

CHAPTER 3 FIRE PROTECTION ENGINEERING

3.1 FIRE PROTECTION CRITERIA and REQUIREMENTS

3.1.1 The following documents are the baseline criteria of the Fire Protection Program. The Program shall be administered to provide and maintain compliance with these requirements as a minimum. The fire protection related codes and standards in effect when facility design commences (code of record) shall remain in effect for the life of the facility.

3.1.2 When substantial upgrades or modifications are made, the current edition of the code shall apply to the upgrade or modification. Also, if there is a significant hazard that endangers building occupants, the public, or the environment as determined by DOE/Chicago, the facility shall be upgraded to the requirements of the current edition of the code or standard.

- A. DOE 5480.7, "Fire Protection"
- B. DOE 6430.1A, "General Design Criteria"
- C. National Fire Protection Association Codes and Standards
- D. Title 29, Code of Federal Regulations 1910 and 1926
- E. DOE/EP- 0108, "Standard for Fire Protection of AEC Electronic Computer Data Processing Systems"
- F. DOE/EV-0043, 8-79, "Standard on Fire Protection for Portable Structures"
- G. Product Directories of "Underwriters Laboratories," along with the periodic supplements.
- H. Factory Mutual Research Corporation Approval Guide
- I. TFTR Final Safety Analysis Reports, 1992
- J. TFTR Technical Specification
- K. PPPL Documents

1. ENG-026, "Fire Detection and Suppression Systems"
2. ESH-014, "NEPA Review System"
3. GEN-003, "Document Distribution Control"
4. GEN-006, "Occurance Reporting and Processing of Operations Information"
5. PPPL Drafting Manual
6. QA-013, "Failure Reporting"
7. TFTR 23.007A, "TFTR Configuration Control"
8. TFTR 23.016, "Design Reviews"

3.2 TECHNICAL LIBRARY

3.2.1 As a minimum, the following shall be maintained in the ES&HD Library:

- A. DOE 5480.7, "Fire Protection"
- B. DOE 6430.1A, "General Design Criteria"
- C. National Fire Protection Association Codes and Standards
- D. Title 29, Code of Federal Regulations 1910 and 1926
- E. DOE/EP- 0108, "Standard for Fire Protection of AEC Electronic Computer Data Processing Systems"
- F. DOE/EV-0043, 8-79, "Standard on Fire Protection for Portable Structures"
- G. Product Directories of "Underwriters Laboratories," along with the periodic supplements.
- H. Factory Mutual Research Corporation Data Sheets
- I. DOE Fire Protection Resource Manual

J. PPPL Documents

1. ENG-026, "Fire Detection and Suppression Systems"
2. ESH-014, "NEPA Review System"
3. GEN-003, "Document Distribution Control"
4. GEN-006, "Occurance Reporting and Processing of Operations Information"
5. PPPL Drafting Manual
6. QA-013, "Failure Reporting"
7. TFTR 23.007A, "TFTR Configuration Control"
8. TFTR 23.016, "Design Reviews"

3.2.2 Desired referenced material includes the following:

- A. "General Fire Fighting Guidance for Nuclear Weapons"; this document is confidential restricted data (DOE TP20-11)
- B. National Fire Protection Association Handbooks
- C. National Fire Protection Association guides, manuals and recommended practices
- D. Factory Mutual Loss Prevention Data Sheets
- E. Society of Fire Protection Engineers (SFPE) Handbook
- F. DOE Explosives Safety Manual, DOE/EV/06194
- G. American Petroleum Institute Guidelines
- H. BOCA National Building Code
- I. BOCA National Fire Prevention Code
- J. BOCA National Maintenance Code

K. State of New Jersey, Uniform Fire Code

3.3 DESIGN/MODIFICATION REVIEWS

3.3.1 All modifications, additions, or new facilities affecting fire protection systems shall be reviewed and approved by the ES&HD Fire Protection Engineer.

3.3.2 All TFTR facility additions or modifications affecting fire protection systems shall be in accordance with:

- A. ENG-026
- B. TFTR 23.007A
- C. TFTR 23.016

3.3.3 Modifications or additions that affect the balance of PPPL facilities shall be in accordance with ENG-026.

3.3.4 Depending upon the nature of the change the following drawings may be required.

- A. Site and Site Utility Drawings
 - 1. Accessibility
 - 2. Flood Control
 - 3. Emergency Personnel/Equipment Deployment
 - 4. Environmental Control
 - 5. Process Equipment, Material Spacing
 - 6. Water Supplies
 - 7. Firewater Mains
 - 8. Hydrants
 - 9. Flammable Liquid Spill Control

10. Gas Distribution Systems
11. Hazardous Material Traffic Routes
12. Fencing Locations
13. Security Control

B. Architectural Drawings

1. Building Code Compliance (Fire Protection)
2. Roof Drains
3. Life Safety Code Compliance
4. Storage (high piled, vital documents, computer tapes, etc.)
5. Fire Walls (protected openings)
6. Access Ladders
7. Security Access Control
8. Flammable/Combustible Liquid Storage
9. Explosion Relief
10. Fireproofing
11. Construction Materials
12. Maximum Possible & Maximum Credible Fire Loss Potentials
13. Placement of Portable Fire Extinguishers
14. Emergency Response Access
15. Classification of Hazardous Areas
16. Smoke Venting
17. Combustible Dust Handling

18. Roof Construction

C. Pipe Drawings

1. Automatic Sprinklers, Water Spray Systems
2. Standpipe Systems
3. Carbon Dioxide, Foam, Dry Chemical Systems
4. Chemical Distribution Systems
5. Compressed Gas Distribution Systems
6. Emergency Venting
7. Truck Loading/Unloading
8. Liquid Runoff Control
9. Piping Identification

D. HVAC Drawings

1. Fire/Smoke Dampers
2. High Temperature/Smoke Interlocks
3. Construction Materials
4. Access Ports
5. Fire Protection Coatings
6. Vapor Removal Systems
7. HEPA Filter Protection

E. Electrical Drawings

1. "Classified Hazardous Areas"
2. Fire Alarm & Detection Systems
3. Emergency Evacuation Systems
4. Accessibility of Equipment
5. Emergency Power (lights, critical equipment, etc.)
6. Lightning Protection
7. Cable Tray Design
8. Critical Equipment Water Shielding
9. Transformer Protection and Fluids
10. Placement of Exit Signs
11. Grounding & Bonding

F. Other

1. Fire Water/Criticality Concerns
2. Storage/Operating Tanks & Vessels
3. Material Handling & Identification
4. Conveyor Systems
5. Monitoring Systems
6. Gloveboxes
7. Mutual Aid
8. Inerting Systems
9. OSHA Requirements

3.4 DESIGN SPECIFICATIONS

- 3.4.1 All fire-protection designs shall use state-of-the-art equipment that has been tested by a nationally recognized testing laboratory for its intended use. All equipment components shall be compatible with existing equipment and installed as required by the applicable NFPA Codes and Standards.
- 3.4.2 Written acceptance test procedures shall be prepared and executed for all new system installations or modifications to verify the systems perform as required. Any deficiencies noted during the tests shall be documented and tracked until resolved or corrected.
- 3.4.3 When site specific guides or design specifications exist, they shall be included in all fire protection design packages as applicable. All fire protection specifications shall be reviewed by the ES&HD Fire Safety staff, FED, QA, and the ESU.

3.5 PROPERTY LOSS CRITERIA

- 3.5.1 The following criteria shall apply to reduce the potential property loss from a fire. Additional criteria is located in DOE 5480.7, "Fire Protection," Draft 1991, and DOE 6430.1A, "General Design Criteria," 1989.
- 3.5.2 Complete automatic fire suppression systems shall be provided and installed per the applicable NFPA Standards for:
 - A. All new structures over 5,000 square feet.
 - B. All structures having a Maximum Possible Fire Loss (MPFL) in excess of \$1 million, or where the maximum credible fire will result in the loss of use of a vital structure for a period longer than that specified as acceptable by the Program Senior Official.
 - C. A redundant fire protection system shall be provided when the MPFL exceeds \$50 million to limit the loss to this figure.
 - D. A redundant fire protection system and a three-hour rated fire barrier, or physical separation, shall be provided when the MPFL exceeds \$150 million to limit the loss to this figure.

- E. All new structures over 5,000 square feet shall be constructed of noncombustible or fire resistive materials.
- F. The water supply for all new fire protection water systems shall have a minimum supply duration of two hours. Facilities having a MPFL in excess of \$50 million shall have an additional independent source of fire protection water.
 - 1. Where a combined fire and process/domestic water system is provided, it shall be able to supply the fire demand plus the maximum daily domestic demand for the required duration.
- G. Portable Structures shall comply with DOE/EV-0043, "Standard on Fire Protection for Portable Structures," 1979.
- H. Electronic computer systems shall comply with DOE/EP-0108, "Standard for Fire Protection of DOE Electronic Computer/Data Processing Systems," 1984.
- I. A fire watch shall be in place whenever a fire protection system is out-of-service. See 3.13.1, "Fire Watch Requirements."

3.6 EQUIPMENT PROCUREMENT APPROVAL

- 3.6.1 All equipment procured for fire protection application shall be tested or approved for its intended use by a nationally recognized laboratory. The FED FPE shall approve all purchase requisitions for fire protection equipment, except exact replacement items.

3.7 FIRE PROTECTION SYSTEMS TESTING/INSPECTION/MAINTENANCE

- 3.7.1 The fire protection systems shall be inspected/tested/maintained in accordance the applicable NFPA Standards, ENG-026, and the FED Maintenance Procedures.

- 3.7.2 The following definitions apply for the purpose of this work:

- A. Inspection (visual observation)
- B. Testing (operating equipment)
- C. Maintenance (servicing/repair)

3.7.3 See Appendix A, Table 6, "Fire Protection Systems Inspection, Testing, and Maintenance Frequencies," for additional information.

3.8 MAINTENANCE PRIORITIZATION SCHEME

3.8.1 A maintenance prioritization scheme shall be in place so all fire-protection items requiring repair or maintenance are appropriately prioritized regarding their significance. The prioritization levels shall be defined as follows:

PRIORITY I: An impairment to a fire protection system that creates an imminent hazard to employees, property, or the potential for an environmental release in excess of allowed limits. Priority I items are considered an emergency condition.

PRIORITY II: An impairment to a fire protection system that reduces the protection to employees, property, or the environment, but is not an imminent hazard.

PRIORITY III: An impairment to a fire protection system that must be corrected, but does not directly reduce the protection to employees, property, or the environment.

3.9 CORRECTIVE ACTION TRACKING SYSTEM

3.9.1 All findings resulting from fire protection facility and program appraisals, both internal and external, shall be placed on a corrective action tracking system until resolved or completed. The tracking system shall include the following input data as a minimum:

- A. The finding
- B. The structure/building or area affected
- C. The date of the finding
- D. Name of the appraiser
- E. Name of the person responsible for corrective action
- F. Corrective action due date

- G. The interim compensatory measures required
- H. Priority level of the finding
- I. Closure date

3.10 FIRE INVESTIGATIONS & REPORTS

3.10.1 Fire investigations and reports shall be performed and prepared in accordance with DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," 1990, and DOE 5000.3A, "Occurrence Reporting and Processing of Operations Information," 1990.

3.10.2 In addition, all field reporting shall be performed in accordance with NFPA 902M, "Fire Reporting Field Incident Manual" and NFPA 904M, "Incident Follow-up Report Manual."

3.11 ANNUAL REPORT

3.11.1 The "Annual Industrial Summary of Fire and Other Property Damage" report shall be prepared by the ES&HD and submitted to the DOE Operations Office by February 15 each year per DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements." The Summary shall include the following information as a minimum:

- A. Loss Experience Analysis
- B. Losses of Interest
- C. Replacement Property Values
- D. Recurring Fire Protection Costs
- E. Calendar Year Major Fire Protection Accomplishments
- F. Calendar Year Major Fire Protection Objectives/Planned Improvements/Construction Activities
- G. Appraisal Program

- H. Extinguishing System Performance
- I. Items of Interest
- J. Notable Personnel Actions
- K. Major third party (DOE-HQ, Tiger Team, etc.) fire protection appraisal findings/recommendations for the reporting year.

3.12 FIRE PROTECTION SYSTEMS OPERABILITY REQUIREMENTS

3.12.1 Wet Pipe Sprinkler Systems

- A. The operability of the wet pipe fire sprinkler system ensures that adequate fire suppression capability is available to contain fires occurring in the protected facility in accordance with its design parameters, and that the Life Safety provisions of the facility are maintained during all anticipated operations.
- B. A wet pipe sprinkler system shall be considered operable when (bounding conditions):
 - 1. The system control valve is in the open position.
 - 2. There is an adequate quantity of water and pressure available from the Elevated Tank water supply system to supply the system at its required minimum design conditions.
 - 3. All piping, fittings, hangers, sprinkler heads, water flow devices, and other components are in required locations and in good repair.
- C. Wet Pipe sprinkler systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 13, and NFPA 25.
 - 1. Reduced frequency of testing (as defined by NFPA 13, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.

- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and ESU Procedure XXX implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 - 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 - 2. DOE 5480.7, "Fire Protection"
 - 3. NFPA 13, "Installation of Sprinkler Systems"
 - 4. NFPA 25, "Water Based Fire Protection Systems"

3.12.2 Dry Pipe Sprinkler Systems

- A. The operability of the dry pipe fire sprinkler system ensures that adequate fire suppression capability is available to contain fires occurring in the protected facility in accordance with its design parameters, and that the Life Safety provisions of the facility are maintained during all anticipated operations.
- B. A dry pipe sprinkler system shall be considered operable when (bounding conditions):
 - 1. The system control valve is in the open position.
 - 2. There is an adequate quantity of water and pressure available from the Elevated Tank water supply system to supply the system at its required minimum design conditions.
 - 3. There is an adequate source of air to maintain the minimum required quantity of air pressure to keep the dry pipe valve from tripping when small piping leaks occur (less than the cross-sectional area of one sprinkler head orifice opening).
 - 4. All piping, fittings, hangers, sprinklers, and other components are in required locations and in good repair.

- C. Dry Pipe sprinkler systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 13, and NFPA 25.
 - 1. Reduced frequency of testing (as defined by NFPA 13, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and ESU Procedure XXX implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 - 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 - 2. DOE 5480.7, "Fire Protection"
 - 3. NFPA 13, "Installation of Sprinkler Systems"
 - 4. NFPA 25, "Water Based Fire Protection Systems"

3.12.3 Deluge Sprinkler Systems

- A. The operability of the deluge fire sprinkler system ensures that adequate fire suppression capability is available to contain fires occurring in the protected facility in accordance with its design parameters, and that the Life Safety provisions of the facility are maintained during all anticipated operations.
- B. A deluge sprinkler system shall be considered operable when (bounding conditions):

1. The system control valve is in the open position.
 2. There is an adequate quantity of water and pressure available from the Elevated Tank water supply system to supply the system at its required minimum design conditions.
 3. The deluge system fire detection subsystem is in service and connected to the deluge valve activation device.
 4. All piping, fittings, hangers, sprinklers, and other components are in required locations and in good repair.
- C. Deluge sprinkler systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 13, NFPA 25, NFPA 72, and NFPA 72E.
1. Reduced frequency of testing (as defined by NFPA 13, NFPA 25, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 13, "Installation of Sprinkler Systems"
 4. NFPA 25, "Water Based Fire Protection Systems"

5. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
6. NFPA 72E, "Automatic Fire Detectors"

3.12.4 Pre-Action Sprinkler Systems (with Supervisory Air)

- A. The operability of the supervised pre-action fire sprinkler system ensures that adequate fire suppression capability is available to contain fires occurring in the protected facility in accordance with its design parameters, and that the Life Safety provisions of the facility are maintained during all anticipated operations.
- B. A pre-action sprinkler system shall be considered operable when (bounding conditions):
 1. The system control valve is in the open position.
 2. There is an adequate quantity of water and pressure available from the Elevated Tank water supply system to supply the system at its required minimum design conditions.
 3. The pre-action system fire detection subsystem is in service and connected to the deluge valve activation device.
 4. The piping is pressurized by a maximum of 1.5 psig air or nitrogen pressure.
 5. All piping, fittings, hangers, sprinkler heads, water flow devices, and other components are in required locations and in good repair.
- C. Preaction sprinkler systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 13, NFPA 25, NFPA 72, and NFPA 72E.

1. Reduced frequency of testing (NFPA 13, NFPA 25, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- D. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 13, "Installation of Sprinkler Systems"
 4. NFPA 25, "Water Based Fire Protection Systems"
 5. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
 6. NFPA 72E, "Automatic Fire Detectors"

3.12.5 Foam/Water Extinguishing Systems

- A. The operability of the Water/Foam extinguishing system ensures that adequate fire suppression capability is available to contain fires occurring in the protected area in accordance with its design parameters.
- B. A Foam/Water extinguishing system shall be considered operable when (bounding conditions):
 1. The system control valve is in the open position.
 2. There is an adequate quantity of water and pressure available from the Elevated Tank water supply system to supply the system at its required minimum design conditions.

3. The system is connected to a foam concentrate supply with an adequate quantity of concentrate to satisfy the system at its required minimum design conditions.
 4. The system is piped to an appropriate proportioner to satisfy the system's foam/water concentration design criteria. The proportioner valves are in the normal operating positions.
 5. The system's discharge appliances (open or closed sprinkler heads, monitor nozzles, discharge lines, mixing chambers, water flow devices, and other components) are in the required positions and are in good repair.
 6. The fire detection subsystem is in service and connected to the deluge valve activation device.
- C. Water/Foam extinguishing systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 11, NFPA 13, NFPA 16, NFPA 25, NFPA 72, and NFPA 72E.
1. Reduced frequency of testing (as defined by NFPA 11, NFPA 13, NFPA 16, NFPA 25, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"

3. NFPA 11, "Low Expansion Foam and Combined Agent Systems"
4. NFPA 13, "Installation of Sprinkler Systems"
5. NFPA 16, "Installation of Deluge Foam-Water Sprinkler Systems"
6. NFPA 25, "Water Based Fire Protection Systems"
7. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
8. NFPA 72E, "Automatic Fire Detectors"

3.12.6 Wet Standpipe Systems

- A. The operability of the wet standpipe system ensures that adequate water is available for manual fire suppression to contain fires occurring in the protected facility in accordance with its design parameters.
 1. The installation of the wet standpipe system is to provide a means of water supply for the ESU; standpipes, hose connections, and hoses (when provided) are for use by the ESU, not the occupants of the facility.
- B. A wet standpipe system shall be considered operable when (bounding conditions):
 1. The system control valve is in the open position.
 2. Hose valves are operable and in the closed position, or hose outlets are capped.
 3. All piping, fittings, hangers, water flow devices, and other components are in required locations and in good repair.
- C. Wet standpipe systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 14, and NFPA 25.

1. Reduced frequency of testing (as defined by NFPA 14, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 14, "Installation of Standpipe and Hose Systems"
 4. NFPA 25, "Water Based Fire Protection Systems"

3.12.7 Dry Standpipe Systems

- A. The operability of the dry standpipe system ensures that adequate water is available for manual fire suppression to contain fires occurring in the protected facility in accordance with its design parameters.
- B. A dry standpipe system shall be considered operable when (bounding conditions):
 1. Fire department connection is operable.
 2. An adequate quantity of water and pressure are available from the ESU pumper(s) to supply the system with the required volume and pressure.
 3. Hose valves are operable and in the closed position or hose connections are capped.

4. All piping, fittings, and hangers are in good repair.
- C. Dry standpipe systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 14, and NFPA 25.
 1. Reduced frequency of testing (as defined by NFPA 14, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 14, "Installation of Standpipe and Hose Systems"
 4. NFPA 25, "Water Based Fire Protection Systems"

3.12.8 Manual Water Spray Systems

- A. The operability of the water spray system ensures that adequate fire suppression capability is available to contain fires occurring in the protected facility in accordance with its design parameters.
- B. A manual water spray system shall be considered operable when (bounding conditions):
 1. The system control valve is in the closed position.

2. There is an adequate quantity of water and pressure available from the Elevated Tank water supply system to supply the system at its required minimum design conditions.
 3. Nozzles with an appropriate pattern, velocity, water particle size, and density are used with an appropriate alignment to satisfy the design requirements.
 4. In pre-priming systems, blow-off plugs are installed properly on all nozzles.
 5. All piping, fittings, and hangers are in good repair.
- C. Manual water spray systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 15, and NFPA 25.
1. Reduced frequency of testing (as defined by NFPA 15, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 15, "Water Spray Fixed Systems"
 4. NFPA 25, "Water Based Fire Protection Systems"

3.12.9 Halon 1301 (Total Flooding)

- A. The operability of the Halon 1301 fire extinguishing system ensures that adequate fire suppression capability is available to contain fires occurring in the protected area in accordance with its design parameters.
- B. A halon system shall be considered operable when (bounding conditions):
 - 1. There is an adequate quantity of containers filled with Halon 1301 fire extinguishing agent.
 - 2. There are Halon 1301 discharge nozzles in place, aligned properly, and unobstructed, to distribute the Halon at its minimum design conditions.
 - 3. Container activation devices are in place and in good repair.
 - 4. System piping, fittings, and hangers are in good repair.
 - 5. Fire detection subsystem is in service and connected to the container actuation devices.
 - 6. All openings to the volume being protected are closed or are connected for remote releasing automatically upon system operation.
 - 7. All equipment interlocks are in operating condition.
 - 8. Container brackets are in good repair.
 - 9. Reserve Halon storage containers, where required, are connected to the system or stored in their designated location.
- C. Halon systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 12A, NFPA 72, and NFPA 72E.

1. Reduced frequency of testing (as defined by NFPA 12A, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 12A, "Halon 1301 Fire Extinguishing Systems"
 4. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
 5. NFPA 72E, "Automatic Fire Detectors"

3.12.10 Dry Chemical Systems

- A. The operability of the dry chemical extinguishing system ensures that adequate fire suppression capability is available to contain fires occurring in protected area in accordance with its design parameters.
- B. A dry chemical system shall be considered operable when (bounding conditions):
 1. There is an adequate quantity of containers filled with an appropriate dry chemical extinguishing agent.
 2. The dry chemical containers are pressurized adequately or an appropriate expellant gas cartridge is provided to discharge the dry chemical agent.

3. Container activation devices are in place and in good repair.
 4. There are dry chemical discharge nozzles in place, aligned properly, and unobstructed, to distribute the dry chemical at its minimum design conditions.
 5. All piping, hoses, fittings, and hangers are in good repair.
 6. Fire detection subsystem and manual activation devices are in service and connected to the container activation devices.
 7. All openings to the hazard being protected are closed or are connected for remote automatic releasing upon system operation.
 8. All equipment interlocks are in operating condition.
 9. Container brackets are in good repair.
 10. Reserve dry chemical containers, where required, are connected to the system or stored in their designated location.
- C. Dry Chemical systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 17, NFPA 72, and NFPA 72E.
2. Reduced frequency of testing (as defined by NFPA 17, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.

G. References

1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
2. DOE 5480.7, "Fire Protection"
3. NFPA 17, "Dry Chemical Extinguishing Systems"
4. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
5. NFPA 72E, "Automatic Fire Detectors"

3.12.11 Wet Chemical Systems

- A. The operability of the wet chemical fire extinguishing system ensures that adequate fire suppression capability is available to contain fires occurring in the protected area in accordance with its design parameters.
- B. A wet chemical system shall be considered operable when (bounding conditions):
 1. There is an adequate quantity of containers filled with an appropriate wet chemical extinguishing agent.
 2. There is an adequately sized expellent gas cartridge provided to discharge the wet chemical agent.
 3. Wet chemical discharge controls are in place and in good repair.
 4. There are wet chemical discharge nozzles in place, with nozzle caps, aligned properly, and unobstructed, to distribute the wet chemical at its minimum design conditions.
 5. All piping, fittings, and hangers are in good repair.
 6. Fire detection subsystem and manual activation devices are in service and connected to the wet chemical discharge controls.

7. Devices ensuring the shut-down of fuel or power to the protected appliances function properly upon system actuation.
 8. Container brackets are in good repair.
 9. Reserve wet chemical containers, where required, are connected to the system or stored in their designated locations.
- C. Wet chemical systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 17A, NFPA 72, and NFPA 72E.
1. Reduced frequency of testing (as defined by NFPA 17A, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 17A, "Wet Chemical Extinguishing Systems"
 4. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
 5. NFPA 72E, "Automatic Fire Detectors"

3.12.12 Carbon Dioxide Systems (High Pressure)

- A. A high pressure carbon dioxide system shall be considered operable when (bounding conditions):
1. There is an adequate number of high pressure cylinder containers with CO₂ fire extinguishing agent under pressure, connected to piping and nozzles.
 2. The quantity of CO₂ fire-extinguishing agent is adequate to meet the system's minimum design conditions.
 3. There are CO₂ discharge nozzles in place, aligned properly, and unobstructed, to distribute the CO₂ at its minimum design conditions.
 4. Cylinder activation devices are in place and in good repair.
 5. System piping, fittings, and hangers are in good repair.
 6. Fire detection subsystem is in service and connected to the cylinder actuation devices.
 7. All openings to the volume being protected are closed or are connected for remote releasing automatically upon system operation.
 8. All equipment interlocks are in operating condition.
 9. Cylinder brackets are in good repair.
 10. Reserve CO₂ storage cylinders, where required, are connected to the system or stored in their designated location.
 11. Low pressure level supervisory signals are in service.
 12. CO₂ hand hose reels, where provided, are in good repair.
- B. High pressure carbon dioxide systems shall be operable at all times.

- C. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 12, NFPA 72, and NFPA 72E.
 - 1. Reduced frequency of testing (as defined by NFPA 12, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- D. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
 - 1. The ESU will notify the appropriate personnel per ESU Procedure XXX, and
 - 2. A tag shall be posted on the control panel indicating that the system or portion of the system is out of service.
 - 3. All hazardous operations shall be stopped, or
 - 4. A recorded fire watch shall be started within one hour of the outage, and
 - 5. An alternate means shall be provided to protect the hazardous operations, and
 - 6. Repair operations shall begin immediately and 3, or 4 and 5 shall be required until the repairs are completed, and
 - 7. Prior to the system being returned to service the system will be visually inspected and the following tests performed, as determined by the FED FPE:
 - a) Weigh CO₂ cylinders and check pressure.
 - b) Conduct a functional test of the system.
- E. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.

F. References

1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
2. DOE 5480.7, "Fire Protection"
3. NFPA 12, "Carbon Dioxide Extinguishing Systems"
4. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
5. NFPA 72E, "Automatic Fire Detectors"

H. The operability of the Carbon Dioxide fire-extinguishing system ensures that adequate fire suppression capability is available to contain fires occurring in the protected area in accordance with its design parameters.

3.12.13 Carbon Dioxide Systems (Low Pressure)

A. The operability of the Carbon Dioxide fire extinguishing system ensures that adequate fire suppression capability is available to contain fires occurring in the protected area in accordance with its design parameters.

B. A low pressure carbon dioxide system shall be considered operable when (bounding conditions):

1. There is a low-pressure storage container with CO₂ fire-extinguishing agent under pressure, connected to piping and nozzles.
2. The quantity of CO₂ fire-extinguishing agent is adequate to meet the system's minimum design conditions.
3. There are CO₂ discharge nozzles in place, aligned properly, and unobstructed, to distribute the CO₂ at its minimum design conditions.
4. Container activation devices are in place and in good repair.

5. System piping, fittings, and hangers are in good repair.
 6. Fire detection subsystem is in service and connected to the cylinder actuation devices.
 7. All openings to the volume being protected are closed or are connected for remote releasing automatically upon system operation.
 8. All equipment interlocks are in operating condition.
 9. Container brackets are in good repair.
 10. Reserve CO₂ storage containers, where required, are connected to the system or stored in their designated location.
 11. Low pressure level supervisory signals are in service.
 12. CO₂ hand hose reels, where installed, are in good repair.
- C. Low pressure carbon dioxide systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 12, NFPA 72, and NFPA 72E.
1. Reduced frequency of testing (as defined by NFPA 12, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.

G. References

1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
2. DOE 5480.7, "Fire Protection"
3. NFPA 12, "Carbon Dioxide Extinguishing Systems"
4. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
5. NFPA 72E, "Automatic Fire Detectors"

3.12.14 Tank Water Supply Systems

- A. The operability of the tank water supply system ensures that adequate water volume and pressure is available for the operation of hydrants, sprinkler systems, standpipe systems, etc., for suppression of fires occurring in the protected area within their design parameters.
- B. A tank water supply system shall be considered operable when (bounding conditions):
 1. Control valves are in operating positions (normally open).
 2. The tank is structurally sound.
 3. Where subject to freezing, the tank and tank riser are adequately heated and/or insulated.
 4. The water discharge system piping is operable and in good repair.
 5. Pressure sensors for refill and fill shut-off are in place and operable.
 6. There is an adequate volume of water and pressure provided for the tank to satisfy its minimum design conditions.
 7. System piping, fittings, and hangers are in good repair.

- C. Tank water supply systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 22, and NFPA 25.
 - 1. Reduced frequency of testing (as defined by NFPA 22, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection, testing, and maintenance shall be maintained for the life of the facility.
- G. References
 - 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 - 2. DOE 5480.7, "Fire Protection"
 - 3. NFPA 22, "Water Tanks for Private Fire Protection"
 - 4. NFPA 25, "Water Based Fire Protection Systems"

3.12.15 Fire Pumps

- A. The operability of the pumping system ensures that an adequate volume and pressure of water is available for the various extinguishing systems to contain fires occurring in the protected facility in accordance with its design parameters.
- B. A fire pump shall be considered operable when (bounding conditions):
 - 1. Control valves are in the appropriate position.

2. Adequate suction and discharge pressures and volumes are available to meet the system's minimum design conditions.
 3. Adequate primary power source and secondary power source are available, where required, to operate drivers and drive the pumps at their minimum design conditions.
 4. The pump is connected to source of water that has an adequate quantity and quality of water to supply the distribution system at its minimum design conditions.
 5. The controller (manual or automatic) is operable to start and stop the pump as needed under an emergency condition.
 6. All piping, fittings, and hangers are in good repair.
- C. Fire pumps shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 20, and NFPA 25.
1. Reduced frequency of testing (as defined by NFPA 20, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 20, "Installation of Centrifugal Fire Pumps"

4. NFPA 25, "Water Based Fire Protection Systems"

3.12.16 Fire Service Mains

- A. The operability of the fire main service ensures that adequate water volume and pressure is available for the operation of hydrants, monitor nozzles, hose/hydrant houses, sprinkler and standpipe risers, etc., for suppression of fires occurring in the protected facility within its design parameters.
- B. Fire service mains shall be considered operable when (bounding conditions):
 - 1. Fire main control valves are in the open position.
 - 2. Hydrants are operable and in proper locations.
 - 3. There is an adequate volume and pressure of water available from the water supply to meet design conditions.
 - 4. All piping and fittings are in good repair.
- C. Fire service mains shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 24, and NFPA 25.
 - 1. Reduced frequency of testing (as defined by NFPA 24, and NFPA 25) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.

G. References

1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
2. DOE 5480.7, "Fire Protection"
3. DOE 6430.1A, "General Design Criteria"
4. NFPA 24, "Installation of Private Water Service Mains and Their Appurtenances"
5. NFPA 25, "Water Based Fire Protection Systems"

3.12.17 Fire Alarm Systems (Building Panels)

- A. The operability of the fire alarm system ensures that the condition causing the alarm is reported to occupants and any required central monitoring service, and that the Life Safety notification provisions of the facility are maintained during all anticipated operations.
- B. A fire alarm system shall be considered operable when (bounding conditions):
 1. Ac power is supplied to the system (primary power source).
 2. Dc power is supplied to the system (secondary power source).
 3. All alarm initiation devices (smoke & heat detectors, water flow devices, manual pull stations, etc.) are installed and operational.
 4. All alarm indicating appliances (alarm bells, lights, etc.) are installed and operational.
 5. All signaling line circuits are in service and operational.
 6. The control panel is cleared of any faults, alarms, supervisory signals, and trouble conditions.
 7. All supervisory initiation devices are installed and operational.

- C. Fire alarm systems shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 72, and NFPA 72E.
 - 1. Reduced frequency of testing (as defined by NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 - 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 - 2. DOE 5480.7, "Fire Protection"
 - 3. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
 - 4. NFPA 72E, "Automatic Fire Detectors"

3.12.18 Central Monitoring (Fire) System

- A. The operability of the central monitoring system ensures that the condition causing the alarm is reported to occupants and any required off-premises service, and that the Life Safety notification provisions of the facility are maintained during all anticipated operations.
- B. A fire alarm system shall be considered operable when (bounding conditions):
 - 1. A power is supplied to the system (primary power source).

2. Dc power is supplied to the system (secondary power source).
 3. All remote fire alarm systems (building fire alarm panels) are installed and operational.
 4. All alarm indicating appliances (alarm bells, lights, etc.) are installed and operational.
 5. All signaling line circuits are in service and operational.
 6. The control panel is cleared of any faults, alarms, supervisory signals, and trouble conditions.
 7. All supervisory indicating appliances are installed and operational.
 8. All system printers are installed and operational.
 9. All off-site alarm circuits are installed and operational.
- C. The central monitoring station shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 71, NFPA 72, and NFPA 72E.
1. Reduced frequency of testing (as defined by NFPA 71, NFPA 72, and NFPA 72E) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.

G. References

1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
2. DOE 5480.7, "Fire Protection"
3. NFPA 71, "Installation, Maintenance, and Use of Signaling Systems for Central Station Service"
4. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems"
5. NFPA 72E, "Automatic Fire Detectors"

3.12.19 Fire barriers

- A. The operability of fire barriers ensures that the spread of a fire will be limited to the area of origin, minimizing potential losses and that the Life Safety provisions of the facility are maintained during all anticipated operations.
- B. A fire barrier shall be considered operable when (bounding conditions):
 1. All fire barrier penetrations are protected by the following approved devices or materials having the appropriate fire ratings:
 - a) Operable fire door (see 3.12.20 for additional information).
 - b) Fire damper (see 3.5.21 for additional information).
 - c) Fire window (see 3.12.20 for additional information).
 - d) Penetration seals for cable trays, conduits, pipes, etc.. (see 3.5.22 for additional information).
 2. Fire doors, fire windows, smoke dampers, fire dampers, are not chocked or blocked open.

3. Security systems do not interfere with or affect the operation or integrity of fire doors (e.g., latch mechanisms), fire dampers, fire windows, or other fire protection system component.

C. Fire barriers shall be operable at all times.

D. Penetration closure devices shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 71, NFPA 72, NFPA 72E, NFPA 80, and NFPA 90A.

E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.

F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.

G. References

1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"

2. DOE 5480.7, "Fire Protection"

3. DOE 6430.1A, "General Design Criteria"

4. NFPA 80, "Fire Doors and Windows"

5. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"

6. NFPA 101, "Safety to Life from Fire in Buildings and Structures"

3.12.20 Fire Doors and Windows

A. Operable fire door and window systems provide an effective fire barrier at the system rated duration for the life of the facility.

B. A fire door or window shall be considered operable when (bounding conditions):

1. Fire doors and windows are installed in all required openings.
 2. It is in the proper position (open or closed depending upon the type of installation).
 3. Each fire door and window is equipped with listed/approved hardware (hinges, latching device, holder/closer, smoke gaskets, etc.), as required, that is in operating condition.
 4. Fire doors and windows shall be kept closed unless arranged for automatic closing and release.
- C. Fire doors and windows shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures and NFPA 80.
1. Reduced frequency of testing (as defined by NFPA 80) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 80, "Fire Doors and Windows"

3.12.21 Fire Dampers

- A. Operable fire damper systems provide an effective fire barrier at the system's rated duration for the life of the facility.
- B. A fire damper shall be considered operable when (bounding conditions):
 - 1. Fire dampers are installed in all required openings.
 - 2. Each fire damper is equipped with listed/approved hardware (fusible link, magnetic closer, smoke gaskets, etc.) as required.
 - 3. Fire dampers shall be kept closed unless arranged for automatic closing and release.
- C. Fire dampers shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures and NFPA 90A.
 - 1. Reduced frequency of testing (as defined by NFPA 90A) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 - 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 - 2. DOE 5480.7, "Fire Protection"

3. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"

3.12.22 Pipe, Conduit, Cable Tray Penetrations in Fire Barriers

- A. Operable penetration protection ensures an effective fire barrier for the systems rated duration for the life of the facility.
- B. Penetrations in fire barriers shall be considered properly sealed when (bounding conditions):
 1. Approved fire resistance rated material is installed in all conduit, pipe, and cable penetrations of fire walls and barriers.
 2. The fire resistant material is installed in accordance with its listing and/or approval.
- C. Penetration seals shall be maintained at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures and NFPA 220.
 1. Reduced frequency of testing (as defined by NFPA 220) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 2. DOE 5480.7, "Fire Protection"
 3. NFPA 220, "Types of Building Construction"

3.12.23 Emergency and Exit Illumination

- A. Operable exit and exit access illumination ensures adequate exit signage and illumination in accordance with the life safety provisions of the facility.
- B. Emergency and Exit Illumination shall be considered operable when (bounding conditions):
 - 1. Exit lights with battery or generator back-up power are installed in all required locations.
 - 2. Emergency lights with battery or generator back-up power are installed in all required locations.
 - 3. The exit and emergency lights are installed, powered, and in good repair.
- C. Exit and emergency lights shall be operable at all times.
- D. The system shall be inspected, tested, and maintained in accordance with the FED Fire Protection Inspection, Testing, and Maintenance Procedures, NFPA 101, NFPA 110, and NFPA 110A.
 - 1. Reduced frequency of testing (as defined by NFPA 101, NFPA 110, and NFPA 110A) is allowed if the facility can prove increased reliability by submitting testing records and proposed schedule to DOE/Chicago for review and acceptance.
- E. If one or more of the bounding conditions is not maintained (impairment), the ESU shall be notified and the requirements of 3.14.5 implemented.
- F. Records showing the current system design and all inspection and testing shall be maintained for the life of the facility.
- G. References
 - 1. DOE 5480.4, "Environmental Protection, Safety, and Health Protection Standards"
 - 2. DOE 5480.7, "Fire Protection"

3. NFPA 101, "Safety to Life from Fire in Buildings and Structures"
4. NFPA 110, "Emergency and Standby Power Systems"
5. NFPA 110A, "Stored Electrical Energy Emergency and Standby Power Systems"

3.13 FIRE PREVENTION PRACTICES

3.13.1 Fire Watch Requirements

- A. Fire watches for welding, cutting, grinding, or open flame activity shall be performed per the "Cutting, Welding, and Open Flame Work" practice.
- B. When automatic fire suppression or alarm systems are installed but are out of service, and the affected area is unattended, management shall ensure that a proper fire watch is initiated.
- C. This fire watch shall:
 1. Understand the specific nature of the impairment and the specific area affected.
 2. Be a roving watch which covers all areas affected by the impairment.
 3. Have been instructed in the appropriate emergency actions, including best method to sound the alarm, the procedure to manually trip suppression systems if they are available, or use of portable extinguishers.
 4. Have been instructed in the frequency of the fire watch tours.
 5. Have documented (by the Office of Certification and Training) portable fire extinguisher training (including actual fire extinguishment).

6. The frequency of tours will be as follows:
 - a) Continuous, when required by facility process standards or process controls.
 - b) Hourly, when automatic suppression systems are out of service.
 - c) Once every two hours, if only automatic alarm capability is out-of-service.
 - d) As amended by the FED Fire Protection Engineer.
7. A log or documentation system is used to provide a record that can be audited.

3.13.2 Portable Space Heaters

- A. Portable space heaters shall be used in a safe manner.
- B. Management shall ensure that:
 1. The FED FPE is consulted regarding size and spacing of heaters.
 2. Manufacturer's recommendations are observed for the following.
 - a) Adequate clearance to combustible furnishings, surfaces, or materials.
 - b) Adequate ventilation for fuel fired heaters to prevent products of combustion buildup and to maintain stable flame quality.
 3. Heaters are Underwriters Laboratories (UL) listed or American Gas Association (AGA) certified.
 4. Fuel for heaters is stored and handled in accordance with the requirements of 3.13.5, "Flammable and Combustible Liquids."
 5. Fuel fired heaters are located outside and heat is ducted indoors, unless otherwise approved by the FED FPE.

6. Indoor use of liquid petroleum gas fired heaters is temporary and only under the following conditions:
 - a) In buildings under construction or undergoing repairs or modifications.
 - b) As temporary heat in noncombustible industrial occupancies.
 - c) In other buildings for temporary emergency heating purposes as necessary to prevent damage to the building or contents, and a fire watch is provided.
7. Portable electric heaters are equipped with tip-over protection, which automatically shuts off the unit when the unit is tipped from its upright position.

3.13.3 Cutting, Welding, and Open Flame Work

- A. Cutting and welding with electric arcs, oxygen-fuel gas flames and other forms of hot work such as open flames, grinding, or brazing activities shall be conducted in a safe manner.
- B. This type of work shall comply with NFPA 51B, "Fire Prevention in Use of Cutting and Welding Processes," and the applicable Compressed Gas Association publications.
- C. Management and craft supervisors shall ensure that:
 1. Cutting and welding are done by authorized personnel in designated cutting and welding areas (shops), to the greatest extent practical.
 2. Adequate ventilation is provided for all cutting and welding work.
 3. Torches, regulators, pressure-reducing valves, and manifolds are Underwriters Laboratory listed or Factory Mutual approved.
 4. Oxygen-fuel gas systems (e.g., oxygen/acetylene welders) are equipped with listed and/or approved backflow valves and pressure-relief devices.

5. Eye protection and protective clothing are worn by all cutters and welders, helpers, and fire watches, as appropriate. Workers adjacent to arc welding areas are protected from the rays by screens or shields.
6. When cutting and welding are done outside of designated areas, the following actions are performed.
 - i. A Hot Flame Permit (issued and tracked by ESU) is completed for each shift.
 - ii. A continuous fire watch is maintained by instructed employees in accordance with 3.13.1.
 - iii. A member of supervision (i.e., craft supervisor) inspects the job site at least once before the start of each job and at least once every 24 hours until the completion of the job.
 - iv. A craft supervisor determines the best locations for the fire watch and verifies that automatic fire protection is in service, that precautions taken are adequate, and that information on the Permit is correct.
 - v. Combustible materials, equipment, or building surfaces within 20 feet of the work or below the work must be either covered with fire-resistant welding blankets, moved, or wetted down. Openings in ducts, tanks, or other confined spaces within 20 feet of the work are also covered or plugged. Fire-resistant welding blankets are used for electric arc operations instead of wetting the work down.
- g) Cutting or welding is prohibited in the following situations.
 - a) In sprinklered areas while sprinkler protection is out-of-service.
 - b) In explosive atmospheres of gases, vapors, or dusts or where explosive atmospheres could develop from residues or accumulations in confined spaces (see 8).
 - c) On metal walls, ceilings, or roofs built of combustible sandwich-type panel construction or having combustible covering.

8. Confined spaces such as tanks are tested to ensure that the atmosphere is not in excess of 10% of the lower flammable limit prior to cutting or welding in or on the tank. Tests are repeated as conditions warrant, once each shift as a minimum. Mechanical ventilation is continuous when cutting or welding in or on a confined space.
9. When cutting or welding must be done on small tanks, piping, or containers that cannot be entered, they are cleaned, purged, and tested prior to starting the work. For work on combustible liquid or gas piping or tanks, intermittent testing is done during the work and a Job Safety Analysis is provided.

3.13.4 Maintenance for Ventilation, Exhaust & Blower Systems

- A. Ventilation, exhaust & blower systems shall be maintained in a safe manner.
- B. Ventilation, exhaust & blower systems consist of ventilation systems (including intake and exhaust openings, plenums, etc.) for change-rooms, exhaust and blower systems in laboratories, paint booths, metal and woodworking areas, and other similar areas where flammable/combustible vapors, residues, lint, and/or fibers may accumulate.
- C. Management shall ensure that:
 1. Compliance with the applicable sections of the following NFPA Standards is met:
 - a) NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
 - b) NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
 - c) NFPA 91, "Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying"
 - d) NFPA 96, "Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment"

NOTE: Ducts with known radiological contamination are excluded from this standard, except where the potential fire hazard is severe. Fire Protection requirements for HEPA filtration systems are provided in the "Fire Protection Criteria for Containment Ventilation Filter Plenum Systems" located in the DOE Fire Protection Resource Manual.

2. All building ventilation, exhaust, and blower systems where flammable/combustible vapors, residues, lint, and/or fibers accumulate are identified and documented.
3. All systems identified in item 2, are included in a minimum, annual preventive maintenance (PM) program. The frequency must be increased when conditions warrant.
4. The PM includes an inspection of all components of the systems and is documented for auditing purposes.
5. The PM includes but is not limited to cleaning grill plates, replacing filter media if design permits, and removing any buildup of foreign material from the duct interior if conditions warrant.
6. A list of all systems, identified in item 2, above, is forwarded to Fire Protection.

3.13.5 Flammable & Combustible Liquids

- A. The use, storage, and handling of flammable/combustible liquids shall be accomplished in a safe manner.
- B. Flammable/combustible liquids are classified as follows.
 1. Flammable Liquid. A liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 lb/in² (absolute) (2,068 mm Hg) at 100°F (37.8°C) is known as Class I liquid.

Class I liquids are subdivided as follows.

- a) Class IA liquids include those having flash points below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C).
 - b) Class IB liquids include those having flash points below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C).
 - c) Class IC liquids include those having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).
2. Combustible Liquid. A liquid having a flash point at or above 100°F (37.8°C).

Combustible liquids are subdivided as follows.

- a) Class II liquids include those having flash points at or above 100°F (37.8°C) and below 140°F (60°C).
- b) Class IIIA liquids include those having flash points at or above 140°F (60°C) and below 200°F (93°C).
- c) Class IIIB liquids include those having flash points at or above 200°F (93°C).

C. Management shall ensure that:

1. The requirements of the following are met:
 - a) NFPA 30, "Flammable and Combustible Liquids Code,"
 - b) NFPA 45, "Fire Protection for Laboratories Using Chemicals,"
 - c) NFPA 395, "Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects."
 - d) Occupational Safety and Health Administration (OSHA), 29 CFR 1910.106, "Flammable and Combustible Liquids"

2. The following general requirements are met:
 - a) Whenever possible, an environmentally benign, non-flammable liquid is substituted for a flammable liquid.
 - b) Minimum quantities are in the workplace. No more than a weeks supply.
 - c) Users of flammable/combustible liquids are familiar with the hazard classification of the material they are using.
 - d) Proper ventilation is in place before using flammable liquids.
 - e) Sources of ignition (sparks, open flame, hot surfaces, etc.) have been eliminated. Since flammable liquid fumes are heavier than air, they may "travel" to ignition sources.
 - f) Combustible waste and residue is stored in a listed, closed, metal, waste container, and is disposed of daily into a satellite accumulation area.
 - g) Unneeded and waste flammable liquids are turned over to the Hazardous Waste Management Group for disposal.
 - h) Gasoline shall be stored in approved containers (less than two gallons) and in areas approved by the ES&HD.

3. The following use/handling requirements are met:
 - a) Containers, for the handling and use of flammable materials in the workplace, are limited to:
 - i. End -use containers that are one gallon or smaller, and
 - ii. Containers listed by Underwriters Laboratory, Factory Mutual, or another nationally recognized testing laboratory (See iv.*, for exception), and
 - iii. Of the "plunger" type, or
 - iv. Squeeze bottles* not exceeding one liter.

* Squeeze bottles are not recommended for flammable liquids and shall only be used in those cases where the work cannot be accomplished using listed containers.

4. The following storage requirements are met:
- a) Not more than one liter of flammable/combustible liquid may be stored in a single fire zone outside of an approved flammable liquid storage cabinet, and
 - b) Storage in flammable liquid storage cabinets is limited to not more than 120 gallons of Class I, II, and IIIA liquids. Of this total, not more than 60 gallons may be of Class I and II liquids, and
 - c) When flammable liquid storage cabinets are used, not more than three cabinets may be stored in a single fire zone. In industrial facilities, additional cabinets (limited to a maximum group of three) may be stored in the same fire area, provided the groups of cabinets are separated by 100 feet, and
 - d) When flammable liquid storage cabinets are used, the vent openings are sealed with properly fitted metal bungs; or when the cabinets are required to be vented, they must be vented to the outside, and
 - e) When storage quantities exceed that permitted in ii, iii, or iv, the liquids are stored in rooms or facilities complying with NFPA 30, and OSHA, 29 CFR 1910.106, and
 - f) All flammable/combustible liquids (except Class IIIB) in nuclear facilities shall be stored in approved flammable liquid storage cabinets or rooms/buildings complying with NFPA 30 and 29 CFR 1910.106 (This requirement does not apply to laboratories), and
 - g) Class IA and IB liquids may be stored in glass containers of not more than 1 gallon, if required for liquid purity or to avoid excessive corrosion of metal containers, and

- h) The storage of liquids does not obstruct corridors, aisles, or exit doors, and liquids are not stored in exit enclosures (e.g., stairwells), and
 - i) Outdoor storage requirements comply with NFPA 30 and 29 CFR 1910, and
 - j) Inside storage rooms comply with NFPA 30 and 29 CFR 1910.106, and
 - k) Storage areas, for the purpose of dispensing shall be limited to C- and D- Sites, comply with 5, and be determined by the Waste Minimization Task Force. A Single individual will be assigned primary responsibility for each dispensing location.
5. The following dispensing requirements are met:
- a) Dispensing shall be permitted in designated dispensing areas only; and
 - b) When dispensing from drums, the drums are equipped with Underwriters Laboratories, Inc.- (UL) listed or Factory Mutual- (FM) approved dispensing devices; and
 - c) When transferring liquids between conductive containers, the containers are bonded with a wire. The bonding wire or one of the containers must be grounded; and
 - d) When transferring Class I liquids in laboratories from containers of less than 5 gallon capacity, the transfer is made in one of the following manners:
 - i. With the use of a laboratory fume hood; or
 - ii. In an area provided with ventilation to prevent the accumulation of a flammable vapor/air mixture exceeding 25% of the lower flammable limit; or
 - e) When transferring Class I liquids in laboratories from containers of 5 gallon capacity or more, the transfer is made in one of the following manners:

- i. From a separate area outside the building; or
 - ii. In a separate, inside storage room that complies with the requirements of NFPA 30 and 29 CFR 1910.106; and
- f) In non-laboratory areas, mechanical ventilation is provided which meets the following criteria, when transferring Class I liquids;
- i. The ventilation flow rate must be $1 \text{ ft}^3/\text{min}/\text{ft}^2$ of floor area but in no case less than $150 \text{ ft}^3/\text{min}$.
 - ii. The intake and exhaust points must be within 12 inches of the floor and positioned at opposite sides or ends of the room.
 - iii. A flow monitor or equivalent mechanism must be provided so an audible alarm will sound if the ventilation system fails.

3.13.6 Employee Training

A. Scope

1. Management shall ensure that:
 - a) All employees receive basic fire prevention training which includes the following items as a minimum:
 - i. Good housekeeping practices.
 - ii. Proper response/notification in the event of a fire.
 - iii. Instruction on the use of portable fire extinguishers.
 - iv. Recognition of potential fire hazards.
 - b) Employees who perform fire watches receive hands-on portable fire extinguisher training.
 - c) All training is documented for auditing purposes.

3.13.7 Control of Combustibles

- A. Combustible materials shall be limited to quantities that are as low as practical.
- B. Management shall ensure that:
 - 1. The applicable sections of NFPA 1, "Fire Prevention Code" are met.
 - 2. Housekeeping inspections are performed monthly in their facilities to ensure equipment and materials are maintained in an orderly arrangement at all times.
 - 3. At least 18 inches vertical clearance is maintained between the top of storage and sprinkler head deflectors.
 - 4. Combustible materials are limited to the quantity required for current needs, and are separated from ignition sources.
 - 5. Workroom floors are maintained clean and dry to the extent practicable.
 - 6. Noncombustible or fire retardant materials are used whenever possible.
 - 7. Combustible waste is collected in metal containers and provided with lids. (Lids are not required for office waste cans.)
 - 8. Combustible waste does not accumulate inside or adjacent to buildings.
 - 9. In nuclear facilities, wood, plastic, and paper materials are strictly limited for uses that are essential to the operation of the facilities, and which do not have a noncombustible substitute.
 - 10. Nuclear facilities shall develop and implement a combustible materials tracking program that includes review and approval for all changes in the combustible loading by a fire protection engineer.

3.13.8 Compressed Gas Cylinders

- A. The storage, transportation, identification, and use of compressed gas cylinders shall be accomplished in a safe manner.
- B. The design, use, and storage of compressed gas cylinders and systems shall comply with the following standards as applicable:
 - 1. NFPA 50, "Bulk Oxygen Systems at Consumer Sites"
 - 2. NFPA 50A, "Gaseous Hydrogen Systems at Consumer Sites"
 - 3. NFPA 50B, "Liquefied Hydrogen Systems at Consumer Sites"
 - 4. NFPA 51, "Design and Installation of Oxygen-Fuel Gas Systems for Welding Cutting and Allied Processes"
 - 5. NFPA 51A, "Acetylene Cylinder Charging Plants"
 - 6. NFPA 51B, "Cutting and Welding Processes"
 - 7. NFPA 52, "Compressed Natural Gas Vehicular Fuel Systems"
 - 8. NFPA 54, "National Fuel Gas Code"
 - 9. NFPA 58, "Storage and Handling of Liquefied Petroleum Gases"
 - 10. NFPA 59, "Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants"
 - 11. NFPA 59A, "Production, Storage and Handling of Liquefied Natural Gas"
 - 12. Occupational Safety and Health Administration (OSHA), 29 CFR 1910.166, "Compressed Gas and Compressed Air Equipment"
 - 13. Occupational Safety and Health Administration (OSHA), 29 CFR 1910.101, "Compressed gases (general requirements)"
 - 14. Occupational Safety and Health Administration (OSHA), 29 CFR 1910.102, "Acetylene"

15. Occupational Safety and Health Administration (OSHA), 29 CFR 1910.103, "Hydrogen"
16. Occupational Safety and Health Administration (OSHA), 29 CFR 1910.104, "Oxygen"
17. Compressed Gas Association Publications

C. Management shall ensure that:

1. Cylinders in transit or storage are provided with protective valve caps and secured in the upright position.
2. All storage areas are clearly identified.
3. The storage of compressed gas cylinders within buildings shall be limited to the quantity required for daily operations unless additional quantities are permitted by the applicable NFPA Standard.
4. Containers when stored inside shall not be located near exits, stairways, or in areas normally used or intended for the safe exit of people.
5. The storage of compressed gas cylinders outside of buildings shall be in accordance with the applicable NFPA Standard.
6. Flammable and oxidizing compressed gas cylinders are separated by 20 feet or with a minimum five foot high, 30 minute fire-rated wall.
7. Empty and full gas cylinders are segregated, and empty cylinders are tagged "empty."
8. Compressed gas cylinders are not exposed to temperatures above 125°F and are protected from direct sun and weather elements.
9. Compressed gas cylinders are identified regarding their contents; they are free of defects and are within their hydrostatic test date.

10. Gases are not mixed or transferred from one compressed gas cylinder to another and are refilled only by trained personnel.
11. Cylinders are not lifted by magnetic devices or by their protective caps. They must be secured to a cradle or platform and never dragged, dropped, or struck.
12. Compressed gas cylinders do not come in contact with electrical circuits, open flames, or arcs.
13. Compressed gas cylinders are not used for any purpose other than compressed gas containment.
14. Gas is not used from compressed gas cylinders without approved reducing regulators.
15. Connecting devices are free of oil, grease, and dirt and have threads corresponding to the cylinder valve.
16. Valves must be closed when cylinders are transported, moved at sites, and when connecting for use.
17. All devices used on compressed gas cylinders comply with the American National Standards Institute and Compressed Gas Association Standards C-4 and V-1.
18. All compressed gas manifolds are designed in accordance with the applicable NFPA Standard.
19. Personnel whom use compressed gas cylinders are trained in accordance with the Office of Training and Certification requirements.

3.13.9 Smoking Policy

- A. To limit the possibility of accidental ignition of flammable/combustible liquids, flammable gases, and combustible materials, "No Smoking" areas shall be established as required by:
 1. NFPA 1, "Fire Prevention Code"
 2. NFPA 30, "Flammable and Combustible Liquids"

B. Management shall ensure that smoking is prohibited in the following areas:

1. All government vehicles.
2. Near hazardous or toxic materials.

C. Areas where smoking is permitted shall be designated.

3.13.10 Construction Sites

A. To minimize the risk and impact of fire during construction, management shall ensure that compliance with the following requirements is achieved:

1. NFPA 241, "Safeguarding Construction, Alterations, and Demolition Operations"
2. OSHA 1926, Safety and Health Regulations for Construction."
3. Access is always maintained to the site for Emergency Response vehicles.
4. The site/project is provided with two way communications for the purpose of emergency notification.
5. The site/project is secured against unauthorized entry.
6. Welding, cutting, and open flame is performed in a designated area whenever possible.
7. The site/project is provided with portable fire fighting equipment.
8. When water is available, the site/project is provided with an adequate supply (including an adequate number of fire hydrants strategically located at the site) for fire fighting capability.
9. Projects involving multiple level buildings are provided with dry standpipe systems. (The limitations of the ESU shall be considered when determining the need for dry standpipes in multiple level buildings during construction.)

10. Construction site safety inspections are conducted weekly, documented, and any unsafe conditions identified and tracked until corrected.

3.14 FIRE PROTECTION PRACTICES

3.14.1 Portable Fire Extinguishers

- A. To provide for incipient stage fire fighting, PPPL facilities shall be provided with portable fire extinguishers installed, tested, and maintained in accordance with NFPA 10, "Portable Fire Extinguishers."
 1. Extinguishers installed in the facilities are for use by the occupants of the area and shall not be removed except for use on actual fires; extinguishers for Hot Flame Permits shall be provided by the group requesting the Hot Flame Permit.
 2. Wheeled Fire extinguishers are for use by the ESU or those individuals that have received appropriate training.
- B. Management shall ensure that:
 1. The location and type of portable fire extinguisher are in accordance with the requirements of NFPA 10. The relocation or installation of any portable fire extinguisher must be approved by ES&HD FPE.
 2. New portable fire extinguishers are approved by the ES&HD FPE prior to purchase.
 3. Portable fire extinguishers are inspected, maintained and tested in accordance with FED Maintenance Procedures.
 - a) The Inspection, testing, and Maintenance of fire extinguishers that meet the requirements of 5a and 5b shall be the responsibility of the ESU.
 - b) The inspection, maintenance, testing of the remaining fire extinguishers shall be the responsibility of the actual owners/users.

- c) All fire extinguishers shall be on the FED PM program.
4. Portable fire extinguishers are conspicuously marked and identified.
 - a) The markings shall include "Picture-Grams" as found in Appendix F of NFPA 10.
 5. Portable fire extinguishers are safely secured by one of the following methods:
 - a) On hangers or in cabinets
 - b) They are of the wheeled type
 - c) Extinguishers associated with Hot Flame Permits may be set on the floor.
 - d) Portable fire extinguishers that are provided for vehicles are mounted or secured to prevent physical damage to the portable fire extinguisher and injury to passengers.
 7. Portable fire extinguishers are not obstructed or obscured from view, with clear access to the portable fire extinguisher maintained.
 8. Immediate corrective action is taken for portable fire extinguishers identified as having a deficiency (e.g., empty, not mounted or missing, broken seal, etc.).
 9. New employees will receive fire extinguisher training upon initial employment through the General Employee Training Program provided by the Office of Certification and Training. This training shall permit them to recognize, identify and use a fire extinguisher. Thereafter, employees will be given a documented refresher every two years.
 10. Employees who are expected to use a fire extinguisher, such as those who will act as a fire watch for Hot Flame Permits, will receive additional training which includes live-fire extinguishment. This training shall be renewed annually.

3.14.2 Non Emergency Use of Fire Hydrants

- A. To provide assurances that the water supply and fire hydrants are available in an emergency, management shall ensure the following:
1. Prior permission is obtained from the ESU Environment Health Branch of the ES&HD, and the FED prior to non-emergency use of fire hydrants.
 2. The hydrant user installs one valve on each of the ports on the fire hydrant being used. The steamer port is reserved for use by the ESU.
 3. The user provides and uses only approved fire hydrant wrenches when opening or closing a fire hydrant (i.e., no pipe wrenches are to be used).
 4. The user keeps the fire hydrant in a fully opened or fully closed configuration.
 5. An approved portable backflow device or air gap is used to protect the potable water system from potential backflow conditions, where water for purposes such as flushing drains, filling tankers, etc., is drawn from a fire hydrant that is connected to a potable water system.
 6. Special precautions are taken during freezing weather conditions to prevent fire hydrant damage. The fire hydrant and any attached hoses are not left pressurized in a non-flowing condition for an extended length of time.

3.14.3 Maintenance of "Means of Egress"

- A. Means of egress shall be maintained in accordance with NFPA 101, "Safety to Life from Fire in Buildings and Structures." Compliance with OSHA 1910, Subpart E, "Means of Egress," is considered satisfied when the requirements of NFPA 101 are met.
- B. Management shall ensure that:
1. Every means of egress to an exit is kept clear and unobstructed.

2. Exit doors are not locked and do not require more than one action to open.
3. Exit doors are maintained in good operating condition.
4. Material is not stored in exit stairwells or exit passageways.
5. Emergency lights, exit signs, and other exit marking systems are maintained in good operating condition.
6. Fire doors are not blocked open.
7. Exit discharges including exterior building stairs are kept clean and unobstructed.
8. Radiation barriers (e.g. roped areas, etc.) do not affect egress routes.
9. Security features are in compliance with NFPA 101.

3.14.4 Emergency Lights

- A. To provide assurances that battery-operated and emergency generator-operated, emergency-lighting systems will function, management shall ensure:
 1. Emergency light systems are installed, maintained, inspected, and tested in accordance with:
 - a) NFPA 101, "Safety to Life from Fire in Buildings and Structures"
 - b) NFPA 70, "National Electrical Code"
 - c) NFPA 110, "Emergency and Standby Power Systems."
 2. All emergency light tests are documented and written records maintained.

3. Emergency lights which are found deficient are repaired within 24 hours, or portable emergency lights are provided at the affected area(s) until the permanent lights are restored to service.
4. Emergency lights are inspected during emergency light tests to verify:
 - a) Electrical cords are not damaged or frayed
 - b) Lamps are not cracked or damaged
 - c) Units are securely mounted
 - d) Lamps illuminate within 10 seconds of switching to the backup power supply.

3.14.5 Fire Protection System Impairment

- A. To ensure that facilities are operated within their design parameters and to minimize the duration and impact of modifications or unplanned impairments to fire protection systems, management shall ensure that:
 1. Fire protection system modifications are reviewed and approved by the FED FPE.
 2. Fire protection system operation is not hindered by storage practices, temporary construction activities, or enclosures.
 3. Corrective actions are implemented for all fire protection system impairments.
 4. The craft personnel, the ESU, and the necessary engineering support are coordinated to properly and expeditiously restore the fire protection system to service.
 5. The ESU and the FED are immediately notified of all fire protection system impairments.
 6. Compensatory measures are implemented as required by FED FPE until the system is restored.

7. When a fire protection system impairment is identified, the FED Maintenance Engineering Branch shall initiate corrective actions as soon as possible. Corrective actions shall consist of, but not be limited to, the following.
 - a) Notify the building occupants affected by the impairment.
 - b) Determine when any unsatisfactory housekeeping, storage, or special hazardous conditions need to be corrected.
 - c) As necessary, terminate hazardous operation or maintenance operations and impose "no smoking" regulations until appropriate protection/detection is restored. Cutting, welding, or other "hot work" shall be prohibited until adequate protection is assured.
 - d) With FED and ES&HD FPE consultation, determine when the ESU should be present at the facility and/or provide alternate water supplies to the impaired system.
 - e) As much of the fire protection system shall be maintained in an operable status as possible.
 - f) Establish a fire watch throughout the area that is affected by the impairment of the fire protection system as required by FED FPE.

3.14.6 Fire Protection System Winterization

- A. To minimize the impact of cold-weather conditions on fire protection systems/components (sprinkler, deluge, foam systems, smoke detectors, standpipes, etc.) management shall ensure that:
 1. A written winterization program is in place for each facility. The program shall require that each facility be inspected annually during the month of October to ensure all areas are adequately winterized. The inspection shall include the following items as a minimum:
 - a) Condition/operation and adequacy of heating systems, e.g. forced air, radiant heaters, portable heaters, etc.
 - b) Condition/operation of thermostats and filters.

- c) Condition/operation/installation of heat tape systems.
 - d) Draining of sprinkler system drip lines and fire pump hose headers.
2. Inspection results shall be maintained for two years in a form that is capable of being audited.
 3. All areas where fire protection systems are present are provided with sufficient heat and/or noncombustible insulation to prevent freezing and/or equipment damage.
 4. Heat tape and portable heaters are used only when no other preventive measures are immediately available. If used, these items must be listed or approved for their intended use.
 5. Heat tape and portable heaters are not used as a permanent means of preventing system freezes, and an engineered solution is provided for deficient areas, e.g. forced hot air, fixed radiant heaters, insulation, etc.

3.15 SPECIAL HAZARDS PROTECTION

3.15.1 Temporary Enclosures

- A. Temporary enclosures shall be installed and maintained in compliance with NFPA 241, "Safeguarding Construction, Alterations, and Demolition Operations," and
- B. Management shall ensure that:
 1. Temporary enclosures erected within a facility are not structurally supported by piping for automatic sprinkler systems or other fire protection equipment.
 2. The enclosure supporting structures are constructed of noncombustible or fire-retardant material which is approved by Fire Protection.

3. 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 Fire Protection are used.
4. Enclosures and 10-foot wide areas on the exterior of the enclosures are posted as "no smoking" areas.
5. Combustible materials are not stored within the no smoking areas.
6. 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.
7. 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.
8. Exits are kept unobstructed at all times.
9. Cutting, welding, open flame, or grinding are not performed in enclosures without an approved Permit.
10. Portable fire extinguishers are provided and positioned for visibility and easy access.

3.15.2 Computer/Data Acquisition Facilities

- A. Computer/data shall comply with the following codes and standards as applicable:
 1. DOE/EP- 0108, "Standard for Fire Protection of AEC Electronic Computer Data Processing Systems"
 2. NFPA 75, "Standard for the Protection of Electronic Computer/Data Processing Equipment,"

B. Computer/Data Acquisition Facilities that meet the following criteria shall meet the provisions of DOE/EP- 0108:

1. Designated as vital to the U.S. Department of Energy mission, or
2. Required for security, or
3. Valued at \$1 million or more, or
4. Required for operations which could be performed by substitute methods but where the substitute methods would result in unacceptable delay or would involve significant additional expenditures for personnel, facilities, and equipment, and

C. Management shall ensure that:

1. Computer areas are posted as "No Smoking" areas.
2. Furniture in computer areas is metal and limited to what is required for efficient operations.
3. Waste containers are noncombustible and listed.
4. Waste containers are emptied daily.
5. Office or computer supplies, forms, stationary, and other combustible supplies are not stored in the computer area.
6. 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.
7. Records and tapes are not stored in the computer area, except those required for daily operations.
8. Records and tapes required for daily operations are stored in closed metal cabinets.
9. Computer areas have an equipment salvage plan in place for the reconditioning of equipment which is exposed to smoke and water.

10. Fire protection features are provided in accordance with standards DOE/EP-0108, and NFPA 75.
11. Employees who normally work in computer facilities are familiar with the fire protection systems in their work area.
12. Computer facilities with raised floors are provided with floor lifters which are mounted near the room exit door.

3.15.3 Oxidizing Materials

- A. The storage, use, and handling of liquid and solid oxidizing materials (as defined by NFPA 49) shall comply with:
 1. NFPA 43A, "Storage of Liquid and Solid Oxidizers"
 2. NFPA 43C, "Storage of Gaseous Oxidizing Materials."
 3. NFPA 49, "Hazardous Chemical Data," and
- B. Management shall ensure that:
 1. An emergency plan is in place for facilities storing oxidizing materials.
 2. Storage facilities are labeled with the "Class" of oxidizer they contain (reference NFPA 43A, "Storage of Liquid and Solid Oxidizers").
 3. Oxidizing material is not stored with noncompatible materials such as ordinary combustibles, flammable/combustible liquids, greases, etc. (This does not apply to approved packaging material.)
 4. The total amount of oxidizing material for each "Class" does not exceed two tons in nonsprinklered buildings or four tons in sprinklered buildings.
 5. Employees involved in the storage operation receive instruction on handling the material in a safe manner.

6. "No Smoking" signs are posted at the entrance and within the storage building.
7. 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.
8. Combustible waste and used or empty containers are not stored with the oxidizing material.

3.15.4 Gloveboxes

- A. Gloveboxes and their use shall comply with the Glovebox Fire Protection Criteria located in the DOE Fire Protection Resource Manual, and
- B. Management shall ensure that:
 1. All new gloveboxes and windows are constructed of noncombustible or fire retardant materials.
 2. Glovebox gloves are of hypalon or neoprene material.
 3. Window size is held to a minimum consistent with good operator vision and maintenance needs.
 4. Gloveboxes are equipped with fire protection (reference the DOE Glovebox Fire Protection Criteria).
 5. Only combustibles required for daily operations are permitted in a glovebox.
 6. Transient combustibles in gloveboxes are kept in closed metal containers.
 7. Combustible waste is removed from gloveboxes daily or placed in closed metal containers.
 8. Flammable and combustible liquids used in gloveboxes are stored and dispensed from approved safety cans.

9. Glovebox exhaust filter openings are equipped with fire screens.
10. 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.

3.15.5 Explosives

A. 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:

1. NFPA 495, "Explosive Material Code"
2. NFPA 498, "Explosive Motor Vehicle Terminals"
3. 27 CFR, Parts 55 & 181, "Explosive Materials Regulations"
4. 49 CFR, Parts 100-199, "Transportation"
5. ATF 5400.7, "Alcohol, Tobacco, and Firearms: Explosives Laws and Regulations"
6. 18 USC 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials"

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

B. Management shall ensure that:

1. The manufacture, storage, and use of explosive materials is prohibited unless it can be done in a safe manner.
2. 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.

3. Smoking and flame-producing equipment are not permitted in the vicinity where explosive materials are produced, handled, stored, or used.
4. All explosive materials which are not in the process of manufacture, being transported, or in use are kept in a storage magazine.
5. Storage magazines are of the proper construction and are properly located for the type and amount of explosive being stored.
6. The area around storage magazines is kept clear of brush, dry grass, leaves, or similar combustibles for a minimum distance of 25 feet.
7. Combustible materials are not stored within 50 feet of explosive magazines.
8. All electrical equipment utilized near explosive material complies with NFPA 70, "National Electric Code" for "Classified Hazardous Areas."
9. 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:
 - a) The posting of signs warning against the use of mobile radio transmitters on all roads within 350 feet of explosive operations, as required.
 - b) Tools used in the handling of explosives shall be constructed of non-sparking materials.
 - c) 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.
 - d) Bonding and grounding straps shall be provided for all equipment where explosive materials are processed and handled.

e) Floorings shall be of non-sparking material.

3.15.6 Transportation of Hazardous Materials

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

1. NFPA 30, "Flammable and Combustible Liquids Code"
2. NFPA 58, "Storage and Handling of Liquefied Petroleum Gases"
3. NFPA 59, "Liquefied Petroleum Gases at Utility Plants"
4. NFPA 59A, "Production, Storage and Handling of Liquefied Natural Gas"
5. NFPA 77, "Static Electricity"
6. NFPA 327, "Cleaning or Safeguarding tanks and Containers"
7. NFPA 385, "Tank Vehicles for Flammable and Combustible Liquids"
8. NFPA 386, "Portable Shipping Tanks"
9. NFPA 495, "Explosive Materials Code"
10. 10 USC 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials"
11. 46 CFR, Parts 1-199, "Shipping"
12. 49 CFR, Parts 100-199, "Transportation"
13. 49 CFR, Parts 393, 396, 397, "Transportation"

B. Management shall ensure that:

1. 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.
2. Hazardous Materials are not be stored in a vehicle that is not in compliance with the U.S. Department of Transportation Hazardous Material Regulations.
3. During transportation, all:
 - a) 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.
 - b) Vehicle drivers are thoroughly trained and licensed in the proper method of operating, loading, and unloading the vehicle.
 - c) Vehicles are operated only when they are in proper repair, devoid of accumulation of grease, oil, and free of leaks.
 - d) Material containers used in transportation are chemically compatible with the material being transported.
 - e) 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.
 - f) Vehicles used for transporting explosive materials are not exposed to spark producing surfaces on the inside of the transporting body.
 - g) Explosive materials are not transported through any prohibited vehicular bridge, roadway, or elevated highway.

4. Vehicle Repairs are:
 - a) Not made unless the repairs can be made without hazard.
 - b) Not performed in a closed building or with the vehicle loaded or unpurged.
5. During the Loading/unloading process:
 - a) 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.
 - b) Vehicles are bonded and grounded as required.
6. Vehicles used for transportation of materials covered by this Section are designated as "No Smoking" areas.
7. Vehicles are provided with at least one 20-B:C rated fire extinguisher, or two 10-B:C rated fire extinguishers.
 - a) Extinguishers are maintained in good operating condition (see 3.14.1, "Portable Fire Extinguishers") and are located on the vehicle in an accessible location.

3.15.7 Clean Rooms

- A. Clean rooms shall be operated and maintained in accordance with:
 1. NFPA 318, "Standard for the Protection of Clean Rooms"
 2. Factory Mutual Data Sheet, FM 1-56, "Clean Rooms"
 3. Factory Mutual Data Sheet, FM 7-7, "Semiconductor Plants."
- B. Management shall ensure that:
 1. 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.

2. 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.
3. Clean rooms are constructed of fire-resistive or noncombustible construction and are separated from other occupancies by minimum one hour fire-rated construction.
4. All piping, duct work, 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.
5. 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.
6. 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.
7. Bench stations handling flammable, combustible, or corrosive materials are provided with ventilation-hood systems.
8. Bench stations and hoods are made of noncombustible materials.
9. Ducting in ventilation systems are 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.
10. All electrical equipment and wiring complies with NFPA 70, "National Electrical Code."
11. Sprinkler protection is provided throughout the clean rooms, including under work benches and under exhaust hood systems.
12. Automatic smoke detection and alarm system are provided throughout clean rooms.

13. Smoke detection is provided on a 200 square foot maximum spacing, due to high air flows associated with clean rooms.
14. Smoke detection sounds internal evacuation alarms, actuates the smoke-control systems, and signals the ESU.
15. Carbon dioxide 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.
16. HEPA filters used in clean rooms are UL listed per UL 900.
17. HEPA filters and ducts are inspected frequently, and filters are cleaned or replaced on a regular schedule.
18. HEPA filters are not patched or plugged to improve their efficiency as this action adversely affects their fire resistance.
19. Exiting from clean rooms comply with NFPA 101, "Safety to Life from Fire in Buildings and Structures."
20. 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.
21. 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.
22. All process and production areas are kept clean and free of all combustible materials such as cartons, papers, and packaging materials.

23. Portable fire extinguishers are provided per NFPA 10, "Portable Fire Extinguishers."
24. Detailed emergency procedures are posted in the clean room. Procedures should include instructions for shutting off all hazardous gases, maintaining fume exhaust systems, and sounding an evacuation alarm. Personnel should be trained in the emergency procedures.

3.15.8 Laboratories

- A. Laboratories, as defined by NFPA 45, shall be operated and maintained per NFPA 45, "Fire Protection for Laboratories Using Chemicals."
- B. Management shall ensure that:
 1. The quantity of hazardous chemicals stored in the "open" in a laboratory work area, shall be limited to the amount required for the specific task being performed.
 2. Noncompatible materials are segregated to prevent accidental contact with one another.
 3. Containers of materials that may become hazardous over time are dated and inspected every six months to evaluate their condition. Materials that are safe may be redated, and those that can be made safe by treating them may be treated and redated. All other materials shall be safely discarded.
 4. Pressure relief systems discharge to a safe location.
 5. All permanent piping is identified (as to its contents) at the supply and discharge points.
 6. Operating controls for apparatus are accessible under normal and emergency conditions.
 7. Entrances to laboratory units or areas are identified with signs to warn emergency personnel of unusual or severe hazards that are not related to the fire hazard of contents.

8. Documented monthly housekeeping inspections are performed for each laboratory, and corrective action is initiated immediately to resolve identified deficiencies.

3.15.9 Pyrophoric Materials

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

1. NFPA 68, "Explosion Venting"
2. NFPA 69, "Explosion Prevention Systems"
3. NFPA 325M, "Fire Hazard Properties of Flammable liquids, Gases, and Volatile Solids"
4. NFPA 480, "Storage, Handling and Processing of Magnesium"
5. NFPA 481, "Production, Processing, Handling and Storage of Titanium"
6. NFPA 482, "Production, Processing, Handling, and Storage of Zirconium"
7. NFPA 651, "Manufacture of Aluminum and Magnesium Powder"

- B. Management shall ensure that:

1. 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.
2. Processes involving pyrophoric materials are performed in an enclosed, oxygen-free, oxygen-deficient, or inerting atmosphere that is moisture controlled (dry).
3. Whenever inert gas systems are used, a reserve supply of gas is available for emergency use.

4. 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.
5. 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.
6. Non-sparking tools are used when handling combustible metal powders.

3.15.10 Portable Structures

- A. Portable structures shall be installed and maintained in compliance with DOE/EV-0043, "Standard on Fire Protection for Portable Structures."
- B. Management shall ensure that:
 1. The placement and use of all portable structures are reviewed by Fire Protection.
 2. Portable structures comply with DOE/EV-0043, "Standard on Fire Protection for Portable Structures" when any one of the following conditions exist:
 - a) Creates a life hazard.
 - b) Endangers the public or environment.
 - c) Replacement value (structure and contents) exceeds \$250,000.
 - d) Is vital to a DOE program.

3.15.11 Hazardous Material Storage

- A. The storage of hazardous materials shall be in compliance with the following standards as applicable:
 1. NFPA 30, "Flammable and Combustible Liquids Code"

2. NFPA 43A, "Storage of Liquid and Solid Oxidizers"
3. NFPA 43B, "Storage of Organic Peroxide Formulations"
4. NFPA 43C, "Storage of Gaseous Oxidizing Materials"
5. NFPA 58, "Storage and Handling of Liquefied Petroleum Gases"
6. NFPA 59A, "Production, Storage and Handling of Liquefied Natural Gas"
7. NFPA 231, "General Storage"
8. NFPA 231C, "Rack Storage of Materials"
9. NFPA 491M, "Hazardous Chemical Reactions"
10. NFPA 704, "System for Identification of the Hazards of Materials"

B. Management shall ensure that:

1. Hazardous-material storage is separated by minimum distances from other facilities and from personnel areas.
2. 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.
3. Incompatible-hazardous materials stored outside of buildings are separated from one another by minimum distances.
4. Hazardous-materials are stored in the appropriate containers.
5. Hazardous-material storage areas and buildings are provided with containment for liquid run-off control.

6. Hazardous-material storage buildings and aboveground tanks are provided with fire protection.
7. Hazardous-materials that may cause environmental damage in the event of fire are located in separate hazardous-material containment buildings or tanks.
8. Separate hazardous-material containment buildings are provided with sprinkler protection or other approved fire-protection control and extinguishing systems.
9. Accumulation of combustible materials such as cartons, papers, and packaging materials is prohibited in and around hazardous-material storage.
10. Weeds or similar combustibles are not permitted within 15 feet of hazardous-material storage areas.
11. Portable fire extinguishers in hazardous storage buildings are provided for the appropriate hazard per NFPA 10, "Portable Fire Extinguishers."
12. Personnel involved in hazardous material-operations receive instructions in handling the materials in a safe manner.
13. Smoking is not permitted in or near hazardous storage areas.
14. Storage facilities are not used as dispensing facilities.

3.15.12 Hydrogen Systems

- A. Hydrogen systems shall be installed and maintained in compliance with the following standards as applicable:
 1. NFPA 50A, "Gaseous Hydrogen Systems at Consumer Sites"
 2. NFPA 50B, "Liquefied Hydrogen Systems at Consumer Sites"
 3. NFPA 77, "Static Electricity"
 4. 49 CFR, Parts 100-199, "Transportation"
 5. Compressed Gas Association Publications.

B. Management shall ensure that:

1. Gas or liquid hydrogen is stored in approved containers equipped with pressure relief-devices.
2. Piping, tubing, fittings, valves, gages, and regulators in hydrogen systems are suitable for hydrogen service.
3. 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.
4. Storage containers, piping, valves, regulating equipment, and other accessories are readily accessible to authorized personnel, the ESU apparatus, and are protected against physical damage.
5. Hydrogen systems are electrically bonded or grounded before discharging hydrogen.
6. Legible instructions are maintained at locations that require operation of hydrogen equipment by the user.
7. A qualified person is in attendance at all times when mobile hydrogen-supply equipment is unloading hydrogen.
8. Each hydrogen system installed is inspected annually and maintained by qualified personnel.
9. Weeds or similar combustibles are not permitted within 15 feet of gaseous hydrogen-system equipment or within 25 feet of liquefied hydrogen system equipment.
10. Personnel using hydrogen and hydrogen equipment are provided documented training on the fire hazards associated with hydrogen, e.g. the flames are practically invisible.

3.15.13 Records Storage

- A. Records storage shall be in compliance with the following standards as applicable:
 - 1. NFPA 232, "Protection of Records"
 - 2. NFPA 232AM, "Fire Protection for Archives and Record Centers"
 - 3. NFPA 910, "Protection of Libraries and Library Collection"
 - 4. 36 CFR, Chapter XII, "Records Management"
 - 5. DOE/EP-0108, "Standard for Fire Protection of DOE Electronic Computer/Data Processing Systems"

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

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

3.15.14 Lightning Protection

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

1. NFPA 70, "National Electric Code"
2. NFPA 78, "Lightning Protection Code"
3. Factory Mutual Data Sheet, FM 5-11 "Lightning Protection"

B. Management shall ensure that:

1. 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 78, Appendix I.
2. Electric power and communication services to all facilities and underground power cables, where connected by overhead power distribution lines, have lightning and surge protection.
3. All lightning protection systems are maintained.
4. All lightning protection systems are visually inspected per NFPA 78, Appendix B, annually.
5. Complete in-depth testing and inspections per NFPA 78, Appendix B, are performed every three years on critical systems providing lightning protection for facilities involving radioactive or explosive materials.
6. Inspection and maintenance procedures are in place for personnel performing lightning protection system maintenance and inspections.
7. Inspection and maintenance records of the lightning protection systems are documented and maintained for auditing purposes.

3.15.15 Electrical System Components In Division 1 & Division 2 Hazardous Areas

- A. Electrical system components in Division 1 and Division 2 hazardous areas shall be installed and maintained in compliance with the following standards as applicable:
 - 1. NFPA 70, "National Electrical Code"
 - 2. NFPA 493, "Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1 Hazardous Locations"
 - 3. NFPA 495, "Explosive Material Code"
 - 4. NFPA 496, "Purged and Pressurized Enclosures for Electrical Equipment"
 - 5. NFPA 497A, "Classification of Class I Hazardous Locations for Electrical Installations in Chemical Process Areas"
 - 6. NFPA 497B, "Classification of Class II Hazardous Locations for Electrical Installations in Chemical Process Areas"
 - 7. NFPA 497M, "Classification of Gases, Vapors and Dusts for Electrical Equipment in Hazardous Locations"
- B. Management shall ensure that:
 - 1. 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.
 - 2. All electrical equipment used in hazardous areas is Underwriters Laboratory Listed or Factory Mutual Approved for use in the appropriate hazardous atmosphere.
 - 3. 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.

3.15.16 Lasers

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

1. NFPA 70, "National Electrical Code"
2. American National Standards Institute, ANSI/Z136.1 "Safe Use of Lasers"

B. Management shall ensure that:

1. All class lasers and laser systems have protective housings, interlocks, circuit breakers, insulation, switching devices, and the appropriate affixed warning labels.
2. When a high valued laser system is located in a building, the building is protected by automatic fire detection and fire suppression systems.
3. All electrical equipment is installed in accordance with NFPA 70.
4. All laser system frames, enclosures, and other accessible, non-current-carrying metallic parts are grounded.
5. Lasers and laser systems are operated and maintained by authorized employees only.
6. Employees involved with lasers and laser systems are properly trained.
7. Procedures are developed for the proper installation and use of all laser systems.
8. Beam target areas of Class IV lasers (per ANSI Z136.1) are free of combustible and flammable materials.
9. Lasers using flammable liquids are provided with effective means of controlling liquid fires.
10. 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.