

NFPA 1221
Standard for
the Installation,
Maintenance, and Use
of Emergency Services
Communications Systems

1999 Edition



National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 1221

Standard for the

Installation, Maintenance, and Use of Emergency Services Communications Systems

1999 Edition

This edition of NFPA 1221, *Standard for Installation, Maintenance, and Use of Emergency Service Communications Systems*, was prepared by the Technical Committee on Public Emergency Service Communication and acted on by the National Fire Protection Association, Inc., at its May Meeting held May 17–20, 1999, in Baltimore, MD. It was issued by the Standards Council on July 22, 1999, with an effective date of August 13, 1999, and supersedes all previous editions.

This edition of NFPA 1221 was approved as an American National Standard on August 13, 1999.

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, and 1994.

The 1999 edition of this standard is a result of very hard work by committee members, and 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 communication centers, the increase in technology-based information systems that assist both those in the communication center and those users in the field of operations, and the role communications play in emergency scene operations within the Incident Command System. In order to reflect the fact that the standard is applicable to all emergency responders, not just the fire service, the title has been changed to *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*.

The development of a professional qualification standard for telecommunicators was added, which enhances the professionalism and emphasizes the importance of the position. In addition, the staffing of the communications centers was increased, especially during peak call times and during times of multiple emergency incidents. The link between the incident commander and the telecommunicator can be a vital safety issue for all emergency response personnel. Recent tragedies involving the response capabilities of multiple agencies highlighted the need for multi-channel, multi-frequency capabilities. The lack of interoperability of these systems was found to be a critical factor in emergency scene operations.

NFPA 297, *Guide on Principles and Practices for Communications Systems*, has been incorporated into this standard. The management and use of portable and mobile radio equipment, cellular telephone service, paging capabilities, and Enhanced 911 (E-911) were added as specific requirements within this standard.

The committee is confident that the work they have done will assist managers and users alike in providing communication capabilities for all emergency response services. The old requirements of a municipal fire alarm system are now incorporated into the revised NFPA 72, *National Fire Alarm Code*®, which has a new chapter that addresses the specificity of municipal fire alarm systems.

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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 communication systems.

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Standard for the

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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 Appendix A.

Information on referenced publications can be found in Chapter 10 and Appendix D.

Chapter 1 Fundamentals

1-1 Scope. This standard covers the installation, performance, operation, and maintenance of public emergency service communications systems and facilities. This standard is intended neither as a design specification nor as an instruction manual.

1-2 Purpose. The purpose of this standard is to specify operations, facilities, and communications systems facilities that receive alarms from the public and to provide requirements for the re-transmission of such alarms to the appropriate emergency response agencies. It is the intent of this standard to establish the required levels of performance and quality of installations. However, it is not the intent of this standard to establish the methods by which these requirements are to be achieved.

1-2.1 Communications systems shall include, but shall not be limited to, public reporting, dispatching, telephone, and one-way and two-way radio systems that fulfill the following functions:

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

1-2.2 Public fire alarm systems and fire alarm systems on private premises from which signals are received directly or indirectly by the communication center shall be in accordance with NFPA 72, *National Fire Alarm Code*[®].

1-2.3 If a system or device that has materials, methods of operation, or forms that differ from those detailed in this standard is examined and tested by the authority having jurisdiction in accordance with the intent of the requirements of this standard, and if found equivalent, the system or device shall be approved.

1-2.4 Emergency reporting systems that are not covered by this standard shall be in accordance with NFPA 72, *National Fire Alarm Code*.

1-3 General Requirements.

1-3.1 Management. The public emergency service communications system shall be under the control of a qualified individual, as designated by the authority having jurisdiction.

1-3.2 Operations. Radio, telephone, and other electronic equipment, operating procedures, and personnel training shall enable messages to be conveyed as quickly and reliably as the situation necessitates.

1-3.3 Design. The systems provided shall respond to normal peak loads in the same manner as when message loads are minimal. Equipment and personnel capacities shall be designed to handle peak loads rather than average loads.

1-4 Definitions. For the purposes of this standard, the terms in this section are defined as given.

Alarm. A signal or message from a person or device indicating the existence of a fire, medical emergency, or other situation that requires emergency services action.

Antenna. A device connected to a receiver, transmitter, or transceiver that is intended to radiate the transmitted signal and/or to receive a signal.

Approved.* Acceptable to the authority having jurisdiction.

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

Band. A range of frequencies between two definite limits.

Base Station. A stationary radio transceiver with an integral alternating current (AC) power supply.

Baud. A unit of signaling speed equal to the number of discrete conditions or signal events per second.

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

Cable. One or more insulated or non-insulated wires used to conduct electrical current or impulses. Grouped insulated wires are called a multi-conductor cable.

CAD (Computer-Aided Dispatching). A dispatching method or process in which a computer and its associated terminal(s) are used to provide relative dispatch data (e.g., response assignments, address locations, equipment status, utility locations, special hazards) to the concerned telecommunicator.

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.

Certification. A formal program of related instruction and testing as provided by a recognized organization or the authority having jurisdiction.

Channel, Data Communication. A single path for transmitting electric signals, distinct from other parallel paths.

Channel, Radio. See *Radio Channel*.

Channel, Talkgroup. See *Talkgroup*.

Channel, Voice Communication. A single path for transmitting electric signals, distinct from other parallel paths.

Channel Access Time. The time from radio PTT (push-to-talk) to the receiving unit's speaker emitting audio.

Circuit. The conductor, or radio channel, and associated equipment that are used to perform a definite function in connection with an alarm system. Specific types of circuits are dispatch, local, and tie.

Circuit, Dispatch. A circuit over which alarms are retransmitted automatically or manually from the communication center to emergency response facilities (ERFs) (formerly called alarm circuits).

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

Circuit, Tie. A circuit that connects a communication center with an alternate communication center or with a public safety answering point.

Coaxial Cable. A transmission line in which one conductor completely surrounds the other, the two being coaxial and separated by a continuous solid dielectric or by dielectric spacers. (Also called a coaxial line or concentric line.)

Common Battery. The battery used to power recorders, transmitters, relays, other communication center equipment, and subsidiary communication center equipment.

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

Communications Officer/Unit Leader. The communications unit leader is responsible for the development of plans to make the most effective use of incident assigned communications equipment and facilities, the installation and testing of all communications equipment supervision and operation of the incident communication center, distribution and recovery of equipment assigned to incident personnel, and the maintenance and on-site repair of communications equipment. This position is a function under the Logistics Section of the Incident Command System (ICS).

Communications System. A combination of links or networks that serve a general function (e.g., a system made up of command, tactical, logistical, and administrative networks).

Comprehensive Emergency Management Plan (CEMP). A disaster plan, which conforms to guidelines established by the authority having jurisdiction, designed to deal with natural, technological, and manmade disasters. In some jurisdictions a CEMP is also known as a disaster management plan.

Computer. A device containing the central processing unit(s), main storage, arithmetic unit, and special register groups.

Control Console. A system containing controls to operate communications equipment.

Converter. Any mechanical or electrical device that changes alternating current (AC) to direct current (DC) or changes direct current voltage to a higher or lower voltage, the latter commonly referred to as a direct current to direct current converter.

CRT. A general term that is used to abbreviate cathode ray tube but, as used in this standard, includes other display devices that provide comparable functional capabilities.

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

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

Dispatcher. See *Telecommunicator*.

Dispatching. A process by which an alarm is received at the communication center, is retransmitted to the ERFs or emergency response units in the field, and is acknowledged when received.

Emergency. Any condition endangering or thought to be endangering life or property; an event requiring the urgent response of a public safety agency.

Emergency Response Agency (ERA). An organization that provides law enforcement, rescue, fire suppression, emergency medical, disaster assistance, and related activities; includes any public, governmental, private, industrial, or military organization engaging in such activity.

Emergency Response Facility (ERF). A structure or a portion of a structure that houses emergency response agency equipment or personnel for response to alarms, such as a fire station, police station, ambulance station, rescue station, ranger station, and similar facilities.

Emergency Response Personnel (ERP). Personnel who respond to fire, emergency medical, and other emergency situations for the preservation of life and property.

Engine-Driven Generator. A generator driven by an internal combustion engine.

Enhanced 911. Emergency telephone service that provides selective routing, automatic number identification (ANI), and automatic location identification (ALI).

Frequency (Radio).* The number of cycles per hertz; usually refers to the assigned channel; specifically, the time taken by a signal to complete one cycle.

Generator. A device that develops either direct or alternating electrical voltage at any frequency.

High Band VHF. Radio frequencies from 132 MHz to 174 MHz.

Incident Management System. A nationally recognized system of roles, responsibilities, and standard operating procedures used to manage emergency operations. Such systems are often referred to as Incident Command Systems (ICS).

Instant Recall Recorder. A device that records voice conversations that is intended to provide a telecommunicator with a means to review such conversations in real time.

Inverter. Any mechanical or electrical device that changes direct current to alternating current.

Jurisdiction. Any government unit, such as a federal agency, state, county, city, town, or fire protection district.

Keying. Activating the transmitter. When the push-to-talk button is pressed, the transmitter is keyed.

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.

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.

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 semipermanent record of operations.

Low Band VHF. Radio frequencies from 30 MHz to 50 MHz.

Microwave. A term applied to radio waves in the frequency range of 1000 MHz and above.

Mobile Unit. A two-way radio-equipped vehicle or person. Also the two-way radio itself, when associated with a vehicle or person.

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

Monitor. To listen to radio messages without transmitting.

Monitoring for Integrity. The automatic monitoring of circuits and other system components to reveal defects or faults that interfere with receiving or transmitting an alarm.

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

Operations Room. The room in the communication center where alarms are received and retransmitted.

Pager. A compact radio receiver used for providing one-way communications.

Portable Radio. A battery-operated, hand-held transceiver.

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

Power Supply. A device that receives its input power from a power source and converts the input power to the alternating current or direct current voltage(s) required to operate systems.

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

Propagation (Electromagnetic). The travel of electromagnetic waves through a medium.

Public 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 communication center in accordance with NFPA 72, *National Fire Alarm Code*.

Public Reporting System, Type A. A system in which an alarm from a fire alarm box is received and is retransmitted to ERFs either manually or automatically.

Public Reporting System, Type B. A system in which an alarm from a fire alarm box is automatically transmitted to ERFs and, if used, to outside alerting devices.

Public Safety Agency/Public Safety Organization. See *Emergency Response Agency (ERA)*.

Public Safety Answering Point (PSAP). Any facility where 911 calls are answered, either directly or through re-routing.

Radio Channel.* A band of frequencies of a width sufficient to permit its use for radio communication.

Radio Circuit. A means for carrying out one radio communication at a time, either in both directions or between two points.

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

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

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

Shall. Indicates a mandatory requirement.

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

Simplex Radio Channel. A singular frequency that only allows transmission or reception at any given time.

Solar Cell. A device that converts light or other radiant energy into electrical energy.

Standard Operating Procedures (SOP). Written organizational directives that establish or prescribe specific operational or administrative methods to be followed routinely for the performance of designated operations or actions; in some jurisdictions, also known as standard operating guidelines.

Stored Emergency Power Supply System (SEPPS). A system consisting of an uninterruptible power system (UPS), a central battery system, or a motor generator, powered by a stored electrical energy source, together with a transfer switch designed to monitor the preferred and alternate power source(s) and provide desired switching of the load, and all necessary control equipment to make the system functional.

Subsidiary Communication Center or Subsidiary. The structure used to house a part of the control equipment of an emergency reporting or communication system. A normally unattended facility that is remote from the communication center and used to house equipment necessary for the functioning of an emergency communication system.

Supervisor. A person or persons certified to manage all operational aspects of a communication center.

Talkgroup. A group of mobile radio units that are addressed as a single entity by the system; functionally equivalent to a conventional repeater channel.

Telecommunicator. An individual whose primary responsibility is to receive, process, or disseminate information of a public safety nature via telecommunication devices and who is certified to receive or retransmit alarms.

Terminal. As used in this standard in relation to CAD systems/networks, an electronic device that combines a keyboard and CRT, which allows an interchange of information between a telecommunicator and one or more computers in the system/network.

Transceiver. Combined transmitter and receiver unit.

Transfer (911 call). The rerouting of a 911 call from one PSAP to another.

Trouble Signal. A signal that indicates an abnormal condition or a fault in a monitored circuit or component.

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

Trunk Line. A telephone line or channel between telephone central offices or switching devices, including lines between communication centers.

UHF (Ultra High Frequency). Radio frequencies from 300 MHz to 3000 MHz.

UPS (Uninterruptible Power System). See *Power Supply, Uninterruptible*.

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

VHF (Very High Frequency). Radio frequencies from 30 MHz to 300 MHz.

Wired Circuit. Metallic circuit, provided to or by a jurisdiction, that is dedicated to a specific alarm system under the control of the jurisdiction and/or operated by the jurisdiction or jointly with another jurisdiction.

Chapter 2 Communication Centers

2-1 General.

2-1.1* Communication centers shall provide the following services:

- (1) Communications between the public and the communication center
- (2) Communications between the communication centers, the emergency response agency (ERA), and the emergency response facility (ERF)
- (3) Communications within the ERA and between different ERA

2-1.2* Communications equipment shall be kept in working order at all times. In the event of the loss of function of communications equipment, an alternate means of communication shall be readily available.

2-1.3* The alternate means of communication identified at the communication center shall be compatible with the alternate means of communication provided by the ERF.

2-2 Location.

2-2.1 If the building that houses a communication center is located within 150 ft (46 m) of another structure, special attention shall be given to guarding against damage from exposure by such a building by protecting openings and by constructing the roof to resist damage that can be caused by falling walls.

2-2.2 A communication center shall not be located below grade. The lowest floor elevation shall be above the 100-year flood plain.

Exception: Communication centers shall be permitted to be located below grade where specifically designed for such a location.

2-2.3* Each jurisdiction shall maintain an alternate communications facility that is capable, when staffed, of performing the

emergency functions provided at the communication center. The facility shall be separated geographically from the primary communication center at a distance that ensures the viability of the alternate facility concept.

2-2.4* Each jurisdiction shall develop a formal plan to maintain and operate the alternative communications facility. The plan shall include the ability to reroute incoming alarm traffic and to process, dispatch, and control emergency alarms. The plan shall be included in the comprehensive emergency management plan (CEMP).

2-3 Construction.

2-3.1 Buildings that house communication centers shall be of Type I, Type II, or Type III construction as defined by NFPA 220, *Standard on Types of Building Construction*. The building shall have a Class A roof as defined by NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*.

2-3.2 Where the building is also occupied for purposes other than emergency communication, the communication center shall be separated from the other portions of the building by vertical separations that have a fire resistance rating of at least 2 hours in accordance with NFPA 221, *Standard for Fire Walls and Fire Barrier Walls*, and by horizontal fire barriers that have a fire resistance rating of at least 2 hours as defined by NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. Openings in fire barriers with a fire resistance rating shall be protected by listed, self-closing fire doors or other assemblies that have a fire resistance rating of not less than 1½ hours to 2 hours.

Openings in fire barriers with a fire resistance rating of greater than 2 hours shall be protected by listed, self-closing fire doors or other assemblies that have a fire resistance rating of not less than 3 hours.

2-3.3 Communication center interior finish material, as defined by NFPA 101®, *Life Safety Code*®, 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*.

2-3.4 The communication center shall be equipped with both a toilet and lunch area that is directly accessible to the operations room within the secured area as required by 2-6.1.

2-3.5 The communication centers shall be protected against seismic damage in accordance with applicable building codes that are required by the authority having jurisdiction.

2-4 Utilities.

2-4.1 Heating, ventilating, and air conditioning (HVAC) systems shall be independent systems that serve only the communication center. Intakes for fresh air shall be arranged to minimize smoke intake from a fire inside or outside the building.

2-4.1.1 The air supply shall be 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*.

2-4.1.2* Alternate HVAC shall be provided for the communication center for use during routine maintenance of the primary system or in the event of a primary system failure. Backup HVAC systems shall provide sufficient conditioning of air to

allow efficient functioning of telecommunicators and equipment in the communication center.

2-4.2 No main utility services shall pass through those portions of the communication center where equipment essential to receiving and retransmitting dispatching is installed.

2-5 Fire Protection.

2-5.1 The communication center shall be provided with fire extinguishers that meet the requirements of NFPA 10, *Standard for Portable Fire Extinguishers*.

2-5.2 The communication center, and spaces adjoining the communication center, shall be provided with an automatic fire detection, alarm, and notification system in accordance with NFPA 72, *National Fire Alarm Code*. Operation of notification appliances shall not interfere with communications operations. The alarm system shall be monitored in the operations room.

2-5.3 The building that houses the communication center and the communication center itself shall be protected throughout with an approved, automatic fire sprinkler system that complies with NFPA 13, *Standard for the Installation of Sprinkler Systems*. The sprinkler system shall be supervised in accordance with NFPA 72, *National Fire Alarm Code*, and monitored in the operations room.

2-5.4 Where applicable, electronic computer/data processing equipment shall be protected in accordance with NFPA 75, *Standard for the Protection of Electronic Computer/Data Processing Equipment*.

2-5.5* In the event of a fire in the communication center, or in the building that houses the communication center, the communication center shall be capable of continuous operation long enough to enable the transfer of operations to an alternate communication center that is capable of continuous operation.

2-6 Security.

2-6.1 The communication center and other buildings that house essential operating equipment shall be protected against damage due to vandalism, terrorism, and civil disturbances.

2-6.2 Entry shall be restricted to authorized persons. Entryways that lead directly from the exterior shall be protected by a security vestibule.

2-6.3 Door openings shall be protected by a 1-hour, listed, self-closing fire door assembly.

2-6.4* Where a communication center has windows, the following requirements shall apply.

- (1) Windows shall be a minimum of 4 ft above floor level.
- (2) Windows shall be rated for bullet resistance to medium-power small arms, high-power small arms, super-power small arms, and high-power rifles as specified in ANSI 752, *Standard for Safety Bullet-Resisting Equipment*.

Exception: Windows that are not bullet resistant shall be permitted, provided that they are located facing an area that cannot be accessed or viewed by the general public.

- (3) Windows shall be arranged so that they cannot be opened.

2-7 Power.

2-7.1 Under all conditions, two sources of power shall be provided for the operation of the communications network and its related support systems and equipment.

The permitted sources shall be as follows:

- (1) One circuit from a utility distribution system and a second from an engine-driven generator
- (2) Two engine-driven generators with one unit that supplies normal power and another unit serving as standby

2-7.1.1 Automatic transfer upon power failure shall be provided.

2-7.1.2 In addition, a stored emergency power supply system (SEPSS), Type O or Type U, Level 1 in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, shall be provided and shall be of a class that is able to maintain essential operations long enough to implement the formal plan required by 2-2.4.

2-7.2 Power and lighting circuits, together with their associated motors, generators, rectifiers, transformers, fuses, and controlling devices, shall be installed in accordance with NFPA 70, *National Electrical Code*®.

2-7.3 The conductors of the power supply circuit shall be connected to the line side of the main service of a commercial light supply circuit or power supply circuit or to the main conductors of an isolated power plant that is located on the premises. The circuit disconnecting means shall be installed so that it is accessible only to authorized personnel.

Exception: Power shall be permitted to be obtained from the load side of the main disconnect switch only where buildings are used exclusively for the housing of alarm and other emergency facilities.

2-7.4 Circuit protection shall be enclosed in a locked or sealed cabinet that is located immediately adjacent to the point of connection to the light and power conductors and shall be provided in series with each ungrounded conductor.

2-7.5 Power supply circuit conductors shall be installed in independent conduit that is not used for any other circuit conductors. The conduit shall run from the disconnect switches to the current-consuming devices. The conductors of this section shall not be routed over any heat-producing equipment, including a distribution transformer or an engine-driven generator set.

2-7.6 Engine-Driven Generator.

2-7.6.1 The engine-driven generator shall conform to the provisions of NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and NFPA 110, *Standard for Emergency and Standby Power Systems*.

Exception: This requirement shall not apply where otherwise modified by this section.

2-7.6.2 The engine-driven generator shall be located in an adequately ventilated and secured area that is remote from the communication center and its equipment. The area that houses the unit shall be used only for the storage of spare parts or equipment that is related to the generator system.

2-7.6.3 Liquid fuel shall be stored in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, and gravity feed shall not be used.

2-7.6.4 Liquefied petroleum gas and natural gas installations shall meet the requirements of NFPA 54, *National Fuel Gas Code*, and NFPA 58, *Liquefied Petroleum Gas Code*.

2-7.6.5* The engine-driven generator shall be of such capacity, as determined by the authority having jurisdiction, that it is able to supply power for the operation of all functions of the communication center. Fuel shall be available on site for 24 hours of operation at full load.

2-7.6.6 Equipment essential to the operation of the generator, such as fuel transfer pumps and other on-site equipment that is required to comply with the requirements of this section, shall be supplied with standby power from the generator.

2-7.6.7 The generator shall not use the public water supply for engine cooling.

2-7.7 Uninterruptible Power Supplies (UPS) and Battery Systems. Each uninterruptible power supply (UPS) shall be provided with a bypass switch, which shall maintain the power connection during switchover, that is capable of isolating all UPS components while allowing power to flow from the source to the load.

2-7.7.1 The following UPS conditions shall be annunciated in the operations room:

- (1) Source power failure, over or under voltage
- (2) High/low battery voltage
- (3) UPS in bypass mode

2-7.7.2 Storage batteries shall be located in the same building as the operating equipment, preferably on the same floor, and shall be readily accessible for maintenance and inspection. The battery space shall be ventilated to prevent the accumulation of explosive gas mixtures.

2-7.7.2.1 Batteries shall be mounted to provide insulation from ground and from other batteries. The battery mounting shall be protected against corrosion.

2-7.7.2.2 Battery leads of both polarities shall be fused at the battery and shall not be located in the same conduit, tubing, or cable between the battery terminals and fuses.

2-7.7.3 All UPS and battery systems shall be installed in accordance with the requirements of NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

2-8 Lighting.

2-8.1 Lighting shall be provided to enable authorized personnel to operate communication equipment that is used for the receipt or transmission of alarms.

2-8.2 Emergency Lighting.

2-8.2.1* The communication center shall be equipped with emergency lighting that shall be immediately placed in service upon a power failure and shall be independent of the power source that is normally used for lighting purposes. Illumination shall be sufficient to allow all essential operations.

2-8.2.2 In addition to the requirement of 2-8.2.1, the operations room shall be equipped with not less than one self-charging, battery-operated emergency lighting unit that lights automatically upon power loss.

2-8.2.3 In addition to the requirements of 2-8.2.1 and 2-8.2.2, a self-charging, battery-operated emergency lighting unit shall be provided at the location of the communication equipment.

2-9 Communications Wiring — Circuit Construction and Arrangement.

2-9.1 IEEE C2, *National Electrical Safety Code*, shall be used for the installation of outdoor circuitry.

2-9.2 All installations shall be protected against damage due to mechanical injury, fire, falling walls, floods, corrosive vapors, and other risks that are identified in the CEMP.

2-9.3 Open local circuits within a single building shall be permitted for the operation of alerting devices and alarm equipment that are provided in addition to those required by this standard.

2-9.4 All circuits shall be routed to allow circuits to be traced.

2-9.5 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 municipality or the agency that is responsible for maintaining the system.

2-9.6 Alarm instruments installed in private buildings shall be on separate dedicated circuits.

2-9.7 Where circuit wires are installed in the same cable with other signal wires, the emergency circuits shall be clearly identified as such at all points that can be exposed to maintenance personnel.

2-9.8 Wiring for control equipment shall be not smaller than No. 24 AWG. Unsupported wires and wires that are subject to vibration shall be not smaller than No. 18 AWG. The outer covering over the insulation of such wires, and the insulation itself, shall be flame retardant and moisture resistant.

2-10 Circuit Conductors.

2-10.1 Wires shall be terminated to prevent breakage from vibration or stress.

2-10.2 Circuit conductors on terminal racks shall be identified and isolated from conductors of other systems and shall be protected from mechanical damage.

2-10.3 Exterior cable and wire shall conform to International Municipal Signal Association (IMSA) specifications or their equivalent.

Exception: Where circuit conductors are provided by a public utility on a lease basis, IMSA specifications shall not apply.

2-11 Cables and Wires.

2-11.1 Cables that are installed overhead, underground, or by direct burial shall be in accordance with NFPA 70, *National Electrical Code*.

2-11.2 Paper or pressed pulp insulation shall not be permitted for an emergency dispatching system. Loss of pressure in cables shall be indicated by a visual or audible warning system that is situated in a constantly attended location. The individual in attendance shall be able to interpret the pressure readings and shall be given the power to authorize the correction of an abnormal condition.

Exception: Cables that contain conductors using paper or pressed pulp insulation shall be permitted where pressurized with dry air or nitrogen.

2-11.3 Natural rubber-sheathed cable shall not be used where it can be exposed to oil, grease, or other substances or conditions that deteriorate the cable sheath. Braided-sheathed

cable shall be used inside buildings only where it is run in conduit or metal raceways.

2-11.4 Other municipally controlled signal wires shall be permitted to be installed in the same cable with circuit wires. Cables that are controlled by, or that contain wiring for, private signaling organizations shall be permitted only with the approval of the authority having jurisdiction.

2-11.5 Signaling wires shall be protected and installed in accordance with NFPA 70, *National Electrical Code*.

2-12 Underground Cables. Underground cables in duct or direct burial cable shall be brought above ground only at points where the potential for mechanical damage or damage from fires in adjacent buildings is minimal.

2-12.1 Cables shall be located in duct systems and manholes that contain only low-tension signaling system conductors, secondary power cables, or both. Where cables are located in duct systems or manholes that contain power circuit conductors in excess of 250 volts to ground, circuit cables shall be located as far as possible from power cables and shall be separated from them by a noncombustible barrier or by other means that are designed to protect the circuit cables from damage.

2-12.2 Underground cables shall be installed in accordance with NFPA 70, *National Electrical Code*.

2-12.3 All cables that are installed in manholes shall be racked and marked for identification.

2-12.4 All conduits or ducts that enter buildings from underground duct systems shall be sealed to prevent moisture or gases from entering the building.

2-12.5 Cable joints shall be located only in locations where accessibility is provided and where there is a low probability of damage to the cable due to falling walls or building operations. Cable joints 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. Cable ends shall be sealed against moisture.

2-12.6 Direct-burial cable shall be installed in accordance with NFPA 70, *National Electrical Code*. If splices are made, such splices shall be accessible for inspection and tests.

2-13 Aerial Cables and Wires. Circuit cables and wires shall be run under all other wires. Precautions 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. Wires and cables shall not be attached to a crossarm that carries electric light and power wires.

Exception: Cables and wires shall not be required to run under communication wires.

2-13.1 Aerial cable shall be supported by messenger wire that is designed for the application.

2-13.2 Self-supported aerial cable and single-wire cable shall be permitted if of a mechanical strength equivalent to No. 10 AWG hard-drawn copper.

2-13.3 Span lengths shall not exceed the manufacturer's recommendations.

2-13.4 Aerial wires and cables connected to buildings shall contact only intended supports and shall enter through an

approved weatherhead or suitable sleeves that slant upward and inward. Drip loops shall be formed on wires and cables outside of buildings.

2-14 Leads Down Poles.

2-14.1 Leads down poles shall be protected against mechanical damage. Any metallic covering shall form a continuous conducting path to ground. In all cases, installation shall prevent water from entering the conduit.

2-14.2 Leads shall have 600-volt insulation that is approved for wet locations, as defined in NFPA 70, *National Electrical Code*.

2-15 Wiring Inside Buildings.

2-15.1 Conductors at the communication center shall extend as directly as possible 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.

2-15.2 All conductors that are inside buildings shall be in conduit, electric metal tubing, metal molding, or raceways. Installation shall be in accordance with NFPA 70, *National Electrical Code*.

2-15.3 Conductor insulation shall be approved. The insulation or other outer covering shall be flame retardant and moisture resistant.

2-15.4 Conductors shall be installed without joints to the extent possible. Splices shall be permitted only in junction or terminal boxes. Wire terminals, splices, and joints shall conform with NFPA 70, *National Electrical Code*.

2-15.5 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. This requirement shall not apply if the conductors are in metallic conduit or are located in a fire-resistive shaft with fire stops at each floor.

2-15.6 Where cables or wiring are exposed to fire hazards, they shall be protected.

2-15.7 Cable terminals and cross-connecting facilities shall be located either in or adjacent to the operations room.

2-15.8 Where signal conductors and electric light and power conductors are run in the same shaft, the light and power conductors shall be in conduit.

2-15.9 All wired dispatch devices and instruments whose failure can adversely affect the operation of the system shall be mounted on noncombustible bases, pedestals, switchboards, panels, or cabinets. All mounting shall be designed and constructed so that all components are readily accessible.

2-16 Circuit Protection.

2-16.1 General.

2-16.1.1 All surge arresters shall be connected to a ground in accordance with NFPA 70, *National Electrical Code*.

2-16.1.2 Fuses and surge suppressors shall be located close to, or shall be combined with, the cable terminals.

2-16.1.3 All protective devices shall be accessible for maintenance and inspection.

2-16.1.4 Wired communications circuits shall have fast surge suppression installed at the point of entrance to the communication center.

2-16.1.5* All public emergency service communication reporting systems conductors that enter the communication center shall be protected by the following devices, in the order named, beginning with the exterior circuit:

- (1) Fuse rated at 3 A minimum to 7 A maximum and at not less than 2000 V
- (2) Surge arrester
- (3) Fuse or circuit breaker, rated at $\frac{1}{2}$ A (omitted at subsidiary communication centers)

2-16.2 Lightning.

2-16.2.1 Buildings that house communication centers shall have surge protection that complies with NFPA 780, *Standard for the Installation of Lightning Protection Systems*.

2-16.2.2 Surge arresters that are designed for the applicable purpose shall be provided. Surge arresters shall be marked with the name of the manufacturer and the model designation.

2-16.2.3 Each conductor that enters a communication center from partially or entirely aerial lines shall be protected by a surge arrester.

2-16.2.4 At the junction points of open aerial conductors and cable, each conductor shall be protected by a surge arrester that is weatherproof or that is protected from the weather. There shall be a connection between the surge arrester ground and any metallic sheath and messenger wire.

2-16.2.5 Aerial open wire and nonmessenger-supported, two-conductor cable circuits shall be protected by surge arresters at intervals of approximately 2000 ft (610 m).

2-16.3 Fuses.

2-16.3.1 All fuses shall be plainly marked with their rated ampere capacity. All fuses that are rated over 2 A shall be of the enclosed type.

2-16.3.2 Fuses shall be located only at the power source.

2-16.3.3 Wired portions of a radio dispatch circuit shall be protected in a manner that is consistent with the provisions of this section.

2-16.4 Grounding.

2-16.4.1 Power supply systems that provide power to critical equipment that is necessary for the receipt and retransmission of alarms shall be wired using the single-point method of grounding. All equipment that is connected to such systems shall not connect to ground by means other than through the single-point ground provided by the system. Listed isolated ground outlets shall be provided for all equipment.

2-16.4.2 Unused pairs shall be grounded where permitted by the authority having jurisdiction.

2-16.4.3 Electric ground for connection to surge suppressors shall be made to a single-point grounding system established for the communication center.

Chapter 3 Emergency Response Facilities

3-1 General.

3-1.1 Communication equipment shall be kept in working order at all times. A primary and a secondary means of communication shall be provided at the ERF.

3-1.2 The primary means of communication at the ERF shall be compatible with the primary means of communication that is provided at the communication center.

3-1.3 The secondary means of communication at the ERF shall be compatible with the secondary means of communication that is provided at the communication center.

3-1.4 Commercial Telephone Circuits.

3-1.4.1 In addition to the required dispatch circuits and receiving equipment, commercial telephone facilities shall be provided and shall meet the requirements of this section.

3-1.4.2 There shall be a telephone at each emergency response facility.

3-2 Location. (Reserved)

3-3 Construction. Communications equipment that is used for the receipt or transmission of alarms shall be separated from other portions of the building by vertical and horizontal separations that have a fire resistance of 1 hour in accordance with NFPA 221, *Standard for Fire Walls and Fire Barrier Walls*, and by horizontal fire barriers with a fire resistance of 1 hour in accordance with NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*. Openings therein shall be protected by listed, self-closing fire doors or other assemblies with a fire resistance rating of 45 minutes.

3-4 Utilities. No main utility services shall pass through those portions of an emergency response facility that houses communications equipment used for the receipt or transmission of alarms.

3-5 Fire Protection. Fire protection shall be provided as required by the building code adopted by the authority having jurisdiction.

3-5.1 Sprinkler systems shall comply with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

3-5.2 Fire alarm systems shall comply with NFPA 72, *National Fire Alarm Code*.

3-6 Security. Communications equipment that is used for the receipt or transmission of alarms shall be installed and maintained so that unauthorized access is prevented.

3-7 Power. Communications equipment that is used for the receipt or transmission of alarms shall be provided with two sources of power.

3-8 Lighting. Lighting shall be provided to enable authorized personnel to operate communications equipment that is used for the receipt or transmission of alarms. In addition, a self-charging, battery-operated emergency lighting unit shall be provided at the location of the communications equipment.

3-9 Communications Wiring. Conductors in an ERF shall extend as directly as possible to alarm equipment in conduits, ducts, shafts, raceways or overhead racks, and troughs of a type of construction that provides protection against fire and mechanical damage.

3-10 Circuit Protection. Circuit protection shall be in accordance with Section 2-16.

3-11 Lightning Protection. Lightning protection shall be in accordance with Section 2-16.

3-12 Dispatching Systems. Each ERF shall have two independent systems for receiving notification from the communication center that shall meet the requirements of Chapter 6.

3-13 Commercial Telephones — ERFs.

3-13.1 In addition to the required dispatch circuits and receiving equipment, commercial telephone facilities shall be provided and shall meet the requirements of this section.

3-13.2 A telephone shall be provided at each ERF.

3-13.3* Where no other means of voice communications with ERFs is provided, telephones at ERFs shall be arranged so that they cannot be used by the public.

Exception: This requirement shall not apply under the following conditions:

- (a) *Where telephones operate through a common switching point in the communication center*
- (b) *Where a community has only one fire station*

Chapter 4 Operations

4-1 Management.

4-1.1 All systems shall be under the control of a responsible jurisdictional employee. Where maintenance is provided by an organization or person other than the municipality or its employees, complete written records of the installation, maintenance, test, and extension of the system shall be forwarded to the responsible employee.

4-1.2 Maintenance performed by an organization or person other than the jurisdiction or a jurisdiction employee shall be by written contract and shall guarantee performance as approved by the authority having jurisdiction.

4-1.3 All equipment shall be accessible to the authority having jurisdiction for the purpose of maintenance.

4-1.4 At least one supervisor shall be on duty in the communication center when three or more telecommunicators are on duty.

4-2 Qualifications and Training.

4-2.1 Telecommunicators shall meet the qualification requirements of NFPA 1061, *Standard for Professional Qualifications for Public Safety Telecommunicator*.

4-2.2 Telecommunicators shall be familiar with general emergency service operations and shall have access to information regarding the following:

- (1) Locations of streets
- (2) Locations of important structures, including schools, hospitals, and other buildings with a high life hazard
- (3) Locations of congested or hazardous areas

4-2.3 Telecommunicators shall have a working knowledge of all communication equipment and systems. They shall be familiar with rules and regulations that relate to equipment

use, including those of the Federal Communications Commission that pertain to emergency service radio use.

4-2.4* The authority having jurisdiction shall require telecommunicators to be certified.

4-2.5 The telecommunicators assigned at the communication center shall be capable of operating and testing the communication systems.

Exception: Telecommunicators shall not be required to operate and test the system where other qualified persons on duty are assigned these tasks.

4-3 Staffing.

4-3.1 The authority having jurisdiction shall ensure that the number of telecommunicators needed to effect the prompt receipt and processing of alarms shall be as follows:

- (1) In jurisdictions receiving 730 or more alarms per year, at least one telecommunicator shall be on duty in the communication center.
- (2) Ninety-five percent of alarms shall be answered within 30 seconds, and in no case shall the initial call taker's response to an alarm exceed 60 seconds.
- (3) The dispatch of the emergency response agency shall be made within 60 seconds of the completed receipt of an emergency alarm.
- (4) Communication centers that provide emergency medical dispatching (EMD) protocols shall have two telecommunicators on duty at all times.

4-3.2 For jurisdictions that receive fewer than 730 alarms per year, alarms that are not retransmitted automatically shall be received and transmitted to the emergency services by a designated person who is on duty for that purpose. In all cases, the performance requirements of 4-3.1 shall apply.

4-4 Operating Procedures.

4-4.1 Alarms that are received shall be recorded and tabulated to indicate the origin of the call.

4-4.2 In cases where the communication center is not the primary answering agency, or public safety answering point (PSAP), for alarms, the answering agency, shall transfer the call directly to the telecommunicator and shall remain on the line until it is certain that the transfer is effected. The transfer procedure shall be used instead of relaying the information to the call taker.

4-4.3 All alarms, including requests for additional resources, shall be transmitted to the proper emergency units over the required dispatch circuit or circuits.

4-4.4 An accurate indication of the status of all emergency response units shall be readily available to telecommunicators at all times.

4-4.5 Dispatch of emergency units in response to alarms shall be recorded. Records shall identify the following:

- (1) Units
- (2) Companies and supervisors for emergencies and subsequent emergencies
- (3) Supervisory officers for alarms and subsequent alarms
- (4) Time of acknowledgment by each unit
- (5) Time of arrival of each unit at the scene
- (6) Time back in service of each unit

4-4.6 Where voice transmission is used as a dispatch method, the announcement for the emergency response shall be preceded by an audible warning or alerting signal [typically a distinctive tone(s)] that differentiates the emergency from routine radio traffic.

4-4.7* The first emergency unit that arrives at the location of the alarm shall provide a brief preliminary report on observed conditions to the communication center.

4-4.7.1* A communications officer shall be assigned at major incidents.

4-4.7.2* All emergency response agencies shall use common terminology and integrated incident communications.

4-4.8 The communications equipment involved in each alarm shall be restored promptly after each alarm.

4-4.9 When the monitoring for integrity device indicates that trouble has occurred anywhere on the system, the telecommunicator shall take appropriate steps to repair the fault or, if repair is not possible, action shall be taken to isolate the fault and notify the official responsible for maintenance.

4-4.10 Standard operating procedures/guidelines (SOP/SOGs) in accordance with NFPA 1201, *Standard for Developing Fire Protection Services for the Public*, and NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, shall be provided for review by the telecommunicator and shall include the following:

- (1) All standardized procedures that the telecommunicator is expected to perform without direct supervision
- (2) Implementation plan that meets the requirements of 2-2.4
- (3) Procedures related to the CEMP
- (4) Emergency response personnel emergencies
- (5) Activation of an emergency distress function
- (6) Assignment of incident radio communications plan matrix
- (7) Time limit for acknowledgment by units that have been dispatched

4-4.11 In the event that unit(s) have not acknowledged dispatch within the time limit and procedures established, the telecommunicator shall perform one or more of the following:

- (1) Redispatch unit(s) in accordance with 4-4.10
- (2) Activate the secondary dispatch system
- (3) Initiate two-way communication with the service's supervisor

4-5 Time.

4-5.1* The clock for the main record-keeping device in the communication center shall be synchronized weekly to coordinated universal time (UTC).

4-5.2 All time-keeping devices in the communication center shall be maintained within ± 5 seconds of the main record-keeping device clock.

4-6 Recording.

4-6.1 Communication centers shall have a logging voice recorder, with one channel for each of the following:

- (1) Each transmitted or received radio channel or talk group
- (2) Each dispatch alarm circuit
- (3) *Each telecommunicator telephone

4-6.2 An instant recall recorder shall be provided for each telecommunicator position in the communication center.

4-6.3 Alarms that are transmitted over the required dispatch circuit(s), including the dates and times of transmission, shall be automatically recorded.

Exception: Where telegraphic retransmission is used, manual entry of dates and times by the telecommunicator shall be permitted.

Chapter 5 Telephones

5-1 Telephone Receiving Equipment.

5-1.1 The provisions of this section shall apply to facilities and equipment that are needed to receive alarms that are transmitted by public use of commercial telephone systems.

5-1.2 The provisions of this section shall apply regardless of the provision of other reporting systems.

5-2 Directory Listing.

5-2.1 Where 911 service is not provided, a specific telephone number shall be assigned for emergency services and shall be publicized as such, with a separate number assigned for business (nonemergency) use.

5-2.2 Where 911 service is provided, the telephone directory listings shall indicate that 911 is the number to call for all emergencies. A seven-digit number shall be maintained for communication with other emergency service agencies and receipt of central station alarms. Such a number shall not be released to the public. In addition, a separate number shall be assigned for business use.

5-2.3 Telephone directory listings shall be as specified in 5-2.3.1.

5-2.3.1 The text and symbols shown in Figures 5-2.3.1(a), 5-2.3.1(b), and 5-2.3.1(c) shall appear on the inside front cover or the page facing the front cover of the white pages of the telephone directory.

Figure 5-2.3.1(a) Telephone directory listing for the fire department.

(a) FIRE



or, where available,

FIRE



Figure 5-2.3.1(b) Telephone directory listing for the police department.

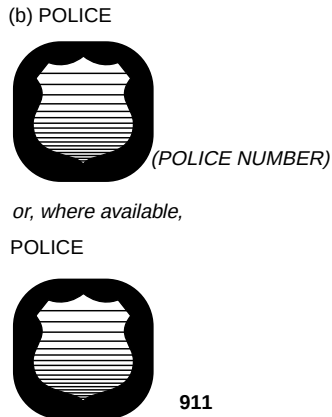


Figure 5-2.3.1(c) Telephone directory listing for emergency medical services.



5-2.3.2 The following listing and numbers shall appear in the white pages of the telephone directory:

- (1) Within directory — FIRE DEPARTMENT
 - a. To report an emergency (*FIRE NUMBER*) *or, where available, 911*
 - b. Nonemergency purposes (*BUSINESS NUMBER*)
- (2) Within directory — POLICE DEPARTMENT
 - a. To report an emergency (*POLICE NUMBER*) *or, where available, 911*
 - b. Nonemergency purposes (*BUSINESS NUMBER*)
- (3) Within directory — EMERGENCY MEDICAL SERVICES
 - a. To report an emergency (*EMERGENCY MEDICAL NUMBER*) *or, where available, 911*
 - b. Nonemergency purposes (*BUSINESS NUMBER*)

5-2.3.3 The emergency services listing shall appear in the directory under the name of the jurisdiction, including in the government listings where provided, and under the headings Police, Fire, and Ambulance.

5-2.3.4 If the directory covers an area that is protected by more than one emergency service, each agency or district shall appear in the listing as specified in 5-2.3.1.

5-2.3.5 If the emergency service protects an area that is covered by more than one directory, each directory shall list the agency or district as specified in 5-2.3.1.

5-2.3.6 Where ERFs that are not continuously staffed by trained personnel are listed in the telephone directory, callers shall be provided with a recorded message that refers them to the appropriate emergency number.

5-3 Equipment and Operations. At the communication centers, at least two telephone lines shall be assigned exclusively for receipt of emergency calls. Additional emergency lines shall be provided as required for the volume of calls handled.

5-3.1 Additional telephone lines shall be provided for the normal business (nonemergency) number(s) as needed.

5-3.2 In addition to the telephone lines required by 5-3 and 5-3.1, at least one outgoing-only line shall be provided.

5-3.3 Where 911 service is not in use, provisions shall be made for the designated emergency lines first. When all emergency lines are in use, emergency calls shall hunt to other predetermined lines that are approved by the authority having jurisdiction. Calls to the business number shall not hunt to the designated emergency lines.

5-3.4 When a PSAP receives an emergency call for a location that is not in its jurisdiction, or a call for an agency not under the control of the PSAP, the PSAP shall transfer the call directly to the responsible communication center, when possible, and shall remain on the line until it is certain that the transfer is effected. This transfer procedure shall be used instead of relaying the information to the communication center.

5-3.5 All incoming calls on designated emergency lines shall be recorded in accordance with this standard.

5-3.6* If an incoming call on any designated emergency line is not answered within 60 seconds, an alarm indication shall be automatically transmitted to a location approved by the authority having jurisdiction.

5-3.7* Where the authority having jurisdiction permits the communication center to receive automated voice alarms, a separate, unlisted telephone line(s) shall be provided to receive such alarms. Automated voice alarms shall not be permitted to connect to the telephone lines required by 5-2.1, 5-3, and 5-3.2.

5-3.8 Where the communication center receives automated data alarms through dial-up telephone service, a separate, unlisted telephone line(s) shall be provided to receive such alarms. Automated data alarms shall not be permitted to connect to the telephone lines required by 5-2.1, 5-3, and 5-3.2.

5-4* Universal Emergency Number 911 Service.

5-4.1 General. Universal emergency number 911 service shall meet the minimum requirements as specified in this section.

5-4.2 Reliability. The universal emergency number service equipment shall be designed so that an equipment failure cannot prevent calls from being answered. Under failure conditions, the full-feature complement shall not be required to be maintained; however, the calling party shall be able to communicate with the telecommunicator.

5-4.3 Circuits.

5-4.3.1 At least two 911 circuits shall be provided to each communication center from each serving telephone central office. These circuits shall have diverse routes, so arranged that no single incident will interrupt both routes.

5-4.3.2* Where multiple communication centers that serve a jurisdiction are not located in a common facility, at least two circuits shall be provided between communication centers. These circuits shall have diverse routes, so arranged that no single incident will interrupt both routes.

5-4.4 911 Alternative Routing.

5-4.4.1* Routing to an Alternative PSAP. Communication centers shall maintain a plan for rerouting incoming 911 calls when the center is unable to accept such calls. The plan shall be included in the comprehensive emergency management plan.

5-4.4.2* Routing to Alternative Numbers. Where the authority having jurisdiction requires that overflow 911 calls shall go to 7-digit or 10-digit numbers within the PSAP, the 7-digit or 10-digit numbers shall meet the requirements of this standard for monitoring for integrity and recording.

5-4.4.3 Night Service. Where a PSAP operates on a part-time basis, an automatic alternative routing plan shall be put in place that ensures the rapid transfer of calls to the designated backup PSAP, even if the transfer switch, where provided, is not turned on.

5-4.4.4 911 Queuing.

5-4.4.4.1* Any call that has not been answered after 20 seconds shall be routed to a recording that informs the caller that he or she has reached 911 and simultaneously places the call in a queue. The system shall periodically remind 911 callers who are in the queue that they are connected during their wait.

5-4.4.4.2 There shall be an audible and visible indication within the communication center that unanswered calls are waiting in the queue.

Chapter 6 Dispatching Systems

6-1 Fundamental Requirements of Alarm Dispatching Systems.

6-1.1* General.

6-1.1.1 An alarm dispatching system shall be designed, installed, operated, and maintained to provide maximum reliability for the receipt and retransmission of alarms.

6-1.1.2 The use of an alarm dispatching system for the transmission of other signals or calls of a public emergency nature shall be permitted where such transmission does not interfere with the transmission and receipt of alarms.

6-1.1.3* Two separate dispatch circuits (primary and secondary) shall be provided for transmitting alarms. A circuit that terminates at a telephone instrument only shall not be considered to be either of the required dispatch circuits.

Exception No. 1: Two dispatch circuits shall not be required as permitted by 6-1.1.4 and 6-1.1.5.

Exception No. 2: In jurisdictions that receive fewer than 730 alarms per year, the second dispatch circuit shall not be required.

6-1.1.4 The primary dispatch circuit shall consist of one of, or a combination of, the following:

- (a) Wired circuit monitored for integrity.
- (b) Voice radio channel with duplicate base transmitters and receivers, microphones, encoders, control circuitry, and antennas capable of visual and audible alerting of failure of signal transmission in accordance with 6-1.2.6.
- (c) Microwave carrier channel monitored for integrity.
- (d) Polling or self-interrogating radio system. If the primary transmitter fails upon operation, switchover to the second transmitter shall be automatic, with audible and visual indications to the telecommunicator. However, if the transmitter controls are in a constantly attended location, switchover shall be permitted to be manual, where manual switchover is possible within 30 seconds.

(e) Approved, dedicated telephone circuit that is monitored for integrity. A telephone connection through a public-switched telephone network via regular dial-up mode and nondedicated phone lines shall not be considered to be an approved telephone dispatch circuit for either the primary or secondary dispatch circuit that notifies emergency response personnel.

(f) When trunked radio systems are used as dispatch circuits, they shall be in compliance with either 6-1.1.4(b) or 6-1.1.4(d).

6-1.1.5* The secondary dispatch circuit shall not be required to be monitored for integrity and shall be one of the following:

- (a) Wired circuit or a radio channel. If radio is used as a secondary dispatch circuit, it shall not be required to have backup.
- (b) Radio for both the primary and secondary circuits. If radio is used for both the primary and secondary dispatch circuits, separate radio systems channels shall be provided, with separate receivers for each channel at the ERF.

(c) Approved dedicated telephone circuit. When a dedicated telephone dispatch circuit is used as a primary dispatch circuit, it shall not be used as a secondary dispatch circuit. A telephone connection through a public-switched telephone network via a regular dial-up mode and nondedicated phone line shall not be considered to be an approved telephone dispatch circuit.

6-1.1.6 Where voice transmission is used as a dispatch method, the announcement for the emergency response shall be preceded by an audible warning or alerting signal [typically a distinctive tone(s)] that differentiates the emergency from routine voice traffic.

6-1.1.7 Alarms shall be retransmitted to emergency response facilities from the location at which alarms are received.

6-1.1.7.1 Alarms from the communication center shall be automatically received at emergency response facilities.

6-1.1.7.2 Dispatch methods shall provide for the operation of houselights or other auxiliary functions at the ERF as required by the authority having jurisdiction.

6-1.1.8 Alarms that are transmitted over the required dispatch circuit(s), including the dates and times of transmission, shall be automatically recorded at the communication center.

Exception: Where telegraphic retransmission is used, manual entry of dates and times by the telecommunicator shall be permitted by the authority having jurisdiction.

6-1.1.9 Audible devices shall be installed throughout the ERF to ensure that all emergency response personnel are always alerted to alarms.

6-1.1.10 Equipment shall be provided to allow watch personnel to alert personnel in the ERF.

6-1.1.11 A means of acknowledging receipt of an alarm from the emergency response personnel to the telecommunicator shall be provided.

6-1.2* Monitoring for Integrity. Wired circuits, microwave carrier channels, dedicated telephone circuits, and devices upon which transmission and receipt of alarms depend shall be monitored constantly to provide prompt warning of conditions that adversely affect reliability.

6-1.2.1 A polling or self-integrating radio system shall be monitored for integrity hourly to ensure system reliability.

6-1.2.2 The power supplied to all required circuits and devices of the system shall be monitored for integrity.

6-1.2.3 Trouble signals shall actuate an audible device, and a visual signal shall be located at a constantly attended location.

6-1.2.4 Trouble signals shall be distinct from alarm signals.

6-1.2.4.1 The audible signal shall be permitted to be common to several monitored circuits and devices.

6-1.2.4.2 A switch for silencing the audible trouble signal shall be permitted if the visual signal continues to operate until the silencing switch is restored to the designated normal position.

6-1.2.4.3 The audible signal shall respond to faults that occur on all other circuits prior to the restoration of the silencing switch to the "normal" position.

6-1.2.5 Where dispatch systems use computer diagnostic software, monitoring of the primary dispatch circuit components shall be routed to a dedicated terminal(s). The dedicated circuit-monitoring terminal(s) shall be labeled and identified as DISPATCH CIRCUIT INTEGRITY STATUS, shall be located within the communication center, and shall not be used for routine dispatch activities.

6-1.2.5.1 The program software shall be capable of displaying and testing each circuit that can be electronically monitored from the dispatch console to the station control unit or junction relay switching equipment in the ERF.

6-1.2.5.2 Any fault condition within the dispatch circuit shall display on the dedicated terminal screen in a prominent (highlighted) fashion that satisfies the visual alarm requirement with an audible alarm that actuates and sounds in accordance with the type of dispatch circuit that is being monitored.

6-1.2.6 The radio communications system shall be monitored for faults and failures. Audible and visual indications of faults or failures shall be provided to the radio system manager or the telecommunicator if no system manager exists.

Exception: This requirement shall not apply to ERFs, emergency response vehicles, and portable radios.

6-2 Wired Dispatching Systems.

6-2.1 Wired Circuits — General.

6-2.1.1 Where a wired dispatch circuit is part of a public alarm reporting system, it shall meet the requirements of NFPA 72, *National Fire Alarm Code*.

6-2.1.2 A wired circuit shall not be connected to alarm instruments in more than five emergency response facilities.

6-2.1.3 Coded signals shall be transmitted at a minimum rate of two strokes per second. If outside alerting devices are employed, transmission shall be achieved over separate circuits at a rate that is suitable for such devices.

6-2.1.4 Where wired voice dispatch circuits are used, each circuit shall be dedicated to each emergency response facility.

6-2.1.5 For coded and telegraphic systems, a permanent record and an audible signal shall be required to indicate the receipt of an alarm. The permanent record shall indicate the exact location from which the alarm is being received.

6-2.1.6 A separate tie circuit shall be provided from the communication center to each subsidiary communication center.

6-2.1.7 Equipment shall be designed and installed so that it is capable of performing its intended function at 85 percent and at 110 percent of the rated voltage.

6-2.1.8 The normal operation of the system shall not require the use of a ground return to provide any essential function. Circuits that extend outside the communication center shall test free of ground.

Exception: This requirement shall not prohibit the use of the ground to provide function under abnormal line conditions where such use does not prevent the reception or transmission of a signal under normal conditions if the circuit were accidentally grounded.

6-2.1.9 A public alarm reporting system circuit that enters an emergency response facility and that is connected to automatic recording and sounding equipment shall be permitted to be one of the two required dispatch circuits.

6-2.1.10 In those jurisdictions where fewer than 730 alarms per year are received, or where all stations have recording and sounding devices that respond to each public reporting circuit, the second dispatch circuit shall not be required. Only the circuit that is monitored for integrity shall be required.

6-2.1.11 The following requirements shall apply to Type B systems:

- (1) Equipment shall be installed to automatically transmit alarms that are received from any public reporting circuit to all emergency response facilities and, where employed, to outside sounding devices.
- (2) Control equipment shall allow any or all circuits to be individually connected to, or disconnected from, the repeating mechanism.
- (3) Coded transmitting devices that use metal conductors shall be provided with a means to transfer the signal from one dispatch circuit to another.

6-2.2 Telephone Circuits.

6-2.2.1 A telephone circuit that is used as one of the dispatch circuits shall meet the requirement in 6-1.1.4.

6-2.2.2 Where the primary or secondary dispatch circuit is a telephone dispatch circuit, it shall have voice amplification with the following capabilities.

- (1) It shall be equipped with loudspeaker(s).
- (2) The use of the handset shall automatically disconnect the loudspeakers from the circuit(s).

6-3 Radio Dispatching Systems.

6-3.1 General.

6-3.1.1* All radio communications shall comply with the rules and regulations governing wireless communications in the country of operation.

6-3.1.2 The communication center shall be equipped for radio communications with emergency vehicles and portable radios.

6-3.1.3* A simplex radio channel shall be provided for on-scene tactical communications.

6-3.1.4 Communications system design shall be such that a portable radio is capable of operating properly within the dispatch area without the use of mobile radio frequency (RF) amplifiers.

6-3.1.5 If the radio includes scanning capability, it shall have an automatic priority feature that causes the radio receiver to revert automatically to its primary channel when the channel is being used.

6-3.1.6 Visual indication shall be provided to alert that radio equipment is turned on.

6-3.1.7 With the exception of mobile and portable radio, radio antenna systems shall include surge arresters.

6-3.1.8 Radio communication equipment shall be capable of transmitting a distinctive alert tone as required in NFPA 1561, *Standard on Fire Department Incident Management System*.

6-3.2 Signaling and Control Systems.

6-3.2.1 Signaling and control systems that are used to alert a specific ERF(s) shall initiate announcement tones for various voice alarms.

6-3.2.2 Signaling and control systems shall use both polling and automatic transmission communications methods.

6-3.2.3 Signaling and control systems shall support redundant designs as required in 6-1.1.4(d).

6-3.3 Conventional Two-Way Voice Systems.

6-3.3.1* **Analog System Requirements.** Systems shall be equipped with a coded squelch system to minimize interference.

6-3.3.2 Digital System Requirements. Digital systems shall comply with the ANSI Standard Common-Air-Interface (CAI).

6-3.4 Trunked Two-Way Voice Systems.

6-3.4.1* Analog Trunked System Requirements.

6-3.4.1.1* Signaling Channel Concept. The trunked system shall operate using a dedicated signaling control channel protocol concept. System control messages and calls and mobile requests for service shall be transmitted to and from the system on the signaling channel.

6-3.4.1.2 Unique Address Transmission. Each unit will send its unique discrete address identification to the system each

time the unit transmits, regardless of whether the system is operating in the message trunking mode or transmission trunking mode.

6-3.4.1.3 Minimum Channel Capability. Mobile and portable units shall be capable of operating on at least five radio channels.

6-3.4.1.4 Scanning. Mobile and portable units shall be capable of scanning talkgroups, with one group being a priority.

6-3.4.1.5* "Time-out" Timer. Mobile and portable units shall be equipped with a timer circuit that will automatically shut off the transmitter and signal the operator with a distinctive tone after a predetermined transmit time.

6-3.4.1.6 Automatic Channel Assignment. A system controller shall automatically assign all channels such that all system users (field units and console dispatchers) shall have access to all voice channels via a system priority protocol.

6-3.4.1.7 Channel Access Time. Channel access time in single site systems, assuming a channel is available, shall be less than $\frac{1}{2}$ second.

6-3.4.1.8* Priority Levels. A minimum of eight levels of operational talkgroup priority shall be incorporated in the system. Dispatch consoles shall be capable of elevating the operational priority of a talkgroup by one increment to facilitate channel assignments in critical situations.

6-3.4.1.9* Emergency Priority. All field units in the system shall be capable of gaining access to the system within $\frac{1}{2}$ second of activation of an instantaneous emergency switch. When emergency activation occurs, the field unit ID shall be displayed at the dispatch terminal and/or console, and an audible alert shall be activated. A voice channel shall be immediately assigned, regardless of system loading, to handle the emergency communications.

6-3.4.1.10* Failure of Trunking System. The system shall be configured so that in the event of a failure of the system controller, which prevents automatic functioning of the system, mobile units shall automatically operate in the conventional mode on pre-assigned channels based upon a selected talkgroup. Emergency response units that share trunked radio systems with other emergency services or other nonemergency services shall operate on a channel that is not shared with non-emergency users.

6-3.4.1.11* Queuing of Request for Voice Channel. If all available talking channels are assigned, the second and lower precedence level requests for a talking channel shall be placed in a queue according to the priority levels involved. The queue shall cause the system to assign talking channels (as they become available) on a priority level basis. If multiple talkgroups with the same priority are in the queue, they shall be assigned a channel on a first-in-first-out (FIFO) basis. The queuing protocol shall process and assign channels to requesting units that have been involved in recent conversations before processing and assigning channels to units not involved in any recent conversations (assuming both talkgroups have equal priorities).

6-3.4.1.12 Busy Queuing Callback. When any unit is placed into a system busy queue, the unit requesting the channel shall be notified automatically by the system when it assigns a channel to the unit.

6-3.4.1.13 Talkgroup Reception. All units operating within the same talkgroup shall receive both sides of every conversation addressed to or from the talkgroup.

6-3.4.1.14 Selective Alerting. The system shall provide (for mobile and portable units equipped with this feature) a means for selectively alerting one unit from another unit or from a dispatch location.

6-3.4.1.15 Continuous Talkgroup Affiliation Notification. The system shall broadcast a continuous update of the talkgroup channel assignments to field units. Those units that become activated during a conversation, or those that leave the system coverage and return, shall use this process to immediately affiliate with their proper talkgroup conversation.

6-3.4.1.16* Out of Contact Indication. Whenever a field unit leaves the coverage of the signaling channel and attempts to access the system (push-to-talk), an audible alert shall be sounded.

6-3.4.1.17* Individual Unit Disable. Hardware and software that allows disablement of any mobile or portable unit(s) currently operational on the system shall be included in the system. This process shall be possible even if the system manager terminal or the console is inoperative.

6-3.4.1.18* Remote Talkgroup Assignment. The system shall allow a telecommunicator to initiate a change in the operating talkgroup of any field unit from a system management terminal.

6-3.4.1.19* Telephone Interconnect Restriction. Where telephone interconnect has been provided as a part of the system, the system shall be configured so that no telephone call shall prevent or delay any dispatch communications required by the authority having jurisdiction.

6-3.4.1.20 Monitoring for Integrity. A subsystem dedicated to monitoring the trunked system infrastructure shall be included. Fault and status information, including information on the condition of base station repeaters and controllers, shall be accessible from a system manager terminal. A printer shall be included with the system manager terminal, which shall be capable of recording system problems as they occur.

6-3.4.1.21 Console Call Indicator. A call indicator shall be provided for each talkgroup and conventional repeater controlled from the control center console. If the channel is selected, the call indicator shall flash when audio is present.

6-3.4.1.22 Console Full Duplex. The console shall operate in the full duplex mode so that a telecommunicator can simultaneously transmit to a trunked talkgroup and receive his or her response, without needing to release the push-to-talk (PTT) switch.

6-3.4.1.23 Console Trunked Busy Indication. If the dispatcher attempts to make a call and all trunked channels are busy, a visual and audible alert shall be initiated at the console. When the channel becomes available, the console shall automatically alert the dispatcher with an audible tone and “hold” the channel for the dispatcher for 2 to 4 seconds to allow the dispatcher time to activate a PTT for that talkgroup.

6-3.4.1.24* Console Dispatch Preemption. The system shall be so configured that no “busy” indication shall be received by a telecommunicator when attempting to access a talkgroup required for dispatch of an alarm. If necessary to accomplish

this requirement, preemption of the lowest-priority communication then present on the system shall occur.

6-3.4.1.25 Elevation of Priority. The telecommunicator shall have the capability to designate certain talkgroups to have a higher tactical priority at their workstation.

6-3.4.1.26* Tactical Communications. Trunked radio system talkgroups shall not be used to fulfill the requirement for the provision of a simplex radio channel for on-scene tactical communications.

6-3.4.2 Digital Trunked Radio System Requirements. Digital trunked radio systems shall meet the requirements in 6-3.4.1.

6-3.5 Two-Way Mobile Equipment.

6-3.5.1 All emergency response vehicles shall be equipped with a two-way mobile radio that is capable of communications with the communication center.

6-3.5.2 Mobile radios shall be equipped with a visual transmit indicator.

6-3.5.3 All mobile radios shall be equipped with a carrier control timer that disables the transmitter after a pre-determined time that is determined by the authority having jurisdiction.

6-3.5.4 Mobile radios and associated equipment shall be manufactured for the environment in which they are to be used.

6-3.5.5 Mobile radios shall be capable of multiple-channel operation to enable on-scene radio communications that are independent of dispatch channels.

6-3.5.6 Where a data transmission function is used, mobile radios shall have the ability to transmit data without distortion, and the equipment shall be designed to ensure data transmission at full power.

6-3.5.7 All emergency response vehicles that are assigned to aircraft emergency responses shall be equipped with radios that are capable of operating on the aircraft ground control emergency channels.

6-3.5.8 Spare mobile radio units shall be provided for emergency response vehicles as follows:

- (1) Minimum of one spare unit for each model not directly interchangeable
- (2) Minimum of one spare unit for each 20 units, or fraction thereof, in service

6-3.6 Two-Way Portable Equipment.

6-3.6.1 All emergency response vehicles shall be equipped with a portable radio that is capable of two-way communication with the communication center.

6-3.6.2 Portable radios shall be manufactured for the environment in which they are to be used and shall be of a size and construction that allow their operation with the use of one hand.

6-3.6.3 Portable radios that are equipped with keypads that control radio functions shall have a means for the user to disable the keypad to prevent inadvertent use.

6-3.6.4 All portable radios shall be equipped with a carrier control timer that disables the transmitter after a pre-determined time that is determined by the authority having jurisdiction.

6-3.6.5 Portable radios shall be capable of multiple-channel operation to enable on-scene simplex radio communications that are independent of dispatch channels.

6-3.6.6 Portable radios shall be designed to allow channels to be changed while emergency response personnel are wearing gloves.

6-3.6.7 Single-unit battery chargers for portable radios shall be capable of fully charging the radio battery while the radio is in the receiving mode.

6-3.6.8 Battery chargers for portable radios shall automatically revert to maintenance charge when the battery is fully charged.

6-3.6.9 Battery chargers shall be capable of charging batteries independently and externally of the portable radio.

6-3.6.10 Spare batteries shall be maintained in quantities that allow continuous operation as determined by the authority having jurisdiction.

6-3.6.11 Where a data transmission function is used from portable radios, the radio shall be capable of transmitting data without distortion, and the equipment shall be designed to ensure data transmission at full power.

6-3.6.12 A minimum of one spare portable radio shall be provided for each 10 units, or fraction thereof, in service.

6-3.7* Mobile Command Vehicles. Vehicles that are used in command or communications functions shall meet the requirements of NFPA 1901, *Standard for Automotive Fire Apparatus*.

6-3.8 Microwave Systems. (Reserved)

6-3.9 Data Systems. (Reserved)

6-3.10 Combination/Hybrid Systems. (Reserved)

6-4 Radio Alerting Systems.

6-4.1 General.

6-4.1.1 Radio alerting systems shall include voice receivers, coded tone receivers, noncoded tone receivers, numeric receivers, and alphanumeric devices.

6-4.1.2 Where radio home alerting receivers, hand-held units, pocket pagers, and similar radio devices are used to receive fire alarms or are used on-scene, they shall conform to the requirements of this standard.

6-4.2 Radio Paging Systems and Pagers.

6-4.2.1 The paging system shall be under the direct control of the authority having jurisdiction where used as a method of emergency dispatch.

6-4.2.2 Page-encoding equipment shall be located in the communication center where used as a method of emergency dispatch.

6-4.2.3 The paging system shall comply with the general requirements for radio systems as outlined in this document.

6-4.2.4 Pagers shall audibly indicate a low-battery condition.

6-4.2.5 Alphanumeric pagers shall support the maximum text message that can be sent from the communication center.

6-4.3 Alerting Receivers. Where radio alerting receivers are used to receive emergency dispatch messages, they shall be provided with two sources of power.

6-5 Outside Audible Alerting Devices.

6-5.1 Where outside alerting devices are used to indicate an emergency, they shall be located to alert all emergency response personnel who are expected to respond.

6-5.2 Coded alerting devices shall operate at speeds of at least one actuation per second. Three or four rounds of coded signals shall be required where outside alerting devices are operated for summoning emergency personnel.

6-5.3 Compressed air alerting devices shall have a distinctive tone. If coded, the duration of the blast shall be neither less than $\frac{1}{2}$ second nor longer than $1\frac{1}{2}$ seconds, with silent intervals of 1 to $1\frac{1}{2}$ times the blast.

6-5.4 Storage tanks shall comply with ASME specifications for unfired pressure vessels and shall be equipped with safety relief valves. Tank size shall be such that, at 85 percent of working pressure, 8 times the largest number of blasts assigned to any signal shall be capable of being sounded, but not less than 50 blasts shall be sounded.

6-5.5 Compressors shall have the capacity to fill storage tanks to working pressure within 30 minutes. Piping of ferrous materials shall be provided with scale traps that are accessible for cleaning. All piping shall be arranged to allow inspection and repair.

Chapter 7 Computer-Aided Dispatch

7-1 General.

7-1.1 Emergency services dispatching entities that employ computer-aided dispatching (CAD) systems shall have qualified technical assistance available for trouble analysis and repair by in-house personnel or by authorized outside contract maintenance services.

7-1.2 Where a CAD system is used for emergency service dispatch operations, a manual backup method shall be provided and shall be available for use in the event of a failure of the CAD system.

7-1.3 Security.

7-1.3.1 CAD systems shall have different levels of security to restrict unauthorized access to sensitive and critical information, programs, and operating system functions.

7-1.3.2 Access shall be limited by log on/password control, workstation limitations, or other means as required by the authority having jurisdiction.

7-2* Support Dispatch Information. There shall be an up-to-date hard copy file of stored information that shall be located on the premises to support the dispatching operation if the CAD system fails.

7-3 Dispatch Capabilities. The installation of a CAD system in emergency service dispatching shall not negate the requirements for a second dispatch method.

7-3.1 The CAD systems shall consist of dedicated pieces of equipment whose use serves only to enhance emergency services dispatching operations. The use of such computer systems to serve unrelated services or other departments shall be prohibited.

Exception: Where dispatching operations are of a combined public service nature, the computer system shall be permitted to be used jointly, provided an automatic control function is installed in the dispatching control console positions to allow the telecommunicator to control the override of all agency dispatching for the purpose of dispatching priority traffic. Any emergency that, in the judgment of the telecommunicator in charge, is categorized as life-threatening shall take precedence over all other traffic in a combined dispatch communication center that uses a shared computer system.

7-3.2 The CAD printers that are located in ERFs shall be capable of printing four pages per minute.

7-4 Classification of Systems. CAD systems in emergency services shall be categorized as Class 1, Class 2, or Class 3.

7-4.1 A Class 1 CAD system shall be equipped with a level of computer technology and equipment that selects and recommends to the telecommunicator the appropriate units to be dispatched. The system shall be redundant and shall provide automatic switchover in case of failure of the primary operating processors and shall transmit and receive data transmissions from ERFs, other administrative sites, and mobile vehicles that are operated by the emergency services.

7-4.2 A Class 2 CAD system shall be equipped with a level of computer technology and equipment that are used in the communication center to support dispatching operations. The system shall be redundant and shall transmit and receive data transmissions from ERFs, other sites, and mobile units that are operated by the emergency services.

7-4.3 A Class 3 CAD system shall be equipped with a level of computer technology that is used as a support function to emergency service dispatching and that is used for status and logging information.

7-5 Class 3 CAD System.

7-5.1 General.

7-5.1.1 The system shall consist of a computer software program and databases that operate on a system that consists of a computer, monitor, keyboard, and printer.

7-5.1.2 The system shall be capable of manually entering alarm information that accesses databases that contain information on items such as hazardous materials, location, emergency contact, and other information that is deemed necessary by the authority having jurisdiction.

7-5.1.3 The system shall provide manual support to the monitoring and management of in-process incidents.

7-5.1.4 The system shall provide detailed and accurate reports of all operations in a format that is approved by the authority having jurisdiction.

7-5.1.5 Alarm data shall be printed in a readable format.

7-5.2 Computer Systems Requirements.

7-5.2.1 The system shall accommodate the call volumes and other sizing parameters that are required by the authority having jurisdiction.

7-5.2.2 The system shall provide the operational capabilities that are required by the authority having jurisdiction.

7-5.2.3 The system full-load response time, measured from the time a telecommunicator completes a keyboard entry to

the completion of the appearance of the system response on the CRT screen, shall not exceed 5 seconds.

7-5.2.4 Computers shall meet the following approved Electronics Industries Association (EIA) code requirements, and other such requirements as applicable, that are associated with good engineering and manufacturing practices:

- (1) RS-152-C, *Land Mobile Communications*
- (2) RS-316-O, *Land Mobile Communications*
- (3) RS-316-C, *Portable Land Mobile Communications*
- (4) RS-374-A, *Land Mobile Signaling Standard*

7-5.3 Applications Software and Database Support.

7-5.3.1 The system applications shall be written in a high-order programming language. The software shall be modular, fully documented in the source code, and designed and implemented in accordance with the accepted standards of software engineering.

7-5.3.2 The system applications shall function under the overall control of a standard operating system. The operating system shall include support functions and features as required by the authority having jurisdiction.

7-5.3.3 The data files shall be maintained and updated in an on-line interactive mode. A set of telecommunicator commands, data entry screens, and related software shall be provided to support the on-line update transactions for all user-modified files.

7-5.4 Computer Hardware.

7-5.4.1 Each computer shall be provided with the memory and the input and output (I/O) capacity that are necessary to support software functions and to meet the performance requirements of this standard.

7-5.4.2 Storage Network.

7-5.4.2.1 The system shall provide on-line storage for programs and data that meets all functional and performance requirements.

7-5.4.2.2 Capacity shall be provided for the storage of a minimum of 100 days of history log data.

7-5.4.3 Workstations.

7-5.4.3.1 The workstation shall have a computer, CRT, keyboard, and printer.

7-5.4.3.2 There shall be a spare workstation loaded with the required software that is immediately available. A workstation that is used for other applications shall be considered to be a spare workstation if it is immediately available.

7-5.4.4 Display Screens/CRT.

7-5.4.4.1 The display screen shall be of a size that has the capacity to display the information that is required by the authority having jurisdiction.

7-5.4.4.2 Characters shall be displayed on the CRT screen in a manner that is approved by the authority having jurisdiction.

7-5.4.4.3 Display intensity shall be adjustable from completely dark to maximum display brightness by using controls that are available to the telecommunicator.

7-5.4.4.4 All characters shall be visible in a lighted room without obstruction from the glare of ambient lighting.

7-5.4.4.5 The display screen shall be stable and free of unintentional motion.

7-5.4.4.6 Characters shall have a uniform appearance on all parts of the screen.

7-5.4.5 Keyboards and Pointers.

7-5.4.5.1 The keyboard shall be capable of controlling all operational functions as well as all CRTs that are associated with the specific workstation.

7-5.4.5.2 The keyboard design shall prevent malfunction caused by the spillage of liquids.

7-5.4.5.3 Pointing devices shall be resistant to dust, dirt, and accidental falls.

7-6 Class 2 CAD System.

7-6.1 General. A Class 2 CAD system shall be an integrated system of computers, CRT/keyboard terminals, display screens, printers, local and remote administrative terminals, databases, and computer software.

7-6.1.1 The system shall be capable of interfacing with related alarm receiving systems and alarm dispatching systems.

7-6.1.2 The system shall perform the following functions:

- (1) Process emergency calls for service
- (2) Handle peak call loads
- (3) Provide the initial alerting and dispatch communications to assigned units
- (4) Provide assigned units with all necessary information
- (5) Provide unit status monitoring
- (6) Support direct entry of status information from the field

7-6.1.3 The system shall provide automated support to the monitoring and management of in-process incidents.

7-6.1.4 Each computer shall be provided with the memory and I/O capacity that are necessary to support software functions and to meet the performance requirements of this standard.

7-6.2 Computer Systems Requirements.

7-6.2.1 The system shall accommodate the call volumes and other sizing parameters that are required by the authority having jurisdiction.

7-6.2.2 The system shall provide the operational capabilities that are required by the authority having jurisdiction.

7-6.2.3 The system full-load response time, measured from the time a console telecommunicator completes a keyboard entry to the completion of the appearance of the system response on the CRT screen, shall not exceed 5 seconds.

7-6.2.4 The system shall be available and fully functional at least 99.5 percent of the time.

7-6.2.5 The failure of any single component shall not disable the system.

7-6.2.6 The system shall include automatic power-fail recovery capability.

7-6.2.7 Computers shall meet the following approved EIA code requirements, and other such requirements as applicable, that are associated with good engineering and manufacturing practices:

- (1) RS-152-C, *Land Mobile Communications*

- (2) RS-316-O, *Land Mobile Communications*

- (3) RS-316-C, *Portable Land Mobile Communications*

- (4) RS-374-A, *Land Mobile Signaling Standard*

7-6.3 Applications Software and Database Support.

7-6.3.1 The system applications shall be written in a high-order programming language. The software shall be modular, fully documented in the source code, and designed and implemented in accordance with the accepted standards of software engineering.

7-6.3.2 The system applications shall function under the overall control of a standard operating system. The operating system shall include support functions and features as required by the authority having jurisdiction.

7-6.3.3 The data files shall be maintained and updated in an on-line interactive mode, using workstations. A set of telecommunicator commands, data entry screens, and related software shall be provided to support the on-line update transactions for all user-modified files.

7-6.4 Computer Hardware.

7-6.4.1 The CAD system shall be based on two identical computers, herein designated A and B.

7-6.4.2 The mass storage configuration of computers A and B shall meet the following requirements:

- (1) It shall maintain redundant copies of all critical CAD on-line files.
- (2) It shall provide protection from the detrimental effect of failure or from the maintenance outage of any single disk, tape drive, or device controller.
- (3) It shall allow the connection of any device to the computers that is independent of the other devices.
- (4) It shall be automatically reconfigurable under software control.

7-6.5 Computer Hardware.

7-6.5.1 Each computer shall be provided with the memory and I/O capacity that are necessary to support software functions and to meet the performance requirements of this standard.

7-6.5.2 Each of the on-line CAD system computers shall continuously monitor its peripheral devices and interfaces for equipment failures, device exceptions, and time-outs. On detection of failure, the computers shall send messages to the supervisor and computer console terminal by visible and audible means.

7-6.5.2.1 Computers shall continuously monitor each other's operation by means of periodic inquiries that necessitate positive acknowledgments.

7-6.5.3 The system shall provide the telecommunicator with the ability to switch over equipment and resume operations within 2 minutes.

7-6.5.4 Computers A and B shall each have a dedicated terminal. The terminal shall include a keyboard, CRT, and printer for a hard copy log of system messages and transactions.

7-6.6 Storage Network.

7-6.6.1 The systems shall provide on-line storage for programs and data that meets all of the functional and performance requirements of this standard.

7-6.6.2 Capacity shall be provided for the storage of a minimum of 100 days of history log data.

7-6.7 Workstations.

7-6.7.1 Each workstation shall have a CRT and keyboard.

7-6.7.2 A spare CRT and keyboard shall be available in the communication center for immediate change out for every three workstations, or fraction thereof, up to a maximum of three spare CRTs and keyboards. For the purpose of this section, any administrative CRTs and keyboards beyond those required for telecommunicator workstations that are not considered essential to the receipt and dispatch of emergencies shall be permitted to be considered as spares.

7-6.8 Display Screens/CRT.

7-6.8.1 The CRT shall be of a size that has the capacity to display the information that is required by the authority having jurisdiction.

7-6.8.2 Characters shall be displayed on the CRT screen in a manner that is approved by the authority having jurisdiction.

7-6.8.3 Display intensity shall be adjustable from completely dark to maximum display brightness by using controls that are available to the telecommunicator.

7-6.8.4 All characters shall be visible in a lighted room without obstruction from the glare of ambient lighting.

7-6.8.5 The display screen shall be stable and free of unintentional motion.

7-6.8.6 Characters shall have a uniform appearance on all parts of the screen.

7-6.9 Keyboards and Pointers.

7-6.9.1 The keyboard shall be capable of controlling all CAD operational functions as well as all CRTs that are associated with the specific workstation.

7-6.9.2 The keyboard design shall prevent malfunction caused by the spillage of liquids.

7-6.9.3 Pointing devices shall be resistant to dust, dirt, and accidental falls.

7-6.10 Printers.

7-6.10.1 The system shall include two printers for dispatch logging in addition to those required in 7-6.5.4.

7-6.10.2 All printers shall be interchangeable.

7-6.10.3 Logging or utility functions shall be assignable to any printer under system control.

7-6.10.4 A spare printer shall be immediately available.

7-6.11 Information Transmittal. Data communications systems that connect ERFs and administrative sites with the system shall communicate at a minimum rate of 9600 bits per second.

7-6.11.1 Mobile units shall communicate with the CAD system at a minimum rate of 2400 bits per second.

7-6.11.2 The transmission of computer information to mobile equipment or fixed locations that are associated with emergency operations shall be in accordance with Federal Communications Commission (FCC) rules and regulations for the type of service being used.

7-6.11.3 The message formats shall be uniform across the system as required by the authority having jurisdiction.

7-7 Class 1 CAD System.

7-7.1 General.

7-7.2 A Class 1 CAD system shall contain all the components and meet all the requirements of a Class 2 CAD system and shall also meet the requirements of 7-7.3 through 7-7.5.

7-7.3 In addition to the requirements of 7-6.1.2, the system shall select units for assignment to calls and shall ensure that the optimum units are selected.

7-7.4 In addition to the requirements of 7-6.5.2, on detection of a failure, the computers shall perform any required reconfiguration and shall queue notification messages to the supervisor and computer terminal.

7-7.5 When a failure is detected, the backup computer shall immediately assume the operation of the on-line CAD applications.

7-7.6 In addition to the automatic switchover capabilities, the telecommunicator shall have the ability to manually initiate computer switchover.

7-8 Remote Data Terminals (RDTs).

7-8.1 General.

7-8.1.1 RDTs and associated equipment shall be manufactured for the environment in which they are to be used.

7-8.1.2 The RDT terminals shall meet all requirements of EIA RS-374-A, *Land Mobile Signaling Standard*.

7-8.1.3 Data communications at RDTs shall accomplish at least the following functions:

- (1) Indicate to the CAD that the RDT system is operational
- (2) Indicate to the CAD the success or failure of any message to an RDT
- (3) Download forms not permanently stored at all RDTs

7-8.1.4 Emergency messages to RDTs shall take priority and shall be immediately indicated and printed if printers are included in the system. An RDT display screen shall not be automatically updated. Displays shall be configured to indicate that a message is waiting.

7-8.1.5 The RDT shall be capable of acknowledging by automatic and manual means after the receipt of a message.

7-8.1.5.1 The RDT shall transmit automatic acknowledgment that indicates that it has received and stored a message.

7-8.1.5.2 A manual acknowledgment shall indicate that the responding personnel have viewed the message and are taking appropriate action.

7-8.1.5.3 Failure to receive an automatic or manual acknowledgment from the RDT shall cause a notification to the controlling telecommunicator CRT in the communication center.

7-8.1.6 The RDT shall not require power to maintain programmed functions.

7-8.2 Equipment and Operation.

7-8.2.1 The RDTs shall be interchangeable so that any RDT can be installed in any vehicle or fixed location.

7-8.2.2 The RDT shall connect to its associated radio transceiver by a plug-in locking-cable assembly.

7-8.2.3 The RDT shall perform all functions as required by the authority having jurisdiction while keeping keystrokes to a minimum.

7-8.2.3.1 The terminal shall provide one keystroke operation for unit status reporting functions.

7-8.2.3.2 The terminal shall display information with a minimum use of multipage display.

7-8.2.4 The RDTs shall have manual controls mounted on the unit for the following:

- (1) Display intensity
- (2) Audible alarm volume
- (3) Alarm test
- (4) Power on/off

The RDTs shall provide visual indication that the unit is energized.

7-8.2.5 The RDTs shall have an emergency alert button (MAY-DAY), which shall transmit a distress signal to the controlling telecommunicator.

7-8.2.6* The RDTs shall activate audible and visual indication of incoming messages. The volume of the audible alarm shall overcome ambient noise.

7-8.2.7 The RDTs shall have a last in/first out feature that shall allow the user to recall the last 10 messages transmitted or received.

7-8.2.8 Each RDT shall have an individual addressing identifier and shall be capable of receiving single, group, or all-call messages. The RDT terminal address identifier shall be transmitted automatically for each message.

7-8.2.9 The RDT shall continuously display a current unit status that includes the following:

- (a) *Transmitter Keyed*. Indicates that a message sent by the RDT is currently being transmitted.
- (b) *Message Received*. Indicates that the last transmission has been correctly received by the communication center.
- (c) *No Acknowledgment/Fail*. Indicates that a transmission was not received after a predetermined number of retransmissions.
- (d) *Channel Busy*. Indicates that the terminal cannot transmit due to other traffic on the frequency and that the message will be sent as soon as the frequency is clear; no manual retransmission is necessary.
- (e) *Message Waiting*. Indicates that a new message is waiting to be sent to the terminal and the user needs to clear the page to allow the message to be accepted.
- (f) *Acknowledgment Required*. Indicates that manual acknowledgment by the user of a received message is required.

7-8.3 Keyboard.

7-8.3.1 The bottoms of detachable keyboards shall have non-skid surfaces.

7-8.3.2 The keyboard design shall prevent malfunction caused by the spillage of liquids.

7-8.4 Display Screen.

7-8.4.1 All information shall be visible in daylight conditions.

7-8.4.2 The CRT shall be stable and free of unintentional motion.

7-8.4.3 Characters shall have a uniform appearance on all parts of the screen.

7-9 Mobile Printers. (Reserved)

Chapter 8 Testing

8-1 General.

8-1.1 Tests and inspections shall be made at the intervals specified in this standard.

8-1.2 All equipment shall be restored to normal condition promptly after each test or alarm for which the equipment functioned.

8-1.3 Where tests indicate that trouble has occurred anywhere on the system, the telecommunicator shall take steps to repair the fault, or, if repair is not possible, action shall be taken to isolate the fault and to notify the official responsible for maintenance.

8-2 Acceptance Testing.

8-2.1 New equipment shall be provided with operation manuals that cover all operations and testing procedures.

8-2.2 All functions of new equipment shall be tested in accordance with this chapter and the manufacturer's specifications before being placed in service.

8-2.3 All cables shall be tested in accordance with this chapter where installed with all taps and splices made. However, before connection to terminals, cables shall be tested for insulation resistance. Such tests shall indicate an insulation resistance of at least 200 megohms per mile between any one conductor and all others, the sheath, and the ground.

8-2.4 The frequency, modulation, power output, and receiver sensitivity and selectivity shall be tested and recorded when the radio is installed or repaired.

8-3 Operational Testing.

8-3.1 Manual test of wired dispatch circuits shall be made and recorded at least once every 24 hours. Circuits for transmission of graphic signals shall be tested by a message transmission.

8-3.2 Outside audible alerting devices, radio, telephone, or other means for alerting emergency response personnel shall be tested as required by the authority having jurisdiction.

8-3.3 All primary and secondary radio and voice amplification circuits shall be subjected to a voice test twice daily.

8-3.4 Manual tests of the power supply for wired dispatch circuits shall be made and recorded at least once during every 24 hours. Such tests shall include the following.

(a) The current strength of each circuit shall be tested. Changes in the current of any circuit that amount to 10 percent of normal current shall be investigated immediately.

(b) The voltage across terminals of each circuit inside terminals of protective devices shall be tested. Changes in the voltage of any circuit that amount to 10 percent of normal voltage shall be investigated immediately.

(c) The voltage between ground and circuits shall be tested. Where this test indicates a reading in excess of 50 per-

cent of that shown in the test specified in 8-3.4(b), the trouble shall be located immediately and cleared; readings in excess of 25 percent shall be given early attention. Systems in which each circuit is supplied by an independent current source shall require tests between ground and each side of each circuit. Such readings shall be taken with a voltmeter of not more than 100 ohms resistance per volt.

(d) A ground current reading shall be allowed in lieu of the test specified in 8-3.4(c). Where this method of testing is used, all grounds that indicate a current reading in excess of 5 percent of the normal line current shall be given immediate attention.

(e) The voltage across common battery terminals on the switchboard side of fuses shall be tested.

(f) Voltage between common battery terminals and ground shall be tested. Abnormal ground readings shall be investigated immediately.

(g) If more than one common battery is used, each common battery shall be tested.

8-3.5 PSAP Telephone Testing. Each incoming circuit shall be tested daily.

8-3.6 Emergency Lighting. Emergency lighting shall be tested in accordance with NFPA 101, *Life Safety Code*.

8-3.7 SEPPS/UPS. SEPPS/UPS shall be tested in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

8-4 Power.

8-4.1 Emergency and standby power systems shall be tested in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

Emergency power sources other than batteries shall be operated to supply the system continuously for 1 hour weekly. The test shall require simulated failure of the primary power source.

8-4.2 Periodic tests shall be performed to ensure that the batteries are capable of supplying the system with power. See Table 8-4.2(a) for the required tests and the maximum intervals at which they are to be performed.

Table 8-4.2(a) Required Tests For Lead-Acid Batteries

Test	Maximum Interval
Measure float voltage	
Of entire battery or a pilot cell	1 week
Of each cell	3 months
Measure specific gravity	
Of a pilot cell	6 weeks
Of each cell	6 months
Discharge for 2 hours	1 year
Clean and inspect	3 months
Calibrate meters	1 year

To maximize battery life, the battery voltage for lead-acid cells shall be maintained within the limits specified in Table 8-4.2(b).

Table 8-4.2(b) Battery Voltage

Float Voltage	High Gravity Battery (Lead Calcium)	Low Gravity Battery (Lead Antimony)
Maximum	2.25 V/cell	2.17 V/cell
Minimum	2.20 V/cell	2.13 V/cell
High-rate voltage	2.33 V/cell	

Note: High- and low-gravity voltages are +0.07 volts and -0.03 volts, respectively.

To maximize battery life, the battery shall be charged as specified in Table 8-4.2(c).

Table 8-4.2(c) Battery Voltage

Float voltage	1.42 V/cell $\pm$ 0.01 V
High-rate voltage	1.58 V/cell + 0.07 – 0.00 V

Chapter 9 Records

9-1 General. Complete records to ensure reliable operation of all dispatching system functions shall be maintained.

9-2 Installation.

9-2.1 Wired Circuits. Records of wired dispatch circuits shall include outline plans that show all terminals in sequence, diagrams of office wiring, and materials used, including trade name, manufacturer, and year of purchase or installation.

9-2.2 Radio Circuits. Records of radio dispatch channels, and any associated wired circuits, shall include outline plans that show transmitters and receivers, diagrams of interconnecting office wiring, and materials used, including trade name, manufacturer, and year of purchase or installation.

9-2.3 Changes or additions shall be recorded in accordance with 9-2.1 and 9-2.2.

9-3 Acceptance Test Records/As-Built Drawings. After completion of acceptance tests that have been approved by the authority having jurisdiction, a set of reproducible as-built installation drawings, operation and maintenance manuals, a written sequence of operation, and the results of all operational tests and values at the time of installation shall be provided.

9-4 Training Records. Training records shall be maintained for each employee as required by the authority having jurisdiction.

9-5 Operational Records.

9-5.1 Performance statistics shall be compiled and maintained annually in accordance with 4-3.1(2) and 4-3.1(3).

9-5.2 A report of operations that summarize statistics that are required by the authority having jurisdiction shall be prepared annually.

9-5.3 Records of test, alarm, and dispatch signals, all circuit interruptions and observations or reports of equipment failures, and all abnormal or defective circuit conditions that are indicated by test or inspection shall be kept by the jurisdiction. Such records shall include the date and time of all occurrences.

9-6 Maintenance Records. Records of maintenance, both routine and emergency, shall be kept for all alarm receiving equipment and alarm dispatching equipment. All such records shall include the date, time, nature of maintenance, and repairer's name and affiliation.

9-7 Retention of Records.

9-7.1 Records required by Sections 9-2, 9-3, 9-4, and 9-6 shall be maintained for the life of the affected equipment.

9-7.2 Records that are required under Sections 4-4, 4-6, 8-3, and 9-5 shall be maintained for 2 years, or as required by law or the authority having jurisdiction.

9-7.3 Where called detail recording (CDR) is provided, records shall be maintained as required in 9-7.2.

Chapter 10 Referenced Publications

10-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix D.

10-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

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

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

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 1998 edition.

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

NFPA 58, *Liquefied Petroleum Gas Code*, 1998 edition.

NFPA 70, *National Electrical Code*®, 1999 edition.

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

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

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

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 1999 edition.

NFPA 101®, *Life Safety Code*®, 1997 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 1999 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 1996 edition.

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

NFPA 221, *Standard for Fire Walls and Fire Barrier Walls*, 1997 edition.

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

NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*, 1996 edition.

NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, 1998 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 1997 edition.

NFPA 1061, *Standard for Professional Qualifications for Public Safety Telecommunicator*, 1996 edition.

NFPA 1201, *Standard for Developing Fire Protection Services for the Public*, 1994 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 1997 edition.

NFPA 1561, *Standard on Fire Department Incident Management System*, 1995 edition.

NFPA 1901, *Standard for Automotive Fire Apparatus*, 1999 edition.

10-1.2 Other Publications.

10-1.2.1 ANSI Publication. American National Standards Institute, Inc., 11 West 42nd Street, 13th Floor, New York, NY 10036.

ANSI 752, *Standard for Safety Bullet-Resisting Equipment*, 1995.

10-1.2.2 EIA Publications. Electronic Industries Association, 2500 Wilson Boulevard, Arlington, VA 22201-3834.

RS-152-C, *Land Mobile Communications*, 1988.

RS-316-O, *Land Mobile Communications*, 1988.

RS-316-C, *Portable Land Mobile Communications*, 1988.

RS-374-A, *Land Mobile Signaling Standard*, 1988.

10-1.2.3 IEEE Publication. Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

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

10-1.2.4 IMSA Publication. International Municipal Signal Association, P.O. Box 539, 165 East Union Street, Newark, NY 14513.

Official IMSA Wire and Cable Specifications Manual, 1995.

Appendix A Explanatory Material

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

A-1.4 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1.4 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad

manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-1-4 Frequency (Radio). The present practicable limits of radio frequency are roughly 10 kHz to 100,000 MHz. Within this frequency range, electromagnetic waves can be detected and amplified as an electric current at the wave frequency.

A-1-4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A-1-4 Radio Channel. The width of the channel depends on the type of transmissions and the tolerance for the frequency of emission. The radio channel is normally allocated for radio transmission in a specified type of service or by a specified transmitter.

A-2-1.1 The complexity and size of the communication center varies with different jurisdictions. While a large communication center can be staffed 24 hours a day by several telecommunicators, other jurisdictions can use a continuously attended watch desk in an ERF. The staffing needs for watch desk telecommunicators or communication center telecommunicators pose problems for agencies with limited funds and limited full-time personnel. Some jurisdictions solve this problem by having one center handle the emergency calls of all public safety organizations.

A-2-1.2 Another solution for emergency response agencies is to have a number of neighboring emergency response agencies operate a joint communication center. To achieve maximum value from limited facilities, emergency response agencies can pool operations with mutual aid arrangements, which are facilitated when a common communication center is used. Many regions and rural and suburban areas exist where no one emergency response agency can afford a communication center. However, a multijurisdictional communication center can be established, and the expense can be shared.

A-2-1.3 Populated areas frequently extend over several contiguous communities within multiple jurisdictions. A telephone company does not limit or separate services on the basis of municipal boundaries. The continued expansion of the public telephone network can cause calls to a telephone company telecommunicator to be routed to a distant location. A person dialing the telephone company telecommunicator to report a fire is not assured that the telecommunicator can transmit the alarm to the proper emergency response agency.

Emergency response agencies and other public safety services recognize the need for the public to be able to reach

them quickly, regardless of where they are when an emergency arises. In January 1968, a proposal was made to implement throughout the country a single national emergency number that the public could use to reach the police, emergency response agencies, and other emergency agencies from any location. The number 911 was chosen. The 911 system is an easy-to-remember, three-digit telephone number that is used to provide the general public with direct access to emergency service resources.

A-2-2.3 Arrangements with other jurisdictions to allow the use of their facility as the alternative facility are acceptable. Such agreements should be made in writing.

A-2-2.4 CEMP is included as part of the SARA Title III requirements. The plan should be exercised on a regular basis to ensure that it is workable and that employees are familiar with the procedures. The local emergency planning committee (LEPC) is comprised of emergency response agency representatives, local government, schools, emergency management personnel, other government agencies, and the private sector. The CEMP is developed by this group and used as part of the planning process in emergency management. NFPA 1600, *Recommended Practice for Disaster Management*, also outlines the requirements for emergency planning. The communication center is a critical component of any emergency plan and serves as a link between the emergency operations center (EOC) and emergency response agencies.

A-2-4.1.2 The ability to provide fresh, properly conditioned air is critical to the operation of the communication center. Security requirements, co-location of communication centers in buildings with other uses, operation of computer equipment, UPS, and radios combine to create a very high cooling demand that is often found in an existing building HVAC system without proper engineering.

The primary HVAC system is to be designed for the task. The goal is to provide uninterrupted conditioning under all types of climatic conditions and to simultaneously protect communication center occupants from hazardous airborne contaminants (such as smoke) that can be drawn into the communication center from the rest of the building.

Methods of providing backup HVAC to the communication center include the use of other systems within a building that is shared by the center, using prepositioned portable air-conditioning units. Another method is to install an HVAC system that can provide the minimum cooling necessary, using an alternate air source, and that is connected to the cooling system ducts.

When HVAC systems fail and no backup is provided, the first casualty is usually security. Doors or windows that are required to be closed will be opened — often without the knowledge or consent of the authority having jurisdiction.

A-2-5.5 The decision to evacuate or not evacuate the communication center in the event of a fire or threat of fire is not simple. It involves moving the telecommunicators to a backup dispatch center or to a cooperating agency in a nearby jurisdiction. The communication center should be assigned dedicated fire suppression resources in the event of a fire in the communication center or in the building housing the communication center. Decisions that involve continued operation or evacuation of the center should be made by the fire suppression officer and the telecommunicator supervisor.

A-2-6.4 For instance, a window facing a break area within the secure area assigned solely for the use of the communication

center does not require bullet-resistant glass as long as a block wall surrounds the break area.

A-2-7.6.5 As part of the CEMP, the authority having jurisdiction should evaluate the effect of natural disasters such as earthquakes, blizzards, hurricanes, and tornadoes on the ability to resupply fuel tanks during such disasters to determine if additional fuel for operation for more than 24 hours should be stored on site.

A-2-8.2.1 See Section 700-12(b) (f) of NFPA 70, *National Electrical Code*.

A-2-16.1.5 For further information, see NFPA 72, *National Fire Alarm Code*.

A-3-13.3 This is not meant to apply to the office of the chief and other executive officers or to the communication center, which can be housed in a fire station.

A-4-2.4 Certification programs for telecommunicators are offered by organizations including the following:

- (1) Associated Public Safety Communications Officials International, Inc. (APCO), 2040 South Ridgewood Avenue, South Daytona, FL 32119
- (2) International Municipal Signal Association (IMSA), P.O. Box 539, 165 East Union Street, Newark, NY 14513

A-4-4.7 The first unit to arrive at an emergency incident is responsible for notifying the communication center by radio of its arrival and for providing a brief description of the visible conditions and the precise location of the incident. The responding officer should report arrival and should establish the initial command post at the emergency. As soon as conditions allow, the incident commander should report supplementary information to the communication center and should make additional progress reports if operations keep the units at the emergency longer than a few minutes. An extended or complex emergency incident can necessitate the use of a communications van for effective coordination, command, and control.

A-4-4.7.1 The assignment of a communications officer to incidents that are more complex ensures that adequate communication is achieved using available telephone and radio systems. Such assignment also ensures that the availability of existing frequencies or networks is maximized and that system overloading is minimized. An assigned communications officer can be particularly important and useful during multiagency fires and other incidents. It can be necessary to establish specific nets and monitoring systems to guarantee communications in some situations. In complex incidents, communications discipline is critical in avoiding system overload.

A-4-4.7.2 The common emergency organization, which uses the incident management system (IMS), includes the following two important communications concepts.

(a) *Common Terminology.* All participating departments and agencies use clear text and established standard terms and phrases. In multiple-agency emergencies, it is extremely difficult to guarantee that all agency and department codes represent identical meanings. To avoid potential misunderstandings between telecommunicators, the IMS requires clear text or plain language for all radio messages. Although this is a significant departure from public safety agency tradition, it has been found to be efficient in actual practice.

(b) *Integrated Incident Communications.* Participating departments and agencies plan in advance for the use of integrated radio frequencies to tie together all tactical and support units assigned to an incident. To ensure the best possible use of all participating department and agency radios at major incidents, an incident radio communications plan matrix is developed. The matrix lists all available radio systems on an incident and aids in assigning them to provide command, tactical, and logistical coverage for a complete operation.

Preparation of the matrix necessitates training and a knowledge of cooperating department and agency frequencies and radio components. Use of the matrix is greatly enhanced by the existence of a frequency-sharing agreement. (See *Appendix B*.)

The FCC has no prohibition against public agencies sharing frequencies during emergencies, provided that the responsible agency has granted permission to assisting agencies to do so. The agreement specifies the mutual permission of participating agencies to use other agency frequencies when assisting them. The agreement lists the terms and conditions of use by others and includes all frequencies that can be made available under critical conditions. Such agreements facilitate better multiagency dispatching and incident communications and can be prepared by groups or agencies that work together frequently.

A-4-5.1 The clock can be synchronized automatically by the use of a radio receiver that receives broadcasts by stations broadcasting standard time and interval signals, such as WWV, WWVH, WWVB in the United States and CHU in Canada, or through the use of GPS satellite time receivers, or by calling NIST in Boulder, CO or the U.S. Naval Observatory in Washington, DC.

A-4-6.1(3) Recording by telecommunicator position, rather than by line, allows all telephone lines that are used in the communication center to be taped using a minimum of recorder resources.

A-5-3.6 The monitoring service is to be provided by the 911 vendor. Monitoring at the communication center itself is not sufficient, since a failure at the communication center can also involve a failure of the monitoring, and monitoring at the communication center does not cover situations where 911 calls are not completed due to cable failure or intermediate central office failure.

A-5-3.7 Automated voice alarms, by their design, repeat their message many times and, therefore, can monopolize an inbound line for a considerable time. Therefore, they are not permitted to connect with published emergency numbers, and their use is not encouraged. Many state and local statutes prohibit such connections to designated emergency lines or to 911.

A-5-4 A document entitled *Planning Guidelines for Universal Emergency Number (911) Systems* is intended as a guide to assist those jurisdictions that are contemplating or that are planning 911 systems. There are three parts to the document, as follows:

- (1) Feature definitions
- (2) Jurisdiction characteristics
- (3) Feature versus characteristics correlation

In the feature definition section, all known 911 features are described. It should be noted, however, that this is a listing of all features and that not all features are technically compatible with each other. Furthermore, certain features can only be provided if special equipment is available at the central office

of the telephone company. The local telephone company should be consulted as early as possible when planning a 911 system.

The jurisdiction characteristics section considers various characteristics of municipalities that can influence the feature complement of a 911 system.

The feature versus characteristics correlation includes a graph that relates municipal characteristics to 911 features.

It should be emphasized that the outline that follows is only a planning guideline. Each jurisdiction has a unique set of characteristics that should be evaluated and matched to a set of 911 features.

(a) *Feature Definitions.* Feature definitions are as follows.

- (1) *Alternate Routing.* Provides routing of 911 calls to a pre-designated PSAP if the primary PSAP is unable to accept the call.
- (2) *Automatic Location Identification (ALI).* Displays the calling party's address and other preselected information at the PSAP attendant position.
- (3) *Automatic Number Identification (ANI).* Displays the calling party's telephone number at the PSAP attendant position.
- (4) *Call Detail Recording (CDR).* Provides a hard copy printout, after every call, of the ANI number, trunk number, and answering attendant number, and the time of seizure, answer, and disconnect/transfer.
- (5) *Called Party Hold.* Allows the PSAP attendant to hold the established connection to the station from which the 911 call was originated, regardless of calling party action.
- (6) *Default Routing.* Provides routing of 911 calls to a designated PSAP when the primary PSAP cannot be selectively routed.
- (7) *Emergency Ringback.* Allows the PSAP attendant to ring the calling station, regardless of the station switch-hook status.
- (8) *Forced Disconnect.* Enables the PSAP attendant to terminate an existing 911 call at any time, regardless of the action of the calling party.
- (9) *Idle Tone Application.* Gives the PSAP attendant an audible indication if the 911 caller terminates the call before the attendant answers the call or after the attendant answers the call.
- (10) *Night Service.* Routes calls to an alternate PSAP when a PSAP closes down for a time.
- (11) *Public Safety Answering Point (PSAP).* Any facility where 911 calls are answered, either directly or through rerouting.
- (12) *Selective Routing.* Routes a 911 call to the correct PSAP based on the calling party's telephone number, regardless of jurisdiction and telephone company central office boundary mismatches.
- (13) *Switch-Hook Status.* Provides a visual, audible, or visual and audible indication of whether the originating station on an established 911 call is on-hook or off-hook.
- (14) *Transfer.* Allows an incoming 911 call to be rerouted from one PSAP to another.

There are three generic types of transfer, as follows:

- a. *Manual.* Voice only is rerouted using a series of operations at the attendant console.
- b. *Fixed.* Voice, ANI, and ALI are rerouted to a specific secondary PSAP by pressing a button associated with the desired PSAP.
- c. *Selective.* Voice, ANI, and ALI are rerouted to any number of secondary PSAPs, based on the telephone number of the calling party, by the operation of a single button.

(b) *Jurisdictional Characteristics.*

- (1) *Number of 911 Centers.* The number of 911 emergency reporting centers (or PSAPs) is one of the key factors that should be considered in planning a 911 system. If multiple answering points are located throughout the system (jurisdiction), many factors can influence the way in which 911 calls are handled. For instance, telephone company and jurisdiction boundaries are rarely coincident. Therefore, calls are routed to improper answering points, and time delays are encountered in handling or rerouting the 911 calls.

On the other hand, having a single answering point minimizes the boundary problem. However, other functions, such as dispatch, become more difficult.

When planning a 911 system, many factors should be considered. The administrative and operational procedures of the answering bureau and the available 911 system features should be reviewed carefully.

- (2) *Force Utilization.* Both the number and types of personnel that will handle 911 calls should be considered when planning a 911 system. For instance, if a large percentage of calls are to be rerouted (i.e., calls are answered by personnel who are not affiliated with any particular emergency agency), then 911 features that provide for the expeditious handling of such calls should be considered. If the primary objective is to optimize force, then 911 features that minimize the number of misrouted calls should be considered.
- (3) *Third-Party Call Handling and Conference Calls.* The characteristics of a particular jurisdiction can necessitate the frequent use of interpreters or subsidiary centers (secondary PSAPs). Frequent rerouting and conferencing of 911 calls can be necessary under such circumstances. The 911 system features that provide expeditious call handling should be considered under such conditions.
- (4) *Improper Call Termination by Call Originator.* When the calling party does not hang up after a 911 call, whether deliberately or accidentally, telephone facilities are tied up for a time, limiting access to the 911 center by other emergency callers. Where such circumstances exist, 911 system features and quantities of telephone access facilities should be reviewed.
- (5) *Inadequate or Untimely Location Information.* Some jurisdictions or portions of jurisdictions have a higher incidence of calls for which location information is inadequate or untimely due to such circumstances as the inability of the caller to speak, a caller's speech or hearing problem, a prank call, or a false alarm. Where the frequency of such occurrences hampers the effectiveness or affects the costs of the municipality emergency services, administrative procedures, operational plans, and 911 system features should be reviewed.
- (6) *Computer-Aided Dispatching (CAD).* Many jurisdictions are considering or are already employing a CAD system. Several 911 system features complement CAD systems and should be very carefully considered when planning a 911 system with a CAD interface.
- (7) *Fire Emergency Call Handling.* In most cases, 911 fire calls are not routed directly to fire dispatch centers. The first response centers are required to reroute the calls to the appropriate fire communication center. Therefore, 911 features that minimize call-handling time (especially