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NFPA 45 – 2015 Edition Changes and Issues Related to Energy Conservation

DOE Fire Safety Workshop

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** Disclaimer **

In the course of this presentation, any comment as to the "meaning" of any part of any NFPA code or standard is only the opinion of the presenter and is NOT to be relied upon as either accurate or official. Only the NFPA may issue a formal interpretation of its codes and standards.

This presentation is not on behalf of any vendors or their products.

OBJECTIVES

- Discuss major changes to the 2015 edition of NFPA 45
  - Some changes are retroactive for laboratory operations
- Discuss laboratory safety issues related to energy conservation
  - New requirements in the 2015 edition of NFPA 45 to address safe laboratory ventilation related to energy conservation

Laboratory Events Related to the Changes in NFPA 45

- School fined over Chemistry Explosion
- Students Burned in Lab Fire Settle
- Laboratory Researcher Dies of Burns from a Pyrophoric Chemical
- CSB Releases Investigation into 2010 Texas Tech Laboratory Accident; Case Study Identifies Systemic Deficiencies in University Safety Management Practices

Safety Costs

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"If you think Safety is expensive,

… try an Accident!"

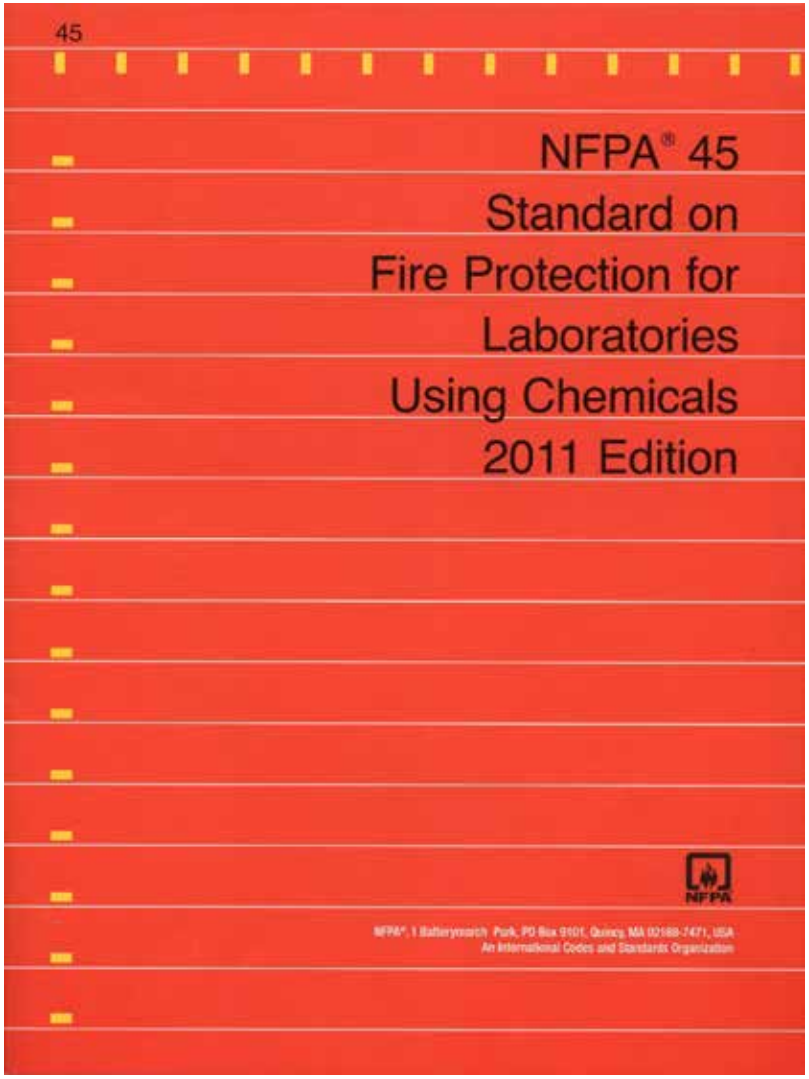
Dr. Trevor Kletz
Adjunct Professor
Texas A&M
Mary O'Conner
Process Safety Center

Typical Labs

Typical Lab – I Hope Not!

NFPA-45: History

- First edition – 1975
  - "Prudent Practices ...." - 1981
- Second edition - 1982
- Third edition – 1986
  - OSHA Lab Standard - 1990
- Fourth edition – 1991
  - ANSI Z9.5 "Laboratory Ventilation - 1992
- Fifth edition – 1996
- Sixth edition – 2000
- Seventh edition – 2004
- Eighth edition – 2011 Fall (2010)
- Ninth edition – fall 2104 (Pending)



Major Changes - Chapter 1: Scope

- NFPA 45 applies to ALL educational instructional laboratory units (1.1.2)
- NFPA 45 does not apply to a laboratory work area containing an explosion hazard great enough to cause property damage outside that laboratory work area or injury outside that laboratory work area requiring medical treatment beyond first aid (1.1.3(9))

Chapter 1: 1.4 Retroactivity

- Unless otherwise specified, the provisions of this standard are not retroactive, but AHJ may apply where unacceptable conditions exist.
- New wording in Chapters 6, 11 and 12 requires compliance with requirements for new and existing laboratories
  - Requirements apply to operational practices

Major Changes - Chapter 6

- 6.5 Fire Prevention and 6.6 Fire Retardant Clothing are retroactive
- 6.5.3 Emergency Plans has been expanded and clarified related to provisions in the emergency plans
- 6.6 Fire Retardant Clothing - new
  - Required for working with pyrophoric reagents outside of a glove box
  - Includes lab coats and gloves (whenever possible)
  - Requires natural fiber clothing to be worn under fire retardant clothing and on legs.

Major Changes - Chapter 7 Ventilation

- Old Chapter 7 on explosion hazards was deleted (most of text was moved to Annex C).
- 7.8.1 Chemical Fume Hood Interiors - revised.
  - Chemical fume hoods shall meet the requirements of UL 1805
- 7.10 Chemical Fume Hood Fire Protection - revised.
  - Requires automatic fire suppression for existing fume hoods with a flame spread index greater than 25 in which flammable liquids are handled.
  - Requires automatic fire suppression if a hazard assessment determines on is need for safe operation of the fume hood.

Major Changes - Chapter 7 Ventilation

- 7.11 Inert Atmosphere Glove Boxes - new
  - 7.11.1 Glove boxes shall be designed and operated in accordance with Section 4.1 of ANSI/AIHA Z9.5, Laboratory Ventilation.
  - Addresses venting of glove boxes and pressure controls
- 7.14 Inspection, Testing, and Maintenance - revised
  - 7.14.2 Deficiencies in hood performance shall result in immediate suspension of all activities inside the hood until the deficiencies are corrected.

Major Changes - Chapter 11

- 11.1 General: This chapter shall apply to new and existing laboratories.
- 11.2.6 Pyrophoric Reagent and Water Reactive Material Handling - New
  - Applies to liquid and solid materials
  - Requires training for researchers and supervision of inexperienced researchers.
  - Provides safe practices for handling materials in glove boxes or in a fume hood.
  - Requires neutralization or passivation of these materials to prevent fires.

Major Changes - Chapter 11

- 11.2.7 Open Flame Operations - new
  - Requires alternative methods whenever possible
  - Safety requirements for providing flame sources
  - Addresses biological operations that use open flames and flammable liquids, such as flame sterilization
- 11.3.2 Refrigeration and Cooling Equipment - revised
  - No longer allows the modification of domestic refrigerators for safe storage of flammable liquids
  - Requires use of listed special purpose refrigerators, freezers, and other cooling equipment

Energy Conservation and Laboratory Safety

- Ventilation of labs is the highest cost of operating a lab
- Energy conservation and reducing energy use is a requirement for all DOE laboratories
- Proper design of laboratory ventilation systems is critical providing a safe work environment
- A number of issues related to safe operation of lab ventilation systems have been reported since the use of energy conservation was started about 15-20 years ago

Energy Conservation and Laboratory Safety

- Issues related to proper ventilation of laboratories include:
  - Inadequate ventilation rates for laboratories where chemicals are stored and used
  - Deposition of liquids or condensable solids in chemical exhaust systems
  - Plugging of heat recovery coils by lab wipes and other debris that can get sucked in the chemical exhaust system
  - Recirculation of hazardous gases, fumes or vapors into the laboratory work space

- NFPA 45 Chapter 7 Ventilation – requirements:
  - Supply and Exhaust Ventilation Design
    - Requirements for control of flammable vapors, gases and mists
    - 7.2.2 Laboratory units and laboratory hoods in which chemicals are present shall be continuously ventilated under normal operating conditions.
    - 7.2.6 The release of chemical vapors into the laboratory shall be controlled by enclosure(s) or captured to prevent any flammable and/or combustible concentrations of vapors from reaching any source of ignition.
    - 7.4.1 Air exhausted from chemical fume hoods and other special local exhaust systems shall not be recirculated.

Energy Conservation and Laboratory Safety

- NFPA 45 Chapter 7 Ventilation – requirements:
  - 7.4.2 Energy Conservation Devices
    - 7.4.2.1 If energy conservation devices are used, they shall be designed in accordance with 7.3.1 and 7.3.2.
    - 7.4.2.2* Energy conservation devices shall only be used in a laboratory ventilation system when evaluated and approved by a qualified person. These systems must meet, or exceed, the criteria established by Section 5.4.7 and Section 5.4.7.1 of ANSI/AIHA Z9.5-2012, Laboratory Ventilation. Systems that recirculate within their respective laboratory work area, such as fan coil units for sensible heat loads, are exempt from these requirements.
    - A.7.4.2.2 It is not the intent of the standard to prohibit or impede the use of any energy conservation devices. However, the committee is concerned that adequate design consideration should be given as to how to clean and maintain these devices as the systems age.

- NFPA 45 Chapter 7 Ventilation – requirements:
  - 7.6 Duct Velocities. Duct velocities of laboratory exhaust systems shall be high enough to minimize the deposition of liquids or condensable solids in the exhaust systems during normal operations in the chemical fume hood.
  - 7.6.1 If dirt, dust, or particulate generation in significant amounts is expected in a hood, then other measures such as separate dust filtration systems shall be required.
  - 7.6.2 If significant amounts of condensable vapors are generated in the hood, then other measures such as condensing systems for condensate traps shall be provided.

Energy Conservation and Laboratory Safety

- Energy conservation devices include
  - Variable Air Volume (VAV) vs. Constant Air Volume (CAV) Hoods
  - Low Flow CAV and VAV Hoods
  - Ductless Fume Hoods – limited use (A.7.4.1)
  - Heat Recovery systems
  - Fume hoods that reduce the exhaust volume as the sash opening is reduced should maintain a minimum exhaust volume Annex A.7.4.7

VAV Fume Hood

VAV Type Chemical Fume Hood

Monitor Panel

Low Flow Fume Hood

Low Flow Type Chemical Fume Hood with VAV

Low Flow Fume Hood

- Installed December 2010
- Operated at 65 lfpm with sash at 18 inches
- VAV reduces air flow to about 40 lfpm with sash closed
- Note: Airflow monitor in lower left corner

Ductless Enclosures & Fume Hoods

Ductless Fume Hoods and Enclosures

- Limited use NFPA 45 - 7.4.1 and A.7.4.1
- Recirculates air from hood through carbon or chemically active adsorbent filter back into lab
- Not for use with toxic/highly toxic materials
- Modern ductless hoods have 2 levels of filters and break though alarms
- Filters may not capture many common gases like hydrogen, CO
- Not appropriate for changing chemistry
- Heat producing operations can drive off hazardous gases/vapors from filters – recommended operating below 100º F
- See Article – Part III on page 5 at: http://www.safelab.com/DOWNLOAD/SCRUBBER.pdf
- Enclosures will not capture heavier than air vapors
- One universities policy on ductless hoods
  - Ø http://www4.uwm.edu/usa/safety/laboratory_safety/ductless_fumehoods.cfm

Ductless Enclosure

Contact Information

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Questions?

Promote safety!

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End

Thank you