

NFPA 76

Recommended Practice for the Fire Protection of Telecommunications Facilities

2002 Edition



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An International Codes and Standards Organization

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NFPA 76

Recommended Practice for the Fire Protection of Telecommunications Facilities

2002 Edition

This edition of NFPA 76, *Recommended Practice for the Fire Protection of Telecommunications Facilities*, was prepared by the Technical Committee on Telecommunications and acted on by NFPA at its November Association Technical Meeting held November 10–14, 2001, in Dallas, TX. It was issued by the Standards Council on January 11, 2002, with an effective date of January 31, 2002.

This edition of NFPA 76 was approved as an American National Standard on January 31, 2002.

Origin and Development of NFPA 76

In April of 1996, the NFPA Standards Council approved a new committee project to develop documents on fire protection for telecommunication networks. The Technical Committee on Telecommunications focused on network reliability of public telecommunications. The Committee was responsive to fire protection challenges identified by the Network Reliability Council, which was sponsored by the U.S. Federal Communications Commission (FCC).

This recommended practice is arranged for use as a performance-based document in the format established by NFPA for performance documents. Background information is provided by NFPA in *Future in Performance-Based Codes and Standards* (July 1995) and *Performance-Based Goals, Objectives, and Criteria, Primer 1* (September 1997).

The performance intended by this document can be achieved by using the performance-based approach of Chapter 5 or by fulfilling the prescriptive requirements of Chapter 6 or Chapter 7 in order to meet the fire safety goals of this document.

Fire protection elements that are applicable as fire protection tools to achieve fire safety in telecommunications facilities are described in Chapter 8. The use of these tools to achieve fire safety is intended to be as determined by Chapter 6 or Chapter 7.

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This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, Annex F lists the complete title and edition of the source documents for both mandatory and nonmandatory extracts. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the appropriate technical committee.

Information on referenced publications can be found in Chapter 2 and Annex F.

Chapter 1 Administration

1.1* Scope. This recommended practice provides recommendations for fire protection of telecommunications facilities where telephone, data, cellular, internet, and video services are rendered. Telecommunications facilities include telecommunications equipment spaces, cable entrance facilities, power areas and battery spaces, main distribution frames, standby engine areas, technical support areas, administrative areas, and building services and support areas within both large and small facilities. This recommended practice includes fire protection of telecommunications service, property protection, and life safety for people in telecommunications facilities. It provides for both performance-based and prescriptive options. This recommended practice specifically excludes telecommunications facilities with less than 46.5 m² (500 ft²) of telecommunications equipment space.

1.1.1* Multiple Tenant Buildings. Telecommunications facilities in multiple tenant buildings not controlled by the telecommunications service provider should be in one of the following:

- (1) A building constructed in accordance with NFPA 220, *Standard on Types of Building Construction*, Type I (443) or (332), or Type II (222) or (111)
- (2) A building provided with an automatic suppression system
- (3) A single-story building constructed in accordance with NFPA 220, *Standard on Types of Building Construction*, Type II (000)

1.1.2 The telecommunications facility should be separated from the remainder of the building by 2-hour fire-resistive-rated walls. Within the building selected, the balance of this recommended practice should only apply to the telecommunications facility.

1.2 Purpose. The purpose of this recommended practice is to establish recommendations to provide a reasonable degree of

fire protection in telecommunications facilities. These recommendations are intended to provide a reasonable degree of life safety for the occupants and to protect the telecommunications equipment and service continuity.

1.2.1 This recommended practice intends to avoid recommendations that could involve unnecessary complications for or interference with the normal use, occupancy, and operations of telecommunications facilities and equipment.

1.2.2* The telecommunications industry has achieved a remarkably good fire safety record over many years with the exception of a few highly visible incidents, which do not diminish the overall performance record. This recommended practice provides a means by which the industry's accepted fire safety methods can be applied to continue the historically good fire safety record of these facilities.

1.3* Application. The provisions of this recommended practice are considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosion. The provisions reflect situations and the state of the art at the time the recommended practice was issued.

1.3.1 The provisions of this recommended practice should not be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the recommended practice, except in those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or adjacent property.

1.3.2* Any alteration of existing buildings or any installation of new equipment in existing buildings should be accomplished as nearly as practical in conformance with the recommendations of this document.

1.4* Design Options. This recommended practice provides both performance-based and prescriptive design options. Fire protection for the individual hazard areas identified in the recommended practice should be based on the performance-based approach of Chapter 5 or the prescriptive approach of Chapters 6 and 7. Either approach should be used selectively by hazard area. Chapters 1, 4, 9, 10, and 11 should apply to all telecommunications facilities within the scope of this recommended practice, regardless of the design approach taken.

1.5 Equivalency. Nothing in this recommended practice is intended to prevent the use of calculation methods, test methods, systems, methods, or devices of superior quality, strength, fire resistance, effectiveness, durability, and safety as alternatives to those recommended by this document, provided technical documentation is submitted to the authority having jurisdiction to demonstrate equivalency, and the system, method, or device is approved for the intended purpose.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this recommended practice and should be considered part of the recommendations of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1998 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 1997 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1999 edition.

NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems*, 2000 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 2000 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2002 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 1999 edition.

NFPA 54, *National Fuel Gas Code*, 1999 edition.

NFPA 70, *National Electrical Code*®, 2002 edition.

NFPA 72®, *National Fire Alarm Code*®, 1999 edition.

NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment*, 1999 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1999 edition.

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 2001 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 1999 edition.

NFPA 92A, *Recommended Practice for Smoke-Control Systems*, 2000 edition.

NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*, 2000 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2001 edition.

NFPA 101®, *Life Safety Code*®, 2000 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2002 edition.

NFPA 204, *Standard for Smoke and Heat Venting*, 1998 edition.

NFPA 220, *Standard on Types of Building Construction*, 1999 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2000 edition.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*, 1999 edition.

NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, 1999 edition.

NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, 2000 edition.

NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*, 1999 edition.

NFPA 266, *Standard Method of Test for Fire Characteristics of Upholstered Furniture Exposed to Flaming Ignition Source*, 1998 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2000 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2000 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2000 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI T1.307, *Fire Resistance Criteria-Ignitability Requirements for Equipment Assemblies, and Fire Spread Requirements for Wire and Cable*, 1997.

ANSI T1.319, *Fire Propagation Hazard Testing Procedure for Equipment*, 1995.

2.3.2 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops*, 1997.

ASTM E 1537, *Standard Method of Fire Testing of Upholstered Furniture*, 1999.

ASTM E 1966, *Standard Test Method for Fire Resistive Joint Systems*, 1998.

2.3.3 CGA Publication. Compressed Gas Association, 1725 Jefferson Davis Highway, Arlington, VA 22202-4100.

CGA P-1, *Safe Handling of Compressed Gases in Containers*, 1991.

2.3.4 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

UL 900, *Standard for Safety Air Filter Units*, 1994.

UL 910, *UL Standard for Safety Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air*, 1998.

UL 1056, *UL Standard for Safety Fire Test of Upholstered Furniture*, 1995.

UL 1666, *UL Standard for Safety Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*, 1997.

UL 1685, *UL Standard for Safety Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*, 1997.

2.3.5 Telcordia GR-63-CORE, *Network Equipment Building System (NEBS) Requirements: Physical Protection*, 1995.

2.3.6 California Technical Bulletin 133, *State of California Department of Consumer Affairs Bureau of Home Furnishings*.

2.3.7 Thermal Insulation Technical Bulletin 133, *Flammability Test Procedure for Seating Furniture for Use in Public Occupancies*.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter apply to the terms used in this recommended practice. Where terms are not included, common usage of the terms applies.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

3.2.3* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.3 General Definitions.

3.3.1 Areas.

3.3.1.1 Administrative Area. These areas typically include general offices (i.e., administrative, accounting, engineering), mail rooms, cafeterias, and customer service operation center types of working environments.

3.3.1.2 Building Services and Support Areas. These areas typically include utility spaces, mechanical equipment spaces, maintenance shops, loading docks, and associated storage areas.

3.3.1.3 Hazard Area. An area with specific, established fuel loads and fire hazard characteristics.

3.3.1.4* Power Area/Room. The area/room of a central office that houses the electrical equipment required to power the switching equipment.

3.3.1.5* Technical Support Areas. Areas or spaces within a telecommunications facility that do not classify as telecommunications equipment space but directly support the equipment.

3.3.2 Cable Entrance Facility. The area of a telecommunications facility where cables from the outside enter the equipment space and are spliced to cables that extend to termination points.

3.3.3 Cable TV. One- and two-way communications service provided over a video network, generally through co-axial cable.

3.3.4 Cable Vault. Another term for a cable entrance facility.

3.3.5 Central Office (CO). Telecommunications equipment facility that houses primary control functions for telecommunications networks.

3.3.6 Contractor. The person or company responsible for fulfilling an agreed upon contract. [1901:1.7]

3.3.7 Detection Systems.

3.3.7.1 Early Warning Fire Detection (EWFD) Systems. Systems that use smoke, heat, or flame detectors to detect fires before high heat conditions threaten human life or cause significant damage to telecommunications service.

3.3.7.2 Standard Fire Detection (SFD) Systems. Systems that use fire detection-initiating devices to achieve certain life safety and property protection in accordance with applicable NFPA standards.

3.3.7.3 Very Early Warning Fire Detection (VEWFD) Systems. Systems that detect low-energy fires before the fire conditions threaten telecommunications service.

3.3.8 Equipment.

3.3.8.1 Building Services Equipment. Building mechanical, electrical, lighting, and power systems not related to telecommunications equipment operations.

3.3.8.2 Co-Located Telecommunications Equipment. Telecommunications equipment that is owned or leased and operated by other service providers (i.e., competitive local or long distance telephone service providers, internet service providers, or cable service providers) that is placed in a telecommunications equipment facility owned by a different telecommunications company.

3.3.8.3 Switching Equipment. Telecommunications equipment that switches calls or data.

3.3.8.4* Telecommunications Equipment. The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data.

3.3.9 Equipment Space. A space within a telecommunications facility that houses the network equipment including hazards areas such as a telecommunications equipment space; a cable entrance facility (CEF); power area (including batteries); main distribution frame (MDF); standby engine area; and technical support areas contiguous to the above hazard areas.

3.3.10 Firestop System. An approved method, utilizing a combination of materials and/or devices, which could include the penetrating items, required to form a complete firestop.

3.3.11 Main Distribution Frame (MDF). The area of a central office where a wiring arrangement connects the telephone lines coming from the cable entrance facility to the internal telephone lines that run to the switching equipment. A main distribution frame could also carry protective devices as well as function as a central testing point.

3.3.12 Non-Equipment Space. A space within a telecommunications facility that is not defined as equipment space including hazard areas such as administrative areas and building service and support areas.

3.3.13 Port. An orifice, sized by a computer program, in smooth bore pipe through which (smoke laden) air is drawn by an aspirating device to a very early warning detector.

3.3.13.1 Sampling Port. An orifice in smooth bore pipe through which air is drawn by an aspiration device to a very early warning detection system.

3.3.14 Rated. A description of performance derived from testing or evaluation that guides appropriate selection, installation, and use of equipment that is not listed.

3.3.15 Sensor. A device, such as a photoelectric cell, that receives and responds to stimulus.

3.3.16 Smoke Control. A system that utilizes fans to produce pressure differences so as to manage smoke movement. [90A:1.6]

3.3.17 Smoke Management System. An engineered system that includes all methods that can be used singly or in combination to modify smoke movement. [92B:1.4]

3.3.18 Smoke Removal. The control of smoke accumulation in the space where it is being generated by providing appropriate supply and exhaust to purge the smoke and prevent smoke movement to adjoining spaces.

3.3.19* Standby Engine Room. The area of a central office where the standby power system resides.

3.3.20 Telecommunications. The transmission, receiving, switching, and management of signals, such as electrical, optical, or electromagnetic, by wire, fiber, or through the air.

3.3.21 Telecommunications Equipment Space. The area in a telecommunications facility in which the telecommunications equipment is located.

3.3.22 Telecommunications Facility. A building or portion of a building that includes telecommunications equipment space and support areas.

3.4 Performance-Based Approach Definitions.

3.4.1 Analysis.

3.4.1.1 Sensitivity Analysis. A procedure or process used to demonstrate or confirm that the proposed design meets the specified criteria. [101:3.3]

3.4.1.2 Uncertainty Analysis. Procedure undertaken to determine the degree to which a predicted value could vary.

3.4.2* Exposure Fire. A fire that starts at a location that is remote from the area being protected and grows to expose that which is being protected. [101:3.3]

3.4.3* Fire Model. A structured approach to predicting one or more effects of a fire. [101:3.3]

3.4.4* Fire Scenario. Specification of fire conditions under which a proposed design is expected to meet the fire safety goals.

3.4.5 Fuel Load. The total quantity of combustible contents of a building, space, or fire area, including interior finish and trim, expressed in heat units or the equivalent weight in wood. [921:1.3]

3.4.6 Incapacitation. A condition under which humans do not function adequately and become unable to escape untenable conditions. [101:3.3]

3.4.7 Occupant Characteristics. The abilities or behaviors of people before and during a fire. [101:3.3]

3.4.8* Performance Criteria. Threshold values on measurement scales that are based on quantified performance objectives. [101:3.3]

3.4.9 Proposed Design. A design developed by a design team and submitted to the authority having jurisdiction for approval. [101:3.3]

3.4.10 Safe Location. A location remote or separated from the effects of a fire so that such effects no longer pose a threat. [101:3.3]

3.4.11 Safety Factor. A factor applied to a predicted value to ensure that a sufficient safety margin is maintained. [101:3.3]

3.4.12 Safety Margin. The difference between a predicted value and the actual value where a fault condition is expected. [101:3.3]

3.4.13 Verification Method. A procedure or process used to demonstrate or confirm that the proposed design meets the specified criteria. [101:3.3]

Chapter 4 Risk Considerations

4.1 Risk Factors. Fire protection programs for telecommunications facilities should be determined based on an evaluation of the risks and hazards associated with public safety, life safety of facility employees, continuity of service, types of services provided, redundancy of facilities, property protection, and the communities served.

4.1.1 The following factors should be considered when determining the fire risk and protection strategies for the network, occupants, equipment, communications function, and data transmission:

- (1) Public safety aspects of the service including emergency communications (such as 911), national defense commu-

nications requirements, video transmission of critical medical operations, and other vital data

- (2) Exposure threat to occupants or exposed property from a fire occurring at, or within, the facility
- (3) Potential economic losses resulting from a loss of communications
- (4) The presence or lack of redundant facilities
- (5) Potential economic losses due to equipment damage, equipment replacement costs, and the availability of replacement equipment
- (6) Extent of the service disruption beyond the facility in question

4.2 Communications Risks. In assessing and evaluating the damage and interruption potential of the loss of communication operations, attention should be given to the impact of the loss of data, voice, and video communications links. The complexity and scope of switching equipment operations can make it necessary to provide internal redundancy, alternative routing, and in some cases dual access terminal in order to prevent communication outages.

4.3 Multiple-Tenant Building Risks. Telecommunications equipment space located in a structure or building housing multiple tenants or occupancies that are or are not associated with the telecommunications equipment space should include additional risk analysis.

4.3.1 The hazard of adjacent tenants/occupancies should be identified and evaluated with respect to the consequences that could result from a fire or explosion exposure to the telecommunications equipment space.

4.3.2 The fire protection features provided for any adjacent tenant/occupancy should at a minimum be consistent with that recommended for building service and support areas that are normally found in telecommunications facilities.

4.3.3 Fire protection provided should be commensurate with the risk factors.

Chapter 5 Performance-Based Approaches

5.1 General Recommendations.

5.1.1* Application. This chapter applies to telecommunications facilities designed to the performance-based option of Section 1.4.

5.1.2* Approved Qualifications. The performance-based design should be prepared by a person with qualifications acceptable to the authority having jurisdiction.

5.1.3* Independent Review. An independent third-party review of the proposed design should be considered.

5.1.4 Final Determination. The authority having jurisdiction should make the final determination as to whether a design meets the performance objectives of this recommended practice.

5.1.5* Maintenance of Design Features. In order for the design features recommended for each hazard area to continue to meet the performance goals and objectives of this recommended practice, they should be maintained for the life of the facility.

5.1.5.1 This should include complying with all originally documented design assumptions and specifications.

5.1.5.2 Any variations from the design assumptions or specifications should be approved by the authority having jurisdiction prior to the actual change.

5.1.6 Special Definitions. A list of special terms used in this chapter follows:

- (1) Analysis
 - (a) Sensitivity Analysis. See 3.4.1.1.
 - (b) Uncertainty Analysis. See 3.4.1.2.
- (2) Exposure Fire. See 3.4.2.
- (3) Fire Model. See 3.4.3.
- (4) Fire Scenario. See 3.4.4.
- (5) Fuel Load. See 3.4.5.
- (6) Incapacitation. See 3.4.6.
- (7) Occupant Characteristics. See 3.4.7.
- (8) Performance Criteria. See 3.4.8.
- (9) Proposed Design. See 3.4.9.
- (10) Safe Location. See 3.4.10.
- (11) Safety Factor. See 3.4.11.
- (12) Safety Margin. See 3.4.12.
- (13) Verification Method. See 3.4.13.

5.2 Performance Objectives.

5.2.1 Life Safety Objectives. The facility design should provide occupants of the telecommunications facility adequate time to exit the building or to reach a safe area of refuge without being exposed to untenable conditions.

5.2.2 Network Objectives.

5.2.2.1 The facility design should limit the effects of a worst credible design fire in a nontelecommunications equipment space from causing an unacceptable network failure.

5.2.2.2 The facility design should limit the effects of a worst credible design fire in a telecommunications equipment space from causing an unacceptable network failure.

5.3 Performance Criteria.

5.3.1* Life Safety Performance Criteria.

5.3.1.1 The fire protection and life safety design of the facility should provide for tenable conditions along egress paths for the time required to evacuate occupants to a safe area using either of the following options:

- (1) NFPA 101®, *Life Safety Code*®, performance-based section
- (2) NFPA 101, *Life Safety Code*, prescriptive sections

5.3.1.2 For purposes of application of NFPA 101, *Life Safety Code*, prescriptive requirements, telecommunications equipment spaces, including technical support areas, should be considered special purpose industrial occupancies.

5.3.1.3 When the NFPA 101, *Life Safety Code*, performance-based methodology is utilized to assess the level of life safety provided in the facility, the fire scenarios specified in this document should be considered along with the scenarios provided in NFPA 101.

5.3.2 Network Performance Criteria.

5.3.2.1* When telecommunications equipment is exposed to a worst credible fire scenario, the facility design should limit temperatures in a manner that protects against unacceptable network failure.

5.3.2.2* When telecommunications equipment is exposed to a worst credible fire scenario, the facility design should limit the

effects of products of pyrolysis or combustion in a manner that protects against unacceptable network failure.

5.4 Design Assumptions.

5.4.1 General. The design should include documentation on the clear statement, data sources, and topics outlined in 5.4.1.1 through 5.4.1.3.

5.4.1.1 Clear Statement. Assumptions used in the performance-based design should be clearly stated.

5.4.1.2 Data Sources. The sources of data used in analyses should be documented.

5.4.1.3 Topics. Assumptions should include, but not be limited to, the topics addressed in 5.4.2 through 5.4.5.

5.4.2 Assumptions Regarding Facility Characteristics.

5.4.2.1 Assumptions about the building dimensions, construction materials, furnishings, spatial geometry, number and size of openings, and other details that are input into calculations or models should be explicitly identified and should be consistent with the facility construction and content.

5.4.2.2 Assumptions regarding characteristics of the building or its contents, equipment, or operations not inherent in the design specifications but that affect occupant behavior or the rate of hazard development should be explicitly identified.

5.4.3* Assumptions Regarding Operational Status and Effectiveness of Building Features and Systems.

5.4.3.1 All fire protection systems and features of the building should comply with applicable NFPA standards for those systems and features and, based on compliance with such standards, should be assumed to be fully operational and reliable.

5.4.3.2 The assumption of full operability and reliability should not apply to those systems or features for which a scenario is specifically and explicitly defined to involve the impairment of that system or features.

5.4.3.3* Assumptions about the performance of fire protection systems and building features should be limited to the documented performance of the components of those systems or features.

5.4.4 Assumptions Regarding Emergency Response Personnel. Assumptions regarding the availability, speed of response, effectiveness, roles, and other characteristics of emergency response personnel should be explicitly identified.

5.4.5 Assumptions Regarding Off-Site Conditions. Assumptions regarding resources or conditions outside the property being designed that affect the ability of the building to meet the stated goals and objectives should be explicitly identified.

5.4.6 Consistency of Assumptions. The design should not include mutually inconsistent assumptions.

5.4.7 Assumptions Applicable to Specific Facility Hazard Areas. Assumptions are intended to provide the design basis for fire scenarios involving telecommunications facilities. To facilitate design, analysis, and review, these assumptions are presented for those hazard areas expected in telecommunications facilities.

5.4.8* Special Provisions. Additional provisions not covered by Section 5.4 assumptions but that are necessary for the de-

sign to comply with the performance objectives should be documented.

5.4.8.1 Telecommunications Equipment Spaces. A telecommunications equipment space is a space in which the telecommunications equipment is located, extending to fire safe compartmentation (either fire-rated walls or exterior walls of the facility in small facilities). Telecommunications equipment spaces could contain associated power, main distribution frame, communications cables, and related support equipment. Telecommunications equipment spaces, if occupied, are normally only occupied by employees directly supporting the equipment. The occupants are assumed to be trained, alert, and capable of self-rescue. The occupancy load is assumed to be low from an egress standpoint. These spaces have a low probability of fire ignition and sustainability because of the limited quantity of combustible products. If a fire does start, the items in the space that could burn include cables that when burning will produce highly corrosive products of combustion.

5.4.8.2 Cable Entrance Facilities. A cable entrance facility is the interface point between the outside plant cabling and the telecommunications equipment. These spaces are normally unoccupied. When these spaces are occupied, it is assumed that the occupants within these spaces are trained, alert, and capable of self-rescue. The occupancy load is assumed to be low from an egress standpoint. These facilities are assumed to contain communications cables as defined in NFPA 70, *National Electrical Code*[®]. These spaces have the potential for accumulating combustible gases, such as methane, that enter the facility through underground cable openings. Fires within cable entrance facilities, whether of high or low heat release rate, are a concern due to the corrosivity of the products of combustion. Combustion products generally contain acid gases and solid particulates. Effects on the reliability of electronic equipment range from degradation of performance and reduction in the expected service life to complete failure of the equipment. Recovery methods such as reduced levels of relative humidity within the space and cleaning of the equipment have shown to minimize the detrimental effects of exposure to combustion products.

5.4.8.3 Power Areas. These areas typically include the batteries, rectifiers, inverters, and related bus bars and cables. It is assumed that the thermal effects of a fire in the equipment will be contained within the equipment. Fires in battery casings and cables are a concern due to the corrosivity of the smoke that is generated. Occupants are assumed to be trained, alert, and capable of self-rescue. The occupancy load is relatively low from an egress standpoint. The fire loading of the area is low. Batteries can generate hydrogen during charging that could be an explosion hazard. It is assumed that the possibility of thermal runaway has been mitigated through battery management. Additionally, it is assumed that the hydrogen explosion hazard will be mitigated and localized by adequate ventilation of the area.

5.4.8.4 Main Distribution Frame. The main distribution frame is a wiring frame through which customer's phone lines are physically connected to telecommunications switching equipment or where cable connections between switching equipment are made. Replacement of a frame damaged as a result of a fire is extremely labor intensive. Occupants in this area are assumed to be trained, alert, and capable of self-rescue. The occupancy load is relatively low from an egress standpoint. This area typically includes large amounts of low

voltage communication wire. Fires within main distribution frame areas, whether of high or low heat release rate, are a concern due to the corrosivity of the products of combustion. Combustion products generally contain acid gases and solid particulates. Effects on the reliability of electronic equipment range from degradation of performance and reduction in the expected service life to complete failure of the equipment. Recovery methods such as reduced levels of relative humidity within the space and cleaning of the equipment have been shown to minimize the detrimental effects of exposure to combustion products.

5.4.8.5* Standby Engine Areas. These areas typically include internal combustion engines, generators, combustible liquids (day tank) or flammable gas, and starting batteries. It is assumed that a fire in the area is a Class B fire or a Class C fire. Occupants are trained, alert, and capable of self-rescue. The occupancy load is low from an egress standpoint.

5.4.8.6 Technical Support Areas and Ancillary Areas. The technical support and vendor staging areas that directly support telecommunications equipment are a part of the telecommunications spaces or areas. The occupancy load is low from an egress standpoint.

5.4.8.7* Administrative Areas. These areas typically include offices (i.e., administrative, accounting, engineering), mail rooms, cafeterias, and customer service operation center types of working environments. The fire loading of these areas varies from low for customer service center to medium for accounting and engineering offices. The occupancy load is medium from an egress standpoint.

5.4.8.8 Building Services and Support Areas. These areas typically include utility spaces, mechanical equipment spaces, the various maintenance shops, loading docks, and associated storage areas. The fire loading of these areas varies from medium for maintenance shops to high for storage areas. It is assumed that combustibles will be in accordance with 9.1.1.

5.5* Fire Scenarios.

5.5.1 Design Fires. A performance-based design should be based on the evaluation of fire safety design alternatives against design fires considered in the fire scenarios in 5.5.2.1 through 5.5.2.1.7.1.

5.5.1.1 Design fires should be developed for each scenario using a method acceptable to the authority having jurisdiction and appropriate for the conditions.

5.5.1.2 The scenario specifications should be as challenging as could realistically occur in the space.

5.5.1.3 The proposed design should meet the goals and objectives if it achieves the performance criteria for each scenario.

5.5.2 Design Fires.

5.5.2.1* Specified Scenarios. The following scenarios should describe ignition sources, general types of fuels involved in a fire, and spread factors expected in telecommunications facilities. The evaluation of alternative designs against the scenario should consider the actual or intended construction and geometry of confining boundaries, if any, and the size, configuration, and location of ventilation openings. Other scenarios should be developed as needed to meet specific design situations. Although life safety might not be a factor in all scenarios, the potential of occupant exposure to fire should be considered in scenario development.

5.5.2.1.1* Electrical Component or Systems Fires. These scenarios should be representative of an electrical fire ignited by an electrical overload or component failure in an electrical component or system that is supported in a rack or cabinet and located in a room dedicated to telecommunications operations that directly support network service.

5.5.2.1.1.1 The design fire developed for these scenarios should address the following:

- (1) The early stages in the fire development when the major damage mechanism is exposure of equipment and circuits in proximity to the failed components in the rack or cabinet to corrosive and conductive products of combustion
- (2) Fire spread to other racks in a cabinet or cabinet-to-cabinet spread if the materials of construction and configuration facilitate such fire growth

5.5.2.1.2* Communication Cable or Power Cable Fires. These scenarios should be representative of a fire in cables or wires installed in or passing through the compartments under analysis.

5.5.2.1.2.1 The design fire developed for these scenarios should consider both the early stages in the fire development when the major damage mechanism is exposure of equipment and circuits in the compartments to corrosive and conductive products of combustion and the later stage fire growth and peak heat release rates that could result in fire extension to additional fuel packages or compartments.

5.5.2.1.3* Nontelecommunications Equipment Fires. These scenarios should be representative of a free-burning fire in ordinary combustibles, ignited by a small open-flame source, and these scenarios should apply in technical support areas and ancillary areas such as administrative areas and building support spaces where telecommunications equipment is not exposed or in spaces containing telecommunications equipment.

5.5.2.1.3.1 The design fire developed for these scenarios should consider fire growth and peak heat release rates that could result in fire extension to additional fuel packages or compartments.

5.5.2.1.4* Ignitable Liquid Fires. These scenarios should consider the ignition of any flammable or combustible liquids located within the area in question, with subsequent ignition of exposed combustibles. The analysis should consider the specific properties of the liquid fuel as related to the development of vapor-air mixtures that could result in deflagrations. The fire size should be based upon the maximum potential exposed liquid surface area, taking into consideration the presence of liquid release or spill containment barriers.

5.5.2.1.4.1 The design fire developed for these scenarios should consider rapid fire growth and short time to reach peak heat release rates and compartment damage that could result in rapid fire extension to additional compartments.

5.5.2.1.5* Combustible Gas Fires. These scenarios should be representative of those areas in which the potential for the build-up of combustible gases and the ignition of a flammable gas-air mixture within the space exists. The selected scenarios should include rapid pressure rise with damage to exposed equipment and compartment boundaries with no subsequent fire or rapid ignition of easily ignited combustible materials within the space or a combination of both. The fire exposure

to adjacent equipment and equipment spaces should be based upon the sustained burning of combustible materials within the space.

5.5.2.1.5.1 The design fire developed for these scenarios should consider damage to equipment and compartment boundaries due to thermal and pressure effects from an explosion or deflagration, and rapid fire extension to additional compartments.

5.5.2.1.6* Interior Exposure Fires. These scenarios should be representative of spread of fire and of passage of fire products from a fire scenario originating in any of the adjacent building spaces into the target area, including exposures from below or above the target area.

5.5.2.1.6.1 The design fire developed for these scenarios should consider both the fire growth and peak heat release rates in the exposing compartment and the fire growth and peak heat release rates that would result from fire growth and spread within the exposed compartment.

5.5.2.1.7* Exterior Exposure Fires. These scenarios should be representative of damage by exposure to smoke or thermal energy from an uncontrolled fire exterior to the building or space in question and should consider ignition of combustible exterior building finishes, building contents exposed through openings or combustible materials adjacent to building openings, or damage resulting from smoke or corrosive products of combustion.

5.5.2.1.7.1 The design fire developed for these scenarios should consider spread by convection, radiation, or direct flame contact as appropriate.

5.6 Methods of Assessing Performance.

5.6.1 General. A proposed design's performance should be assessed relative to each performance objective in Section 5.2 and each applicable scenario in Section 5.5, with the assessment conducted through the use of appropriate calculation methods, including computerized modeling programs.

5.6.1.1 The proposed design should meet the goals and objectives if it achieves the performance criteria for each scenario.

5.6.1.2 The installation should be deemed to meet the goals and objectives if its performance is verified.

5.6.2 Use. The design professional should use the assessment methods to demonstrate that the proposed design will achieve the goals and objectives, as measured by the performance criteria in light of the safety margins and uncertainty analysis, for each scenario, given the assumptions.

5.6.3 Safety Factors. Reasonable safety factors should be included in the design methods and calculations to reflect uncertainty in the assumptions and other factors associated with the performance-based design.

5.6.4 Output Data. The assessment methods used should accurately and appropriately produce the necessary output data from input data based on the design specifications, assumptions, and scenarios.

5.6.5 Validity. Evidence should be provided confirming that the assessment methods are valid and appropriate for the proposed facility, use, and conditions.

5.6.5.1 The validity and applicability of all mathematical models, computer models, scale models, or any combina-

tion used in developing a performance-based design should be documented.

5.6.5.2 Limitations of models used should be clearly stated.

5.6.6* Methods for Verifying Performance. The performance predicted by the performance design analysis should be verified, to the extent practical, by field testing of the installed subsystems (e.g., fans, dampers, fire detection, fire alarm) in accordance with industry practices.

5.7 Documentation.

5.7.1 General. All aspects of the design, including those described in 5.7.2 through Section 5.8, should be documented.

5.7.1.1 The format and content of the documentation should be acceptable to the authority having jurisdiction.

5.7.2 Hazard Mitigation Specifications. All details of the proposed hazard mitigation plan to meet the stated goals and objectives should be documented.

5.7.3 Building Design Specifications. All details of the proposed building design that affect the ability of the building to meet the stated goals and objectives should be documented.

5.7.4 Survivability Criteria. Survivability criteria, with sources, should be documented.

5.7.5 Fire Scenarios. Descriptions of fire scenarios should be documented.

5.7.6 Input Data. Input data to models and assessment methods, including sensitivity analysis, should be documented.

5.7.7 Output Data. Output data from models and assessment methods, including sensitivity analysis, should be documented.

5.7.8 Safety Factors. Safety factors utilized should be documented.

5.7.9 Prescriptive Elements. Any prescriptive elements used should be documented.

5.8 Acceptance. Acceptance testing, evaluation, and approval by the authority having jurisdiction should be documented.

Chapter 6 Large Telecommunications Facilities

6.1* General.

6.1.1 Application. A large telecommunications facility includes operations such as switching, transmission, and routing of voice data and/or video signals within an enclosed area of greater than 232 m² (2500 ft²) of telecommunications equipment space.

6.1.2* Prescriptive Approach. Where the performance-based approach of Chapter 5 is not used, the prescriptive recommendations of this chapter should apply.

6.1.3 Co-Located Telecommunications Equipment. Major co-located telecommunications equipment installation, operation, and maintenance should meet the recommendations of this chapter.

6.2 Construction. Building construction should be in accordance with Section 8.2.

6.3* Protection from Exposures. Exterior walls and openings should be protected as required by the applicable building code or should be protected in accordance with the provisions

of NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, where no building code is adopted.

6.4 Means of Egress. Means of egress should be provided in accordance with NFPA 101, *Life Safety Code*.

6.4.1 For purposes of application of NFPA 101, *Life Safety Code*, requirements, telecommunications equipment spaces, including technical support areas, should be considered special purpose industrial occupancies.

6.5 Telecommunications Equipment Spaces.

6.5.1 General. Telecommunications equipment spaces should be arranged to provide protection against fires in adjacent spaces; to provide protection against fire spread to adjacent equipment; to provide protection from fire, smoke, and related thermal and nonthermal equipment damage; and to increase the survivability of the equipment for continuity of service.

6.5.2 Construction.

6.5.2.1 Floor/Ceiling Assemblies. Floor/ceiling assemblies over telecommunications equipment spaces should be constructed to protect against the penetration of water from the roof or occupied spaces above.

6.5.2.2 Raised Floors.

6.5.2.2.1 Structural supporting members and decking for raised floors should be of noncombustible material.

6.5.2.2.2 Access sections or panels should be provided in raised floors so that all the space beneath is accessible. Floor puller(s) should be provided to gain access beneath the raised floor.

6.5.2.2.3 Electric cable openings in floors should be made smooth or should be otherwise protected to preclude the possibility of damage to the cables.

6.5.2.2.4 The space beneath any raised floors should not be used for storage.

6.5.2.2.5 Abandoned cables should not be allowed to accumulate. Cables not identified for future use should be removed.

6.5.3* Compartmentation. Telecommunications equipment spaces should be separated from nonequipment spaces by a minimum 1-hour fire-resistive construction in accordance with Section 8.3.

6.5.4 Building Service Equipment. Building services should be provided in accordance with the requirements of the applicable mechanical and electrical codes.

6.5.4.1 Where a heating, ventilating, and air-conditioning (HVAC) system is provided for the telecommunications equipment spaces, it should comply with one of the following:

- (1) An HVAC system that is dedicated for telecommunications equipment use and is separate from other building/hazard areas
- (2) An HVAC system that serves other hazard areas and serves the telecommunications equipment spaces where the air ducts are provided with automatic smoke and fire dampers

6.5.4.2 Dampers in HVAC systems serving compartmented telecommunications equipment spaces should operate upon

activation of smoke detectors, unless the HVAC system is part of the smoke management system. (See Section 8.7.)

6.5.4.3* HVAC ducts and air transfer openings serving non-telecommunications equipment areas should have smoke dampers or combination fire/smoke dampers installed in the ducts or air transfer openings where they penetrate the wall to the telecommunications equipment area. The dampers should be installed in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

6.5.4.4 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems should comply with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

6.5.4.5 Air filters for use in air-conditioning systems should be rated either as Class 1 or Class 2 in accordance with UL 900, *Standard for Safety Air Filter Units*, and NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

6.5.4.6* HVAC systems should be provided with either automatic shutdown or manual shutdown or both. The automatic shutdown of the HVAC system should be accomplished through the fire alarm system or the facility management system. Automatic shutdown of HVAC should not take place prior to confirmation of the presence of smoke.

6.5.4.6.1 HVAC components that make up part of the automatic smoke management system should not be arranged to shut down upon detection of smoke. (See Section 8.7.)

6.5.4.6.2 When the affected compartment is smoke isolated from the balance of the facility, the system design should be reviewed to determine if the balance of the HVAC system should continue to operate.

6.5.4.6.3 HVAC systems in individual unaffected spaces should be permitted to continue to operate.

6.5.4.6.4* HVAC systems in individual affected spaces should be permitted to continue to operate until confirmation of circulation of smoke. HVAC units should be permitted to be shut down on an individual basis.

6.5.4.7 Emergency lighting should be provided in the telecommunications equipment spaces in accordance with NFPA 101, *Life Safety Code*.

6.5.5 Telecommunications Equipment.

6.5.5.1 All cables and telecommunications equipment installed after January 1, 2003, whether owned or co-located, should meet the recommendations in Section 8.8 as appropriate for the type of cable or telecommunications equipment.

6.5.5.2* Telecommunications equipment should be industry-standard compliant and should be installed and used in configurations and uses for which it has been tested.

6.5.5.3 Cables and equipment that do not comply with the fire safety requirements of standards referenced in Section 8.8 should be separated from the remainder of the telecommunications equipment space by either of the following:

- (1) Sufficient spatial separation and smoke management to prevent fire and smoke damage to equipment other than the equipment of fire origin
- (2) A rated fire separation with a minimum fire resistance of 1 hour

6.5.5.3.1 Where major equipment, wire, or cable do not comply with Section 8.8, automatic fire suppression should be provided.

6.5.6 Fire Detection.

6.5.6.1 General. Telecommunications equipment spaces should be provided with a very early warning fire detection (VEWFD) system for detection and alarm processing in accordance with Chapter 8.

6.5.6.1.1 Raised floor areas that do not have a common airflow with the above floor area and contain combustibles should be provided with an early warning fire detection (EWFD) system.

6.5.6.1.2 Where raised floor areas share common airflow with the above floor area, the VEWFD provided above should be considered adequate to protect the area below the raised floor.

6.5.6.2 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72®, *National Fire Alarm Code*®.

6.5.7 Fire Suppression.

6.5.7.1 Portable Fire Extinguishers. Telecommunications equipment spaces should be provided with listed portable fire extinguishers suitable for use on electronic equipment in accordance with Section 8.6.

6.5.7.1.1 The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.5.7.1.2 Because of the sensitive nature of the electronic equipment, dry chemical and corrosive liquid agent portable fire extinguishers should not be used.

6.5.7.2 Automatic Fire Suppression. Where automatic fire suppression systems are provided, they should be in accordance with Section 8.6. Careful consideration should be made to recognize the impact the agent could have on the energized telecommunications equipment.

6.5.8 Limitation of Combustibles. Telecommunications equipment spaces should not be used for the storage of combustible materials or other equipment unrelated to the switching, transmission of voice, data, or video signals, and associated power systems.

6.5.8.1 Combustible construction and maintenance materials for work that directly supports telecommunications equipment should be limited in accordance with Section 9.4.

6.5.8.2 Small work spaces, directly related to the support of the telecommunications equipment, should be permitted within the equipment area if the following conditions are met:

- (1) Case furniture, including desks, should be constructed of noncombustible material (e.g., metal). The construction can include a high pressure laminate veneer on desk top
- (2) Any paper records, manuals, and drawings should be stored in fully enclosed noncombustible cabinets or cases
- (3) Chairs with upholstered seats and backs should comply with one of the following:
 - (a) NFPA 266, *Standard Method of Test for Fire Characteristics of Upholstered Furniture Exposed to a Flaming Ignition Source*, or ASTM E 1537, *Standard Method for Fire Testing of Upholstered Furniture Items*, or UL 1056, *UL Standard*

for *Safety Fire Test of Upholstered Furniture*, with a maximum rate of heat release of 80 kW (76 Btu/s) and a maximum total heat released, within the first 10 minutes of the test, of 25 mJ (23,700 Btu)

- (b) California Technical Bulletin 133, *State of California Department of Consumer Affairs Bureau of Home Furnishings*, and Thermal Insulation Technical Bulletin 133, *Flammability Test Procedure for Seating Furniture for Use in Public Occupancies*, or UL 1056, *UL Standard for Safety Fire Test of Upholstered Furniture*, and noncombustible containers are provided for combustible material.

6.5.9 Special Hazards.

6.5.9.1 Hazardous operations, such as cutting and welding, should not be conducted without special permits.

6.5.9.2 Heat-producing appliances not related to the support of telecommunications equipment should not be permitted within the space.

6.5.10 Smoke Management Systems. Where smoke management systems are provided, they should comply with Section 8.7.

6.6 Cable Entrance Facilities.

6.6.1 General. Cable entrance facilities should be arranged to minimize the intrusion of gas into the building, to limit the fuel load, to prevent the spread of fire and smoke to other areas, and to prevent the intrusion of unwanted electrical sheath currents in accordance with NFPA 70, *National Electrical Code*.

6.6.2 Compartmentation. Cable entrance facilities should be separated from adjacent equipment and nonequipment spaces by a minimum of 2-hour fire-resistance-rated construction in accordance with Section 8.2.

6.6.2.1 The recommended fire resistance should be permitted to be reduced to 1 hour, if the cable entrance facility is protected throughout by an automatic fire suppression system.

6.6.2.2 Compartmentation is not necessary where the cable entrance terminates directly within the main distribution frame area.

6.6.3 Building Service Equipment. Building service equipment should be limited to that needed to support the space.

6.6.4 Telecommunications Equipment. All cables and equipment that extend from the cable entrance facility to other spaces within the building installed in cable entrance facilities after January 1, 2003, whether owned or co-located, should be in accordance with Section 8.8 as appropriate for the type of cable or equipment.

6.6.5 Fire Detection.

6.6.5.1 General. Cable entrance facilities should be provided with EWFD systems in accordance with Chapter 8 for detection and alarm processing.

6.6.5.1.1 Where ambient conditions prohibit installation of automatic smoke detection, other appropriate automatic fire detection should be considered.

6.6.5.2 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72, *National Fire Alarm Code*.

6.6.6 Fire Suppression.

6.6.6.1 Portable Fire Extinguishers. Cable entrance facilities should be provided with listed portable extinguishers suitable for use on electronic equipment in accordance with Section 8.6. The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.6.6.2 Automatic Fire Suppression. Where automatic fire suppression systems are provided, they should be in accordance with Section 8.6.

6.6.7 Limitation of Combustibles. Cable entrance facilities should not be used for the storage of combustible materials or other equipment not related to the cable entrance facility operations.

6.6.8 Special Hazards. Cable entrance facilities should be vented with either gravity vents or with positive venting in order to minimize the buildup of methane gas.

6.7 Power Areas.

6.7.1* General. Power areas should be arranged to provide protection against fire and smoke in adjacent spaces, to provide protection against fire and smoke spread to adjacent equipment, and to provide for the capability to disconnect power from telecommunications equipment to facilitate emergency intervention.

6.7.2 Compartmentation. Power areas should be separated from adjacent nonequipment spaces by a minimum of 1-hour fire-resistance-rated construction in accordance with Section 8.2.

6.7.3 Building Service Equipment. Building services should be provided in accordance with the requirements of the applicable mechanical and electrical codes.

6.7.4 Telecommunications Equipment. All cables and equipment installed in power areas after January 1, 2003, whether owned or co-located, should be in accordance with Section 8.8 as appropriate for the type of cables and equipment.

6.7.5* Fire Detection.

6.7.5.1 General. Power areas should be provided with an EWFD system in accordance with Chapter 8 for detection and alarm processing.

6.7.5.2 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72, *National Fire Alarm Code*.

6.7.6 Fire Suppression.

6.7.6.1 Portable Fire Extinguishers. Power areas should be provided with listed portable extinguishers suitable for use on electronic equipment in accordance with Section 8.6. The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.7.6.2 Automatic Fire Suppression. Where automatic fire suppression systems are provided in power areas, they should be in accordance with Section 8.6. Careful consideration should be made to recognize the impact the agent could have on the energized telecommunications equipment.

6.7.7 Limitation of Combustibles. Power areas should not be used for the storage of combustible materials or other equipment not related to the power area operations.

6.7.7.1 Combustible construction and maintenance materials for work that directly supports telecommunications equipment should be limited in accordance with Section 9.4.

6.7.8 Special Hazards.

6.7.8.1 Safety Venting. Lead acid batteries should be provided with safety venting caps.

6.7.8.2 Spill Control and Neutralization. An approved method and appropriate materials for the control and neutralization of a spill of electrolyte should be provided in power areas.

6.7.8.2.1 The method and materials should be capable of controlling and neutralizing a spill from the largest battery cell to a pH of between 7.0 and 9.0.

6.7.8.3* Thermal Runaway. The potential of thermal runaway of valve regulated lead acid (VRLA) batteries should be reduced by a proper battery management program.

6.7.8.4 Ventilation. When a separate room is provided for the DC power plant, the room should be provided with mechanical exhaust ventilation to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room, or continuous ventilation should be provided at the rate of not less than $0.3 \text{ m}^3/\text{min}/\text{m}^2$ ($1 \text{ ft}^3/\text{min}/\text{ft}^2$) of floor area of the room.

6.7.8.5 Signs. When a separate room is provided for the direct current (dc) power plant, doors into the room should be provided with signs indicating the use of the room.

6.7.8.6 Seismic Protection. The battery systems should be seismically braced in seismic zones that need such bracing.

6.7.9 Smoke Management Systems. Where smoke management systems are provided, they should comply with Section 8.7.

6.8 Main Distribution Frames.

6.8.1 General. Main distribution frame spaces should be arranged to provide protection against fires in adjacent spaces, to protect against fire spread to adjacent equipment, to provide protection from smoke and related nonthermal damage, and to increase the survivability of the main distribution frame.

6.8.2* Compartmentation. Main distribution frames should be separated from nonequipment spaces by a minimum of 1-hour fire-resistance-rated construction in accordance with Section 8.3.

6.8.2.1 Main distribution frames consisting of components that do not meet the fire safety requirements of standards referenced in Section 8.8 should be separated from other equipment spaces by 1-hour fire-resistance-rated construction, or the area should be protected throughout by an automatic fire suppression system.

6.8.3 Building Service Equipment. Building service equipment should be limited to that needed to support the space.

6.8.4 Telecommunications Equipment. All cables and equipment installed after January 1, 2003, whether owned or co-located, should be in accordance with Section 8.8 as appropriate for the type of cables and equipment.

6.8.5 Fire Detection.

6.8.5.1 General. Main distribution frame spaces should be provided with a VEWFD system in accordance with Chapter 8 for detection and alarm processing.

6.8.5.1.1 Raised floor areas that do not have a common airflow with the above floor area and contain combustibles should be provided with EWFD.

6.8.5.1.2 Where raised floor areas share common airflow with the above floor area, the VEWFD provided above should be considered adequate to protect the area below the raised floor.

6.8.5.2 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72, *National Fire Alarm Code*.

6.8.6 Fire Suppression.

6.8.6.1 Portable Fire Extinguishers. Main distribution frame spaces should be provided with listed portable fire extinguishers suitable for use on electronic equipment in accordance with Section 8.6.

6.8.6.1.1 The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.8.6.1.2 Because of the sensitive nature of the electronic equipment, dry chemical and corrosive liquid agent portable fire extinguishers should not be used.

6.8.6.2 Automatic Fire Suppression. Where automatic fire suppression systems are provided, they should be in accordance with Section 8.6. Careful consideration should be made to recognize the impact the agent could have on the energized equipment.

6.8.7 Limitation of Combustibles. Main distribution frame spaces should not be used for the storage of combustible materials or other equipment not related to the main distribution frame operations.

6.8.7.1 Combustible construction and maintenance materials for work that directly supports telecommunications equipment should be limited in accordance with Section 9.4.

6.8.8 Special Hazards. Heat-producing appliances not related to support of main distribution frame activities should not be permitted.

6.8.9 Smoke Management Systems. Where smoke management systems are provided, they should comply with Section 8.7.

6.9 Standby Engine Areas.

6.9.1 General. Standby engine areas should be arranged to prevent the spread of fire to adjacent spaces and to reduce the hazards associated with the fuel supply for the generator. General standby engines should be installed and maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

6.9.2 Construction. Where used, soundproofing should be of noncombustible or limited-combustible materials.

6.9.3 Compartmentation.

6.9.3.1 Standby Engine Areas. Standby engine areas should be separated from adjacent spaces by a minimum of 2-hour fire-resistance-rated construction in accordance with Section 8.3, or for standby engine areas protected by automatic fire suppression systems, the fire resistance rating of the enclosure can be reduced to a minimum of 1 hour.

6.9.3.2* Fuel Control. To limit fire spread and flashback, fuel supplies to standby engines should be controlled by appropriate containment, automatic fuel cutoffs in lines supplying the standby engine and any tanks in the compartment, and by appropriate control of effluent.

6.9.4 Building Service Equipment. Building services should be provided in accordance with the requirements of the applicable mechanical and electrical codes.

6.9.5 Telecommunications Equipment. Standby engine installations should comply with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*.

6.9.6 Fire Detection.

6.9.6.1 General. Standby engine installations should be provided with a heat or flame detection system for detection and alarm processing in accordance with Chapter 8.

6.9.6.2 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72, *National Fire Alarm Code*.

6.9.7 Fire Suppression.

6.9.7.1 Portable Fire Extinguishers. Standby engine spaces should be provided with listed portable extinguishers suitable for use on both electronic equipment and liquid fuel fires in accordance with Section 8.6.

6.9.7.1.1 The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.9.7.2* Automatic Fire Suppression. Where automatic suppression systems are provided, they should be in accordance with Section 8.6. Careful consideration should be made to recognize the impact the agent could have on the energized telecommunications equipment.

6.9.8 Limitation of Combustibles. Standby engine areas should not be used for the storage of combustible materials or other equipment not related to standby engine operations.

6.9.8.1 Combustible construction and maintenance materials for work that directly supports standby engine areas should be limited in accordance with Section 9.4.

6.9.9 Special Hazards. Standby engine fuel supply installations should comply with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*; NFPA 30, *Flammable and Combustible Liquids Code*; or NFPA 54, *National Fuel Gas Code*.

6.9.10 Smoke Management Systems. Where smoke management systems are used in standby engine areas, they should comply with Section 8.7.

6.10 Technical Support Areas.

6.10.1 General. Technical support areas should be arranged to protect against fire spread to adjacent equipment areas.

6.10.1.1 Binders and other paperwork associated with the support of telecommunications equipment should be kept to a minimum and should be stored in noncombustible cabinets.

6.10.1.2 Office furniture supporting these operations should comply with California Technical Bulletin 133, *State of California Department of Consumer Affairs Bureau of Home Furnishings*, and Thermal Insulation Technical Bulletin 133, *Flammability*

Test Procedure for Seating Furniture for Use in Public Occupancies, or UL 1056, *UL Standard for Safety Fire Test of Upholstered Furniture*.

6.10.1.3 Cooking and portable heating equipment should not be allowed in these areas.

6.10.2 General Fire Protection Measures. Technical support areas should be protected with standard fire detection systems when separate from telecommunications space and with VEVFD systems when within the telecommunications space in accordance with Chapter 8 for detection and alarm processing. Portable fire extinguishers appropriate for the expected fuel load should be provided.

6.11 Administrative Areas.

6.11.1 General. Administrative areas should be arranged to prevent the spread of fire to adjacent equipment areas.

6.11.2 Construction. Soundproofing, if used, should be of noncombustible or limited-combustible materials. Floor assemblies over equipment spaces should be constructed to protect against the penetration of water.

6.11.3 Compartmentation. Administrative areas should be separated from adjacent equipment spaces by a minimum of 1-hour fire-resistance-rated construction in accordance with Section 8.3.

6.11.4 Fire Protection. The administrative area should be protected by either a standard fire detection or an automatic fire suppression system.

6.11.4.1 Fire Detection. Where a fire detection system is provided, it should be in accordance with Chapter 8 requirements for detection and alarm processing.

6.11.4.1.1 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72, *National Fire Alarm Code*.

6.11.4.2 Fire Suppression.

6.11.4.2.1 Portable Fire Extinguishers. Administrative areas should be provided with listed portable extinguishers suitable for use in accordance with Section 8.6.

6.11.4.2.1.1 The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.11.4.2.2 Automatic Fire Suppression. Where automatic suppression systems are provided in administrative areas, they should be in accordance with the requirements of Section 8.6. Careful consideration should be made to recognize the impact the agent could have on energized equipment.

6.11.5 Cooking Areas. Cooking areas should be protected in accordance with NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*.

6.12 Building Service and Support Areas.

6.12.1 General. Building service and support areas should be arranged to prevent the spread of fire and products of combustion to adjacent equipment areas.

6.12.2 Construction. Soundproofing, if used, should be of noncombustible or limited-combustible materials. Floor assemblies over equipment spaces should be constructed to protect against the penetration of water.

6.12.3 Compartmentation. Building service and support areas should be separated from adjacent equipment spaces by a

minimum of 2-hour fire-resistance-rated construction or a minimum of 1-hour fire-resistance-rated construction where automatic fire suppression is provided within the building services and support compartment(s).

6.12.3.1 Building service and support areas should be separated from adjacent nonequipment spaces by a minimum of 1-hour fire-resistance-rated construction.

6.12.3.2 All construction should be in accordance with Section 8.3.

6.12.4 Fire Protection. The building service and support areas should be protected by either a standard fire detection system or an automatic fire suppression system.

6.12.4.1 Fire Detection. Where a fire detection system is provided, it should be in accordance with Chapter 8 requirements for detection and alarm processing.

6.12.4.1.1 Installation. All fire alarm, detection, and alarm notification equipment should be installed and maintained in accordance with NFPA 72, *National Fire Alarm Code*.

6.12.4.2 Fire Suppression.

6.12.4.2.1 Portable Fire Extinguishers. Building service and support areas should be provided with listed portable extinguishers suitable for use in accordance with Section 8.6.

6.12.4.2.1.1 The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

6.12.4.2.2 Automatic Fire Suppression. Where automatic suppression systems are provided in building service and support areas, they should be in accordance with the requirements of Section 8.6. Careful consideration should be made to recognize the impact the agent could have on energized equipment.

6.12.5 HVAC Systems. An HVAC system(s) should be installed in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

6.12.6 Electrical. Nontelecommunications power circuits should be installed in accordance with NFPA 70, *National Electrical Code*.

6.12.7 Lightning and Surge Protection. Lightning and surge protection, where provided, should be installed in accordance with NFPA 780, *Standard for the Installation of Lightning Protection Systems*, and NFPA 70, *National Electrical Code*, respectively.

6.12.8 Special Hazards. Flammable and combustible liquids and aerosols should be stored in listed fire-rated storage cabinets.

Chapter 7 Small Telecommunications Facilities

7.1* General.

7.1.1 Application. A small telecommunications facility includes operations such as switching, transmission, and routing of voice, data, or video signals within an enclosed area of 46 m² to 232 m² (500 ft² to 2500 ft²) of telecommunications equipment space.

7.1.2* Prescriptive Approach. Where the performance-based approach of Chapter 5 is not used, the prescriptive elements of this chapter should apply.

7.1.3 Co-Located Telecommunications Equipment. Major co-located telecommunications equipment installation, operation, and maintenance should meet the recommendations of this chapter.

7.1.4 Automatic Fire Protection. Where the prescriptive approach elements of Chapter 7 are not provided, automatic fire suppression should be provided.

7.2 Construction. Building construction should be in accordance with Section 8.2.

7.3 Protection from Exposures. Exterior walls and openings should be protected as required by the applicable code or should be protected in accordance with the provisions of NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, where no building code is adopted.

7.4 Means of Egress. Means of egress should be provided in accordance with NFPA 101, *Life Safety Code*.

7.4.1 For purposes of application of NFPA 101, *Life Safety Code*, requirements, telecommunications equipment spaces, including technical support areas, should be considered special purpose industrial occupancies.

7.5 Telecommunications Equipment Spaces.

7.5.1* General. The following should pertain to telecommunications spaces.

7.5.2 Construction. Partitions should be of noncombustible or limited-combustible construction in accordance with Section 8.2.

7.5.3* Compartmentation. Compartmentation should not be necessary in small facilities, except as recommended in Sections 7.5 and 7.6.

7.5.4 Telecommunications Equipment.

7.5.4.1 All cables and telecommunications equipment installed after January 1, 2003, whether owned or co-located, should be in accordance with Section 8.8 as appropriate for the type of cables and telecommunications equipment.

7.5.4.2 Telecommunications equipment should be industry-standard compliant and should be installed and used in configurations and uses for which it has been tested.

7.5.4.3 Cables and equipment that do not comply with Section 8.8 should be separated from the remainder of the telecommunications equipment space by either of the following:

- (1) Sufficient spatial separation and smoke management to prevent fire and smoke damage to equipment other than the equipment of fire origin
- (2) A rated fire separation with a minimum fire resistance of 1 hour

7.5.5 Fire Detection. Small facilities should be provided with an EWFD system for detection and alarm processing in accordance with Chapter 8.

7.5.5.1 Installation and maintenance should be in accordance with NFPA 72, *National Fire Alarm Code*.

7.5.6 Fire Suppression.

7.5.6.1 Portable Fire Extinguishers. Listed portable fire extinguishers suitable for use on electronic equipment should be provided in accordance with Section 8.6.

7.5.6.1.1 The selection, placement, and maintenance of portable fire extinguishers should be in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

7.5.7 Limitation of Combustibles. Small telecommunications facilities should not be utilized for the storage of combustible materials or other equipment not related to the switching and transmission of voice, data, and video signals.

7.5.7.1 Temporary staging areas of construction and maintenance materials should be permitted for current work that directly supports telecommunications equipment in accordance with Section 9.4.

7.5.8 Special Hazards. Hazardous operations, such as cutting and welding, should not be conducted without special permits.

7.5.8.1 Heat-producing appliances not related to the support of telecommunications equipment should not be permitted within the space.

7.5.9 Smoke Management. Where smoke management systems are used, they should comply with Chapter 8.

7.6 Administrative, Building Service and Support, and Standby Engine Areas. Where administrative, building service and support, and standby engine areas are provided in small telecommunications facilities, they should be separated from equipment spaces by 1-hour fire-resistance-rated construction in accordance with Section 8.3.

7.6.1 Building Service Equipment. Building services should be provided in accordance with the requirements of applicable mechanical and electrical codes.

Chapter 8 Fire Protection Elements

8.1 General. Chapter 8 contains fire protection elements used to meet the prescriptive recommendations of Chapters 6 and 7 and should not be applied independently of Chapters 6 and 7.

8.2 Construction. Buildings housing telecommunications facilities should be of noncombustible construction in accordance with NFPA 220, *Standard on Types of Building Construction*.

8.2.1 Telecommunications Facilities. Telecommunications facilities should be of noncombustible or limited-combustible construction as defined in NFPA 220, *Standard on Types of Building Construction*.

8.2.2 Interior Walls. All interior walls should be of noncombustible or limited-combustible construction.

8.3* Compartmentation. Compartmentation should be provided to reduce the spread of fire and smoke within the telecommunications facility and to other building occupancies.

8.3.1 Fire-Resistance-Rated Construction.

8.3.1.1 Fire-Resistance-Rated Construction. Where recommended in this document, fire-resistance-rated construction (e.g., wall and floor/ceiling assemblies) should be provided around designated spaces to prevent the spread of fire.

8.3.1.1.1 The fire resistance rating of the assembly should correspond to the highest rating recommended for the separated spaces.

8.3.1.1.2 Fire-resistance-rated walls should extend from the foundation or floor below to the underside of the roof or floor deck above to provide a complete separation.

8.3.2 Protection of Fire-Resistance-Rated Construction Openings.

8.3.2.1 Doors. Doors should be fire tested under positive pressure to NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, and should be installed in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows*.

8.3.2.1.1 The fire rating of the door assemblies should correspond to the fire rating of the wall assemblies, as follows:

- (1) 1-hour wall should have 1-hour fire-resistance-rated door assembly.
- (2) 2-hour wall should have 1½-hour fire-resistance-rated door assembly.
- (3) 3-hour wall should have 3-hour fire-resistance-rated door assembly.

8.3.2.1.2 Doors should be self-closing or automatic-closing upon appropriate alarm signal activation.

8.3.2.2 Glazing Materials in Doors. Glazing materials in doors should be fire tested under positive pressure to NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, and should be installed in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows*.

8.3.2.3 Glazing Materials in Fire-Resistance-Rated Construction. Glazing materials in fire-resistance-rated walls should have an equal fire resistance rating as the wall or be protected with an automatic fire-resistance-rated shutter in accordance with NFPA 80, *Standard for Fire Doors and Fire Windows*.

8.3.2.3.1 The fire-resistance-rated glazing material should be fire tested to NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*.

8.3.2.3.2 The fire-resistance-rated glazing material should be listed and labeled.

8.3.2.4 Construction Joints. Joints in or between walls and floor/ceiling assemblies of fire-resistance-rated construction should be fire tested in accordance with ASTM E 1966, *Standard Test Method for Fire Resistive Joint Systems*.

8.3.2.4.1 The fire-resistance-rated joint systems should be listed.

8.3.3 Penetrations in Fire-Resistance-Rated Construction.

8.3.3.1 Pipes, Conduits, Cables, and Cable Trays. Pipes, conduits, cables, and cable trays that penetrate fire-resistance-rated construction (e.g., walls or floor/ceiling assemblies) should be protected with assemblies tested in accordance with ASTM E 814, *Standard Test Method for Fire Test of Through-Penetration Fire Stops*, or NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*.

8.3.3.1.1 The penetration fire stop systems should be listed.

8.3.3.2* HVAC Systems. Fire dampers, smoke dampers, or combination fire/smoke dampers should be used to protect penetrations of fire-resistance-rated walls, floor/ceiling assemblies, and smoke barriers created by HVAC system elements in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

8.3.3.2.1 Combination fire/smoke dampers in the affected area should be automatically activated by a smoke detection

system installed throughout the area or by duct smoke detectors installed in the duct adjacent to the dampers.

8.3.3.2.2 The annular space around the HVAC system duct-work through fire-resistance-rated construction (e.g., walls or floor/ceiling assemblies) and smoke barriers should be protected with a listed fire stop system in accordance with ASTM E 814, *Standard Test Method for Fire Test of Through-Penetration Fire Stops*, or NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*.

8.4 Alarm Processing.

8.4.1 General.

8.4.1.1 Alarm processing described in Section 8.4 should include automatic or manual actions and responses to be performed as a result of a change in status of monitored alarm initiating devices, supervisory initiating devices, and trouble conditions.

8.4.1.2 Fire alarm, supervisory, and trouble signals should be annunciated at a constantly attended location.

8.4.1.3* Use of VEWFD systems with an alert (pre-alarm) condition should provide for an initial response by authorized personnel prior to fire department notification.

8.4.1.3.1 The initial response should be by owner designated personnel such as a telecommunications facilities person or technician.

8.4.1.4* Network alarm monitoring centers maintained by the telecommunications service provider that have dedicated personnel 24 hours per day 7 days per week should be permitted to be the supervising station.

8.4.1.5 Supervising stations meeting the requirements of NFPA 72, *National Fire Alarm Code*, for proprietary or central station service should be acceptable supervising stations.

8.4.2 Signaling. Fire alarm control units should provide for receipt and processing of signals for transmission to an approved supervising station.

8.4.2.1 Supervisory Signals.

8.4.2.1.1 Disposition of supervisory signals should conform to the requirements of NFPA 72, *National Fire Alarm Code*.

8.4.2.1.2* Supervisory signals should be given priority over all other general building maintenance alarm signals.

8.4.2.1.3 Supervisory signals should be immediately transmitted to a supervising station.

8.4.2.1.4 Supervisory signals should include, but not be limited to, the following:

- (1) Alert signal (pre-alarm) from a VEWFD system
- (2) Hydrogen gas (danger level)
- (3) Methane gas (danger level)
- (4) Battery room ventilation fan failure
- (5) Fire alarm initiating devices, where designated as such (e.g., duct smoke detectors)
- (6) Sprinkler valve supervisory switches
- (7) Fire pump off-normal conditions
- (8) Other safety systems

8.4.2.1.5 The alert pre-alarm signal from a VEWFD system should be distinguishable from all other fire alarm, supervisory, and trouble signals.

8.4.2.1.6 The supervisory station operator should initiate the following actions upon receipt of a supervisory signal:

- (1) Where required, communicate immediately with the designated person(s) to ascertain the reason for the signal
- (2) Where required, investigate, unless supervisory conditions are promptly restored to normal
- (3) Where required, notify the fire department
- (4) Where required, notify the authority having jurisdiction when the fire protection systems are wholly or partially out of service for 8 hours or more
- (5) Where required, provide written notice to the authority having jurisdiction as to the nature of the signal, time of occurrence, and restoration of service, when equipment has been out of service for 8 hours or more

8.4.2.1.7 Supervisory signals should not cause activation of building fire alarm notification appliances.

8.4.2.2 Fire Alarm Signals.

8.4.2.2.1 Disposition of fire alarm signals should conform to the requirements of NFPA 72, *National Fire Alarm Code*.

8.4.2.2.2 Manual fire alarm signals should be initiated by manual pull stations.

8.4.2.2.3 Automatic fire alarm signals should be initiated by, but not be limited to, the following:

- (1) Smoke detectors
- (2) Heat detectors
- (3) Flame detectors
- (4) Suppression system release
- (5) Waterflow initiating devices

8.4.2.2.4 Fire alarm signals should take precedence in processing over all other signals.

8.4.2.2.5 The automatic or manual initiation of alarm conditions should cause the building fire alarm notification appliances to operate in accordance with the requirements of NFPA 72, *National Fire Alarm Code*.

8.4.2.2.6 Fire alarm signals should be automatically and immediately transmitted to a constantly attended supervising station.

8.4.2.2.7 The supervising station should immediately notify the local fire service of any fire alarm signal, and in addition, should provide the fire service with information as to the site location and any special conditions that could exist.

8.4.2.2.8 Designated telecommunications personnel should be dispatched to the site immediately upon receipt of alarm.

8.4.2.2.9 The fire alarm system should be restored to its normal operating condition as soon as possible after the disposition of the cause of the alarm signal.

8.4.2.2.10 Systems should be arranged so that loss of commercial power does not cause a fire alarm signal.

8.4.2.3 Trouble Signals.

8.4.2.3.1 Disposition of fire alarm system trouble signals should conform to the requirements of NFPA 72, *National Fire Alarm Code*.

8.4.2.3.2 Trouble signals should include, but not be limited to, the following:

- (1) Ground fault condition
- (2) Open or short circuit fault

- (3) Loss of primary power
- (4) Fire alarm system component failure
- (5) Alarm transmitter failure
- (6) Microprocessor failure

8.4.2.3.3* Upon receipt of a trouble signal, designated maintenance personnel should be dispatched to the site to determine the trouble and to begin repairs.

8.4.2.3.4 Where required, notification of trouble conditions to the local fire department should be provided.

8.4.2.3.4.1 Where monitoring systems provide the supervising station with detailed trouble information that allows determination of the degree of system impairment, response should be permitted to be delayed until the next working day where it is determined that the trouble does not affect the ability to detect and report a fire condition.

8.4.3 Signal Path Integrity. Wiring between the fire alarm control unit and the telephone equipment that processes the signals to be sent to the supervising station should be monitored for integrity such that an open, shorted, or ground fault condition on any conductor(s) should cause a trouble signal to be indicated at a supervising station.

8.4.3.1 Systems using a method of switching ground in normal operation should not cause a trouble indication upon grounded condition.

8.4.3.2 The recommendation of 8.4.3 should not apply where the distance between the fire control unit and the telephone equipment that processes the signal to be sent to the supervising station is no more than 0.9 m (3 ft).

8.4.3.3 The recommendation of 8.4.3 should not apply where the primary notification location for alarm, supervisory, and trouble signals is an approved supervising station and the monitoring is accomplished in accordance with the requirements of *NFPA 72, National Fire Alarm Code*.

8.5 Fire Detection.

8.5.1* General. Fire detection systems should be designed, installed, and maintained to provide the level of protection recommended in Chapters 6 and 7. The levels of protection are as follows:

- (1) VEWFD (Very Early Warning Fire Detection)
- (2) EWFD (Early Warning Fire Detection)
- (3) SFD (Standard Fire Detection)

8.5.2 Detection Systems.

8.5.2.1 EWFD and VEWFD smoke detection systems should use sensors or ports with spacing that is less than that normally required by *NFPA 72, National Fire Alarm Code*.

8.5.2.2 Flame detection systems provided for EWFD use should be installed to provide line-of-sight detection for critical areas of a room where flaming fires can occur in a rapid manner.

8.5.3 Installation.

8.5.3.1 VEWFD.

8.5.3.1.1 Where recommended by Chapters 6 and 7, VEWFD systems should comply with 8.5.3.

8.5.3.1.2* Every type of sensor and port installed in a space should be limited to a maximum coverage area of 18.6 m² (200 ft²). When two levels (high and low) of ports or sensors

are provided, each level should be limited to a coverage of 37.2 m² (400 ft²) or less per port or sensor. The coverage limitation between high and low levels should be limited to 18.6 m² (200 ft²) providing for staggered port or sensor arrangements between each level.

8.5.3.1.3 The sensors or ports do not need to be located directly in the center of the bay but should be located so that they are exposed to the movement of smoke. The sensor or port should not be located within 0.9 m (3 ft) of supply duct registers. Locations selected should be visible from the floor and accessible for maintenance.

8.5.3.1.4* Sensors or ports should be installed to monitor return air from the space. Spacing of sensors or ports should be installed such that each covers no greater than 0.4 m² (4 ft²) of the air grille.

8.5.3.1.4.1* Where stand-alone packaged HVAC units are used, sensors or ports should be installed where return air is brought back to the unit. Spacing of sensors should be installed such that each covers no greater than 0.4 m² (4 ft²) of the return air opening.

8.5.3.1.5 Where air-sampling systems are used, the systems should be designed using manufacturer-provided listed criteria to determine at each sampling port, as a minimum, the pipe air pressure, the airflow rate through that sampling port, the percentage of the total pipe flow through the sampling port, and the time needed for a smoke sample to be drawn from that sampling port to the detector.

8.5.3.1.6* Minimum sensitivity settings above ambient airborne particulate levels for the VEWFD systems used should be as follows:

- (1) Alert condition is as follows:
 - (a) Air-sampling systems 0.2 percent per foot obscuration (effective sensitivity at each port)
 - (b) Spot-type sensors 0.2 percent per foot obscuration
- (2) Alarm condition is as follows:
 - (a) Air-sampling systems 1.0 percent per foot obscuration (effective sensitivity at each port)
 - (b) Spot-type sensors 1.0 percent per foot obscuration

8.5.3.1.7 Maximum transport time from the most remote port to the detection unit of an air-sampling system should be limited to 60 seconds.

8.5.3.2 EWFD.

8.5.3.2.1 Smoke Detection Systems.

8.5.3.2.1.1 Where recommended by Chapters 6 and 7, EWFD systems should comply with 8.5.3.

8.5.3.2.1.2* The area of coverage for a single sensor or port should be limited to 37.2 m² (400 ft²).

8.5.3.2.1.3 The sensors or ports do not need to be located directly in the center of the bay but should be located so that they are exposed to the movement of smoke. The sensor or port should not be located within 0.9 m (3 ft) of supply duct registers. Locations selected should be visible from the floor and accessible for maintenance.

8.5.3.2.1.4 The minimum alarm sensitivity setting at the sensor or port used for EWFD in telecommunications equipment spaces should be 1.5 percent per foot.

8.5.3.2.1.5 Maximum transport time from the most remote port to the detection unit of an air-sampling system should be limited to 90 seconds.

8.5.3.2.1.6 Where air-sampling systems are used, the systems should be designed using manufacturer-provided listed criteria to determine at each sampling port, as a minimum, the pipe air pressure, the airflow rate through that sampling port, the percentage of the total pipe flow through the sampling port, and the time needed for a smoke sample to be drawn from that sampling port to the detector.

8.5.3.2.2 Flame Detection Systems.

8.5.3.2.2.1 Where recommended by Chapters 6 and 7, flame detection systems should be installed in accordance with this section.

8.5.3.2.2.2* The flame detection systems should be installed to provide line-of-site detection for critical areas of the space.

8.5.4 SFD. Where recommended by Chapters 6 and 7, SFD systems should comply with the requirements of NFPA 72, *National Fire Alarm Code*.

8.6 Fire Extinguishing Systems.

8.6.1* General. Where provided, fire suppression systems should comply with Section 8.6.

8.6.2 Automatic Fire Suppression.

8.6.2.1 General.

8.6.2.1.1 Automatic fire suppression systems provided in telecommunications facilities should be selected with due consideration given to the hazards being protected and the impact of the agent on energized equipment. Facilities should be protected from accidental discharge of extinguishing agents to prevent damage to equipment or danger to personnel.

8.6.2.1.2 Fire suppression agents should not cause severe damage to the equipment. Suppression agents such as those containing dry chemical agents or corrosive wet agents in fixed systems should not be used in any area containing telecommunications equipment.

8.6.2.1.3 Activation of any fire suppression system should transmit an alarm to a constantly attended location.

8.6.2.2 Fire Sprinkler Systems.

8.6.2.2.1* Where provided, fire sprinkler systems should be designed, installed, tested, and maintained in accordance with the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

8.6.2.2.2 All piping for dry pipe and pre-action sprinkler systems should be installed with a pitch in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, whether or not the piping is subjected to freezing conditions.

8.6.2.2.3 Detection systems used to actuate pre-action fire sprinkler systems should be installed in accordance with Section 8.5.

8.6.2.3 Clean Agents.

8.6.2.3.1* Where provided, clean agent extinguishing systems should be designed, installed, and maintained in accordance with the requirements of NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*.

8.6.2.3.2 Detection systems used to actuate clean agent suppression systems should be designed in accordance with Section 8.5. Detection should be either cross-zoned or an equivalent method should be used to limit the possibilities of false discharges.

8.6.2.4 Halon Systems.

8.6.2.4.1* Where provided, halon systems should be designed, installed, and maintained in accordance with NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*.

8.6.2.4.2 Detection systems used to actuate halon suppression systems should be designed in accordance with Section 8.5. Detection should be either cross-zoned or an equivalent method should be used to limit the possibilities of false discharges.

8.6.2.5 Water Mist Fire Protection Systems.

8.6.2.5.1 Where provided, all water mist fire protection systems should be installed in accordance with the requirements of NFPA 750, *Standard on Water Mist Fire Protection Systems*.

8.6.2.5.2 Water mist fire protection systems should be designed and installed for the specific hazards and protection objectives specified in the listing.

8.6.2.5.3 Detection systems utilized for the operation of water mist fire protection systems should be installed in accordance with Section 8.5 or the listing criteria.

8.6.3 Manual Fire Suppression.

8.6.3.1 Portable Fire Extinguishers.

8.6.3.1.1 Where recommended, listed portable extinguishers suitable for use on energized telecommunications equipment should be provided. They should be installed and maintained in accordance with NFPA 10, *Standard for Portable Fire Extinguishers*.

8.6.3.1.2* Portable fire extinguishers containing dry chemical or corrosive liquid agents should not be installed for the protection of telecommunications equipment areas.

8.6.3.2* Standpipes. Where standpipes are provided, they should be installed and maintained in accordance with NFPA 14, *Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems*.

8.7 Smoke Management Systems.

8.7.1 General. Smoke management systems should be considered as a means to meet the prescriptive elements of this recommended practice. Where properly designed, installed, tested, and maintained, smoke management systems, which include smoke control systems and smoke removal systems, should be recognized as an effective means to prevent smoke from spreading to noninvolved areas in low heat release rate fires, minimize damage, and facilitate search and cleanup operations. (See Annex D.)

8.7.2 Installation. Where provided, smoke management systems installed in accordance with the applicable sections of NFPA 92A, *Recommended Practice for Smoke-Control Systems*; NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas*; and NFPA 204, *Guide for Smoke and Heat Venting*, except as noted herein, should be permitted to be used to meet the performance objectives of Section 5.5.

8.7.2.1 Operation of the smoke management system installed in the telecommunications equipment space, power area,

main distribution frame space, or standby engine area should be automatically activated or manually activated from a location outside of the space.

8.7.2.2 Where mechanical exhaust systems are installed, a source of make-up air should be provided. Make-up air inlets should be designed so that the velocity of the supplied air does not exceed 61 m/min (200 ft/min) and to take maximum use of the mixing and diluting effects created. If air enters the smoke layer above the interface it should be accounted for in the exhaust calculations. Where outside air is used, consideration should be given to conditioning the outside air to provide an environment that would be similar during regular operations to avoid temperature shocks to electronic equipment.

8.7.2.3* Exhaust points should be used to reduce the possibility of smoke being drawn into noninvolved equipment.

8.7.2.4 The smoke exhaust should discharge to the outside of the building, away from fresh air intakes, make-up air intakes, and building openings.

8.7.2.5 HVAC systems for telecommunications equipment areas should be provided in accordance with Section 8.1 of NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment*.

8.8 Equipment Ignition and Fire Resistance.

8.8.1* General. Where needed to achieve an objective of a performance-based design permitted by Chapter 5 or to meet the prescriptive recommendations permitted by Chapters 6 and 7, the equipment, cables, wiring, and associated components should comply with the provisions of Section 8.8.

8.8.2 Wire and Cable.

8.8.2.1* Wire, fiber, and cable should comply with the flammability requirements in ANSI T1.307, *Fire Resistance Criteria-Ignitability Requirements for Equipment Assemblies, and Fire Spread Requirements for Wire and Cable*, and the test methods referenced therein including smoke generation tests, where available.

8.8.2.2* Where nonmetallic conduit and trays are used for wires, fibers, and cables, they should comply with the following:

- (1) Trays, unless installed in plenums, should meet the requirements for limited smoke as specified in UL 1685, *UL Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.
- (2) Trays and conduit for wires, fibers, and cables installed in plenums should comply with NFPA 262, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*, with a maximum flame spread of 1.52 m (5 ft), a maximum peak optical density of 0.5, and a maximum average optical density of 0.15 (as outlined in UL 910, *UL Standard for Safety Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air*).
- (3) Trays and conduit for wires, fibers, and cables installed vertically between floors in a building should comply with UL 1666, *UL Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*, and demonstrate limited smoke generation by testing in accordance with UL 1685.

8.8.3 Major Equipment Systems.

8.8.3.1* Major telecommunications equipment should meet the fire resistance criteria specified in Telcordia GR-63-CORE,

Network Equipment Building System (NEBS) Requirements: Physical Protection, following the methodologies specified in ANSI T1.307, *Fire Resistance Criteria-Ignitability Requirements for Equipment Assemblies, and Fire Spread Requirements for Wire and Cable*, and ANSI T1.319, *Fire Propagation Hazard Testing Procedure for Equipment*. Other equipment should be permitted to be evaluated using appropriate standards referenced in Annex F.

8.8.3.2 Where cable and equipment are not labeled to indicate compliance with the requirements of 8.8.3.1, then documentation regarding compliance with the fire resistance criteria specified in 8.8.3.1 should be readily available.

Chapter 9 Fire Prevention

9.1* General. Telecommunications facilities should implement a level of fire prevention measures and should be constructed, maintained, and occupied in a way that reduces the likelihood of ignition and the spread of a fire by minimizing the ignition potential and reducing the fire load.

9.1.1* Housekeeping.

9.1.1.1 All combustibles should be kept to a minimum.

9.1.1.2 Combustibles should be removed daily or, when necessary, be stored appropriately in protected storage rooms, noncombustible enclosed storage cabinets or bins, noncombustible covered refuse containers, or listed self-extinguishing-type trash receptacles.

9.1.2* Limiting Other Combustibles. Combustible materials, such as packing materials and office supplies, should not be stored in areas exposing critical equipment and related components unless these materials are located in noncombustible cabinets or are within areas provided with fire suppression systems.

9.1.2.1 Areas around the outside of the facility, especially areas near the ventilation system intake, or any openings (e.g., equipment doors and egress routes) should be free of combustibles.

9.1.2.2 Inspections should be performed by telecommunications personnel or by a designated outside agency.

9.1.2.2.1 One part of the inspection should cover housekeeping practices.

9.1.3 Portable Heating Appliances in Telecommunications Spaces. Portable heaters should not be permitted.

9.1.3.1 If the primary heating source is inadequate, the building management should take appropriate permanent action to correct the heating deficiencies.

9.1.3.2 Where portable space heaters are necessary for work activities or due to extraordinary problems with HVAC, they should include the following features:

- (1) Electrically powered
- (2) Listed
- (3) De-energized upon tilt or tipover
- (4) Illuminated "power-on" pilot light
- (5) Variable temperature control
- (6) Building management approval
- (7) Limited to temporary use of no more than 7 consecutive days

9.1.4* Heat-Producing Appliances. The use of portable heat-producing appliances and/or devices not related to the support of telecommunications equipment (e.g., heaters, mug warmers, coffee pots, hot plates, microwave units, refrigerators) should not be located in any telecommunications equipment space, computer room, individual office spaces/cubicles, or storage/shipping areas.

9.1.5* Smoking. Smoking, carrying, or depositing any lighted or smoldering substance should not be permitted in telecommunications equipment and support buildings (e.g., switching spaces, power and battery rooms, generator rooms, warehouse/combustible storage/staging spaces, computer rooms) and all additional areas identified by local management as a risk to the network operation.

9.1.5.1 Designated Smoking Areas. If a designated smoking area is to be allowed in other areas of the building, local management should conduct a fire risk analysis prior to designating such areas.

9.1.5.1.1 The fire risk analysis should include consideration of the following criteria to protect the network:

- (1) Noncombustible ash trays
- (2) Noncombustible waste receptacles
- (3) Ignition-resistant furnishings
- (4) Commensurate detection and/or suppression
- (5) A minimum 1-hour fire separation of the space

9.1.5.2 Signage.

9.1.5.2.1 In buildings where smoking is prohibited, signs should be posted at the entrances to the building.

9.1.5.2.2 If smoking is only permitted in designated areas, signs should be posted at the entrances of the building and at the designated space that state, "Smoking only permitted in the designated smoking area."

9.1.5.2.3 In buildings where smoking is permitted, "No Smoking" signs should be posted in conspicuous designated locations where smoking is prohibited.

9.1.6 Outdoor Grills/Barbecues. Grills/barbecues should be located not less than 15.3 m (50 ft) from any structure. No unit should be kindled or maintained on combustible patios or within or upon any portion of a structure. Use of liquid or solid fueled (charcoal burners) units should be governed by local management and prohibited when atmospheric conditions or local circumstances make the use of units hazardous. Cooking fires should be constantly attended by an assigned person until such fire is extinguished and heat dissipated. This person should have a garden hose connected to the water supply or other fire extinguishing equipment readily available for use. The storage of the units and associated liquids, gases, and flammable materials (lighter fluids) should comply with local codes. All ashes should be rendered harmless and properly disposed.

9.1.7* Hot Work. A hot work permit should be used for operations involving open flame or spark-producing equipment. Hot work permits that are issued for welding, cutting, and use of torches should comply with Chapter 9 and NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, for areas not designed for this type of operation. Where soldering irons, heat guns, glue guns, and other similar heat-producing tools are used, they should be attended at all times when in use. Additionally, these tools should be de-energized and safely stored when not in use.

9.1.8 Flammable and Combustible Liquids. The storage, handling, and use of flammable and combustible liquids, including waste liquids, should comply with the requirements of NFPA 30, *Flammable and Combustible Liquids Code*.

9.1.8.1 Flammable and combustible liquids such as paints, solvents, and other lubricants should not generally be permitted in telecommunications equipment facilities.

9.1.8.2 All liquids should be stored in approved fire-rated cabinets at the end of each shift (work day).

9.1.9 Compressed Gases. Noncombustible compressed gases within telecommunications spaces should follow the Compressed Gas Association guide for safe handling, CGA P-1, *Safe Handling of Compressed Gases in Containers*.

9.1.9.1 Propane stored in cylinders and containers on the exterior of the building should comply with NFPA 54, *National Fuel Gas Code*, and NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*.

9.1.10 Clear Access. Clear and unobstructed access to telecommunications facilities should be maintained for fire and EMS operations.

9.1.11 Exterior Maintenance. The telecommunications-controlled exterior land around telecommunications buildings should be maintained free of combustible vegetations (e.g., brush and weeds) and combustible products.

9.1.12 Vehicle Parking. All vehicle parking should be at a safe distance from all structures and storage.

9.2* Nontelecommunications Electrical Equipment and Wiring. The installation and maintenance of electrical equipment and wiring should be in accordance with applicable requirements of NFPA 70, *National Electrical Code*, such as the use of listed electrical fittings, materials, and equipment.

9.2.1 Electrical Cords. Electrical extension cords should only be used when a flexible, temporary (i.e., less than 30 days) connection is necessary and never for permanent wiring. Flexible electric cords (e.g., extension cords) should be adequate to carry the anticipated amperage and should be listed. Cords should never be under carpets, rugs, or chair mats. Cords should be placed in a cord tray to avoid tripping hazards and wear. If additional electrical demand is needed, the local management should correct the condition.

9.2.2 Current-Limiting Devices. Fuses, circuit breakers, and other current-limiting protection for both telecommunications equipment and building equipment should be listed for the intended use.

9.3 Staging of Equipment. Staging areas assigned for crating, de-crating, and containment of combustibles for equipment installation and removal should be designed with appropriate detection and/or separation and managed so as not to lower the overall level of fire safety within the telecommunications building.

9.4* Construction and Alterations. All construction and alteration projects should comply with NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, and should be carefully reviewed by management to ensure conformance with all codes, regulations, and company standards.

9.4.1 Installation of Telecommunications Equipment. The delivery, storage, installation, testing, and cleanup associated with the installation of telecommunications equipment

should be performed in a manner that exhibits the highest degree of fire safety procedures.

9.4.2 Vendors and Installers. The vendors, installers, and contractors associated with the installation of telecommunications equipment should comply with the safety standards of the telephone company during the installation of such equipment.

9.4.3 Cutting and Welding Activities. Cutting and welding activities should comply with 9.1.7, and hand-held fire extinguishers should be provided and should comply with 8.6.3.1.

9.4.4 Use and Storage of Combustible Materials. Combustible materials should not be stored in telecommunications equipment areas.

9.4.5* Building Construction and Alteration Work. The delivery, storage, construction, and cleanup associated with building construction and alteration work should be performed in a manner that complies with NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, and the telecommunications company policies. In buildings under construction, renovations, or alterations of buildings, adequate escape facilities should be maintained at all times for the use of construction workers. Escape facilities should consist of doors, walkways, stairs, ramps, fire escapes, ladders, or other approved means or devices arranged in accordance with the general principles of NFPA 101, *Life Safety Code*.

9.4.6 Contractors Access, Security, and Work. The activities of building construction contractors should be regulated by policies of the telecommunications company.

9.4.7 Bus Bar Protection During Construction Work. Provisions should be made to protect the bus bars when building construction activity occurs in the area around or over live bus bars.

9.4.8 Fire Prevention Awareness for Contractors. Telecommunications companies should provide awareness information to contractors of fire prevention and protection issues or measures within telecommunications facilities.

9.4.8.1 Contractors should disseminate this information to all of their employees and their contractors prior to commencement of work.

9.4.9* Maintenance Work — Building Services. Building maintenance and janitorial staff should consider all the activities that would increase the fire load or ignition probability and should take appropriate steps to limit or remove these potential hazards.

9.5 Employee Awareness. All employees should receive information regarding fire prevention policies, procedures, and fire safety hazards.

9.6* Physical Security. A review of the security procedures and compliance to internal practices should be conducted to identify any potential exposures, and corrective actions should be implemented. Access should be controlled to the building or to areas containing critical equipment to reduce the possibility of arson. A key box(es), when required by the authority having jurisdiction, should be listed and installed in an accessible location. The operator of the premises should immediately notify the authority having jurisdiction and provide the new key(s) when a lock is changed or re-keyed and a key(s) to that lock is contained in the key box.

9.7 Means of Egress. All means of egress should be maintained in accordance with the requirements of NFPA 101, *Life Safety Code*.

9.8 Displays and Decorations. Displays, holiday trees, or other decorations should not be allowed in telecommunications equipment areas.

9.8.1 Displays, holiday trees, or other decorations should not be allowed to obstruct corridors, exit ways, or other means of egress.

9.8.2 Natural cut holiday trees should not be permitted.

9.8.3 Artificial holiday trees, displays, and decorations should be labeled or otherwise identified or certified by the manufacturer as being flame retardant or flame resistive.

9.8.4 Only listed electrical lights and wiring should be used on holiday trees and similar decorations.

9.8.5 Electrical lights should be prohibited on metal artificial trees, displays, and other decorations not labeled for the use of listed lights.

9.9* Open Flame Devices. In nontelecommunications spaces, the use of solid-fueled heat sources for warming of food trays should be permitted and should be constantly attended and operated with the approval of management. Other open flames should only be permitted as otherwise stated in this document. Areas should have appropriate portable fire extinguishers.

9.10* Cable Management. The management of telecommunications and power cables should be based on the consideration of potential fuel load and hazards within any given equipment space or hazard area.

9.10.1* For new cable distribution installations, ac, dc, and telecommunications cable should be run in separate paths and not mixed. Points or tips of metal horns and other protruding devices on cable racks and ladders should be insulated from the cables.

9.10.2 Where practical, unused or dead cable should be mined (removed) and discarded. Care should be taken during the removal process so as to protect the existing live cables from damage. All cables that have been cut and abandoned in place should be capped.

9.11 Vacant Areas. Vacant areas or spaces in a building should be annually reviewed for the fire risk and to ensure that the areas or spaces do not add an additional risk.

Chapter 10 Pre-Fire Planning, Damage Control, and Emergency Recovery

10.1 General. (See Annex E.)

10.1.1 Annual Review. Management of each facility should develop and implement a written pre-fire plan.

10.1.1.1 This plan should be reviewed and updated annually or where necessary because of personnel changes, management structure realignment, or facility changes.

10.1.1.2 All employees of the facility should be provided with appropriate information regarding their emergency assignments, relocation, or evacuation during an emergency.

10.1.1.3 This plan should identify authority responsibilities and actions of employees to ensure the safety of themselves and all occupants of the facility.

10.1.1.4 Based upon local management conditions and required compliance with local, state, and federal regulations, all documentation should be in writing and approved by the management of the facility.

10.1.2 Elements. An effective pre-fire plan should include the following:

- (1) Identification of an emergency contact and telephone number
- (2) Life safety issues of the occupants of the facility
- (3) Life safety of the responding fire fighters to the facility
- (4) Life safety issues of the community provided by the telecommunications facility through its normal operation and its continuity during fire emergencies (e.g., 911-type services)

10.1.2.1 For large facilities, the plan should include an annual exercise to ensure that management and staff can implement and work with the plan and incorporate lessons learned from the exercise into an updated plan.

10.2 Fire Safety Manager. Management should appoint a fire safety manager who is responsible for the protection of the facility from fire.

10.2.1 The fire safety manager's duties should include the following:

- (1) Pre-fire planning
- (2) Life safety systems
- (3) Fire prevention programs
- (4) Fire inspections
- (5) Periodic property surveys
- (6) Proper operation of fire suppression and detection equipment and portable fire extinguishers

10.2.2 Other duties should include, where requested, the familiarization of the local fire department personnel with the unique aspects of telecommunications buildings and the switching facilities contained therein.

10.3* Life Safety of Occupants of the Facility. As part of the pre-fire plan, a building evacuation procedure should be developed and exercised to ensure the safe evacuation for facility occupants in cooperation with the local fire department and other applicable authorities and updated annually.

10.3.1 All employees should receive adequate orientation regarding the building evacuation procedure.

10.3.2 In circumstances regarding specially assigned tasks, orientation should be provided to ensure the safety of the employees and occupants of the facility during an emergency incident.

10.3.3 Additional orientation should be provided as needed.

10.3.4* Fire drills should be conducted annually at the facility for all employees.

10.3.5 Records should be maintained for these activities.

10.4* Fire Safety of Fire Fighters. Where requested by the local fire department, the following should be provided:

- (1) A general description of the equipment within the building and how it's powered

- (2) An up-to-date drawing of all vital equipment and equipment areas
- (3) Recommended actions to be taken concerning ventilation and contamination of areas not affected by the fire

10.4.1* Fire Service Orientation and Information. When requested by the local fire department, orientation and information should be provided to the fire personnel by the company management as follows:

- (1) A general description of the facilities and all the equipment
- (2) An orientation walk through of the facility to address all the orientation and information issues to ensure life safety and service continuity is upheld
- (3) The strategy and tactics to confine, suppress, and limit an incident's impact in the telecommunications equipment area

10.5* Damage Control Procedure. A damage control procedure should be developed for each telecommunications facility.

10.6* Emergency Recovery Procedures for Continued Operations. A recovery procedure should be developed for each telecommunications facility.

Annex A Explanatory Material

Annex A is not a part of the recommendations of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 It is not the intent to apply this practice to the telephone rooms of private (nontelecommunication) industry.

A.1.1.1 The objective in multiple tenant buildings not controlled by the telecommunications service providers is to ensure that the telecommunications facility is located in a building that has a low probability of a catastrophic fire loss. As such, care should be taken in selecting the host structure to house the telecommunications facility both from a fire protection and risk consideration (*see Chapter 4*).

A.1.2.2 Fire loss records for the industry are compiled infrequently. The most current authoritative study can be found in the Federal Communications Commission Network Reliability Council Report to the Nation, Section G, "Fire Prevention in Telecommunications Facilities." This report includes a compilation of fire incidents, a root cause of analysis, and recommended countermeasures and business practices. Additional information is found in Chapters 9 through 27 of the *NFPA Fire Protection Handbook*. In general, the lessons learned in the prior incidents have been incorporated into this document.

A.1.3 This document contains both performance and prescriptive recommendations for new buildings and installations. Existing buildings and installations were designed using prescriptive features and are difficult to summarize into one comprehensive set of prescriptive recommendations. Existing buildings could benefit from an evaluation using a performance-based perspective.

The performance of the varying prescriptive standards in existing buildings has been validated over time. No retrofitting is required by this document except under those cases where it has been determined by the authority having jurisdiction.

tion that the existing situation involves a distinct hazard to life or adjacent property. Care should be taken when this document is applied in existing buildings because the new prescriptive recommendations could vary from the existing standard.

A.1.3.2 Alterations or new installations in existing facilities should not diminish the level of protection below that which existed prior to the alteration except that protection features in excess of those features recommended in this document can be left in service, removed, or abandoned in place. If abandoned in place, such systems should be clearly identified as no longer being in service.

A.1.4 Users of this recommended practice outside of the United States and Canada should be aware that telecommunications equipment and cables used in the United States and Canada have fire resistance properties that limit flame spread and fire growth.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction might base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority might require evidence of proper installation, procedure, or use. The authority having jurisdiction might also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.3 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1.4 Power Area/Room. Examples of electrical equipment usually found in a power area/room includes rectifiers, inverters, and batteries.

A.3.3.1.5 Technical Support Areas. These areas are usually separated from the equipment space by glass or solid partitions and have one or two computer workstations where technicians program the switching equipment. These areas are not occupied on a full-time basis.

A.3.3.8.4 Telecommunications Equipment. This equipment typically includes but is not limited to switching equipment,

servers, routers, computers, and cable television equipment that establishes any form of one- or two-way communications. The equipment is generally owned or leased by a telecommunications company offering wired telephone, cellular, cable television, or internet service.

A.3.3.19 Standby Engine Room. The standby power system is an apparatus consisting of either a gas turbine or a diesel powered internal combustion engine and a generator, capable of providing the appropriate amount of ac power to run the telecommunications equipment of a central office in the event of a commercial power failure.

A.3.4.2 Exposure Fire. This term usually refers to a fire that starts outside a building (e.g., wildland fire or vehicle fire) and that consequently exposes the building to a fire. Exposure fires include fires starting in areas or floors occupied by other tenants of a multitenanted building.

A.3.4.3 Fire Model. Due to the complex nature of the principles involved, models are often packaged as computer software. Relevant input data, assumptions, and limitations needed to properly implement the model should be considered. The user should be aware of the limitations of the software or calculation method and not exceed these limitations.

A.3.4.4 Fire Scenario. The fire scenario describes factors critical to the outcome of the fire such as ignition sources and locations, nature and configuration of the fuel, ventilation, characteristics and locations of occupants, and condition of the supporting structure and other equipment.

A.3.4.8 Performance Criteria. Engineering terms include temperatures, radiant heat flux, and levels of exposure to fire products. Performance criteria provide threshold values that are treated as data for calculations used to develop a proposed design and implementation plan.

A.5.1.1 The objectives of this recommended practice are as follows:

- (1) Provide fire protection measures so that the risk of injury or death due to fire in a telecommunications facility is comparable to the levels of risk abatement for similar business-type uses
- (2) Provide fire protection measures so that telecommunications equipment is not damaged due to a fire to a point that the damage will have an unacceptable impact on network operation
- (3) Provide fire protection measures so that property is not damaged due to a fire to a point that the damage will have an unacceptable impact on property

A.5.1.2 Qualifications should include experience, education, and credentials that demonstrate knowledgeable and responsible use of applicable models and methods.

A.5.1.3 A third-party reviewer is a person(s) selected to review proposed performance-based designs.

A.5.1.5 Continued compliance with the goals and objectives of this recommended practice involves many things. The building construction, including openings, interior finish, and fire- and smoke-resistive construction; contents and hazards within the facility; and the facility fire protection systems should retain at least the same level of performance as provided by the original design parameters. The use and hazards should not change to the degree that assumptions made about life safety and network reliability characteristics, combustibility of furnishings, and existence of trained personnel are no

longer valid. In addition, actions provided by other personnel, such as emergency responders, should not be diminished below the documented assumed levels. Also, actions needed to maintain reliability of systems at the anticipated level need to meet the initial design criteria. Significant changes in any of these factors should result in a review of the performance plan.

A.5.3.1 See Figure A.5.3.1.

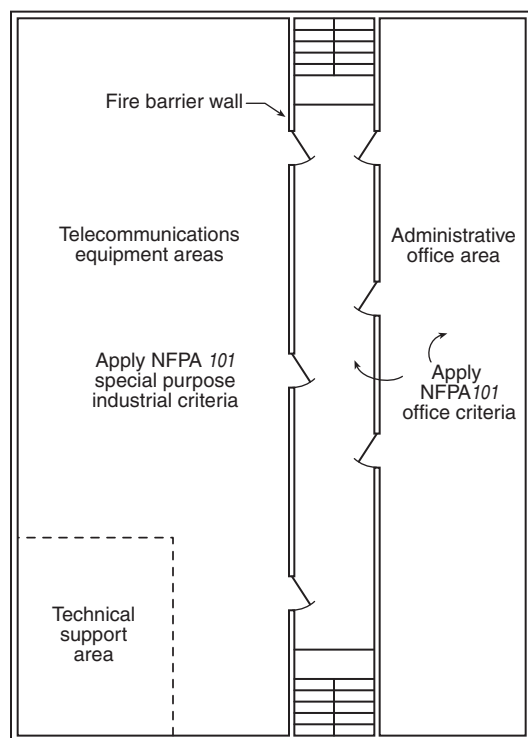


FIGURE A.5.3.1 Example of the Application of NFPA 101 to Telecommunications Equipment Areas and an Administrative Office Area.

A.5.3.2.1 One method that has been demonstrated to provide a measure of the ability of equipment to withstand elevated temperature exposure is ANSI 304, *Test Procedure for Evaluation and Classification of Insulation Systems for Direct-Current Machines*. Additional information can be found in Telcordia's GR-63-CORE, Issue 1 (formerly Bellcore).

A.5.3.2.2 Acid corrosion and conductive products of combustion have been known to cause problems after fires. (Also see Annex D.) The following extract is from Barbara T. Reagor's article in the *Journal of Fire Sciences*.

In general, an electronic switch would be expected to accumulate zinc chloride levels in the range of 30 to 60 $\mu\text{g}/\text{sq. in.}$ (micrograms per square inch) from interaction with the normal environment over its expected lifetime of 20+ years. A clean product is expected to have less than 10 $\mu\text{g}/\text{sq. in.}$ of chloride contamination present. After exposure to a fire involving halogenated materials, we have observed levels that range from 30 to 6000 $\mu\text{g}/\text{sq. in.}$ As a general rule we have found that equipment with contamination levels below 200 $\mu\text{g}/\text{sq. in.}$ can be easily restored to service with very little impact on long-term reliability. Equipment with expo-

sure from 200 to 600 $\mu\text{g}/\text{sq. in.}$, can also be restored to service as long as no unusual corrosion problems arise and the environment was strictly controlled soon after the fire. However, as the contamination level rises above 600 $\mu\text{g}/\text{sq. in.}$, the effectiveness of cleaning dwindles and the cost of cleaning quickly approach the replacement cost of the equipment.

A.5.4.3 This category of assumptions applies both to systems and features recommended by this document, that reference applicable standards, and to any additional systems or features included in the design at the discretion of the builder. The referenced standards are hereby expected to state maintenance, testing, and other requirements needed to provide positive assurance of an acceptable level of reliability. The referenced standards themselves could be prescriptive or performance based.

A.5.4.3.3 Systems addressed by this recommendation include automatic fire suppression systems and fire alarm systems. Performance issues that need to be documented could include response time indexes, discharge densities, and distribution patterns. Calculations should not include an unlimited supply of extinguishing agent if only a limited supply will be provided in the actual structure or building.

A.5.4.8 Characteristics requiring assumptions include occupant abilities and locations, and the nature of the thermal and nonthermal threats expected in telecommunications facilities (e.g., fuel loading and heat release rate of materials, extent of fire spread, amount and nature of smoke generated). The fuel loading and potential heat release rate of fires are dependent on the materials and equipment that are employed.

A.5.4.8.5 Although it would be expected that a fire in this area would be a Class B liquid fuel fire, recent history has shown that fires in these areas have been Class C electrical in nature.

A.5.4.8.7 Typical work location consists of metal furniture with a personal computer workstation. Some amounts of file storage and catalog library are expected.

A.5.5 Scenarios define the challenge to which equipment, personnel, and buildings can be exposed. Fire scenarios capture and limit value judgments on the type and severity of the fire challenge to which a proposed fire safety system should respond. The fire safety system includes any and all aspects of the proposed design that are intended to mitigate the effects of a fire, such as materials control, smoke management, egress system, automatic detection and suppression, barriers, staff training, and placement of manual extinguishers.

In order to provide a comprehensive design (i.e., demonstrate how the fire safety system will respond to a variety of fires) more than one scenario needs to be considered. Scenarios are composed of an initial fire location, an ignition source, the first and second fuel items ignited, and the geometry and ventilation features of confining spaces. In telecommunications areas, the early smoke generation rate and initial growth in fire severity could be significant considerations.

It is desirable to run a wide variety of different fire scenarios to evaluate the range of effects on telecommunications equipment, personnel, and buildings. Fire scenarios should not be limited to a single or a couple of "worst credible" fire scenarios. Scenarios should not always assume that fire safety systems will function as designed. Furthermore, failure modes and reliability of systems should be included in scenario development.

A.5.5.2.1 Design fires are typically quantified in terms of their potential generation of heat, smoke, and combustion gases that are released into the environment. The generation of these products could be represented as time-based rates (heat release rates or mass production rates). A fire's heat release is partitioned between the radiative fraction and the convected fraction transported by the plume. Radiation and convection heat transfer modes control the thermal impact of the fire and should be considered. Smoke and combustion gases are the fire's mass effluent and are generically termed species. In any particular fire scenario, species such as particulate smoke, CO, HCl, HBr, HF, and so forth could be important in terms of equipment survivability and life safety hazard and should be quantified when indicated.

Heat release rates and species generation rates for specific burning objects can be obtained from the following:

- (1) Full-scale fire tests
- (2) Estimations from correlation
- (3) Generic fire curves (t-squared curves)
- (4) Predictions from fire models
- (5) References including *SFPE Handbook of Fire Protection Engineering*, *Drysdale's Introduction to Fire Dynamics*, and the *SFPE Guide to Performance-Based Design*

Numerous data sources, fire test methods, correlation, and predictive models are available in the fire safety research and engineering literature. Specific data sources and fire test methods that could be appropriate for fire scenario development are identified in the appendices of the individual scenarios.

A.5.5.2.1.1 An example of such a scenario would have the failure or fire initiated in a component or system where damaging combustion products would be generated and transported to a nearby critical target. Fire could spread to other components located on different racks or cabinets depending on the fire exposure from the initially ignited component or systems and the ignition properties of the exposed materials.

Factors to be considered in developing design fire curves for component or systems fire scenarios include the following:

- (1) Chemical composition of wiring insulation, circuit boards and substrates, and electrical components
- (2) Species generation rates of overheated, electrically energized components or devices
- (3) Heat release rate and species generation rates of ignited items, and the potential for fire spread to other items based on the exposure fire and the ease of ignition of other items (racks or cabinets)

Significant amounts of combustion (pyrolysis) products could be generated prior to flaming ignition with overheated, electrically energized equipment. These products could pose a direct threat to critical network equipment. Therefore, particular attention should be placed on the pre-ignition scenario development.

Fire tests involving energized telecommunications equipment have demonstrated that where ignition is attributable to an electrical fault, such fires are slow to develop but do release great volumes of corrosive smoke soon after ignition. Products of combustion emitted during such tests included chlorine from combusted plastics, tin and lead from solder connections, zinc from transistor chip coatings, copper and bromine from circuit boards, manganese, silicon, and so forth. When combined with moisture, chlorine formed hydrochloric acid, and ionic chlorides formed electrically conducting compounds that can lead to corrosion damage and electrical

shorts or signal noise in the system. ["Fire Extinguishment Testing of Sprinkler Protected Telecommunications Equipment," Bell Northern Research, 1987; "The Special Need for a Smoke Exhaust System to Minimize Secondary Damage to Electronic Telephone Switching Equipment," H. H. Angus & Associates, 1992.]

Research sponsored by the Nuclear Regulatory Commission and performed by Sandia National Laboratories of the effects of smoke on electronic circuit reliability was performed. The research suggests that particle deposition onto circuit packs leads to bridging and resultant current leakage that contributes to the deterioration of equipment performance and a loss of reliability. [Tanaka, Nowlen, and Anderson, "Circuit Bridging of Components by Smoke," NUREG/CR-6476 SAND96-2633; Tanaka, "Effects of Smoke on Functional Circuits," NUREG/CR-6542 SAND97-2544.]

Two useful benchmarks in considering switching equipment fires are a fully involved printed circuit board fire, which can release 5 kW, and a fully involved frame, which can release 150 kW, heat release rate. This higher heat release rate was observed in testing to Telcordia GR-63-CORE (formerly Bellcore), *Network Equipment Building System (NEBS) Requirements: Physical Protection*.

A.5.5.2.1.2 The ignition is electrical in nature and caused by an electrical overload or short circuit fault. An example of such a scenario would be arcing ignition of cable insulation resulting in a growing fire and an inability to interrupt power due to failure or absence of emergency power disconnection. Factors to be considered in developing design fire curves for cable fire scenarios include the following:

- (1) Rating of cables (plenum, riser, vertical tray, FMRC Group 1, 2, or 3 of *FMRC Specification Test Standard for Cable Insulation*, Class No. 3972, other appropriate tests)
- (2) Quantity of cables
- (3) Orientation of cables (vertical or horizontal)
- (4) Quantity and composition of materials used in cable construction (jacketing and insulation)
- (5) Presence or absence of fire-stopping materials

Literature values for heat release and species generation rates for cable fires measured in large-scale calorimeter tests can be useful as a basis for scenario and design fire development.

A.5.5.2.1.3 An example of such a scenario would be ignition of construction waste by a defective or damaged electrical extension cord igniting equipment packaging in a switching or rack space. Another example would be ignition of computer equipment in an office module and failure to achieve closure of openings connecting to telecommunications equipment areas.

Literature values for heat release and species generation rates for typical nontelecommunications fuel packages measured in large-scale calorimeter tests can be useful as a basis for scenario and design fire development. Typical fuels and sources of data can be found in the *SFPE Handbook of Fire Protection Engineering* and reports of full-scale tests by the Building Fire and Research Laboratories at the National Institutes for Standards and Technology. In the absence of available literature data, large-scale calorimeter tests can be conducted. In some cases, typical nontelecommunications fuel package fire scenarios could be represented by "standard" t-squared fires commonly referred to as "slow, medium, fast, and ultra-fast" fires (see NFPA 72®, *National Fire Alarm Code*®, and *SFPE Handbook of Fire Protection Engineering*).

Design fire curves should include the heat release contributions of the first fuel ignited and the subsequent fuel packages associated with the scenario in question.

A.5.5.2.1.4 An example of such a scenario would be failure of a fuel line on an operating generator, vaporization of the spilled fuel on a hot surface with subsequent ignition resulting in a flash fire or deflagration. Another example of such a scenario would be an accidental spill and ignition of a flammable liquid solvent in telecommunications and nontelecommunications spaces.

Factors to be considered in developing design fire curves for ignitable liquid fires include the following:

- (1) Volatility and flash point of liquid
- (2) Initial quantity spilled and rate of additional liquid release
- (3) Liquid surface area and burning rate

In some cases, the growth phase of ignitable liquid fire scenarios could be represented by “standard” t-squared fires commonly referred to as “fast or ultra-fast” fires (*see NFPA 72, National Fire Alarm Code, and SFPE Handbook of Fire Protection Engineering*).

Some flammable liquids with high vapor pressures can result in explosive range mixtures and damaging deflagrations. Flash fires or deflagrations can also result from accidental releases of liquids into heated environments or onto surfaces above their flash points. Overpressures from explosions and deflagrations can cause further release of fuel or failure of compartment boundaries. Guidance for determining pressure rise is provided in NFPA 68, *Guide for Venting of Deflagrations*.

A.5.5.2.1.5 An example of such a scenario would be a combustible gas leaking into a cable entrance facility or vault from sources outside the telecommunications facility followed by ignition of an explosive mixture. Another example of such a scenario would be accumulation of hydrogen gas produced from battery use in a space with inadequate ventilation followed by ignition of an explosive mixture. Guidance for determining pressure rise can be found in NFPA 68, *Guide for Venting of Deflagrations*.

A.5.5.2.1.6 An example of such a scenario would be a fire in nontelecommunications-controlled space involving flaming ignition of stored upholstered furniture that is controlled but not extinguished by a sprinkler system. The fire compartment is open to a corridor that is common to a leased space containing a switch.

Factors to consider in analysis of interior exposure fire scenarios include the following:

- (1) The nature and degree of closure of the opening between compartments
- (2) Integrity of fire and smoke barriers between compartments
- (3) The presence or absence of telecommunications equipment in the exposed space

Experimental values of heat release rate and species generation rates for suppressed and unsuppressed full-scale compartment fires are available in the literature and can be a basis for the interior exposure fire.

A.5.5.2.1.7 An example of such a scenario would be a fire involving chemicals producing corrosive products of combustion and a failure of the detection system to shut down air intakes for the HVAC serving a central office facility.

Factors to consider in analysis of exterior exposure fire scenarios include the following:

- (1) Existing and potential property uses of the adjacent property
- (2) Property line set-back (separation distance)
- (3) Exposure geometry (shape factor)
- (4) Radiant flux required for ignition
- (5) Ignition and flame spread properties of exposed materials
- (6) Degree of closure or protection of outside air intake

A.5.6.6 Where a fire detection system is used in a performance-based approach, system performance should be verified by test.

VEWFD systems should be designed, installed, and maintained to detect the products of combustion from the Heated Wire Tests described in Annex B.

EWFD systems should be designed, installed, and maintained to detect the products of combustion from the Lactose-Potassium Chlorate Test described in Annex B.

It should be recognized that there are potential fire scenarios in most telecommunications facilities that can grow to the point where a major service interruption can occur before an effective response can be mounted by facility personnel. Examples of such scenarios include fires of incendiary origin and arcing short circuits in battery plants or other primary power systems or cables. Because fires involving these scenarios are rare, the performance objectives and design approaches in this document have been developed to provide protection against more frequently occurring scenarios.

The performance verification indicated in 5.6.6 is based in part on the criteria in BS 6266, *Code of Practice for Fire Protection for Electronic Data Processing Installations*. The criteria define test fires for the VEWFD and EWFD levels of fire detection discussed in this document. The appropriate test fire is used to properly demonstrate fire detection system operation at initial acceptance and subsequent periodic system testing.

Fire detection systems should be designed, installed, and maintained to detect the test fires referenced in this section when the HVAC system serving the space is operating at normal air exchange rates, and also when the HVAC system is shut off. They should also be designed, installed, and maintained to detect the test fires when equipment in the space is fully operational.

It is common practice in some companies for some spaces to have minimal HVAC for energy conservation purposes. This is typical in colder regions where mechanical cooling is not necessary to relieve the heat gain from equipment with high energy density. Fan cycling is also a typical condition for equipment with lower energy density that does not produce as much heat (e.g., frame spaces, many transmission systems). Because a fire of a given size can cause the same damage irrespective of airflow in the area, it is essential that the fire detection system be able to function in any foreseeable condition. This recommendation can also ensure adequate fire detection in the event of fan failure.

A.6.1 Figure A.6.1 provides a summary of recommendations from Chapter 6.

The fire protection recommended is based on noncombustible construction, fire ratings of major systems installed in the telecommunications areas, compartmentation of fire areas, EWFD and VEWFD systems, and effective response of trained individuals.

A.6.1.2 The prescriptive approach consists of elements including fire-resistant major equipment systems, cable, and wire; compartmentation; fire detection; alarm processing; and manual intervention strategies as the primary means to prevent major network failure due to fire.

A.6.3 Site selection should anticipate exposures from other hazards such as flood, earthquake, and so forth.

A.6.5.3 Compliance with compartmentation should be achieved in existing telecommunications equipment spaces provided rated separations and listed penetrations are practicable.

A.6.5.4.3 It is preferable to install HVAC ducts serving non-telecommunications equipment areas so that they do not pass through telecommunications equipment areas.

A.6.5.4.6 The confirmation of the presence of smoke can be accomplished by the following:

- (1) Cross-zoning
- (2) Time/smoke density factors
- (3) Activation of multiple detectors
- (4) Manual pull station in combination with detection strategy
- (5) Heat detection
- (6) Automatic suppression system actuation

A.6.5.4.6.4 The objective is to prevent undesirable smoke movement between compartments and/or spaces while permitting HVAC operation to prevent equipment overheating. HVAC operation within a fire-affected compartment is permitted until it circulates smoke that contributes to the telecommunications equipment contamination.

A.6.5.5.2 A provision of telecommunications equipment that is resistant to ignition and subsequent fire spread has a direct impact on the frequency and severity of fires in telecommunications facilities.

A.6.7.1 Direct current power is what typically drives telephone systems and the circuits that move the transmission.

A.6.7.5 Batteries meeting the fire resistance recommendations might not be available at the time this document is published.

A.6.7.8.3 A battery management program can include an automatic battery monitoring system or periodic battery inspection and testing.

A.6.8.2 Compliance with compartmentation should be achieved in existing main frame distribution spaces provided rated separations and listed penetrations can be achieved.

A.6.9.3.2 Drainage and/or secondary containment systems should be provided to prevent fuel spills or leaks from contaminating soils or public drainage systems.

A.6.9.7.2 Appropriate segregation of the fuel supply is accomplished with a thermally actuated valve or equivalent in the fuel line to the standby generator to isolate the fuel sources from the engine in the event of fire.

A.7.1 Table A.7.1 provides a summary of recommendations from Chapter 7.

A.7.1.2 The prescriptive approach consists of elements including fire-resistant major equipment systems, cable, and wire; compartmentation; fire detection; alarm processing; and manual intervention strategies as the primary means to prevent major network failure due to fire.

A.7.5.1 Many small telecommunications facilities have only one room. Some of these buildings could have separate rooms for the cable entrance facility and for the standby engine.

A.7.5.3 If separate rooms are desired, the telecommunications equipment space should be separated with noncombustible construction.

A.8.3 Compartmentation is accomplished by the use of separation between floors and of hazard/occupancy areas within a floor such as telecommunications equipment spaces from administrative areas and building support and service areas. The use of noncombustible construction is essential in restricting the spread of fire. Smoketight construction is essential in restricting the spread of smoke. It is assumed that the structural members not included in these recommendations are of listed noncombustible construction.

A.8.3.3.2 Automatic sprinklers and fusible links are a form of automatic fire detection.

Table A.7.1 Small Telecommunications Facilities

Hazard Area	Detection	Suppression	Smoke Management Systems	Compartmentation
Telecommunications equipment	EWFD ¹	NR	NR	NR
Cable entrance facility	EWFD ¹	NR	NR	NR
Power area	EWFD ¹	NR	NR	NR
Main distribution frame	EWFD ¹	NR	NR	NR
Standby engine area	SFD	NR	NR	1 hour
Technical support area	Yes ²	NR	NR	NR
Administrative area	SFD	NR	NR	1 hour
Building service and support area	SFD	NR	NR	1 hour

¹Per 7.5.5, small facilities should be provided with EWFD systems.

²Technical support areas should be protected with fire detection systems consistent with the main area in which the technical support area is located.

NR — not required.

					Equipment Space														
					Common Area Containing Some or All of the Following: Telecommunications Equipment, Power, Main Distribution Frame, and Contiguous Technical Support Area										Telecommunication Equipment Space Including Contiguous Technical Support Area		Power Area Including Contiguous Technical Support Area		
					Detection				VEWFD								VEWFD		EWFD
Automatic Suppression					No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No		No	Yes	
Smoke Management System					No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No		
Equipment Characteristics Scenario					1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Common Area Containing Some or All of the Following: Telecommunication Equipment, Power, Main Distribution Frame, and Contiguous Technical Support Area	VEWFD	No	No	1 Only Compliant Equipment or Wire or Cable*	NR	1	1	1	1	1	1	1	1	1	NR	1	NR	1	
		No	Yes	2 Compliant Telecommunication Equipment or Wire or Cable*, Except Power Equipment	1	NR	1	NR	1	NR	1	1	1	1	1	1	1	1	1
		Yes	Yes	3 Compliant Telecommunication Equipment or Wire or Cable*, Except Power Equipment	1	1	NR	1	NR	1	NR	NR	NR	NR	1	1	1	1	1
		No	Yes	4 Compliant Telecommunication Equipment or Wire or Cable*, Except Main Distribution Frame Equipment	1	NR	1	NR	1	NR	1	1	1	1	1	1	1	1	1
		Yes	Yes	5 Compliant Telecommunication Equipment or Wire or Cable*, Except Main Distribution Frame Equipment	1	1	NR	1	NR	1	NR	NR	NR	NR	1	1	1	1	1
		No	Yes	6 Compliant Telecommunication Equipment or Wire or Cable*, Except Telecommunication Equipment	1	NR	1	NR	1	NR	1	1	1	1	1	NR	1	1	1
		Yes	Yes	7 Compliant Telecommunication Equipment or Wire or Cable*, Except Power and Main Distribution Equipment	1	1	NR	1	NR	1	NR	NR	NR	NR	1	1	1	1	1
		Yes	Yes	8 Compliant Telecommunication Equipment or Wire or Cable*, Except Power and Telecommunication Equipment	1	1	NR	1	NR	1	NR	NR	NR	NR	1	1	1	1	1
		Yes	Yes	9 Compliant Telecommunication Equipment or Wire or Cable*, Except Main Distribution Frame and Telecommunication Equipment	1	1	NR	1	NR	1	NR	NR	NR	NR	1	1	1	1	1
		Yes	Yes	10 Noncompliant Equipment or Wire or Cable*	1	1	NR	1	NR	1	NR	NR	NR	NR	1	NR	1	NR	NR
Telecommunication Equipment Space Including Contiguous Technical Support Area	VEWFD	No	No	11 Compliant Equipment or Wire or Cable*	NR	1	1	1	1	1	1	1	1	1	NR	1	NR	1	
		Yes	Yes	12 Noncompliant Equipment or Wire or Cable*	1	1	1	1	1	NR	1	1	1	NR	1	NR	1	NR	
Power Area Including Contiguous Technical Support Area	EWFD	No	No	13 Compliant Equipment or Wire or Cable*	NR	1	1	1	1	1	1	1	1	1	NR	1	NR	1	
		Yes	Yes	14 Noncompliant Equipment or Wire or Cable*	1	1	1	1	1	1	1	1	1	NR	1	NR	1	NR	
Main Distribution Frame Including Contiguous Technical Support Area	VEWFD	No	No	15 Compliant Equipment or Wire or Cable*	NR	1	1	1	1	1	1	1	1	1	N/A	1	NR	1	
		No	No	16 Noncompliant Equipment or Wire or Cable*	1	1	1	1	1	1	1	1	1	1	1	N/A	1	NR	
Cable Entrance Facility	EWFD	Yes	No	17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
		No	No	18	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	VEWFD	No	No	19 Direct Termination on Main Distribution Frame Compliant Equipment or Wire or Cable*	NR	1	1	1	1	1	1	1	1	1	NR	1	NR	1	
Standby Engine Area	STD Heat or Flame	No	No	20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Nonequipment Space																			
Administration Area	STD	No	No	21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	NR	Yes	No	22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Building Service and Support Area	STD	No	No	23	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	NR	Yes	No	24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Space Occupied by Third Parties	N/A	N/A	N/A	25	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
1: Rating in table refers to minimum floor, ceiling, and wall separation recommendations only. Additional separation may be required for structural elements due to building type. 2: Additional provisions may be recommended as per Section 4.3 in multiple-tenant buildings not controlled by telecommunication operator. *: as per Section 8.8 NR: No rating SABC: See applicable building code																			

FIGURE A.6.1 Large Telecommunications Facilities — Summary of Recommendations for Detection, Suppression, Smoke Management, and Compartmentation of Hazard Area [Rating of Compartment Fire Walls, Floor, and Ceiling (hours)].

				Equipment Space							Nonequipment Space				
				Main Distribution Frame Including Contiguous Technical Support Area		Cable Entrance Facility			Standby Engine Area	Administration Area		Building Service and Support Area		Space Occupied by Third Parties	
Equipment Space	Detection				VEWFD	EWFD		VEWFD	STD Heat or Flame	STD	NR	STD	NR	N/A	
	Automatic Suppression				No	Yes	No	No	No	No	Yes	No	Yes	N/A	
	Smoke Management System				No	No	No	No	No	No	No	No	No	N/A	
	Equipment Characteristics Scenario				15	16	17	18	19	20	21	22	23	24	25
Common Area Containing Some or All of the Following: Telecommunication Equipment, Power, Main Distribution Frame, and Contiguous Technical Support Area	VEWFD	No	No	1 Only Compliant Equipment or Wire or Cable*	NR	1	1	2	NR	2	1	1	2	1	2
		No	Yes	2 Compliant Telecommunication Equipment or Wire or Cable*, Except Power Equipment	1	1	1	2	1	2	1	1	2	1	2
		Yes	Yes	3 Compliant Telecommunication Equipment or Wire or Cable*, Except Power Equipment	1	1	1	2	1	2	1	1	2	1	2
		No	Yes	4 Compliant Telecommunication Equipment or Wire or Cable*, Except Main Distribution Frame Equipment	1	1	1	2	1	2	1	1	2	1	2
		Yes	Yes	5 Compliant Telecommunication Equipment or Wire or Cable*, Except Main Distribution Frame Equipment	1	1	1	2	1	2	1	1	2	1	2
		No	Yes	6 Compliant Telecommunication Equipment or Wire or Cable*, Except Telecommunication Equipment	1	1	1	2	1	2	1	1	2	1	2
		Yes	Yes	7 Compliant Telecommunication Equipment or Wire or Cable*, Except Power and Main Distribution Equipment	1	1	1	2	1	2	1	1	2	1	2
		Yes	Yes	8 Compliant Telecommunication Equipment or Wire or Cable*, Except Power and Telecommunication Equipment	1	1	1	2	1	2	1	1	2	1	2
		Yes	Yes	9 Compliant Telecommunication Equipment or Wire or Cable*, Except Main Distribution Frame and Telecommunication Equipment	1	1	1	2	1	2	1	1	2	1	2
		Yes	Yes	10 Noncompliant Equipment or Wire or Cable*	1	1	1	2	1	2	1	1	2	1	2
Telecommunication Equipment Space Including Contiguous Technical Support Area	VEWFD	No	11 Compliant Equipment or Wire or Cable*	1	1	1	2	1	2	1	1	2	1	2	
		Yes	12 Noncompliant Equipment or Wire or Cable*	N/A	1	1	2	NR	2	1	1	2	1	2	
Power Area Including Contiguous Technical Support Area	EWFD	No	13 Compliant Equipment or Wire or Cable*	1	N/A	1	2	1	2	1	1	2	1	2	
		Yes	14 Noncompliant Equipment or Wire or Cable*	NR	1	1	2	NR	2	1	1	2	1	2	
Main Distribution Frame Including Contiguous Technical Support Area	VEWFD	No	15 Compliant Equipment or Wire or Cable*	1	NR	1	2	1	2	1	1	2	1	2	
		No	16 Noncompliant Equipment or Wire or Cable*	NR	1	1	2	NR	2	1	1	2	1	2	
Cable Entrance Facility	EWFD	Yes	17	1	NR	1	NR	1	2	1	1	2	1	2	
		No	18	1	1	NR	2	1	2	1	1	2	1	2	
	VEWFD	No	19 Direct Termination on Main Distribution Frame Compliant Equipment or Wire or Cable*	2	2	2	NR	2	2	2	2	2	2	2	
Standby Engine Area	STD Heat or Flame	No	20	2	2	2	2	2	NR	2	2	2	2	2	
Nonequipment Space															
Administration Area	STD	No	No	21	1	1	1	2	1	2	NR	NR	1	1	SABC
	NR	Yes	No	22	1	1	1	2	1	2	NR	NR		1	SABC
Building Service and Support Area	STD	No	No	23	2	2	2	2	2	2	1	1	NR	NR	SABC
	NR	Yes	No	24	1	1	1	2	1	2	1	1	NR	NR	SABC
Space Occupied by Third Parties	N/A	N/A	N/A	25	2	2	2	2	2	2	SABC	SABC	SABC	SABC	SABC
1: Rating in table refers to minimum floor, ceiling, and wall separation recommendations only. Additional separation may be required for structural elements due to building type. 2: Additional provisions may be recommended as per Section 4.3 in multiple-tenant buildings not controlled by telecommunication operator. *: as per Section 8.8 NR: No rating SABC: See applicable building code															

FIGURE A.6.1 Continued

A.8.4.1.3 In determining desired response time, whether or not a telecommunications equipment building could be unstaffed for any period of time should be considered as part of a response strategy as well as anticipated response time to an alert signal by owner or operator designated personnel.

A.8.4.1.4 Supervising stations meeting the requirements of *NFPA 72, National Fire Alarm Code*, for proprietary or central station service are acceptable supervising stations.

A.8.4.2.1.2 Generally, alert signals from VEWFD systems should not be transmitted to the municipal fire department.

A.8.4.2.3.3 Trouble signals should be responded to and remedied by local, trained telecommunications personnel.

A.8.5.1 A system designed, installed, and maintained to provide one level of protection will not, in every case, also provide another level of protection that could be necessary for a hazard area.

A.8.5.3.1.2 In general, two sensors or ports per 6.1 m × 6.1 m (20 ft × 20 ft) building bay are recommended. This size bay is typical but not universal in many traditional central offices.

Installation of sensors and ports should be determined on a case-by-case basis for buildings and enclosures that are different from the typical building bay design. In areas that have cable trays between the telecommunications equipment and the ceiling, and the cable density is such that the free flow of smoke will be inhibited to the ceiling, then sampling ports or sensors should be located both at the ceiling level and below the cable trays to overcome this stratification. (Refer to *NFPA 72, National Fire Alarm Code*.) In general, where stratification could be a concern, one high and one low sensor or port should be installed per building bay. See Figure A.8.5.3.1.2 for clarification.

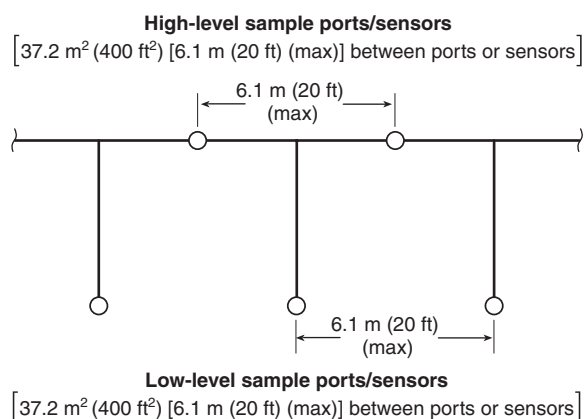


FIGURE A.8.5.3.1.2 Staggered Layout of Sample Ports/Sensors.

High level sample ports or sensors should have 37.2 m² (400 ft²) coverage per port or sensor [i.e., 6.1 m (20 ft) maximum spacing between ports and sensors]. Lower level sample ports or sensors should have 37.2 m² (400 ft²) coverage per port or sensor [i.e., 6.1 m (20 ft) maximum spacing between ports and sensors].

A.8.5.3.1.4 Subsection 8.5.3.1.4 provides recommendations for the number of sensors and ports to be installed at return

air grilles. However, to increase performance additional ports should be provided in accordance with manufacturer's requirements. (Also see *NFPA 72, National Fire Alarm Code*, for guidance on port and sensor placement.)

A.8.5.3.1.4.1 Subsection 8.5.3.1.4.1 provides recommendations for the number of sensors and ports to be installed at return air grilles. However, to increase performance additional ports should be provided in accordance with manufacturer's requirements. (Also see *NFPA 72, National Fire Alarm Code*, for guidance on port and sensor placement.)

A.8.5.3.1.6 Because the listed sensitivity for an air-sampling smoke detection system is that measured at the detector rather than that at each individual sampling port on its piping network, the entire piping network should be evaluated to determine the effective sensitivity at a sampling port.

Sampling ports that draw in clean air will dilute smoke-laden air being drawn in by other ports. The accumulative effect of clean air being drawn through some ports causes dilution that reduces the effective sensitivity of other ports on the same pipe network. Conversely, the accumulative effect of smoke being drawn into multiple sample ports causes the overall effective sensitivity of the air-sampling system to increase beyond the sensitivity expected at a single sampling port.

The effective sensitivity of a sampling port is a function of the total number of ports on a piping network and the percentage of those sampling smoke-laden air. As the number of ports sampling clean air increases, the effective sensitivity at individual ports on an air-sampling smoke detection system is reduced to less than the listed sensitivity of the detector unit.

The following two examples show a best and a worst credible scenario:

- (1) Assuming all sampling ports will sample smoke-laden air, with all the ports in one common interior area with the smoke being uniformly mixed throughout the space by an HVAC system, then the effective sensitivity of each sampling port is approximately equal to the listed sensitivity of the detector unit.
- (2) Assuming that only one sampling port will sample smoke-laden air, and assuming a balanced piping network design where there is equal airflow, and thus equal sensitivity, at each sampling port, then the effective sensitivity of each sampling port is the listed sensitivity of the detector unit multiplied by the total number of sampling ports.

A.8.5.3.2.1.2 In general, one sensor or port per 6.1 m × 6.1 m (20 ft × 20 ft) building bay is recommended. This size bay is typical but not universal.

A.8.5.3.2.2.2 See *NFPA 72, National Fire Alarm Code*, for flame detector selection considerations.

A.8.6.1 This section provides for the use of automatic or manual fire suppression equipment as tools available to be used as fire safety elements in a fire protection plan for a telecommunications facility. Telecommunications facilities have achieved an excellent fire loss record due to the high standards of construction, compartmentation of hazards, and high quality of telecommunications equipment. This high record of reliability has been achieved mostly without the use of automatic extinguishing systems. Automatic suppression should be considered when other fire protection elements cannot be employed.

A.8.6.2.2.1 Wet pipe, dry pipe, and pre-action systems are acceptable for use in the protection of telecommunications facilities.

The introduction of wet pipe sprinkler systems into telecommunications equipment areas should be carefully controlled. In addition to the recommendations for pipe pitch in 8.6.2.2.2, galvanized steel pipe could be necessary to prevent failure of the piping system and resultant leakage of water on equipment. Consideration should also be given to the use of dry pendent sprinklers to prevent water from residing in pipe drops, where pendent sprinklers are utilized.

The use of pre-action, double-interlocked sprinklers will minimize the risk of inadvertent water discharge.

A.8.6.2.3.1 Piping systems installed to deliver clean agents into telecommunications spaces should have particular attention paid to internal cleaning of the piping. Any debris discharged into the telecommunications space can cause catastrophic damage to the telecommunications equipment. All piping systems should be cleaned internally after fabrication to prevent discharge of debris. Cleaning should be in accordance with the requirements of NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, and manufacturer's recommended guidelines.

A.8.6.2.4.1 Piping systems installed to deliver halon systems into telecommunications spaces should have particular attention paid to internal cleaning of the piping. Any debris discharged into the telecommunications space can cause catastrophic damage to the telecommunications equipment. All piping systems should be cleaned internally after fabrication to prevent discharge of debris. Cleaning should be in accordance with the requirements of NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, and manufacturer's recommended guidelines.

A.8.6.3.1.2 Dry chemical agents and corrosive liquid agents will contaminate the switching equipment and cause damage to the terminals and connectors. It has been experienced that such contamination and damage can be catastrophic to the equipment. It is recommended that any occupancy near or adjacent to telecommunication areas not have dry chemical or corrosive liquid extinguishers installed.

A.8.6.3.2 All pipes carrying water in or around telecommunications equipment should be monitored for waterflow to prevent catastrophic water damage and loss of network reliability. All hose connections should be installed outside telecommunications areas.

A.8.7.2.3 Consideration should be given to using exhaust point(s) to reduce the possibility of smoke being drawn into noninvolved equipment. Exhaust openings should be designed and positioned to take maximum use of the mixing and dilution effects created by the airflow in the room.

A.8.8.1 Section 8.8 describes the procedures and test methods used to quantify ignition and fire resistance in equipment.

Provision of telecommunications equipment that is resistant to ignition and subsequent fire spread has a direct impact on the frequency and severity of fires in telecommunications facilities.

A.8.8.2.1 ANSI T1.307, *Fire Resistance Criteria-Ignitability Requirements for Equipment Assemblies, and Fire Spread Requirements for Wire and Cable*, lists the specific test methods applicable to wire and cable, according to the various installed locations or configurations in a typical telecommunications facility.

A.8.8.2.2 Nonmetallic conduit and trays should be permanently marked or labeled to indicate the successful completion of the tests.

A.8.8.3.1 While 100 percent compliance with some type of assembly level fire tests are highly desirable, it is recognized that such a level of testing is not generally achievable for most electrical equipment assemblies. By requiring industry-standard-compliant equipment, the committee feels that an acceptable level of fire safety is achieved. Where large non-compliant subsystems are installed, it is recommended that users consider placing noncompliant equipment in a separate fire compartment to prevent a fire initiating in the noncompliant equipment from spreading to the major system, or provide a fire suppression system in the noncompliant equipment areas.

A.9.1 Fire prevention recommendations apply to both owned and leased structures.

A.9.1.1 Inadequate housekeeping provides a potential fuel for an ignition source and allows combustibles to be closer to potential ignition sources. The basic prevention is prompt disposal of combustible materials or safe storage of these materials and periodic inspections to verify this is being done.

A.9.1.2 Such combustibles within unprotected areas and having a heat release rate greater than 500 kW represents a potential hazard even for noncritical areas of telecommunications facilities (see appendix material within NFPA 72, *National Fire Alarm Code*, for various examples of heat release rates and see guidance within NFPA 230, *Standard for the Fire Protection of Storage*, and NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations, concerning such storage*). If such combustibles cannot practically be stored within protected areas, then other prevention measures within this recommended practice should be implemented to ensure that the buildup of or the amount of combustibles is limited or otherwise kept to a minimum.

A.9.1.4 These devices could be located in an established break or food services area within a facility.

A.9.1.5 Smoking is defined as the carrying or use of a lighted pipe, cigar, cigarette, tobacco, or any other type of smoking substance.

A.9.1.7 The objectives of these actions should be to reduce ignition risks and to provide appropriate fire prevention intervention strategies.

A.9.2 Electrical powering of telecommunications equipment is exempt from the requirements of NFPA 70, *National Electrical Code*®. [See Section 90-2(b)(4) of NFPA 70.]

A.9.4 Construction and alteration projects could pose an additional risk exposure to a telecommunications facility.

A.9.4.5 Reference NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*; NFPA 1, *Fire Prevention Code*; and other appropriate standards for additional information.

A.9.4.9 Examples of potential hazards include flammable cleaning solvents, aerosol products, worn or frayed extension cords, improperly sized extension cords, worn out motors, and improperly grounded equipment.

A.9.6 Security is a deterrent of potential arson, both from interior and external parties.

A.9.9 See NFPA 10, *Standard for Portable Fire Extinguishers*, for selection of an appropriate portable fire extinguisher(s). Otherwise, open flames should not be permitted.

A.9.10 For new cabling installations, ac, dc, and telecommunications cables should be run in separate paths and not mixed. Where practical, unused or dead cables should be mined (removed) and discarded. Care should be taken during the removal process so as to protect the existing live cables from damage.

Infrared thermography or other like technology can be used to detect hot spots in telecommunications operations. Thermography scanning should be conducted for power boards, rectifiers, batteries, power room bus connectors, switchgear, ac/dc, and primary power supply.

A.9.10.1 The intent is to separate major cable distribution systems. In-bay or in-cabinet wiring should be installed in accordance with manufacturer's instructions.

A.10.3 The telecommunications company should ensure that employees receive periodic and regular orientation pertinent to their assigned responsibilities involving the following:

- (1) Facility evacuation
- (2) Facility fire prevention measures
- (3) Facility fire detection systems
- (4) Alarm processing
- (5) Fire suppression or response to fire incidents

A.10.3.4 See NFPA 101®, *Life Safety Code*®, for exemptions for number of occupants.

A.10.4 Figure A.10.4 is an example of a pre-fire plan drawing.

A.10.4.1 Fire service orientation and information might include the review of the equipment placement, the depowering issues, and how to perform them.

A.10.5 The purpose of this procedure, which can be a subset of the pre-fire plan, is to address methods by which damage to the telecommunications equipment can be minimized and timely restored to operation.

A damage control procedure should provide a means for the following:

- (1) Preventing or minimizing damage to operations and equipment (Whenever electronic equipment or any type of record is wet, smoke damaged, or otherwise affected by the results of a fire or other emergency, it is vital that immediate action be taken to clean and dry the electronic equipment. If the water, smoke, or other contaminants are permitted to remain in the equipment longer than absolutely necessary, the damage could be grossly increased.)
- (2) A means for preventing water damage to electronic equipment (The proper method of doing this will vary according to the individual equipment design. Consideration should be given to the provision of waterproof covers, which should be stored in easily accessible locations.)

A.10.6 The purpose for the procedure is to ensure that if a major fire loss occurs within a telecommunications facility that affects its service, provisions have been addressed to identify critical service, alternative site locations, replacement equipment, emergency call-back of employees, temporary rerouting of services, and other functions. Further the procedure is intended to ensure that the down-time of the telecommunica-

tions facility is kept to a minimum and that service is restored promptly. This procedure should be updated annually.

The procedure should include the following:

- (1) Procedures to identify and prioritize types and levels of service affected
- (2) A list of salvage equipment suppliers, vendors, and tradespeople
- (3) A current contact list of telecommunications disaster recovery specialists
- (4) A list of internal and external people or agencies assigned to assist with recovery
- (5) Operations, including staff to deal with the press, fire authorities, police, and authorities that can restrict entry following a fire of suspicious origin
- (6) Measures to maintain up-to-date copies of important documents in a secure off-site location (Examples of such records include but are not limited to essential business records, insurance records, building plans, and system documentation.)
- (7) Procedures to identify and handle hazardous materials that can cause a health hazard or contaminate the structure, equipment, or contents

Annex B Performance Test Procedures for Very Early Warning and Early Warning Fire Detection Systems

This annex is not a part of the recommendations of this NFPA document but is included for informational purposes only.

B.1 Introduction.

B.1.1 Scope. Performance of the tests described in this annex can result in the release of noxious fumes, the presence of localized heat, and the introduction of a fire hazard to the tested space. Precautions should be taken to protect personnel from these potential hazards. It is the responsibility of the testing personnel to conduct testing in a manner that complies with federal, state, and local health and safety regulations.

B.1.1.1 These tests are intended to simulate the small amounts of smoke that would be created in the early stages of a fire in an equipment space. If an actual fire were to produce the amounts of smoke produced by these tests, telecommunications companies would want to be alerted by the fire alarm system.

B.1.1.2 The tests represent a good balance between the desire to use smoke sources that are representative of the types of fires that have occurred in equipment spaces and the desire to minimize the introduction of smoke that can cause damage to operating equipment in the space.

B.1.2 Objectives. These tests are also intended to meet the general objectives listed in B.1.2.1 through B.1.2.4.

B.1.2.1 The tests are intended to be repeatable, in that a consistent quantity, temperature, and color of smoke is produced each time the test is performed.

B.1.2.2 The tests are intended to use test equipment that can be quickly set up in actual telecommunications facilities (i.e., in situ).

B.1.2.3 The tests are intended to prevent or minimize the potential for smoke damage to the equipment in the room

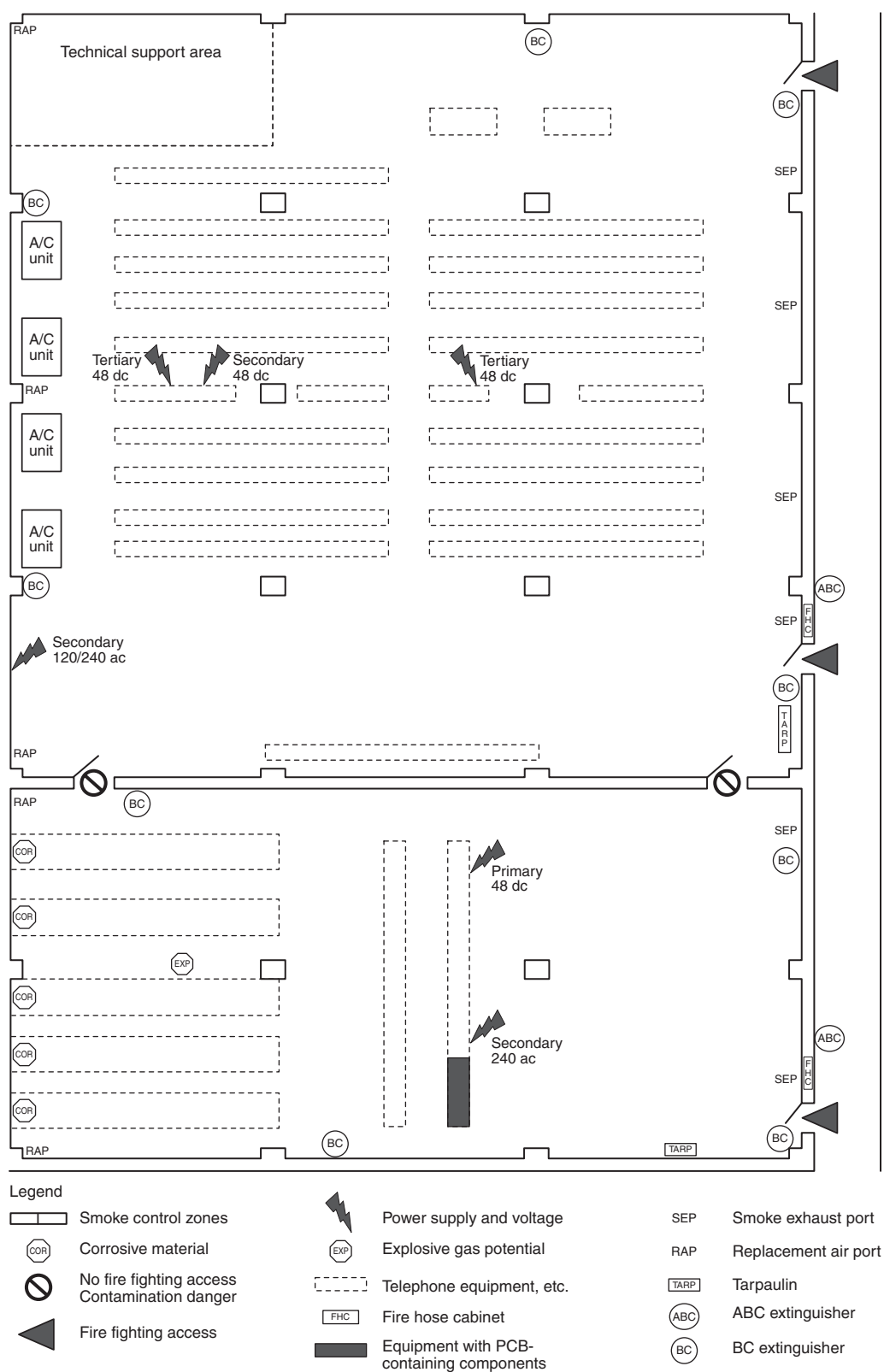


FIGURE A.10.4 Example of a Pre-Fire Plan Drawing.

under test. They should create little or no corrosive products of combustion.

B.1.2.4 The tests are intended to avoid the creation of large amounts of smoke and gas that could pose a health threat to personnel in the test area.

B.2 Heated Wire Test.

B.2.1 This test uses an electrically overloaded PVC-coated wire to simulate the early stages of a fire. Although a PVC wire is used, hydrogen chloride vapor is unlikely to be produced in quantities significant enough to be of concern, if the test procedures herein are followed due to the relatively low temperatures reached. If the current is applied for a longer time, or if the wire sample is shorter than stated, small quantities of hydrogen chloride can be generated. In either event, a clearly perceptible odor that should dissipate in short time is produced by the test.

The tests are based on the test specified in Section A.3 of BS 6266, *Fire Protection for Electronic Data Processing Installations*. The principal differences for some tests include the use of a regulated dc power supply and different wire, electrical load, and wire length.

Users are directed to Table B.2.1 to select the parameters to be used during the testing.

The test parameters to be used should be selected based on the detection system performance levels dictated by the performance-based analysis.

B.2.2 Test Apparatus. The test apparatus consists of the items listed in B.2.2.1 through B.2.2.4.

B.2.2.1 Wire. Table B.2.1 lists four options for wire selection and test parameters for the users to select. Test wire should be cut cleanly to the length specified in Table B.2.1.

B.2.2.2 Wire Mounting. The wire should be arranged by placing it on a noncombustible, nonconductive board, or suspending it on a noncombustible, nonconductive support. The wire should be arranged so that there are no kinks or crossovers where localized higher temperature heating can occur.

B.2.2.3 Power Supply and Leads. A regulated dc power supply capable of supplying a current of 0 to 30 amperes at 0 to 18 volts dc (i.e., Kenwood Model XL6524E-D). The lead wires between the power supply and the test wire(s) should be 10 AWG, 3.25 m (10.66 ft) long to avoid unacceptable voltage drop.

Table B.2.1 Heated Wire Test Parameters

Parameter	BS 6266 Test (1992)		Modified BS 6266 Test: Two 1 m Wires in Parallel	North American Wire Test: North American Wire
	2 m Wire Test	1 m Wire Test		
Wire Specs	10 strands of 0.1 mm diameter tinned copper wire.	Total cross-sectional area of conductor is 0.078 mm ² . Insulated with PVC to a radial thickness of 0.3 mm.	Wire is very flexible due to stranded construction and highly plasticized insulation.	A single strand of 22 AWG copper wire, insulated with PVC to a radial thickness of 1.1 mm (0.041 in.). This wire is stiffer than the BSI wire due to the single-strand construction and the minimally plasticized PVC insulation.
Smoke Characterization	Smoke is very light (barely visible). HCl vapor is unlikely to be produced due to the low temperature achieved in the wire. The primary constituent of the smoke is plasticizer.	More visible smoke than the 2 m test, but still very light smoke. Due to the higher temperature in the wire, a very small amount of HCl vapor will be produced.	More visible smoke than the 2 m test or the single wire 1 m test but still very light smoke. Due to the higher temperature in the wires, a small amount of HCl vapor will be produced.	More visible smoke than the BSI wire tests but still very light. A minor amount of HCl is produced but for a shorter duration than the BSI wire tests.
Test Period	180 seconds	60 seconds	60 seconds	30 seconds
Electrical Load	Constant voltage — 6.0 volts dc, current varies from 0 to 15 amperes during the test due to changing resistance in the wire.	Constant voltage — 6.0 volts dc, current varies from 0 to 15 amperes during the test due to changing resistance in the wire.	Constant voltage — 6.0 volts dc, current varies from 0 to 30 amperes during the test due to changing resistance in the wire.	Constant current of 28 amperes. Voltage varies from 0 to 18 volts dc during test due to changing resistance in the wire.
Pass/Fail Criteria	Fire detection system should “respond” within 120 seconds of the end of the test period.		“Alert” or “pre-alarm” signal within 120 seconds of the end of the test period.	