

NFPA®

1221

**Standard for the
Installation, Maintenance, and
Use of Emergency Services
Communications Systems**

2019



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NFPA® 1221

Standard for the

Installation, Maintenance, and Use of Emergency Services Communications Systems

2019 Edition

This edition of NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, was prepared by the Technical Committee on Public Emergency Service Communication. It was issued by the Standards Council on May 4, 2018, with an effective date of May 24, 2018, and supersedes all previous editions.

This edition of NFPA 1221 was approved as an American National Standard on May 24, 2018.

Origin and Development of NFPA 1221

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, dates back to 1898. Originally, it was part of a general standard on signaling systems, but the material on municipal fire alarm systems was separated from the general standard in 1911. This standard has been revised and reissued in editions dated 1904, 1911, 1926, 1934, 1940, 1941, 1946, 1948, 1949, 1950, 1952, 1954, 1955, 1956, 1962, 1963, 1964, 1967, 1973, 1975, 1978, 1980, 1984, 1988, 1991, 1994, 1999, 2002, and 2007.

The 1999 edition of NFPA 1221 was a result of very hard work by committee members, especially the previous chairman, Evan E. Stauffer, Jr. The goal of the committee was to completely rewrite the standard to reflect an emergence of joint communications centers, the increase in technology-based information systems that assist users in both the communications center and the field of operations, and the role communications play in emergency scene operations within the Incident Command System. To reflect the fact that NFPA 1221 applies to all emergency responders, not just the fire service, the title was changed from *Standard for the Installation, Maintenance, and Use of Public Fire Service Communication Systems* to *Standard for the Installation, Maintenance, and Use of Emergency Communication Systems*.

The 2002 edition of this document continued to enhance the capabilities of personnel assigned to communications centers as well as the interoperability of systems. Because technology is continually changing, committee members began to assess potential changes to the next edition of this standard. It was recognized that it is incumbent on both users and enforcers of this standard to understand the impact of the standard, both in the area of service delivery and in the safety of those emergency response personnel delivering services.

Competing interests and priorities in a communications center need to be addressed by the authority having jurisdiction to develop standard operating procedures on how calls for service are processed, dispatched, and tracked. The mission of the communications center should be to serve as a conduit between those requesting services and those providing the services. This standard with its current revisions provides the requirements to accomplish that mission.

The 2007 edition of NFPA 1221 was a complete revision incorporating the requirements of the *Manual of Style for NFPA Technical Committee Documents*. As part of the 2007 revision, the committee restructured several chapters and added a new chapter on data network security and several new sections. Subsequently, all chapters were renumbered to accommodate those changes. The entire document was reviewed and editorially updated to clarify requirements and ambiguous language. In addition, the title of the document was again changed, to *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*.

The 2010 edition of NFPA 1221 added requirements to include an emergency fire plan to safeguard personnel and minimize disruption of vital public safety communications. New communication centers and the buildings in which they are located were now required to be

protected from the approach of unauthorized vehicles or to have the building designed to be blast resistant. The committee also addressed the need for reliable in-building tactical emergency communications by developing performance requirements for two-way radio communication enhancement systems.

The 2013 edition of NFPA 1221 added a section on retroactivity that allowed the authority having jurisdiction to require the application of any provision of the document. The committee also addressed an important alarm processing issue. NFPA staff had been receiving frequent calls from emergency services about alarm processing times that exceeded the time allotted in the standard. These alarm calls required more time to process because dispatchers and call takers were required to gather additional information before dispatching the appropriate resources. The committee addressed the issue by including six categories of calls that require additional time to process within the standard.

The 2016 edition of NFPA 1221 included requirements regarding two-way radio communications enhancement systems and pathway survivability from *NFPA 72®*, *National Fire Alarm and Signaling Code®*, that the committees of both standards felt were more appropriate to NFPA 1221. Additionally, call processing times were revisited, resulting in a change to the emergency call processing timeline in the alarm processing section to include verification. The change addressed improvements to the technologies whereby telecommunicators receive emergency calls and the time it takes to verify the location of the emergency before processing. A requirement that two telecommunicators be on duty in the communications center at all times was another change made to the 2016 edition. Two additional categories of calls requiring additional time to process at the public safety answering point (PSAP) also were added.

For the 2019 edition, the committee made a global change in using the word *event* instead of *alarm* to recognize the many ways calls for service are processed by emergency communications centers. The committee updated extracts and definitions for the revised document. The committee evaluated call processing time benchmarks and updated as appropriate. Multi-line telephone system challenges were addressed in response to a tentative interim amendment (TIA) issued for the 2016 edition. Requirements regarding two-way radio communications enhancement systems were changed to incorporate the TIA filed for the 2016 edition and eliminate the need for pathway survivability for antenna cables. The committee addressed data security needs for communication systems.

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Committee Scope: This Committee shall have primary responsibility for documents relating to the operation, installation, and maintenance of public emergency services communications systems.

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2019 Edition

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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, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex C. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

Chapter 1 Administration

1.1 Scope.

1.1.1 This standard shall cover the installation, performance, operation, and maintenance of public emergency services communications systems and facilities.

1.1.2 This standard shall not be used as a design specification manual or an instruction manual.

1.2 Purpose. The purpose of this standard shall be as follows:

- (1) To specify operations, facilities, and communications systems that receive events from the public
- (2) To provide requirements for the retransmission of such events to the appropriate emergency response agencies
- (3) To provide requirements for dispatching of appropriate emergency response personnel

- (4) To establish the required levels of performance and quality of installations of emergency services communications systems

1.2.1 Public fire alarm systems and fire alarm systems on private premises from which signals are received directly or indirectly by the communications center shall be in accordance with NFPA 72.

1.2.2 Emergency reporting systems that are not covered by this standard shall be in accordance with NFPA 72.

1.3* Application. This standard shall apply to publicly and privately owned communications systems that include, but are not limited to, the following:

- (1) Computer aided dispatching systems
- (2) Telephone systems
- (3) 9-1-1 systems
- (4) Next Generation 9-1-1 systems
- (5) Multi-line telephone systems (MLTS) used to access the Enhanced 9-1-1 systems
- (6) Telematics
- (7) Emergency response facility alerting systems
- (8) Public and private alarm reporting systems
- (9) One-way and two-way radio systems

1.3.1 The communication systems listed in Section 1.3 shall provide the following functions:

- (1) Communication between the requester and emergency response agencies
- (2) Communication within the emergency response agency under emergency and nonemergency conditions
- (3) Communication among emergency response agencies

1.4 Retroactivity.

1.4.1 Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document.

1.4.2 In those cases where it is determined that the existing situation involves a distinct hazard to life or property, the authority having jurisdiction shall be permitted to require retroactive application of any provisions of this document.

1.4.3 The portions of this standard that shall be applied retroactively are listed in Table 1.4.3, Retroactivity.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

Table 1.4.3 Retroactivity

Chapter	Retroactive
1	N/A
2	N/A
3	Yes
4	4.1, 4.5.1, 4.5.2, 4.5.5–4.5.7
5	No
6	No
7	Yes
8	Yes
9	No
10	No
11	Yes
12	Yes
13	Yes
14	No

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2018 edition.

NFPA 54, *National Fuel Gas Code*, 2018 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 72®, *National Fire Alarm and Signaling Code®*, 2019 edition.

NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, 2017 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2018 edition.

NFPA 101®, *Life Safety Code®*, 2018 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2019 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2019 edition.

NFPA 220, *Standard on Types of Building Construction*, 2018 edition.

NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2017 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2017 edition.

NFPA 1061, *Standard for Public Safety Telecommunications Personnel Professional Qualifications*, 2018 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2014 edition.

NFPA 1600®, *Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations Programs*, 2016 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2018 edition.

2.3 Other Publications.

2.3.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2016.

2.3.2 FCC Publications. Federal Communications Commission, 445 12th Street SW, Washington, DC 20554.

FCC 13-21, *Use and Design of Signal Boosters Report and Order*, 2013.

2.3.3 IEEE Publications. IEEE, 3 Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE C2, *National Electrical Safety Code*, 2017.

2.3.4 IESNA Publications. Illuminating Engineering Society of North America, 120 Wall Street, Floor 17, New York, NY 10005.

HB-9-00, *Lighting Handbook*, 9th edition, 2009.

2.3.5 NENA Publications. National Emergency Number Association, 1700 Diagonal Road, Suite 500, Alexandria, VA 22314

NENA-ADM-000.21-2017, *NENA Master Glossary of 9-1-1 Terminology*, August 8, 2017.

NENA/APCO ANS 2.105.1-2017, *NG9-1-1 Emergency Incident Data Document (EIDD)*, 2017.

2.3.6 TIA/EIA Publications. Telecommunications Industry Association/Electronic Industries Alliance, 1320 North Courthouse Road, Suite 200, Arlington, VA 22201.

ANSI/TIA-102.BAAA, *FDMA Common Air Interface*, 1998.

TIA-102.BBAB, *Project 25 Phase 2 Two-Slot Time Division Multiple Access Physical Layer Protocol Specification*.

TIA-102.BBAC, *Project 25 Phase 2 Two-Slot TDMA Media Access Control Layer Description*.

TIA-603-D, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*, 2010.

2.3.7 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 752, *Standard for Bullet-Resistant Equipment*, 2005, Revised 2015.

2.3.8 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 72®, *National Fire Alarm and Signaling Code®*, 2019 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2019 edition.

NFPA 1000, *Standard for Fire Service Professional Qualifications Accreditation and Certification Systems*, 2017 edition.

NFPA 1005, *Standard for Professional Qualifications for Marine Fire Fighting for Land-Based Fire Fighters*, 2014 edition.

NFPA 1021, *Standard for Fire Officer Professional Qualifications*, 2014 edition.

NFPA 1061, *Standard for Public Safety Telecommunications Personnel Professional Qualifications*, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* 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.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Alarm. A signal or message from a device indicating the existence of an emergency or other situation that requires action by an emergency response agency.

3.3.1.1* Alarm Data. Digital information related to an alarm that contains the physical location of the alarm and other explanatory information.

3.3.2 Alert Data Message (ADM). An analog or digital signal containing instructions for how a public alerting system alerting appliance (PASAA) is to deliver and, if capable, to acknowledge a public alert.

3.3.3 Alphanumeric Devices. Used as a part of a radio alerting system, paging receivers that provide an audible alert and a text message to the user and that do not have the ability to provide voice messages.

3.3.4 Alternate Communications Center. A designated communications center capable of assuming the functions normally performed at the primary communications center.

3.3.5 Annunciator. A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location. [72, 2019]

3.3.6 Antenna. A device connected to a radio receiver, transmitter, or transceiver that radiates the transmitted signal, receives a signal, or both.

3.3.7 Automatic Call Distributor (ACD). Equipment that automatically distributes incoming calls to available PSAP attendants in the order the calls are received, or queues calls until an attendant becomes available.

3.3.8* Automatic Location Identification (ALI). The automatic display at the PSAP of the caller's telephone number, the address/location of the telephone, and supplementary emergency services information of the location from which a call originates.

3.3.9* Automatic Number Identification (ANI). A series of alphanumeric characters that informs the recipient of the source of an event.

3.3.10* Backbone. A communications cable in an in-building radio enhancement system that carries wideband signals important to the entire building, from the donor antenna, through the amplifiers, and to distribution antenna lines.

3.3.11 Band. A range of frequencies between two defined limits.

3.3.12 Base Station. A stationary radio transceiver with an ac or dc power supply or power supply module.

3.3.13 Cable. A factory assembly of two or more conductors having an overall covering. [70, 800.2]

3.3.14 Call. A generic term used to include any type of request for emergency assistance (RFEA), and is not limited to voice.

3.3.15 Call Answer. The condition when a call is delivered to and acknowledged by a telecommunicator (or an auto greeting) and two-way communication can begin.

3.3.16 Call Answer Interval. The elapsed time between call arrival and call answer.

3.3.17 Call Arrival. The condition when a call is presented to the PSAP customer premises equipment (CPE), which can include acknowledgement by an auto attendant.

3.3.18 Call Detail Recording (CDR). A system that provides metadata for each call, including automatic number identification (ANI), trunk number, and answering attendant number, and the time of seizure, answer, and disconnect/transfer.

3.3.19* Call Server. A system of electrical, mechanical, and computer components the function of which is to process incoming and outgoing telephone calls.

3.3.20 Certification. An authoritative attestation; specifically, the issuance of a document that states that an individual has demonstrated the knowledge and skills necessary to function in a particular fire service professional field. [1000, 2017]

3.3.21 Channel Access Time. The time lapse from activation of a radio transmitter's push-to-talk (PTT) switch to an acknowledgment from the system and commencement of transmission.

3.3.22* Circuit. The conductor or radio channel and associated equipment that are used to perform a specific function in connection with an alarm system.

3.3.23 Coded Receivers. Used as a part of a radio alerting system, paging receivers that respond only to messages directed to the specific unit or to units in an assigned group.

3.3.24 Common Battery. The battery used to power recorders, transmitters, relays, other communications center equipment, and alternate communications center equipment.

3.3.25* Communications Center. A building or portion of a building that is specifically configured for the primary purpose of providing emergency communications services or public safety answering point (PSAP) services to one or more public safety agencies under the authority or authorities having jurisdiction.

3.3.26* Communications Officer. The individual responsible for development of plans to make the most effective use of incident-assigned communications equipment and facilities, installation and testing of all communications equipment, supervision and operation of the incident communications center, distribution and recovery of equipment assigned to incident personnel, and maintenance and on-site repair of communications equipment.

3.3.27* Communications System. A combination of devices, networks, applications, computers, and services.

3.3.28* Comprehensive Emergency Management Plan (CEMP). A disaster plan that conforms to guidelines established by the authority having jurisdiction and is designed to address natural, technological, and man-made disasters.

3.3.29* Computer-Aided Dispatch (CAD). A combination of hardware and software that provides data entry, makes resource recommendations, and notifies and tracks those resources before, during, and after events, preserving records of those events and status changes for later analysis.

3.3.30 Control Console. A wall-mounted or desktop panel or cabinet containing controls to operate communications equipment.

3.3.31 Conventional Radio. A radio system in which automatic computer control of channel assignments is not required or used, system-managed queuing of calls is not provided, and channels are selected manually by the users.

3.3.32 Coordinated Universal Time. A coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM), which forms the basis of a coordinated dissemination of standard frequencies and time signals.

3.3.33 Critical Operations Power Systems (COPS). Power systems for facilities or parts of facilities that require continuous operation for the reasons of public safety, emergency management, national security, or business continuity. [70:708.2]

3.3.34 Customer Premise Equipment (CPE). Equipment for the reception and origination of telephone calls located at a PSAP.

3.3.35 Cyber Security. The vulnerability of any computing system, software program, or infrastructure to resist intentional interference, compromise, or incapacitation through the misuse of the Internet or public or private telecommunications systems, or similar conduct that harms interstate commerce or threatens public health or safety.

3.3.36 Data Security. Protection of the integrity of an organization's data resources to insure that they are available to support the mission and that the data is not compromised.

3.3.37* Delivered Audio Quality (DAQ). A measure of speech intelligibility of land mobile radios.

3.3.38 Denial-of-Service Attack. An attack on a computer system or network with the objective of causing a loss of service to some or all users, by saturating the system or network with useless traffic, making it impossible for legitimate users of the system to use the facility.

3.3.39 Digital Radio System. A radio system that uses a binary representation of audio from one radio to another.

3.3.40 Direct Exterior Window. A window in a communications center that faces an area that is not part of the secure area assigned solely to the communications center or that is accessible to the public.

3.3.41* Dispatch Circuit. A circuit over which a signal is transmitted from the communications center to an emergency response facility (ERF) or emergency response units (ERUs) to notify ERUs to respond to an emergency.

3.3.42 Dispatcher. See 3.3.107, Telecommunicator.

3.3.43 Dispatching. See 3.3.50, Emergency Event Processing/Dispatching.

3.3.44 Display Screen. An electronic device that is capable of displaying text, video, and graphics.

3.3.45 Distribution Antenna. A radio antenna that is specifically designed to radiate RF energy into a building area, and is typically non-descript in appearance so as not to disturb the décor of the area.

3.3.46* Distribution Antenna Cable. A communications cable that carries RF energy in both directions along its length to distribution antennas in one or more places in the building.

3.3.47 Donor Antenna. Antennas used with two-way radio communications enhancement systems that provide the connection between the wide-area communications system of interest and the in-building system.

3.3.48 Donor Site. The specific wide-area communications site from which the donor antenna acquires services.

3.3.49* Emergency. A condition that is endangering or is believed to be endangering life or property; an event that requires the urgent response of an emergency response agency.

3.3.50* Emergency Event Processing/Dispatching. A process by which an event answered at the communications center creates a call for service and is transmitted to emergency response facilities (ERFs) or to emergency response units (ERUs) in the field.

3.3.51 Emergency Dispatch Protocol. A standard sequence of questions used by telecommunicators that provides post-dispatch or pre-arrival instructions to callers.

3.3.52* Emergency Response Agency (ERA). Organizations providing law enforcement, emergency medical, fire, rescue, communications, and related support services.

3.3.53* Emergency Response Facility (ERF). A structure or a portion of a structure that houses emergency response agency equipment or personnel for response to events.

3.3.54 Emergency Response Unit (ERU). Personnel who respond to fire, medical, law enforcement, and other emergency situations for the preservation of life and safety.

3.3.55 Enhanced 9-1-1. Emergency telephone service that provides selective routing and both automatic number identification (ANI) and automatic location identification (ALI) of the calling party.

3.3.56* Event. An emergency or other situation that requires action by an emergency response agency.

3.3.57* Event Data. Information related to an event that contains the physical location of the event, callback number of the reporting party/system, and other explanatory information.

3.3.58 Immediately Dangerous to Life or Health (IDLH). Any condition that would pose an immediate or delayed threat to life, cause irreversible adverse health effects, or interfere with an individual's ability to escape unaided from a hazardous environment. [1005, 2014]

3.3.59 Incident Management System. A plan that defines the roles and responsibilities to be assumed by personnel and the operating procedures to be used in the management and direction of emergency operations.

3.3.60 Information Communication Technology (ICT) Security. Security of the integrity of the organization's data within the organization's normal use of that data as well as in preventing unauthorized external parties from attempting access or damage to the data using cyber attack techniques.

3.3.61 Instant Recall Recorder. A device that records voice conversations and provides a telecommunicator with a means to review such conversations in real time.

3.3.62 Intelligent Transportation System. A means of electronic communications or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

3.3.63* IP-Enabled Device. A data-centric device that uses Internet protocol (IP) as a means of communication.

3.3.64* Logging Recorder. A device that records event and dispatch information.

3.3.65 Master Time Source. A system providing time information to connected PSAP equipment that is traceable to Coordinated Universal Time (UTC).

3.3.66 Microwave. Radio waves with frequencies of 1000 MHz and higher.

3.3.67 Modem (Modulator/Demodulator Unit). A device that converts data that is compatible with data-processing equipment to a form that is compatible with transmission equipment, and vice versa.

3.3.68 Monitor. To listen to or observe message traffic without transmitting a response.

3.3.69 Monitoring for Integrity. Automatic monitoring of circuits and other system components for the existence of defects or faults that interfere with receiving or transmitting data related to an event.

3.3.70* Multi-Line Telephone System (MLTS). A system designed to aggregate more than one incoming voice communication channel for use by more than one telephone. This includes network- and premises-based systems.

3.3.71 Next Generation 9-1-1 (NG9-1-1). NG9-1-1 is an Internet Protocol (IP)-based system comprised of managed emergency services IP networks (ESInets), functional elements (applications), and databases that replicate traditional E9-1-1 features and functions and provide additional capabilities. NG9-1-1 is designed to provide access to emergency services from all connected communications sources and provide multimedia data capabilities for public safety answering points (PSAPs) and other emergency service organizations. [NENA Master Glossary of 9-1-1 Terminology]

3.3.72* Notification. The time at which an event or alarm is received and acknowledged at a communications center.

3.3.73 Numeric Receivers. Used as a part of a radio alerting system, paging receivers that provide an audible alert and a numeric message to the user and that do not have the ability to provide text or voice messages.

3.3.74 Operations Room. The room in the communications center where events and alarms are received and processed and communications with emergency response personnel are conducted.

3.3.75 P.01 GOS. A probability statement for grade of service that no more than 1 call out of 100 attempts made during the average busy hour will receive a busy signal.

3.3.76 Pager. A compact radio receiver used for providing one-way communication or limited digital/data two-way communication.

3.3.77 Path (Pathways). Any circuit, conductor, optic fiber, radio carrier, or other means connecting two or more locations. [72, 2019]

3.3.78 Permanent Visual Record (Recording). An immediately readable, not easily alterable record of all occurrences of status change.

3.3.79 Portable Radio. A battery-operated, hand-held transmitter.

3.3.80 Power Source. The power obtained from a utility distribution system, an engine-driven generator, or a battery.

3.3.81* Private Branch Exchange (PBX). A system designed to connect to a local exchange carrier (incumbent or competitive) to allow telephone calls to be distributed to extensions and extensions to use a set of voice communication channels to make outbound calls. A PBX also allows extension-to-extension telephone calls without connecting to the public switched telephone network.

3.3.82 Public Alarm Reporting System. A system of alarm-initiating devices, receiving equipment, and connecting circuits, other than a public telephone network, used to transmit alarms from street locations to the communications center.

3.3.83 Public Alerting System (PAS). A system that creates, transmits, and displays a public alert message or sounds a signal, or both, that is intended to alert the public to situations that could result in loss of life, endanger their health, or destroy property.

3.3.84 Public Alerting System Alerting Appliance (PASAA). A device that receives a signal from a public alerting system (PAS) and broadcasts an audible and visual alarm that could be in the form of text or speech.

3.3.85 Public Safety Agency/Public Safety Organization. See 3.3.52, Emergency Response Agency (ERA).

3.3.86 Public Safety Answering Point (PSAP). A facility in which 9-1-1 calls are answered.

3.3.87* Public Safety Emergency Communications System. A communications system dedicated to the receipt of events, the coordination and dispatch of first responder resources, and the management of resources and activities post-dispatch.

3.3.88 Radiating Cable. A coaxial cable that distributes small amounts of RF energy along its length by means of periodic breaks in the shield surrounding the center conductor.

3.3.89* Radio Channel. A band of frequencies of a width sufficient to allow its use for radio communications. [72, 2019]

3.3.90 Radio Control Station. A mobile or base station radio in a fixed location (often on a desktop or in a dispatcher's console) that operates on a radio frequency configuration so that it can access a land mobile radio-fixed repeater station or fixed trunking station to gain access to the communication system. A radio control station is often used in a 9-1-1 center to provide a backup means to access the public safety communications system.

3.3.91* Radio Frequency. The number of electromagnetic wave frequency cycles transmitted by a radio in 1 second.

3.3.92 Radio Licensing Authority. The government authority in a country that issues licenses for use of radio frequencies by authorized agencies and individuals.

3.3.93* Remote Communications Facility. A normally unattended facility, remote from the communications center that is used to house equipment necessary for the functioning of a communications system.

3.3.94 Repeater. A device for receiving and re-transmitting one-way or two-way communication signals.

3.3.95 Requester. Any person, device, machine, or system observing and reporting an event requiring an emergency response.

3.3.96* Response Unit. A vehicle, equipment, or personnel identified by the AHJ for dispatch purposes.

3.3.97 RF-Emitting Device. An active device that emits a radio frequency signal as part of a two-way radio communications enhancement system.

3.3.98 Security Vestibule. A compartment provided with two or more doors where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door at a time.

3.3.99 Simplex Radio Channel. A radio channel using a single frequency that, at any one time, allows either transmission or reception, but not both, by a particular radio.

3.3.100* Standard Operating Procedures (SOPs). Written organizational directives that establish or prescribe specific operational or administrative methods that are to be followed routinely for the performance of designated operations or actions.

3.3.101 Stored Emergency Power Supply System (SEPSS). A system consisting of a UPS, a rectifier plant, or a motor generator powered by a stored electrical energy source; a transfer switch designed to monitor preferred and alternate load power source and provide desired switching of the load; and all necessary control equipment to make the system functional. [111, 2019]

3.3.102 Subscriber. A mobile radio, portable radio, or radio control station operated by a user in a wireless communications system on a radio frequency configuration so that it can access a land mobile radio fixed repeater station or fixed trunking base station to gain access to the communication system.

3.3.103 Supervisor. An individual responsible for overseeing the performance or activity of other members. [1021, 2014]

3.3.104 Tactical Interoperable Communications Plan (TICP). A document used to clearly define the breadth and scope of interoperable assets available in the area and how those assets are shared and how their use is prioritized, and the steps individual agencies should follow to request, activate, use, and deactivate each asset.

3.3.105 Talkgroup. A group of radios addressed as a single entity by the system and functionally equivalent to a conventional repeater channel.

3.3.106 TDD/TTY. A device that is used in conjunction with a telephone to communicate with persons who are deaf, who are hard of hearing, or who have speech impairments, by typing and reading text.

3.3.107 Telecommunicator. An individual whose primary responsibility is to receive, process, or disseminate information of a public safety nature via telecommunication devices. [1061, 2018]

3.3.108 Telematics. The combination of communications and information systems used to provide information and/or communications from a vehicle to a PSAP through a telematics service provider. Vehicle systems can include GSM, GPRS, SMS, GPS, and vehicle telemetry.

3.3.109 Tie Circuit. A circuit that connects a communications center with an alternate communications center or with a public safety answering point (PSAP).

3.3.110 Transceiver. A combined transmitter and receiver radio unit.

3.3.111 Trouble Signal. A signal initiated by a dispatch system or device indicative of a fault in a monitored circuit or component.

3.3.112 Trunked Radio. A radio system that uses computer control to automatically assign channels from an available pool of channels to users and groups of users.

3.3.113* Two-Way Alphanumeric Devices. Used as a part of a radio-alerting system, paging transceivers that provide an audible alert and a text message to the user and that have the ability to acknowledge messages received back to the control point.

3.3.114 Two-Way Radio Communications Enhancement System. A combination of components, RF-emitting devices, antennas, cables, power supplies, control circuitry, and programming installed at a specific location to improve wireless communication at that location.

3.3.115* Uninterruptible Power Supply (UPS). A system consisting of a stored energy source, designed to continuously provide a clean, conditioned sinusoidal wave of power under normal conditions and for a finite period of time upon loss of the primary power source. [111, 2016]

3.3.116* Voice Communication Channel. A single circuit for communication by spoken word that is distinct from other circuits for communications.

3.3.117 Wired Circuit. A metallic or fiber-optic circuit, leased to or owned by a jurisdiction, that is dedicated to a specific alarm or communication system under the control of that jurisdiction.

Chapter 4 Communications Centers

4.1 General.

4.1.1* Communications centers and alternate communications centers shall comply with Chapter 4.

4.1.2* A comprehensive emergency management plan (CEMP) shall be in place for each communications center.

4.1.2.1 The CEMP shall comply with the applicable requirements of *NFPA 1600* and additional requirements specified in this document.

4.1.2.2 The AHJ shall review the CEMP for currency and applicability annually.

4.1.3 When provided, remote communications facilities shall comply with Section 4.10.

4.1.4 Communications equipment shall be kept in working order at all times.

4.1.5 Each center shall be provided with a designated primary means of communication that shall be compatible with the designated primary means of communication provided at the Emergency Response Facilities (ERFs).

4.1.5.1 Each center shall be provided with an alternate means of communication that is compatible with the alternate means of communication provided at the ERFs. The alternate means shall be readily available to the telecommunicator in the event of failure of the primary communications system.

4.1.6* Each jurisdiction shall maintain an alternate communications center that meets the criteria in 4.1.6.1 and 4.1.6.2.

4.1.6.1 The alternate communications center shall be capable, when staffed, of performing the emergency functions performed at the primary communications center.

4.1.6.2* The alternate communications center shall be separated geographically from the primary communications center at a distance that ensures the survivability of the alternate center.

4.1.6.3 Each jurisdiction shall develop a formal plan to maintain and operate the alternate communications center.

4.1.6.3.1 The plan shall include the ability to reroute incoming event and alarm traffic to the alternate center and to process and dispatch events at that center.

4.1.6.3.2* The plan shall be included in the Comprehensive Emergency Management Plan (CEMP).

4.1.6.4* When operations are from the alternate communications center, receipt, transfer, processing, and dispatching of alarms and events in accordance with the requirements of this standard shall not be dependent on the functioning of any equipment at the primary communications center.

4.1.7* The communications center shall be capable of continuous operation long enough to enable the transfer of operations to the alternate communications center in the event of fire or other emergency in the communications center or in the building that houses the communications center.

4.1.8 Systems that are essential to the operation of the communications center shall be designed to accommodate peak workloads as determined by the authority having jurisdiction (AHJ).

4.1.9* Communications centers shall be designed to accommodate the staffing level necessary to operate the center as required by Chapter 7.

4.1.10 The design of the communications center shall be based on number of personnel needed to handle peak workloads as determined by the AHJ.

4.2 Exposure Hazards.

4.2.1 Where the building that houses a communications center is adjacent to another structure, the exposed walls shall be protected in compliance with *NFPA 5000* or in compliance with the building code legally in effect, whichever is more restrictive.

4.2.2* When the building that houses a communications center is located within 150 ft (46 m) of the potential collapse zone of a taller structure, the roof shall be designed to resist damage from collapse of the exposing structure.

4.2.3* The lowest floor elevation of the communications center shall be above the 100-year flood plain established by the Federal Emergency Management Agency.

4.3 Construction.

4.3.1 Communications centers shall be located in buildings of Type I or Type II construction as defined by NFPA 220.

4.3.2 Buildings that house communications centers shall have Class A roof coverings.

4.3.3 Communications centers shall be separated from other portions of buildings occupied for purposes other than emergency communications by fire barriers having a fire resistance rating of 2 hours.

4.3.4 Fire barriers shall comply with NFPA 101 Section 8.3.

4.3.5* Communications centers shall not be located below grade unless the elevation of the lowest floor in the facility is above the 500-year flood plan. Communications centers located below grade shall comply with 11.7.3 of NFPA 101 and be specifically designed for the location.

4.3.6 The exposed surfaces of interior walls and ceilings shall have a flame spread index of 25 or less and a smoke development index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

4.3.7 Interior floor finish shall comply with the requirements of NFPA 101 interior floor finish testing and classification and shall be Class I as established by NFPA 101 or shall have a minimum critical radiant flux of 0.1 W/cm².

4.3.8 The operations room shall be equipped with a toilet facility and a lunch area that are directly accessible to the telecommunicators within the secured area as required by Section 4.6.

4.3.8.1* Communications centers shall be provided with backup facilities for sanitation and drinking water to provide for the health and safety of employees during extended periods of failure of public water or sewer systems.

4.3.9 The communications center or that portion of a building to be utilized as a communications center shall be protected against seismic damage in accordance with NFPA 5000 or the building code legally in effect.

4.4 Climate Control.

4.4.1 Heating, ventilating, and air-conditioning (HVAC) systems shall be provided in accordance with NFPA 90A and NFPA 90B.

4.4.1.1 HVAC systems shall be designed to maintain temperature and relative humidity within limits specified by the manufacturers of the equipment critical to the operation of the communications center as determined by the AHJ.

4.4.1.1.1* Separate temperature and humidity controls shall be provided for each equipment room, for the operations room, for office areas, and for other spaces designated by the AHJ.

4.4.1.2* HVAC systems shall be independent systems that serve only the communications center.

4.4.1.3* HVAC system intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building and to resist intentional introduction of irritating, noxious, toxic, or poisonous substances into the HVAC system.

4.4.1.4 Emergency controls shall be provided in the operations room to permit closing of outside air intakes.

4.4.1.5* Backup HVAC systems shall be provided for the operations room and other spaces housing electronic equipment determined by the AHJ to be essential to the operation of the communications center.

4.4.1.6 Backup or redundant HVAC units shall be capable of receiving power from all power sources required by Section 4.7.

4.4.1.7* HVAC systems shall be designed so that the communications center is capable of uninterrupted operation with the largest single HVAC unit or component out of service.

4.4.1.8* Primary and backup HVAC systems shall be capable of operating from the normal power source required by 4.7.2 and the alternate power source required by 4.7.3.

4.4.1.9* Primary and backup/redundant HVAC units shall be located to prevent tampering, vehicle impact, or introduction of hazardous/noxious chemicals or odors.

4.4.2 Penetrations into the communications center shall be limited to those necessary for the operation of the center.

4.5 Fire Protection.

4.5.1 The communications center shall be provided with fire extinguishers that meet the requirements of NFPA 10.

4.5.2 The communications center and spaces adjoining the communications center shall be provided with an automatic fire detection, alarm, and notification system in accordance with NFPA 72.

4.5.2.1 The alarm system shall be monitored in the operations room.

4.5.2.2 Operation of notification appliances shall not interfere with communications operations.

4.5.3 The building that houses the communications center shall be protected throughout by an approved, supervised automatic sprinkler system that complies with NFPA 13.

4.5.4 Supervision shall be in accordance with 9.7.2 of NFPA 101.

4.5.5 Electronic computer and data processing equipment shall be protected in accordance with NFPA 75.

4.5.6* Emergency Fire Plan. There shall be a management-approved, written, dated, and annually tested emergency fire plan that is part of the CEMP.

4.5.7* Damage Control Plan. There shall be a management-approved, written, dated, and annually tested damage control plan that is part of the CEMP.

4.5.8* Each jurisdiction shall develop a tactical interoperable communications plan (TICP) utilizing TIA-603-D, *Land Mobile FM or PM Communication Equipment Measurement and Performance Standards*, or a similar reference.

4.5.9 The TICP shall be included in the comprehensive emergency management plan (CEMP).

4.6 Security.

4.6.1 The communications center and other buildings that house essential operating equipment shall be protected against damage from vandalism, terrorism, and civil disturbances.

4.6.2 Entry to the communications center and other buildings and structures that contain equipment essential to the operation of the communications systems shall be restricted to authorized persons.

4.6.2.1 Potential points for unauthorized entry as determined by the AHJ shall be protected by an electronic intrusion detection system.

4.6.2.2 The intrusion detection system shall be annunciated in the operations room and at another location designated by the AHJ.

4.6.3* Entryways to the communications center shall be protected by a security vestibule.

4.6.3.1 Door openings shall be protected by listed, self-closing fire doors that have a fire resistance rating of not less than 1 hour.

4.6.3.2 Door openings shall be protected by listed, self-closing doors that are rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*.

4.6.4 Where a communications center has windows, the requirements of 4.6.4.1 through 4.6.4.5 shall apply.

4.6.4.1 Window sills on all direct exterior windows shall be a minimum of 4 ft (1.2 m) above floor level or 4 ft (1.2 m) above finished grade, whichever is higher.

4.6.4.2 Direct exterior windows shall be rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*.

4.6.4.3 Direct exterior windows that are not bullet resistant shall be permitted, provided that they face a secured area that cannot be accessed or viewed from outside the secured perimeter of the communications center.

4.6.4.4 Direct exterior windows that are required to be bullet resistant shall be configured so that they cannot be opened.

4.6.4.5* Direct exterior windows shall be arranged so that it is not possible to view the interior of the communications center from outside the secured perimeter.

4.6.5* Perimeter walls shall be designed and constructed to provide the same level of ballistic protection as that required for windows.

4.6.6 Means shall be provided to prevent unauthorized vehicles from approaching the building housing the communications center to a distance of no less than 82 ft (25 m).

4.6.7* As an alternative to 4.6.6, unauthorized vehicles shall be permitted to approach closer than 82 ft (25 m) if the building has been designed to be blast resistant, as approved by the AHJ.

4.7 Power.

4.7.1 General. Each communications center shall be provided with a critical operations power system in compliance with NFPA 70.

4.7.1.1 Designated critical operations areas (DCOAs) shall include the operations room, information technology (IT) rooms, telephone rooms, electrical equipment rooms, mechanical equipment rooms, fire protection equipment rooms, sani-

tary facilities, and other spaces and equipment designated by the AHJ as requiring critical operations power.

4.7.1.2 At least two independent and reliable power sources shall be provided, one primary and one emergency, and each shall be of adequate capacity for operation of the communications center.

4.7.1.3 Power sources shall be monitored for integrity, with annunciation provided in the operations room.

4.7.1.4 In addition to the two power sources required by 4.7.1.2, a means for connecting a portable or vehicle-mounted generator shall be provided.

4.7.1.5* The means shall include an outdoor weatherproof power connector and a manual disconnecting means for the power connector. The disconnecting means shall connect to the center's power system on the load side of the automatic transfer switch required by 4.7.3.2.

4.7.1.6* Wiring methods for feeders, branch circuits, and any control wiring utilized in the delivery of power for the operation of the communications center shall be designed in accordance with NFPA 70.

4.7.2 Primary Power Source. One of the following shall supply primary power:

- (1) A feed from a commercial utility distribution system
- (2) An approved engine-driven generator installation or equivalent under the control of communications center staff, designed for continuous operation, and with a person specifically trained in its operation on duty at all times
- (3) An approved engine-driven generator installation or equivalent under the control of communications center staff, arranged for cogeneration with commercial light and power, and with a person specifically trained in its operation on duty at all times

4.7.3 Emergency Power Supply System.

4.7.3.1 The emergency power supply system shall consist of one or more engine-driven generators installed in accordance with NFPA 70.

4.7.3.2 Upon failure of primary power, transfer to the standby emergency supply system shall be automatic.

4.7.4* Engine-Driven Generators.

4.7.4.1 Engine-driven generators shall conform with the provisions of Chapter 4 of NFPA 37 and with NFPA 110.

4.7.4.2 Engine-driven generators shall conform with the provisions of NFPA 110, Type 10, Level 1, Class 72.

4.7.4.2.1 The authority having jurisdiction shall be permitted to require a higher class if necessary to comply with the CEMP.

4.7.4.3* Engine-driven generators shall be sized to supply power for the operation of all functions of the communications center and for any additional loads determined by the AHJ.

4.7.4.4 When installed indoors, engine-driven generators shall be located in a ventilated and secured area that is separated from the communications center by fire barriers having a fire resistance rating of 2 hours.

4.7.4.5 Fire barriers shall comply with NFPA 101, Section 8.3.

4.7.4.6 When installed outdoors, engine-driven generators shall be located in a secure enclosure concealed from public view and accessible only to authorized personnel.

4.7.4.6.1 The enclosure shall be capable of resisting the entrance of precipitation at the maximum wind velocities referenced in *NFPA 5000* or in accordance with the building code legally in effect, whichever is more restrictive.

4.7.4.6.2 The enclosure shall be capable of resisting penetration by small arms fire. Doors, and windows if provided, shall be rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*.

4.7.4.6.3 The enclosure shall be equipped with an intrusion detection system complying with NFPA 731 that shall be monitored in the operations room and at another location designated by the AHJ.

4.7.4.7 The area that houses an engine-driven generator shall not be used for storage other than spare parts or equipment related to the generator system.

4.7.4.8 Liquid fuel shall be stored in accordance with NFPA 37.

4.7.4.9 Liquid fuel for engine-driven generators shall not use a gravity-fed system.

4.7.4.10 Natural gas installations shall comply with NFPA 54.

4.7.4.11 Liquefied petroleum gas (LPG) installations shall comply with NFPA 58.

4.7.4.12* Fuel to operate an engine-driven generator for 72 hours at full load shall be available on site.

4.7.4.12.1* Diesel fuel shall be maintained and tested at regularly scheduled intervals as determined by the AHJ.

4.7.4.12.2 Fuel tank levels shall be monitored electronically in the operations room. A low-fuel supervisory alert shall be annunciated when the fuel level in a tank drops to two-thirds rated capacity. The AHJ shall be permitted to designate additional levels for tank level annunciation.

4.7.4.12.3 A dedicated fuel tank shall be provided for each engine.

4.7.4.13 Equipment essential to the operation of the generator shall be supplied with standby power from the generator.

4.7.4.14 Generators shall not use the public water supply for engine cooling.

4.7.4.15 The engine conditions requiring remote audible annunciation for Level 1 systems in NFPA 110, Table 5.6.5.2, shall be individually visually annunciated in the operations room.

4.7.4.15.1 In addition to the visual annunciation, an audible signal common to all annunciated signals shall be provided.

4.7.4.15.2 A silencing switch for the audible signal in the operations room shall be permitted on the condition that when all supervisory signals have cleared, the silencing circuit will automatically reset or the audible alert will re-sound as a reminder to restore the switch to normal.

4.7.5 Power Circuits. Power circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and

controlling devices, shall be installed in accordance with *NFPA 70* and the requirements of this subsection.

4.7.5.1 Primary power shall be obtained from the line side of the main service disconnect switch of the connection to a commercial utility distribution system or to the main conductors from an isolated power plant that is located on the premises.

4.7.5.2 Power shall be permitted to be obtained from the load side of the main service disconnect switch only when the building is used exclusively for housing of emergency communications facilities.

4.7.5.3 Power circuit conductors shall not be installed in conduit that is used for other circuits.

4.7.5.4 The power circuit disconnecting means shall be installed so that it is accessible only to authorized personnel.

4.7.6 Surge Arresters.

4.7.6.1* Surge arresters shall be provided in accordance with *NFPA 70*.

4.7.6.2 Transient voltage surge suppression (TVSS) shall be provided in accordance with *NFPA 70* for protection of telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be essential to the operation of the communications center.

4.7.7* Single-Point Facility Grounding System. Telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be essential to the operation of the communications center shall be bonded to the single-point facility ground system in accordance with *NFPA 70*.

4.7.8 Uninterruptible Power Supply (UPS) and Battery Systems.

4.7.8.1* In addition to the required engine-driven generators, an uninterruptible power supply system shall be provided. It shall comply with the requirements of 4.7.8 and *NFPA 70*.

4.7.8.2 The UPS shall provide conditioned, uninterrupted power to telecommunications equipment, two-way radio systems, IT equipment, and other sensitive electronic equipment determined by the AHJ to be essential to the operation of the emergency communication systems.

4.7.8.3* The UPS shall be sized to carry the connected load for the length of time required to transfer operations to the alternate communications center as determined by the AHJ in connection with the CEMP, but in no case less than 15 minutes (Class 0.25.)

4.7.8.4 The UPS shall provide performance equivalent to Type O or Type U stored emergency power supply system (SEPSS) as specified in Table 4.2.2 of NFPA 111.

4.7.8.5 The UPS shall meet the SEPSS requirement for Level 1 as defined by NFPA 111.

4.7.8.6 Each UPS shall be provided with a bypass switch that maintains the power connection during switchover and that is capable of isolating all UPS components while allowing power to flow from the source to the load.

4.7.8.7 The following UPS conditions shall be annunciated in the operations room:

- (1) Source power failure, overvoltage, and undervoltage
- (2) High and low battery voltage
- (3) UPS in bypass mode

4.8 Lighting.

4.8.1 General.

4.8.1.1 Artificial lighting shall be provided to enable personnel to perform their assigned duties.

4.8.1.2 Lighting intensity shall be in accordance with IESNA HB-9-00, *Lighting Handbook*.

4.8.1.3 Lighting circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with NFPA 70.

4.8.2 Emergency Lighting.

4.8.2.1 The communications center shall be equipped with emergency lighting that illuminates automatically within 15 seconds of failure of normal lighting power.

4.8.2.1.1 Illumination levels shall be sufficient to allow all essential operations.

4.8.2.2 In addition to the requirement of 4.8.2.1, the operations room shall be equipped with redundant emergency lighting provided by individual unit equipment in accordance with NFPA 70.

4.8.2.3 Individual unit equipment emergency lighting shall be provided at locations of communications equipment situated outside the operations room and at the locations of engine-driven generators.

4.9* **Lightning.** Buildings that house communications centers shall have lightning protection that complies with NFPA 780.

4.10 Remote Communications Facilities.

4.10.1 General.

4.10.1.1 Remote communications facilities, where provided, shall comply with Section 4.10.

4.10.1.2 Equipment essential to the operation of a remote communications facility shall be kept in working order at all times.

4.10.1.3 Equipment that is essential to the operation of a remote communications facility shall be designed to accommodate peak loads as determined by the AHJ.

4.10.2 Exposure Hazards.

4.10.2.1 Where the building that houses a remote communications facility is adjacent to another structure, the exposed walls shall be protected in compliance with NFPA 5000 or in accordance with the building code legally in effect, whichever is more restrictive.

4.10.2.2* Where the building that houses a remote communications facility is located within 150 ft (46 m) of the potential collapse zone of a taller structure, the roof shall be designed to resist damage from collapse of the exposing structure.

4.10.2.3 In climates where communications towers are subject to accumulation of ice, roofs of communications equipment enclosures located within the falling ice danger zone shall be designed to resist damage from falling ice.

4.10.2.4* Remote communications facilities shall be located above the 100-year floodplain established by the Federal Emergency Management Agency.

4.10.3 Construction.

4.10.3.1 Where located inside buildings, remote communications facilities shall be located in buildings of Type I, Type II, or Type III construction as defined by NFPA 220.

4.10.3.2 Buildings that house remote communications facilities shall have Class A roof coverings.

4.10.3.3 Remote communications facilities shall be separated from other portions of buildings occupied for purposes other than emergency communications by fire barriers having a fire resistance rating of 2 hours.

4.10.3.4 Fire barriers shall comply with NFPA 101, Section 8.3.

4.10.3.5* Remote communications facilities shall not be located below grade unless the elevation of the lowest floor in the facility is above the 500-year floodplain. Facilities located below grade shall comply with NFPA 101, Section 11.7, "Underground and Limited Access Structures," and shall be specifically designed for the location.

4.10.3.6* The exposed surfaces of walls and ceilings inside a remote communications facility shall have a flame spread index of 25 or less and a smoke development index of 50 or less when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

4.10.3.7* Interior floor finish inside a remote communications facility shall be of noncombustible material or shall comply with the requirements of NFPA 101 interior floor finish testing and classification and shall be Class I as established by NFPA 101 or shall have a minimum critical radiant flux of 0.1 W/cm².

4.10.3.8 The AHJ shall determine whether anti-static flooring is required for protection of sensitive electronic equipment.

4.10.3.9 Remote communications facilities shall be protected against seismic damage in accordance with NFPA 5000 or in accordance with the building code legally in force, whichever is more restrictive.

4.10.4 Climate Control.

4.10.4.1 Heating, ventilating, and air-conditioning (HVAC) systems shall be provided in accordance with NFPA 90A or NFPA 90B.

4.10.4.1.1 HVAC systems shall be designed to maintain temperature and relative humidity within limits specified by the manufacturers of the equipment critical to the operation of the remote communications facility as determined by the AHJ.

4.10.4.1.2 HVAC systems shall be independent systems that serve only the remote communications facility.

4.10.4.1.3 HVAC system intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building and to resist intentional introduction of irritating, noxious, toxic, or poisonous substances into the HVAC system.

4.10.4.1.4 Backup HVAC systems shall be provided for spaces and enclosures housing electronic equipment determined by the AHJ to be essential to the operation of the remote communications facility.

4.10.4.1.5 HVAC systems shall be designed so that the remote communications facility is capable of uninterrupted operation with the largest single HVAC unit or component out of service.

4.10.4.1.6 Upon failure of the primary HVAC system, the backup system shall come on-line automatically.

4.10.5 Fire Protection.

4.10.5.1 Remote communications facilities shall be provided with clean-agent fire extinguishers that meet the requirements of NFPA 10.

4.10.5.2 A remote communications facility and building spaces adjoining that facility shall be provided with an automatic fire detection and alarm system in accordance with NFPA 72.

4.10.5.2.1 The alarm systems shall be monitored in the communications center's operations room in accordance with NFPA 72.

4.10.5.3 Where the remote communications facility equipment is housed in a building, the building shall be protected throughout by an approved, supervised automatic sprinkler system that complies with NFPA 13.

4.10.5.4* Remote communications facilities not housed in buildings shall not be required to have automatic sprinkler protection.

4.10.5.5 Penetrations into remote communications facilities shall be limited to those necessary for the operation of the facilities.

4.10.5.6* Facilities that can be exposed to uncontrolled wild-fires shall comply with NFPA 1, Chapter 17, Wildland Urban Interface.

4.10.6 Security.

4.10.6.1 Remote communications facilities shall be protected against damage from vandalism, terrorism, and civil disturbances.

4.10.6.2 Entry into remote communications facilities shall be restricted to authorized persons.

4.10.6.3 Doors furnishing access shall be protected by listed, self-closing fire doors that have a fire resistance rating of not less than 1 hour or by doors that are rated for bullet resistance to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*. The AHJ shall determine which type of door is most appropriate for each location.

4.10.6.4* A remote communications facility shall not have windows in exterior walls.

4.10.6.5* Exterior walls shall provide resistance to direct small arms fire equivalent to Level 4 as defined in ANSI/UL 752, *Standard for Bullet-Resistant Equipment*.

4.10.6.6* Means shall be provided to prevent unauthorized vehicles from approaching the structure housing the remote communications facility to a distance of no less than 82 ft (25 m).

4.10.6.7* As an alternative to 4.6.6, unauthorized vehicles shall be permitted to approach closer than 82 ft (25 m) if the building has been designed to be blast resistant, as approved by the AHJ.

4.10.6.8* An electronic intrusion detection system shall be provided. The system shall be monitored for alarm and trouble signals in the communications center or by a listed central station, as determined by the AHJ. The system shall comply with NFPA 731.

4.10.7 Power.

4.10.7.1 General. Each remote communications facility shall be provided with a critical operations power system that complies with NFPA 70.

4.10.7.1.1 Primary and emergency power sources shall be provided, each of which shall be of adequate capacity for operation of the facility.

4.10.7.1.2 Power sources shall be monitored for integrity, with annunciation provided in the operations room.

4.10.7.2 Primary Power Source. One of the following shall supply normal power:

- (1) A feed from a commercial utility distribution system
- (2) An approved engine-driven generator installation or equivalent under the control of the AHJ, designed for continuous operation and with a person specifically trained in its operation on duty at all times
- (3) An approved engine-driven generator installation or equivalent under the control of the AHJ, arranged for cogeneration with commercial light and power, and with a person specifically trained in its operation on duty at all times

4.10.7.3 Emergency Power Source.

4.10.7.3.1 The emergency power source shall consist of one or more engine-driven generators installed in accordance with NFPA 70.

4.10.7.3.2 Upon failure of the normal source, transfer to the alternate source shall be automatic.

4.10.7.4 Stored Emergency Power Supply System (SEPSS). In addition to the alternate source, a stored emergency power supply system (SEPSS) shall be provided. It shall comply with the requirements of 4.7.4.

4.10.7.5* Engine-Driven Generators. Engine-driven generators shall comply with the requirements of NFPA 110 and the requirements of 4.7.4.

4.10.7.6* Power Circuits. Power circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with NFPA 70 and the requirements of 4.7.5.

4.10.7.7 Surge Arresters.

4.10.7.7.1 Surge arresters shall be provided in accordance with NFPA 70.

4.10.7.7.2* Transient voltage surge suppression (TVSS) shall be provided in accordance with NFPA 70 for protection of telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be essential to the operation of the remote communications facility.

4.10.7.8* Single-Point Facility Grounding System. Telecommunications equipment, two-way radio systems, computers, and other electronic equipment determined by the AHJ to be

essential to the operation of the remote communications facility shall be bonded to the single-point facility grounding system in accordance with *NFPA 70*.

4.10.8 Lighting.

4.10.8.1 General.

4.10.8.1.1 Artificial lighting shall be provided to enable authorized personnel to safely perform tasks necessary for equipment maintenance.

4.10.8.1.2* Lighting intensity shall be in accordance with IESNA HB-9-00, *Lighting Handbook*.

4.10.8.1.3 External lighting shall be provided as directed by the AHJ in accordance with the security plan for each facility.

4.10.8.1.4 Lighting circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with *NFPA 70*.

4.10.8.2 Emergency Lighting.

4.10.8.2.1 The remote communications facility shall be equipped with emergency lighting that illuminates automatically upon failure of normal lighting power.

4.10.8.2.1.1 Illumination levels shall be sufficient to allow troubleshooting and emergency maintenance during a power outage.

4.10.8.2.2 Individual unit equipment emergency lighting shall be provided at the locations of engine-driven generators.

4.10.9* **Lightning Protection.** Remote communications facilities shall have lightning protection that complies with *NFPA 780*.

4.10.9.1 Remote communications facilities not housed in buildings shall have lightning protection that complies with *NFPA 780* and *NFPA 70*.

Chapter 5 Communication and Signal Wiring

5.1 Circuit Construction and Arrangement.

5.1.1* Installation shall be in accordance with *NFPA 70*.

5.1.2 As an alternative to 5.1.1, installation of outdoor circuitry shall be in accordance with IEEE C2, *National Electrical Safety Code*, where approved by the AHJ.

5.1.3 Circuits shall be routed so as to avoid damage due to mechanical injury, fire, falling walls, floods, corrosive vapors, and other risks that are identified in the CEMP.

5.1.3.1 Alternate communications centers shall comply with the requirements of Chapter 4.

5.1.4 All circuits shall be routed to allow circuits to be traced.

5.1.5 Record drawings shall be provided as required by Chapter 12.

5.1.6 Circuits shall not pass over, pass under, pass through, or be attached to buildings or property that is not owned by, or under the control of, the AHJ or the entity that is responsible for maintaining the system.

5.1.7 Alarm instruments installed in buildings not under control of the AHJ shall be on separate dedicated circuits.

5.1.8 The combination of public emergency services communication and signaling (C&S) circuits in the same cable with other circuits shall comply with 5.1.8.1 and 5.1.8.2.

5.1.8.1 Other municipally controlled C&S circuits shall be permitted.

5.1.8.2 Circuits of private signaling organizations shall be permitted only by permission of the AHJ.

5.2 Circuit Conductors.

5.2.1 Wires, conductors and fiber-optic strands shall be terminated in order to prevent breaking due to vibration or stress.

5.2.2 Circuit conductors and fiber-optic cables on terminal racks shall be identified and isolated from conductors of other systems wherever possible and shall be protected from mechanical injury.

5.2.3 Fiber-optic cables containing metallic protection or strength members shall be grounded and protected in accordance with *NFPA 70*.

5.2.4 Wiring for control equipment shall be not smaller than 24 AWG.

5.2.5 Unsupported wires and wires that are subject to vibration shall be not smaller than 18 AWG.

5.2.6 The insulation and outer jacket of cables and wiring shall be flame retardant and moisture resistant.

5.2.7 Exterior metallic, fiber-optic cables and wires shall conform to International Municipal Signal Association (IMSA) specifications or an approved equivalent, except where circuit conductors or fiber-optic strands are provided by a public utility on a lease basis.

5.3 Underground Cables.

5.3.1 Underground metallic and fiber-optic communication and signal cables in ducts or of the direct burial type shall be permitted to be brought above ground only at locations approved by the AHJ.

5.3.1.1 Protection from physical damage or heat incidental to fires in adjacent buildings shall be provided.

5.3.2 Underground cables installed in ducts, vaults, and manholes shall comply with 5.3.2.1 through 5.3.2.2.

5.3.2.1 Metallic and fiber-optic communication and signal cables shall be permitted to be located only in duct systems, manholes, and vaults that contain low-voltage C&S system conductors, secondary power cables not exceeding 600 volts nominal, or both.

5.3.2.2 Where located in duct systems or manholes that contain conductors of other circuits operating in excess of 250 volts to ground, metallic and fiber-optic communication and signal cables shall be located as far as possible from such power cables and shall be separated from them by a noncombustible barrier or other means approved by the AHJ to protect the communication and signal cables from physical damage.

5.3.3 All cables that are installed in manholes, vaults, handholes, and other enclosures shall be racked and marked for identification.

5.3.4 All raceways or ducts entering buildings from underground duct systems shall be effectively sealed with an identi-

fied sealing compound or other means acceptable to the AHJ to prevent moisture or gases from the underground duct system from entering the building.

5.3.5 Cable splices, taps, and terminal connections shall be located only where accessible for maintenance and inspection and where the AHJ has determined that no potential for damage to the cable due to falling structures or building operations exists.

5.3.6 Cable joints shall be made to provide and maintain conductivity, optical continuity for fiber-optic cable insulation, and protection that is at least equal to that afforded by the cables that are joined.

5.3.7 Cable ends shall be sealed against moisture.

5.3.8 Direct-burial cable, without enclosure in ducts, shall be laid in grass plots, under sidewalks, or in other places where the ground is not likely to be opened for other underground construction.

5.3.8.1 Where splices are made, such splices shall be accessible for inspection and tests.

5.3.8.2 Such cables shall be buried at least 24 in. (609 mm) deep.

5.3.8.2.1 Where crossing streets or other areas likely to be opened for other underground construction, cables shall be installed through solid wall duct or conduit.

5.3.8.2.2 Detectable warning tape shall be buried 12 in. (304 mm) deep above all direct buried cables.

5.4 Aerial Cable and Wire Construction.

5.4.1 Aerial C&S circuit cables and wires shall be run under all power wires but shall not be required to run under other communication wires.

5.4.2 Protection shall be provided where cables and wires pass through trees, under bridges, and over railroads, and at other locations where damage or deterioration is possible.

5.4.3 Wires and cables shall not be attached to a crossarm that carries electric light and power wires.

5.4.4 Support of aerial cables shall comply with 5.4.4.1 and 5.4.4.2.

5.4.4.1 Aerial cable shall be supported by messenger wire that is designed for the application or shall conform to one of the following:

- (1) IMSA specifications as a self-supporting cable assembly or an approved equivalent
- (2) Fiber-optic cable with integral supporting means or all-dielectric self-supporting (ADSS) type

5.4.4.2 Span lengths shall not exceed the wire or cable manufacturer's recommendations.

5.4.4.3 Single wire shall meet IMSA specifications and shall not be smaller than No. 10 Roebbling gauge if of galvanized iron or steel; 10 AWG if of hard-drawn copper; 12 AWG if of approved copper-covered steel; or 6 AWG if of aluminum. Span lengths shall not exceed the manufacturer's recommendations.

5.4.5 Aerial wires and cables connected to buildings shall contact only intended supports.

5.4.6 Aerial circuits shall enter through an approved weather-head or sleeves slanting upward and inward.

5.4.7 Drip loops shall be formed on wires and cables prior to entering buildings.

5.4.8 Aerial cables extending down poles shall comply with 5.4.8.1 through 5.4.8.4.

5.4.8.1 Aerial cables extending down poles shall be protected against mechanical damage.

5.4.8.2 Any metallic covering of the aerial cables extending down pole(s) shall form a continuous conducting path to earth ground.

5.4.8.3 The installation shall prevent water from entering the conduit.

5.4.8.4 Aerial cables extending down poles shall have 600-volt insulation that is approved for wet locations, as defined in *NFPA 70*.

5.5 Wiring Inside Buildings.

5.5.1 At the communications center, all conductors, cables, and fiber-optic cables shall extend to the operations room in conduits, ducts, shafts, raceways, or overhead racks and troughs that are listed or identified as suitable to provide protection against physical damage.

5.5.1.1 Where fire survivability is required, a listed electrical circuit protective system or a fire-rated cable that is listed to maintain circuit integrity shall be used.

5.5.2* Where installed in buildings, conductors and fiber-optic cables shall be installed in accordance with *NFPA 70* in any one of the following wiring methods:

- (1) Electrical metallic tubing
- (2) Intermediate metal conduit
- (3) Rigid metal conduit
- (4) Surface metal raceways
- (5) Reinforced thermosetting resin conduit (RTRC)
- (6) Metallic cable trays

5.5.2.1 Rigid polyvinyl chloride conduit shall be permitted where approved by the AHJ.

5.5.3 Wire, conductors, and metallic and fiber-optic cables shall have approved insulation in accordance with *NFPA 70*.

5.5.4 The insulation, cable sheath or jacket for wire, conductors, and fiber-optic cables shall have an approved insulation in accordance with *NFPA 70*.

5.5.5 Conductors and fiber-optic cables shall be installed as far as possible without splices or joints.

5.5.5.1 Splices or joints shall be permitted only in listed junction terminal boxes, enclosures, or other approved termination devices.

5.5.5.2 Wire and fiber-optic terminals, terminal boxes, splices, and joints shall conform to *NFPA 70*.

5.5.5.3 Communications and signal circuits shall be identified by the use of a distinctive color on covers or doors.

5.5.5.4 The words "emergency communication-signal circuit" shall be clearly marked on all terminal and junction locations to prevent unintentional interference.

5.5.6 Conductors that are installed in a vertical riser that connects two or more floors shall meet the requirements of riser-rated cable and installation in accordance with *NFPA 70*.

5.5.7 Metallic and fiber-optic cable terminals and cross-connecting facilities shall be located either in or adjacent to the operations room.

5.5.8 At the communications center, metallic and fiber-optic cable terminals and cross-connecting facilities shall be located either in or adjacent to the operations room.

5.5.9 Where signal conductors, non-dielectric fiber-optic cables, and electric light and power wires are run in the same shaft, they shall be separated by at least 2 in. (51 mm), or each system shall be encased in a noncombustible enclosure.

5.5.10 All wired dispatch circuit devices and instruments whose failure can adversely affect the operation of the system shall be mounted in accordance with the following:

- (1) On noncombustible bases, pedestals, switchboards, panels, or cabinets
- (2) With mounting designed and constructed so that all components are readily accessible

5.6 Circuit Protection.

5.6.1 Circuit protection required at the communications center shall be provided in all buildings that house communications center equipment.

5.6.1.1 All surge arresters shall be connected to the single-point facility ground in accordance with *NFPA 70*.

5.6.2 The protective devices shall be located in proximity to or shall be combined with the cable terminals.

5.6.3 All protective devices designed and approved for the purpose shall be installed at a location accessible only to qualified persons, marked with the name of the manufacturer and the model designation, and shall be accessible for maintenance and inspection.

5.6.4* Wired communications circuits shall have fast-acting surge suppression installed at the point of entrance to the communications center.

5.6.5 Surge arresters shall be designed and listed for the specific application.

5.6.6 Each conductor that enters a communications center from a partially or entirely aerial line shall be protected by a surge arrester.

5.6.7 At the junction points of open aerial conductors and cable, each conductor shall be protected by a surge arrester in accordance with 5.6.7.1 and 5.6.7.2.

5.6.7.1 The surge arrester shall be weatherproof or protected from the weather.

5.6.7.2 A connection shall be provided between the surge arrester ground and any metallic sheath and messenger wire.

5.6.8 Aerial open wire and non-messenger-supported, two-conductor cable circuits shall be protected by surge arresters at intervals of approximately 2000 ft (610 m).

5.6.9 Wired portions of a radio dispatch circuit shall be protected in a manner that is consistent with the provisions of Sections 5.1 through 5.8.

5.6.10 Buildings that house communications equipment shall have lightning protection that complies with *NFPA 780*.

5.7 Fuses.

5.7.1 All fuses, fuseholders, and adapters shall be clearly marked with their ampere rating.

5.7.2 All fuses that are rated over 2 amperes shall be of the enclosed type.

5.7.3 Fuses shall be located only at the power source.

5.8 Grounding.

5.8.1* Sensitive electronic equipment determined by the AHJ to be essential to the operation of telecommunications and dispatching systems shall be connected to the single-point facility ground in accordance with *NFPA 70*.

5.8.2 Listed isolated ground receptacles in accordance with *NFPA 70* shall be provided for all cord-and-plug-connected essential and sensitive electronic equipment.

5.8.3 Where required by the AHJ, unused wire or cable pairs shall be grounded.

5.8.4 Ground connection for surge suppressors shall be made to the single-point facility ground system in accordance with *NFPA 70*.

5.9 Access. All equipment shall be accessible for the purpose of maintenance.

Chapter 6 Emergency Response Facilities

6.1 General. A primary and a secondary means of dispatch notification shall be provided at the ERF and comply with 6.1.1 and 6.1.2.

6.1.1 The primary means of dispatch notification at the ERF shall be compatible with the primary means of dispatch notification that is provided at the communications center.

6.1.2 The secondary means of dispatch notification at the ERF shall be compatible with the secondary means of dispatch notification that is provided at the communications center.

6.1.3 Dispatch notification equipment shall be kept in working order at all times.

6.1.4 A publicly accessible means for reporting events to the communications center shall be provided on the exterior of the ERF.

6.2 Commercial Telephone.

6.2.1* A commercial telephone shall be provided at each emergency response facility.

6.2.2* When no other means of voice communication between the communications center and an ERF is provided, the telephone at the ERF shall be arranged so that it cannot be used by the public.

6.3 Fire Protection. Fire protection shall be provided as required by *NFPA 5000* or in accordance with the building code legally in force, whichever is more restrictive.

6.3.1 Sprinkler systems shall comply with *NFPA 13*.

6.3.2 Fire alarm systems shall comply with *NFPA 72*.