

NFPA 1221

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

2007 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
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NFPA 1221
Standard for the
Installation, Maintenance, and Use of Emergency Services
Communications Systems
2007 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 July 28, 2006, with an effective date of August 17, 2006, and supersedes all previous editions.

This edition of NFPA 1221 was approved as an American National Standard on August 17, 2006.

Origin and Development of NFPA 1221

This standard 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, and 1999.

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 the following: an emergence of joint communications centers, the increase in technology-based information systems that assist both users in the communications center and users in 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 is applicable to all emergency responders, not just the fire service, the title was changed to *Standard for the Installation, Maintenance, and Use of Emergency Services Communications 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 is incumbent on both users and enforcers of this standard to understand the impact of this standard, both in the area of service delivery and on the safety of those emergency response personnel delivering those 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 those services. This standard with its current revisions provides the requirements to accomplish that mission.

The 2007 edition of NFPA 1221 is 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 have been renumbered to accommodate those changes. The entire document was reviewed and editorially updated to clarify requirements and to clean up ambiguous language.

Technical Committee on Public Emergency Service Communication

Gary S. Santoro, *Chair*

Town of Wethersfield, Connecticut, CT [E]

Catherine L. Stashak, *Secretary*

Des Plaines, IL [E]

Rep. Illinois Fire Inspectors Association

Douglas M. Aiken, Lakes Region Mutual Fire Aid, NH [U]

Rep. International Municipal Signal Association

William Ambrefe, City of Beverly, MA [E]

Charles M. Berdan, Lawrence Livermore National Laboratory, CA [U]

Ken Burdette, Central Kitsap Fire and Rescue, WA [E]

Rep. International Association of Fire Chiefs

Christopher H. Lombard, Seattle Fire Department, WA [U]

Nathan D. McClure III, CTA Communications, VA [SE]

Lawrence M. Nyberg, Motorola, Incorporated, IL [M]

Evan E. Stauffer, Jr., U.S. Department of the Navy, PA [U]

Edward F. Straw, Insurance Services Office, Incorporated, GA [I]

Stephen Verbil, Verbil Communications, Incorporated, CT [U]

Rep. Association of Public-Safety Communications Officials-International, Incorporated

Alternates

Russell L. Shaw, Poquonnock Bridge Fire District, CT

[U]

(Alt. to D. M. Aiken)

Laurence J. Stewart, NFPA Staff Liaison

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.

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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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 E. 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 technical committee responsible for the source document.

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

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 alarms from the public
- (2) To provide requirements for the retransmission of such alarms 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, *National Fire Alarm Code*.

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 communications systems that include, but are not limited to, dispatching systems,

telephone systems, public reporting systems, and one-way and two-way radio systems that provide the following functions:

- (1) Communication between the public 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. 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 except where the authority having jurisdiction determines that nonconformity to this standard presents a safety hazard to emergency services dispatch or emergency services personnel.

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.

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

NFPA 10, *Standard for Portable Fire Extinguishers*, 2007 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2007 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2006 edition.

NFPA 54, *National Fuel Gas Code*, 2006 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2004 edition.

NFPA 70, *National Electrical Code*®, 2005 edition.

NFPA 72®, *National Fire Alarm Code*®, 2007 edition.

NFPA 75, *Standard for the Protection of Information Technology Equipment*, 2003 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2002 edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2006 edition.

NFPA 101®, *Life Safety Code*®, 2006 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2005 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2005 edition.

NFPA 220, *Standard on Types of Building Construction*, 2006 edition.

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, 2006 edition.

NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, 2003 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2004 edition.

NFPA 1061, *Standard for Professional Qualifications for Public Safety Telecommunicator*, 2002 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System*, 2005 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2003 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2006 edition.

2.3 Other Publications.

2.3.1 IEEE Publications. Institute of Electrical and Electronics Engineers, Three Park Avenue, 17th Floor, New York, NY 10016-5997.

IEEE C2, *National Electrical Safety Code*, 1997.

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

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

2.3.3 IMSA Publications. International Municipal Signal Association, P.O. Box 539, 165 East Union Street, Newark, NJ 14513-0539.

Official IMSA Wire and Cable Specifications Manual, 1998.

2.3.4 TIA/EIA Publications. Telecommunications Industry Association/Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201.

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

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

UL 752, *Standard for Safety Bullet-Resistant Equipment*, 1985 (rev. 1988).

2.3.6 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*®, 2005 edition.

NFPA 72®, *National Fire Alarm Code*®, 2007 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2005 edition.

NFPA 1000, *Standard for Fire Service Professional Qualifications Accreditation and Certification Systems*, 2006 edition.

NFPA 1021, *Standard for Fire Officer Professional Qualifications*, 2003 edition.

NFPA 1061, *Standard for Professional Qualifications for Public Safety Telecommunicator*, 2002 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. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

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

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 Alternate Communications Center. A structure used to house a part of the control equipment of an emergency reporting system or communications system; also, a normally unattended facility that is remote from the communications center and is used to house equipment necessary for the functioning of an emergency communications system.

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

3.3.5 Band. A range of frequencies between two definite limits.

3.3.6 Base Station. A stationary radio transceiver with an integral AC power supply.

3.3.7 Box Circuit. A circuit that is connected to boxes that transmit an alarm to the communications center.

3.3.8 Cable. A factory assembly of two or more conductors having an overall covering. [70, 2005]



3.3.9 CAD Terminal. An electronic device that combines a keyboard and a display screen to allow exchange of information between a telecommunicator and one or more computers in the system/network.

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

3.3.11 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, 2006]

3.3.12 Channel Access Time. The time lapse from activation of a radio transmitter's push-to-talk (PTT) switch to the receiving unit's speaker emitting audio.

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

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

3.3.15* 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.

3.3.16* 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.

3.3.17 Communications System. A combination of links or networks that serves a general function such as a system made up of command, tactical, logistical, and administrative networks.

3.3.18* 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.

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

3.3.20 Control Console. A wall-mounted or desk-top panel or cabinet containing controls to operate communications equipment.

3.3.21 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.

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

3.3.23 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.

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

3.3.25 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.

3.3.26* 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.

3.3.27 Dispatcher. See 3.3.70, Telecommunicator.

3.3.28* Dispatching. A process by which an alarm answered at the communications center is retransmitted to emergency response facilities (ERFs) or to emergency response units (ERUs) in the field.

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

3.3.30 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.

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

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

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

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

3.3.35 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.

3.3.36 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.

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

3.3.38 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.

3.3.39 Local Circuit. A circuit that does not depend on the receipt of alarms over box circuits or the retransmission of alarms over dispatch circuits.

3.3.40 Logging Voice Recorder. A device that records voice conversations and automatically logs the time and date of such conversations; normally, a multichannel device that keeps a semi-permanent record of operations.

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

3.3.42 Mobile Unit. A two-way radio-equipped vehicle or person; also a two-way radio by itself that is associated with a vehicle or person.

3.3.43 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.

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

3.3.45 Monitoring for Integrity. Automatic monitoring of circuits and other system components for the existence of defects or faults that interfere with receiving or transmitting an alarm.

3.3.46 Motor-Generator. A machine that consists of a generator driven by an electric motor.

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

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

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

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

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

3.3.52 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.

3.3.53 Public Alert Signal. A signal or message delivered to a person or device indicating the existence of a situation that affects public safety.

3.3.54 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.

3.3.55 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.

3.3.56 Public Safety Agency/Public Safety Organization. See 3.3.32, Emergency Response Agency (ERA).

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

3.3.58* Radio Channel. A band of frequencies of a width sufficient to allow its use for radio communications. [72, 2007]

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

3.3.60 Rectifier. A device without moving parts that changes alternating current to direct current.

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

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

3.3.63 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.

3.3.64 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.

3.3.65* 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.

3.3.66 Stored Emergency Power Supply System (SEPSS). A system consisting of a UPS, a central battery system, or a motor generator, powered by a stored electrical energy source, together with 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, 2005]

3.3.67 Supervisor. An individual responsible for overseeing the performance or activity of other members. [1021, 2003]

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

3.3.69 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.

3.3.70 Telecommunicator. An individual whose primary responsibility is to receive, process, or disseminate information of a public safety nature via telecommunication devices. [1061, 2002]

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

3.3.72 Transceiver. A combined transmitter and receiver radio unit.

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

3.3.74 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.

3.3.75 Uninterruptible Power Supply (UPS). A system designed to provide power, without delay or transients, during any period when the primary power source is incapable of performing.

3.3.76 Voice Communication Channel. A single path for communication by spoken word that is distinct from other parallel paths.



3.3.77 Wired Circuit. A metallic circuit leased to or owned by a jurisdiction, which 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 Communications equipment shall be kept in working order at all times.

4.1.3 The communications center shall be provided with an alternate means of communication that is compatible with the alternate means of communication provided at the emergency response facilities (ERFs).

4.1.3.1 The alternate means shall be readily available to the telecommunicator in the event of failure of the primary communications system.

4.1.4* Each jurisdiction shall maintain an alternate communications center that meets the criteria in 4.1.4.1 and 4.1.4.2.

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

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

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

4.1.4.3.1 The plan shall include the ability to reroute incoming alarm traffic to the alternate center and to process and dispatch alarms at that center.

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

4.1.5* 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.

4.1.6 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).

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

4.1.8 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, Building Construction and Safety Code*.

4.2.2* Where 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, Type II, or Type III construction as defined by NFPA 220, *Standard on Types of Building Construction*.

4.3.2 Buildings that house communications centers shall have Class A roof coverings as defined by NFPA 256, *Standard Methods of Fire Tests of 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, *Life Safety Code*, Section 8.2.

4.3.5* Communications centers located below grade shall comply with NFPA 101, Section 11.7, and be specifically designed for the location.

4.3.6 The exposed surfaces of walls, ceilings, and floors shall have a flame spread rating of 25 or less, and a smoke development rating of 50 or less, when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

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

4.3.8 The communications center shall be protected against seismic damage in accordance with *NFPA 5000*.

4.4 Utilities.

4.4.1 Heating, ventilating, and air-conditioning (HVAC) systems shall be provided in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*.

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

4.4.1.2 HVAC system intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building.

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

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

4.4.1.5* Alternate 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.

4.4.2 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, *Standard for Portable Fire Extinguishers*.

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, *Standard for the Installation of Sprinkler Systems*.

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, *Standard for the Protection of Information Technology Equipment*.

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 shall be restricted to authorized persons.

4.6.3 Entryways to the communications center that lead directly from the exterior shall be protected by a security vestibule.

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

4.6.4 Where a communications center has windows, the following requirements shall apply:

- (1) Windows shall be a minimum of 4 ft (1.2 m) above floor level.
- (2) Windows shall be rated for bullet resistance to Level 4 as defined in UL 752, *Standard for Safety Bullet-Resistant Equipment*.
- (3)*Windows that are not bullet resistant shall be permitted provided that they face an area that cannot be accessed or viewed by the general public.
- (4) Windows that are required to be bullet resistant shall be configured so that they cannot be opened.

4.6.5 Walls with bullet-resistant windows shall be required to provide the same level of protection as the window.

4.7 Power.

4.7.1 General.

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

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

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 designed for continuous operation, where a person specifically trained in its operation is on duty at all times
- (3) An approved engine-driven generator installation or equivalent arranged for cogeneration with commercial light and power, where a person specifically trained in its operation is on duty at all times

4.7.3 Secondary Power Source.

4.7.3.1 The secondary power source shall consist of one or more standby engine-driven generators installed in accordance with NFPA 70, *National Electrical Code*, Article 701.

4.7.3.2 Upon failure of primary power, transfer to the standby source shall be automatic.

4.7.4 Stored Emergency Power Supply System (SEPSS). A stored emergency power supply system (SEPSS) shall comply with the requirements of 4.7.4.1, 4.7.4.2, and 4.7.4.3.

4.7.4.1 The SEPSS shall be Type O or Type U, Level 1, in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, and shall be provided for telecommunications equipment, two-way radio systems, computer systems, and other electronic equipment determined by the AHJ to be essential to the operation of the communications center.

4.7.4.2 The SEPSS shall be of a class that is able to maintain essential operations long enough to implement the formal plan required by 4.1.4.

4.7.4.3 The instrumentation required by NFPA 111 shall be remotely annunciated in the operations room.

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 where 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, Article 280.

4.7.6.2 Transient voltage surge suppression (TVSS) shall be provided in accordance with NFPA 70, Article 285, 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 Isolated 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 connected to an isolated grounding system in accordance with NFPA 70, Article 647.

4.7.8 Engine-Driven Generators.

4.7.8.1 Engine-driven generators shall conform with provisions of NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and the provisions of 4.7.8.

4.7.8.2 Standby engine-driven generators shall conform with the provisions of NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.7.8.3 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.

4.7.8.4 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.

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

4.7.8.6 When installed outdoors, engine-driven generators shall be located in a secure enclosure capable of resisting the entrance of precipitation at the maximum wind velocities referenced in NFPA 5000.

4.7.8.7 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.

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

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

4.7.8.10 Natural gas installations shall comply with NFPA 54, *National Fuel Gas Code*.

4.7.8.11 Liquefied petroleum gas (LPG) installations shall comply with NFPA 58, *Liquefied Petroleum Gas Code*.

4.7.8.12 Fuel to operate the engine-driven generator for 24 hours at full load shall be available on site.

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

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

4.7.9 Uninterruptible Power Supply (UPS) and Battery Systems.

4.7.9.1* All uninterruptible power supply (UPS) and battery systems shall be installed in accordance with the requirements of NFPA 111 and the provisions of 4.7.9.

4.7.9.2 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.

4.7.9.3 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 shall illuminate automatically immediately upon 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, Article 700.

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, *Standard for the Installation of Lightning Protection Systems*.

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 Conductors shall be terminated so as to prevent breakage from vibration or strain.

5.2.2 Conductors shall be protected from mechanical damage.

5.2.3 Conductors on terminal racks shall be identified and isolated from conductors of other systems.

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 cable and wire shall conform to the *Official IMSA Wire and Cable Specifications Manual* or its equivalent, except where conductors are provided by a public utility on a lease basis.

5.3 Underground Cables.

5.3.1 Underground communication and signal cables shall be brought above ground only at points where the AHJ has determined there is no potential for mechanical damage or damage from fires in adjacent buildings.

5.3.2 Underground cables installed in ducts, vaults, and manholes shall comply with 5.3.2.1 through 5.3.2.3.

5.3.2.1 Communication and signal cables shall be permitted 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, communication and signal cables shall be located away from the other cables.

5.3.2.3 The communication and signal circuit cables shall be separated from power cables by a noncombustible barrier or by other means approved by the AHJ.

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

5.3.4 All conduits or ducts that enter buildings from underground duct systems shall be sealed to prevent moisture or gases 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 splices, taps, and terminal connections shall be made to provide and maintain levels of conductivity, insulation, and protection that are at least equivalent to those afforded by the cables that are joined.

5.3.7 Cable ends shall be sealed against moisture.

5.3.8 Direct-burial cable shall be permitted in accordance with NFPA 70.

5.4 Aerial Cables and Wires.

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 self-supported if it is of a mechanical strength equivalent to 10 AWG hard-drawn copper.

5.4.4.2 Span lengths shall not exceed the wire or cable 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 approved weather-heads or sleeves that slant upward and inward.

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

5.4.8 Leads down poles shall comply with 5.4.8.1 through 5.4.8.4.

5.4.8.1 Leads down poles shall be protected against mechanical damage.

5.4.8.2 Any metallic covering of the leads 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 Leads shall have 600-volt insulation that is approved for wet locations, as defined in NFPA 70.

5.5 Wiring Inside Buildings.

5.5.1 Conductors at the communications center shall extend to the operations room in conduits, ducts, shafts, raceways, or overhead racks and troughs of a construction type that protects against fire and mechanical damage.

5.5.2 All conductors located inside buildings shall be installed in accordance with NFPA 70 in one of the following:

- (1) Conduit
- (2) Electric metal tubing
- (3) Metal molding
- (4) Raceways

5.5.3 Wire and cable shall be listed for the environment in which they are installed.

5.5.4 The insulation or other outer covering for wire and cable shall be flame retardant and moisture resistant.

5.5.5 Conductors shall be installed without splices except where the length of run exceeds the length in which the wire or cable is manufactured.

5.5.6 Conductors that are bunched together in a vertical run that connects two or more floors shall have a flame-retardant covering to prevent the spread of fire from floor to floor.

