



DO YOUR LABORATORY OPERATIONS MEASURE UP TO NFPA 45?

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Greetings! It's that time of year (again) when students and faculty return to campus from summer vacations, distracted by thoughts of football and leaves changing color, as they begin the fall academic season. It's a good time to review how your chemical laboratory has been prepared for safe and ongoing use by students and faculty. A thorough and well-thought-out laboratory safety plan is often the difference between a laboratory that remains safe throughout all seasons of its use, and one that's been prepared for use by incoming students new to your campus and its college scientific experience. To assist you in developing your laboratory safety plan, NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals, 2011 edition*, is available for your review on the NFPA website at www.nfpa.org. It can also be found using the following hyperlink: [NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals, 2011 Edition](#). Changes to NFPA 45 are identified by a vertical line in the left-hand margin of the page next to the paragraph containing the requirement.

The 10th edition of the NFPA 45 standard contains new requirements, information, and resources that are available on the NFPA website for your review in Real-Read format and the new or revised requirements should be incorporated into your laboratory safety plan. The 2011 edition of NFPA 45 includes major modifications to Chapters 4, 5, 9, 10, and 11 to modify the design, construction, and operational requirements for laboratories located in buildings over 1 story in height. Height restrictions were added for Class A and Class B laboratory units. See the definition of these laboratory classes in Chapter 3. The fire resistance rating of laboratory units, height restrictions, and quantities of hazardous materials were modified for laboratory units depending upon the height of the building containing the laboratories. Laboratories located in health care facilities previously covered by [NFPA 99: Standard for Health Care Facilities, 2005 Edition](#) were added to NFPA 45.

Hazardous materials in storage or use in a laboratory work area that could present an explosion hazard were quantified. Requirements for the management of time-sensitive chemicals were clarified in the 2011 edition.

NFPA 45 works hand-in-hand with the CRC *Handbook of Laboratory Safety* and the [OSHA Laboratory Standard \(29 CFR 1910.1450\)](#) to address the safety issues and considerations of a "wet bench" chemistry laboratory that meets the definition and criteria set forth in NFPA 45.

Whether you need to know the definition of a term used in the standard related to safe laboratory operations or what are the safe limits for flammable and combustible liquid storage in a laboratory, NFPA 45 has the information that you need to evaluate your laboratory.

- If you need to know the scope, purpose, and application of NFPA 45, then refer to Chapter 1. NFPA 45 applies to laboratory buildings, laboratory units, and laboratory work areas whether located above or below grade in which chemicals, (as defined in Chapter 3), are handled or stored. It also applies to handling and storage of chemicals where laboratory-scale operations are conducted, excluding the handling of explosive materials and radioactive materials. NFPA 45 does not apply to laboratories that handle only chemicals with hazard ratings of 0 or 1, as defined in [NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response, 2012 Edition](#).
- If you are looking to identify the referenced publications within NFPA 45, then refer to Chapter 2. Chapter 2 contains all of the mandatory references that are included in the standard, including those published by NFPA and those published by other organizations.

- If you are looking for answers on the definitions of terms used in NFPA 45, then refer to Chapter 3. If the term that you are looking for is not found in Chapter 3, then you should refer to Webster's Dictionary to define the term.
- If you are looking for requirements on how to classify the unit hazard level of a laboratory, then refer to Chapter 4. Chapter 4 contains the classification scheme for laboratory unit fire hazard assessment including laboratory work area and laboratory unit explosion hazard requirements. Types and quantities of chemicals and chemicals processes that present an explosion hazard are provided.
- If you are looking for the life safety requirements on how to classify a laboratory unit's design and construction, then refer to Chapter 5. Chapter 5 contains the maximum area of laboratory units, the requirements for life safety, and the means of access to an exit.
- If you are looking for the fire protection requirements for a laboratory unit, then refer to Chapter 6. Chapter 6 contains the requirements for automatic fire extinguishing systems, standpipe and hose systems, portable fire extinguishers, fire alarm systems, and the fire prevention strategies that must be applied to laboratory units. Chapter 6 includes procedures for handling, use, and storage of hazardous chemicals, flammable and combustible liquids and gases, a work permit system for open flame work, procedures for emergency operations and coordination with first responders, and procedures for extinguishing clothing fires. In addition, all labs must have automatic fire suppression systems installed.
- If you are looking for the explosion hazard protection requirements for a laboratory unit, then refer to Chapter 7. Chapter 7 addresses explosion-resistant construction, explosion venting, unauthorized access, and inspection and maintenance of explosion protection features. Chapter 7 addresses explosion protection features to consider including limiting quantities of explosion-prone chemicals/processes, the use of special protective measures (shields) or explosion-resistant construction features. It also contains requirements for limiting the number of people and access to area. It also has provisions for using explosion suppression in combination with explosion venting for very hazardous operations involving explosion-prone chemicals/processes.

Chapter 5 can help you determine how to arrange your laboratory furniture, casework, and equipment so as to not limit the egress capability from your laboratory unit. Laboratory units must comply with [NFPA 101: Life Safety Code, 2012 Edition](#), unless modified by NFPA 45. Laboratory units classified as Class A, Class B, or Class C are considered to be industrial occupancies due to the quantities of flammable and combustible liquids that they handle and store. While laboratory units that are classified as Class D, they are regulated as a business occupancy, which can also include instructional labs. See definition 3.3.31 for an instructional laboratory unit. Educational laboratory units are regulated as an educational occupancy.

Chapter 5 requires a 2nd means of exit access when any of the several identified conditions exist in a laboratory work area. Chapter 5 also addresses the swing of exit doors in the laboratory. For Class A and B laboratory units, the exit doors must swing in direction of exit travel. For Class C and D laboratory units, exit doors can swing in either direction, or slide horizontally, if they are in accordance with [NFPA 101: Life Safety Code, 2012 Edition](#).

- If you are looking for information on laboratory ventilation systems and hood requirements for a laboratory unit, then refer to Chapter 8. Chapter 8 contains all the information that you need to evaluate the basic requirements for laboratory air supply systems, where to locate exit air discharge ductwork, the requirements for duct construction for hoods and local exhaust systems, including duct velocities and chemical fume hood construction, location, and fire protection. Chapter 8 also contains the identification requirements for chemical fume hoods and the inspection testing and maintenance requirements for lab hoods.

Chapter 8 contains energy conservation considerations including fume hoods that reduce the exhaust

volume as the sash opening is reduced, must maintain a minimum exhaust volume. See the information in Annex A.8.4.7 on this subject. Chapter 8 contains requirements for laboratory work areas to be designed to be under negative pressure.

- If you are looking for information on chemical storage, handling, and waste disposal requirements, then refer to Chapter 9. Chapter 9 contains the requirements for handling and storage of all hazardous chemicals handled, stored, and used in the laboratory unit including waste disposal requirements.

Chapter 9 contains requirements on handling, receiving, and unpacking laboratory chemicals by trained personnel. It also requires the user to know how hazardous materials and waste will be disposed of, before they are used. Chapter 9 has requirements for liquid containers to be limited to 20 L (5 gal) capacity and provisions for quantities of hazardous chemicals to be within the design considerations commensurate with the chemical limits for the facility. Chapter 9 contains requirements for segregation of incompatible materials and time sensitive chemicals, which need to be identified with dates and tracked in storage.

- If you are looking for information on flammable and combustible liquid usage and storage requirements, then refer to Chapter 10. Chapter 10 contains the quantity limitations on flammable and combustible liquids, requirements for supply piping, provisions for liquid dispensing, including from pressurized-liquid dispensing containers, and other authorized equipment being used with flammable and combustible liquids.

In addition, Chapter 10 contains requirements for liquid dispensing and liquid transfer operations and the use of flammable liquid storage cabinets that comply with [*NFPA 30: Flammable and Combustible Liquids Code, 2008 Edition*](#).

- If you are looking for information on compressed and liquefied gases usage and storage requirements, then refer to Chapter 11. Chapter 11 contains the

requirements for the storage, handling, and use of compressed and liquefied gases in cylinders, storage and piped gas systems, including outdoor installation of compressed gas cylinders for servicing, and the requirements for cryogenic fluids.

In addition, Chapter 11 contains requirements that pertain to cylinder gas safety using extracted text from [*NFPA 55: Compressed Gases and Cryogenic Fluids Code, 2010 Edition*](#).

- If you are looking for information on laboratory operations and apparatus requirements, then refer to Chapter 12. Chapter 12 contains information on laboratory operations when handling very hazardous chemicals and laboratory apparatus, including heating operations involving distillations and separations and mixing and grinding of hazardous chemicals. There are safety requirements for the use of refrigeration and cooling equipment used to store flammable and combustible liquids.
- If you are looking for information on hazard identification requirements for laboratory units, then refer to Chapter 13. Chapter 13 contains the requirements for the identification of entrances, exhaust systems, labeling of containers, and the identification system for the marking of laboratory units.
- Annex A contains additional information that supplements the requirements in the body of the standard for all the chapters.
- Annex B contains the supplemental definitions that are needed to fully understand NFPA 45 that come from other NFPA codes and standards.
- Annex C contains supplementary information on laboratory explosion hazards and the protection features that are available to manage those hazards.
- Annex D contains supplementary information explaining the concept of the laboratory unit.

- Annex E contains information on the flammability characteristics of common compressed and liquefied gases.
- Annex F contains information safety tips for compressed gas usage in laboratory units.
- Annex G contains the informational references that are identified in all the annexes (A through F) in the standard.

References to other codes and standards in this article:

(Note: Not a complete list of codes, standards, or handbooks referenced in NFPA 45-2001)

- [NFPA 30: Flammable and Combustible Liquids Code, 2008 Edition](#)
- [NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals, 2011 Edition](#)
- [NFPA 55: Compressed Gases and Cryogenic Fluids Code, 2010 Edition](#)
- [NFPA 99: Standard for Health Care Facilities, 2005 Edition](#)
- [NFPA 101: Life Safety Code, 2012 Edition](#)
- [NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response, 2012 Edition](#)
- [OSHA Laboratory Standard \(29 CFR 1910.1450\)](#)

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