

# TEMPORARY CHANGE REQUEST

TCR NO. ES & HD 5008, Sect 5, Chapt. 9, R0-001

The Temporary Change Request (TCR) Form is to be used to process urgent or minor changes for PPPL Policies, Organization/Mission Statements and Procedures. The TCR should be used when changes are:  
1) urgent, and can not wait the 2-4 week period for Department Head review/comment, or  
2) minor, and do not warrant Department Head review.

**Person Requesting Change:** R. Jeanes

**Department Name:** Facilities & Site Services **Phone Ext:** 2532

**Document Number:** ES & HD 5008, Section 5 **Revision No.:** 0

**Document Title:** "Fire Protection for Special Hazards"

**Reason for change:** Reflect changes in organizations and in referenced Standards.

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**Change description:** (Summarize and attach changed pages, with changes clearly indicated)

Standard References Updated; organizational names updated

1. Does this TCR significantly alter the intent or scope of the document? **YES:**    **NO:** X

2. Does this TCR significantly impact **ES&H**? **YES:**    **NO:** X

If 1 or 2 is **YES**, Explain why the changes should not be routed for Department Head review:

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O OXkqrc  
Department/Division Head Approval

9B; B5  
Date

LOF gNqqr gt  
Head, Best Practices and Outreach

945B5  
Date

Release/Effective date of this TCR: 945B5

Incorporate this TCR into next revision of this document? **Yes** Z **No**

PPPL	PRINCETON PLASMA PHYSICS LABORATORY ES&H DIRECTIVES	
	ES&HD 5008 SECTION 5, CHAPTER 9 Fire Protection For Special Hazards	
Approved	Date: 1/31/06      Revision 0	Page 1 of 16

**ES&HD 5008, Sect. 5, Chapt. 9, R0-001**

## CHAPTER 9, FIRE PROTECTION FOR SPECIAL HAZARDS

### 9.1 Temporary Enclosures

9.1.1 Temporary enclosures shall be installed and maintained in compliance with NFPA 241, "Safeguarding Construction, Alterations, and Demolition Operations," and

9.1.2 Management shall ensure that:

- A. Temporary enclosures erected within a facility are not structurally supported by piping for automatic sprinkler systems or other Facilities and Site Services FPE equipment.
- B. The enclosure supporting structures are constructed of noncombustible or fire-retardant material which is approved by Facilities and Site Services FPE.
- C. The coverings for enclosure walls, ceilings, and floors are of noncombustible or approved fire-retardant materials. Where plastic films are used, only plastic films approved by Facilities and Site Services FPE are used.
- D. Combustible materials are not stored within the enclosure.
- E. Flammable and/or combustible liquids are kept to an absolute minimum and are stored in and dispensed from Underwriters Laboratories (UL) or Factory Mutual (FM) approved safety cans. Flammable or combustible liquid-soaked clothes, rags, or waste are stored in UL or FM approved safety containers.
- F. Combustible materials which are used in the enclosure operations (e.g., rags, paper products, etc.) are removed from the enclosure immediately after use or transported and stored in approved metal containers with lids. All combustible waste is removed from the enclosure after each work shift.
- G. Exits are kept unobstructed at all times.
- H. Cutting, welding, open flame, or grinding are not performed in enclosures without an approved Permit.
- I. Portable fire extinguishers are provided and positioned for visibility and easy access.

### 9.2 Computer/Data Acquisition Facilities

9.2.1 Computer/data shall comply with the following codes and standards as applicable:

- A. NFPA 75, “Standard for the fire protection of information technology equipment,”

9.2.2 Management shall ensure that:

- A. Furniture in computer areas is metal and limited to what is required for efficient operations.
- B. Waste containers are noncombustible and listed.
- C. Waste containers are emptied daily.
- D. Office or computer supplies, forms, stationary, and other combustible supplies are not stored in the computer area.
- E. Maintenance operations are not performed in the computer area, except for those repairs made directly to equipment which is impractical to remove from the area.
- F. Records and tapes are not stored in the computer area, except those required for daily operations.
- G. Records and tapes required for daily operations are stored in closed metal cabinets.
- H. Computer areas have an equipment salvage plan in place for the reconditioning of equipment which is exposed to smoke and water.
- I. Fire protection features are provided in accordance with NFPA 75.
- J. Employees who normally work in computer facilities are familiar with the fire protection systems in their work area.
- K. Computer facilities with raised floors are provided with floor lifters which are mounted near the room exit door.

### 9.3 Oxidizing Materials

9.3.1 The storage, use, and handling of liquid and solid oxidizing materials (as defined by NFPA 49) shall comply with:

- A. NFPA 430, “Storage of Liquid and Solid Oxidizers”
- B. NFPA 55, “Compressed Gases and Cryogenic Fluids Code.”

Identification of the Hazards of Materials for Emergency Response,”

9.3.2 Management shall ensure that:

- A. An emergency plan is in place for facilities storing oxidizing materials.

- B. Storage facilities are labeled with the “Class” of oxidizer they contain (reference NFPA 400, “Hazardous Materials Code”).
- C. Oxidizing material is not stored with incompatible materials such as ordinary combustibles, flammable/combustible liquids, greases, etc. (This does not apply to approved packaging material.)
- D. The total amount of oxidizing material for each “Class” does not exceed two tons in non-sprinklered buildings or four tons in sprinklered buildings.
- E. Employees involved in the storage operation receive instruction on handling the material in a safe manner.
- F. “No Smoking” signs are posted at the entrance and within the storage building.
- G. Any wood construction in storage buildings that may come in contact with oxidizers is protected with a compatible material to prevent the wood from impregnation by the oxidizers.
- H. Combustible waste and used or empty containers are not stored with the oxidizing material.

#### **9.4 Gloveboxes**

9.4.1 Gloveboxes and their use shall comply with the Glovebox Fire Protection Criteria located in the DOE Fire Protection Resource Manual, and DOE-STD-1066-97, "Fire Protection Design Criteria"

9.4.2 Management shall ensure that:

- A. All new gloveboxes and windows are constructed of noncombustible or fire retardant materials.
- B. Glovebox gloves are of hypalon or neoprene material.
- C. Window size is held to a minimum consistent with good operator vision and maintenance needs.
- D. Gloveboxes are equipped with fire protection (reference DOE-STD-1066-97).
- E. Only combustibles required for daily operations are permitted in a glovebox.
- F. Transient combustibles in gloveboxes are kept in closed metal containers.
- G. Combustible waste is removed from gloveboxes daily or placed in closed metal containers.
- H. Flammable and combustible liquids used in gloveboxes are stored and dispensed from approved safety cans.
- I. Glovebox exhaust filter openings are equipped with fire screens.

- J. Heat-producing equipment in gloveboxes (e.g., calciners, hot plates) are equipped with high temperature automatic shut-off devices, safety shut-off valves, or safety tip-over switches.

## 9.5 Explosives

9.5.1 Any material classified as an explosive by Title 18, USC, Chapter 40 and the Hazardous Material Regulations of the U.S. Department of Transportation shall be stored, and handled in compliance with the following codes and standards as applicable:

- A. NFPA 495, “Explosive Material Code”
- B. NFPA 498, “Safe Havens and Interchange Lots for Vehicles Transporting Explosives”
- C. 27 CFR, Parts 55 , “Explosive Materials Regulations
- D. 49 CFR, Parts 100-180, “Transportation”
- E. ATF 5400.7, “Alcohol, Tobacco, and Firearms: Explosives Laws and Regulations”
- F. 18 USC 40, “Importation, Manufacture, Distribution, and Storage of Explosive Materials”

NOTE: Charges for Powder Actuated Fastening Devices (Hilti, etc.) are considered as small arms ammunition. As such, handling and use is governed by NFPA 495.

9.5.2 Management shall ensure that:

- A. The manufacture, storage, and use of explosive materials are prohibited unless it can be done in a safe manner.
- B. The safety of the explosive workers, the general public, and the environment in the vicinity of the explosive materials are the primary importance of the operations.
- C. Smoking and flame-producing equipment are not permitted in the vicinity where explosive materials are produced, handled, stored, or used.
- D. All explosive materials which are not in the process of manufacture, being transported, or in use are kept in a storage magazine.
- E. Storage magazines are of the proper construction and are properly located for the type and amount of explosive being stored.
- F. The area around storage magazines is kept clear of brush, dry grass, leaves, or similar combustibles for a minimum distance of 25 feet.
- G. Combustible materials are not stored within 50 feet of explosive magazines.

- H. All electrical equipment utilized near explosive material complies with NFPA 70, “National Electric Code” for “Classified Hazardous Areas.”
- I. Precautions are taken to prevent accidental detonation of explosives from currents induced by radar and radio transmitters, lightning, adjacent power lines, dust and snow storms, or other sources of extraneous electricity. These precautions shall include:
  - 1. The posting of signs warning against the use of mobile radio transmitters on all roads within 350 feet of explosive operations, as required.
  - 2. Tools used in the handling of explosives shall be constructed of non-sparking materials.
  - 3. All handling of explosive materials shall be discontinued during the approach and progress of an electrical storm. All personnel shall move to a safe location.
  - 4. Bonding and grounding straps shall be provided for all equipment where explosive materials are processed and handled.
  - 5. Floorings shall be of non-sparking material.

## **9.6 Transportation of Hazardous Materials**

9.6.1 The transportation of hazardous materials shall be in compliance with the following codes and regulations as applicable:

- A. NFPA 30, “Flammable and Combustible Liquids Code”
- B. NFPA 58, “Liquefied Petroleum Gas Code”
- C. NFPA 59, “Liquefied Petroleum Gases at Utility Plants”
- D. NFPA 59A, “Production, Storage and Handling of Liquefied Natural Gas”
- E. NFPA 77, “Static Electricity”
- F. NFPA 326, “Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair”
- G. NFPA 385, “Tank Vehicles for Flammable and Combustible Liquids”
- H. Deleted
- I. NFPA 495, “Explosive Materials Code”
- J. 18 USC 40, “Importation, Manufacture, Distribution, and Storage of Explosive Materials”
- K. 46 CFR, Parts 1-199, “Shipping”

- L. 49 CFR, Parts 100-199, "Transportation"
- M. 49 CFR, Parts 393, 396, 397, "Transportation"

9.6.2 Management shall ensure that:

- A. Hazardous materials are transported in compliance with the U.S. Department of Transportation Hazardous Material Regulations. All vehicles and containers used for transportation of hazardous materials are provided with the proper valves, piping, hoses, connectors, pumps, meters, dispensers, regulators, strainers, and emergency venting.
- B. Hazardous Materials are not being stored in a vehicle that is not in compliance with the U.S. Department of Transportation Hazardous Material Regulations.
- C. During transportation, all:
  - 1. Vehicles and containers used for transportation of any material covered by this Section (regardless of quantity being transported, or whether loaded or empty) are conspicuously and legibly marked in accordance with the requirements of the U.S. Department of Transportation Hazardous Material Regulations.
  - 2. Vehicle drivers are thoroughly trained and licensed in the proper method of operating, loading, and unloading the vehicle.
  - 3. Vehicles are operated only when they are in proper repair, devoid of accumulation of grease, oil, and free of leaks.
  - 4. Material containers used in transportation are chemically compatible with the material being transported.
  - 5. Vehicles, except in an emergency situation, are not parked and left unattended adjacent to any building, street, highway, avenue, or alley, that is not connected with the normal duties of the vehicle.
  - 6. Vehicles used for transporting explosive materials are not exposed to spark producing surfaces on the inside of the transporting body.
  - 7. Explosive materials are not transported through any prohibited vehicular bridge, roadway, or elevated highway.
- D. Vehicle Repairs are:

1. Not made unless the repairs can be made without hazard.
  2. Not performed in a closed building or with the vehicle loaded or unpurged.
- E. During the Loading/unloading process:
1. Material is not removed from a vehicle unless the parking brake is securely set, wheels blocked as required, and all other reasonable precautions have been taken to prevent motion of the vehicle.
  2. Vehicles are bonded and grounded as required.
- F. Vehicles used for transportation of materials covered by this Section are designated as “No Smoking” areas.
- G. Vehicles used for transportation of materials covered by this Section are provided with at least one 20-B:C rated fire extinguisher, or two 10-B:C rated fire extinguishers.
1. Extinguishers are maintained in good operating condition (see this section, Chapter 8, Paragraph 8.3, “Portable Fire Extinguishers”) and are located on the vehicle in an accessible location.

## 9.7 Clean Rooms

9.7.1 Clean rooms shall be operated and maintained in accordance with:

- A. NFPA 318, “Protection of Semiconductor Fabrication Facilities”
- B. Factory Mutual Data Sheet, FM 1-56, “Cleanrooms”
- C. Factory Mutual Data Sheet, FM 7-7, “Semiconductor Fabrication Facilities.”

9.7.2 Management shall ensure that:

- A. The interior finish of clean rooms has a flame-spread rating of 25 or less and a smoke development of 50 or less in accordance with ASTM E-84.
- B. Carpet and flooring used in clean rooms has a minimum, average, critical-radiant flux of 0.25 watts per square centimeter when tested in accordance with ASTM E-648.
- C. Clean rooms are constructed of fire-resistive or noncombustible construction and are separated from other occupancies by minimum one-hour fire-rated construction.
- D. All piping, ductwork, cables, etc., passing through fire-rated construction are fire stopped or wrapped with the appropriate materials for the penetration rating. Fire dampers shall not be installed in exhaust ventilation systems.

- E. Clean rooms are subdivided by one-hour fire rated partitions into the smallest areas possible to limit damage in the event of fire. Individual clean room areas should not exceed 10,000 square feet.
- F. Clean rooms have an engineered smoke-control systems, designed to exhaust 100% air in the fire area and simultaneously provided areas adjacent to the fire area with 100% supply so that at least 0.20 inch water-gauge higher pressure is provided in the adjacent areas.
- G. Bench stations handling flammable, combustible, or corrosive materials are provided with ventilation-hood systems.
- H. Bench stations and hoods are made of noncombustible materials.
- I. Ducting in ventilation systems is made of noncombustible materials or of materials that have a flame spread of 25 or less and smoke development of 50 or less when tested in accordance with UL 181.
- J. All electrical equipment and wiring complies with NFPA 70, "National Electrical Code."
- K. Sprinkler protection is provided throughout the clean rooms, including under workbenches and under exhaust hood systems.
- L. Automatic smoke detection and alarm system are provided throughout clean rooms.
- M. Smoke detection is provided on a 200 square foot maximum spacing, due to high airflows associated with clean rooms.
- N. Smoke detection sounds internal evacuation alarms, actuates the smoke-control systems, and signals the ESU.
- O. Clean agent, or sprinkler systems are provided for underfloor spaces over 5,000 cubic feet where the space contains power, communication, or data cables that are not located in approved conduit or metallic tubing.
- P. HEPA filters used in clean rooms are UL listed per UL 900.
- Q. HEPA filters and ducts are inspected frequently, and filters are cleaned or replaced on a regular schedule.
- R. HEPA filters are not patched or plugged to improve their efficiency as this action adversely affects their fire resistance.
- S. Exiting from clean rooms complies with NFPA 101, "Life Safety Code."
- T. Combustible and/or flammable liquids and corrosive liquids are limited to one day supply in a clean room and are stored in approved safety containers. A maximum of a 10 day supply of combustible and/or flammable liquids and corrosive liquids may be located in a clean room provided they are stored in an approved, noncombustible storage cabinet or locker. All other combustible and/or

flammable or corrosive liquids shall be separated from the clean room by one-hour, fire-rated construction.

- U. Flammable gases used within clean rooms have the supply cylinder or bulk tanks located outside the clean room, separated by one-hour, fire rated construction.
- V. All process and production areas are kept clean and free of all combustible materials such as cartons, papers, and packaging materials.
- W. Portable fire extinguishers are provided per NFPA 10, "Portable Fire Extinguishers."
- X. Detailed emergency procedures are posted in the clean room. Procedures should included instructions for shutting off all hazardous gases, maintaining fume exhaust systems, and sounding an evacuation alarm. Personnel should be trained in the emergency procedures.
- Y. No sprinkler head or smoke detector shall be within 3 feet of a diffuser.

## **9.8 Laboratories**

- 9.8.1 Laboratories, as defined by NFPA 45, shall be operated and maintained per NFPA 45, "Fire Protection for Laboratories Using Chemicals." and per Section 8, Chapter 3 of this EHSD, "Chemicals in Laboratories".

## **9.9 Pyrophoric Materials**

- 9.9.1 Processes and facilities where pyrophoric materials and combustible metals are stored, processed, or handled shall be in compliance with the following standards, as applicable:

- A. NFPA 68, "Explosion Protection by Deflagration Venting"
- B. NFPA 69, "Explosion Prevention Systems"
- C. NFPA 704, "Identification of the Hazards of Materials for Emergency Response"
- D. NFPA 484, "Combustible Metals"

- 9.9.2 Management shall ensure that:

- A. The appropriate extinguishing agents are utilized where pyrophoric materials and combustible metals are processed, stored, or handled. Most pyrophoric materials react violently with water, foam agents, halogenated agents, and carbon dioxide gas. Some combustible metals cannot be extinguished with water and require special extinguishing powders (for Class D fires) or special inerting gases.

- B. Processes involving pyrophoric materials are performed in an enclosed, oxygen-free, oxygen-deficient, or inerting atmosphere that is moisture controlled (dry).
- C. Whenever inert gas systems are used, a reserve supply of gas is available for emergency use.
- D. Ordinary combustible materials, such as paper, wood, cartons, packing material, etc., are not stored or allowed to accumulate near processes where pyrophoric materials and combustible metals are handled.
- E. Smoking and uncontrolled use of open flames are prohibited where materials are processed, stored, or handled. Areas shall be clearly posted with “No Smoking” signs.
- F. Non-sparking tools are used when handling combustible metal powders.

## 9.10 Portable Structures

9.10.1 Portable structures shall be installed and maintained in compliance with DOE-STD-1088-95, "Fire Protection for Relocatable Structures"

9.10.2 Management shall ensure that:

- A. The placement and use of all portable structures are reviewed by the Facilities and Site Services FPE.

## 9.11 Hazardous Material Storage

9.11.1 The storage of hazardous materials shall be in compliance with the following standards as applicable:

- A. NFPA 30, “Flammable and Combustible Liquids Code”
- B. NFPA 400, “Hazardous Materials Code”
- C. Deleted
- D. NFPA 55, “Compressed Gases and Cryogenic Fluids Code”
- E. NFPA 58, “Liquefied Petroleum Gas Code”
- F. NFPA 59A, “Production, Storage and Handling of Liquefied Natural Gas”
- G. NFPA 13, “Installation of Sprinkler Systems”
- H. Deleted

- I. Fire Protection Guide to Hazardous Materials”
- J. NFPA 704, “Standard System for the Identification of the Hazards of Materials for Emergency Response”

9.11.2 Management shall ensure that:

- A. Hazardous-material storage is separated by minimum distances from other facilities and from personnel areas.
- B. Incompatible hazardous-materials in the same building are separated by suitable fire rated construction. A material that is incompatible with another is a material that can cause hazardous reactions or can promote or initiate combustion with the material. Examples of materials that require separation between each other are flammable and/or combustible liquids, corrosive materials, oxidizers, and water reactives.
- C. Incompatible-hazardous materials stored outside of buildings are separated from one another by minimum distances.
- D. Hazardous-materials are stored in the appropriate containers.
- E. Hazardous-material storage areas and buildings are provided with containment for liquid run-off control.
- F. Hazardous-material storage buildings and aboveground tanks are provided with fire protection.
- G. Hazardous-materials that may cause environmental damage in the event of fire are located in separate hazardous-material containment buildings or tanks.
- H. Separate hazardous-material containment buildings are provided with sprinkler protection or other approved fire-protection control and extinguishing systems.
- I. Accumulation of combustible materials such as cartons, papers, and packaging materials is prohibited in and around hazardous-material storage.
- J. Weeds or similar combustibles are not permitted within 15 feet of hazardous-material storage areas.
- K. Portable fire extinguishers in hazardous storage buildings are provided for the appropriate hazard per NFPA 10, “Portable Fire Extinguishers.”
- L. Personnel involved in hazardous material-operations receive instructions in handling the materials in a safe manner.
- M. Smoking is not permitted in or near hazardous storage areas.
- N. Storage facilities are not used as dispensing facilities.

## 9.12 Hydrogen Systems

9.12.1 Hydrogen systems shall be installed and maintained in compliance with the following standards as applicable:

- A. NFPA 50A, "Gaseous Hydrogen Systems at Consumer Sites"
- B. NFPA 55, "Standard for Liquefied Hydrogen Systems at Consumer Sites"
- C. NFPA 77, "Recommended Practice on Static Electricity"
- D. 49 CFR, Parts 100-199, "Transportation"
- E. Compressed Gas Association Publications.

9.12.2 Management shall ensure that:

- A. Gas or liquid hydrogen is stored in approved containers equipped with pressure relief-devices.
- B. Piping, tubing, fittings, valves, gages, and regulators in hydrogen systems are suitable for hydrogen service.
- C. Hydrogen storage is not permitted inside buildings other than in separate, specially designed buildings or rooms or in conjunction with systems having a total inventory (including storage) of less than 400 cubic feet.
- D. Storage containers, piping, valves, regulating equipment, and other accessories are readily accessible to authorized personnel, the ESU apparatus, and are protected against physical damage.
- E. Hydrogen systems are electrically bonded or grounded before discharging hydrogen.
- F. Legible instructions are maintained at locations that require operation of hydrogen equipment by the user.
- G. A qualified person is in attendance at all times when mobile hydrogen-supply equipment is unloading hydrogen.
- H. Each hydrogen system installed is inspected annually and maintained by qualified personnel.
- I. Weeds or similar combustibles are not permitted within 15 feet of gaseous hydrogen-system equipment or within 25 feet of liquefied hydrogen system equipment.

- J. Personnel using hydrogen and hydrogen equipment are provided documented training on the fire hazards associated with hydrogen, e.g. the flames are practically invisible.

### 9.13 Records Storage

9.13.1 Records storage shall be in compliance with the following standards as applicable:

- A. NFPA 232, "Protection of Records"
- B. NFPA 232A, "Guide for Fire Protection for Archives and Records Centers"
- C. NFPA 909, "Protection of Cultural Resource Properties - Museums, Libraries, and Places of Worship"
- D. 36 CFR, Chapter XII, "Records Management"
- E. NFPA 75, "Standard for the Fire Protection of Information Technology Equipment,"

9.13.2 Management shall ensure that:

- A. Vital and important records (as defined by NFPA 232) are protected against fire.
- B. Records that can be reproduced are duplicated and stored away from the originals so they will not be subject to the same fire incident.
- C. Vital and important records are located and stored in noncombustible buildings protected with automatic sprinklers.
- D. Areas that provide storage of vital and important records are provided with smoke detection systems.
- E. Appropriate fire extinguishers are provided for record storage vaults, file rooms, and record storage areas.
- F. Good housekeeping, orderliness, and maintenance of equipment are provided for record storage areas.
- G. Record storage areas are posted as "No Smoking" areas.
- H. File rooms and storage vaults are not used as working spaces.

- I. Persons other than those authorized to handle records are not permitted in file rooms and record vaults.

## 9.14 Lightning Protection

9.14.1 The installation and maintenance of lightning protection shall be in compliance with the following standards as applicable:

- A. NFPA 70, “National Electric Code”
- B. NFPA 780, “Standard for the Installation of Lightning Protection Systems”
- C. Factory Mutual Data Sheet, FM 5-11 “Lightning and Surge Protection For Electrical Systems”

9.14.2 Management shall ensure that:

- A. Lightning protection systems are provided for facilities that handle, process, or store radioactive materials, explosives, or similarly hazardous materials; buildings containing high value equipment; and structures having a severe lightning risk value per NFPA 780, Appendix H.
- B. Electric power and communication services to all facilities and underground power cables, where connected by overhead power distribution lines, have lightning and surge protection.
- C. All lightning protection systems are maintained.
- D. All lightning protection systems are visually inspected per NFPA 780, Appendix B, annually.
- E. Complete in-depth testing and inspections per NFPA 780, Appendix B, are performed every three years on critical systems providing lightning protection for facilities involving radioactive or explosive materials.
- F. Inspection and maintenance procedures are in place for personnel performing lightning protection system maintenance and inspections.
- G. Inspection and maintenance records of the lightning protection systems are documented and maintained for auditing purposes.

## 9.15 Electrical System Components In Division 1 & Division 2 Hazardous Areas

9.15.1 Electrical system components in Division 1 and Division 2 hazardous areas shall be installed and maintained in compliance with the following standards as applicable:

- A. NFPA 70, “National Electrical Code”
- B. NFPA 495, “Explosive Material Code”

- C. NFPA 496, “Purged and Pressurized Enclosures for Electrical Equipment”
- D. NFPA 497, “Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas”
- E. NFPA 499, “Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas”

9.15.2 Management shall ensure that:

- A. Electrical equipment of the proper classification is provided in locations where flammable vapors, liquids, gases, or combustible dusts or fibers may be present in concentrations sufficient to produce explosive or ignitable mixtures.
- B. All electrical equipment used in hazardous areas is Underwriters Laboratory Listed or Factory Mutual Approved for use in the appropriate hazardous atmosphere.
- C. No alterations or modifications are made to Listed or Approved equipment for hazardous locations. If modifications are made, the equipment shall be void for use in a classified hazardous location.

## 9.16 Lasers

9.16.1 The installation, maintenance, and use of laser systems shall be in compliance with the following standards as applicable:

- A. NFPA 70, “National Electrical Code”
- B. American National Standards Institute, ANSI/Z136.1 “Safe Use of Lasers”

9.16.2 Management shall ensure that:

- A. All class lasers and laser systems have protective housings, interlocks, circuit breakers, insulation, switching devices, and the appropriate affixed warning labels.
- B. When a high valued laser system is located in a building, the building is protected by automatic fire detection and fire suppression systems.
- C. All electrical equipment is installed in accordance with NFPA 70.
- D. All laser system frames, enclosures, and other accessible, non-current-carrying metallic parts are grounded.
- E. Lasers and laser systems are operated and maintained by authorized employees only.

- F. Employees involved with lasers and laser systems are properly trained.
- G. Procedures are developed for the proper installation and use of all laser systems.
- H. Beam target areas of Class IV lasers (per ANSI Z136.1) are free of combustible and flammable materials.
- I. Lasers using flammable liquids are provided with effective means of controlling liquid fires.
- J. Experimental lasers that are not listed or approved for use in classified hazardous locations and have unique electrical components are provided with the necessary precautions to control all fire hazards.