Feet per Minute (fpm) as Appropriate**	**Examples of Use**
General laboratory ventilation	6–12 air changes/hour, depending on laboratory design and system operation	• Nonvolatile chemicals • Nonhazardous materials
Environmental rooms	0 air changes	• Materials that require special environmental controls • Nonhazardous amounts of flammable, toxic, or reactive chemicals.
Chemical fume hoods	100 fpm (± 20 fpm) at a sash height of 18 inches, depending on the hood type.	• Flammable, toxic, or reactive materials • Products or mixtures with uncharacterized hazards
Unventilated storage cabinets	0 air changes	• Flammable liquids • Corrosives • Moderately toxic chemicals
Ventilated storage cabinets	1–2 air changes/minute	• Highly toxic, hazardous, or odiferous chemicals (if equipped with flame arrestors)
Recirculating biosafety cabinets (1/2)	A1: 75 fpm A2: 100 fpm	• Biological materials • Nanoparticles, as of the date of publication
Recirculating biosafety cabinets (2/2)	B1: 100 fpm	• Biological materials • Nanoparticles, as of the date of publication • Minute amounts of volatile chemicals
Total exhaust biosafety cabinet	B2: 100 fpm	• Biological materials • Nanoparticles, as of the date of publication • Minute amounts of volatile chemicals
Glovebox	Varies from no change to a very high rate of change, depending on the glovebox and the application	• Positive pressure for specialty environments • Negative pressure for highly toxic materials
Downdraft table	150–250 fpm depending on design	• Perfusions with paraformaldehyde, work with volatile, low to moderately hazardous materials with higher vapor density where

[65] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C. Adapted from Table 9.3.

[66] **Face Velocity –** The average velocity of air drawn through the face of the chemical fume hoods.

		access from more than one side is necessary
Elephant trunk	150–200 fpm at opening	• Local ventilation of a tabletop • Discharge from equipment such as a gas chromatograph
Canopy	N/A	• Ventilation of heat, steam, and low or nontoxic materials with low vapor density
Slot hood	Varies with application	• Local ventilation of higher-density materials at the source, such as an acid bath
Ventilated balance enclosure	5–10 air changes/minute	• Weighing and initial dissolution of highly toxic or potent materials
Benchtop ventilated enclosures	Variable per the needs of the materials	• Benchtop equipment, such as rotovaps

Generally, national trends to adopt lower FPM requirements at fume hoods continue to persist. Lower FPM translates into lower energy usage, lower noise levels, and lower first cost.

2.3.6. Make-up Air

A. An adequate supply of make-up air should be provided to the lab. Make-up air should be introduced at the opposite end of the laboratory room from the chemical fume hood(s), and flow paths for room HVAC systems shall be kept away from hood locations to the extent practical. Make-up air shall be introduced in such a way that negative pressurization is maintained in all laboratory spaces and does not create a disruptive air pattern.

2.3.7. Pressurization

A. Laboratories shall be well-sealed to create a secondary containment for reactions or releases and for pressurization control. Generally, a lab space should be able to maintain a 0.03” wc differential pressure with surrounding spaces without losing more than 0.1 cfm per square foot of lab envelope surface to leakage.[67]

B. Negative Pressurization – Labs must maintain negative pressure in relation to corridors or other less hazardous areas.[68, 69] In other words, a differential should exist between the amount of air exhausted from the laboratory and the amount supplied to the laboratory to maintain a negative pressure between the laboratory and adjacent non-laboratory spaces. This pressure differential prevents uncontrolled chemical vapors from leaving the laboratory.

    a. Airflow shall be from low-hazard to high-hazard areas.

[67] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[68] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.4. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[69] National Fire Protection Association (NFPA). 2004. NFPA 45: *Standard on Fire Protection for Laboratories Using Chemicals*. Quincy, MA. https://www.nfpa.org/codes-and-standards/nfpa-45-standard-development/45.

   b. An air lock or vestibule may be necessary for certain high-hazard laboratories to minimize the volume of supply air required for negative pressurization control. These doors should be provided with interlocks so that both doors cannot open at the same time.[70]

C. Positive Pressurization – Positive pressure rooms should be limited to the maximum extent practicable. However, some clean rooms or biosafety labs may require a slightly positive pressure differential. There should be a separation between common spaces and the positive-pressure room to prevent the migration of airborne contaminants.

   a. Clean rooms requiring positive pressure should have entry vestibules provided with door-closing mechanisms so that both doors are not open at the same time.[71]

   b. Most biological labs should be negatively pressurized, but some animal surgical suites may be positive. Biological laboratories that require positive pressurization relative to immediately-adjacent spaces shall be provided with an ante-room between the lab, and surrounding non-lab spaces such that the laboratory is negatively pressurized relative to the surrounding building space and the ante-room is negatively pressurized relative to the laboratory. The target differential pressure will vary depending on the laboratory use and biosafety level of the lab and of adjacent spaces, but in no case shall the differential pressure be less than 0.03" wc negative relative to non-laboratory spaces. Walls, floors, and ceilings which enclose and define a laboratory space shall be continuous, without openings between the lab space and adjacent spaces. Penetrations between lab spaces and adjacent spaces shall be sealed to prevent contaminant migration and pressure equalization between spaces.[72]

2.3.8. Insulation Prohibition

A. No lab ventilation system ductwork shall be internally insulated.

2.3.9. Exhaust Prohibition

A. Chemical fume hoods must not be the sole means of room air exhaust. General room exhaust outlets shall be provided to maintain minimum air change rates and temperature control.

B. Note: For more details, see Facilities Management, Engineering & Energy Services' 2025 UNM Design Standards. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[70] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.

[71] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.

[72] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 23 30 00 HVAC Air Distribution sub-§ 4. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

2.3.10. Chemical Fume Hoods

Chemical fume hoods are the primary and most important components used to protect laboratory personnel from exposure to hazardous airborne chemicals and substances.

A. See § 2.3.4 Continuous Air Ducts for design requirements, including supply and exhaust air for chemical fume hoods. To review general industry guidelines for laboratory ventilation using engineering controls, reference

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Table 1 – General Ventilation Controls for Personnel Protection

D. .

E. Construct chemical fume hoods and the associated exhaust ducts of nonflammable materials.[73] For operations involving materials that could explode, protection aimed at preventing ignition and containing an explosion may be necessary. The sash should be composed of a composite material of safety glass backed by polycarbonate, with the safety glass on the interior side of the sash. In addition, all components of the hood, including the electrical supply, lighting, etc., must be explosion-proof.[74] This protective measure includes welded ducts and explosion-proof motors at the exhaust fans, as well as flame arrestors.

F. Equip hoods with vertical, horizontal, or combination vertical/horizontal sashes that can be closed.[75]

    (1) For the glass within the sash, use either laminated safety glass that is at least 7/32-in. thick or other equally safe material that will not shatter if there is an explosion inside.[76]

G. Equip hoods with airfoils and baffles. Airfoils built into the bottom and sides of the sash opening significantly reduce boundary turbulence and improve capture performance. All hoods should have baffles. When air is drawn through a chemical fume hood without a baffle, most of the air is drawn through the upper part of the opening, producing an uneven velocity distribution across the face opening.[77]

[73] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.9.1.

[74] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.E.6.

[75] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.9.1.

[76] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.9.1.

[77] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.9.2.

H. The general policy of the EHS department is that the face velocity for chemical fume hoods shall be 100 fpm (± 20 fpm) at a sash height of 18 inches. Face velocities below 100 fpm should only be used for light volatile substances. For capture velocities based on the molecular weight of substances, see ASHRAE *HVAC Applications Handbook*, Chapters 14-16, Laboratories.

(1) **Note:** The 2021 *UNM Design Standards* state, "Hoods shall have a minimum face velocity of 100 fpm and a maximum face velocity of 120 fpm at all times. Face velocity setbacks shall not be permitted."[78] Section 1.2.1 above gives *UNM Design Standards* precedent over this *Lab Design Standard*. However, EHS has requested that future versions of the *UNM Design Standards* be updated to reflect this EHS policy.

I. Each hood, laboratory, facility, or site must define the acceptable average face velocity, minimum acceptable point velocity, and maximum standard deviation of velocities, as well as when ASHRAE/ANSI 110 or visualization testing is required.[79]

J. "Snorkels" or "Elephant Trunks" – An elephant trunk is particularly effective for capturing discharges from gas chromatographs, pipe nipples, and pieces of tubing if the hose is placed directly on top of the discharge (i.e., the work being performed). The face velocity for a snorkel or elephant trunk is usually 150–200 fpm.

(1) Local exhaust ventilation, other than chemical fume hoods, shall be designed to adequately control exposure to hazardous chemicals. An exhausted manifold or manifolds with connections to local exhaust may be provided as needed to collect potentially hazardous exhausts from gas chromatographs, vacuum pumps, excimer lasers, or other equipment which can produce potentially hazardous air pollutants. The contaminant source needs to be enclosed as much as possible, consistent with operational needs, to maximize control effectiveness and minimize air handling difficulties and costs.[80]

K. For some operations, condensers, traps, and/or scrubbers are recommended or necessary to contain and collect vapors or dust to prevent the release of harmful concentrations of hazardous materials from the chemical fume hood exhaust. Fume hoods with chemical filters shall incorporate a sensor to detect chemical breakthroughs.[81]

(1) **Note:** Installing condensers, traps, and/or scrubbers for operations exhausting to outside air requires prior written approval from EHS. The operation may require a pre-approved air quality permit from the City of Albuquerque. EHS manages these environmental permits, and they can take more than a year to obtain in some circumstances.

[78] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 11 53 00 Laboratory Equipment. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[79] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.1

[80] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.3.1

[81] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 11 53 00 Laboratory Equipment. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

L. Hoods should be labeled to show which fan or ventilation system they are connected to.

M. Chemical Fume Hood Location –

(1) Hoods should be located away from activities or facilities which produce air currents or turbulence. Locate them away from high-traffic areas, air supply diffusers, doors, and operable windows. They should not be located adjacent to a single means of access to an exit. It is recommended that hoods be located more than ten feet from any door or doorway.[82]

(2) Hood openings should not be located opposite workstations where personnel will spend much of their working days, such as desks or microscope benches.

(3) An emergency eyewash/shower station, equipped with a floor drain, shall be within ten seconds (i.e., ~55 feet) of each hood. For more details, see § 2.4.

N. Laboratory chemical fume hoods in clean rooms must be easy to clean and not subject to rust or chalking. Polypropylene chemical hoods are commonplace in clean rooms. The main concern is that this material burns and melts very easily. In the event of a fire, a polypropylene chemical hood may become fully involved. For this reason, it is prudent to choose either a fire-retardant polypropylene or another thermoplastic or to install an automatic fire extinguisher within the hood.[83]

2.3.11. Vented Chemical Cabinets

A. Toxic or corrosive chemicals that require vented storage should be stored in vented cabinets instead of in a chemical fume hood.[84] If the use of such chemicals is anticipated, incorporate vented chemical cabinets into the final design.

(1) The use of laboratory chemical hoods to store bottles of toxic or corrosive chemicals is a very wasteful practice, which can seriously impair the effectiveness of the hood as a local ventilation device. Thus, it is preferable to provide separate vented cabinets for the storage of toxic or corrosive chemicals. Most new chemical fume hoods are designed with chemical storage cabinets beneath them, which are ventilated via the hood exhaust – these are acceptable. Ultimately, the amount of air exhausted by such cabinets is much less than that exhausted by a properly operating hood.[85]

(2) Vented chemical cabinets must exhaust outdoors or to chemical fume hood ducting, which also exhausts outdoors. Chemical cabinet vents shall not exhaust directly into the work area of the hood.

[82] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.2.3.

[83] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.E.2.3.

[84] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.4.(a). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[85] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.2.

(3) Mechanical venting of flammable storage cabinets is not recommended, as it requires isolated, sealed ducts, explosion-proof motors and fans, and flame arrestors.

(4) Oxidizers and corrosives should not be stored near flammables.

B. Vented cabinets with electrical receptacles and sound insulation should be provided for the placement of individual vacuum pumps where their use is anticipated. A one to two-inch hole for the vacuum line hose from the cabinet to the bench top should be provided. Likewise, cabinetry or other structures or equipment must not block or reduce the effectiveness of supply or exhaust air.

2.4. Eyewash & Safety Showers

2.4.1. OSHA Standard

A. An adequate number and placement of safety showers and eyewash units should be provided for laboratories.[86]

B. Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.[87]

2.4.2. ANSI Guidelines

A. The selection and installation of eyewash and safety showers must comply with the most recent American National Standards Institute guidelines. Specifically, *American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1).* The 2014 edition is the most current version of this publication. It is also Copyright to ANSI, but Guardian Equipment publishes a compliance checklist to help meet the Standard, and it is freely available at https://www.gesafety.com/downloads/ANSIGuide.pdf. Designers may also obtain original copies of this ANSI guide at

https://webstore.ansi.org/Standards/ISEA/ANSIISEAZ3582014?source=blog&_ga=2.260217866.649349740.1658346556-732283038.1658346556.

(1) Note: according to ANSI Z358.1-2014, emergency drench hose units are an ideal supplement to emergency eyewash and safety shower equipment but may not be utilized as a replacement for that equipment.

2.4.3. UNM Guidelines

A. At a minimum, an emergency eyewash and safety shower station, equipped with a floor drain, shall be installed within ten seconds (i.e., ~55 feet) of each chemical fume hood.[88]

[86] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.C.2.(a). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[87] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.151(C). Available at https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.151.

[88] UNM's "55-foot" rule is promulgated from the recommendation put forth in ANSI Z358.1. Therein, ANSI states, "emergency equipment (should) be installed within 10 seconds walking time from the location of a hazard (approximately 55 feet)." Details can be found at https://www.gesafety.com/downloads/ANSIGuide.pdf.

If the use of strong corrosives is anticipated, the safety shower shall be within 10 feet of the chemical fume hood. This distance shall be measured along the path of travel from the chemical fume hood to the emergency eyewash and safety shower station. The path of travel should be free of obstructions and as straight as possible.

B. All labs must have at least one emergency eye wash and safety shower with floor drains, regardless of the original use for the lab. For details regarding drains, see § 2.2.21. Planners must receive prior written approval from EHS in order to deviate from this rule.

C. Emergency eyewash and shower units must be actively or passively connected to drain piping (i.e., wastewater drains). Likewise, see section 2.2.21 Wastewater Drains (i.e., Sink & Floor Drains). It is prudent to have floor drains near the units sloped to the drain to prevent excessive flooding and potential slip hazards. Consider choosing barrier-free safety showers and eyewash units that can accommodate individuals with disabilities.

D. For additional design considerations, review the UNM *Emergency Safety Shower & Eyewash Program (2024),* available at https://ehs.unm.edu/assets/documents/sop-copies/eyewash_shower-program---signed.pdf. Sections 3 and 4 address equipment and installation, respectively.

2.5. Gas Cylinders & Other Pressure Vessels

2.5.1. General

A. Compressed gases expose laboratory personnel to both chemical and physical hazards. At a minimum, it is essential that adequate space is allotted for gas cylinders and a means to secure them (i.e., racks and clamps) is provided.[89] If the use of **asphyxiant**[90] and/or toxic gases is anticipated, additional requirements may include:

   a. Oxygen (O_2) concentration monitoring – designed to continuously monitor oxygen concentration and alert personnel of oxygen-deficient atmospheres. O_2 sensors should be used when the room size and configuration are inadequate to mitigate risks from the accidental release of asphyxiants stored inside (e.g., cryogenics such as nitrogen, argon, methane, butane, and propane).

   b. Gas cabinets – designed to monitor for and contain leaks of toxic gases such as ammonia, carbon monoxide, diborane, hydrogen cyanide, and phosgene.

B. Neither life safety nor process systems (e.g., fire alarms, O_2 monitors, process gas control systems, etc.) shall interface with the HVAC DDC Building Automation Controls System. Life Safety systems require a dedicated, supervised SCADA system with telemetry control

[89] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.E.4. Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[90] An **asphyxiant gas**, also known as a simple asphyxiant, is a nontoxic or minimally toxic gas which reduces or displaces the normal oxygen concentration in breathing air. Breathing of oxygen-depleted air can lead to death by asphyxiation (suffocation). Because asphyxiant gases are relatively inert and odorless, their presence in high concentration may not be noticed, except in the case of carbon dioxide (hypercapnia). Common asphyxiant gases include argon, butane, helium, methane, nitrogen, and propane.

to automatically monitor and alarm for device failures. Chemical fume hoods and airflow controls are not considered Process or Life-Safety systems.[91]

C. For additional guidance on storing compressed gas in labs, reference the UNM *Compressed Gas Cylinder Safety Program*. Section 6 addresses storage requirements and section 10 addresses the Maximum Allowable Quantity (MAQ) of compressed gas that can be used and stored within a building. Likewise, the program addresses general engineering and administrative controls. The *Compressed Gas Cylinder Safety Program* is available at https://ehs.unm.edu/assets/documents/sop-copies/compressed-gas-safety.pdf.

2.5.2. Vented Gas Cylinder Cabinets

A. Whenever possible, minimize the use of highly toxic or hazardous gases and restrict them to lecture bottles that are placed on stands and used within the confines of a chemical fume hood. Use and store containers for highly toxic or hazardous gases, such as diborane, phosgene, or arsine, that are too large to be used within a chemical fume hood in ventilated gas cabinets.[92]

B. Connect gas cabinets to laboratory exhaust ventilation using metal ductwork rather than flexible tubing because such tubing is more apt to develop leaks. Use coaxial tubing for delivering gas from the cylinder to the apparatus. Coaxial tubing consists of an internal tube containing the toxic gas inside another tube. Nitrogen, which is maintained at a pressure higher than the delivery pressure of the toxic gas, is between the two sets of tubing, ensuring that, in the event of a leak in the inner tubing, the gas will not leak into the room.[93]

2.6. Hazardous Material & Chemical Storage

Note: the pre-design risk assessment (see § 2.1.1) should involve compiling a list of chemicals expected to be used in each lab along with each chemical's Safety Data Sheet (SDS). Ensure the lab is designed to account for the following considerations.

A. Chemicals should be separated and stored according to the hazard class and compatibility. Chemicals should not be stored in the chemical fume hood, on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight.[94] See the final page of the UNM *Chemical Hygiene Plan* to review a simple, one-page diagram showing chemical storage compatibility. This chemical compatibility chart is available in Attachment 6 at https://ehs.unm.edu/assets/documents/sop-copies/chem-hygiene-plan.pdf.

[91] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 23 09 00 Instrumentation and Control for HVAC (General Information). Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

[92] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.3.7.

[93] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.3.7.

[94] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.2.Chemical Storage (a-k). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

B. SDS and label information should be consulted for storage requirements.

C. Laboratory-grade, flammable-rated refrigerators and freezers (i.e., non-sparking motor-operated units) should be used to store sealed chemical containers of flammable liquids that require cool storage.[95]

D. Highly hazardous chemicals, such as carcinogens and reproductive toxins, should be stored in a well-ventilated and secure area designated for that purpose.[96]

E. Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets.[97]

F. Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.[98]These areas should not be equipped with floor drains.

2.7. Flammable Liquids Storage

Note: the pre-design risk assessment (see § 2.1.1) should involve compiling a list of chemicals expected to be used in each lab along with each chemical's Safety Data Sheet (SDS). Ensure the lab is designed to account for the following considerations.

A. Store flammable and combustible liquids only in approved flammable-liquid storage cabinets (typically made of metal). Best practices for storing flammable liquids in storage cabinets are available in NFPA 30 § 9.5, freely available at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=30.

  (1) Ventilation for flammable storage cabinets is not required or recommended by the NFPA (see NFPA 30 – *Flammable and Combustible Liquids Code Handbook*).

  (2) If a ventilated flammable-liquid storage cabinet is used under a chemical fume hood, do not vent it into the work area of a hood above it. It should have a separate exhaust duct connected to the exhaust system.[99]

  (3) If a specially designed flammable storage cabinet ventilation system is installed, use an Air Movement Control Association C-type spark-resistant fan and an explosion-proof motor. Most fractional horsepower fans commonly used for this purpose do not meet this criterion and should not be used. If the building has a

[95] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.2.Chemical Storage (i). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[96] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.2.Chemical Storage (m). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[97] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.2.Chemical Storage (n). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[98] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1450(l) Appendix A.D.2.Chemical Storage (n). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1450.

[99] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.3.8.

common chemical fume hood exhaust system, you may interconnect flammable-liquid storage cabinet vents to the hood exhaust.[100]

2.8. Corrosive Storage

A. All laboratories must be equipped with corrosive cabinets that allow for the separate storage of acids and bases. Storage cabinets for corrosive materials should be constructed of or lined with HDPE (i.e., plastic). Metal cabinets are subject to corrosion when storing these substances. These cabinets may be ventilated or unventilated, but ventilation is prudent when the materials stored in the cabinet are highly toxic or extremely odoriferous.[101] Newer chemical fume hoods have corrosive cabinets beneath them that are vented via the hood exhaust. This is where highly toxic or odiferous materials should be stored.

2.9. Cryogenic Liquid Storage

While various definitions exist, OSHA defines **cryogens** as substances used to produce very low temperatures (below -243°F [-153°C]).[102] UNM defines **cryogenic liquids** as liquids with extremely low boiling points (below -150°F [-101°C]).[103] Nevertheless, the following liquified substances are considered cryogenic liquids: argon, helium, hydrogen, methane, nitrogen, and oxygen.

A. Cryogenic liquid containers must be stored in well-ventilated areas or areas with forced ventilation and away from air intakes, high-traffic areas, floor drains, and other underground openings.[104]

    (1) Storage in unventilated rooms (or rooms with limited airflow) is prohibited.

    (2) Large dewars must be tethered/anchored to a wall.

    (3) Store flammable cryogenic liquids and liquid oxygen away from oil, grease, combustible materials, and sources of ignition.

    (4) Follow all substance-specific storage guidance provided in safety data sheets.[105]

B. Containers must be equipped with a pressure relief valve that protects the container from over-pressurization.

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[100] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.3.8.

[101] National Research Council 2011. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12654. See § 9.C.3.8.

[102] U.S. Department of Labor, Occupational Safety and Health Administration. 2011. *Quick Facts. Laboratory Safety: Cryogens and Dry Ice*. Available at https://www.osha.gov/sites/default/files/publications/OSHAquickfacts-lab-safety-cryogens-dryice.pdf .

[103] The University of New Mexico, Environmental Health & Safety. 2023. *Cryogenic Liquid Safety Guidelines*. Available at https://ehs.unm.edu/assets/documents/sop-copies/cryogenic-liquid-safety.pdf.

[104] The University of New Mexico, Environmental Health & Safety. 2021. *Cryogenic Liquid Safety Guidelines* §4.1. Available at https://ehs.unm.edu/assets/documents/sop-copies/cryogenic-liquid-safety.pdf.

[105] The University of New Mexico, Environmental Health & Safety. 2021. *Cryogenic Liquid Safety Guidelines* §6. Available at https://ehs.unm.edu/assets/documents/sop-copies/cryogenic-liquid-safety.pdf.

C. Oxygen monitoring is required for use with cryogenic liquids, depending on the room size and the volume of liquid stored. Consult with EHS if you need help determining if O_2 monitoring is required.

Cryogenic liquids pose both chemical and physical hazards to laboratory personnel. It is essential that these are monitored for leaks and have the proper labeling. Consider which monitoring devices are necessary for each type of cryogenic liquid expected to be used in each laboratory. For example, an oxygen sensor will alert personnel to oxygen-deficient and oxygen-rich atmospheres. Oxygen-rich environments are highly flammable, while oxygen-deficient environments are Immediately Dangerous to Life and Health (IDLH).

D. Lab processes that intend to thaw cryotubes should integrate into the lab design a heavy-walled container (e.g., a desiccator) or a safety shield to protect personnel from tube shattering.[106]

2.10. Formaldehyde Use

2.10.1. OSHA Standard

For labs intending to use formaldehyde:

A. Designs shall integrate engineering controls to reduce and maintain employee exposures to formaldehyde at or below the TWA and the STEL.[107]

B. Designs shall include change rooms, as described in 29 CFR 1910.141, for employees who are required to change from work clothing into protective clothing to prevent skin contact with formaldehyde.[108]

2.11. Radiation & Radioactive Materials

2.11.1. NRC Standard

A. Federal rules and regulations concerning the proper use of radioactive materials are enforced by the Nuclear Regulatory Commission (NRC) and contained in 10 CFR 20, available at https://www.ecfr.gov/current/title-10/chapter-I/part-20?toc=1. Lab designs must account for these rules.

2.11.2. NMED Standard

A. The State of New Mexico has entered into an agreement with the NRC. This agreement gives the New Mexico Environment Department's (NMED) Radiation Control Bureau the authority to license and inspect all radioactive materials and radiation-producing machines within the state. NMED is required to implement all provisions set in place by the NRC.

[106] The University of New Mexico, Environmental Health & Safety. 2021. *Cryogenic Liquid Safety Guidelines* §5.8. Available at https://ehs.unm.edu/assets/documents/sop-copies/cryogenic-liquid-safety.pdf.

[107] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1048(f)(1). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1048.

[108] U.S. Department of Labor, Occupational Safety and Health Administration. 29 CFR 1910.1048(i)(1). Available at https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-Z/section-1910.1048.

NMED's regulations fall under 20.3 NMAC, available at https://www.srca.nm.gov/nmac-home/nmac-titles/title-20-environmental-protection/chapter-3-radiation-protection/.

2.11.3. UNM Guidelines

A. UNM follows the Radiation Safety Manual (RSM) as an internal policy to enforce the requirements set forth by NMED. Labs must be designed in compliance with federal and state standards and the UNM Radiation Safety Office's RSM, which is available at https://hsc.unm.edu/research/compliance/radiation-safety/_media/radiation-safety-manual.pdf.

B. General ventilation and wastewater systems should be designed such that, in the event of an accident, they can be shut down and isolated to contain radioactivity. See § 2.2.21 Wastewater Drains (i.e., Sink & Floor Drains)2.2.21 for radiation-specific pollution prevention requirements associated with wastewater drains.

C. For environmental health considerations, lab designs must also be based on the U.S. EPA, Radiation and Indoor Air Office's *Guide for Radiological Laboratories for the Control of Radioactive Contamination and Radiation Exposure*, freely available at https://www.epa.gov/sites/default/files/2015-05/documents/402-r-12-005_contamination_guide_aug_2012.pdf. Section 2 (Preparing the Laboratory) and Appendix A (Planning Considerations for Laboratory Layout and Process Flow) address design considerations.

2.12. LASERS

2.12.1. ANSI Standards

A. Labs intending to use lasers must design the space to comply with the most recent American National Standards Institute guidelines. Specifically, lab design must comply with (1) *American National Standard for Safe Use of Lasers (ANSI Z136.1-2014)* and (2) the *American National Standard for Safe Use of Lasers in Research, Development, or Testing (ANSI Z136.8-2012).* Both standards are Copyrighted by ANSI. You may obtain original copies of ANSI guides by following the link below or contacting ANSI:

https://webstore.ansi.org/Standards/LIA/ansiz1362020
American National Standards Institute, Inc.
11 West 42nd Street
New York, New York 10036
Phone: (212) 642-4900

B. Entryway Controls shall include one of the following:

(1) Non-defeatable safety latches, entryways, or interlocks (e.g., electrical switches, pressure-sensitive floor mats, infrared, or sonic detectors) shall be used to deactivate the laser or reduce the output in the event of unexpected entry into the LCA.

(2) Defeatable safety latches, entryway, or interlocks shall be used if non-defeatable area/entryway safety controls limit the intended use of the laser.

(3) Where safety latches or interlocks are impractical or inappropriate, the following shall apply:

i. A means shall be used to block, screen, or attenuate the laser radiation at the entryway (e.g., door, blocking barrier, screen, or curtains).

C. Laser Warning Lights must be posted at the exterior of the LCA near eye height and no higher than 6 feet from the floor. The lights may be operated by a switch or wired, so it activates when the laser is activated.

D. Emergency shutoff for the lab should be installed to allow the elimination of electrical hazards during emergencies.

E. A Class 3B or Class 4 laser-controlled area shall have only diffusely reflecting materials in or near the beam path when feasible. Avoid metal trim or faceplates.

F. Facility Windows that are located within the NHZ of a Class 3B or Class 4 laser or laser system shall be provided with an appropriate absorbing filter, scattering filter, blocking barrier, or screen that reduces any transmitted laser radiation. Such laser windows shall be specifically selected to withstand direct and diffusely scattered beams.

G. A blocking barrier screen or curtain that can block or filter the laser beam at the entryway should be used inside the laser-controlled area to prevent the laser radiation from exiting the area.

H. The beam height should be maintained at a level other than the normal position of the eye of a person in the standing or seated positions unless additional controls have been put into place to protect individuals at such locations. The use of grounded optical tables is recommended.

2.12.1. NFPA Guidelines

A. The National Fire Protection Association (NFPA) provides minimum fire protection requirements for the design, manufacture, installation, and use of lasers and associated equipment. During the planning and design phases, laser lab designers should consult *NFPA 115 - Standard for Laser Fire Protection* for minimum fire protection requirements, which are only valid for Class 3b and 4 laboratory lasers. It’s freely available at https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=115.

2.13. Biosafety Level 1, 2, 3, & 4 Labs

In general, biological labs are categorized into four Biosafety Levels (BSLs):

Biosafety Level 1 (BSL-1) is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans and that present minimal potential hazard to laboratory personnel and the environment.

Biosafety Level 2 (BSL-2) builds upon BSL-1 and is suitable for work with agents associated with human disease and poses moderate hazards to personnel and the environment.

Biosafety Level 3 (BSL-3) is suitable for work with indigenous or exotic agents that may cause serious or potentially lethal diseases through the inhalation route of exposure.

Biosafety Level 4 (BSL-4) is required for work with dangerous and exotic agents that pose a high individual risk of aerosol-transmitted laboratory infections and life-threatening diseases that are frequently fatal, agents for which there are no vaccines or treatments, or work with a related agent with unknown risk of transmission.

2.13.1. General

A. In general, BSL-1 labs should not be installed across UNM. Whenever technically and economically feasible, BSL-2 labs should be installed in lieu of BSL-1 labs to accommodate current and future operations. This recommendation is put forth because most BSL operations at UNM involve working with BSL-2 materials, and it can be costly to retrofit BSL-1 labs once built.

B. All biological labs should be designed consistent with the following:

   a. CDC/NIH's *Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th ed*, freely available at https://www.cdc.gov/labs/bmbl/index.html,

   b. NIH's *Design Requirements Manual (DRM)*, Revision 2.1 (8/6/2024), freely available at https://orf.od.nih.gov/TechnicalResources/Pages/DesignRequirementsManual2016.aspx,

   c. NIH's *Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules*, April 2024, freely available at https://osp.od.nih.gov/wp-content/uploads/NIH_Guidelines.pdf, and

   d. American Committee of Medical Entomology and American Society of Tropical Medicine and Hygiene's *Arthropod Containment Guidelines, Version 3.2*, freely available at https://www.liebertpub.com/doi/10.1089/vbz.2018.2431.

2.13.2. CDC Standards

A. All labs intending to use select agents or toxins must comply with 42 CFR 73, 7 CFR 331, and 9 CFR 121, which implements the provisions of the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, setting forth the requirements for possession, use, and transfer of select agents and toxins (defined therein).

B. Lab design must comply with 42 CFR 71.54 to maintain UNM's CDC Import Permits for infectious biological agents, infectious substances, and vectors. Specifically, these labs must be designed according to the *Biosafety in Microbiological and Biomedical Laboratories, 6th ed*.

2.13.3. NIH-funded Laboratory Standards

A. The National Institutes of Health (NIH) Design Requirements Manual (DRM) establishes policy, design requirements, standards, and technical criteria for use in planning, programming, and designing NIH-owned, leased, operated, and funded buildings and facilities. The NIH Design Requirements Manual is freely available at https://orf.od.nih.gov/TechnicalResources/Pages/DesignRequirementsManual2016.aspx

B. As a condition for NIH funding of recombinant or synthetic nucleic acid molecule research, institutions shall ensure that such research conducted at or sponsored by the institution, irrespective of the source of funding, shall comply with the *NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules, April 2024*, freely available at https://osp.od.nih.gov/wp-content/uploads/NIH_Guidelines.pdf. Note: Every rDNA research lab at UNM must follow the NIH Guidelines.

2.13.4. ANSI Guidelines

A. BSL-3 labs must design ventilation systems to comply with the most recent American National Standards Institute guidelines. Specifically, *Testing and Performance Verification Methodologies for Biosafety Level 3 (BSL-3) and Animal Biosafety Level 3 (ABSL-3) Ventilation Systems* (ANSI/ASSP Z9.14-2020). It is Copyright to ANSI, and you may obtain original copies of ANSI guides at https://webstore.ansi.org/Standards/ASSE/ANSIASSPZ9142020.

2.13.5. Animal Biosafety Labs

A. Labs expecting to use animals for laboratory research should be designed in reference to the BMBL and the National Research Council's *Guide for the Care and Use of Laboratory Animals, 8th Ed*, freely available at https://grants.nih.gov/grants/olaw/guide-for-the-care-and-use-of-laboratory-animals.pdf.

3. Post-Construction Standards

3.1. Commissioning Labs & Their Components

3.1.1. Commissioning Labs

A. Each lab must ensure that it complies with the *UNM Chemical Hygiene Plan (CHP)* before use. UNM's *CHP* is available at https://ehs.unm.edu/assets/documents/sop-copies/chem-hygiene-plan.pdf.

B. As applicable, a universal, chemical, hazardous, infectious, and/or biohazardous waste management plan is required to be in place for each lab before use. Learn more at https://ehs.unm.edu/waste-management/index.html.

3.1.2. Commissioning General Ventilation Systems

A. When a new ventilation system is installed, certification is required. Evaluations and certifications will be conducted by qualified FM personnel or one of their approved third-party vendors.

3.1.3. Commissioning Chemical Fume Hoods

A. New laboratory hoods shall be certified by the installing contractor to ACGIH standards, and they shall be tested by a qualified, independent tester (i.e., not a subcontractor of the general contractor) to ASHRAE 110 standards.[109] EHS may assist with the initial certification, but this cost is to be borne by the project or lab.

B. To request initial certification via EHS, please call 505-277-2753 or email us at ehsweb-L@list.unm.edu

Note: depending on the design and EHS's current capacity, the department may consult a third-party vendor with laboratory facility experience. Costs will be passed on to the responsible party as necessary. A third-party vendor ensures that the system meets the necessary criteria, notes any design errors, handles problems, and facilitates testing, installation, etc. EHS, Facilities Management, or a third-party vendor will continue to maintain the equipment, but the startup issues can easily be overwhelming.

[109] The University of New Mexico, Facilities Management, Engineering & Energy Services. 2025. *UNM Design Standards*. See § 11 53 00 Laboratory Equipment. Available at https://fm.unm.edu/assets/documents/design-standards.pdf.

UNM Laboratory Design Standard R0.1

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